UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

EARLY WARNING SERVICES, LLC,

Petitioner

vs.

INTELLECTUAL VENTURES II, LLC,

Patent Owner

Videotaped Deposition of Kevin Berisso

Date: Thursday, July 3, 2025

9:00 a.m.

Location: Volpe Koenig

30 South 17th Street, 18th Floor

Philadelphia, PA 19103

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P R O C E E D I N G S

THE VIDEOGRAPHER: Good morning. We are on the record at 9:02 a.m. on July 3, 2025, for the video deposition of Kevin Berisso.

Please note that the microphones are sensitive and may pick up whispering and private conversations.

Please turn off all cell phones or place them away from the microphones as they may interfere with the deposition audio.

Recording will continue until all parties agree to go off the record.

This deposition is being taken in the matter of Early Warning Services LLC, Petitioner, versus Intellectual Ventures II, LLC, Patent Owner.

This deposition is being held at Volpe Koenig, 30 South 17th Street in Philadelphia, Pennsylvania.

The Court Reporter is Jen Miller. The video specialist is Vincent Falcetano. We are both from the Digital Evidence Group.

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All counsel appearances will be reflected on the transcript.

Will our Court Reporter please swear in the witness.

KEVIN BERISSO, after having been first duly sworn, was examined and testified as follows:

- - -

E X A M I N A T I O N

- - -

BY ATTORNEY KRIEGER:

Q. Good morning, Dr. Berisso.

Am I pronouncing your name correctly?

A. Yes, you are.

Q. Okay. Great.

Thank you for being here today.

I understand that you've been through this process before. I'm going to go through some basic ground rules. I'm sure you're very familiar with most of these. But if you have any questions as I walk through these, just feel free to let me know. Okay?

A. Sure.

Q. All right. So you have been deposed

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before, correct?

A. Yes.

Q. About how many times?

A. Two, three.

Q. Okay. When was your last deposition?

A. About a year ago.

Q. Okay. Have you been involved in a PTAB proceeding?

Are you familiar with the term "PTAB"?

A. No.

Q. Okay. The Patent Trial and Appeal Board is --

A. I have not.

Q. -- frequently abbreviated as the "PTAB."

A. I have not.

Q. You have not. Okay.

Is there anything today that impacts your ability to understand the questions and understand them truthfully here today?

A. Not that I'm aware of.

Q. Not any medications that might impact that?

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A. No.

Q. Okay. If you don't understand a question at any point during the proceeding, if you could just let me know. I'm happy to try and rephrase it or otherwise restate the question so that you can understand it. Okay?

A. Yep.

Q. And if you don't ask for clarification, I'm going to understand that you understood the question. Okay?

A. Yep.

Q. All right. Now, sometimes I have difficulty with this, and I ask Mrs. Miller to please let me know if I need to slow down.

But please do speak slowly. And, more importantly, please wait until my question is finished before you state your answer so we can have a very clear record and so it's as easy as possible in terms of having a clear transcript. Okay?

A. Yep.

Q. So this deposition constitutes your formal IPR testimony.

Do you understand what that means?

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A. Yes.

Q. Okay. The deposition is obviously being videotaped here today, and it's possible that portions of the video could be played for the judge during proceeding -- as trial proceeds.

Do you understand that?

A. Yes.

Q. Your counsel may object from time to time. And unless you're instructed not to answer by your counsel, it is understood that you are to answer the question that's being presented even if there is an objection pending.

Do you understand?

A. Yes.

Q. Another point is it's important that you do not discuss the subject matter of the proceeding with your attorney during breaks. Okay?

A. Yep.

Q. You are permitted to discuss with your attorney matters of privilege. To the extent that you're -- you're concerned about an answer -- if you think an answer may involve

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some privileged information, attorney-client privileged information, for example, feel free to say you need to consult with your attorney about that issue. I'm happy to oblige.

A. Thank you.

Q. So this proceeding involves U.S. Patent 7,314,167. And I may refer to that periodically as "the challenged patent" or "the '167 patent." Okay?

A. Yep.

Q. I'll also refer from time to time to the so-called "person of ordinary skill in the art."

You're familiar with that term?

A. I am.

Q. And I may refer to it abbreviated as a "POSA" or a "POSITA." Okay?

A. Okay.

Q. And when I use those terms, I want you to understand that I'm referring to a person of ordinary skill in the art as of the March 2005 time frame. Okay?

A. Okay.

Q. So how did you prepare for your deposition here today?

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A. I reviewed my report. I reviewed some of the exhibits that were referenced in the report. Primarily those -- those items.

Q. Were there any exhibits that you reviewed in preparation for your deposition today -- strike that.

Were there any documents that you reviewed in preparation for your deposition here today that were not listed at the beginning of your declaration?

A. No.

Q. Are you familiar with an individual named Kai Johnson?

A. No.

Q. So you never reviewed a declaration of a Kai Johnson in preparation for your testimony or in your preparation of your declaration?

A. I did not.

Q. Okay. Did you do any research in preparation for your deposition?

A. What do you mean by "research"?

Q. For example, online computer research in preparation for your deposition.

A. Online, no.

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I might have used my computer to keyword search things in the documents that were part of the exhibits.

Q. Okay. Okay. But, again, no documents outside of what's already cited in your declaration?

A. Correct.

Q. Okay. Did you have any meetings with your attorneys in preparation for your deposition here today?

A. Yeah. Very brief, just going over the -- how the depositions work.

Q. Was that in person or online?

A. Online.

Q. Okay. Was that -- what days were those?

A. I don't recall.

Q. Was it this week?

A. No. It -- maybe last week, week before.

Q. Okay. About how many hours were those meetings?

A. Half.

Q. Half an hour?

A. Half an hour.

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Q. Okay. Do you have any financial interest in the outcome of this proceeding?

A. No.

Q. So you mentioned you spoke with your attorneys in preparation for this deposition.

Did you speak with anybody who was not an attorney in preparation for your deposition --

A. No.

Q. -- here today?

So before we begin, I -- I wanted to give you an opportunity -- you, obviously, have reviewed your declaration in preparation for your deposition here today.

Was there anything that you saw that you feel is incorrect that you would like to clarify before we begin?

A. Not that is of any relevance. I think maybe part of my CV, some of the stuff I've had -- donated over the years might be out of date a little bit, I realize.

But that, I mean, has no bearing that I'm aware of.

Q. But nothing substantive?

A. Correct.

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Q. Okay. Is there anything you would change in your declaration, as you sit here today?

A. No.

ATTORNEY KRIEGER: So I'm handing you what's been previously marked as Exhibit 2030 in the proceeding.

THE WITNESS: Thank you.

- - -

(Whereupon, Exhibit 2030 was previously marked for identification.)

- - -

BY ATTORNEY KRIEGER:

Q. Which is labeled curriculum vitae, and it has your name underneath it.

Do you see that?

A. I do.

Q. Okay. You submitted this along with your declaration in this proceeding, correct?

A. Correct.

Q. Okay. All right. I'd like to just basically walk through some of this with you.

Could you just briefly tell me a little bit about your educational background?

A. Sure. So I started at Ohio

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University in engineering technology.

The discipline has gone through a name change, so it was industrial technology for a lot of years. It originally started in the industrial arts for high school tech-ed-type teachers.

They would pull those teachers into industry, give them a couple of business classes, and they worked great in manufacturing supervision, things like that, because they understood processes, working with people, communication skills, all the -- all the things you'd want in a line manager, as an example.

And so that program at Ohio University was very much a discrete manufacturing-based program.

While there, the department chair, James Fales, was heavily interested and involved in barcode research. And so he ran a barcode class that I ended up taking my junior year. And that is kind of what got me into the -- the automatic identification industry.

The degree creates a student that is really a technical generalist. So they understand a broad range of topics around

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manufacturing but is not necessarily an expert in any one of them.

So, for example, they're not a machinist. They're not a -- necessarily a computer programmer.

But students that have graduated from the program can go in those directions and continue to further refine their skill sets and become those types of job titles and -- and vocations.

My master's degree was pretty much the same thing. I continued to concentrate on automation and robotics and automatic identification.

That program at Indiana State, which is where I got my master's degree, was, again, a technical generalist in a sense but more the automation concentration at that point.

My -- as I -- as I list here, my final -- instead of doing a thesis, I did a major project. It was integration of barcode scanning for tote diversion and sequencing where totes would go down a conveyor system, and so read the barcode scanner.

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The back-end automation system, figured out where it should go, whether it diverted to Route 1, Route 2, Route 3, things like that.

Q. What's a tote?

A. Just a -- a bin, a plastic stick bin.

Q. Okay.

A. It could have been -- it is representative whether it's a pallet or a product or a box that -- I use FedEx as an example all the time now because I'm in Memphis and so is FedEx-centric. And you get yelled at when you mention the other company.

But yeah -- so that -- those -- those bins, those totes were just representative of something being scanned and decisions being made on it.

My PhD program was technology management. It was developed back in the mid-late 1990s because, arguably and technically, there is no PhD-level terminal degree for engineering technology or industrial technology.

And the folks at Indiana State, along with -- it is a consortium program. So

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Indiana State, University -- East Carolina University, Wisconsin-Stout, University of Central Missouri, and Bowling Green realized that we need these faculty members with terminal PhD degrees.

And so it is a technology management degree, the idea being how do you apply technology solutions to business problems, really, at the end of the day.

My PhD ended up going down a slightly different route from what we're talking about today in that it was on something called coordinate metrology, which is robotic measuring systems.

And so I can talk about that if you want or not.

Q. No. That's okay. Thank you. I appreciate that.

Do I understand that your dissertation for your PhD did not focus on any aspects of automatic identification technology?

A. That is correct.

Q. Okay. So in your -- your doctorial studies, you didn't -- did not focus on barcode scanning in any aspect.

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Is that fair to say?

A. I still would draw it into the class -- classes that I took. A lot of times, if I had to write a paper on something, I would address it from that perspective.

Q. Okay. All right. So after your -- your education -- it looks like you've been a professor. You've been at a few institutions.

Could you walk me through your professional career?

A. Sure. So when I finished my master's degree in 1996, I went to work for a software company doing warehouse management software.

And so the company wrote software for companies like Colgate-Palmolive, Pillsbury, folks like that, for their warehouse management activities, going back into something called SAP, which is an enterprise resource planning system, which is kind of that big, ugly mess software-wise that exists at most companies.

A lot of barcode scanning, as you can imagine, in that because all of the products were barcoded, all of the cases were barcoded, all of the pallets were barcoded.

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And so we were having to scan the barcodes as a way to track specific items, whether it's a pallet or a case or whatever, as it's being put away into inventory, when it's being pulled, validating that the right pallets and, therefore, the right products were going onto the right trucks for shipment.

Because the customers I worked with were the manufacturers, it was generally single products going onto a truck. But, occasionally, there would be mixed products going onto a truck, and they would have to ensure that they got the right quantities of everything on that truck.

And so I did everything -- I joke I did everything but the site surveys.

So I would do traditional project management. I did software development, software design, user training, hardware support, service support, database administration support.

Yeah, I occasionally helped with shipping stuff and expediting shipments coming out of the company, you know, everything but going and doing that initial site survey saying

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where we should put what was then the equivalent of the WiFi access points.

Q. Okay. And then you went to Indiana State?

A. So I did that. Then I went to work for Delphi Automotive as a manufacturing engineer, building equipment to build car batteries. Did that for two years.

That should be -- oh, wow. That is not on there. I apologize.

Q. Oh, that's okay. So between 1998 and 2001?

A. Yeah. I worked at Delphi Automotive as a manufacturing engineering.

I don't know how that has not been noted before. Anyway, so I did that for a couple years.

The automatic identification activities there were minimal. We did still do identification of individual batteries as -- in terms of where they were manufactured and assembled. But after that, I then went back to Indiana State for my PhD.

While doing my PhD, I ended up doing a quick -- or a short stint as an

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instructor when one of the faculty members in the department went on sabbatical and they needed someone to cover the classes. So I took over those classes under -- I think it was a one-year -- might have been one-semester instructor position.

Upon completion of my PhD in 2003, I went to work for what is now the University of Central Missouri. It was Central Missouri State University at the time.

I worked there for two years when I got a call from the department chair at Ohio University, where I started, saying, "Hey, I'm looking to retire. I want someone to come take over the AutoID lab" that he had started back in 1988, because he knew I was interested in being involved in the industry.

I had started -- while in Missouri, I started trying to figure out how do I create a similar lab without really directly competing against Dr. Fales because I felt it was a little -- it wasn't going to be fair to try and go steal activities and stuff that he was doing.

Q. Sure.

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A. Even though that's exactly where -- the space I wanted to be.

So I ended up going back to Ohio University and teaching there for eight years. I ran the Automatic Identification Lab there --

Q. If I could interrupt you for a moment.

A. Sure.

Q. Was that -- your departure from University of Central Missouri, was that of your own choosing or were you denied tenure or -- what was the --

A. It was definitely my own choosing.

Tenure, traditionally, in higher education, is, as you may know, is six, seven years. This was two years in. No problems with the annual reviews.

It was very much a -- I can try to build a lab from the ground up, or I could take one that's been around for the last 15, 20 years, whatever it was at that time. And I decided I was going to be more efficient than trying to start from scratch.

Q. Got it.

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Okay. So you're with Ohio State then?

A. Ohio University.

Q. Excuse me. Ohio University through 2013, it looks like?

A. Yes. Correct.

Q. And then what brought you to University of Memphis?

A. Primarily, I was not getting along with my department chair. I had already gotten tenure, so that was not a problem.

And so I was not happy at -- at Ohio anymore, and so -- the opportunity at the University of Memphis came along. It was a really good fit. They were looking for someone to take over the automation and controls classes because the department chair was having to teach those plus being department chair.

And so they were looking for someone with some fresh ideas and more time to dedicate to the lab. And so -- so I made that move and brought the AutoID lab from Ohio with me because no one in Ohio wanted it.

Q. Who was that department chair?

A. Where?

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Q. At Ohio University.

A. That was Peter Klein.

Q. Okay. And then your -- your work at University of Memphis?

A. So I've been there since -- went through tenure second time. Didn't have any problems with it the second time. I've been running the Automatic Identification Lab since 2013.

2021, '22, somewhere in there, we got a new president of the university, a gentleman, Dr. Bill Hardgrave, who I'd known for a number of years in the RFID industry, became our president, and came over and saw where I was and decided that it was insufficient to the task and actually ended up finding 4,000 square feet, 20-foot ceilings, and then paid to renovate the space for me.

So I have a great new lab space that I get to play in and do all sorts of crazy things with and have been doing barcode and RFID research and working there continually, but also prior to moving into that space.

Q. Okay. Were you working in the automatic identification field at the time of

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the priority date of the challenged patent, around --

A. Yes, I was.

Q. -- March of 2005?

A. Yes.

Q. Is your current research primarily with robotics?

A. No. It's actually barcode first, RFID second as far as dollars and time invested.

Q. You can set that aside.

A. Okay.

Q. Thank you.

Before I proceed, I did want to just let you know, if, at any time, you want to take a break, no problem at all. Just let us know. We're happy to break. We just ask that if there's a question pending, that you complete the answer, and then we can proceed with the break. Okay?

A. No problem.

Q. All right.

ATTORNEY KRIEGER: Actually we can mark this one.

- - -

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(Whereupon, Exhibit 1043 was marked for identification.)

- - -

BY ATTORNEY KRIEGER:

Q. Okay. I'm handing you what's been marked as Exhibit 1043, which purports to be an article entitled [as read]:

"Reed-Solomon Based Bar Code Character Substitution Rates."

Do you recognize this document?

A. I do.

Q. What is it?

A. It is a published peer-reviewed article that I published, whatever the date was -- wow. 2018. Okay -- in 2018 of some research I undertook.

Q. Okay. Can you explain what a Reed-Solomon error correction is?

A. Sure. So in 2D matrix barcode symbologies, to the best of my knowledge, without exception, there is what's called error correction built into them.

And so Reed-Solomon error correction was originally developed, I want to

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say, in the '70s for communications with satellites and for spacecraft by NASA engineers.

And the idea is that in barcodes, if part of the barcode is damaged and unreadable, the Reed-Solomon error correction is able to actually reconstitute the entire message through a series of mathematical calculations and manipulations so that -- in modern world processors, we can have -- Microsoft Word is an example -- tell us not only is a word misspelled and you get the little red triangles under it but you also have the auto-correct functionality.

And so one of the things I'm bad at doing is I keep trying to type t-e-h instead of t-h-e for "the." And so it will auto-correct that because it recognizes what's wrong with it.

The Reed-Solomon error correction doesn't work quite the same way, but it's the same principle and concept in that it will take the entire message, generate what are called error-correction code words, and transmit those -- or include those in the

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barcode. And then when the barcode reader reads the barcode, it will try to read the message.

It will then read the error-correction code words and use those to reconstitute the message. Compared to, say, is it correct, transmit it. If it is not correct, it will correct it and transmit the corrected version.

Q. Okay. Thank you for that.

If you could turn to document page 71. It looks like page 2 of this document.

You can see that in Section 2, it refers to 2D barcode symbologies.

Do you see that?

A. Yes, I do.

Q. Okay. What are -- what is a 2D barcode symbology?

A. So a linear barcode is something where data is encoded in one direction only.

So the UPC code on the side of a Coke can or a bottle of water is a linear.

A two-dimensional barcode is a barcode that has data encoded in multiple

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directions, two dimensions. So horizontally and vertically, traditionally, is the way it's looked at.

The vertical component of a linear barcode is what's is a called vertical redundancy. It's the same message over and over and over going up.

In theory, you could have a barcode scanner that is a laser scanner that goes across. And the height of the linear barcode has to be that tall. And in theory, if you can hold it straight enough, it will read.

2D barcode, you have to read not only across but up and down. And the reason they're generally called "matrix symbologies" is there is a -- a grid or a matrix supplied, and each of those locations is either turned on or off to eventually constitute the message.

Q. Okay. And then there is a table here that lists several types of 2D symbologies; is that correct?

A. That is correct.

Q. And we'll talk about the patent more in a moment, but you probably recall the patent refers to 2D barcodes.

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Do you recall that?

A. I do.

Q. Okay. Is it fair to say that all of these are examples of 2D barcodes?

A. They are all 2D barcodes. PDF417 is normally categorized as a stacked barcode because it does contain, in a sense, linear components.

However, it does still require vertical scanning because those linear components are stacked on each other so that you do have to have that two-dimensional read capability.

Q. Okay. So can you explain to me just generally how the process works in terms of scanning a 2D barcode and obtaining the information derived from that barcode?

A. Sure.

Q. Okay.

A. The process generally is you take a picture of barcode, and you apply a -- a grid to that image. And once you find the barcode, within it, there's a whole separate process for finding the barcode.

Do you want me to go into that?

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Q. Yes, please.

A. Okay. So the processor, after the picture is taken, will search the image looking for key patterns within the barcode.

QR codes are a simple example to explain. And so the three corner images on a QR code are referred to as the finder pattern.

And it's a very intentionally designed pattern of a 11311 as you look across it or up and down it in terms of the number of modules used for that -- for those symbols.

And so what it will do is --

Q. I'm sorry. If I could interrupt you for just a moment.

So in the QR code that's shown on page 2, when you mention a finder pattern, are you referring to the three squares within a square that are shown in the 2D barcode adjacent the QR label?

A. I am.

Q. Okay. Thank you.

Please proceed.

A. Sure.

Once those are found, the software is able to straighten, in a sense, the

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image so it knows which way X and Y are. And it will then apply a grid to that pattern, to that picture.

And it will determine what a module is, which is the single square or single dot, in a sense, within the QR code.

It will determine how wide it needs to be by virtue of the finder pattern, and then it will map all of those locations.

And so each location has either a 0 or a 1 assigned to it as to whether it's dark or light. And so if it's dark, it's a 1. If it's light, it's a 0 or light. The system will then follow what's referred to as the reference decode algorithm out of the ISO standard and go through and decide what the correct pattern is to read the barcode.

It will look at the resulting bit stream, which is the 0s an 1s that have been assigned to each of those modules and attempt to reconstitute the message.

As I mentioned previously, there is this idea of the -- the error correction and -- and code words.

And so, roughly, the left half

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of a QR code is error correction. Roughly, the right hand of the QR code is actually the data, which is why people can put pictures in the middle of a QR code in what has been termed "designer QR codes" where there's a graphic which has no meaning. It's just a graphic that someone has placed inside of it for aesthetic reasons.

But the -- the system will go through in 8-bit sections or clumps, decide what the value of that 8 bits is. Go to the next section, the next section through the data component.

It will then do the same through the covert component. Do the calculations to determine if there were detected errors in the symbol. If there were, it will attempt -- attempts to use the error-correction words to reconstitute the original message and then will transmit that back to the computer or -- or the system that the -- the scanner is connected to.

Q. Okay. You mentioned finder patterns.

Are they also referred to as anchors?

A. Probably, in some literature, you

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could find it that way. But if you read the standard, it's referred to as a finder pattern.

Q. Are you familiar with the term "anchors" used to generally in barcode -- barcode technology?

A. I don't believe I've run across that used in that -- that sense, no.

Q. Okay. Do you have any other publications related to barcodes other than Exhibit 1043?

A. I believe I do.

If you look at my CV, on page 9 of 21 of the exhibit, at the bottom, it said "Select Presentations."

The 2012 -- that's really more of a presentation -- but the mobile AIDC rethinking barcodes.

There is another paper that, apparently, I did not include in this -- and I apologize again -- talking about DotCode, which is another symbology, some research I did along those lines.

And I thought we did a paper -- it might have been a white paper. It may not have been a peer-reviewed. I also --

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Q. If I could --
A. Sure.
Q. -- was that publicly available --
A. Yes.
Q. -- that white paper?
A. If it -- if I did do it as a white paper, and I thought I did, then it would have been publicly available.
Q. Okay. Do you think you could provide that to your counsel --
A. I should be able to, yes.
Q. -- a copy of that?
ATTORNEY KRIEGER: Do you mind maybe following up with us once he provides that so we can have a copy of that?
ATTORNEY GOLUB: This is not a place for you to be taking discovery.
ATTORNEY KRIEGER: I'm just asking if you'd be willing to provide that to us.
ATTORNEY GOLUB: No.
ATTORNEY KRIEGER: Okay.
BY ATTORNEY KRIEGER:
Q. And that paper that you're referring

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to, this white paper, is a paper you published concerning barcodes?

A. Yes.

Q. Okay. Do you recall the title?

A. I do not.

Q. Do you recall any words that are in the title?

A. "DotCode."

Q. DotCode. Okay.

And you say "a white paper."

Was that in a publication?

A. It would have probably been on a website.

Q. Do you know the website?

A. If it's not on the lab's website, it might be on the AIM Global website.

Q. I'm sorry. The what?

A. AIM Global.

Q. What is -- A-I-M?

A. AIMGlobal.org.

Q. Thank you.

Any other articles that you've authored concerning barcodes?

A. The only other one, which I didn't see in here -- and, again, I thought was in

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there -- was on designer QR codes.

Q. And you said that one's not listed here either?

A. I didn't necessarily see that one either.

Actually, I apologize. The DotCode is listed there on page 8 of 21, the first item.

Q. Where -- which page?

A. 8 of 21.

Q. Okay. Great. Thank you.

And then the designer QR codes?

A. Designer QR codes was only a white paper. And, that, I believe is on the lab's website -- or a reference code is. I don't know if -- I don't remember if there's a download to it.

Q. Okay. But you have access to that document?

A. I do.

ATTORNEY KRIEGER: Okay. And, Counsel, would you be willing to provide that document if he provides it to you?

ATTORNEY GOLUB: I'll consider it.

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ATTORNEY KRIEGER: Okay.

BY ATTORNEY KRIEGER:

Q. All right. So I guess what I would ask is would you please provide a copy of that to your counsel, and then we can follow up as -- as appropriate.

Thank you.

ATTORNEY GOLUB: Just as a point of clarification.

When do you want him to do that?

ATTORNEY KRIEGER: In the next week or so is fine.

ATTORNEY GOLUB: I see. Not today?

ATTORNEY KRIEGER: No. Today -- not today is fine.

ATTORNEY GOLUB: I misunderstood your question, then.

ATTORNEY KRIEGER: I mean, if you can access it -- well, if you can access it today, that would be great, if that's possible during a break. And then you can provide it, and then we can take a look at it.

So, yes, I mean, ideally, it

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would be today. But if you can't today, then later is fine too.

THE WITNESS: I doubt I'll be able to get to it today.

ATTORNEY KRIEGER: All right. Thank you.

BY ATTORNEY KRIEGER:

Q. Any other articles that you've authored relating to barcodes that you can recall, as you sit here today?

A. Pardon me.

There's also the article in 2013[as read]:

"Determining QR Code Sizes for Mobile Scanning."

That is on page 9 of 21, the first entry at the top.

Q. Any others?

A. Not that come to mind.

Q. Okay. I'm sure we'll talk about this more later, but does your work relate to image-capture devices?

A. Yes.

Q. You're familiar with that term?

A. Yes.

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Q. What is an image-capture device?
A. A device that uses electronics generally to capture an image, capture a picture.
Q. For example, the images shown on Table 1 of Exhibit 1043?
A. Yes.
Q. You can set that aside.
ATTORNEY KRIEGER: Okay. I'm handing you what has been previously marked as Exhibit 1001, which appears to be U.S. Patent 7,314,167.
- - -
(Whereupon, Exhibit 1001 was previously marked for identification.)
- - -
BY ATTORNEY KRIEGER:
Q. I'm sure you recognize this document.
A. I do.
Q. Okay. This is the challenged patent in the proceeding, correct?
A. Yes.
Q. And you reviewed this patent in preparation for your deposition here today?
A. Yes, I did.

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Q. You can see that there is a first named inventor, Han Kiliccote.

Do you see that?

A. I see that.

Q. Do you know Mr. Kiliccote?

A. I do not.

Q. Have you ever spoken with Mr. Kiliccote?

A. I have not.

Q. Have you ever communicated in any way with Mr. Kiliccote?

A. I have not.

Q. Okay. It also lists a company called Pisafe as the assignee.

Do you see that?

A. I do.

Q. Are you familiar with this company?

A. This specific patent was used as prior art in one of my other cases, so I've heard of it prior to this.

But other than that, no, I've never heard of the company.

Q. When you say one of your cases, you mean one of your patent applications?

A. No. One of my other expert witness

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projects.

Q. Which expert witness project was that?

A. The Shell witness project, 2020 to 2023, expert witness for the defense, Shell, working with the UK legal team.

Q. And it -- that's referenced in your CV?

A. Yes, it is.

Q. And where is that?

A. Under "Consulting Experience," page 5 of 21, the fourth item down.

Q. So this entry in Exhibit 2030 on page 5 refers to expert witness for the defense Shell.

Is that what you're referring to?

A. Yes, it is.

Q. And it refers to a UK legal team.

So, presumably, this was a UK patent that corresponded with the challenged patent; is that correct?

A. Say that again, please.

Q. Sure. So this entry refers to a UK legal team.

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So did this involve an issue of patent infringement under UK law?

A. Yes.

Q. Okay. So, presumably, there was a UK patent involved?

A. I believe so.

Q. Okay. And was that UK patent a corresponding application to what we have here as Exhibit 1001?

A. No.

Q. So you're just familiar with the Pisafe company in connection with that litigation, but it was an unrelated patent; is that right?

A. Correct.

Q. Okay. Who were the parties in that case, aside from Shell?

A. I don't honestly recall.

Q. Do you recall the nature of the patent that was in dispute in that case?

A. Vaguely at best.

Q. What was it about, the patent?

A. I'm not sure what I can and can't discuss about that, honestly.

Q. Yeah. I certainly don't want to --

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you to breach any confidentiality obligations.

A. Right.

Q. But to the extent that information is publicly available concerning this, you know, my question certainly would elicit responses that are publicly available information.

ATTORNEY GOLUB: Counsel, before you ask a question, can I just confer briefly with --

ATTORNEY KRIEGER: Of course.

ATTORNEY GOLUB: -- my client about this? Take a one- or two- or five-minute break?

ATTORNEY KRIEGER: Absolutely. No problem at all.

ATTORNEY GOLUB: Just to make sure I understand the confidentiality issues.

ATTORNEY KRIEGER: Feel free.

Yeah. Let's go off the record.

THE VIDEOGRAPHER: Going off the record, 9:44 a.m.

- - -

(Whereupon, a short recess was taken.)

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- - -

THE VIDEOGRAPHER: We are back on the record, 9:46 a.m.

BY ATTORNEY KRIEGER:

Q. Okay. So, Dr. Berisso, you've had an opportunity to speak with your attorney concerning your confidentiality obligations, correct?

A. Yes.

Q. And you feel comfortable continuing to discuss this matter, subject to those obligations, of course?

A. I'm willing to answer questions that I'm able to.

Q. Okay. I'm actually going to table that for now.

A. Okay.

Q. We'll probably revisit that a little later.

A. Okay.

Q. All right. Any other work that you've done that related in any way to this company Pisafe?

A. No.

Q. Have you ever done any work that

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related in any way to the petitioner in this case, Early Warning?

A. I have not.

Q. Did you speak with anyone at Pisafe concerning this matter?

A. I did not.

- - -

(Whereupon, Exhibit 2029 was previously marked for identification.)

- - -

BY ATTORNEY KRIEGER:

Q. Okay. So I'm handing you what's been previously marked Exhibit 2029. This is your declaration in this proceeding.

A. Thank you.

Q. Now, as we proceed, I'm sure I'll ask questions that you can answer to the extent that you feel comfortable doing so, of course.

I would ask that you not look at your declaration unless you can't recall or can't answer the question otherwise, in which case, I just want to make sure the record's clear, when you're looking at your declaration to answer questions versus answering it as you understand the facts of the case.

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Do you understand?

A. Yes.

Q. Okay.

ATTORNEY GOLUB: I'm just going to put an objection in.

I object with respect to the witness not being able to refer to his declaration whenever he wants to for any reason.

BY ATTORNEY KRIEGER:

Q. Okay. And just to clarify the record, I will permit you to review the declaration at any time you'd like to. I just want the record to be clear when you need to do so. Okay?

A. I'm happy to do that.

Q. Let's turn to paragraph 29, please, of Exhibit 2029.

A. Paragraph 29, you said?

Q. Yes.

Go ahead and review it, just so you can refresh your recollection on this paragraph.

A. Okay.

Q. So here you discuss that it's your

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understanding that [as read]:

"Words of a claim are generally given their ordinary and customary meaning, which is the meaning that the term would have to a person of ordinary skill in the art at the time of the invention."

Is that correct?

A. Yes.

Q. It's also your understanding that [as read]:

"Claim interpretation can involve looking at those sources available to the public that show what a person of skill in the art would have understood disputed claim language to mean."

Is that correct?

ATTORNEY GOLUB: Objection to form.

THE WITNESS: Rephrase that, if you would. I want to make sure I understood that correctly.

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BY ATTORNEY KRIEGER:

Q. Sure. I'm just -- I'm reading quoted language from this paragraph here.

So it's your understanding that [as read]:

"Claim interpretation can involve looking to those sources available to the public that show what a person of skill in the art would have understood disputed claim language to mean."

A. Ah.

Q. Is that correct?

A. Yes.

I forgot about -- I missed when I scanned through it, the "disputed," and that's what I was confused about.

Q. No problem.

And you applied those standards in preparing your opinion in this case; is that right?

A. Yes.

Q. Okay. Let's go to paragraph 77, please.

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You mention here at the top of page 43 of 58 -- when I refer to pages, I'm going to refer to the Bates pages.

Do you know what I mean by that?

A. I do.

Q. Okay. So if there's an inconsistency with numbers of the document versus the Bates pages, I'm going to do my best to refer to the actual Bates numbers. Okay?

A. Understood.

Q. So on page 43, towards the top, you mention -- you refer to an institution decision.

Do you see that?

A. Third line down?

Q. Yes.

A. Yes, I do.

Q. And you mention [as read]:

"The board credited Mr. Purves's testimony that the transaction information derived from the barcode constitutes embedded information."

Do you see that?

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A. I do.
Q. And you -- okay. Then you mention [as read]:
"In this regard, Mr. Purves's testified that it is my opinion that the plain and ordinary meaning of 'embedded' includes information contained in any barcode."
Do you see that?
A. I do.
Q. And then you mention that you [as read]:
"Understand that patent owner accepts Mr. Purves's opinion that embedded information includes information contained in any barcode."
Do you see that?
A. I do.
Q. I found it interesting, the phraseology of that last sentence. You mention that you understand the patent owner accepts

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that opinion.

By "patent owner," are you referring to Intellectual Ventures?

A. Yes.

Q. Okay. Is this also your opinion?

Do you accept Mr. Purves's opinion that embedded information includes information contained in any barcode?

A. Yes.

Q. I mentioned a Mr. Kai Johnson, and I'll represent to you that Mr. Kai Johnson submitted a declaration in the preinstitution stage of this proceeding.

He defined the term "embedded" slightly differently in Exhibit 2001. And I understand from your prior testimony you did not review this document.

But I'll represent to you that he defined the term "embedded" as [as read]:

"Information that is hidden in the image and used to provide security for the transaction."

And for the record, that's Exhibit 2001 at paragraph 91.

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My question for you is:

Do you disagree with that interpretation of the word "embedded"?

ATTORNEY GOLUB: Objection. Scope.

THE WITNESS: Having not read that document, I'm not in a position to have an opinion at this point.

BY ATTORNEY KRIEGER:

Q. Okay. Well, I'm just asking you in your professional experience.

If I said the definition of the term "embedded" was "information that is hidden in the image and used to provide security for the transaction," would you agree with that as a truthful statement?

ATTORNEY GOLUB: Objection. Asked and answered.

THE WITNESS: At this point, I'm not ready to have an opinion.

BY ATTORNEY KRIEGER:

Q. So you have no opinion concerning that?

A. That is correct.

Q. So you can't indicate here today

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whether you agree with that?

A. I will not agree with that, yes.

Q. But will you disagree with that or not?

A. I have no opinion at this point.

Q. Okay. But you'll agree that that language is very different than what you've just testified is the meaning of the term "embedded," correct?

A. I'm going to have no opinion at this point on that.

Q. You can't answer the question?

A. I am not going to provide an opinion at this point.

Q. So you refuse to answer?

ATTORNEY GOLUB: Objection. Asked and answered.

THE WITNESS: I think that having stated that I do not have an opinion at this point is an answer.

BY ATTORNEY KRIEGER:

Q. So you mention in your declaration that the term "embedded" includes information contained in any barcode, right?

A. Yes, I said that in here.

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Q. Okay. But you'd also agree, wouldn't you, that the term "embedded" also includes information beyond barcodes, correct?

A. That is not something I was asked to provide an opinion on, so I do not have an opinion at this point.

Q. Well, let's look at Claim 1 of Exhibit 1001, the challenged patent.

A. You don't have a bigger copy, do you, because of the shrinking of it, by any chance?

Q. I don't.

Do you have an extra copy of it? Or do you have -- if you brought one, an unmarked copy, I'd be happy to replace it. But, unfortunately, that's all we have.

A. No. Mine has doodles and scribbles and notes on it.

Q. Okay.

A. I apologize. I probably need new reading glasses.

Q. Well, I can tackle this a different way. Okay?

A. Okay.

Q. Claim 1 does not mention barcodes.

Would you agree with that?

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A. I do not see the word "barcode" in Claim 1, correct.

Q. Okay. Instead it refers to an image [as read]:

"Having information embedded therein."

Do you see that?

A. I do.

Q. Okay. That image in Claim 1 is not limited to barcodes.

Wouldn't you agree?

A. I would have to agree there is not a limitation.

Q. Okay. And so while embedded may "include," as you state in your declaration, information contained in any barcode, it is not necessarily limited to information contained in any barcode.

Wouldn't you agree?

ATTORNEY GOLUB: Objection. Form.

THE WITNESS: As you read the rest of the patent, there are examples -- there are some examples included that specifically do include barcodes.

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BY ATTORNEY KRIEGER:

Q. Okay. Certainly.

Is it your testimony, then, that Claim 1 is limited to barcode images?

ATTORNEY GOLUB: Objection. Scope.

THE WITNESS: I don't have an opinion at this point on that.

BY ATTORNEY KRIEGER:

Q. Well, I mean, this is the whole focus of your testimony in your declaration. It's really important we understand your position on this. Okay?

You've testified in your declaration that "embedded" includes information contained in barcodes.

And I'm trying to understand if it's your testimony that it is limited to information contained in barcodes or if information contained in barcodes is just one type of example of embedded information.

Which is it?

A. Given the scope of -- and the -- what's the word I'm looking for?

The -- the -- in terms of

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looking at the patent, the examples given specifically show and -- and talk to barcodes as being in the image.

Q. Are barcodes the only examples of images in the patent?

A. I do not recall seeing text in the -- in the patent that talks about other information in the -- other stuff in the image.

Q. So wouldn't you agree, though, that from the language itself in Claim 1, which does not refer to barcodes, that the term "embedded" for Claim 1 refers to any information contained in any image?

ATTORNEY GOLUB: Objection. Form.

THE WITNESS: Say that again, please.

BY ATTORNEY KRIEGER:

Q. Sure.

From the language specifically recited in Claim 1, wouldn't you agree that the term "embedded" refers to any information contained in any image, whether a barcode or otherwise?

ATTORNEY GOLUB: Objection.

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Form.

THE WITNESS: I would not agree to that.

BY ATTORNEY KRIEGER:

Q. Why not?

A. Because you said "any image."

Q. Why does the word -- words "any image" make that an incorrect statement?

A. The way I read Claim 1, [as read]:

"An image-capturing device configured to capture an image."

So it is limited to what was captured by the image-capturing device.

Q. Understood.

But I'm talking about the image that was being captured by the image-capturing device. Okay?

And Claim 1 refers to this. I'm just reading the language from Claim 1 [as read]:

"The image having information embedded therein."

Do you see that language?

A. Yes.

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Q. Okay. That image is not defined in Claim 1.

Wouldn't you agree?

ATTORNEY GOLUB: Objection. Form.

THE WITNESS: What do you mean by "the image is not defined"?

BY ATTORNEY KRIEGER:

Q. The image is not necessarily a barcode -- it could be -- but it is not necessarily a barcode, correct?

ATTORNEY GOLUB: Objection. Asked and answered.

THE WITNESS: The examples in the patent talk to taking a -- capturing an image of a barcode, and that's what it's specifically trying to teach.

BY ATTORNEY KRIEGER:

Q. Okay. So it is your position here today that the word "image" in Claim 1 refers to barcodes exclusively?

A. In the context -- and that's the word I was looking for earlier.

In the context of the patent, it is referring to and is teaching capturing of a

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barcode as part of that image.

Q. So is the answer yes?

A. Based on the teachings, it is images of a barcode, yes.

Q. Okay. So Claim 1, in your view, the term "image" is limited to barcodes, correct?

A. In the context of the patent, yes.

Q. And so the term "image" in Claim 1 could not refer to an image that contained hidden information that is not a barcode.

Is that your view?

ATTORNEY GOLUB: Objection. Scope.

THE WITNESS: The patent talks to capturing an image of a barcode specifically, and so I did not ponder other use cases.

ATTORNEY KRIEGER: Okay. I think this is a good time for a -- a brief break.

Let's go off the record.

THE WITNESS: Sure.

THE VIDEOGRAPHER: Going off the record, 10:03 a.m.

- - -

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(Whereupon, a short recess was taken.)

- - -

THE VIDEOGRAPHER: We are back on the record, 10:19 a.m.

BY ATTORNEY KRIEGER:

Q. Dr. Berisso, are you familiar with the term "digital signature"?

A. I am.

Q. What is a digital signature?

ATTORNEY GOLUB: Objection. Scope.

THE WITNESS: That is more -- that is outside the scope of what I was prepared to talk about.

ATTORNEY KRIEGER: Okay. But -- okay. I'm going to have to -- if this continues, I'll have to ask you to limit it to form objections. Okay? Because it's clear that he's taking counsel from your objections here.

BY ATTORNEY KRIEGER:

Q. I asked you a question, and you said you knew what it meant. So I'm entitled to know what you think it means. So I'm going to

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ask it again.

Please tell me what is a digital signature.

A. It is a digital convolution of data that is usually run through a hash that is unique and allows for a reasonable level of -- of confidence in the signing source.

Q. Okay. What do you mean by "digital convolution of data"? Is that like an alphanumeric string?

A. Generally, it's a mathematical process that is applied to alphanumeric data.

Q. And does -- is the digital signature itself an alphanumeric string of characters?

A. To the best of my knowledge, yes.

Q. Okay.

A. It's not an area I'm an expert on, but it's something that I touch on so I have a more than layman understanding.

Q. Okay. If you could pull up the patent again and go to Column 7.

I'd like you to read, please, lines 49 to 61 to yourself.

A. 49 to what?

Q. Just that paragraph that begins at

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Column 7, line 49.

A. Okay. [As read]:

"The image or video captured"?

Q. Correct.

A. Okay.

Okay.

Q. So this paragraph is referring to what the image may be in the context of the '167 invention.

Would you agree?

ATTORNEY GOLUB: Objection.

THE WITNESS: Please repeat that.

BY ATTORNEY KRIEGER:

Q. Sure.

This paragraph is referring to what the image may be in the context of the '167 invention -- alleged invention?

ATTORNEY GOLUB: Objection.

THE WITNESS: I would agree with that.

BY ATTORNEY KRIEGER:

Q. Okay. And it lists several different types of information, none of which is a

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barcode.

Would you agree?

A. I agree with that.

Q. It includes information such as website, server, terminal, device, structure, or vehicle information; is that correct?

A. It says that -- says that, yes.

Q. Okay. And it also says, "The image may include a digital signature generated by a trusted party" at the end of that paragraph.

Do you see that?

A. It -- I see that, and it does.

However, there's a paragraph -- I thought it was before that. Yes.

However, on the preceding page, Column 5 -- where did it go? I just saw it.

Starting at 21 (sotto voce).

Third sentence [as read]:

"The captured image and/or video information may include a barcode including an one-dimensional barcode, such as a linear barcode or multidimensional barcode, such as a 2D barcode."

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And because of that, my understanding, in the context of the patent, further discussions are relying on that as what that information is being displayed as.

Because the paragraph you reference doesn't say how that information is referenced, so I have to go back to the preceding paragraph.

Q. I'm sorry. I don't understand that logic, but maybe you can elaborate and clarify this for me.

The paragraph here in Column 7, lines 49 through 61, as you've testified, does not mention barcodes.

It is talking about different forms of images, correct?

A. Correct. It says [as read]:

"The image or video captured by the secure device may also include additional information, such as information relating to..."

And it lists some stuff, but it doesn't say how that information is being presented.

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So I'm forced to go back to the paragraph I referred to at 21, which explicitly says that that information is being displayed in a barcode.

Q. Right.

A. That's the logic.

Q. I certainly understand that that previous paragraph in Column 5 does say the image may be a barcode.

A. Correct.

Q. What does the term "may" mean to you? Strike that.

Is there a difference between saying "the image must be a barcode" and that "the image may be a barcode"?

A. Yes, there is a difference.

Q. What is the difference?

A. "Must be" says it has to be. "May be" says that it can be displayed in another form.

Q. Okay. So it doesn't have to be a barcode, correct?

A. Correct. But the -- the problem is that the patent is teaching that it's a barcode and then doesn't clarify other options.

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Q. Well, doesn't it, in fact, do exactly that in this paragraph we just read in Column 7?

It says, for example, last sentence, Column 7, lines 59 to 61 [as read]:

"The image or video captured by the device may include a digital signature generated by a trusted party."

Do you see that?

A. I do.

Q. Okay. So isn't it saying that, in fact, it does show another example?

The image could be a digital signature, correct?

A. How is --

ATTORNEY GOLUB: Objection.

THE WITNESS: How is that digital signature being displayed?

BY ATTORNEY KRIEGER:

Q. In -- presumably, in the alphanumeric way that you just testified, right?

Wouldn't you agree?

A. No.

Q. How else could you display a digital

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signature?

A. It could be done as a barcode, which is what the patent is trying -- I believe the patent is trying to teach.

It can be transmitted electronically, in which case it's not necessarily being displayed.

Q. Well, I mean, clearly an image must be displayed, correct?

Just the general nature of the word "image" requires that you can see it, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: Yeah. I'll agree that the image has to be displayed. It does talk about the image.

How else can the -- by the nature of my understanding of what a digital signature is, I can't envision how you would want to display a digital signature because of the volume of characters and numbers as straight alphanumeric plain text.

It would have -- have to be done in something that's machine-readable, such

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as barcode.

BY ATTORNEY KRIEGER:

Q. Or an OCR reader?

I mean, an OCR reader is machine-readable, right?

A. Yes.

Q. Okay. So you agree then -- okay.

Let's also look at Column 7, line -- the sentence beginning on line 55.

It says here [as read]:

"In addition, the image or video captured by the secure device 100 may include a unique number."

And then it continues, unquote.

Do you see that?

A. I do.

Q. Okay. So here, too, they're saying the image could be a unique number, right?

A. That's what it's saying, yes.

Q. And a unique number is different than a barcode, correct?

A. Yes.

Q. Okay. Are you familiar -- I'm probably dating myself here.

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But are you familiar with, like -- it was actually probably before my time -- like, ring decoders you might get from a Cracker Jack box?

ATTORNEY GOLUB: Objection.

THE WITNESS: Unfortunately.

BY ATTORNEY KRIEGER:

Q. Okay. And how does that work?

A. The concept of a ring decoder is that you have a message that's been transposed, and you use the decoder ring by twisting it to get back to the original message.

Q. Okay. So, for example, a number might correspond to a letter.

Is that fair to say?

A. Yes.

Q. Okay.

A. It's a substitution system.

Q. It's a substitution system where you're substituting something for a letter, correct?

A. Correct.

Q. Okay. In order to form a coded message, correct?

A. Correct.

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Q. Okay. And it can be used to form a message that might be in the form of numbers, which, if you had the corresponding decoder ring, you could use to uncode the message, correct?

A. Yes.

Q. Okay. So using that sort of children's decoder ring, you could create alphanumeric or numeric messages that were -- contained information that corresponded to the actual message being sent.

Fair to say?

A. Yes.

Q. Okay. So alphanumeric -- so in that context, alphanumeric messages could include embedded information, such as a message that was intended for the recipient?

ATTORNEY GOLUB: Objection.

THE WITNESS: Repeat that again.

BY ATTORNEY KRIEGER:

Q. So in that context, a numeric message could include embedded information, such as the message that is intended for the recipient?

ATTORNEY GOLUB: Objection.

THE WITNESS: Yes.

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BY ATTORNEY KRIEGER:

Q. You're the -- are you currently the director of the Automatic Identification Lab at the University of Memphis?

A. Yes, I am.

Q. What is automatic identification?

A. Automatic identification is a collection of enabling technologies that include barcodes, radio frequency identification, magnetic stripe, biometrics, smart cards like what we use with credit cards, mag stripe on the back of a credit card, touch memory, and then a collection of really weird solutions like gait analysis and keystroke analysis.

It's a way to automatically identify something or someone.

Q. Okay. And this might -- you mentioned it might include barcodes, correct?

A. Yes.

Q. All right. Before I proceed along that line of questioning, I do want to come back to the patent again. Okay?

We talked a moment ago before our break about the word "image" in Claim 1.

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Do you recall that?

A. I do.

Q. And if I understood your testimony correctly, it was your position that the word "image" in Claim 1 refers exclusively to barcodes, but correct me if I'm mistaken in that regard.

A. The word "image" in Claim 1 is referring to barcodes based on the context of the patent.

Q. Okay. After having reviewed this paragraph in Column 7 which talked about the image being potentially other sorts of information, potentially unique numbers or digital signatures or a website or server information, isn't it true that the image referred to in Claim 1 could refer to any of those types of information as well?

A. My understanding of the patent is that that would be the information in the barcode.

Q. But you said this paragraph is talking about the image and doesn't mention a barcode, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: But I believe I also qualified that because it doesn't say how the information is specifically placed in the image; it's understood that it's in a barcode.

BY ATTORNEY KRIEGER:

Q. What is it in paragraph 7 that tells you that the information that they're saying is in the image must be in a barcode?

ATTORNEY GOLUB: Objection.

THE WITNESS: The digital signature, more than anything, wants me to find a way to ensure that the correct digital signature information is transmitted to whatever is being -- consuming it.

And the best way to do that, from what the patent is teaching, is through a barcode so that you ensure that this crazy-long alphanumeric string is correctly and accurately captured.

BY ATTORNEY KRIEGER:

Q. Okay. But that's not what this paragraph says.

It says, for example [as read]:

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"The image may include a unique number."

A. Correct.

Q. Barcodes don't include unique numbers, do they?

A. They can.

Q. In what context?

A. Whatever you program the barcode to have in it is what is in the barcode.

And so I could have a barcode say "Coca-Cola." I could have it contain my digital signature. I could have it contain a URL.

I could have it contain pretty much anything that I need it to contain.

Q. Okay. So I think there's a little confusion here, but correct me if I'm wrong.

Claim 1 is talking about an image, and then it talks about the image having information embedded therein. Okay?

A. Yes.

Q. This paragraph in Column 7, line 49, is not referring to the information embedded in the image, correct?

ATTORNEY GOLUB: Objection.

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THE WITNESS: I'm thinking about how to respond to that. May I reference my report real fast, because I think I answer that in the report?

BY ATTORNEY KRIEGER:

Q. If you can answer this without doing so, I'd like you to do so.

A. I'd like to make sure I get my answer correct.

Q. If you -- if you want to testify that you cannot answer without looking at your declaration, then that's fine. You can do so.

ATTORNEY GOLUB: Objection.

THE WITNESS: To ensure that I correctly state what I said in my report, I would like to reference that, yes.

ATTORNEY KRIEGER: Okay. So let the record reflect that the witness cannot answer the question without reviewing his declaration.

BY ATTORNEY KRIEGER:

Q. Go ahead.

A. So I'm referencing the correct place and where I think I need to be.

Can you repeat the question?

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Q. Yeah. I can -- I can rephrase it here.

Claim 1 of the challenged patent refers to an image having information embedded therein.

Okay. You agree with that, right?

A. Yes.

Q. Okay. Would you further agree that the image is a different thing than the information that's embedded in the image?

ATTORNEY GOLUB: Objection.

THE WITNESS: Is the image different than the information embedded in the image? I'm not sure what that question is asking.

BY ATTORNEY KRIEGER:

Q. Okay. What confuses you about that question?

A. The image is what the image is.

Q. Okay.

A. And regardless of what's in it, it is the image.

Q. Okay. But the image contains embedded information, right?

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A. In this, yes, it is.
Q. Okay. And the embedded information is different than the image itself, correct?
ATTORNEY GOLUB: Objection.
THE WITNESS: That's the part that confuses me because, in my mind, if I'm looking at a picture of a can of Coke, it's a picture of a can of Coke.
BY ATTORNEY KRIEGER:
Q. Is there embedded information in a picture of a can of Coke?
ATTORNEY GOLUB: Objection.
BY ATTORNEY KRIEGER:
Q. A picture of a can of Coke does not have embedded information in it.
Would you agree?
ATTORNEY GOLUB: Objection.
THE WITNESS: It can.
BY ATTORNEY KRIEGER:
Q. How?
A. So I would disagree.
Q. How?
A. There's a barcode on a can of Coke.
Q. Okay.
A. And so the information embedded in

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the barcode is part of the picture, and that -- that is the picture.

Q. Okay. So you have an image of a barcode in your can-of-Coke hypothetical, correct?

A. Yes.

Q. And that barcode has embedded information about the product itself, correct?

A. It has embedded information. It may not be about the product, but yes.

Q. Okay. And that embedded information is a different thing than the barcode itself, correct?

The barcode just gets you there?

ATTORNEY GOLUB: Objection.

BY ATTORNEY KRIEGER:

Q. I'm not trying to be tricky. This is what the claim says. I'm just trying to get your understanding of this.

A. The data in the barcode is -- is the barcode -- I guess -- to me, it sounds like you are trying to separate the barcode from the data, yet the barcode -- the embedded data in the barcode is what makes that barcode.

Q. Okay. Okay. I understand that.

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I'm just trying to walk through the claim language and get an understanding of what your interpretation of "image" versus the information embedded in the image is.

In the context of this paragraph in Column 7, which is not -- doesn't mention the word "embedded" anywhere.

It is talking about the image itself, correct?

A. Yes. But, again, in the context of the patent overall, I feel you have to refer back to the Column 5 paragraph that says how is that information displayed.

Q. Does the fact that the paragraph you're referring to in Column 5 uses the permissive word "may" change that conclusion in terms of it could be something other than a barcode?

A. It could be something -- I agree with that, except that the patent seems to limit itself to talking about as a barcode because that's the example they gave. And they don't give an example of something else.

Q. Well, I think you already testified they do.

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They give examples of unique numbers as the image in Column 7, correct?

A. Column 7 does say that, yes.

Q. Okay.

A. But as I think I, again, said previously, I -- I was led to believe, as I read the -- within the context of the patent, that those numbers are -- or those -- that data is being encoded in a barcode.

Q. Even though --

A. My mind is driven in that direction by reading the -- the patent itself.

Q. The patent that uses the permissive term "may" in the paragraph in Column 5 we just referenced?

A. Yes.

Q. Notwithstanding the fact that Column 7, lines 29 through 61, do not refer to barcodes or embedded information at all.

Is that your testimony?

ATTORNEY GOLUB: Objection.

THE WITNESS: Yes.

ATTORNEY KRIEGER: Correction.

Lines 49 through 61.

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BY ATTORNEY KRIEGER:

Q. Okay. Are you, by chance, familiar with a legal doctrine called claim differentiation?

A. No.

Q. Okay. In the patent, you can see Claim 1, which we've already discussed, and you can see Claim 7.

Claim 7 specifies that [as read]:

"The image includes a barcode."

Do you see that?

A. I do.

Q. Okay. And as a general principle, claims in a patent have different scope.

Would you agree with that?

ATTORNEY GOLUB: Objection.

THE WITNESS: That's my understanding. But, obviously, I'm not a patent lawyer.

BY ATTORNEY KRIEGER:

Q. Okay. So if the term "image" necessarily was limited to barcodes, wouldn't you agree it would be unnecessary to have

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Claim 7 which specifically states that the image includes a barcode?

ATTORNEY GOLUB: Objection.

THE WITNESS: That is going to be outside the scope of my opinion because now you're starting to talk about how the legal stuff works.

BY ATTORNEY KRIEGER:

Q. I'm asking logically.

So setting aside the legal aspects of it, logically, doesn't it make sense that if Claim 7 says the image includes a barcode, that Claim 1 must be broader and include other things other than barcodes?

ATTORNEY GOLUB: Objection.

BY ATTORNEY KRIEGER:

Q. Otherwise, there would be no purpose of having Claim 7, right?

A. Again, that's going outside the scope of my opinion.

Q. So you're unable to testify to this issue, logically?

A. I have not given it a thought, so --

Q. Well, you --

A. I don't have an opinion at this

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point.

Q. But you have analyzed and provided your opinion concerning all of these claims that are challenged, so it is within the scope of your testimony.

But I'm asking you here today, logically, doesn't it make sense that it would be unnecessary to have Claim 7 if, in fact, Claim 1 was limited to images including a barcode?

ATTORNEY GOLUB: Objection.

THE WITNESS: That's going -- same answer.

BY ATTORNEY KRIEGER:

Q. Okay. So you're unable to answer?

A. I'm not going to answer.

Q. You refuse to answer?

A. I'm going to continue to state that I feel it's outside the scope of what I was asked to provide an opinion on.

Q. Okay. You did provide an opinion concerning Claim 7, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: I believe that was one of them, but I've have to check.

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BY ATTORNEY KRIEGER:

Q. I'll represent to you that it is, as well as Claim 1.

So I would submit it is within the scope. But if you refuse to answer, that's fine. I'll move on.

I just want to make sure the record's clear that you refuse to answer that question.

Is that true?

ATTORNEY GOLUB: Objection.

THE WITNESS: No. I feel that's not true.

I feel what I'm not wanting to provide an opinion on is how the patent claims get constructed. I provided an opinion on what -- I interpreted what is there as meaning.

BY ATTORNEY KRIEGER:

Q. Okay. I don't understand that answer.

Can you rephrase that? I just don't understand what you just said.

A. I can try.

Q. Okay. Thank you.

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A. So I provided an opinion on Claims 1 and 7 and other claims that are listed in my report that I don't remember -- I didn't bother to memorize as they were actually recorded in the patent.

I did not provide an opinion as to extracting one out and looking at it and saying do you need -- what I think you're asking is "Do you need to have Claim 7 to make Claim 1 work or not?"

Q. Well, you did testify about the meaning of the term "image," correct?

A. Yes.

Q. Okay. I mean, this is all I'm getting at is doesn't the fact that Claim 7 indicates that the image includes a barcode, doesn't that impact your view of the scope of the term "image" in Claim 1?

ATTORNEY GOLUB: Objection.

THE WITNESS: That helps define it, yes.

BY ATTORNEY KRIEGER:

Q. How?

A. As the patent overall tries to teach, you can go ahead -- you can scan an image of a

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barcode that has embedded data therein to get where you need to go with whatever the application that the patent is trying to execute against is doing.

Q. Okay. All right. I'll just move on.

Laser scanning background, we started talking about this a moment ago, your Automatic Identification Lab work.

What is the goal, generally speaking, of your work at the Automatic Identification Lab?

A. So, generally speaking, I kind of list -- the tagline, if you want to call it, for the lab is educate, advocate, and tech transfer. And so it is educating people on the correct and best use for barcodes, RFID, biometrics, whatever the technology may be.

I'm involved in various standards organizations and groups that are associated with standards organizations.

So, specifically, I'm the university and -- I'm the representative for the university, so I tend to say "I."

The university is a member of a group called AIM Global, which is an industry

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association that has the goal of promoting the correct use of barcodes, RFID, and other technologies.

We are -- "we" being AIM are a representative to ISO, which is the international standards organization that holds a number of the standards for barcode and RFID technologies, both from the use and the technical way in which they work.

And so I do a lot of work along those lines on committees. Sometimes it's working to help develop new barcode symbologies. Sometimes it is educational efforts.

I recently did something up in Chicago where we did an AIDC or AutoID 101 class for people in the industry, new -- new hires, people that are working for various companies that may have been hired for their legal expertise or their sales expertise --

Q. Okay.

A. -- and don't have that background in the industry.

Q. Okay. That's good. Very helpful. If that's okay.

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A. Sure.

Q. Okay. Barcodes are -- are one type of automatic identification.

Is that fair to say?

A. Yes.

Q. Okay. If you could turn to your declaration, Bates page 20.

You mention that there are two barcode formats, specifically one-dimensional barcodes such as a linear barcode or a multidimensional barcode such as a 2D barcode.

A. Okay.

Q. What's the difference between a one-dimensional or linear barcode and a multidimensional barcode?

A. So as I believe I had kind of touched on earlier, a linear or one-dimensional barcode is a barcode that encodes data in only one dimension.

Q. And so -- okay. You can continue in a moment.

A one-dimensional barcode is the same as a linear barcode?

A. Yes.

Q. Okay. Sorry. Please proceed.

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A. No problem.

So, yes, a one-dimensional or linear barcode has the information encoded in one direction only, traditionally in the bars and spaces. There are exceptions on what is considered a bar or a space from a technological point of view, but I won't get into that unless you really want me to.

In comparison, a matrix or a stacked two-dimensional barcode uses both horizontal and vertical dimensions to encode the data in a stacked symbology, which is still two-dimensional.

Imagine a bunch of linear barcodes stacked literally on top of one another, and -- so that you have to move up and down the overall height of that barcode.

So terminology-wise, I'll use the term "symbol" to refer to an instance of a barcode, whether it's a QR code or a UPC or any of the other types.

Symbology is the barcode type. And so think of symbology as a language: German, French, Italian, Chinese, Korean, whatever.

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The symbol would be a word in that language.

Does that make sense, that differentiation?

Q. Kind of.

How do you know which language your symbol is?

A. So just like looking at written languages, there are indications and rules that you can look at and say, "Oh, this is obviously English versus Spanish," which is the only language I can slaughter really badly.

And so as I look at the structure of the sentence in English, I look at the structure of the sentence in Spanish, there are indicators, especially if it's a written question. So we have the upside-down question mark, the words, right-side up question mark, generally that's an indicator that "Hey, I'm looking at probably a Spanish sentence." I don't know if other languages do the same thing.

If I look at the barcode, as I look at the bars and spaces, if it's a linear barcode, the ends of it generally have special

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characters that have specific meaning. And I can use them just like a capital letter at the beginning of a sentence in English and a period or the question mark or the exclamation mark at the end of a sentence. And so I know where the start and the end are.

With the barcodes, we have what are called start characters and stop characters. Start character is at the beginning. Stop character is at the end.

Depending on the bar code symbology, some of them cheat and use the same word. Code 39, most famously, is the asterisk. And so -- the asterisk character.

And so it's the same character at each end of barcode. But because you look at the pattern and bars and spaces, you can tell whether I am at the beginning or the end because, as I look at it, the last four elements in a Code 39 are narrow bar, narrow space, wide bar, narrow space, wide bar, narrow space, narrow bar.

And so I can say, "Hey, if I read narrow, wide, wide, narrow on the bars, I know I'm coming from the tail end. If I don't

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see that at the beginning, I know I'm coming from the front end as along, as I go through that full character, I see all the requisite components of it."

And so I'm able to, through that, determine what is my symbology. If it's a matrix symbology, which QR code, Data Matrix, Aztec code. So if you fly enough, unless you're on Southwest, generally the apps will always show Aztec code. It's that square-looking, you know, code that's in one of the exhibits in one of the pictures.

As the barcode -- the decoder engine, the logic that reads the barcode, looks at it, there's something referred to as auto-discrimination, which is probably not a politically correct term anymore. But that's really what -- it's discriminating between the different barcodes inside and saying, "Oh, am I looking at Code 39? Am I looking at UPC? Am I looking at Code 128. Am I looking at Aztec, QR code, Data Matrix?" So and on so forth.

And it's applying the rules around that symbology just like we would do or Google Translate would do. When it looks at

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foreign language text in its translator, it applies the different rules and decides: Does it match? Nope. Does it match? Nope? Does it match? Yes. So it must be this barcode specifically.

Q. Got it. That's really helpful. Thank you.

So what devices read -- can read a one-dimensional barcode?

ATTORNEY GOLUB: Objection. Form.

THE WITNESS: Generally speaking, any laser scanner can read a 1D. And, generally speaking, most imager systems will also read 1D.

BY ATTORNEY KRIEGER:

Q. Okay. And what sorts of devices can read two-dimensional barcodes?

A. For two-dimensional, you are limited to the imager-type scanners because you have to have that vertical component and a -- the term used in the -- in the report was a flying laser, a flying spot.

It's a laser scanner, is not able to capture the information that a 2D

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matrix symbol has because it's not -- it's not designed that way.

Q. Okay.

A. It just doesn't work.

Q. So is it your testimony that it is impossible to use a laser scanner to read a two-dimensional barcode?

ATTORNEY GOLUB: Objection. Form.

THE WITNESS: Yes.

BY ATTORNEY KRIEGER:

Q. Impossible?

A. Yes.

Q. Okay. Could you turn to your declaration, paragraph 81.

A. Yes.

Q. Just wanted to clarify something here actually specifically on the second page of this paragraph. So Bates page 46 of your declaration.

A. Yep.

Q. So at the end of this paragraph here, you use the term "linear barcode scanner" a few times.

Do you see that?

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A. Yes.

Q. Okay. What is that? What is a linear barcode scanner?

A. Especially in 2005, the time frame we're talking about, most, if not all, of the folks in the industry, if you just said "barcode scanner," would assume a linear barcode scanner.

Because the -- the growth of the industry and -- and the development of the industry, originally, we did not have 2D barcodes. We had no way to do it. No one had -- it hadn't been invented.

In the '70s and '80s, the first 2D barcode -- stacked barcodes existed, I want to say, late '80s developed by a gentleman name Dr. David Allais from Intermec.

But as we look at him today, QR code was mid-late '90s. I want to say '97 jumps to mind as a year, but I might be wrong on that.

And so for folks that were in the industry, unless there was a qualifier, when you said "barcode scanner," you're talking about that linear barcode. Because there was

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no other option until these 2D barcodes came along.

Q. Right. But 2D barcodes were very common in 2005 time frame, correct?

A. They were becoming more popular. They definitely were not at the levels they are today.

Q. Right. But, I mean, you just mentioned a moment ago that they were invented -- when did you say?

A. Late '90s.

Q. Late '90s.

A. Mid-late '90s.

Q. Okay. So a decade and a half has -- had gone by from when they were developed. I mean, I was around in 2005. I remember seeing QR codes all over the place in 2005.

Isn't it fair to say that -- isn't it fair to say that QR codes were very common in 2005 time frame?

ATTORNEY GOLUB: Objection.

THE WITNESS: In the industry, I would definitely agree.

Outside in the general public, I would argue that they were becoming

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popular, but a lot of people still did not know what they were. They just knew they were this weird thing that's on -- starting to show up on billboards and things like that.

The exception would probably be Japan where they were a lot more popular. But it still was this weird issue of, at the time, that a lot of people still, even in the industry, didn't think in those terms.

It was still understood that that linear barcode scanner was a laser scanner. And when you said "barcode scanner," unless you said "barcode imager," it was understood that you were talking about the lower-cost laser scanner.

BY ATTORNEY KRIEGER:

Q. Okay. But you've already testified that you can read a 1D linear barcode with an imaging device, correct?

A. Yes.

Q. Okay. And you could do that in the 2005 time frame as well, correct?

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A. Yes.

Q. Okay. And so isn't it fair to say that the term "linear barcode scanner," as used in this paragraph of your declaration, it could be either type of device?

ATTORNEY GOLUB: Objection.

THE WITNESS: No. Because, again, if you talk to someone who's an expert in the industry who's been in the industry for even a few years, they will think "linear" and think "laser."

BY ATTORNEY KRIEGER:

Q. But it could have also been an imaging-based scanner because that was available technology at the time as well, right?

ATTORNEY GOLUB: Objection.

THE WITNESS: The technology was available. But unless you specifically said "imager" or if you said "I need a scanner to scan a QR code," they would not necessarily think to use an imager.

An example that I ran into about that time frame -- actually, it would have been after that.

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Gillette literally had to borrow a barcode imager from the lab at Ohio University to do some testing because they didn't have any and didn't want to have to go buy one.

So it's -- still, even after 2005, it was still very much, in a sense, biased towards that -- that laser scanner when you said "barcode scanner."

BY ATTORNEY KRIEGER:

Q. Okay. But based on your prior testimony that imaging-based scanners were available in the 2005 time frame, isn't it fair to conclude that a POSA would certainly understand that a linear barcode scanner could include either laser-based capture devices or image-based capture devices?

A. I'm going to continue to say no.

Because when you use the qualifier "linear," it tells that person of ordinary skill that you're talking about a laser system, not an imager.

Q. Okay. So it's your testimony that "linear" is the same thing as saying "laser scanner"?

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A. The words are not the same, but they are -- they will drive you to the same place, yes.

I'm not -- I'm not saying "linear" and "laser" are synonymous.

Q. But it's kind of what you just said.

So I'm trying to understand, if it's not synonymous, why is it not synonymous?

A. I'm trying to think of the best way to explain and -- and provide an example.

So to anyone in the industry, if you said, "Hand me a linear scanner," they are going to hand you a laser scanner.

Q. Okay. So let me ask you another question, then.

If you didn't say "linear," if you just said "barcode scanner," "hand me a barcode scanner" in that context, that could refer to either -- or that refers to either a laser barcode scanner or an image-based barcode scanner, correct?

A. Without the word "linear," yes.

Q. Okay. Let's turn to -- let's -- you're familiar with -- presumably, you have an iPhone or a similar mobile phone?

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A. Android, yes.
Q. Android. Okay.
And your Android phone has a camera, right?
A. Yes.
Q. In the 2005 time frame, there were mobile devices, perhaps not as advanced as today, but mobile devices, certainly, that had cameras.
Wouldn't you agree?
A. Limited, yes.
Q. Limited?
A. Yes.
Q. Okay. What do you mean by "limited"?
A. At the 2000 frame, they were starting to become a little more popular, but there were -- I believe there were a fair number of phones out there still that were not -- that did not have cameras.
Q. Okay. But for those that did have cameras, isn't it true that in the 2005 time frame, technology permitted the use of cell phone cameras to image linear barcodes?
ATTORNEY GOLUB: Objection.
THE WITNESS: Yes.

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BY ATTORNEY KRIEGER:

Q. Okay. In your declaration, if you could turn, please, to page 22.

I'd just like to spend a few minutes walking through what's shown in Figure 12 on page --

A. You said 22.

Q. I'm sorry. It's Bates page 25.

A. Apologies.

Q. Okay. You are familiar with this Figure 12 on Bates page 25 of Exhibit 2029, correct?

A. Yes.

Q. Okay. I'd like to just basically walk through this with you just to get a better understanding of what's being shown here.

Can you just start by walking me through each of the -- the steps that's provided in Figure 12?

A. Sure. So kind of -- I want to start with a little bit of a background before we dive into that --

Q. Sure.

A. -- if that's acceptable.

So the way a traditional laser

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barcode scanner system works is the scanner projects a laser beam. Originally, they were true lasers. Anymore, they're LED lasers. So a little bit less fragile and all that stuff.

But laser hits the substrate the barcode is printed on, and the light is reflected back. There is a sensor inside the scanner that is picking up that -- with a filter that's picking up that specific wavelength.

And so what happens is, as that laser dot is moved across the barcode, it -- generally, it's what's referred to as Scan Reflectance Profile, SRP. That profile is what you're seeing at that yellow -- orange, I guess, box level of Figure 12.

And so it's showing you the amount of reflected light that the sensor is seeing. Generally speaking, on those reflectance profiles, the way they are plotted is the y-axis. The vertical is the amount of reflected light. The x-axis is roughly positioned or timed, depending on how you want to look at it.

And so as I scan across it, I'm

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seeing high reflection in the white areas, low reflection in black areas, so on and so forth.

Q. Just to understand, it seems like what I'm looking at as enhanced analog signal here, it seems to be the reverse of that.

A. Yeah, it is. And that's fine.

Q. Okay.

A. And so, generally speaking, that is -- so ignoring the exact picture, that's what's happening. You have this graph that looks similar to that orange box.

This paper that was referenced is talking about an additional process -- I think it's a patent, actually -- additional processing that can be done in that signal, which is why, in a sense, they flipped it. And it's -- the enhanced analog signal is -- as you look at it, a -- a traditional reflectance profile, in a sense, is upside down.

And so as you're looking at it, the high points on the graph are actually the spaces. The low points are the bar.

And so for the average person, it gets very confusing. And so they -- I believe what they did in this -- in this

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reference is they flip it so that it's a little bit more readable and coherent to someone who's not doing barcode signal processing.

So the top layer is showing where the bars and spaces are, showing narrow and wide relative sizes.

Next level down, with the enhanced analog signal, it's showing what the reflectance profile, in an enhanced state, might look like. There could be any sort of processes that have been done, mathematical or otherwise, to that signal to help clean that signal up and make it smoother. Sometimes you get stray light and other things impacting the sensor.

And so instead of a nice clean profile, like we see here, it may be very jagged and rough-looking edges, which make it harder to process.

First differentiated signal and second differentiated signal are getting to additional processing that's happening inside the scanner and is really getting at trying to find the edges of the bars and spaces.

Because at the end of the day,

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the way a barcode works is that -- it's about contrast. And it's the, quote/unquote, dark areas versus the, quote/unquote, light areas.

The cleaner those edges are, the easier it is to determine am I looking at a narrow or a wide bar.

For UPC codes, it's made up of what the specification terms as modules, and so it's a variable width -- actually, it's finite variability. But it can be one, two, three, or four modules wide.

And so if the edge definition is not clean enough, the question becomes "Am I looking at a two-module wide or a three-module wide? Am I looking at one-module wide space, or is it really a two-module wide space?"

And so if I recall correctly from -- from the source that we're looking at here, that is trying to make it easier and faster and more definitive that, yes, I saw what I thought I saw.

And think about somebody writing with a fat Magic Marker and doing it in fairly small print. All that bleed from the marker makes it really hard -- what have I read? Is

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it a 1? Is it a 2? Is it a W? Is it an I? What is it?

And so that becomes the problem with barcode scanning is, depending on what the substrate is, there's what's referred to in the industry as "substrate scatter" where when that laser light hits the -- the surface, the light doesn't cleanly just reflect off.

It hits the surface, and it will actually scatter a little. It will make bars and spaces look different than what they are.

And there's a gentleman, Sprague Ackley, that used to be with Intermec who had -- I think he said it took him, like, three years to build a piece of equipment. Because at Intermec, at the time, they were having problems where their printers were printing something out. And their own barcode scanners -- forget about another brand -- their barcode scanners were having trouble reading it.

And so he did all this work and research and developed what ended up being a NIST-traceable barcode scanner that was crazy stupid uber precise. He used -- he still tells

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stories about being able to pick up blasting -- roadwork for blast -- blasting for roadwork, like, a mile and a half away from the offices when -- on his system when he was trying to do stuff and trying to figure out where this noise was coming from.

But they realized that that substrate scatter is a big problem. And so now in the industry, we have bar width reduction. And so you shave the bars by a little bit so that when you get the scatter, that edge doesn't bleed over too much into the white space between it.

And that's really what -- and believe it or not, that's the shorter version of what this picture is talking about. And then it's taking it to a bottom step where it's converting it from the second differentiated signal into digitized.

And it looks weird in the picture because what they've done is they've isolated the edge -- leading trailing edges of the bars and spaces, and they converted that with the other information back into whether I'm looking at a bar or a space.

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Q. Okay. Okay.

A. I know.

Q. That's actually very helpful, and it does help me understand what's being shown here.

But it's fair to say that the ultimate goal of what's being shown in Figure 12 is to create a digitized output signal, correct?

A. Yes.

Q. And that's what's shown at the bottom of Figure 12, correct?

A. Correct.

Q. Okay. And the digital -- digitized output signal corresponds to the bars that are being scanned, as shown at the top, right?

A. Yes.

Q. Okay. And so the signal rises when there's a bar present, and it drops down when there is a space between the barcodes, right?

A. Yes.

Q. All right. And so the digitized output signal is a visual representation of the light intensity that's detected by the laser-based barcode scanner, right?

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A. Yes.

ATTORNEY GOLUB: Objection.

BY ATTORNEY KRIEGER:

Q. Could you superimpose -- if you were to superimpose the digitized output signal onto the symbol being scanned at the top of Figure 12, you can see that they correspond with one another, correct?

A. Say that again real fast.

Q. Sure.

So you could superimpose the digitized output signal onto the barcode being scanned at the top of the Figure 12, and you could see that they correspond with one another, correct?

A. Yes.

Q. Okay. All right. Let's turn to paragraph 39, please, of your declaration.

ATTORNEY KRIEGER: And are you okay? Do you need a break, or are you okay to --

THE WITNESS: I'm good for the moment.

ATTORNEY KRIEGER: Okay. Because we're switching topics a little

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bit.

ATTORNEY GOLUB: I could use a five-minute break.

ATTORNEY KRIEGER: All right. Let's do it. Let's go off record.

THE VIDEOGRAPHER: Going off the record, 11:16.

- - -

(Whereupon, a short recess was taken.)

- - -

THE VIDEOGRAPHER: We are back on the record, 11:24 a.m.

BY ATTORNEY KRIEGER:

Q. Okay. Dr. Berisso, let's go back real quick to Bates page 25 of your declaration, Figure 12 that we just talked about.

Okay. And a moment ago, you just testified that you could superimpose the digitized output image -- excuse me.

You could superimpose the digitized output signal onto the symbol being scanned at the top of Figure 12, correct?

A. Yes.

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Q. Okay. And so that digitized output signal is a visual representation of what's being shown in the barcode itself, right?

A. Yes.

Q. What is the purpose of generating these digitized output signals?

A. So at the end of the day, the barcode scanner is a digital device, and it...

Everything is ultimately converted back to digital, whether it's an analog signal such as a reflectance or not or a digital signal coming over the cable saying, "Configure me to do something else."

And so the barcode functionally is a digital construct in that it's on or it's off. So I have a bar, or I don't have a bar.

And it's really the gapping between the bars and spaces and the width of the bars and the spaces that allows me to have a data stream encoded in the barcode.

And so you have to convert that analog signal, which is the sensor feed from the photo receptor that's physically in the laser scanner picking up the reflected light back into a digital format that the barcode

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scanner engine and the circuitry is able to process and convert back to a known character, ultimately, for the message.

Q. Okay. You mentioned "photo receptor."

That's just something in the laser scanner that detects when the laser is reflected back.

Is that fair to say?

A. Yes. It's a sensor that reacts to light hitting it. And because there's a filter in front of it, traditionally, for barcode laser scanners, it was a red filter, specifically around 660 nanometers because that's what the original red CO2 lasers that they use for the scanner was based off of.

And so you don't want any light coming into it to be processed. You only want the laser signal functionally coming back to be processed.

And so by putting in that narrow-band filter, you say, "Okay. I only want 660 nanometers wavelength, plus or minus whatever the tolerance is," which allows me to say, "Okay. I'm seeing the laser coming back,

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not the overhead fluorescent lights or the flashlight or the sun coming in through the window or whatever."

Q. Okay. And the image-capture devices we had talked about previously, in some respects, those operate in a very similar way to the laser scanner, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: I would say -- I'd have to say no.

The imager is -- at the end of the day, it's a camera. And so if you go back to traditional film cameras, the film is exposed to light. And the light intensity across the film and across the grains in the film will result in the image being produced ultimately after processing.

On a digital camera, there is a two-dimensional array of sensors that are able to capture light --

BY ATTORNEY KRIEGER:

Q. Those sensors are photo sensors, correct?

A. Yes. And so in a sense, it's an

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array of that sensor that laser scanner uses. However, they're going to be much smaller there, generally speaking, than the laser scanner's sensor.

And each of those sensors picks up certain -- certain light level. Depending on the sensor, it's either picking up RGB or black and white and -- or present absence of light and is not necessarily relying specifically on the laser to illuminate anything.

It's using ambient light or, in some cases, it's using its own illumination. But it is -- it is definitely a different process compared to the -- the linear scanner.

Q. Is that primary difference that you're forming an array of photo sensors as opposed to a photo sensor that is detecting the laser's return?

ATTORNEY GOLUB: Objection.

THE WITNESS: There is a lot more happening on the imager than on the -- than on the -- the laser scanner.

The imager has a couple of issues, one of the big ones being the lens

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in the scanner.

So if you have done anything with traditional photography where you can control focal length and other things and -- in my classes, we talk -- I actually have an entire lecture just talking really about image generation.

And one of the things I impress on the students is that with an imager, you can take a perfectly good barcode or a perfectly good product, image, or whatever you're trying to take a picture of and absolutely destroy it by having the settings wrong because you've got the focal length, iris, the aperture wrong, whatever it is, the focus wrong. Or you can actually take a pretty bad image and make it perfectly usable and perfectly serviceable.

And so one of the examples I show my class is I've got a picture of our cat sitting up on the balcony in the apartment we used to live in. And the only thing in focus is the cat, and everything out is out of focus. And so --

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talking about a term called "depth of field."

And so for imagers, the problem is, if you don't have it set right, you're going to get very widely varying results. So a laser scanner is closer to -- closer to an old-school point-and-shoot camera that probably only some of us remember and -- in that it's fixed focused and it's designed in a way where, within this pretty generous range, it just works.

You can't change anything. You can't adjust anything. It is what it is.

And so the imager, in addition to all of those complications, when I go to do the image processing, before I even try to deal with the barcode, it will have to do a whole litany of things to address whether it is a color image or a black-and-white image.

Because at the end of the day, with three exceptions that I'm aware of, all of the barcodes, whether they are linear or two-dimensional or stacked linear, are based around black-and-white.

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They're not based around color.

Can I print a UPC in red? Sometimes no, actually. I mean, physically, I can print it, but I may not be able to read it.

Whole separate discussion that I won't get into. I'll save you that.

But with the imager, especially because it's a color imager, because a lot of times it's -- and it started happening in the mid-2005-ish time frame. It was cheap enough just to put a color camera into that barcode imager instead of a very specific black-and-white one.

BY ATTORNEY KRIEGER:

Q. Okay.

A. You now have to decide whether you're going to filter it physically or in software, and you have to address some other things before you can even decide "Do I see a barcode?"

Q. Okay. That's good. I'm sure you could continue even longer on that, but let's just go ahead and proceed, too, as we have.

Bates page 21 of your

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declaration, paragraph 39.

You mention here -- you show an exemplary UPC barcode, correct?

A. Yes.

Q. All right. And you highlight different features within a UPC barcode, correct?

A. I do.

Q. And you label them. Moving from left to right, it looks like the barcode here includes a left guard bar, an industry designator, left five characters of code, center guard bar pattern, right five characters of code, check digit, right guard bar pattern, and digits at the bottom; is that correct?

A. That is correct.

Q. All right. What is a guard bar?

A. So a little while ago, I discussed the idea of a start and stop character as the beginning of a sentence, end of a sentence type of scenario.

The left and right guard bar patterns are, for all intents and purposes, the same thing. They're saying, "Hey, I'm at the beginning of my barcode. I'm at the end of my

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barcode."

Nothing else within the barcode is going to match this pattern, this 101 pattern that's referenced. That's what the parenthetical data is getting to so that I know "Oh, I can stop processing."

So if I see something to the left or the right outside -- so, for example, on the image we have, there's a 0 outside of the left guard part -- guard bar pattern -- that's a rough one to say -- that if I draw a line straight through the middle of this picture, would functionally look like additional bars and spaces to the scanner.

And so because they're smaller, because of where they are and how far out they are, the scanner is able to say, "Oh, I can ignore that information. It's not part of the barcode. I need to start at what is functionally that left guard bar pattern."

Q. So why is that 0 there?

A. So that is part of the human-readable text.

Q. What do you mean by that?

A. It's the text that is often placed

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next to a barcode so that if the barcode is sufficiently damaged that it's unreadable, a human at the checkout can still type in the -- the data.

Q. So is that tied to the numbers that are underneath the barcode?

A. It's part of that number sequence, yes. What's encoded here is actually 01234567890, not starting at the 1.

Q. So what is the 0 -- I mean, is that, like, basically telling an OCR reader that there are numbers underneath here so that if you want to OCR it, you can?

ATTORNEY GOLUB: Objection.

THE WITNESS: No. It's just stylistically where they placed it.

BY ATTORNEY KRIEGER:

Q. Well, where is -- I'm sorry. I'm really trying to understand.

What does the 0 mean?

A. The 0 is part of the human-readable text that is the rest of the information that, in this case, happens to have been encoded in that barcode.

Q. But it's not part of the code

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1234567890, is it?

A. Yes, it is.

If you were to take your cell phone and scan that barcode, it should show up as 01234567890.

Q. So the 0 is part of the product code?

If there's -- let me back up.

Does a UPC barcode generally represent a product?

A. Yes.

Q. Okay. So each number corresponds with a different product, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: Yes. The -- the number is controlled by a group called GS1. It's just the letters GS and the number 1.

And there are two components to that number. The first component is the company that owns the product, and the second component is the individual item.

And so a Coke will have one number, and a Diet Coke will have another number.

The first part of that number

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will be the same. The latter part of that number will be different, indicating it's a Coke versus a Diet Coke versus the 12-ounce versus the 16-ounce bottle versus something else.

BY ATTORNEY KRIEGER:

Q. Okay. So is there a specific significance of that first digit that's outside of the UPC code?

A. It's -- again, it's stylistically where the source chose to put it, but it's part of that number. The number really is 0123, not 123.

Q. Why would somebody put it outside of the UPC?

A. Why does anyone stylistically do what they do? There is no reason.

Q. It's purely just a visual choice? It's not like there's, like, a user standard that requires a number on the outside of the UPC code?

A. That is correct.

Q. Okay. Interesting.

So there could be, in theory, different digits all around a UPC barcode if a

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user chose to put them there?

A. That is correct.

Q. Okay. I just would have expected there to be a standardized format for UPC barcodes, but is that not the case?

A. So GS1 has something they call the general specification.

Q. Who is that?

A. GS1.

Q. GS1.

A. And the number after the general specification generally is the year.

So we're on Gen Spec 25. At this time, it would have been Gen Spec 5 for 2005. And they have recommendations on where the human-readable should go relative to the symbol, the barcode symbol.

However, there is no such thing as the GS1 police.

Q. Okay.

A. They have no enforcement capabilities. They have advisory capabilities only. And enforcement actually comes through purchasing agreements.

And so if you're Walmart or

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ShopRite or Kroger or whatever it is, you can say in your purchasing agreement with Coke, "You will follow these rules. And you will do this, and you will do that. And if you fail to do that, we will do what's called a chargeback."

Q. Okay.

A. But there is nothing that says you have to do it a certain way.

Q. Okay. So back to the barcode that you have in paragraph 39.

I just noticed that it says "industry designator," and it puts "0" in parentheses.

Do you see that?

A. Yes.

Q. Is that 0 there telling you that the 0 to the left that we were just talking about is the industry designator?

A. Yes --

Q. Okay.

A. -- in this case.

But it could have been a 1. It could have been a 2, 3. And as you read the rest of that parenthetical and, below it, the

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picture, 0 for grocery, 3 for pharmaceuticals.

We have 0 through 9 that can be placed there. I want to say coupons are 7. 9 is reserved, if I remember correctly.

Q. Okay.

A. But that's just the data construct. That is not driving how the barcode symbol is generated.

Q. Okay. So -- and if you were going to use a -- let's say you were using an image-capture device, not a laser scanner, but an image-capture device to try and decode this information, you'd have to be able to capture an image that had all of these numbers in it, 0 through 0, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: That is incorrect.

BY ATTORNEY KRIEGER:

Q. Oh, it is incorrect.

Why is that incorrect?

A. The -- the human-readable text is not required for the barcode to be scanned.

Q. Okay. Okay. If you were using OCR to decode this image, you would be required to have an image that included the numbers

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01234567890, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: The OCR system would have to be able to see all those numbers, yes.

BY ATTORNEY KRIEGER:

Q. Okay. In the image itself?

A. Yes.

Q. Okay. What is a check digit?

A. So the concept of a check digit is a self- -- I'm trying to figure out how to phrase this without using the word "check digit."

It's a self-validating methodology for determining whether the decoded data from the barcode is correct.

And so in UPC codes specifically, the check digit is a calculation based off the values of the rest of the data in the -- in the barcode.

And you -- and you do some math on it. And when you decode it, the check digit that has been encoded in the barcode has to match -- has to match the mathematically calculated check digit at decode, or the system knows that a mistake has been made and

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something is not correct. And it will reject that decode as a result of it.

Unlike -- we talked earlier about error correction in Reed-Solomon. A check digit is not able to correct the data stream. It just marks the data stream as being invalid for some reason.

And the big issue, especially with UPC, there is -- there are four digits that the symbols are -- the patterns are close enough that there's a higher likelihood, statistically speaking, of a -- of a missed decode where it thinks it's a 2 and it's really a 7 type of a scenario.

And so a check digit is there to help catch those and say, "Hey, what you thought you decoded can't be right because I told you the check digit was 0 and you calculated it as 3." And so that mismatch is -- is the error-detection component.

Q. Got it.

And that number 5 for the check digit doesn't appear in the numeric numbers under the bars and dashes, correct, or spaces -- bars and spaces?

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A. In that image, it does not.
Q. Okay. Is that unusual? Usually, is it included, or is it just something you don't include for OCR reading?
ATTORNEY GOLUB: Objection.
THE WITNESS: It is -- it's not a direct comparison, I think, is the easiest way to phrase that.
BY ATTORNEY KRIEGER:
Q. So is it just -- it's just not necessary to use the check digit when you're doing OCR?
ATTORNEY GOLUB: Objection.
THE WITNESS: It's a question of how you choose to process the data.
BY ATTORNEY KRIEGER:
Q. Okay. So you could use it as one of the numbers provided under the bars or it might not be; is that correct?
A. So remembering that the numbers are not required for the barcode, the OCR can choose to have that or not have it if you know that your system is constrained to only reading UPC codes.
Q. Okay. I'd like to talk a little bit

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more about the guard bars here.

They seem to extend a little above and below the code that's included in the bars and spaces, correct?

A. In this image, yes.

Q. Why is that?

A. So that is, generally speaking, a stylistic choice more than anything else. Functionally, they do not, for scanning, technically have to be there.

The way a UPC symbol is decoded is a little bit different than most other barcodes in that it's designed to be decoded in halves. And so there's the left half and the right half. Then it talks about left five characters, right five characters in the image.

And the idea is that the early barcode scanners at checkout, as the product is spun in space, you need to make sure you get the laser to cross all the bars and spaces in the symbol.

By designing it the way they designed it, a UPC code can actually work on the left half by itself and the right half by itself independently. And they call them

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strikes.

And so if I get a full strike across all of the left half and all of the right going from either the left guard to the center guard or the right guard to the center guard, I can process that barcode in two operate halves and reassemble the message.

Because the way the UPC codes work at the encoding level, the -- the bars and spaces, there's parity functionally assigned to them in the way the combinations of bars, spaces, and narrow-wide modules are assigned, constructed, whatever you want to call it. And so I can tell am I on the right half or on the left half.

And so, generally speaking, common practice is to put the -- the guard bars, left, right, or center -- at least left or right -- below the symbol. You can put them above the symbol. You can actually functionally remove them altogether.

I've seen stylistic versions of UPC codes that will work, but not as well, where I want to say it is done as a fish. And I've seen them -- also Coke was really bad

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about this. They would do it as the Classic Coke shape -- Coke bottle shape that they trademarked.

And so they put the UPC code in that, which causes problems when it comes to scanning it because you no longer have what's referred to as -- as over-tall halves, which make it -- makes it harder to scan at a laser point of sale, which is traditionally what it is used at.

That's changing because of some efforts in the industry. Now we're moving towards imagers at point of sale.

Q. Okay.

A. Whole other discussion, obviously.

Q. Yeah. We'll talk, I'm sure, a little bit more about image-capture devices and OCR.

But, you know, a moment ago, we just talked about OCR and how, if you are going to OCR what's shown in paragraph 39 of your declaration, you'd have to first take an image of this barcode, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: You would have to take an image of the text that -- that is

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printed around the barcode.

BY ATTORNEY KRIEGER:

Q. Right. And in doing so, especially since the 0 is shown on the left center portion of the barcode, you'd have to be able to take an image that would include part of that barcode, correct?

A. Yes.

Q. Okay. And just for clarity, the numbers that are indicated underneath the bars and spaces of what's shown in paragraph 39 of Exhibit 2029, those correspond with the information contained in the bars and spaces themselves, correct?

I can restate that if you need me to.

A. Yes, please.

Q. I mean, I think this is a given, but I just want to make sure that I -- I am correct on this.

The numbers that are indicated underneath the bars and spaces of what's shown in paragraph 39 of Exhibit 2029 correspond with the information that is contained within the bars and spaces themselves?

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ATTORNEY GOLUB: Objection.

THE WITNESS: So without scanning it to confirm it -- and I'll be honest, I did not think to double-check that image. We pulled it out of the source --

BY ATTORNEY KRIEGER:

Q. Sure.

A. -- whatever the source was. I don't recall.

Because the -- the image -- the picture shows and talks about the check digit of 5, assuming that that is correct, the text that you see -- the numbers you see in that picture are most of what's in the barcode.

The 5 is encoded in the barcode as well. They just chose, again, not to bother to display it in this picture, for whatever reason.

And so if you were to decode this and compare it to the text -- the numbers you see, the values will be different. It will have that appended 5 that is not -- that is referenced but not showing.

Q. Okay. Well, that makes sense, then.

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You're right. The 5 is not included in the numbers beneath it.

But isn't it fair to say that the numbers underneath the bars and spaces should correspond with the product that is reflected by the bars and spaces?

A. They can, but they don't have to. Because, again, the -- the human-readable text that's there is not required for the barcode to work.

Q. Right. But can you give me -- why would somebody want something different in the numbers below a barcode?

A. If you look at a QR code that says "scan me," nowhere in that QR code are the words "scan me." It's -- generally, it could be a URL or something else that is of interest and importance to the person doing the scanning.

Q. Well, let's talk about linear barcodes, like the UPC code specifically.

The numbers underneath the UPC code, why would you ever have a situation where you would be directing to a different product with the numbers underneath the barcode than

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what the barcode is encoded to reflect?

A. If we're truly constraining it and confining it to just UPC, there is no good reason to do that.

However, expanding that just slightly to linear barcodes, one of the things we used to do at the software company I worked for was the locations that you had to scan had a barcode. And that had an embedded L at the beginning of every value.

And so if the location was ABCD, the label printed "ABCD" in the barcode. But when you scan the barcode, it came back as actually "LABCD" so that the software that was processing the scan could determine and confirm that, yes, I scanned a location barcode instead of something else because I'm feeling lazy, and I don't want to walk or drive all the way over to that location to do the pick.

Q. Got it. Okay.

Okay. And just to confirm, a UPC code is a type of one-dimensional or linear barcode, correct?

A. UPC/EAN is the full name for the symbology, yes.

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ATTORNEY KRIEGER: Okay. Let's go ahead and -- and break for lunch --

THE WITNESS: Okay.

ATTORNEY KRIEGER: -- before I get into the next section.

THE VIDEOGRAPHER: Going off the record, 11:53 a.m.

- - -

(Whereupon, a lunch recess was taken.)

- - -

THE VIDEOGRAPHER: We are back on the record, 12:58 p.m.

BY ATTORNEY KRIEGER:

Q. Okay. Good afternoon, Dr. Berisso.

Just following up, did you have any discussions with your counsel during the break concerning the substance of your testimony?

A. No.

Q. Okay. Thank you.

We were talking before lunch about UPC codes.

And I just wanted to ask you if you had a UPC code that was not on a product

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but it corresponded to a product, could you tell what that product was by looking at the UPC code?

A. It can be done but not by someone normal.

Q. Okay.

A. You could memorize the patterns and, theoretically, look at them and say, "Okay. That's a 1. That's a 3," and you could do that if you were so inclined. I cannot.

Q. Okay. Well, let's say you could -- the numbers were provided at the bottom of the bar and spaces. Okay?

A. Yep.

Q. In that case, you could see the number.

Could you tell what product that was?

A. Again, if you memorize enough, yes, you could because you could memorize what Coke's company code is and what their appropriate item reference value is for that company code for that product and be able to say, "Oh, it's a Coke. It's a Diet Coke. It's a Poland Spring water," whatever.

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But, again, unless you are one of those people that have a photographic memory or way too much time on your hands, I don't envision how someone could look at the number in the abstract and say, "Oh, that must be a can of Coke."

Q. Okay. So if, generally speaking, an individual can't tell what the product is from the UPC code alone, how do they figure out what the product is from that code?

A. So the UPC code is what the industry terms as a license plate. And so the idea is there is a master database.

I mentioned a company called GS1 before lunch. They are the holders of the master database.

And you subscribe to their database. You download it into your computer system. And in it are all the UPC codes that have been assigned and declared along with what the descriptions are so you know what that means.

Then at cash register point-of-sale level, you would scan the barcode. And the system is designed to go do a

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lookup and say, "Okay. 04963406 is a can of Coke Original 12-ounce," blah-blah-blah-blah.

And in my database that I maintain as the company selling the product, I am going to charge a dollar for it.

Q. Okay. And so is it fair to say that if someone were to scan a barcode, the software in the device would typically go to a lookup table and find what the corresponding product was based on that information?

A. For UPC codes?

Q. Yes, for UPC codes.

A. Specifically for UPC codes, yes.

Q. Okay. And so have you ever -- do you have a -- a barcode scanner on your -- your mobile phone?

A. I do.

Q. Have you ever used it?

A. Yes.

Q. Okay. Do you use it a lot with work or -- or no?

A. Yes.

Q. Presumably, if you're in this field, having an easy-access device would be handy?

A. Correct.

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Q. All right. So the information contained in the barcode corresponds to a product; is that right?

A. By virtue of the database, yes.

Q. Okay. And so that information, by virtue of the database, is embedded in the barcode, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: If you mean that after decoding the barcode and doing the database lookup, yes.

But the data from the database is not -- the rest of the data is not in the barcode. It just says, with your license plate on your car, there's really -- maybe there's a little bit of intelligence in what the data on your license plate is, if you're in a rural enough area where they don't need a lot of license plates.

But in New Jersey, it's just whatever that next random number happens to be. And until you've done the lookup, there is nothing associated with the license plate versus the car versus the

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owner or anything.

BY ATTORNEY KRIEGER:

Q. Okay. So the product information is contained in the software that's used to decode the barcode, correct?

A. No.

Q. Where is it, then?

A. The product information is in the database.

Q. Okay.

A. And so the software that decodes the barcode really is separate from the software that does everything else.

Q. Okay. So the product information is contained in the database that is used to decode the barcode, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: I think that's still wrong.

So the information in the database and -- is -- is accessed by software. That software will also potentially access the barcode scanner functionality and pull it out.

Or the other way to do it is

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what's referred to as a wedge solution, where whatever is active, whatever has a focus -- whether it's Word, whether it's a website, whether it's something else, a custom software package -- whatever has focus -- excuse me -- receives what the barcode scanner has transmitted out.

BY ATTORNEY KRIEGER:

Q. Okay. I do understand the distinction you're making here.

So how about this? The product information is contained in the database that is accessed to decode the barcode; is that correct?

A. No, because it's not used to access the barcode.

The barcode -- the decoding of the barcode is a separate event by itself, if I'm understanding what you're saying correctly.

Q. Well, you have to access a database in order to find what is encoded in the barcode, correct?

A. No. What is encoded in the barcode is -- if we're talking about a UPC code is that number. And that number is what it is by

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itself.

The data that says it's a can of Coke versus a bottle of water is in the database, and that is totally separate.

It's -- I have nine digits that I give you, 9016784300. Without context --

Q. Yep.

A. -- it has no meaning.

Q. Okay.

A. With context, knowing it's a phone number, you can then do a lookup that says, "Oh, this is Dr. Berisso's phone number at his office for University of Memphis."

But those numbers by themselves are not -- they're separate. And so if I encode the phone number in my barcode, when I decode it, all I've done is retrieve those numbers.

Until I use additional software to go say, "What does this number stream or this character stream mean," we don't have anything else about what that product is.

Q. Got it. Got it.

So if I'm understanding you correctly, when you are scanning a barcode,

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it's a two-step process.

The first is decoding the barcode to arrive at the numbers that correspond with the barcode, and then the second step is to go to a lookup table and access what the product information is from those numbers; is that correct?

A. Yes, if the goal is to do point-of-sale purchase.

Q. Okay. And for OCR purposes, if you were to take an image of a barcode containing -- containing numbers at the bottom, the OCR would, similarly, go to those databases and find the encoded product information from those numbers?

A. Correct.

ATTORNEY GOLUB: Objection.

THE WITNESS: Yes.

BY ATTORNEY KRIEGER:

Q. Okay.

A. If that's what the software was designed to do.

Q. Fair enough.

ATTORNEY KRIEGER: Okay.

Let's -- I'm going to introduce an

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exhibit.

- - -

(Whereupon, Exhibit 2012 was previously marked for identification.)

- - -

BY ATTORNEY KRIEGER:

Q. So I'm handing you what's been marked as Exhibit 2012.

A. Thank you.

Q. Which purports to be definition of the word "image."

A. Okay.

Q. Are you familiar with this document?

A. I believe that is the one that I reference in my report, yes.

Q. That's right.

Let's look your declaration. If you could open that up side by side, Exhibit 2029. And turn to Bates page 39.

Are you there?

A. Yep.

Q. Okay. And at the bottom of this page, you can see footnote 4.

Do you see that?

A. I do.

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Q. Okay. And it appears to be your definition of what the term "image" means to you.

Is that fair?

A. Yes.

Q. And you cite to this Exhibit 2012 in this footnote 4, correct?

A. Correct.

Q. And it's your opinion here, as you sit here today, that this is the proper construction of the term "image," as it is used in the challenged patent, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: Yes.

BY ATTORNEY KRIEGER:

Q. And you pulled this information in footnote 4 from Definition 1A of Exhibit 2012, correct?

A. Yes.

Q. Okay. You would agree, wouldn't you, that various dictionaries provide different definitions for the term "image," right?

A. I would not be surprised if there was a slight deviation.

Q. Okay. Did you consult any other

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dictionary definitions of the term "image" when you were preparing your declaration?

A. Not that I recall.

Q. Do you recall why you chose this one in particular?

A. I don't recall whether it was the first one that came up or -- I grew up with Merriam-Webster's dictionary, so it kind of would be a knee-jerk unconscious decision.

Q. So did you find this exhibit?

A. I -- yeah. I did look that up at one point, yes.

Q. Okay. So this Exhibit 2012 was actually previously cited by Kai Johnson in his declaration before the institution stage.

Were you involved in this matter prior to institution?

A. What do you mean, "prior to institution"?

Q. Were you involved in this case when Kai Johnson's declaration was prepared?

A. No.

Q. Okay. So was it a coincidence that Kai cited to the same "image" definition that you cited to?

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A. Yes.

Q. You just happened to independently find the same one?

A. Yes. Because it's a standard definition on the website.

Q. Okay. Were you aware that Kai Johnson cited to Exhibit 2012 in his declaration?

A. I was not.

Q. Was this document, Exhibit 2012, provided to you in connection with your preparation of your declaration?

A. I don't recall either way.

I do know that I did some basic research at one point to look up, among other things, the word "image." And, yeah, I tripped across this, and so I probably said, "Yep. Close enough."

But the fact that it had been previously used, I was not aware.

Q. Okay. And there are a total of, it looks like, nine different definitions for the term "image" in this document, Exhibit 2012.

Do you see that?

A. I do.

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Q. You only quoted the first one.
Is there a reason for that?
A. It probably would have been because it seemed to fit my needs, and so I didn't worry about alternative expanded-upon definitions.
Q. What do you mean, fit your needs?
A. I was asked, "Okay. How do you define 'image'?"
I probably, during a call, gave an answer. They said, "Can you cite that?"
I would have gone to Google and typed in "image" and sorted through the silliness that Google throws up there. And once I saw Merriam-Webster, I said, "Okay. I trust them" type of scenario and said, "Yes, that coincides with what I would have, without citation, expected to see as a definition of 'image'" and stopped there.
Q. Okay. Are there any other definitions here in Exhibit 2012 that you think are equally applicable to the use of the term "image" in the challenged patent?
A. Because I stopped at 1B, technically, I guess, I don't think I have an opinion at

this point as to whether or not any of the others are -- what's the word I'm looking for -- I guess sufficient or equivalent.

I never -- I have not spent any time thinking about it.

Q. Okay. So you didn't review any of the other definitions that are provided here in Exhibit 2012 in connection with preparing your declaration.

Is that your testimony?

A. Not that I recall. That's correct.

Q. Okay. Well, you do testify concerning the meaning of the term "image."

A. Yep.

Q. And you provided this document. So it's certainly within the scope of your testimony.

I'd like for you to please go through these definitions and provide for me today your thoughts on which of these definitions could be applicable to the challenged patent's use of the term "image." Okay?

A. Okay.

Just to make sure I'm answering

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the question correctly, can you read it back to me again?

Q. Sure.

So I'd like for you to please go through these definitions and provide me your thoughts on which of these definitions are applicable to the interpretation of the term "image," as used in the challenged patent.

A. Obviously, the one I cited, which is 1.

Q. Uh-hum.

A. And I would say 6.

Q. Okay. Any others?

A. I would have to say 1 and 6 are the two I'm most comfortable with.

Q. Okay.

Okay. The Definition 6 refers to a graphic representation.

Do you see that, "vivid or graphic representation or description"?

A. Yes.

Q. What is meant by the word "graphic" there?

ATTORNEY GOLUB: Objection.

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BY ATTORNEY KRIEGER:

Q. In your opinion?

A. So without using the word "image," I'm not sure I could come up with a description of that. It seems to be somewhat self-referencing --

Q. Okay.

A. -- in my mind.

Q. Okay. In your declaration, you mention, again, Definition 1. And you specifically refer to the term "image" as meaning [as read]:

> "A visual representation of something such as, 1, a likeness of an object produced on a photographic material; or, 2, a picture produced on an electronic display, such as a television or a computer screen."

Is that correct?

A. Yes.

Q. Okay. So in essence, the term "such as" in that definition provided two examples of information that could constitute an image.

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Is that fair to say?

A. Yes.

Q. But there may be other examples outside of that scope that also constitute a visual representation of something, correct?

A. Yes.

Q. Okay. The example provided in Definition 1A2 of Exhibit 2012 refers to an electronic display.

Do you see that?

A. I do.

Q. Now, an image-capture device might include a display that shows what the camera is looking at, correct?

A. That is correct.

Q. Okay. But it might not also, right?

A. Correct.

Q. Okay. Can you explain in what circumstances might it not?

A. So, yeah, I can't come up with an example that this would happen.

A barcode imager will not show on the device itself what it is seeing. The only exception might be is if you have software that is connected to that device and, through

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the cable, you're forcing the device to project what it sees into that software for usual configuration purposes.

But I'm not aware of any barcode scanners that have a imager -- or an image display device built into it.

I guess, technically, if you're going to call a cell phone a barcode imager, it might show the -- what the camera is seeing.

Q. Okay. Fair enough.

And the reason that the imaging device typically doesn't include a display of what it's looking at is because it doesn't need to in order to process the information, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: So, generally, barcode scanners are using the minimum amount of computing power required to keep the price of the device as low as possible and as affordable as possible.

And as a result of that if there's no need to have the equivalent of a viewfinder, they're not going to put one on.

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BY ATTORNEY KRIEGER:

Q. And when you say "viewfinder," what are you -- I'm talking about like a digital display.

Same thing as a viewfinder?

A. Potentially, yes.

Q. All right. Thank you.

A. Camera terminology.

Q. The definition also refers to photographic material.

Do you know what's meant by that?

A. I would assume it -- and assumed that it is talking about photographic paper specifically.

Q. Okay. I think you have a copy of the patent there. Again, apologies for the small text size.

A. Okay.

Q. Could you please turn to Column 10, line 33.

Okay. Now, I'd just like for you to please read to yourself Column 10, line 29 through line 36. And then I'll ask you some questions about that.

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A. Okay.

Q. And feel free to review Figure 7 in connection with this discussion, as needed.

A. You said starting at 29, right, that paragraph?

Q. Yes.

A. Okay. Thank you.

Okay.

Q. Okay. So this section of the patent, in its discussion of Figure 7, refers to a printed form 700.

Do you see that?

A. Yes.

Q. And printed form 700, in Figure 7, appears to be -- looks like a cover fax sheet.

Do you think that's fair to say?

A. I would call it that, yes.

Q. And it also refers to an image 710.

Do you see that?

A. I do.

Q. What is the image 710?

A. It appears to be a QR code.

Q. It's a QR code on the fax cover page, document 700, correct?

A. That is correct.

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Q. Did you review this figure in connection with preparing your declaration?

A. Yes. I did not concentrate on it specifically, but I did review the entire patent.

Q. In the image 710 shown on Figure 7 is a barcode in printed form, correct?

A. It's a 2D matrix symbology, yes.

- - -

(Stenographer clarification.)

- - -

BY ATTORNEY KRIEGER:

Q. So in the '167 patent, the term "image," as you can see here, is used to refer to what's shown on a printed document, correct?

A. Yes.

Q. Now let's look at another section of the patent, Column 5, line 24 through 30.

And just let me know when you're done with that.

A. 24, you said?

Q. You can read the whole paragraph if you'd like.

A. Okay.

Q. Beginning at Column 5, line 21

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through line 32.

A. Okay.

Q. Okay. Here you can see the use of the term "captured image."

Do you see that?

A. I do.

Q. And the term "captured image" in Exhibit 1001 refers to the image on the paper, right, since that's what's being captured by the image-capture device?

ATTORNEY GOLUB: Objection.

THE WITNESS: Okay. Sorry. You threw me with the 1001.

BY ATTORNEY KRIEGER:

Q. Sorry.

A. Say that again.

Q. Sure. No problem.

The term "captured image" in the challenged patent refers to the image on the paper, since that's what's being captured by the image-capture device?

ATTORNEY GOLUB: Objection.

THE WITNESS: To the image on Figure 7, specifically 710, I believe that is correct.

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BY ATTORNEY KRIEGER:

Q. And as I think we've already established, you can use a laser-based barcode scanner to scan a printed barcode, correct?

A. If it is a linear barcode, yes.

Q. And as you indicated, the challenged patent uses "image" to refer to the printed barcode, right?

Although here it is a QR code, assuming it was a linear barcode, as you just clarified.

Isn't it fair to say that the challenged patent uses "image" to refer to the printed barcode?

A. Yes.

Q. And so isn't it true that a laser barcode scanner can scan an image, such as a UPC barcode, as the term "image" is used in the '167 patent?

A. Is the image assumed to be the paper, or is the image assumed to be the captured image?

Q. I thought you just testified that they were the same.

Are they different?

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A. So the laser can specifically scan the printed paper version.

Q. And the printed paper version is the image, right?

A. The image that has been captured, yes.

Q. Right. Because we -- as we've talked about before, the patent refers to the printed barcode as being the image, right?

So that is what is being imaged by the imaging device?

A. Yes.

Q. Or in the case of a -- well, yeah.

Okay. So I just want to make sure that I understand your position on this because I feel like we've gone back and forth.

Is it true that the captured image is the same as the image that's on the printed document --

ATTORNEY GOLUB: Objection.

BY ATTORNEY KRIEGER:

Q. -- according to the challenged patent --

A. Yes.

Q. Okay. And you would agree, then,

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that a laser barcode scanner can scan an image, such as a UPC barcode, as the term "image" is used in the challenged patent, wouldn't you?

A. Yes.

Q. So let's talk a little bit about OCR reader. We touched on this earlier. Just let me -- I want to back up a little bit.

You mentioned earlier that you have a mobile phone and it presumably has a camera and you've used apps in your phone to image barcodes, correct?

A. Yes.

Q. Are you familiar with the term "scanner module"?

A. Yes.

Q. What is that?

A. So, generically, within a device, there are multiple modules. They are subsystems or components that make up the greater whole.

In a laptop, there will be a display module, a keyboard module, a speaker module, a camera module.

In a barcode scanner, there will be a scanner module. That is what is industry

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termed the scan engine.

Q. Okay. And is that for imaging-based camera devices?

A. That is for both linear and imager. They work differently, but they both will have a scanner module.

Q. Okay. What about if it was specifically a scanner module in a cell phone? That would be referring to an image-based scanner; is that right?

A. So if you're talking about a cell phone, the scanner module would most likely be considered the software that resides on the cell phone to do the decoding component of that image-capture process.

And so the camera would be able to take a picture. The application would be able -- the scanner module application would be able to trigger the cell phone to take a picture.

And that module -- which would be software only, not hardware, in this case -- would ingest that picture, determine if there's a barcode in there, determine if it's able to read the barcode and, if so, do whatever it was

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configured to do with the data that it extracted out of the barcode.

Q. Okay. All right. Let's shift gears to the OCR aspects.

I think we've established this, but isn't it true that an OCR reader is an image-capture device? Let me strike that.

Isn't it true that an OCR reader requires an image-capture device?

ATTORNEY GOLUB: Objection.

THE WITNESS: To the best of my knowledge, yes.

BY ATTORNEY KRIEGER:

Q. Why is that?

A. There could be solutions that work with OCR that did not capture an image.

Q. That seems to be contrary to what you just said. So let's make sure I understand.

So I asked you:

"QUESTION: Isn't it true that an OCR reader requires an image-capture device?"

And you said:

"ANSWER: To the best of my knowledge."

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And I said:

"QUESTION: Why is that?"

Then you said:

"ANSWER: There could be solutions that work with OCR that did not capture an image."

A. So think about old-school credit cards --

Q. Okay.

A. -- and the impression machine. That does not necessarily have to capture an image. You could theoretically have a system that used OCR on the numbers off of your credit card impression.

Q. Okay. I see.

But in order to OCR it, in the example you just gave, you'd have to take an image of that in order to have the numbers digitized and be able to OCR them, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: You could use the raised surfaces and sensors to determine what those values are and not have what we or anyone reasonably would consider an image or image capture.

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BY ATTORNEY KRIEGER:

Q. Okay. But in the context of what we're talking about here with the challenged patent and the Wang reference, which I know you talk about, the Wang reference mentions OCR readers, correct?

A. Correct.

Q. So in that context, those OCR readers would use an image-capture device, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: I would expect them to, yes.

BY ATTORNEY KRIEGER:

Q. Is there a difference between an OCR reader and an OCR scanner? Are they the same thing?

A. I would -- I would expect someone to use the two interchangeably.

Q. And so an OCR reader or scanner would take an image of numbers or text. And then that image would be analyzed, presumably by software, in order to provide digitized information corresponding to the alphanumeric characters that were initially imaged; is that correct?

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ATTORNEY GOLUB: Objection.

THE WITNESS: Yes.

BY ATTORNEY KRIEGER:

Q. Okay. Could you turn to your declaration, page 23, please. Let's see if it's Bates page --

A. 26?

Q. Hold on. I think that's wrong.

Yeah. Let's go to Bates page 26 of Exhibit 2021.

A. All right.

Q. All right. You can see an image here on this page of your declaration, do you not?

A. I do.

Q. Okay. What's being shown here?

A. It is a representation of a linear barcode that has been captured with an -- with a two-dimensional image-capture device, so a camera.

Q. Could you use an OCR scanner to interpret this barcode?

ATTORNEY GOLUB: Objection.

THE WITNESS: No.

BY ATTORNEY KRIEGER:

Q. Why not?

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A. An OCR scanner is a task-specific device that is looking for characters to optically recognize. It would look at this picture, say there are no characters there, and so nothing would happen.

Q. Okay. Now, let's say, hypothetically, that the bars and spaces shown on Bates page 26 of Exhibit 2029 corresponded to the numbers 12345. Okay?

If you assume that is true, which I know it's not, if you were to place those numbers 12345 underneath this barcode, could an OCR reader at that point determine -- excuse me. Let me start over again.

If those numbers 12345 were provided under the bars, then the image shown on Bates page 26 of Exhibit 2029 could be read using an OCR reader or scanner, correct?

ATTORNEY GOLUB: Could you read that back?

ATTORNEY KRIEGER: Sure.

BY ATTORNEY KRIEGER:

Q. If those numbers 12345 were provided under the bars, then the image shown on Bates page 26 of Exhibit 2029 could be read using an

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OCR reader or scanner, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: And just to make sure I'm understanding that. So if I were to take a pen and literally write "12345" or if the image already had "12345" printed below the barcode, the bars and spaces there, could I use OCR to read that image?

BY ATTORNEY KRIEGER:

Q. Correct.

A. I could use OCR to read the numbers 12345 that were printed below the barcode but not the barcode.

Q. Okay. And in that hypothetical, the image would include the bars and spaces as well as the numbers, correct?

A. As you describe, yes, it would have the bars and spaces making up the barcode and would have the numbers 12345 printed -- written below them or near them.

Q. But the OCR software would focus in on the alphanumeric characters, correct?

A. It -- it's designed to look for the characters, yes. It would ignore the barcode.

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Q. Okay. How does OCR know how to find alphanumeric characters in an image?

A. How much time do we have?

Q. Well, why don't you --

A. It's complicated.

Q. -- give me a CliffNotes version, and I can ask follow-up questions to hopefully clarify.

A. Yeah. I know that came off as flippant. I apologize.

Q. No. No. I appreciate that.

A. But it is -- it's one of those "it depends" type of an answer.

So there are a couple of types --

Q. Let me rephrase the question and hopefully hone you in on --

A. Okay.

Q. -- a little bit more narrow area.

How would an OCR reader of a UPC code of the type that you included in your declaration know how to find and OCR the alphanumeric characters in that barcode.

And the barcode I'm referring to is the one on Bates page 21 of your exhibit.

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ATTORNEY GOLUB: Objection.

THE WITNESS: So the answer actually does not change.

BY ATTORNEY KRIEGER:

Q. Oh, it's unfortunate. Go ahead.

A. So there are a couple of different types of processes OCR can take. I understand it, but I am not a OCR programming expert per se.

So in somewhat general terms, you can do one of a couple of things. You can look at the -- all right. I'm going to have to back up a little further.

In image capture and processing, there is a term that's used that's called blob analysis, b-l-o-b, blob.

It is defined as a collection of pixels that are touching each other, for all intents and purposes.

And so if we look at the picture on Bates 26 that -- and one of the bars or one of the spaces, each one of those bars would be a blob. And, hopefully, that makes sense so far.

And so what the OCR software

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will have to do is decide -- find all the blobs in the picture, decide which blobs it wants to concentrate on. And it can do it a couple of different ways.

There are various algorithms. To the best of my knowledge, there are various patents on the algorithms on how to optimize this process.

But it can either look and say, "Does this match pictures that I basically have in memory that say: This is what a C looks like. This is what an O looks like. This is what a 0 looks like. This is what a 1 looks like." And it can try to do matching.

And in a sense, that's kind of a brute-force option because, if there's potentially even the slightest variation, the match will fail.

And so if we look at a 1, the question suddenly becomes: Is it a 1? Is it an I? Is it a lowercase l?

And so that's one of the challenges with OCR in a separate discussion.

But the other option is -- I think the term they use is, like, "stroke

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analysis." And it's looking for patterns of directions of the pixels.

And so if you think about how the letter b is drawn -- it's looking for -- a lowercase b. It's a downstroke and then most of a circle. And it's looking for those components.

And when it finds them, it then does an analysis and says, "Yeah, I am 70 percent sure that that is a b. I'm 50 percent that's a b. I'm 30 percent sure it's a b, but it might be a 6."

And then it will continue through that process for all the blobs it finds and then decide, "Okay. I think I found 01234567890," if we are talking about the UPC code on page -- Bates page 21.

And depending on how the software has been configured and set up, it will decide did it meet the minimum threshold for its decision to say, "Yes, this is an acceptable collection of alphanumeric characters" and "I am willing to say with X degree of confidence that, yes, this is what the resulting string would be."

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There is a lot of other stuff that has to go on: binarizing, basically converting it to a black-and-white image to make it easier for it to process, and some filtering and some other things happen that we're not going to get into.

Q. Okay. Let me just stop you there, if you're comfortable with that.

A. I'm good.

Q. Okay. Thank you.

So the barcode that you showed on Bates page 26 is shown at an angle, right?

A. Yes.

Q. And if there were numbers underneath it, presumably, they would be at a similar angle, would you agree, if it were a UPC code?

A. Possibly, yes.

Q. Okay. How does the OCR software know how to find those characters when they're not straight across and they're at an angle?

Are there guideposts or indicators from the barcode itself, the -- the lines and the spaces in the barcode that the OCR would look to to help it find the location of the numbers underneath it?

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And I could rephrase it if you'd like. That was a pretty --

A. No.

Q. Okay.

A. I think I understand.

And the answer is generally no. The OCR solutions that I'm aware of and I've worked with over the years will take the whole image.

And this is why OCR is not the best answer for a lot of processing because the levels of confidence are not as high. As you rotate the image, it becomes harder. You don't have that baseline to necessarily go against.

One of the solutions the industry has encountered -- or has gone after is specialty fonts that are called OCR-A, -B, and -C so that as you look at those images, you are going after known predefined shapes that make it easier to match against.

And then it becomes just a scale question, not a question of "Is this the number 7?" But, "Oh, hey is it the equivalent of 6-point font number 7 or is it a 30-point font number 7," which is a lot easier for the

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software to handle and address versus determining is this a 7.

And so whether or not it's rotated, whether or not it's perfectly square will generally have little to no impact on the speed of the system, from my experience.

It is more the -- what else is in the image? If all I have is a set of numbers, it generally is going to work faster than if there was anything else on the page. Those numbers have to be high-definition, high-edge sharpness and not my handwriting.

Because trying to figure out -- and most people are this way. We'll cheat a little bit and are -- when we print something out, it will be a combination of printing in cursive and script. And that is something that's going to give an OCR system absolute fits.

Q. Sure.

A. Because now it's trying to decide -- it thought, "Oh, hey, it was this font type. Well, maybe it's not that font type. Maybe it's a different font."

And especially if it's trying to

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image-matching, the additional load on the system is going to have a very marked and noticeable impact. And the chances of it coming up with an incorrect answer becomes significantly higher, to the point where most experienced users will actually not rely on it because it becomes so, in a sense, unstable.

Q. Okay. In your UPC code, you provide on page 21 of Exhibit 2029, do -- those guard bars that you indicated there, do those play any role in helping an OCR reader identify the numeric characters underneath the bars and spaces?

A. In general, no.

Q. Can they?

A. Not that I've run across.

Q. Okay. Okay. We've already covered this, but just to make sure that we're clear.

My understanding is that you agree in your declaration that Wang discloses an OCR reader, correct?

A. I don't remember going over that, but I believe --

Q. Paragraph 81 of your declaration.

A. Thank you.

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And so what was it that Wang --

Q. Just you agree that Wang discloses an OCR reader?

A. Yes.

Q. And so it follows that Wang discloses an image-capture device, right?

ATTORNEY GOLUB: Objection.

THE WITNESS: Yes.

BY ATTORNEY KRIEGER:

Q. Now, as I think we've established, an OCR reader or scanner takes an image, correct?

A. Correct.

ATTORNEY GOLUB: If you're going to switch to a new exhibit, can we take a -- like, a five-minute break?

ATTORNEY KRIEGER: Of course.

ATTORNEY GOLUB: Okay.

THE VIDEOGRAPHER: Going off the record, 1:51 p.m.

- - -

(Whereupon, a short recess was taken.)

- - -

THE VIDEOGRAPHER: We are back on the record, 2:00 o'clock p.m.

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ATTORNEY KRIEGER: Okay. I'm handing you what I've marked as Exhibit 1044.

- - -

(Whereupon, Exhibit 1044 was marked for identification.)

- - -

BY ATTORNEY KRIEGER:

Q. It purports to be a document entitled [as read]:

"Datalogic. Datalogic Automation."

A. Thank you.

Q. Are you familiar with a company called Datalogic?

A. I am.

Q. In what capacity?

A. They have donated hardware to various labs to me in the past.

Q. And what is -- I'm sorry. Go ahead.

A. And I -- I'm trying to remember. I think I've had a couple of students end up working for them.

Q. What does Datalogic do?

A. They do a combination of things,

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including barcode scanning, RFID reading, and machine automation sensors.

Q. Have you ever seen this document before?

A. Not this one specifically, no.

Q. Okay. Go ahead and just take a look at it generally.

I want to talk about this, and I'll point you to specific portions. But I just want you to get a general sense of what's contained in this document before I start.

ATTORNEY GOLUB: Have you marked this as an exhibit?

ATTORNEY KRIEGER: Yes. Just now.

ATTORNEY GOLUB: What number?

THE WITNESS: 1044.

Okay.

BY ATTORNEY KRIEGER:

Q. Okay. So if you look at page 2 of this Exhibit 1044, right at the top, it states [as read]:

"Encoded information into text and codes can be automatically extracted

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through a 2D imager device."

Do you see that?

A. I do.

Q. Do you understand what that means?

A. In general, yes. Although the phrasing is a little weird, but it is an Italian company.

Q. I was thinking it might be a translation, yes.

A. Yeah.

Q. Okay. What does the term "encoded" mean to you in that sentence?

A. Generally, in the barcode industry, the information in the barcode, whether it's linear or 2D, is the encoded -- you would encode the information into the barcode.

And so the encoded information is that information contained in the barcode.

Q. Okay. And would you say "encoded" is basically the same thing as having that information embedded in it?

ATTORNEY GOLUB: Objection.

THE WITNESS: I believe, in my report, that is what I say, yes.

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BY ATTORNEY KRIEGER:

Q. And so to have information encoded in text or codes means that information is contained in those texts or codes.

Is that fair?

ATTORNEY GOLUB: Objection.

THE WITNESS: That's where the grammar of that sentence throws me. I'm a little confused by what they're trying to say when they say "encoded information into texts and codes."

I'm not sure what they're trying to get at and have not had time, obviously, to digest the document and come up with an opinion.

BY ATTORNEY KRIEGER:

Q. Okay. But from this statement, would you agree that text and barcodes can contain encoded information?

ATTORNEY GOLUB: Objection.

THE WITNESS: Barcodes can have encoded information.

I don't believe I provided an opinion as to whether the text can have information encoded into the text in my --

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in my report. And so I'm not sure I'm ready to provide an opinion on that.

BY ATTORNEY KRIEGER:

Q. Well, and we talked about the decoder ring example earlier.

You recall that?

A. Yes.

Q. I mean, that's an example of encoded text, isn't it?

A. Yes.

Q. Okay. It has a secret message that is embedded in the numbers in the example we talked about earlier, right?

A. Yes.

Q. Okay. Okay. Let's look at page 3 of the same exhibit.

You can see two images in the bottom -- not the -- all the way to the bottom but -- under "lighting," there are two images that appear to show differences in lighting, as viewed through an OCR reader or a scanner.

Would you agree with that?

A. Right above where it says "multiple regions of interest"?

Q. Correct.

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A. I see that.
Q. Would you agree with how I characterized that?
ATTORNEY GOLUB: Objection.
ATTORNEY KRIEGER: I'll restate it.
BY ATTORNEY KRIEGER:
Q. Would you agree that those two images above the words "multiple regions of interest" in Exhibit 1044 appear to show differences in lighting as viewed through an OCR reader or scanner?
ATTORNEY GOLUB: Objection.
THE WITNESS: They are images as seen through something, but we don't know what specifically.
BY ATTORNEY KRIEGER:
Q. Okay.
A. And yes to the -- to the lighting difference.
Q. In the paragraph above those images, it states that [as read]:
"Even lighting improves the quality of the captures."
Do you see that?

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A. I do.
Q. I mean, is it fair to conclude that they're referring to capturing in the OCR context?
ATTORNEY GOLUB: Objection.
THE WITNESS: It could be for that purpose or some other purpose.
As I mentioned previously, Datalogic does a lot of different stuff.
And so this could -- this statement is equally true for traditional machine vision, where you're doing measurements, you're doing presence/absence. It is recently true for barcode scanning.
BY ATTORNEY KRIEGER:
Q. Maybe this will help a little bit more. Right under the heading "Lighting."
Do you see that?
A. I do.
Q. It states [as read]:
"The lighting selection plays a crucial rule in OCR applications."
So from that, isn't it --

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doesn't it appear that these images they're providing are in the context of OCR imaging?

ATTORNEY GOLUB: Objection.

THE WITNESS: Given that previous paragraph -- or sentence, I guess, really -- yes, I would have to agree with that.

BY ATTORNEY KRIEGER:

Q. And so you would agree, wouldn't you, that the view through an OCR reader or scanner takes an image like the ones shown here on page 3 of Exhibit 1044 -- that's it.

Sorry. It didn't come out quite the way I planned it. Let's start that again.

A. Okay.

Q. So you'd agree, wouldn't you, that the view through an OCR reader or scanner takes an image like the one shown here on page 3 of Exhibit 1044?

ATTORNEY GOLUB: Objection.

THE WITNESS: I agree that those pictures could be taken from an OCR system.

BY ATTORNEY KRIEGER:

Q. And these images include the

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barcodes, correct?

A. Those two images specifically do, yes.

Q. And they also include alphanumeric text, correct?

A. They appear to, yes.

Q. Let's go back to page 2.

Right under the center image on page 2 of Exhibit 1044, the paragraph states [as read]:

"Additionally, both the orientation and the positioning of a code 1D or 2D into the scanning area do not affect the correct reading. A 2D barcode reader always features omnidirectional reading with also unpredictable code positioning."

Do you see that?

A. I do.

Q. And it continues [as read]:

"Conversely, the automatic character

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recognition must respect some constraints in relation to the text position and rotation that are required to be known or should be calculated at runtime. In more detail, text can be located through the use of anchors that could be barcodes or reference edges."

Do you see that?

A. I do.

Q. Do you understand what they're referring to there?

A. I believe so.

Q. Okay. What is -- what is your interpretation of that paragraph?

A. That they are saying one of the constraints of their specific system is that it wants some sort of an indicator, for lack of a better way to phrase it, which way is up so that the OCR is able to work in a better manner.

Q. Okay. And is that -- they use that term "anchors" here.

Is that what you're referring

to, the anchors help identify where the text is located?

A. In the context of this sentence, that's what I would expect the term "anchors" to be used as.

Q. And here they indicate that the anchors could be barcodes, correct?

A. Yes.

Q. How could a barcode be used as an anchor?

ATTORNEY GOLUB: Objection.

THE WITNESS: In general, anything in the picture, arguably, should be able to be used as what I am perceiving the anchor to be, the term "anchor" to be from our quick review of this.

And so the barcode, from the OCR scanner's perspective, is nothing more than a collection of blobs that we talked about earlier. And so it could just as easily be referencing a logo.

And so having worked with Datalogic systems in the past but not their OCR systems, you can define what's called a "region of interest," which is

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which part of the picture you want to look at.

You can also have features in that region of interest that are used to help determine where to look specifically for what you're trying to read.

And so, for example, using a different brand of OCR functionality, we would put the University of Memphis logo on the label and have the OCR text next to it. And then we were able to tell the system, "Reduce the area you look at. Go find the University of Memphis logo." And in this terminology, it would act as, I guess, the anchor.

And then to the right of it, for this amount of space, look for characters so that the system is not having to look at the entire picture but just a small segment after it further reduced it based off of the anchor.

And so if it's a barcode, if it's a University of Memphis logo, if it is a hole that's in the part or an edge that is clearly definable in the -- in the

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area that's -- the picture is being taken, it shouldn't matter.

BY ATTORNEY KRIEGER:

Q. And you mentioned regions of interest. It looks like this document uses the abbreviation ROI.

Are you familiar with that?

A. That is the common abbreviation for that.

Q. Okay. And so is it fair to say that the use of anchors can help focus an OCR reader on a specific region of interest?

A. Yes, but that it's not required.

Q. So if I were to use an OCR reader for a UPC barcode, the OCR reader or scanner would use the bars to determine where the alphanumeric phrase -- let me start over again.

So if I were to use an OCR reader for a UPC barcode, the OCR reader or scanner would use the bars as an anchor to determine a region of interest; is that correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: If it was programmed to do that, it could

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potentially do that, yes.

ATTORNEY KRIEGER: All right. Let's pull up another exhibit.

- - -

(Whereupon, Exhibit 1005 was marked for identification.)

- - -

BY ATTORNEY KRIEGER:

Q. So I've handed you what's been marked as Exhibit 1005's.

This is the "Take An Order!" reference, which -- I believe you're familiar with this reference, correct?

A. I have reviewed it, yes.

Q. Are you familiar with the term "socket barcode scanners"?

A. Yes, I am.

Q. What is that?

A. So the early portable digital assistant, PDA, the most popular company was Palm Computing and their product PalmPilot.

There was a spinoff from that called Handspring, which basically had the same product, different branding, slightly different functionality. But they both supported the

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idea of a -- of an extension card that could be plugged into the device to give additional functionality, whether it's memory or, as discussed here, the ability to do either mag stripe reading or linear barcode scanning.

And, ironically, I did own one of the Handsprings, but I couldn't afford the scanner ever. I was very sad about that.

Q. What was that scanner like? What did it -- what did it do?

A. It scanned standard linear barcodes. And because I was never able -- I only ever got to kind of see pictures of it, I was never able to play with it.

Q. Like, with a camera or what?

A. It was a -- a laser scanner.

Q. Okay. So you reviewed this "Take An Order!" reference, presumably, in preparation of your declaration, correct?

A. Yes, I did.

Q. And so you would agree, wouldn't you, that "Take An Order!" describes software for use in Palm devices, as you just mentioned?

A. Yes.

Q. And the Palm devices could be paired

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with a barcode scanner such as those from simple technologies which you talk about in your declaration; isn't that correct?

A. Yes.

Q. Did you review the barcode scanners described in Take An Order!?

ATTORNEY GOLUB: Objection.

THE WITNESS: I reviewed the user manual from the symbol technology system. And like I said, I did have some indirect experience with seeing what they were supposed to be able to do.

BY ATTORNEY KRIEGER:

Q. Okay. I'd like to direct your attention to page 3 of Exhibit 1005. The second paragraph under the heading [as read]:

"Want to learn more about Palm OS handhelds."

Do you see that?

A. I do.

Q. That paragraph there, beginning [as read]:

"Take An Order! is enhanced."

Do you see that?

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A. I didn't realize it was enhanced, but okay. I see the paragraph between "Want to learn more" and where it says "Take An Order! is enhanced," yeah.

Q. Yeah. Could you please read that paragraph, "Take An Order! is enhanced," just to yourself.

A. Okay.

Q. Okay. You can see at the end of that paragraph, they mention [as read]:

"There are a variety of options for barcode scanning using Palm OS handhelds. You can read all about them here."

Do you see that?

A. I do.

Q. And the word "here" is underlined.

Do you see that?

A. I do.

Q. And that would appear to indicate it's a hyperlink, does it not?

A. That is correct.

Q. Okay. Did you click that link, by chance?

A. I believe the version of the document

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I had did not have a link in it.

ATTORNEY KRIEGER: Okay. The exhibit I'm going to introduce is an excerpt of an exhibit that's already been put in this case. But since it's an excerpt, I'm going to relabel it, just so there's no confusion about having different versions in the record.

And so I will label this as Exhibit 1045.

- - -

(Whereupon, Exhibit 1045 was marked for identification.)

- - -

ATTORNEY GOLUB: Can you tell us what it's an excerpt from?

ATTORNEY KRIEGER: It is the first six pages of Exhibit 1010. It's a very long exhibit, and these are the only relevant pages. So I figured I'd save the trees.

BY ATTORNEY KRIEGER:

Q. Okay. So just for clarity, what I'm handing you now, I have now marked as Exhibit 1045. And I have stricken out the

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Exhibit Number 1010 in the bottom right just to avoid confusion.

It is the first six pages of Exhibit 1010, which was filed earlier in this proceeding.

A. Thank you.

Just for my knowledge, the struck-out Early Warning IPR comment at the bottom was because you relabeled it at the top?

Q. That's exactly right. Just wanted to avoid confusion.

This is no longer Exhibit 1010. This portion -- this excerpt is Exhibit 1045.

Now, the relevant portion of this Exhibit 1045 begins on page 5. So if you could turn there, please.

Do you recognize this document?

A. Is this page 5 that you're talking about?

Q. Correct.

A. Okay. I do not recall seeing this website.

Q. So you did not review this document in preparation of your declaration; is that correct?

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A. That is correct.

Q. Now, you did list various documents at the beginning of your declaration at paragraph 3. And consistent with what you just testified to, this exhibit, full Exhibit 1010, was not referenced in there.

So that is consistent with what you just indicated.

A. Okay.

Q. Is there a reason you did not review this exhibit?

A. It was not provided to me.

Q. But you did review the declaration of Tom Purves's Exhibit 1002, correct?

A. Yes.

Q. All right. Now, I'll represent to you that Mr. Purves cited to this Exhibit 1010, the full exhibit, in his declaration.

And so is the reason you didn't review this exhibit in the context of it being cited in Mr. Purves's declaration?

A. You lost me on that.

Q. Well, this document was cited by Mr. Purves in his declaration, which you've reviewed, correct?

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A. Correct.
Q. And so I'm curious why you didn't ask for that exhibit since it was cited by him.
A. Honestly, I'm not -- I don't know why I didn't think to ask for it.
Q. Okay.
A. But I never did.
ATTORNEY KRIEGER: All right. I'm handing you the declaration of Thomas Purves, Exhibit 1002.
- - -
(Whereupon, Exhibit 1002 was previously marked for identification.)
- - -
THE WITNESS: Thank you.
BY ATTORNEY KRIEGER:
Q. Let's direct your attention to paragraph 59, please, of Exhibit 1002.
A. Sorry. Paragraph 59, you said?
Q. Correct.
You can see here on page 29 of Exhibit 1002, there's a block quote towards the bottom of the page.
Do you see that?
A. I do.

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Q. And it says in the declaration [as read]:

"Per Stevens Creek" -- and I quote -- "the socket SDIO scanner is a camera scanner, not a laser scanner. Whereas, the laser scanner above can go zap, zap, zap and scan a series of barcodes in quick succession, the SDIO scanner can take a second or two to successfully scan. So the bottom line is that you really need to evaluate the SDIO scanner to see if it meets your needs. If it does, it's an excellent choice."

Do you see that?

A. I do.

Q. Do you understand what that's referring to there?

A. That is referring to whether or not the socket SDIO scanner being referenced is a laser scanner or an imager.

Q. Okay. And this device that's being

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referred to on page 29 of Exhibit 1002, that's an image-based sensor, correct?

A. The SDIO card?

Q. Correct.

A. From the information here, yes, it looks like it is an imager.

Q. Okay. So Stevens Creek website does, in fact, disclose an imaging-based barcode scanner, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: Yes.

BY ATTORNEY KRIEGER:

Q. So from this discussion, isn't it fair to say that Take An Order! refers to an image-based barcode scanners?

ATTORNEY GOLUB: Objection.

THE WITNESS: Repeat that one just to make sure I got that right.

BY ATTORNEY KRIEGER:

Q. Sure.

So from this discussion and the block code that you just read, isn't it fair to say that "Take An Order!" refers to an image-based barcode scanner?

ATTORNEY GOLUB: Objection.

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THE WITNESS: My problem with that is, in the 1005, it does not and -- directly, that I ever saw.

And assuming that the 1045 is part of the -- or is a link -- is the link for the "you can read all about them here," I would have to agree with it.

But excepting that, I would have to say, from what I've seen, no, it doesn't.

Can I add one more comment to that?

BY ATTORNEY KRIEGER:

Q. Of course.

A. The other thing I would like to know even -- regardless of what Purves mentions in his document, looking at the 1045, as I continue to read it, I don't know that any of those are imagers.

Because it specifically says [as read]:

"There are four options for laser barcode scanning using the Palm OS handheld devices."

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It says nothing about an imager or camera.

Q. Well, the -- I can help you with this.

The block quote you just read was taken directly from pages 5 to 6 of this exhibit that refers to specifically camera scanner. So, in fact, it is there.

I realize the print is small.

A. Can you point me to that?

Q. I can. It's in the middle of the paragraph -- top paragraph on page 6 of Exhibit 1045.

A. I missed page 6. Sorry.

Q. That's okay.

A. That explains a lot.

Q. So it shows --

A. I found it. Thank you.

Q. Sure.

So, I mean, as you testified, I think this passage from Exhibit 1045, page 6, refers to an SDIO scanner having a camera. And from that, I believe you concluded the SDI scanner is, in fact, an image-based scanner, correct?

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ATTORNEY GOLUB: Objection.

THE WITNESS: It is. However, the paragraph does go on to also say [as read]:

"Furthermore, it doesn't have the resolution of laser scanners. So while you can scan most typical UPC barcodes, when it comes to the tiny lines found, for example, in the barcodes which are used for serial numbers, the SDIO scanner will often simply not scan them."

BY ATTORNEY KRIEGER:

Q. And then it proceeds that if it does work, it's an excellent choice.

Do you see that?

A. I do see that.

Q. Okay. By the way, is that a true statement, though?

I just want to make sure that we're clear.

A. I'm comfortable with that, yes.

Q. Okay. That, just for clarity, the

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socket SDIO scanner is an imaging-based barcode scanner, correct?

A. Yes.

Q. And this is, in fact -- well, strike that.

ATTORNEY KRIEGER: Yeah.

Let's -- let's take a break, please.

THE WITNESS: Sure.

THE VIDEOGRAPHER: Going off the record, 2:33 p.m.

- - -

(Whereupon, a short recess was taken.)

- - -

THE VIDEOGRAPHER: We are back on the record, 2:44 p.m.

- - -

(Whereupon, Exhibit 1046 was marked for identification.)

- - -

BY ATTORNEY KRIEGER:

Q. Okay. Handing you what I've marked as Exhibit 1046 and which purports to be a UPC-A barcode.

A. Okay.

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Q. Would you agree with my characterization that what is shown in Exhibit 1046 is a UPC barcode?

A. I will agree that is how it is labeled. I would question as to whether or not it was actually scannable.

Q. Okay. But from all appearances, it -- it would appear to be a UPC barcode, correct?

ATTORNEY GOLUB: Objection.

THE WITNESS: It looks like it's purporting to be one, yes.

BY ATTORNEY KRIEGER:

Q. Okay. Could you use your -- do you have your cell phone with you?

A. I do not have it on me.

Q. You don't.

Is it in the building?

A. It is.

Q. Okay. Do you mind going to -- I would like to see you use your app on your phone to scan this UPC barcode.

ATTORNEY GOLUB: I object.

ATTORNEY KRIEGER: You can do it.

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THE WITNESS: Am I allowed to still do it?

BY ATTORNEY KRIEGER:

Q. Yep. He can't instruct you not to do that. So, yes, please go get your phone, if you don't mind, and let's see if this is a real UPC barcode.

THE VIDEOGRAPHER: Do you want me to go off the record?

ATTORNEY THEISS: No. Please keep it running.

BY ATTORNEY KRIEGER:

Q. What is the app that you use for this?

A. So the app I traditionally use for barcode scanning is the Cognex, C-o-g-n-e-x, barcode scanner app. It is available on Android and, I'm almost positive, on iPhone.

Do I need to show a picture of this to the camera?

Q. That's not necessary.

A. Okay.

Q. But I -- I apologize, but I would like to hover a little bit just to see what you're doing.

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A. Sure.

ATTORNEY GOLUB: I just want to be clear here. There is information on your phone.

ATTORNEY KRIEGER: I'm not asking for any information on his phone.

ATTORNEY GOLUB: I need a minute here to instruct my client.

There is information on your phone that is privileged. And so I need you to be careful, when Mr. Krieger asks to look at your phone, that there's nothing on your phone that he can see other than what you are scanning.

So if you can manipulate your phone in that way, then you can proceed. But if you can't, then you cannot proceed.

THE WITNESS: Understood.

ATTORNEY KRIEGER: And that's a fair instruction.

I just want to be clear. I'm not seeking any confidential or privileged information here. Okay? So I agree 100 percent.

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BY ATTORNEY KRIEGER:

Q. Please, you know, don't share that with me. But I just want to go through this exercise. Okay?

A. Yep.

Q. Okay.

A. I have the application open. So the only thing you can see is the application itself.

Q. Okay.

A. And it actually did scan.

Q. Okay. Can you screenshot that, please?

A. (Witness complies.)

Q. And what is it doing now?

A. It's displaying the value 038261857361.

Q. Okay. And that's consistent with the numbers provided on the bottom of what is shown on Exhibit 1046, correct?

A. It is consistent with the human-readable text on that -- in that picture, yes.

Q. Okay. Does it tell you what product it is?

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I'm just curious.

A. It does not.

Q. Okay. What would be required in order for it to do that?

A. I would have to go to the internet and look up that value.

Q. Okay. Since you're not connected to the internet currently, you're unable to do that; is that right?

A. Correct.

Q. Okay. Okay. All right. If you could, email that screenshot to your counsel so that he can review it and make sure that he's comfortable.

ATTORNEY KRIEGER: And then we can -- I would like to label that screenshot as Exhibit 1047.

BY ATTORNEY KRIEGER:

Q. Okay. So with that, thank you for humoring me with that exercise. I do appreciate it.

Is it fair to conclude from that exercise that this does, in fact, appear to be a legitimate UPC code?

A. Yes.

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Q. Okay. And although you can't access the internet and determine the -- what product relates to this, isn't it fair to say that the bars and spaces on what is shown in Exhibit 1046 contain product information?

ATTORNEY GOLUB: Objection.

THE WITNESS: No. Because you can encode any numeric string of the appropriate length into a UPC-A, that does not necessarily correspond to a physical product or an actual product.

I could -- the example we talked about earlier of 01234567890 can be encoded, but that will not ever resolve to an actual product that is out in the world.

BY ATTORNEY KRIEGER:

Q. Okay. Well, I will represent to you that this UPC code, if you had access, corresponds to product information for pickles.

A. Okay.

Q. Okay. Is it a jar of pickles?

A jar of pickles. Okay?

A. Okay.

Q. So if you accept that as true, as I

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represent it to you, in that case, isn't it fair to say that the bars and spaces on the barcode contain information regarding a product?

ATTORNEY GOLUB: Objection.

THE WITNESS: Indirectly, yes.

BY ATTORNEY KRIEGER:

Q. And isn't it also true, then, that the numbers at the bottom of what is shown in Exhibit 1046 also contain product information?

A. Again, indirectly, yes.

ATTORNEY KRIEGER: Okay. Subject to introduction of new Exhibit 1047, we have no further questions.

ATTORNEY GOLUB: Just give us about five minutes, please.

ATTORNEY KRIEGER: Okay.

THE VIDEOGRAPHER: Going off the record, 2:52 p.m.

- - -

(Whereupon, a short recess was taken.)

- - -

THE VIDEOGRAPHER: We are back

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on the record, 2:56 p.m.

ATTORNEY GOLUB: We don't have any questions.

ATTORNEY KRIEGER: Okay. Thank you very much.

Is there -- can we get that printed up and entered as an exhibit, that 1047?

ATTORNEY GOLUB: I'll consider it.

ATTORNEY KRIEGER: It's my deposition. I'm entitled to do this. This is something I'm entirely entitled to do, and I ask you to do it.

ATTORNEY GOLUB: I told you I would consider it.

ATTORNEY KRIEGER: Well, can you consider it now so that we can conclude the deposition appropriately?

ATTORNEY GOLUB: We can conclude the deposition. I am not prepared to --

ATTORNEY THEISS: What we'll do is we'll agree he won't destroy it. We'll get back to you and --

ATTORNEY KRIEGER: Okay. So

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you're refusing to enter it into the record today.

Is that -- is that your position?

ATTORNEY GOLUB: I told you I would consider it.

ATTORNEY KRIEGER: I know. I just need to know your position.

Considering isn't good enough because I need to know what your position is.

Either you're going to or you're not. I need to know that so that I can preserve our rights.

ATTORNEY GOLUB: I'm not prepared to tell you anything other than I'll consider it.

To tell you the truth, I've never been asked before in a deposition to have the witness email me something so that opposing counsel could enter it in the record.

It's something that I would like to think about before I decide.

ATTORNEY KRIEGER: Okay. We can

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go through this another way.

And I can do it on my phone, and I can email it to myself, if that will appease your concerns.

ATTORNEY GOLUB: You can do whatever you want.

You had no further questions.

ATTORNEY KRIEGER: Well, but that was subject to the entering of Exhibit 1047, so...

ATTORNEY GOLUB: No, it was not.

ATTORNEY KRIEGER: I can read from the record. I said absolutely "subject to the entering of Exhibit 1047," that we are -- we have no further questions. That's exactly, word for word, what I said.

ATTORNEY GOLUB: You turned the witness over. You asked if I had redirect. I had no redirect.

The deposition is done.

ATTORNEY KRIEGER: Do you want me to read the transcript?

ATTORNEY GOLUB: You can read the transcript all you want.

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ATTORNEY KRIEGER: So you're refusing to provide the exhibit?

I just need to know your position so that I can --

ATTORNEY GOLUB: I'm not refusing. I'm not agreeing.

I said I would consider it.

ATTORNEY KRIEGER: Okay. Here's the quote [as read]:

"Subject to introduction of new Exhibit 1047, we have no further questions."

Clear as day. So we are not complete.

Okay. We can go through this and go through this at another angle if you like. This seems really unnecessary.

There have been many depositions I've been at where the witness draws and labels things. This is no different than that.

ATTORNEY GOLUB: Well --

ATTORNEY KRIEGER: And I'm giving you time to review the document. If you have concerns of privilege or

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anything else, by all means, you're entitled to stop that.

There's nothing privileged here. There's nothing appropriate for you to withhold this as an exhibit to this deposition.

And I insist that you provide it, because there's no legal basis for you not to provide it. It is part of the deposition record.

ATTORNEY GOLUB: I'll consider it.

ATTORNEY KRIEGER: Okay. Can you give me more? Like, what do you mean? Like tomorrow? Next week?

I mean, what is your situation here?

ATTORNEY GOLUB: I'll tell you tomorrow. I want some time to think about it.

ATTORNEY KRIEGER: Do you want to take some time and call some other people?

I'm happy -- we have plenty of time. We finished early. I'm happy for

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you to consult with others.

But there's absolutely no legal basis for you to withhold that as evidence in this proceeding.

ATTORNEY GOLUB: I told you I would consider it.

ATTORNEY KRIEGER: And you're not willing to take a break to consider it over the next hour or so?

We have several hours left in our allotted our time.

ATTORNEY GOLUB: Yes. If you want to take a break and give me time to consider it, I'll let you know.

ATTORNEY KRIEGER: That's fine. That's fine. Let's do that.

Let's go off on the record, then.

THE VIDEOGRAPHER: Going off the record, 3:00 o'clock p.m.

- - -

(Whereupon, a short recess was taken.)

- - -

THE VIDEOGRAPHER: We are back

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on the record, 3:29 p.m.

ATTORNEY GOLUB: Subject to my objections, here you go.

ATTORNEY KRIEGER: All right. Thank you very much. I appreciate it.

I'm going to go ahead and label this exhibit.

- - -

(Whereupon, Exhibit 1047 was marked for identification.)

- - -

BY ATTORNEY KRIEGER:

Q. So, Dr. Berisso, I'm handing you what's been marked as Exhibit 1047, which purports to -- yes, which purports to be the screenshot that you emailed to your attorney a moment ago.

Is that, in fact, what is shown in this exhibit?

A. Yes, it is.

ATTORNEY KRIEGER: Okay. Thank you very much.

Nothing further.

THE VIDEOGRAPHER: This is the end of the deposition.

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The time is 3:30 p.m., and we are off the record.

ATTORNEY GOLUB: Read and sign.

- - -

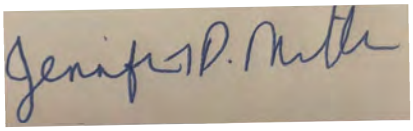
(Whereupon, the deposition was concluded at 3:30p.m.)

- - -

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CERTIFICATE

I HEREBY CERTIFY that the proceedings, evidence and objections are contained fully and accurately in the stenographic notes taken by me upon the deposition of Kevin Berisso, taken on 7/3/25 and that this is a true and correct transcript of same.



Jennifer Miller, RMR, CCR, CRR
and Notary Public

(The foregoing certification of this transcript does not apply to any reproduction of the same by any means unless under the direct control and/or supervision of the certifying reporter.)

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Ex. 1048-223

Kevin Berisso, c/o
VOLPE KOENIG
30 South 17th Street, 18th Floor
Philadelphia, PA 19103

Case: Early Warnings Services, LLC v. Intellectual Ventures II, LLC
Date of deposition: July 3, 2025
Deponent: Kevin Berisso

Please be advised that the transcript in the above referenced matter is now complete and ready for signature. The deponent may come to this office to sign the transcript, a copy may be purchased for the witness to review and sign, or the deponent and/or counsel may waive the option of signing. Please advise us of the option selected. Please forward the errata sheet and the original signed signature page to counsel noticing the deposition, noting the applicable time period allowed for such by the governing Rules of Procedure. If you have any questions, please do not hesitate to call our office at (202)-232-0646.

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(202) 232-0646

SIGNATURE PAGE
Case: Early Warnings Services, LLC v. Intellectual Ventures II, LLC
Witness Name: Kevin Berisso
Deposition Date: July 3, 2025

I do hereby acknowledge that I have read and examined the foregoing pages of the transcript of my deposition and that:

(Check appropriate box):
( ) The same is a true, correct and complete transcription of the answers given by me to the questions therein recorded.
( ) Except for the changes noted in the attached Errata Sheet, the same is a true, correct and complete transcription of the answers given by me to the questions therein recorded.

_____ _____
DATE WITNESS SIGNATURE

_____ _____
DATE NOTARY

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Washington, D.C. 20036

(202)232-0646

ERRATA SHEET

Case: Early Warnings Services, LLC v. Intellectual Ventures II, LLC

Witness Name: Kevin Berisso

Deposition Date: July 3, 2025

Page No. Line No. Change

_____ _____

Signature Date

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Curriculum Vitae

Kevin Berisso, Ph.D.
3222 Highland Park Place
Memphis, TN 38111
kevin@bait-consulting.com (740) 707-5882

EDUCATION

Ph.D.	Indiana State University, Terre Haute, Indiana. May 2003. Major: Technology Management, with a manufacturing systems specialization. Dissertation title: *A Comparison Of Measurement Variations For Selected Probe Head Configurations For Coordinate Measuring Machines.* Advisor: Dr. Jeffery McNabb.
M.S.	Indiana State University, Terre Haute, Indiana. May 1996. Major: Industrial Technology, with an emphasis on computer integrated manufacturing and bar coding.
B.S.	Ohio University, Athens, Ohio. June 1994. Major: Industrial Technology, with an emphasis on computer systems.

TEACHING EXPERIENCE

2019-Present	University of Memphis. Associate Professor, Graduate Coordinator, and director AutoID Lab.
2013-2019	University of Memphis. Assistant Professor. Responsibilities include the robotics and automation lab (increased robot count from 2 to 16) and the automatic identification lab. Classes include automation and robotics, introduction to engineering technology, PLCs, data structures, modern programming and the senior project two-class sequence. Graduate classes include technical writing and statistics. Automatic identification lab responsibilities include the development of the lab, solicitation of projects and equipment and technology transfer activities with Memphis based companies. Robotics familiarity include Fanuc, Adept, Mitsubishi, ABB, IBM, Sony and Motoman.
2011-2013	Ohio University. Associate Professor & Director of the Automatic Identification and Data Capture (AIDC) Laboratory
2005-2011	Ohio University. Assistant Professor & Director of the Automatic Identification and Data Capture (AIDC) Laboratory. Responsibilities have included teaching and maintaining the laboratories for the machining courses, the production tooling (jigs and fixtures) course, the AIDC Lab and the robotics course. Internal collaborative activities have included obtaining and commissioning a portable CMM from the Mechanical Engineering department and the development of a new interface for the Electrical Engineering and Computer Science's model automated storage and retrieval system. Center activities include the development of a new business plan, grant/contract solicitation and

execution, hardware acquisitions, tech-transfer activities, educational/workshop activities and the annual summer technical institute.

2003-2005 University of Central Missouri *(formally Central Missouri State University)*. Assistant Professor (tenure track). Responsible for teaching undergraduate and graduate classes, student advising, and the Automation and Robotics Laboratory in the Industrial Technology department. Topics taught include computer numerical control, robotics, industrial automation, materials testing, production planning and control and facilities management.

2001-2002 Indiana State University. Instructor (1-year contract). Responsible for teaching a standard load, as well as continued duties in the Computer Integrated Manufacturing Laboratory. Classes taught were MCT 578 (graduate class), MCT 478, MCT 477, MCT 430 and MCT 295. All classes were personally developed, based on existing syllabi or class descriptions.

1996-1998 Industrial Training (Applied Tactical Systems). Provide applications training to end users and system administrators for custom inventory programs. Additional training was conducted for system administration and maintenance for computer support personnel. Responsibilities included the development of all training material, as well as the on-site training.

CLASSES TAUGHT

2013-Present
TECH 1411 – Introduction to Engineering Technology
TECH 1811 – Electronic Circuit Technology
TECH 2261 – Data structures
TECH 3822 – PLCs
TECH 4234 – Automatic Identification Applications
TECH 4474 – Automation and Robotics
TECH 4623 – Server Application Technology
TECH 4823 – Advanced PLCs
TECH 4943 – Senior Project Planning
TECH 4945 – Senor Project
EECE 4992 – Electrical Computer Project II (for EE/CE department)
TECH 7015 – Applications of Statistical Methods for Industry
TECH 7020 – Technical Research Writing
TECH 7402 – Advanced Quality Systems

2005-2013
IT 103 – Computer Applications in Industrial Technology
ETM 1030 – Computer Applications in Industrial Technology
ETM 206 – Computer Methods in Industrial Technology
ETM 216 – Metal Machining
ETM 217 – Production Metal Machining (CNC)
ETM 303 – Applications in Object Oriented Programming (C#)
ETM 351 – Production Tooling
ETM 3540 – Automatic Identification
ETM 4330 – Radio Frequency Identification for the Supply Chain
ETM 4350 – Robotics and Automation
ETM 464 – Robotic Applications
ETM 490 – Independent Studies

2003-2005	INDM 5020 - International Technology Management MMgt 4520 - Robotics and Automation MMgt 4240 - Facilities Management. Co-taught with Dr. Ron Woolsey. MMgt 3562 - Computer Numerical Control MMgt 3550 - Principles of Numeric Control MMgt 3520 - Manufacturing Economy MMgt 3510 - Manufacturing Planning and Control MMgt 2040 - Materials Testing MMgt 1012 - Global Production Technology
2000-2003	ECT 663 - Theory of Electronic Control. Assisted Dr. Jeff McNabb. ECT 661 - Robotic Electronic Control. Assisted Dr. Jeff McNabb. MCT 5/478 - Industrial Organization MCT 477 - Plant Layout and Materials Handling MCT 430 - Senior Seminar MCT 295 - Introduction to Computer Applications in Industrial Technology

CURRICULUM DEVELOPMENT

2016	TECH 3822 (PLCs). Significantly overhauled PLC class to incorporate the Compactlogix platform by Rockwell Automation (class previously only went as far as the SLC processor family). FactoryTalk View (HMI) and FactoryTalk Transaction Manager was also added.
2015	TECH 4474 (Automation and Robotics). Significantly updated existing robotics class to incorporate machine vision, Fanuc-based palletizing and integration of PLCs with the robots. An additional Fanuc LR-Mate was added.
2012	ETM 4350 (Robotics and Automation). Updated robotics class to incorporate ETM 435 (Industrial Controls). The merging of the two classes was a part of the conversion from quarters to semesters, and required a complete redesign of the class so as to allow for an additional 7 weeks of content from the industrial controls class, including sensors, PLCs and PIDs.
2008	IT433 (Radio Frequency Identification in the Supply Chain). Updated and functionally developed and submitted to the curriculum council an RFID class based on the concept of Dr. Todd Myers. The class covers the technical aspects of RFID, use of the technology, integration issues, privacy issues and a practical final project. Additionally, there is a strong programming component of the class where students are required to develop functioning RFID applications.
2004	MMgt 2040 (Engineering Material Science) Revised the existing Materials Testing class so that the new class will meet the changing needs of the department. The new class will be included in the proposed Industrial Engineering Technology program being developed by the department. The revised class will incorporate material from an introductory materials class and will concentrate on various materials and the appropriate testing methodologies.
2000	MCT 295 (Introduction to Computer Applications in Industrial Technology). Redeveloped the existing class curriculum so that it satisfied the new Information Technology Literacy requirement for the university. The new class

design was successfully approved after review by the Department, School of Technology, Dean, Curriculum Academic Affairs Committee and University Faculty Senate.

INDUSTRIAL EXPERIENCE

2012-Present BAIT Consulting. President. Responsible for the development of solutions for the various customers. The majority of the work is custom RFID based applications development using Alien and MTI RFID hardware. The company was created based on the need to distribute software that was developed while a professor at Ohio University, however the bulk of the revenue is from custom software development for RAIN RFID systems.

1998-2000 Delphi Automotive/Rapid Design Service, Inc. Manufacturing Engineer. Responsibilities included creating mechanical and electrical build prints, management of the build process, and the installation and validation of the machines. Required skills included mechanical and electrical design work, AutoCAD drafting, General Motors process design activities (FMEA analysis, design for manufacture-ability, lean cell design, etc.), Allen Bradley PLC programming, project management, troubleshooting/debugging and machine documentation. The job also required integration support and training for the machines, on-site in Mexico.

1996-1998 Applied Tactical Systems. Project Engineer. Responsibilities included project management, programming, end-user training, system design and project implementation. Interfacing with the customer was necessary in order to determine their needs and to insure that they received what they needed, as well as what they requested. Required skills included programming in Visual Basic and TCL/TK, application training, troubleshooting, design work and on site modifications, as well as any required coordination with the office. Additional skills included database administration in Oracle 7 and SQL Server 6.5, hardware (PC and mobile data collection tools) installation and support, and Windows NT/95 administration.

SOFTWARE DEVELOPMENT

2007-Present Developed, sold and supported various software programs.

- RFID ME Software Development Kit – Developed a .NET compliant interface for the RFID ME family of RFID readers. The units are USB HID devices and the manufacturer only provides a low level API for communicating with the readers. This development kit allows programmers to more easily interface with the device.
- RFID ME keyboard wedge software – Developed an interface to the RFID ME USB reader. The unit is a USB/HID compliant device.
- Alien RFID Wedge – Software to interface with the Alien Technologies series of RFID readers. The software took the tag information and pushed it to the keyboard buffer allowing any computer program to consume the RFID tag data.
- Alien tag programming software – Allowed user to scan a bar code and encode the value into a UHF RFID tag. System also interfaced with a PLC.

- Alien RFID Race Management Software – Developed software that captured tags being used in races (5K, 10K, marathons) to track runners. System logged data from multiple readers and generated a single output file that could be imported into traditional race management software.
- Feig RFID Wedge – Software to interface with the Feig MR-100 series HF-RFID reader. The software took the tag information and pushed it to the keyboard buffer allowing any computer program to consume the RFID tag data.
- Alien RFID tracking service – Software that was developed as a Windows service that consumed the tag data from an unlimited number of RFID readers, allowing for the tracking of tags within a conference center.
- Various handheld (Windows Mobile/Windows CE and Android OS) applications that included bar code and RFID data collection as well as miscellaneous utilities.

CONSULTING EXPERIENCE

2024-Present	Expert Witness (undisclosed client). Assisting with early-stage RFID patent portfolio review with intent to embark on a licensing campaign. Reviewing claim charts for patent portfolio to determine licensing opportunities.
2022	Expert Witness (undisclosed client). Design Patent case, working for the defense. Initial review of materials was begun, general topic is mobile bar code scanning. Dismissed.
2021-2024	Expert Witness for plaintiff, Paragon Data Systems, Inc. – Bar code/SAP system development trade secret misappropriation case. Deposed. Case was settled in favor of client.
2020-2023	Expert Witness for the defense (Shell). Worked with a UK legal team on a patent infringement case for Shell, where they were sued for patent infringement in the use of QR Codes on their mobile payment system. Testified in UK court. Judgement was in the client's favor.
2020-Present	Expert Witness for the plaintiff (Tomra) – machine vision performance. Expert reports have been exchanged. I have reviewed a baseline example of the solution in dispute and have traveled to the defendant's site. Deposed. Case has been settled.
2016	Expert Witness for the defense – Mobile bar code patent infringement. *Symbology Innovations, LLC v. Adams Extract et al.,* Case No. 2:15-cv-01169-JRG-RSP, 2:15-cv-01170-JRG-RSP (E.D. Tex.). Produced expert report but was not deposed. Settled.
2016	Expert Witness for the defense – Programmable Logic Controller patent infringement. *Rockwell Automation, Inc. v. 3S-Smart Software Solutions, GmbH,* Case No. 2:15-cv-1543 (E.D. Tex.). Settled. Assisted with claim

	construction for 17 contented patents. Settled prior to final submission of expert report.
2013-2014	Expert Witness for the defense – Software trade secret infringement. *GlobeRanger Corporation v Software AG, Software AG USA, Inc., Software AG Inc., Naniq Systems, LLC and Main Sail, LLC., C. A. No. 3:11-CV-403-B* in the United States District Court Northern District of Texas Dallas Division. Testified, no deposition.
2013	Expert Witness for the defense – Patent infringement. *Aeritas, LLC v. Alaska Air Group, Inc., C.A. No. 11-967-SLR; Aeritas, LLC v. Delta Airlines, Inc., C.A. No. 11-969-SLR; and Aeritas, LLC v. US Airways, Inc., C.A. No. 11-1267-SLR* settled in the United States District Court for the District of Delaware. Deposition only.
2012-Present	BAIT Consulting – Created my own consulting company to allow for the licensing and sales of the software that was created while at Ohio University. The company provides custom and standard AIDC based software solutions, incorporating MTI and Alien RFID readers.
2007-2012	RFID Enabled Solutions – Provided RFID based technical support, hardware integration development and support. Projects included integrated and stand-alone RFID reader solutions as well as the integration of other input devices such as scales, finger print readers, magnetic door locks and light stacks. UHF antenna development and integrated mobile UHF RFID readers are currently underway.
2010	Source Technologies – Conducted 2 day AIDC training for marking, sales and technical support staff. Topics centered on how the company can better use various AIDC technologies in their current solutions. A follow-up training session was conducted at Source Technologies.
2009	Medtronic – Conducted half-day AIDC training and technology transfer session with engineering and information technology personnel. Various processes were evaluated for compatibility with RFID and direct part marking technologies.
2009	IEEE – Indianapolis Chapter – Conducted 1 day RFID workshop for local chapter members.
2008	Emerson Power – Conducted RFID training for the engineering staff, concentrating on how Emerson can leverage RFID to improve field service operations.
2008	Sam Houston State University – Worked with Sam Houston State faculty, as well as Dr. Pedro Reyes from Baylor University, to develop the RFID component of The Sower Technology Laboratory. Activities included developing self-paced lab activities, setting up and configuring hardware, developing necessary software and training Lab faculty on the use of the purchased RFID equipment.

2007 Adena Ventures – Conducted a needs analysis for Designer Furniture Warehouse to determine how and where they could integrate bar coding into their existing processes.

2006 Northrop Grumman Space Technologies – Developed a three-day workshop for Northrop Grumman on the DOD requirements for radio frequency identification and unique identification. The presentations were supplemented with equipment demonstrations and the third day was a hands-on mini exhibit that was composed of invited vendors who demonstrated their equipment offerings.

1991-2011 Miscellaneous Consulting. Industrial Training (Miscellaneous). Provided computer aided drafting (CAD), bar code and radio frequency identification training to individuals from various companies. Training sessions were customized to the requirements and knowledge levels of the participants being trained. Various manuals, interactive activities and teaching aids were developed to assist in the training.

FELLOWSHIPS / ASSISTANTSHIPS

2002-2003, 2000-2001 Indiana State University. Doctoral Fellow. Responsible for assisting students with the use of the machinery in the Computer Integrated Manufacturing Laboratory at Indiana State University. Knowledge of PLC's, the laboratory's robots, basic electronics and automation is required. Included in the laboratory were a Brown & Sharpe coordinate measuring machine and a Stratasys rapid prototyping system. Laboratory responsibilities extended to the maintenance and operation of both machines. Also responsible for assistance with new course development and some teaching.

1994-1996 Indiana State University. Graduate Assistant. Responsible for assisting students with the use of the machinery in the Computer Integrated Manufacturing and the SIMCO Laboratories at Indiana State University. Knowledge of PLC's, the laboratory's robots, basic electronics, automation, basic woodworking equipment, product design, jig and fixture design, and product design was required.

Spring 1994 IT 454 Automatic Identification (Ohio University). Responsible for assisting students in a variety of laboratory activities as well as serving as an advisor for the students' final project. Required knowledge of all the hardware and software systems used in class.

LABORATORY EXPERIENCE

2013-Present Automatic Identification laboratory, Robotics/Automation laboratory, DC electronics laboratory. Responsible for obtaining new equipment, maintaining existing equipment and general lab layout and configuration. Allen Bradley PLC 5s, Micrologix 1100/1200, CompactLogic, AIDC equipment and software, Fanuc LRMate-200i arms w/vision, Fanuc M1-iA (delta robot) w/vision, Cognex 7404, Keyence CV-3502P, 4 Mitsubishi RH-18S arms and multiple conveyor systems.

2005-2013	Machining Laboratory, Automatic Identification and Data Capture Laboratory, Robotics Laboratory (Ohio University). Responsible for supervising maintenance, upgrading and teaching in the machining lab which includes four vertical mills, three horizontal mills, six lathes, a CNC mill and a CNC lathe. The automatic identification lab requires supervision of multiple computers, $750,000+ in purchased and donated equipment that includes robots, variable speed powered conveyors, bar code scanners and printers, bar code verifiers, radio frequency identification, mobile data collection and biometric equipment. The lab requires constant solicitations to ensure that the equipment is current. The robotics laboratory has been developed from the ground up to currently include two Fanuc S-10 robots, a Mitsubishi RV-M2 robot, powered and gravity conveyors and Keyence machine vision systems.
2003-2005	Automation and Robotics Laboratory (Central Missouri State University). Responsible for the development and future direction of the Automation and Robotics Lab. The lab includes a CNC router, 2 Adept SCARA robots, 2 Yamaha robots, 2 Dynamill 2800 CNC mills, 20 Mastercam stations and various bar coding equipment. As a part of my efforts, a five-year plan was developed for the lab, numerous equipment donations were secured and the lab was rearranged.
2000-2003, 1994-1996	Computer Integrated Manufacturing Laboratory (Indiana State University). Responsible for assisting students with the use of the machinery in the Computer Integrated Manufacturing Laboratory at Indiana State University. Knowledge of PLC's, the laboratory's robots and RobCad was required.
1994	Center for Automatic Identification at Ohio University. Responsible for assisting with the various projects with which the center was involved. This included the creation of a data collection system for the Financial Aid Office at Ohio University. Further duties included assisting with the Center's "Automatic Identification and Data Capture Technical Institute", a weeklong program to educate educators on automatic identification. Responsibilities included preparation and running of various "hands on" laboratories during the course of the program.

PUBLICATIONS (PEER-REVIEWED)

Berisso, K. (2018). "DotCode Damage Testing." *Journal of Computer Sciences and Applications.*

Berisso, K. (2018). "Addressing Color Blind Awareness." *Journal of Business and Management Sciences.*

Berisso, K. (2018). "Reed-Solomon Based Bar Code Character Substitution Rates." *Journal of Business and Management Sciences*.

Koch, D., Ollison, T., Berisso, K., Dalton, A. & Washer, B. (2015). "Robotics in Education: A Postsecondary Perspective." *Techniques, vol. 90-6*.

Berisso, K. (2013). "Determining QR Code Sizes for Mobile Scanning." *International Journal of Automated Identification Technology. Vol. 5(1)* .

Ollison, T. & Berisso, K. (2010). "Coordinate Measuring Machine Variations for Selected Probe Head Configurations." *Journal of Industrial Technology*. January 2010, *vol. 26-1*.

Berisso, K. & Ollison, T. (2010). "Three-Dimensional Printing Build Variables That Impact Cylindricity." *Journal of Industrial Technology*, January 2010, *vol. 26-1*.

Berisso, K. (2009). "Teaching an Applications-Based Radio Frequency Identification Class." *the Technology Interface Journal*, Fall, 2009, *Vol.10(1).*

Matta, V., Berisso, K. & Brokaw, T. (2009). "Prototyping for the Holy Grail of RFID: Return on Investments." *Issues in Information Systems, Vol. X,(2).*

Matta, V., Koonce, D. & Berisso, K. (2009). "Extending the Semantic Model of RFID functionality." Poster presented at the International Conference of Information Systems, WEB 2009 track in Phoenix, AZ. Won best poster award.

Berisso, K. & Ollison, T. (2005). "Impacts of Part Orientation on the Roundness of Cylinders Using Three-Dimensional Printing." *2005 NAIT Selected Conference Paper*

Clyburn, W. & Berisso, K. (2003). "Human-Machine Interfaces for Industrial Control Systems." *2003 NAIT Selected Papers*.

McNabb, J. & Berisso, K. (2002). "The treatment of five key independent variables for conducting coordinate measuring machine (CMM) experiments." *2002 NAIT Selected Papers*.

PUBLICATIONS (MANUALS)

2004 Automation and Robotics Laboratory Manual (Central Missouri State University). Developed a laboratory manual that discusses the use of the robots in the lab. The manual includes instructions on how to use the various robots, programming tips and exercises. The sections of the manual include instructions for two different Adept robots, two different Yamaha robots and an automatic identification station.

2001 Computer Integrated Manufacturing Trainer Laboratory Manual (Indiana State University). Developed a laboratory manual to be used with the computer integrated manufacturing trainer purchased by the department. The unit came with no manuals, literature or other reference material. The manual was developed so that the students would be able to start with a minimal amount of knowledge. Through the exercises, the student would be exposed to the various skills required to do the final integration project in the manual.

SELECTED PRESENTATIONS

Peer Reviewed Presentations:

Berisso, K. & McGinnis, J (2017) "Internet Of Things Security" Conference on Internet Computing and Internet of Things. Selected presentation. Las Vegas, NV

Berisso, K. (2014). "Managing Expectations with Industry – A University Indirect Rate Survey." 2014 ATMAE Conference. Scope: national conference.

Chandra, V. & Berisso, K. (2014). “What’s The Frequency, Kenneth? Integrating RFID Theory with Microcontroller-Based Lab Projects.” 2014 ATMAE Conference. Scope: national conference.

Berisso, K. (2013). “Teaching Hands-on Online: A Proposed Solution for RFID Classes”. 2013 ATMAE Conference. Scope: national conference.

Berisso, K. (2012). “Mobile AIDC: Rethinking Bar Codes”. 2012 ATMAE Conference. Scope: national conference.

Clyburn, W. & Berisso, K. (2012). “Introducing RFID into the Curriculum of an Engineering Technology Program”. 2012 ATMAE Conference. Scope: national conference.

Berisso, K. (2010). “Technical Issues for RFID Adoption.” Industry Studies 2nd Annual Conference. Scope: national conference.

Berisso, K. & Kuruppalil, Z. (2009). “Lean Sigma & RFID.” Co-presented at the 2009 ATMAE conference. Scope: national conference.

Berisso, K. & Deering, P. (2009). “Phidgets: A Practical Solution for Teaching Programming.” Co-presented the 2009 ATMAE conference. Scope: national conference.

Berisso, K. (2009). "Teaching Practical RFID: A Review of Hardware Options.” Presented at the 2009 ATMAE conference. Scope: national conference.

Matta, V. & Berisso, K. (2009). “Prototyping for the holy grail of RFID: Return on Investments.” Co-presented at the 2009 IACIS conference. Scope: national conference. *(It should be noted that the presentation was reviewed separately from the paper)*

Clyburn, W. & Berisso, K. (2008). “Identifying and Solving Interference Problems in Radio Frequency Identification Systems.” Co-presented with at the 2008 NAIT Convention. Scope: national conference.

Berisso, K. & Kuruppalil , Z. (2008). “Real time Inventory in Job Shops Utilizing RFID.” Co-presented at the 2008 NAIT Convention. Scope: national conference.

Myers, T. & Berisso, K. (2007). “RFID for the Supply Chain Manager.” Co-presented at the 2007 NAIT Convention. Scope: national conference.

Berisso, K. (2007). “The outlook for RFID Integrated Supply Chain Studies” Decision Sciences Institute conference. Scope: international conference.

Moeeni, F., Fales, J., & Berisso, K. (2007) “RFID: Dispelling the hype.” Decision Sciences Institute Annual Conference. Scope: international conference.

Berisso, K. & Ollison, T. (2006). “Comparing The Impacts of Part Orientation On Multiple Rapid Prototyping Technologies.” National Association of Industrial Technology convention. Scope: national conference.

Kangas, G. & Berisso, K. (2006). “Web-based HMI – Process access from around the globe.” National Association of Industrial Technology Convention. Scope: national conference.

Fales, J. & Berisso, K. (2005). “The Role of AutoID Technologies - RFID, Bar Coding, Biometrics, & Smart Cards in Decision Making & Supply Chain Integration.” Decision Sciences Institute Conference. Scope: international conference.

Ohrenberg, R. & Berisso, K. (2005). “Student Recruitment: Help is on the way for Manufacturing Programs.” National Association of Industrial Technology convention. Scope: national conference.

Berisso, K. & Ollison, T. (2005). “Impacts of Part Orientation on the Roundness of Cylinders Using Three-Dimensional Printing.” National Association of Industrial Technology convention. Scope: national conference.

Ollison, T. & Berisso, K. (2005). “Impacts of Part Orientation on Model Strength for Three Dimensional Printing” National Association of Industrial Technology convention. Scope: national conference.

McBride, R. E. & Berisso, K. (2004) “Rapid prototyping purchasing considerations for academia and smaller companies.” Rapid Prototyping & Manufacturing Conference 2004. Scope: international conference.

Berisso, K. (2003). “Hands-on bar coding for the technology education lab,” Technology Education Association of Missouri Fall Conference. Scope: regional conference.

Berisso, K. (2003). “A comparison of measurement variations for various probe head configurations for coordinate measuring machines.” National Association of Industrial Technology convention. Scope: national conference.

Clyburn, W. W. & Berisso, K. (2003). “Human machine interfaces for industrial control systems.” National Association of Industrial Technology convention. Scope: national conference.

McNabb, J. & Berisso, K. (2002). “The treatment of five key independent variables for conducting coordinate measuring machine (CMM) experiments.” National Association of Industrial Technology convention. Scope: national conference.

McNabb, J., McBride, R. E. & Berisso, K. (2002). “Rapid prototyping – after the purchase.” National Association of Industrial Technology convention. Scope: national conference.

Selected Invited Presentations:

Berisso, K (2025). Various presentations and live demonstrations at RFID Journal Live.

Berisso, K (2024). Various presentations and live demonstrations at RFID Journal Live.

Berisso, K (2023). Various presentations and live demonstrations at RFID Journal Live.

Berisso, K (2022). Various presentations at RFID Journal Live.

Berisso, K (2021). Linking RFID to PLCs Linking RFID to PLCs Part II – The PLC Strikes Back . RFID Journal Live Encore

Berisso, K (2020). Linking RFID to PLCs to Automate Manufacturing. RFID Journal Live

Berisso, K. (2019). Bluetooth Low Energy workshop. RFID Journal Live.

Berisso, K. (2018). Bluetooth Low Energy workshop. RFID Journal Live.

Berisso, K. (2015). “Is it really IoT? Developing a methodology.” Internet of Things – West Conference (Las Vegas). Scope: international conference.

Berisso, K. (2015). “Is it really IoT? Developing a methodology.” 2015 Alien User Conference (Las Vegas). Scope: international conference

Berisso, K. (2015). “Automatic Identification – Use it or lose it.” Material Handling Teacher’s Institute. Scope: national conference

Berisso, K. (2013). “Mobile AIDC: QR Codes Reduex?”. ProMat 2013. Scope: international conference.

Berisso, K. (2012). “A survey of Internet of Things applications.” MODEX 2012. Scope: international conference.

Berisso, K. (2010). “Unlocking the Value in RFID.” IEEE & SME Columbus area chapters. Scope: regional meeting.

Berisso, K. (2010). “AIDC Data Integration.” RFID Journal Live. Scope: international conference.

Berisso, K. (2009). “An RFID Demonstration.” Baylor RFID Integrated Supply Chain Symposium. Scope: national conference.

Berisso, K. (2008). “RFID Hands-On Demonstration.” Baylor RFID Integrated Supply Chain Symposium. Scope: national conference.

Berisso, K. & Myers, T. (2007). “Radio frequency identification: A practical discussion of how it can help your business.” IEEE & SME Columbus area chapters. Scope: regional meeting.

Berisso, K. (2007). “Applied Bar Coding and RFID Workshop” Identity Solutions Symposium and Workshop. Scope: national conference.

Berisso, K. (2006). “2D Bar Codes for the Normal Person.” Coast Guard 2D Symposium. Scope: national conference.

Berisso, K. (2006). “Future Trends – Today: RFID and AIDC - Radio Frequency Identification Tags and Automatic Identification and Data Capture.” Ohio MRDD Conference. Columbus OH.

Berisso, K. (2006). “Supply Chain Gadgets: AIDC in the Supply Chain.” SupplyNet 2006. Scope: regional conference.

Myers, T. & Berisso, K. (2006). “Radio Frequency Identification for Manufacturers.” Columbus, Ohio chapter of the Society of Manufacturing Engineers. Scope: local meeting.

Myers, T. & Berisso, K. (2005). “Future Trends – Today: RFID and AIDC - Radio Frequency Identification Tags and Automatic Identification and Data Capture.” Ohio MRDD Conference. Scope: regional conference.

FUNDING / GRANTS / CONTRACTS

2021-2023 GS1 Bar Code Testing. $455,000 to conduct various robotic bar code testing projects.

2021-Present ARM Technology grant. $498,000 to develop an AI assisted task creation solution. Project manager/principle investigator with two sub-awardees (DeepHow and Ready Robotics). The system will assist novice robot programmers in the task development process, helping the programmer to develop programming solutions that are equal to those that are produced by experienced, expert programmers.

2021-Present FRONTIERS "RFID Tracking Shipments" project. $10,000 to work with a FedEx Institute of Technology client on the implementation of an RFID tracking system that leverages machine learning to improve system design and functionality.

2020-Present Workforce Opportunity for Rural Communities (WORC 2): A Grant Initiative for the Appalachian and Delta Regions (FOA-ETA-20-04). $1,013,896 grant from the U.S. Dept. of Labor for workforce development. Principle Investigator.

2018 2018 FedEx Institute of Technology Biologistics Research Fellow. $10,000. "Smart Sensor Communications Congestion Testing." Currently conducting Bluetooth Low Energy performance testing.

2017 MCR Safety Vest Testing. $6,666. Conducted testing in conjunction with the Dept. of Mechanical Engineering on new safety vest liner material for MCR.

2016 2016 FedEx Institute of Technology DRONES Research Fellow. $12,000. "Bluetooth Low Energy (BLE) Beacon-assisted Localization Solutions." Investigate the feasibility of implementing a BLE beacon based solutions. University of Memphis FedEx Institute of Technology Seed Grant.

2015-2016 Solicited and received funds ($43,300) for the annual Automatic Identification Teacher's Institute (AITI).

- Obtained $30,000 from the Material Handling Educational Foundation for the summer AITI
- Obtained $10,000 from GS1-Global Office for the summer AITI
- Obtained $2,500 from the AIDC 100 for the summer AITI
- Plus additional sponsors

2015-2016 GS1 US "Supplemental 1D Judge." $91,500 to develop and build a NIST traceable linear bar code verification solution that will become the new "gold standard," performing the initial verification and certification of all GS1 US Certified Calibration Standard Test Cards.

2015 HMI Project. $18,331 to assist in the development of a fail-over HMI solution for the PLCs that control the conveyors within the facility.

2014 Solicited and received funds for the annual AIDCTI.

- Obtained $20,000 from the Material Handling Educational Foundation for the summer AIDCTI
- Obtained $10,000 from GS1-Global Office for the summer AIDCTI

- Obtained $2,500 from the AIDC 100 for the summer AIDCTI
- Obtained $1,000 from MSM Systems for the summer AIDCTI
- Obtained $1,000 from Evanhoe & Associates for the summer AIDCTI
- Obtained $1,000 from Axicon for the summer AIDCTI
- Obtained an addition $3,500 from paying participants

GS1- "Set up testing lab." $6,000 to assist in the setup and development of a bar code testing lab at the University of Pittsburg.

2013 GS1- "Set up testing lab." $6,999 to assist in the setup and development of a bar code testing lab at the University of Pittsburg.

2012 Solicited and received funds for the annual AIDCTI.

- Obtained $25,000 from GS1-Global Office for the summer AIDCTI
- Obtained $14,000 from the Material Handling Educational Foundation for the summer AIDCTI
- Obtained $1,000 from the AIDC 100 for the summer AIDCTI
- Obtained $1,000 from PathGuide Technologies for the summer AIDCTI
- Obtained $1,000 from Alien Technology for the summer AIDCTI
- Obtained $800 from Axicon for the summer AIDCTI
- Obtained an addition $2,300 from paying participants

2011 Solicited and received funds for the annual AIDCTI.

- Obtained $25,000 from GS1-Global Office for the summer AIDCTI
- Obtained $10,000 from the Material Handling Educational Foundation for the summer AIDCTI
- Obtained $1,000 from the AIDC 100 for the summer AIDCTI
- Obtained $1,000 from PathGuide Technologies for the summer AIDCTI
- Obtained $800 from Axicon for the summer AIDCTI
- Obtained $500 from Mr. Chuck Biss for the summer AIDCTI

2011- 2012 GS1 – "Cell phone testing". $30,000 to test cell phones as a bar code scanning device. Testing is currently ongoing, but more than 60,000 scans have been performed and analyzed. Fifteen student workers, a graduate researcher and an undergraduate researcher were managed. Software development for iPhones, Android phones and Windows Phone 7 were included in the project.

2011-2012 GS1 – "Multiple bar code testing". $30,000 to test how point of sale scanners respond to multiple symbols within the scan envelope.

2010 Intermec – "Bar code printer testing". $1,503 to test the performance of printer heads.

2010 Formica – "RFID tag study". $1,000 to determine if RFID tags can be embedded in the metal plates used during production.

2009-2012 GS1 – "Bar code robustness testing". $198,689 to date to test various bar code symbologies under a number of different simulated conditions including point of sale scanning, hand held scanning and high speed scanning.

2008 Ontario Lottery and Gaming Corp – "Magnetic Card Testing". $5,896 to test the performance of various card readers and cards of varying age.

2008 Solicited and received funds for the annual AIDCTI.
- Obtained $17,000 from AIM Global for the summer AIDCTI
- Obtained $1,000 from the Automotive Industry Action Group for the summer AIDCTI
- Obtained $800 from Axicon for the summer AIDCTI

2008 GS1-US – "A Proposal to provide the hardware for a device to measure and analyze high precision, NIST traceable, matrix symbology test targets." $194,700 to build a 2D bar code verification system.

2007 Altec Cartridges – "Bar code print quality report." $500 to verify the print quality from remanufactured laser printer cartridges.

2007 Arjobex – "RFID Moisture testing." $3,234 to test the impacts of humidity on RFID labels.

2007 Explotrack – "RFID/PJM testing assistance." $2,284 to help test the functionality of an RFID tunnel.

2007 Explotrack – "RFID chipless technology report." $800 to develop a report on the current availability of chipless RFID technologies.

2007 Ontario Lottery and Gaming Corp – "Interleaved 2 of 5 robustness testing." $27,601 to test the character substitution rates of the I 2 of 5 bar code symbology.

2007 RFID Solutions Center – "RFID freezer testing." $9,880 to test RFID tags while in a -100 F freezer.

2006 Solicited and received funds for the annual AIDCTI.
- Obtained $17,000 from AIM Global for the summer AIDCTI
- Obtained $2,800 from Hand Held Products for the summer AIDCTI
- Obtained $1,000 from LXE for the summer AIDCTI
- Obtained $1,000 from Logmation for the summer AIDCTI
- Obtained $800 from Axicon for the summer AIDCTI

2004 Central Technology Grant – Received $2,600 to obtain concrete training for the construction management faculty and myself. The training was presented by the Portland Cement Association, one of the concrete trade associations. The training lasted 1.5 days and covered the basics of concrete, mix design, wet concrete tests and finishing practices. Six professors/doctoral fellows and six students attended.

2004 CMSU Faculty Professional Travel Grant – Received $270 to present at the National Association of Industrial Technology convention in Louisville, Kentucky.

2004 CMSU Professional Enhancement Committee Grant (Primary Applicant) – Received $570 for materials to be used for rapid prototyping research (this was a peer reviewed grant).

2003 CMSU Faculty Professional Travel Grant – Received $600 to present two papers at the National Association of Industrial Technology convention in Nashville, Tennessee.

PROFESSIONAL DEVELOPMENT / TRAINING

2021 Yaskawa Academy Certified trainer for YRC1000 controller (renewed for 2024)

2018 Laser Safety Training

2014 Nao robot training.

2014 Self-taught Java programming

2013 Sony Robotics training.

2012 Keyence Vision Systems training.

2011 Self-taught Microsoft C# programming language.

2010 Alien RFID Academy – "Beyond the Physics" two day advanced training session on the use of RFID.

2010 Datalogic Automation (bar code scanners, RFID readers).

2007 Received my CompTIA RFID+ certification.

2006 RF Code Training. Attended a two day training session on the use of RF Code's active RFID equipment.

2006 Alien RFID Academy. Attended a three day training session on the use of RFID and specifically Alien Technology's RFID equipment.

2005 Faro CMMs. Attended a 3 hour training session from the local Faro representative on the use of the Faro portable CMM arm the depart has on loan from the Mechanical Engineering Department. I have become the department lead on internal trainings of the equipment and software.

2005 Portland Cement Association. Attended 10 hours of training on the basics of concrete. Topics included the basics of concrete, mix design, wet concrete tests and finishing practices.

2004 National Science Foundation Regional Grants Conference. Attended the grant conference at Washington University in St. Louis. The conference included sessions on grant writing, awards management, the merit review process and breakout sessions for the Education & Human Resources Division and the Engineering Division.

2004 Automatic Identification and Data Capture Technical Institute. Attended this week-long institute in Athens, Ohio, that includes a series of lectures as well as hands-on lab time. Topics addressed include bar coding, magnetic stripe, biometrics and radio frequency identification (RFID), among others. This year's emphasis included RFID and the new electronic product code specifications.

2004	Project Lead The Way. Attended the Project Lead The Way (PLTW) level one summer training session for the Principles of Engineering course. PLTW is a national pre-engineering program whose goal is to increase the quality and quantity of engineers and engineering technologists. The Principles of Engineering class is designed to help students to understand what engineering is through the exploration of various engineering skills and activities.
2004	ZCorp end-user training. This training was for the new rapid prototyping machine that CMSU owns. The machine is being used in MMgt 3560 and for personal research.
2004	Instron end-user training. This training was for the new universal testing machine that the Industrial Technology department had purchased. The training covered usage of the machine which is used in MMgt 2040.
2002	Brown and Sharpe. Received training on the use of DataPage and DataView for UNIX. These two packages are used for the collecting and evaluating of data received from the Brown & Sharpe Microval PFx coordinate measuring machine that Indiana State University has.
2001	Stratasys FDM3000. Received training on the use of the FDM3000 rapid prototyping machine and software (Insight).

AWARDS / HONORS

2022/3	Named R. Eugene Smith Professor for the Herff College of Engineering
2017	Department of Engineering Technology received the AIM North America Business of the Year award for efforts in the AIDC space
2017	Memphis Joint Engineering Council - Featured Engineer
2013	Inducted into the AIDC 100, a not-for-profit, self-sustaining, non-political, international organization of automatic identification and data capture (AIDC) professionals and others who have significantly contributed to the growth and advancement of the industry
2012	Ted Williams Award (presented annually by AIM Global to a professor or student in recognition of innovative and exceptional contributions that can further the growth of the industry through their work as a teacher, researcher and entrepreneur)
2007, 2009, 2011, 2012	Marvin E. and Ann D. White Department Research Award.
2002	Epsilon Pi Tau – Inducted to EPT as a Member-At-Large. EPT is the International Honorary for Professions in Technology.
1994	2nd Place – 1994 SME Ohio Intercollegiate CADD Shoot-out.
1993	1st Place – 1993 Ohio Intercollegiate CADD Shoot-out, Autocad division.
1993	2nd Place – 1993 Ohio Intercollegiate CADD Shoot-out, finals.

1989 Eagle Scout – Boy Scouts of America

GRADUATE COMMITTEES

2010 Thesis committee member for Harish Bharti (Ohio University, MS Industrial and Systems Engineering). *To Validate the Model of "Semantic Breakdown of Functionality of a Matrix of RFID Technology to Support Application Development"*

2009 Thesis committee member for Will Holland - (Ohio University, MS Industrial and Systems Engineering). *Development of an Indoor Real-time Localization System Using Passive RFID Tags and Artificial Neural Networks.*

2009 Thesis committee member for Jermey Anderson - (Ohio University, MS Industrial and Systems Engineering). *A Study of Nutrient Dynamics in Old Woman Creek Using Artificial Neural Networks and Bayesian Belief Networks.*

2009 Thesis committee member for Mathivanan Sivanesan (Ohio University, Master of Communication Technology and Policy). *RFID Security System Development.*

2008 Thesis committee member for Carlos Egas – (Ohio University, MS Industrial and Systems Engineering). *A Methodology For Datamining Customer Orders History For Storage Assignment*

2008 Dissertation committee member for Jeff Ulmer (Indiana State University, PhD program). *A Study Of ASQ And SME Members On The Effects Of Continuous Improvement Practices And Certifications On Quality Cost For Small-To-Midsized United States Manufacturing Companies.*

2007 Dissertation committee member for Troy Ollison (Indiana State University, PhD program). *The Effect Of Build Orientation, Printhead Wear And Recycled Build Material Utilization On The Cylindricity Of Three-Dimensional Printed Parts.*

2007 Dissertation committee member for Zaki Kuruppalil (Indiana State University, PhD program). *Leanness And Agility In Job Shops: A Survey Instrument Developed Using The Delphi Method.*

2005 Thesis committee member for Andy Dick (Ohio University, MS Mechanical Engineering). *Development Feasibility of a Universal Industrial Robot / Automation Equipment Controller.*

2002 Committee member for Dimas Gutierrez (Indiana State University, MS Industrial Technology - Major Project). *Barcode System Integration with an Automated Storage and Retrieval System in the CIM Lab at ISU.*

2002 Committee member for George Terzakis (Indiana State University, MS Industrial Technology - Major Project). *Development of a Mobile Robotic System Performing Spatial Inspection and Mapping.*

SERVICE / COMMITTEES / VOLUNTEER WORK

2024	College Graduate Student Coordinator.
2018	Working with Sheffield Career and Technology Center (Memphis vocational high school) and their Transportation, Distribution and Logistics program providing technical advice/support and program development assistance. Helped to develop AIDC based equipment solicitations (received commitments by Avery Dennison, Alien Technology and Seagull Scientific to-date).
2017-2020	IEEE CRFID Educational Mega-Challenge Chairman.
2018	AIM REG Committee Chairman.
2014-Present	AIM REG Committee. This workgroup is responsible for drafting responses to the various issues the develop in the RFID arena.
2014-Present	RFID Journal Live, Ask the Experts volunteer. This booth is included as a service to the industry by acknowledged experts (via invite by the RFID Professionals Institute) in the industry to help conference and show floor attendees with vendor and RFID technology agnostic advice.
2012-Present	AIM UDI Committee. This workgroup is responsible for drafting responses to the Food and Drug Administration's (FDA) new unique device identification ruling.
2011-Present	AIM Internet of Things Committee. This group is responsible for the development of AIM's position and white papers in the area of the Internet of Things. Chair, 2015.
2009-Present	GS1 Bar Code Identification Technical Group. This group provides independent technical advice back into GS1on bar code matters.
2010-Present	AIM Technical Symbology Committee (TSC). This group provides independent technical advice back into AIM on bar code symbology matters. Chair, 2014.
2009-Present	RFID Journal Live Awards Judge. Member of the panels for "Best Use of RFID to Enhance a Product or Service" and "Best Thesis".
2006-2013	Ohio University Russ College Computer Security Council. As the department's member of the computer security council, I am responsible for helping to make recommendation on computer issues for the college.
2006	OU District Science Day Judge. Participated in the annual science fair that Ohio University hosts as an Engineering and Technology judge.
2005-2011	Ohio University Russ College Co-Op committee. As the department's member of the Co-Op committee, advising of all Co-Op students becomes a part of my advising load.
2005	Dream It-Do It Expo 2005 Planning Committee. As part of the National Association of Manufacturer's Dream It-Do It campaign, the 2005 Expo was a career recruitment event that targeted high schools in the Kansas City area. I was one of two representatives from Central Missouri State University. My

responsibilities included vendor solicitation and automation development for the Expo.

2004-2005 College of Applied Science and Technology Curriculum Committee. This is the college curriculum level committee that determines the appropriateness of courses and programs with the University mission and goals, the quality of courses and programs, overlapping interests, duplicate offerings and the proliferation of courses and programs and the impact on students and their educational goals.

2004- 2005 Faculty Senate Distance Education Committee. The function of the committee is to provide input regarding the development, initiation and maintenance of distance education efforts for the University. Membership is based on confirmation by the Faculty Senate.

2004- 2005 Central Missouri State University Information Technology Policy Council. The Council serves at the behest of the President to develop, recommend, and review policies regarding the acquisition, distribution, use, and maintenance of information technology, and recommend university priorities which are consistent with those policies. Membership is based on recommendations by the Faculty Senate and appointment by the President.

2002-2003 Major Project Committee member for the Master of Science program. I was one of three committee members for various final projects that were conducted in the computer integrated manufacturing lab at Indiana State University. Project topics included mobile robots, PLCs and bar coding.

2002 Volunteer Volleyball Coach – I was the assistant coach for the girls 15-2's and 17-2's Crossroads Volleyball Club, and the Terre Haute South Junior Varsity volleyball team.

2001 Light House Mission, Inc. – I worked with the administrative staff on the development and implementation of an inventory control and point of sale system for the Mission.

2000-2003 Indiana State University Microlab Committee. Participated as the School of Technology representative on the committee. The committee is responsible for investigating and advising on microcomputer issues for campus.

1995-1996 Academic Computing Advisory Committee for Indiana State University. Participated as a graduate student representative.

1993, 1989 Boy Scouts of America. – National Jamboree Volunteer, assistant scoutmaster.

1988-1990 West Essex Volunteer First Aid Squad (New Jersey). – Riding junior member.

MISCELLANEOUS

Professional Associations IEEE- Member at large, CRFID member. Epsilon Pi Tau (member-at-large), Society for Manufacturing Engineers (CMfgT – last renewed January 2004), National Association of Industrial Technology, Association for Information Systems, GS1-GO, Association for Automatic Identification and Mobility (AIM Global), International Association for Computer Information Systems

Computer Skills	AutoCAD, Allen Bradley PLC ladder logic, RSView32 Works, SQL Server, bar coding, radio frequency data collection, Mitsubishi robotic programming language, Yamaha robotic programming language, V+ (Adept robot language), Karel (robotic programming language), Keyence Vision Systems, .NET (Visual Basic & C#) development for desktops, PocketPC/CE devices and Windows Phone 7 devices, Windows XP\Server2003\Win7 administration, Microsoft Office products and UNIX, CompTIA RFID+ certified.
Hobbies/ Activities	Computer programming, sailing, photography, recreational cycling, Boy Scouts of America (Eagle Scout).

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Reed-Solomon Based Bar Code Character Substitution Rates

BESSERO
EXHIBIT 1043
7-3-25

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Abstract The use of Reed-Solomon error correction (RSEC) in bar code symbologies has been around since the early 1990s, but there hasn't been an in depth, publicly accessible study done on their resistance to character substitution errors since the original studies done in the early 1990s at Ohio University. This article reports on the test results from the scanning of more 23 million scans resulting in more than 2.39 billion characters across four different RSEC enabled bar code symbologies (Data Matrix, QR code, PDF417 and Aztec Code) with five different scanners. The results show that the RSEC enabled symbologies are capable of achieving at least a 1 in 797 million error rate, allowing for their use in instances where decoded data accuracy is imperative.

Keywords: *2D symbology, bar codes, data matrix, QR code, reed-solomon*

Cite This Article: Kevin Berisso, "Reed-Solomon Based Bar Code Character Substitution Rates." *Journal of Business and Management Sciences*, vol. 6, no. 3 (2018): 70-75. doi: 10.12691/jbms-6-3-1.

1. Introduction

Within the automatic identification industry, the use of bar code symbologies (the various types of bar codes or 'languages') that include Reed-Solomon error correction (RSEC) is often taken as a given for applications that require a higher degree of data confidence. The reasoning is that the Reed-Solomon error correction methodology is known to be a proven, robust solution that is used across multiple industries. Data substitution errors are instances where the bar code scanner processes a bar code symbol and returns an incorrect answer that is of the correct length and formatting, but with one or more incorrect characters or digits (e.g. "1235" instead of "1234"). However, if the reader were to specifically look for published evidence of the applicability of Reed-Solomon based 2D symbologies for industries with a zero tolerance of character substitutions exist, there exists little or no published evidence. In fact, the only known publicly available discussion of 2D symbology data substitution rates is an unpublished Ohio University report by Fales & Vincent [1] from 1993 in which they scanned approximately 62 million characters between the Data Matrix and PDF417 symbologies. Considered a seminal work for its time, the current level of 2D symbology usage today implies that this work is in dire need of an update.

In 2013 the Federal Drug Administration (FDA) released a final rule that required the unique identification of medical devices through their distribution and use. Known as the Unique Device Identification (UDI) rule, this FDA mandate requires all devices not under exemption to carry a label that contains both a human readable component and in an automatic identification and data capture (AIDC) form [2]. In the rule, the specification of specific technologies was avoided. However, due to the required data content and the nominal size of many of the medical devices that would have to comply, smaller high density bar code symbologies would have to be incorporated. And because of the sensitivity to data accuracy within the medical industry, the implicit use of a symbology with error correction was functionally build into the rule.

The FDA's UDI rule is not the first government mandate that implicitly or explicitly require 2D symbologies. As early as 2003, the U.S. Department of Defense required Item Unique Identification (IUID) marking on all serially managed items via MIL-STD-130 (which started out as Department of Defense Policy 4140.01) where all items above a specified value or that were otherwise specified received a unique identifier. Within the standard, Data Matrix is specifically listed as an acceptable method of marking required items.

The use of 2D symbols is also an accepted practice within the consumer goods supply chain. GS1, a global business standards organization that enables companies "…to identify, capture and share information smoothly, creating a common language that underpins systems and processes all over the world." [3], adopted the Data Matrix symbology in 2006 as a way to allow members to mark items for the healthcare industry. In fact, one only has to look to their cans of soup, shampoo or medication to see the adoption of Data Matrix as a tracking or validation tool.

And finally there is the airline industry. The use of PDF417 and Aztec Code have been an integral part of the airline industry since the early 2000's as a way to encode passenger data on both paper tickets and cell phone-based e-tickets. Since the passenger's name and flight information is encoded, a single incorrect character has the potential to disrupt or even prevent a traveler's passage through security and onto the plane.

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What all of these groups have in common is the need to have a symbology that is resistant to physical damage (erasures, additional marks inside the symbol, etc.) ensuring that the data is still available and still accurate. 2D symbologies such as Aztec Code, Data Matrix, Han Xin, PDF417, and QR Code provide this level of protection and data integrity insurance. However, as previously mentioned, there currently exists a lack of empirical evidence to this effect. While a seminal piece of work for its time, the 1993 study by Ohio University has two short-comings. This first is that the study is over 24 years old; there have been numerous significant improvements in micro-computer processing and imaging since the tests were conducted. The second issue is that there has been a significant increase in the usage of the tested symbologies. The 1993, results indicated that in at a worst case there could be a one in 10.5 million probability of a character substitution error and a best case of one in 613 million. However, because of the data set size, 31 million characters scanned over 622,080 instances, this result was only a statistical probability based on the confidence interval of the test.

The goal of this research was to determine if the one in 10.5 million character substitution probability was realistic and to hopefully provide the AIDC industry with a new benchmark on the robustness of Reed-Solomon based symbols. This research is not looking at the comparative performance of the scanners used nor the symbologies but instead is concentrating on the ability of correctly printed, non-damaged symbols to consistently and reliably result in accurate data. The reasoning for this limitation is that to compare scanners or symbologies would actually be testing the various image processing and decode methodologies used by the various scanner manufacturers, not the error correction robustness; something that is outside the scope of the papers intent.

2. 2D Bar Code Symbologies

To the lay person, all bar codes are often grouped together. However, to the AIDC expert, there are often profound differences that allow the various symbologies to be used to solve specific problems. For example, the use of QR Codes in an on-demand high speed printing process would make as much sense as using a hammer to drive screws would be to the carpenter. Additionally, not all symbologies include error correction, making their use a poor choice when encoding data in environments that are prone to label damage or are in need of a high level of data accuracy confidence. For example, in his 1991 report, Dr. Fales reported a worst case character substitution rate for the UPC-A symbology of 1 in 394,003 characters at a 95% confidence interval. While Code 128 did better, 1 in 2,764,151 characters at a 95% confidence interval, the test showed that character substitutions could and did occur [4].

2.1. Terminology

Within the AIDC industry, there are some common terms that are used that the lay person may not know or may incorrectly use.

1) 2D symbology – A symbology that encodes data in two dimensions. Both stacked and matrix symbologies are often categorized together as 2D symbologies.

2) Codeword – "symbol character value, an intermediate level of coding between source data and the graphical encodation in the symbol" [5]

3) Error correction codeword (ECC) – Codewords that are specifically used for error correction instead of data encoding.

4) Linear symbology – A symbology that encodes data in one direction only.

5) Matrix symbology – A symbology that encodes data in a matrix of modules that are either on or off.

6) Module – A single cell or element within a grid that represents a single data bit for a matrix symbology.

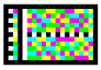
7) Stacked symbology – A symbology that encodes data in multiple rows that often look like linear symbologies stacked upon each other.

8) Substitution error – An instance where one or more decoded characters differ from the encoded character(s).

9) Symbol – A specific instance of a bar code that has been encoded with data following a bar code symbology. An analogy would be a word written in a specific language.

10) Symbology – A standard way of encoding data in machine readable form. An analogy would be a language (e.g. French, Spanish, Korean).

Table 1. Some common 2D symbologies in use

Symbology	Example	Comments
Aztec Code		Currently used in the airline industry.
Data Matrix		Most commonly seen 2D symbology when manufacturing is included.
Dot Code		While an open standard, only the tobacco industry has seen any level of adoption.
Han Xin		China is the primary user at the moment.
Maxicode		Maxicode is only used by UPS.
PDF417		PDF417 is a stacked symbology, where the rows in the symbol contain varying information.
QR Code		Commonly seen in mobile applications, arguably the most recognizable 2D symbology.
Ultracode		While an open standard, Ultracode has not seen large scale adoption to date.

11) X Dimension – The module size for matrix symbologies and the smallest bar or space width for linear and stacked symbologies. An analogy would be the font size used for the symbol.

2.2. Types of Symbologies

In general there are three primary types of bar codes in use; linear, stacked and matrix. In traditional linear

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symbologies (e.g. EAN/UPC), the height is referred to as vertical redundancy. No additional information is stored in the vertical height of the symbol. Instead, the vertical height exists to make the scanning process easier. Stacked symbologies use stacked rows of linear type bars to encode data and matrix symbologies use the presence or absence of modules within a grid to encode the binary data. For the purposes of this paper, stacked and matrix symbologies have been grouped together under the heading 2D symbologies.

While there are numerous stacked and matrix based bar code symbologies in existence (see Table 1), this paper is concentrating on what are arguably four of the five most commonly seen symbologies; Aztec Code, Data Matrix, PDF417 and QR Code. Han Xin is a newer symbology out of China that is seeing an expanding role in some areas of the supply chain. However, due to its newness, not all scanners support it, limiting its use.

What the four selected symbologies have in common is wide-spread adoption and the inclusion of error correction. These symbologies take the data that is to be encoded and convert the information into a series of codewords. These codewords are then mapped to the required patterns for printing.

The bar code symbol also will include some method of indicating an origin or start and stop location (e.g. QR Codes use the three distinct finder patterns, in the shape of squares with bounding boxes as seen in Figure 1). This finder pattern helps the decoder to determine the extents of the symbol and makes it easier for the imaging processor to know what is and is not part of the bar code.



Figure 1. Finder patterns (black areas) for Aztec Code (left), Data Matrix (middle-left) and QR Code (right). PDF417 (middle-right) uses start (left side) and stop (right side) patterns

Of the four symbologies discussed, only Data Matrix has a fixed level of error correction. The others have some level of user selectability when it comes to the amount of error correction that is applied to a given symbol. Additionally, Data Matrix is the most efficient of the symbologies. Given the same data and the same X Dimension, Aztec Code requires 1.7 times more space, QR Code requires 3.2 times more space and PDF417 requires 29.2 times more space when encoded at their minimal error correction levels.

2.3. Reed-Solomon Error Correction

RSEC is a methodology for auto-correcting erroneously decoded messages. Originally developed for the telecommunications industry, RSEC that has been widely adopted as an error correction solution across multiple industries. With a solid history of use within the communications disciplines, RSEC was adopted by the AIDC industry when 2D symbologies were developed as a method for addressing the potential of having missing modules (erasures) or instances where codewords were incorrectly decoded (errors) [6,7,8].

While a full discussion of the mechanics of the RSEC methodology is beyond the scope of this article, the general process is to pass the data to be encoded though a series of steps that convert the source data into a series of integer based code words that is constrained to a mathematical field of a predetermined prime size (the Galois Field). These codewords are then combined with the appropriate Galois Field based RSEC polynomial for the desired number of error correction code words. The resulting error correction code words are embedded within the message and everything is sent to the receiving device; which in the case of bar codes is the logic that converts the code words into a series of on or off modules within the symbol [9].

When a bar code symbol is read, the decoder will reverse the process since the RSEC polynomial is known and the number of codewords will be either explicitly or implicitly defined. If a remainder exists after dividing the code word(s) into the generating polynomial then errors have been detected and the corrected code words can be calculated, allowing for the recovery of the original message.

The four symbologies selected for this study use a variety of Galois Field values and differing prime modulus numbers. The exact GF values and prime modulus numbers are listed in the symbology's respective AIM or ISO/IEC standards and are based on the idiosyncrasies of the individual symbology.

3. Methodology

The physical testing setup for this paper was relatively simple. Bar code scanners were attached to a simple gantry frame that allowed each scanner to be individually positioned as shown in Figure 2. The individual symbols used were printed on a standard laser printer from the Bartender Designer 2016 R3 software from Seagull Scientific and the symbols were attached to simple medal plates with magnets. The plates were attached to a reciprocating table that was driven by a variable speed motor. The table was set to reciprocate at a rate of 2 Hz. The table was located such that at the end of each stroke, the symbols were moved within the scan field of the bar code scanners.

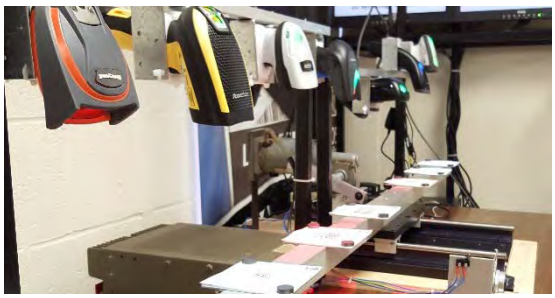


Figure 2. Physical testing setup

The symbols that were used contained various random data that was in five different formats (boarding passes, GS1 data formats, FDA UDI encoded using GS1 data constructs, random numbers, alphanumeric data). All symbols were printed in their correct format without any

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manufactured defects (e.g. erasures, additions, skewing). It was decided a priori that for this specific test a stressing of the individual decode algorithms that had been implemented by the various scanner manufacturers would not be conducted. Instead, this test was intended to determine if random character substitutions would occur as was found with most of the traditional linear symbologies (e.g. Code 39, EAN/UPC) in the studies done by the Center for Automatic Identification at Ohio University in the early 1990's [2].

The bar code scanners were connected via RS-232 serial interfaces that fed directly into the computer (instead of using USB to RS-232 adapters) so as to remove any potential transmission errors due to the USB interface or the existence of multiple USB to Serial adapters on the same computer. The specific bar code scanners used were all hand-held scanners that were placed in "presentation mode" which allows the scanner to continuously decode symbols that are within the scanner's field of view without the need for a physical trigger pull. The selection of scanners was random in that specific scanners with a priori capabilities were not identified. Instead, scanners that were readily available in the lab, or that could be obtained via donations were used. All scanners had only the four symbologies being tested enabled and were configured to transmit the AIM Symbology Identifier (a "]" plus two additional characters) as a prefix and a carriage return and or line feed as a terminator.

Custom software written in C# using Microsoft's Visual Studio was developed to capture the serial port data and insert it into a SQL Server database that was maintained on a separate computer. The software captured the scanned data and recorded the scanner station. It should be noted that the data reported in this report is actually from a second data collection run. In the first data collection run, an unacceptable number of transmission error occurred due to the method in which the custom software processed data. It was discovered that when searching through the serial buffer data for the termination characters, casting the hexadecimal ASCII values to characters instead of using the escape sequence (e.g. "(char)0x000A" instead of "\r") significantly improved processing time and reduced the number of transmission based errors within the software.

4. Discussion

Over the course of the research, a total of 23,869,258 scans were collected for a total of 2,391,925,961 characters. 55 unique symbols were processed. The results of the scans were grouped by encoded data and scanner and three types of data were searched for; correct data (99.9967%), incorrect data due to transmission errors (0.0033%) and incorrect data due to character substation errors (0.0000%).

4.1. Correct Data

Correct data was identified within the database as data strings that matched the encoded data in the various symbols. In some instances the custom software left a null character at the end of an otherwise valid string. For these instances, the null character was stripped away and the resulting data string was added to the count for those instances where the null character was already stripped.

Table 2. Breakdown Of Symbologies Scanned

Symbology	Total Scans	Characters Scanned
Aztec Code	4,216,918	606,895,007
Data Matrix	7,084,222	603,184,399
PDF417	6,265,983	551,891,004
QR Code	6,302,135	629,955,551

Table 2 shows the breakdown of the symbologies scanned and the relevant overall number of symbol scans and characters scanned. The quantities listed are of the scans that were indicated as good. Scans that were ultimately categorized as having transmission errors were left out of the totals since the character counts would have skewed the results.

4.2. Transmission Errors

Despite the efforts taken to eliminate transmission errors between the scanners and the software, some still occurred. The errors that did occur can be grouped into three types; dropped characters, truncated data, and corrupted data. For the purpose of this paper, dropped characters are instances where no more than three characters were missing from the data stream. Truncated data is being defined as more than three characters were missing from the data stream but where there was no other issues with the data stream. Corrupted data is defined as instances where non-printable ASCII character appeared in the data stream or where additional unexpected data

By far, the most frequent occurrence of transmission error was the dropping of one or more characters, 514 occurrences. The majority of the time the dropped character was the carriage return and/or line feed that indicated the end of transmission of a data set. The reason for this is unknown, but at a rate of 21.5 per million transmissions it is assumed that the problem was either in the custom software or due to minor glitches in the serial buffers on the computer. However, this type of error would occur infrequently enough that it shouldn't be of major concern to users as properly written programs will provide a level of data validation prior to the consumption of the data.

There were 60 instances where the data transmission appeared to be significantly truncated. Once again, the cause is unknown but it was assumed that the causes were either in the custom software or due to minor glitches in the serial buffers on the computer.

The third type of transmission error exhibited itself as corrupted data. Two types of corrupted data were observed during the testing; truncated and expanded. In terms of unique data streams, there were a significantly higher number of truncated transmission errors. However, most of these occurred only once or twice.

The corrupted data that resulted in truncated data primarily manifested itself as non-printable ASCII characters. While the exact cause is unknown, it is believed that there was some sort of interruption in the bit stream that caused some sort of bit shift. There were,

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however, 116 instances where printable ASCII characters were introduced into the data stream (e.g. "?", "@").

Conversely, there were relatively few unique instances of expanded data streams, but when they did occur, there were thousands of instances. In terms of the number of times it occurred, the most prominent problem (over 66 thousand occurrences) was the addition of one or more instances of the string "]C0?" with an additional number after the question mark (0, 6 or 8). It is unknown why this occurred. The string "]C0" indicates that the symbology scanned is Code 128. However, this is occurred on a single scanner despite Code 128 being turned off in the scanner's configuration. There were also six instances where a question mark was inserted into the data stream as the first character instead of the "]" that was supposed to be there. However, despite the additional character(s) added to the data stream in all of these cases, the encoded data was not impacted. The manufacturer of the scanner was contacted and it was determined that there was a bug in the scanner's firmware that resulted in the unintentional additional characters. This was proved when an updated firmware version was loaded into the scanner and the problems went away.

The other unexplained occurrence was where a single scanner (which was different from the one previously discussed) inexplicitly substituted a random sequence of numbers into the middle of a string of 87 zeros a total of 83 times. The result was that instead of transmitting

"]Q1100000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000006"

the scanner would transmit

"]Q1100000000000000000000063894522544000000000000000000000000000000000000000000000000000000000000000000000000000000"

to the data collection software. The symbol in question was a QR Code with the error correction level set to Q or H. When the same scanner processed the same data but encoded at an error correction level of M or L, the problem did not manifest. After discussions with the manufacturer, it was determined that the cause was a bug in the firmware, not in the symbology because a) no other scanner exhibited the behavior – including a different model scanner from the same manufacturer, b) that the final character in the incorrect string was not correct and c) that despite numerous attempts, the researcher was not able to mathematically show how the change in data would have been possible within the confines of the Reed-Solomon error correction process. Furthermore, it should be noted that when other over-corrected symbologies were tested on the scanner in question, no instances of invalid data were observed, adding to the belief that the problem was isolated to the specific version of firmware.

4.3. Substitution Errors

Of the 2,391,925,961 characters scanned over 55 symbols, there were zero identified instances where a character substitution occurred after 23,869,258 scans. There were 83 instances where one scanner produced data that appeared similar to a character substitution error. However, as previously discussed, these occurrences were ultimately classified as firmware specific error and were not attributable to the symbologies or error correction.

4.4. Statistical Conclusion

Based on van Belle, "given no observed events in *n* trials, a 95% upper bound on the rate of occurrence is 3/n" [10]. Thus, for the generated data, it can be said with a 95% confidence that RSEC will provide protection to at least a 1 in 797 million character substitution rate based on the data collected.

5. Conclusions

The results from this study show that at a 95% confidence level, bar code symbologies that employ RSEC have at character substitution resistance that results in an occurrence rate that is at least 1 in 797 million. Instances of character substitution found outside the lab, in symbols that are in good condition without physical damage, will most likely be due to either transmission errors or bugs in the firmware of the bar code scanner producing the data. And even then, the likelihood that a user will see data similar to what was used to provoke the errors found during this test are highly unlikely – how often would a real-world business case require the encoding of 87 consecutive zeros.

During the course of the research it became apparent that solution providers will need to ensure that they are accessing data in a manner that best suits the individual application. A careful implementation of any serial port based data collection will reduce the number of transmission errors and the proper validation of incoming data will further ensure that invalid data doesn't make its way into the system.

This study shows that RSEC based symbologies are sufficiently immune to character substitutions errors such that the adoption of these symbologies can be comfortably accomplished during the compliance process to such initiatives as the FDA UDI or the Department of Defense IUID programs. However, there is still room for additional improvements to the body of knowledge about RSEC based symbologies. Testing of the error correction capabilities due to erasures or symbol errors should be done to help determine the true level of robustness of these symbologies. Additionally, testing of the various bar code scanner interfaces should be done to help determine if an avoidance of specific interfaces should occur if the reduction in the number of transmission errors is desired.

Acknowledgements

This paper would not have been possible without the support and advice of the GS1 Barcode and Identification Technical Group and the AIM Technical Symbology Committee. Additional thanks are owed to Cognex, Datalogic, Honeywell Scanning and Mobile Productivity, and Zebra for their outstanding technical support in configuring and optimizing the settings for their respective devices. For further information about this study please visit www.memphis.edu/autoid/research.

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US007314167B1

(12) **United States Patent**
Kiliccote

(10) **Patent No.: US 7,314,167 B1**
(45) **Date of Patent: Jan. 1, 2008**

(54) **METHOD AND APPARATUS FOR PROVIDING SECURE IDENTIFICATION, VERIFICATION AND AUTHORIZATION**

(75) Inventor: **Han Kiliccote**, Los Altos, CA (US)

(73) Assignee: **Pisafe, Inc.**, Sunnyvale, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 232 days.

(21) Appl. No.: **11/075,493**

(22) Filed: **Mar. 8, 2005**

(51) **Int. Cl.**
G06K 5/00 (2006.01)

(52) **U.S. Cl.** **235/380**; 235/382

(58) **Field of Classification Search** 235/380, 235/375, 379, 382, 382.5; 705/39, 76; 340/10.52, 340/10.3, 5.8; 358/1.15, 1.1
See application file for complete search history.

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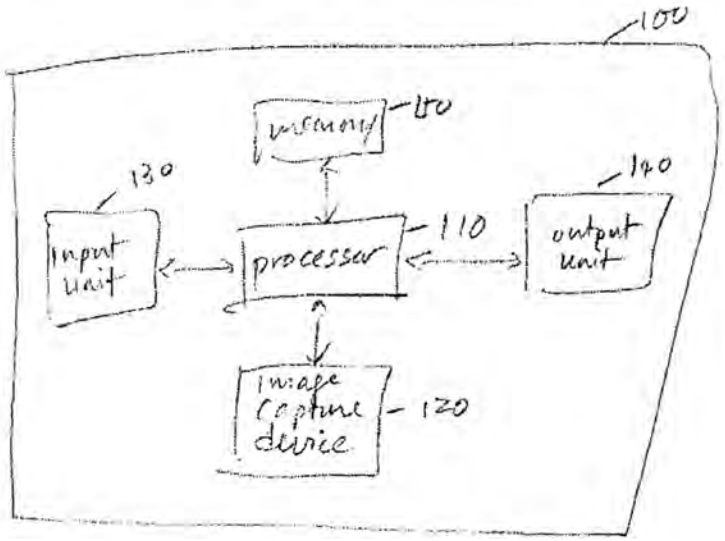
* cited by examiner

Primary Examiner—Thien Minh Le
(74) *Attorney, Agent, or Firm*—Pillsbury Winthrop Shaw Pittman LLP

(57) **ABSTRACT**

An apparatus for providing a secure transaction is disclosed. The apparatus includes an image capture device configured to capture an image, the image having information embedded therein, a memory configured to store predetermined information, an input unit configured to receive input information provided by a user, a processor configured to: verify the user based on the input information to ensure that the user is authorized to use the apparatus, and generate an output based on the information embedded in the image and the predetermined information, and an output unit configured to forward the output generated by the processor.

43 Claims, 13 Drawing Sheets



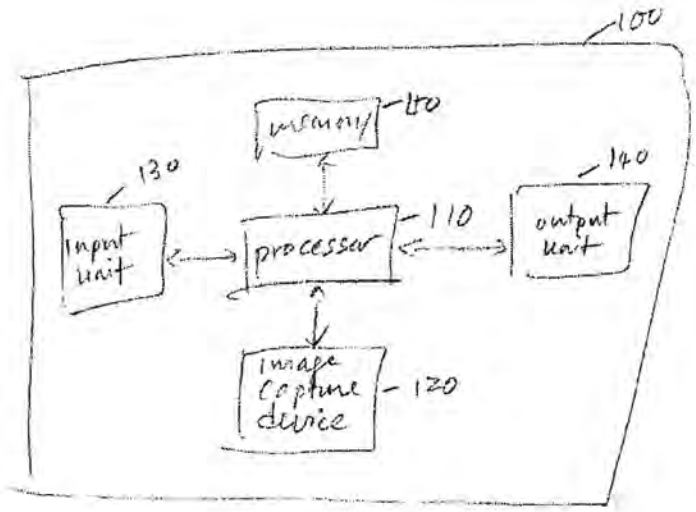


FIG. 1

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Ex. 1001-2

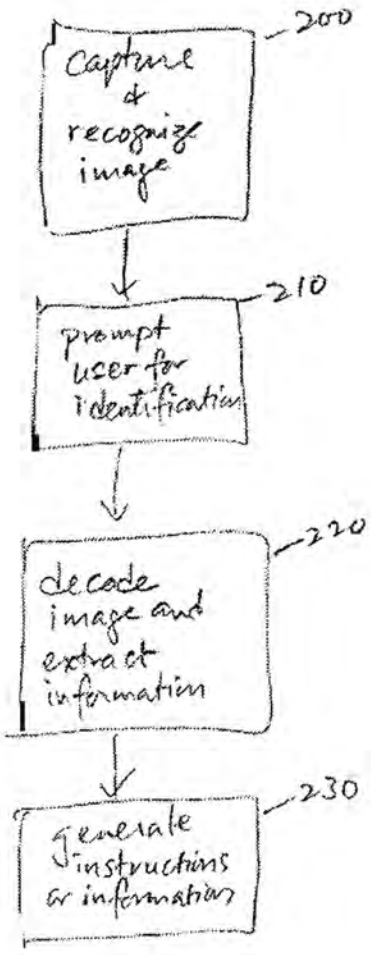


FIG. 2

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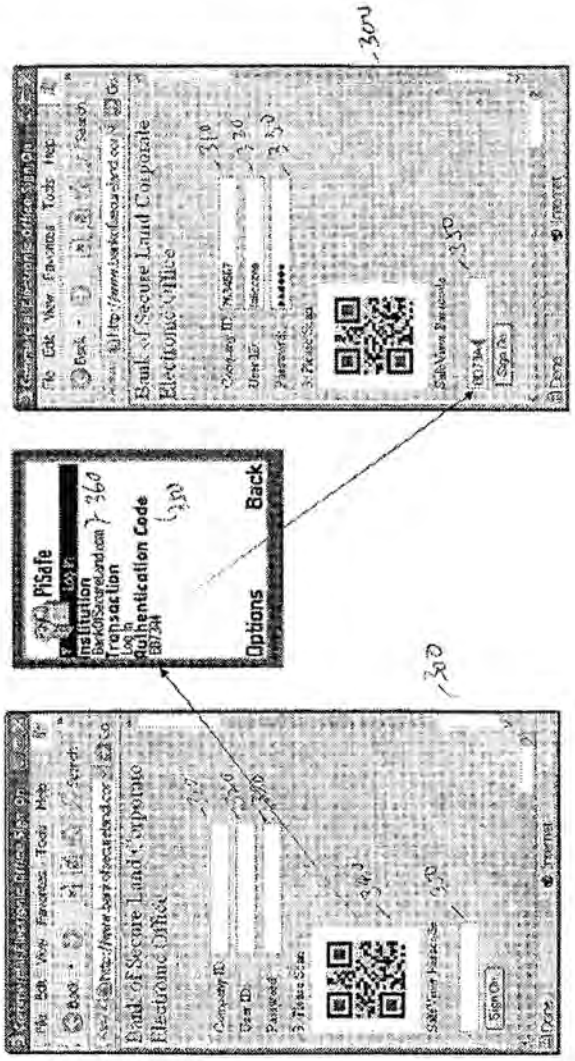

PSafe
Institution
BankOfSecureLand.com
Transaction
Login
Authentication Code
Options
Back
Bank of Secure Land Corporate
Electronic Office
Sign On

FIG. 3

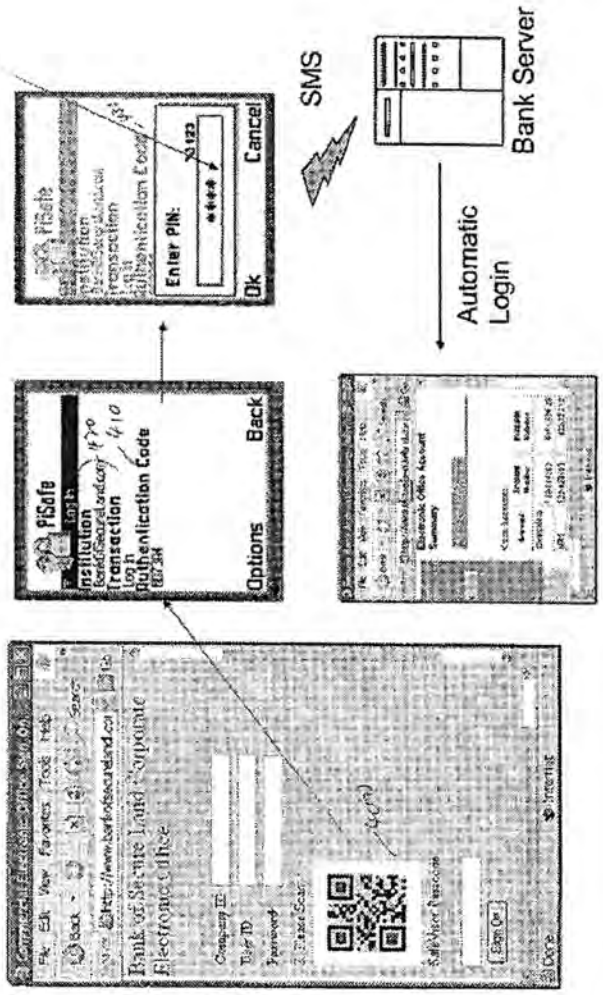

SMS
Bank Server
Automatic Login
Enter PIN:
Ok
Cancel
Options
Back

FIG. 4

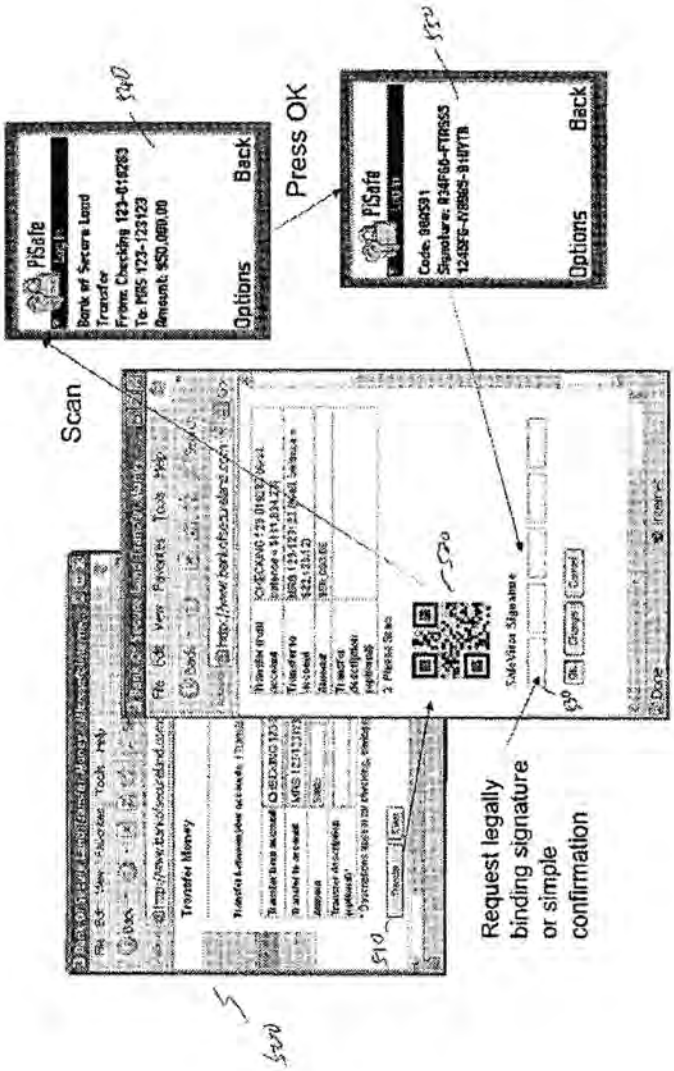

PiSafe
Bank of Secure Land
Transfer
From: Checking 123-012563
To: IRS 123-123123
Amount: $50,000.00
Options
Back
Press OK
PiSafe
Code: 989531
Signature: R34F66-FTR555
1243FG-NY8865-91HYTR
Options
Back
Scan
Request legally binding signature or simple confirmation
510
520
530
540
550

FIG. 5

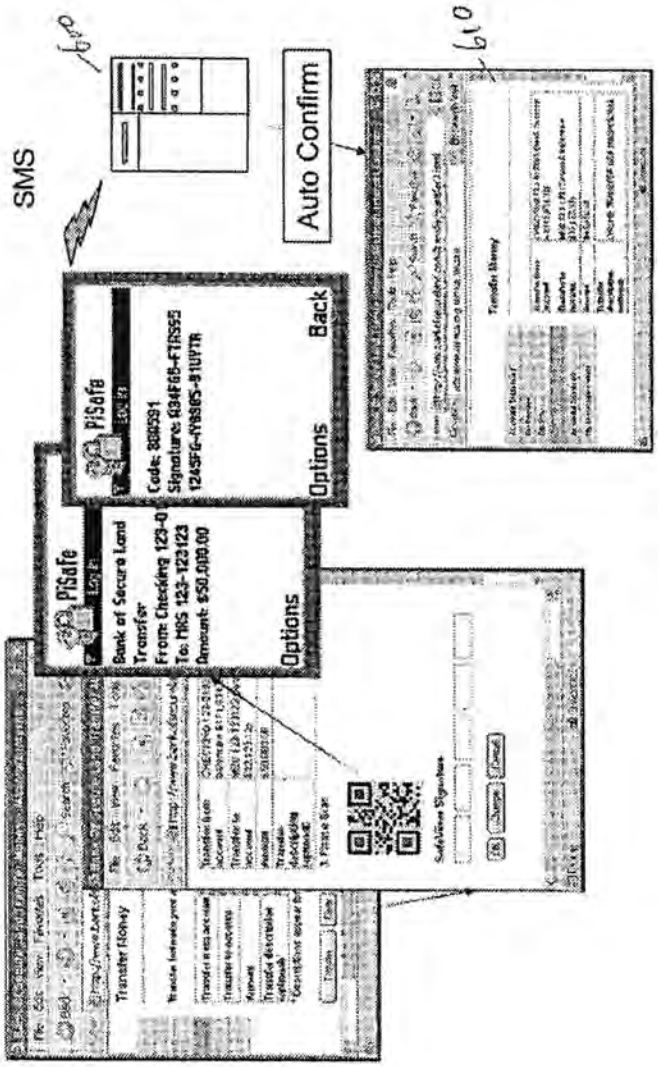

SMS
Auto Confirm
PiSafe
Options
Back
Bank of Secure Land
Transfer
From Checking 123-0
To: HIS 123-123123
Amount: $50,000.00
Transfer Money

FIG. 6

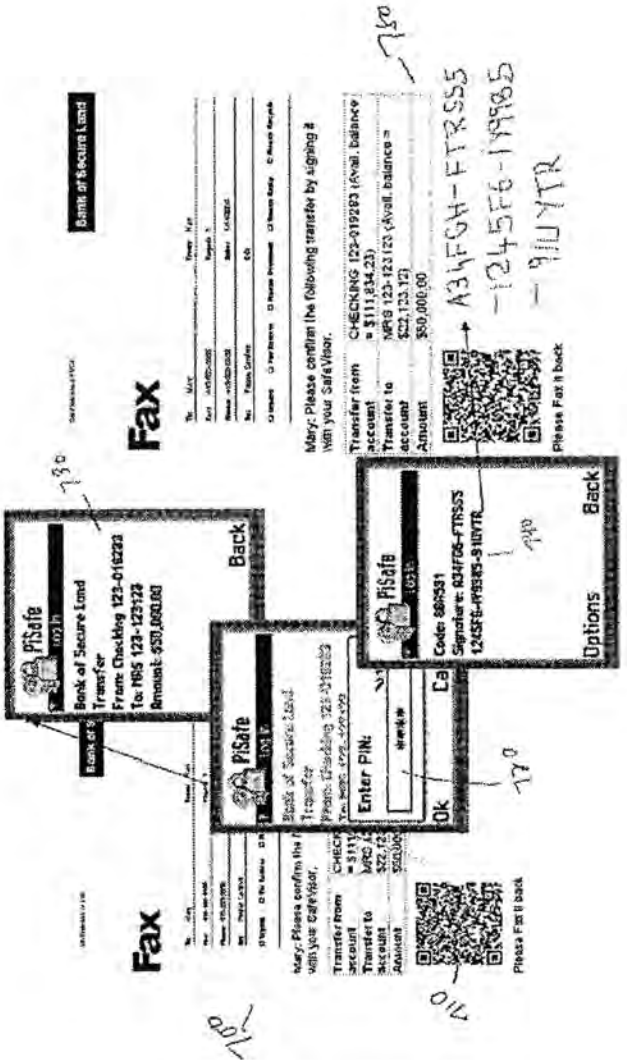


FIG. 7

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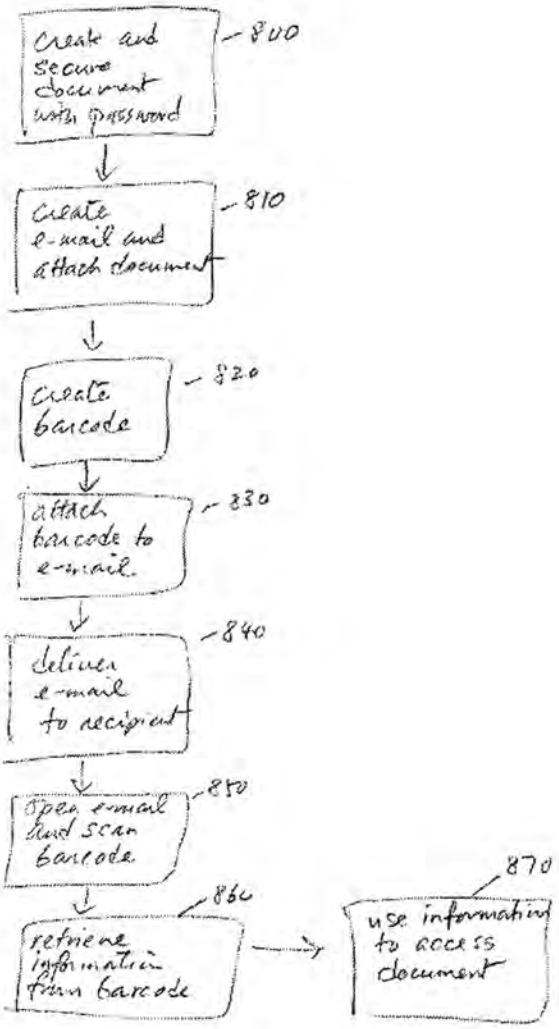

Create and secure document with password
800
Create e-mail and attach document
810
Create barcode
820
attach barcode to e-mail.
830
deliver e-mail to recipient
840
Open email and scan barcode
850
retrieve information from barcode
860
use information to access document
870

FIG. 8

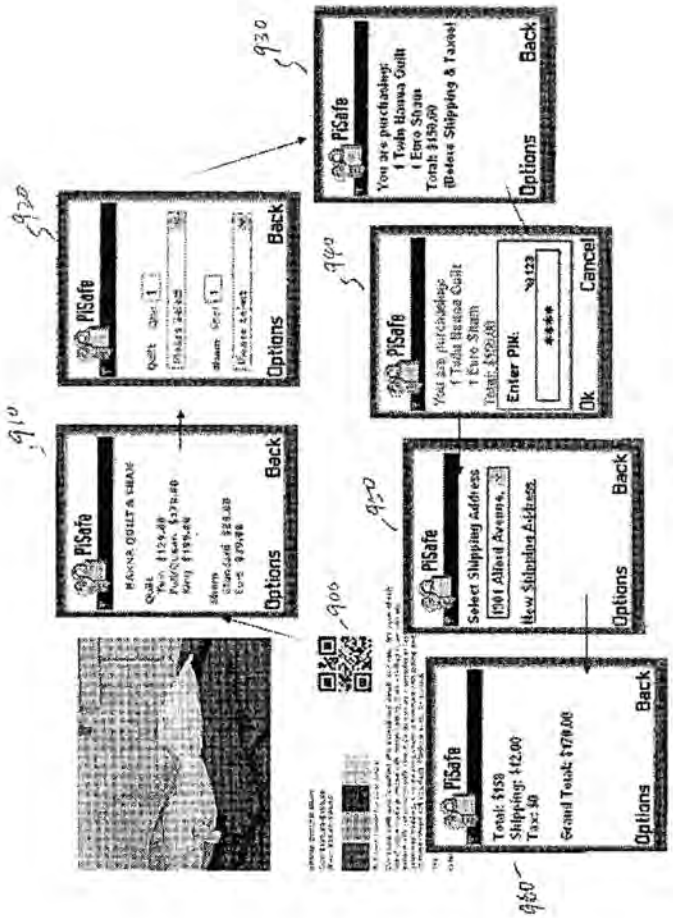


FIG. 9

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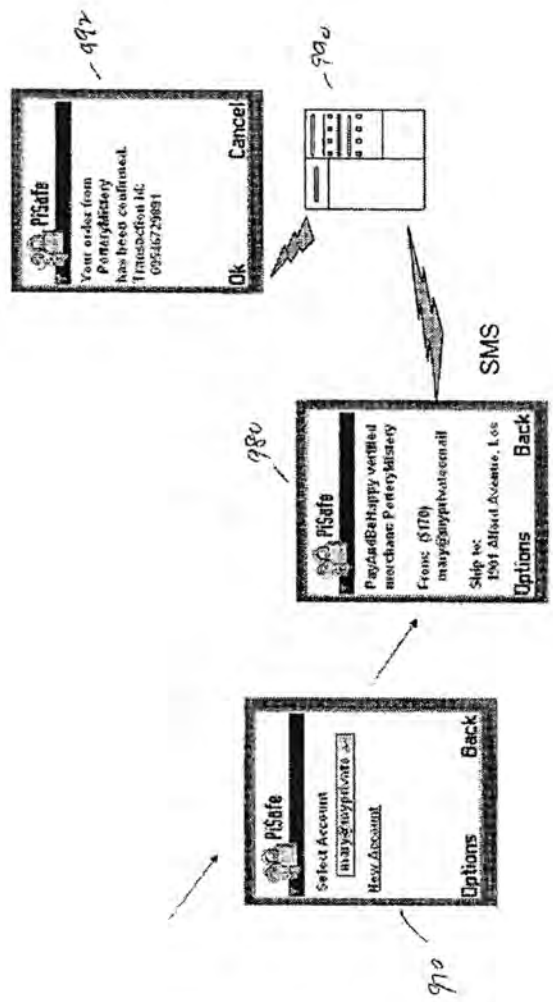


FIG. 9
(Continued)

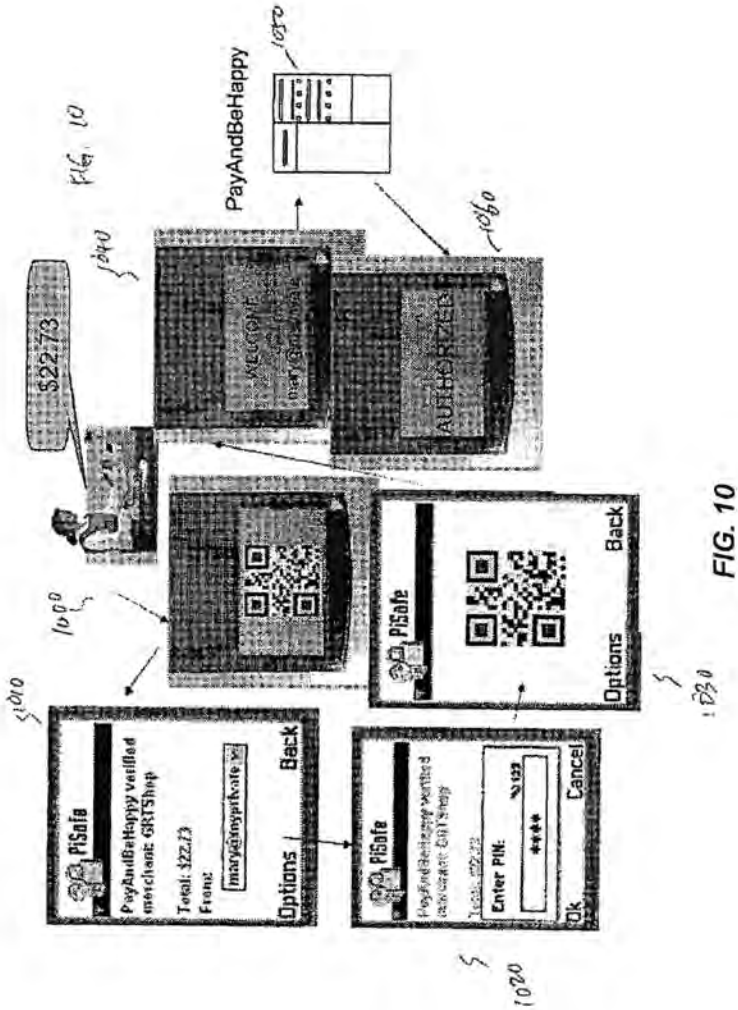

PayAndBeHappy
$22.73
PiSafe
Back
Options
Cancel
Ok
Enter PIN:

FIG. 10

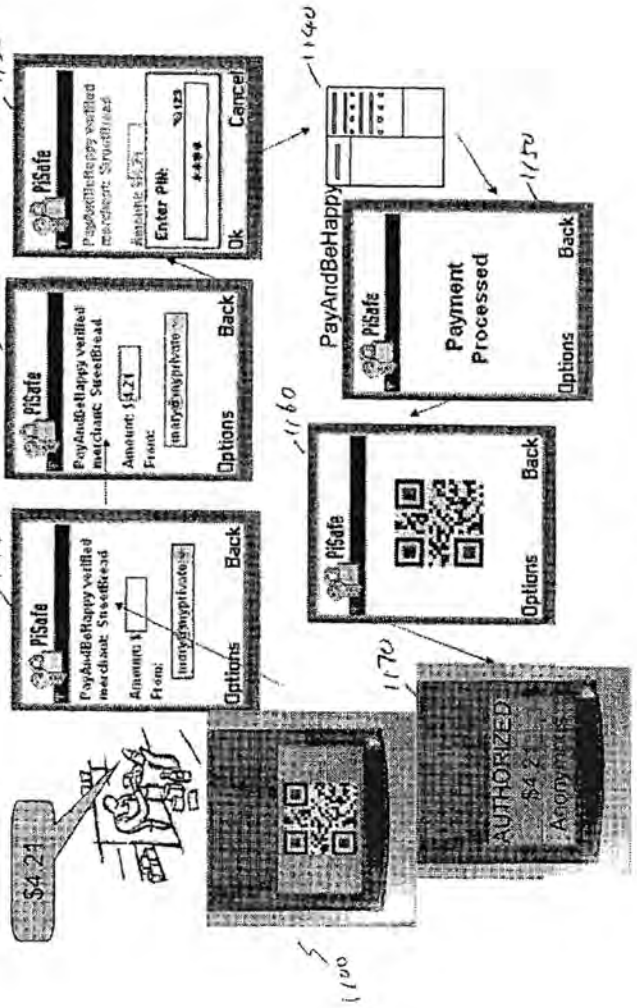

1130
1140
1120
1160
1110
1170
1150
PiSafe
Enter PIN:
Ok
Cancel
PayAndBeHappy
Payment Processed
Options
Back
AUTHORIZED
$4.21

FIG. 11

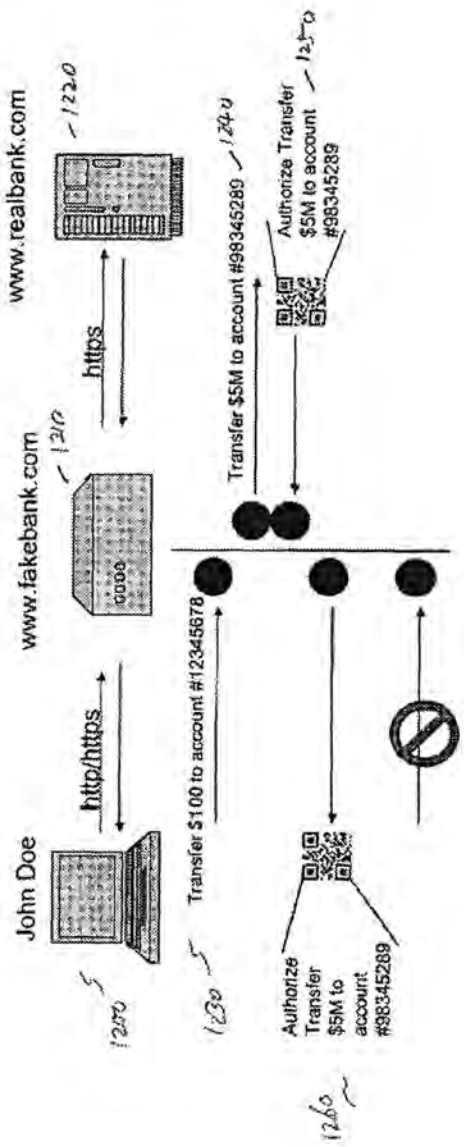

John Doe
http/https
www.fakebank.com
https
www.realbank.com
Transfer $100 to account #12345678
Transfer $5M to account #98345289
Authorize Transfer $5M to account #98345289
Authorize Transfer $5M to account #98345289

FIG. 12

METHOD AND APPARATUS FOR PROVIDING SECURE IDENTIFICATION, VERIFICATION AND AUTHORIZATION

BACKGROUND

1. Field

The present invention relates generally to secure transactions, and more specifically, to methods and devices for providing secure identification, verification and authorization using a portable secure device.

2. Background

There are many applications where authentication can be useful including, for example, e-commerce transactions, secure system access, etc. Authentication technologies are generally implemented to verify the identify of a user prior to allowing the user to have ability to perform certain tasks, such as, accessing confidential information or conducting authorized transactions. Many authentication systems are known in the art and the methodologies associated with these systems cover a wide range of techniques.

The use of credit and debit cards to conduct payment transactions is very popular. Credit and debit cards can be used for paying telephone charges and purchase transactions. With the burgeoning growth of online or e-commerce, the use of credit and debit cards to pay for online transactions is also increasing. Such increase use of credit and debit cards also results in increase in identity theft crimes including credit card fraud. In response, card issuers are employing various different measures in order to minimize and/or prevent such crimes. For example, in order to provide sufficient authentication, a user may be required to provide additional information during the card approval process, such as, certain numbers printed on the back of the card, the postal zip code for the billing address associated with the card, or a persona identification number (PIN) linked to the card. Because such information is static, it may be of nominal effectiveness.

In one existing system, an apparatus is provided for identifying an individual. The apparatus employs a static value and a dynamic variable to generate passwords. For every transaction to be completed, a fixed code is entered into the card by the user at the start of the access request procedure. This fixed code constitutes the static value. The dynamic variable is produced which varies dynamically as a function of time. The static value and the dynamic variable are next used as input parameters of a secret encryption algorithm implemented in order to produce a password in the card. This password is displayed on the card and the user is invited to transfer it to a server. The fixed code is also transferred to the server. The server then calculates the password by using the same encryption algorithm and the dynamic variable. The password generated by the password is compared with the password transmitted to the server by the user. In the event of matching, authorization for access to the function can be delivered. It will be noted that the dynamic variable is a time-dependent dynamic value. Since this variable is necessarily produced independently, both in the card and in the server, the clocks of these two facilities used to produce the dynamic variable on each side must be synchronized with a given accuracy. As a result, the apparatus requires time-dependent synchronization and shared secret keys.

Another existing system discloses a method and apparatus for secure credit card transactions. This apparatus comprises an authorization computer and a credit card that work in conjunction with each other to enhance the security of credit

card transactions. More specifically, the system includes a smart credit card that has a microprocessor, associated memories and a liquid crystal display. The credit card is used to produce a unique verification number by processing a transaction sequence number with an encryption algorithm. The verification number is then displayed in the display device, and can be transmitted to the authorization computer along with a customer identifying account number. The computer, which is used for authorizing the credit card transactions for the customers of the credit card issuer, uses the account number to access an account file for the credit cardholder. The account file contains a de-encryption algorithm, which is complementary to the encryption algorithm of the credit card, such that the computer can use the de-encryption algorithm together with the verification number to produce a computed transaction sequence number. Both transaction sequence numbers, the one in the card and the one in the computer, are changed by increment after the authorized transaction so that a different verification number is generated and used in the authorization in each subsequent credit card transaction. Synchronization between the card and the computer is required.

In another existing system, a portable information and transaction processing system and method utilizing biometric authorization and digital certificate security is disclosed. The system uses a portable client PDA with touch screen, microphone, and CPU for processing voice commands, and processing biometric data to verify a user. In fact, the system requires the use of a PDA in which the user stores his financial and personal information. A digital certificate is downloaded from a central server of a service provider. The digital certificate accomplishes the goal of identification verification by checking whether the digital certificate is expired before providing any credit card information. This system is intended for managing financial data. The foregoing system requires use of shared secret keys between the user and the verifier. It also requires time-dependent synchronization for user verification purposes.

Another prior art system discloses a token issuing system, a mobile communication means, a token verification system and tokens. A user of the mobile communication means can use this system by ordering a certain token from the token issuing system, which produces a token and transmits the token to the mobile communication means. The user of the mobile communication means can then later use the token by effecting the transfer of the token to the token verification system, which receives and processes the token, and allows the user to obtain the benefit, right, or product associated with the token. In one embodiment, the user of the mobile communication means types the token on a keypad of the verifying system. The verifying system can include a scanning or image capture device for reading information on a display of the mobile communication means. The verifying system can comprise a digital camera for obtaining images. In another embodiment, the mobile communication means displays the token as a bar code on a display of the mobile communication means. The verifying system uses a shared key to decrypt the encoded string received from the mobile communication means.

Another prior art system discloses an authentication and verification method and apparatus employing tokens. The token, which can be a credit-card sized clip or carried as part of a key chain, works in conjunction with hardware or software running on a supplier's server system to generate a new, unpredictable code every 60 seconds that is known to the supplier server. For instance, each user may receive a personal token having a hidden 6-digit numerical string. The

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user further selects a 4-digital personal identification number (PIN) that is appended to the hidden numerical string in the token. The user's password is therefore the combination of the 4-digit PIN plus the hidden 6-digit numerical string. The 6-digit numerical string in the token automatically changes every 60 seconds. A security server compares the user-entered password with its knowledge of what password should have been entered for that 60-second period. The foregoing system requires time-dependent synchronization. Further, the passwords change every 60 seconds.

Hence, it would be desirable to provide methods and devices that are capable of providing secure transactions in a more efficient manner.

SUMMARY

An apparatus for providing a secure transaction is disclosed. In one embodiment, the apparatus includes an image capture device configured to capture an image having information embedded therein, a memory configured to store predetermined information, an input unit configured to receive input information provided by a user, a processor configured to: verify the user based on the input information to ensure that the user is authorized to use the apparatus, and generate an output based on the information embedded in the image and the predetermined information, and an output unit configured to forward the output generated by the processor.

The processor may be further configured to generate the output using the input information. The input information may include one of a personal identification number and biometric information. The processor may also be configured to decode the information embedded in the image for use in generating the output by using an encryption, decryption or message authentication code algorithm.

In one aspect, the information embedded in the image may include information relating to a transaction. The output may represent an authentication code to be used to authenticate the user with respect to the transaction. The output may also include a digital signature to be used to signify authorization by the user with respect to the transaction. The transaction includes an online transaction.

In another aspect, the information embedded in the image may include information relating to a set of items and the information embedded in the device may include payment card account information. The output may further include some or all of the information relating to the payment card account to be used for payment with respect to the transaction along with the signature or authorization code to be used as proof that the user of the device has authorized the transaction.

In yet another aspect, the information embedded in the image may include information relating to a password to be used to unlock a secured document. The output may include the password to be used to unlock the secured document.

In a further aspect, the information embedded in the image may include information provided by a vendor relating to a pending transaction. The output may include some or all of the information provided by the vendor to be used to alert the user with respect to the pending transaction.

The apparatus may include one of a mobile device, a smartcard, a card, a badge or a token. The mobile device may further include one of a cell phone and a personal digital assistant.

It is understood that other embodiments of the present invention will become readily apparent to those skilled in the art from the following detailed description, wherein various embodiments of the invention are shown and described by way of illustration. As will be realized, the invention is capable of other and different embodiments and its several details are capable of modification in various other respects, all without departing from the spirit and scope of the present invention. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

Aspects of the present invention are illustrated by way of example, and not by way of limitation, in the accompanying drawings, wherein:

FIG. **1** is a simplified schematic diagram illustrating a secure device according to one embodiment of the present invention;

FIG. **2** is a flow diagram illustrating general operations of the secure device according to one embodiment of the present invention;

FIG. **3** is a simplified schematic diagram illustrating one authentication application of the secure device according to one embodiment of the present invention;

FIG. **4** is a simplified schematic diagram illustrating another authentication application of the secure device according to one embodiment of the present invention;

FIG. **5** is a simplified schematic diagram illustrating one authorization application of the secure device according to one embodiment of the present invention;

FIG. **6** is a simplified schematic diagram illustrating another authorization application of the secure device according to one embodiment of the present invention;

FIG. **7** is a simplified schematic diagram illustrating one digital signature application of the secure device according to one embodiment of the present invention;

FIG. **8** is a flow diagram illustrating general operations of a document distribution application using the secure device according to one embodiment of the present invention;

FIG. **9** is a simplified schematic diagram illustrating one online e-commerce application of the secure device according to one embodiment of the present invention;

FIG. **10** is a simplified schematic diagram illustrating one check-out application of the secure device according to one embodiment of the present invention;

FIG. **11** is a simplified schematic diagram illustrating another check-out application of the secure device according to one embodiment of the present invention; and

FIG. **12** is a simplified schematic diagram illustrating one phishing-prevention application of the secure device according to one embodiment of the present invention;

DETAILED DESCRIPTION

The detailed description set forth below in connection with the appended drawings is intended as a description of various embodiments of the present invention and is not intended to represent the only embodiments in which the present invention may be practiced. The detailed description includes specific details for the purpose of providing a thorough understanding of the present invention. However, it will be apparent to those skilled in the art that the present invention may be practiced without these specific details. In some instances, well-known structures and components are shown in block diagram form in order to avoid obscuring the concepts of the present invention.

The present invention may be used for a number of different purposes including, for example, authentication,

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authorization, secure document distribution and guarding against phishing attacks, as will be further described below. The present invention may be used in both the offline and online environments and provide on-demand input capability.

One or more embodiments of the present invention will now be described. FIG. **1** illustrates one secure device **100** according to one embodiment of the present invention. The secure device **100** may include a processor **100**, an image capture device or circuit **120**, an input unit **130**, an output unit **140** and a memory **150**. The secure device **100** may be incorporated as part of a token, card, badge, key fob, personal digital assistant (PDA), and cellphone, etc.

The processor **110** may include control logic configured to control operations of the secure device **100** including, for example, managing decryption and encryption functions. In some embodiments, the processor **110** may be implemented in the form of a smartcard. The smartcard may include a ciphering unit and a secure memory for storing, public keys, private keys and/or shared keys.

The image capture circuit **120** may include a digital camera or other types of image capturing devices. The image capture circuit **120** is used to capture image and/or video information. The captured image and/or video information may include a barcode including an one-dimensional barcode, such as a linear barcode, or a multi-dimensional barcode, such as a 2D barcode, multiple barcodes in a single image or multiple barcodes in multiple images where multiple images form a stream of images or a video. As will be further described below, the captured image and/or video information is used and processed for a number of different purposes.

The input device **130** may include a keypad, a touch sensitive screen, a biometric input unit or other types of devices that are capable of allowing a user to provide input information. The biometric input unit may include at least one of a fingerprint recognition module and a facial recognition module. As will be further described below, the input information may be used for identification purposes to allow the secure device **100** to be activated by the user, as well as other purposes.

The output unit **140** may include a LCD (Liquid Crystal Display). The display **140** is used to display information to a user of the secure device **100**.

The memory **150** may include any type of storage devices that can be used to store information.

The secure device **100** generally operates in the following manner, as shown in FIG. **2**. At block **200**, the secure device **100** via the image capture circuit **120** captures information on a still or moving image or a stream of images. The stream of images may constitute a video. The image or video may include, for example, a linear or 2D barcode. Multiple barcodes may be embedded in the same image, or alternatively, multiple barcodes may be transmitted in multiple frames or images. The image or stream of images contain embedded information that is relevant to the transaction to be conducted. The information embedded in the image or stream of images may be created using any one of a number of well-known decryption/encryption algorithms, such as, a symmetric system using shared keys an asymmetric system using public/private key pairs. For example, the information embedded in an image may be encrypted using a public key or signed by a private key. Based on the disclosure and teachings provided herein, a person of ordinary skill in the art will know how to select the appropriate decryption/encryption algorithm for use according to the present invention.

At block **210**, the secure device **100** also prompts a user to provide identification information via the input unit **130**. The identification information may include a personal identification number (PIN), a password, and/or biometric information. The identification information is used to identify the user to ensure that the user is authorized to use the secure device **100**.

At block **220**, the secure device **100** via the processor **110** decodes the captured image or video and extracts the relevant embedded information. The processor **110** has knowledge of the encryption algorithm that is used to create the image and thus is able to use the corresponding decryption algorithm to decode the captured image. The decryption algorithm may use one or more input parameters for decoding. For example, if the image is created using a public key, the corresponding private key (as well as other information, such as, predetermined information stored in the memory **150** and the input information provided by the user) may be used to decrypt or decode the captured image. The predetermined information may include, for example, address information, personal profile information and payment account information. The secure device **100** also checks the identification information provided by the user to verify or authenticate the user's identity. The identification information provided by the user is checked against information previously supplied by the user during registration.

At block **230**, upon successful verification of the user's identity and decoding of the captured image, the secure device **100** generates the appropriate instructions or information for the user. The instructions or information may then be provided via the output unit **140** for further action by the user. The user may act on the instructions or information in a number of ways. For example, the instructions or information may be transmitted in the form of a radio or sonic signal. The transmitted signal may then be received by another party, such as, a merchant, seller, vendor or third-party service provider, for use in connection with various purposes, as will be further described below.

The secure device **100** can be deployed in a number of applications. In one illustrative application, the secure device **100** is used to effect authentication, as shown in FIG. **3**. Authentication is needed for any system where the identity of a user has to be ascertained. As shown in FIG. **3**, a user visits a website and is presented with a log-on screen **300**. The user is required to enter certain correct information (such as, company ID **310**, user ID **320** and password **330**) before further access to the website is granted. In addition, the log-on screen **300** further displays an image or video **340**. The image or video **340**, such as a linear barcode, or multiple barcodes in moving images contain certain embedded information that will be used to derive the corresponding authentication code **350**. The correct authentication code **350** has to be entered in order to allow the user to continue to access the website.

The user activates the secure device **100** and uses the secure device **100** to scan the image or video **340**. As part of the activation process, the user may need to enter a password or other types of identification information into the secure device **100** to ensure that the user is authorized to use the secure device **100**. The secure device **100** then derives the authentication code **350** and other relevant information **360** based on the embedded information stored in the scanned image or video **340** and, optionally, other types of information including, for example, predetermined information stored in the secure device **100** and identification information provided by the user. The derivation process may be performed using an encryption, a decryption or a message

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authentication algorithm. If the image **340** has been generated using an encryption or decryption algorithm, the derivation process may correspond to the encryption or decryption algorithm used to create the information embedded in the image or video **340**. The authentication code **350** and other relevant information **360** are displayed on secure device **100** for viewing by the user. The user may then key in the authentication code **350** as well as other required information (such as, company ID **310**, user ID **320** and password **330**) to obtain further access to the website. Since the website initially provides the image or video **340**, the website also has knowledge regarding the correct authentication code **350** corresponding to the information embedded in the image or video **340**. The foregoing method may also be used to identify users or authenticate users to computer terminals, servers, and devices, etc.

If the output of the secure device **100** is transmitted in the form of a radio or sonic signal, a corresponding reception device at a station (such as, a computer, terminal or server) receiving the transmitted signal may deem the user identified if the signal corresponds to an expected value at the station for a specific user and secure device **100** previously registered for that station.

The secure device **100** may also be used to identify or authenticate persons for physical access to structures and/or vehicles through entry points, such as, doors and gates. If the output of the secure device **100** is transmitted in the form of a radio or sonic signal, a station (e.g., a merchant, seller, vendor, third part service provider, guard) receiving the transmitted signal may deem the user identified if the signal corresponds to an expected value at the station for a specific user and secure device **100**. If, on the other hand, the output is in the form of a visual display displayed on the secure device **100**, the user can enter the displayed information on a keypad attached to the station. The user can also read the information to a machine or a person over the telephone at the station. The user can also write down the displayed information on paper for immediate or later processing. The display may display an image that can be captured with a camera at the station, thereby eliminating the need for user to enter, read or write down the information.

In the identification mode, the output from the secure device **100** received at a station may be compared to all the registered users and devices to identify the user and the secure device **100** that would generate the expected output. With suitable selection of the encryption protocols, the output can be rendered deterministically or probabilistically unique for each user and device combination.

The image or video captured by the secure device **100** may also include additional information, such as, information relating to a website, server, terminal, device, structure or vehicle which the user is gaining access to. The image or video captured by the secure device **100** may further include a description of the action, such as, login to a server or terminal or access to a structure. In addition, the image or video captured by the secure device **100** may include a unique number, nonce, a transaction number or a random number, a number that the secure device **100** will use to derive the authentication code. Furthermore, the image or video captured by the device may include a digital signature generated by a trusted party.

The authentication process can also be accomplished in two steps to improve the security. The user may provide his or her information such as company ID, user ID, and a password in the first step of the authentication. The terminal, server, or website receiving the information may generate an image in the second step of the authentication process. The image generated in the second step of the authentication process may contain information specific for the user. Such information may include the identity of the user as established by the first step and a piece of information that can be used to prevent replay attacks. The piece of information that can be used to prevent replay attacks include, for example, time of the last login, a sequence number assigned at the last authentication process, or a sequence number greater than a number embedded in the image at the last authentication process. Furthermore, such information may be digitally signed to prevent other parties from generating such information. The secure device **100** can be used to capture such information and the secure device **100** may verify the validity of such information by verifying the signature and the piece of information added to prevent replay attacks. For example, the secure device **100** may verify that the sequence number used by the site is larger than the last sequence number that the secure device **100** has captured.

The speed of the authentication process can be increased by establishing a secret key shared by the secure device **100** and the website, server or terminal requiring authentication. Such shared secret key can be selected by the website, server or terminal requiring authentication and sent to the secure device **100** through the images that embed such information. The shared secret key may be encrypted by the public key of the secure device **100** and signed by the private key of the website, server or terminal requiring information. The secure device **100**, upon receiving the information related to the shared secret key, may confirm the validity by verifying the digital signature associated with the information. Upon verification, the secure device **100** may store the shared secret key in a secure fashion. Any interaction with the website, server or terminal requiring authentication can use the shared secret key to create shorter signatures. Furthermore, such signatures can be created and verified faster than the digital signatures created using asymmetric encryption algorithms.

In another illustrative application, the secure device **100** can be used to effect authentication in an alternative manner, as shown in FIG. **4**. Similarly, the user uses the secure device **100** to derive the authentication code **410** and other relevant information **420** from the scanned image or video **400**. The secure device **100** then further prompts the user to enter his/her personal identification number (PIN) **430** and/or other identification information. The PIN **430** and/or identification information may then be forwarded by the secure device **100** in the form of a message to the website server **440** via, for example, a wide area network (such as, a cellular or wireless network), SMS (Short Message Service), EMS (Extended Message Service), or other types of message delivery services or protocols. The message may include identity of the user and secure device **100**, a unique value generated by the secure device **100**, and a unique number, nonce, a transaction number or a random number embedded in the image. The message might be digitally signed and encrypted to protect and prove the identity of the user and the secure device **100** and also to prevent eavesdropping. If a shared secret key has been established previously, the shared secret key can also be used to increase the speed of the encryption and signature generation and shorten the message length.

The server **440**, by using the unique number, the nonce, the transaction number or the random number transmitted with the message, may identify the session that the user is using to authenticate his or her identity and may then deem the session as authenticated, thereby allowing the user to conduct any desired transactions on the website. In one

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embodiment, the secure device **100** may be implemented as part of a cell phone or a personal digital assistant.

In another illustrative application, the secure device **100** can be used to effect authorization, as shown in FIG. **5**. Initially, the user may be authenticated for permission to enter a website, terminal, server or device using the secure device **100** as described above or through other mechanisms. It is also possible that no prior authentication took place. After the user successfully logs in to the website, terminal, server or device, the user may perform a desired transaction, such as, transferring money between accounts. Such desired transaction may need to be further authorized to provide additional security. For example, as shown in FIG. **5**, the user may complete a form **500** to effect transfer of money between accounts. Upon hitting the "transfer" button **510**, the website, terminal, server or device displays an image or stream of images **520** and a blank designated entry **530** for a confirmation signature. The image or stream of images **520** include embedded information relating to the transfer transaction and possibly a unique transaction number. The embedded information might be encrypted and digitally signed for authentication purposes to prevent eavesdropping. The correct confirmation signature has to be provided in order to effect the transfer. The correct confirmation signature can be derived from the information embedded in the image or stream of images **520** using the secure device **100**. More specifically, the user may use the secure device **100** to scan the image or stream of images **520**. The secure device **100** may then decode the scanned image or stream of images **520** and derive the embedded information. The derived information relating to the transfer transaction may then be shown on a display **540** by the secure device **100** for viewing by the user. The user may then verify the information. The user may optionally be asked to enter his or her personal identification number for authentication.

Upon completion of the authentication process, the secure device **100** may generate the corresponding confirmation signature **550**. The confirmation signature may be a digital signature generated based on embedded information contained in the image or stream of images **520** and, optionally, other types of information, such as, an identification code that uniquely identifies the user and the secure device **100**. If a shared secret key has been established beforehand, the generated confirmation signature may also be an authentication code derived from the identity of the user and secure device **100**, the transaction information and the shared secret key. The user may then input the generated confirmation signature or authorization code into the designated entry **530**. The website, terminal, server or device may then check the generated confirmation signature or authorization code relative to the information embedded in the image or stream of images **520**. If the generated confirmation signature is correct for a specific user and/or secure device **100**, the transfer transaction will be completed. Furthermore, the generated confirmation signature may be used as undisputed proof that the user has authorized the transfer transaction, thereby preventing the user from denying having performed the transaction.

In a similar illustrative application, the secure device **100** can be used to effect authorization in an alternative manner, as shown in FIG. **6**. The authorization process is similar to that described in connection with FIG. **5** above. Alternatively, upon the secure device **100** generating the confirmation signature or authorization code, the secure device **100** may transmit the generated confirmation signature or authorization code to a transaction server **600** handling the transaction. The generated confirmation signature or authorization code may be transmitted in the form of a message in a number of ways including, for example, a wide area network (such as, a cellular or wireless network), email, SMS and EMS. The message may also include the unique transaction number embedded in the image or stream of images. In response, upon receiving the generated confirmation signature or authorization code, the transaction server **600** may then use the transaction number to identify the session and check the generated confirmation signature or authorization code relative to the information embedded in the image or stream of images and, if appropriate, effect the transaction and display the confirmation information **610** to the user.

Authorization involving multiple parties, such as credit and debit card transactions, can also be achieved. For example, the authorization can be achieved by embedding values derived from the transaction with secret information shared by the user of the secure device **100** and the other parties. The secrets shared by the user of the secure device **100** and the other parties can be credit card numbers, the expiration date of the card, the registered address of the user, and a password established by the user. The other parties can be merchants, banks, credit card issuers, and service providers that may need to be involved with the transaction. A party receiving a user response can forward the response to any of the other parties for verification purposes. Such authorization may be used in connection with an online e-commerce transaction, as will be further described below.

In another illustrative application, the secure device **100** can be used to provide offline digital signature to effect authorization, as shown in FIG. **7**. A sender seeking authorization for a transaction forwards a printed form **700** to a user. The printed form **700** includes certain transaction information as well as an image **710**, such as a barcode, or a set of images, such as a set of barcodes. The image **710** includes embedded information relating to the transaction. The user using the secure device **100** scans the image **710**. The secure device **100** may then prompt the user to enter his/her personal identification number (PIN) **720** for authentication purposes. Once the correct PIN **720** is entered, the secure device **100** decodes the scanned image **710** and derives the embedded transaction information. The transaction information is then shown via a display **730** on the secure device **100** to the user. The user may then provide approval of the transaction by entering the corresponding command into the secure device **100**. The secure device **100** may then generate the corresponding confirmation signature or authorization code **740** based on the information embedded in the image **710** and optionally the PIN **720** of the user and display the generated confirmation signature or authorization code **740** to the user. In response, the user may then provide the generated confirmation signature or authorization code **740** to the sender to confirm authorization via, for example, a telephone, a wide area network (such as, cellular or wireless network), an email, SMS message, EMS message or facsimile **750**. Since the sender initially provides the image **710**, the sender also has knowledge with respect to the corresponding confirmation signature or authorization code. As a result, by receiving the generated confirmation signature or authorization code **740** from the user, the sender may verify whether the user is authorized to provide approval for the transaction.

In another illustrative application, the secure device **100** can be used to provide secure document distribution. FIG. **8** illustrates the logic flow with respect to using the secure device **100** to provide secure document distribution. At block **800**, a document is created and secured using a

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password. The password can be viewed as the correct answer to a challenge. The challenge is presented to someone who attempts to access the secured document. At block **810**, a message, such as an email, instant message (IM), SMS or EMS message, is created for a recipient with the secured document being included as an attachment. At block **820**, an image or a stream of images is created. The image or stream of images includes embedded information relating to the password used to secure the document. The information embedded in the image or stream of images can be created using public keys that are stored locally or centrally managed. In one implementation, creation of the image or stream of images may be automated. For example, using the Microsoft Office application, a plug-in can be added to allow the image or stream of images containing the password to be inserted automatically into a message, such as an email; alternatively, the image or stream of images may also be created for S/MIME compatibility on an automated basis by generating a one-time certificate and attaching the certificate to the image or stream of images or encrypting the certificate with a randomly generated password, storing the certificate at a server and providing the password and the location of the certificate to the user through the image or stream of images.

At block **830**, the image or stream of images is also included as part of the message. At block **840**, the message including the secured document and the image or stream of images is delivered to the recipient. At block **850**, upon opening the message, the recipient may use the secure device **100** to scan the image or stream of images. At block **860**, upon retrieving the images or stream of images, the secure device **100** may then derive the embedded information from the images or stream of images including information relating to the password. Such information is then displayed to the user. At block **870**, the user uses such information to access the secured document. For example, a challenge may be presented to the user when the user attempts to access the secured document. Upon providing the password, the challenge is satisfied and the secured document can be accessed by the user. It can be seen that the secure device **100** provides a number of benefits with respect to secure document distribution. For example, the secure device **100** enables secure document distribution without incurring any additional software resources on the recipient. Furthermore, the recipient does not have to manage any digital certificates, nor does the recipient have to install any drivers for hardware tokens. Finally, the recipient may use distrusted terminals to retrieve secured documents.

In a similar illustrative application, the secure device **100** can be used to effect digital rights management. The document may contain an access control list to limit the users to certain operations. For example, only certain users might be allowed to open, modify, change, copy and/or print the information embedded in a document or media, such as, music or video. Furthermore, the digital certificates of the users might be embedded in the document or media directly. When a user tries to open, modify, change, print and/or copy the document or media through a program, the program might generate a challenge for a specific user dynamically. The challenge might be embedded in an image or stream of images which, for example, contain barcodes. In response to the challenge, the user scans the image or stream of images using the secure device **100**. The user might be optionally asked to provide a password to either the secure device **100** or the program. The secure device **100** might use the private key of the certificate associated with the user or secure device **100** to generate an authentication code in response to the challenge. The user may then provide the authentication code by entering it manually on a terminal. The secure device **100** might also generate radio or sonic signals that might be captured by the terminal. The secure device **100** might also send a message, such as email, SMS or EMS message, to a server to provide the authentication code. The program upon receiving the authentication code confirms the identity of the user by comparing the response received. If the identity of the user is confirmed and the operation that the user is trying to accomplish is allowed, the program performs the operation.

In a further illustrative application, the secure device **100** can be used to conduct transactions using images displayed on printed materials, such as books, signs, and catalogs, or transmitted to computers or television screens, as shown in FIG. **9**. An image **900** or stream of images can be displayed on a catalog, book or sign. The image **900** or stream of images may also be shown on a television or computer screen. The image **900** or stream of images may include embedded information relating to a particular product or service (such as, product or service description and transaction identification), information related to a merchant providing the product or service, a public key assigned to the merchant, a digital signature of the public key, a digital signature for the transaction, the Internet address of the merchant, etc. Using the secure device **100**, a user may scan the image **900** or stream of images. The secure device **100** may then derive the relevant information relating to the product or service and display such information to the user as shown in block **910**. The secure device **100** may further allow the user to conduct a transaction as shown in blocks **920-960**. For example, as shown in block **920**, the user may use the secure device **100** to enter selection and purchase information. Upon receiving the selection and purchase information, the secure device **100** may then display the summarized transaction information to the user, as shown in block **930**. If the user agrees with the summarized transaction information, the user may then authorize the transaction. As shown in block **940**, the secure device **100** may require the user to provide a PIN to ensure that the user is authorized to order the transaction. Upon verifying the PIN provided by the user, the secure device **100** may then proceed with the transaction, for example, by allowing the user to select a shipping address and displaying the final transaction information to the user, as shown in block **950-960**. In addition, the secure device **100** may also allow the user to designate how the transaction is to be paid for, as shown in blocks **970-980**. The secure device **100** may then forward the relevant transactional information to a server associated with the merchant for further processing, as shown in block **990**. Such information may be forwarded to the merchant using a number of different methods including, for example, a wide area network (such as, a cellular or wireless network), SMS, EMS or other types of message delivery services. The information may be encrypted. In addition, the secure device **100** may also forward a digital signature or authorization code associated with the transaction and generated by the secure device **100** to the server. The digital signature or authorization code may be used to prove that the transaction was legitimately ordered by the secure device **100**. Upon the server completing the transaction, confirmation information can be sent by the merchant to the secure device **100** for viewing by the user, as shown in block **992**.

Alternatively, the transaction can be handled via a third party service provider. The image or stream of images can be generated by the third party service provider. In this case, the

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public key and the server address of the third party service provider can be embedded in the secure device **100**. The server of the third party service provider can conduct the transaction on behalf of the user of the secure device **100**. The secure device **100** upon deciphering the image or stream of images can send a confirmation to the third party service provider through, for example, a wide area network (such as, a cellular or wireless network). The third party service provider can then cooperate with the server associated with the merchant to complete the transaction including, for example, transferring the information required to complete the transaction, such as payment and shipping information, to the server associated with the merchant. The third party service provider may also bill the user of the secure device **100** directly for the transaction amount.

In the situation where there is no communication channel between the secure device **100** and the third party service provider or the merchant, the secure device **100** and the third party service provider or merchant can utilize a shared secret key and identification information assigned to the secure device **100** or to the user of the secure device **100**. The shared secret key and the identification information are previously provided to the secure device **100** and the service provider. The secure device **100** can capture the image or stream of images and decode its embedded information. The secure device **100** can then combine the decoded information and the identification information and encode the combination using the shared secret key. The encoded value, including a portion of the identification information, can be displayed on the secure device **100**. The user may then provide the encoded value to the terminal, device, or website or may call the merchant or third party service provider to provide the encoded information. The third party service provider, upon receiving the encoded value, can send the information to the merchant for identification and verification purposes. The merchant, upon receiving the encoded value, can derive the identity of the user and verify that the secure device **100** has been in legitimate possession of the user.

In another illustrative application, the secure device **100** can be used in a checkout process, as shown in FIG. **10**. At block **1000**, upon checkout, a register generates an image or a stream of images for a transaction. The image or stream of images includes embedded information relating to the transaction. The image or stream of images is presented to the user. The user then uses the secure device **100** to scan the image or stream of images. The secure device **100** then derives the relevant information relating to the transaction from the barcode and displays such information to the user, as shown in block **1010**. The user may then authorize the transaction. The secure device **100** may further require the user to provide a PIN, as shown in block **1020**, to ensure that the user is indeed authorized to approve the transaction. If the correct PIN is provided, the secure device **100** generates its own image or stream of images, as shown in block **1030**. The image or stream of images generated by the secure device **100** may include relevant transaction and payment information including, for example, credit card or other payment account information. The image or stream of images is then provided to the register, as shown in block **1040**. The register may include a scanning device capable of scanning the image or stream of images displayed on the secure device **100**. Upon retrieving the image or stream of images from the secure device **100**, the register may then derive the relevant information and use such information to contact a payment server to obtain payment for the transaction, as shown in block **1050**. Depending on the information received from the register, the payment server may then provide the appropriate response to the register accordingly, as shown in block **1060**.

In a further illustrative application, the secure device **100** can be used in a checkout process in an alternative manner, as shown in FIG. **11**. At block **1100**, upon checkout, a register generates an image or a stream of images for a transaction. The image or stream of images includes embedded information relating to the transaction. The image or stream of images is presented to the user. The user than uses the secure device **100** to scan the image or stream of images. The secure device **100** then derives the relevant information relating to the transaction from the image or stream of images and displays such information to the user, as shown in block **1110**. The user may then further provide any additional information, such as, the transaction amount, and authorize the transaction, as shown in block **1120**. The secure device **100** may further require the user to provide a PIN, as shown in block **1130**, to ensure that the user is indeed authorized to order the transaction. If the correct PIN is provided, the secure device **100** may then contact a payment server to complete payment for the transaction, as shown in block **1140**. Upon successfully completing payment for the transaction, the payment server may then forward the appropriate confirmation information to the secure device **100**, as shown in block **1150**. The confirmation information may be forwarded to the secure device **100** in a number of ways including, for example, a wide area network (such as, a cellular or wireless network), SMS, EMS and other types of message delivery services. Upon receiving the confirmation information, the secure device **100** may then generate its own image or stream of images, as shown in block **1160**. The image or stream of images generated by the secure device **100** may include relevant information relating to the transaction including, for example, the confirmation information. The image or stream of images may then be presented to the register for scanning. Upon retrieving the image or stream of images from the secure device **100**, the register may then derive the relevant information and confirm that the transaction has been paid for and proceed to conclude the transaction, as shown in block **1170**.

In yet another illustrative application, the secure device **100** can be used to defend against real-time phishing attacks, as shown in FIG. **12**. Phishing attacks involve fraudulently capturing information from a user, for example, via a fake website, and then using such information to conduct unauthorized transactions. At **1230**, a user **1200** unknowingly provides information to a fake website **1210**, thinking that s/he is dealing with the legitimate website **1220**. At **1240**, the fake website **1210**, upon capturing the information, then uses such information to contact the legitimate website **1220** and attempts to conduct an unauthorized transaction. At **1250**, in order to confirm the transaction, the legitimate website **1220** generates an image or a stream of images that requires confirmation by the secure device **100**. The image or stream of images may include confirmation information relating to the transaction. If the image or stream of images is forwarded to the secure device **100**, as shown in **1260**, the secure device **100** may then derive the confirmation information and display such information to the user, thereby allowing the user to detect that an unauthorized transaction has been attempted. The user may then terminate any connection to the fake website **1210**. Alternatively, the legitimate website **1220** may include warning information in the image or stream of images, such as, information alerting the user to disconnect from the website **1210** and re-connect to the legitimate website **1220** directly. To guarantee only the

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legitimate user visits the legitimate website **1220**, the information embedded in the image or stream of images may include a unique but randomly generated number. Such a number may be combined with the URL of the website to form a unique URL for a specific user for a specific period of time. Upon deriving the relevant information from the image or stream of images, the secure device **100** may then display such information to the user, thereby alerting the user to potential fraud and unauthorized transactions and also providing the user the unique URL that the user has to enter in a browser.

The legitimate website **1220** may also detect a legitimate user by using a cookie stored at the computer associated with the user. A cookie is a message stored in a text file and given to a Web browser by a Web server. The message is then sent back to the server each time the browser requests a page from the server. The main purpose of cookies is to identify users and possibly prepare customized Web pages for such users. A website can detect that a user has never used a particular computer to visit that website by requesting cookies stored in a browser associated with that computer. The cookie stored by the browser can uniquely identify a user. In the absence of the cookie, the website may request the user to visit the unique URL as described above.

In addition to the applications described above, the present invention can also be deployed in various other types of applications including, for example, digital signatures, encryption, secure ATM cards and secure credit cards, etc. Based on the disclosure and teachings provided herein, a person of ordinary skill in the art should know how to deploy the present invention in many other types of applications.

The various illustrative logical blocks, modules, circuits, elements, and/or components described in connection with the embodiments disclosed herein may be implemented or performed with a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic component, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general purpose processor may be a microprocessor, but in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing components, e.g., a combination of a DSP and a microprocessor, a number of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

The methods or algorithms described in connection with the embodiments disclosed herein may be embodied directly in hardware, in a software module executable by a processor, or in a combination of both, in the form of control logic, programming instructions, or other directions, and may be contained in a single device or distributed across multiple devices. A software module may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, hard disk, a removable disk, a CD-ROM, or any other form of storage medium known in the art. A storage medium may be coupled to the processor such that the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor.

The previous description of the disclosed embodiments is provided to enable any person skilled in the art to make or use the present invention. Various modifications to these embodiments will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments without departing from the spirit of scope of the invention. Thus, the present invention is not intended to be limited to the embodiments shown herein, but is to be accorded the full scope consistent with the claims, wherein reference to an element in the singular is not intended to mean "one and only one" unless specifically so stated, but rather "one or more". All structural and functional equivalents to the elements of the various embodiments described throughout this disclosure that are known or later come to be known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed by the claims. Moreover, nothing disclosed herein is intended to be dedicated to the public regardless of whether such disclosure is explicitly recited in the claims. No claim element is to be constructed under the provisions of 35 U.S.C. §112, sixth paragraph, unless the element is expressly recited using the phrase "means for" or, in the case of a method claim, the element is recited using the phrase "step for".

What is claimed is:

1. An apparatus for providing a secure transaction, the apparatus comprising:

an image capture device configured to capture an image, the image having information embedded therein including information relating to a transaction;

a memory configured to store predetermined information;

an input unit configured to receive input information provided by a user; a processor configured to:

verify the user based on the input information to ensure that the user is authorized to use the apparatus; and

generate an output based on the information embedded in the image and the predetermined information; and

an output unit configured to forward the output generated by the processor, wherein

the output includes a digital signature to be used to signify authorization by the user with respect to the transaction.

2. The apparatus of claim **1** wherein the processor is further configured to generate the output using the input information.

3. The apparatus of claim **1** wherein the processor is further configured to decode the information embedded in the image for use in generating the output by using a decryption algorithm.

4. The apparatus of claim **1** wherein the input information includes one of a personal identification number and biometric information.

5. The apparatus of claim **1** wherein the output unit is a display.

6. The apparatus of claim **1** wherein the output is provided to a verifier, the verifier having access to the information embedded in the image.

7. The apparatus of claim **1** wherein the image includes a barcode.

8. The apparatus of claim **7** wherein the barcode includes a multi-dimensional barcode.

9. The apparatus of claim **1** wherein the image includes a set of barcodes.

10. The apparatus of claim **9** wherein the set of barcodes includes a set of multi-dimensional barcodes.

11. The apparatus of claim **1** wherein the output includes an authentication code to be used to authenticate the user with respect to the transaction.

12. The apparatus of claim **1** wherein the transaction includes an online transaction.

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13. The apparatus of claim 1 wherein the predetermined information includes information relating to a payment card account; and

wherein the output further includes some or all of the information relating to the payment card account to be used for payment with respect to the transaction.

14. The apparatus of claim 1 wherein the information embedded in the image includes information relating to a password to be used to unlock a secured document; and

wherein the output includes the password to be used to unlock the secured document.

15. The apparatus of claim 1 wherein the information embedded in the image includes information relating to a challenge; and

wherein the output includes a password to be used to satisfy the challenge and unlock a secured document.

16. The apparatus of claim 1 wherein the information embedded in the image includes information provided by a vendor relating to a pending transaction; and

wherein the output includes some or all of the information provided by the vendor to be used to alert the user with respect to the pending transaction.

17. The apparatus of claim 1, wherein the apparatus is a cellphone.

18. The apparatus of claim 1, wherein the apparatus includes a smartcard claim 1.

19. An apparatus for providing a secure transaction, the apparatus comprising:

an image capture device configured to capture an image, the image having information embedded therein;

a memory configured to store predetermined location;

an input unit configured to receive input information provided by a user; a processor configured to:

verify the user based on the input information to ensure that the user is authorized to use the apparatus; and

generate an output based on the information embedded in the image and the predetermined information; and

an output unit configured to forward the output generated by the processor, wherein

the output unit includes control logic configured to forward the output using a message delivery protocol.

20. The apparatus of claim 19 wherein the message delivery protocol includes the Short Message Service.

21. The apparatus of claim 19 wherein the message delivery protocol includes email.

22. The apparatus of claim 19 wherein the message delivery protocol includes the Extended Message Service.

23. A method of providing secure transaction, the method comprising:

configuring a portable device to:

capture an image, the image having information embedded therein, the information embedded in the image including information relating to a transaction;

store predetermined information;

receive input information provided by a user;

verify the user based on the input information to ensure that the user is authorized to use the portable device;

generate an output based on the information embedded in the image and the predetermined information; and

forward the generated output to the user,

wherein the output includes a digital signature to be used to signify authorization by the user with respect to the transaction.

24. The method of claim 23 further comprising:

configuring the portable device to generate the output using the input information.

25. The method of claim 23 further comprising:

configuring the portable device to decode the information embedded in the image for use in generating the output by using a decryption algorithm.

26. The method of claim 23 wherein the input information includes one of a personal identification number and biometric information.

27. The method of claim 23 further comprising:

configuring the portable device to display the output.

28. The method of claim 23 wherein the output is provided to a verifier, the verifier having access to the information embedded in the image.

29. The method of claim 23 wherein the image includes a barcode.

30. The method of claim 29 wherein the barcode includes a multi-dimensional barcode.

31. The method of claim 23 wherein the image includes a set of barcodes.

32. The method of claim 31 wherein the set of barcodes includes a set of multi-dimensional barcodes.

33. The method of claim 23 wherein the output represents an authentication code to be used to authenticate the user with respect to the transaction.

34. The method of claim 23 wherein the transaction includes an online transaction.

35. The method of claim 23 wherein the predetermined information includes information relating to a payment card account; and

wherein the output further includes some or all of the information relating to the payment card account to be used for payment with respect to the transaction.

36. The method of claim 23 wherein the information embedded in the image includes information relating to a password to be used to unlock a secured document;

and wherein the output includes the password to be used to unlock the secured document.

37. The method of claim 23 wherein the information embedded in the image includes information provided by a vendor relating to a pending transaction; and

wherein the output includes some or all of the information provided by the vendor to be used to alert the user with respect to the pending transaction.

38. The method of claim 23 wherein the information embedded in the image includes information relating to a challenge;

wherein the output includes a password to be used to satisfy the challenge and unlock a secured document.

39. A method of providing secure transaction, the method comprising:

configuring a portable device to:

capture an image, the image having information embedded therein;

store predetermined information;

receive input information provided by a user;

verify the user based on the input information to ensure that the user is authorized to use the portable device;

generate an output based on the information embedded in the image and the predetermined information; and

forward the generated output to the user using a message delivery protocol.

40. The method of claim 30 wherein the message delivery protocol includes the Short Message Service

41. The method of claim 39 wherein the message delivery protocol includes email.

42. The method of claim 39 wherein the message delivery protocol includes the 5 Extended Message Service.

43. A method of providing secure transaction, the method comprising:

configuring a portable device to:

capture an image, the image having information embedded therein;

store predetermined information;

receive input information provided by a user;

verify the user based on the input information to ensure that the user is authorized to use the portable device;

generate an output based on the information embedded in the image and the predetermined information; and

forward the generated output to the user, wherein

the portable device includes one of a cell phone, a personal digital assistant, and a smartcard.

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

EARLY WARNING SERVICES, LLC,

Petitioner,

v.

INTELLECTUAL VENTURES II, LLC,

Patent Owner.

Case No. IPR2024-01221
U.S. Patent No. 7,314,167

DECLARATION OF DR. KEVIN BERISSO IN SUPPORT OF PATENT OWNER'S RESPONSE

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XIV. GROUND V FAILS TO DEMONSTRATE THAT ALL OF THE ELEMENTS OF THE CHALLENGED CLAIMS ARE MET BY THE RELIED ON REFERENCES 52

XV. GROUND VI FAILS TO DEMONSTRATE THAT ALL OF THE ELEMENTS OF THE CHALLENGED CLAIMS ARE MET BY THE RELIED ON REFERENCES 53

XVI. DECLARATION 55

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I, Dr. Kevin Berisso, do hereby declare:

I. INTRODUCTION

1. I am making this declaration at the request of Intellectual Ventures II, LLC ("Intellectual Ventures") in the matter of the *Inter Partes* Review ("IPR") proceedings before the United States Patent and Trademark Office ("USPTO") of U.S. Patent No. 7,314,167 ("the '167 Patent") to provide expert technical opinions with respect to the '167 Patent.

2. I am being compensated for my work in this matter at my standard hourly rate for such consulting services. My compensation in no way depends on the outcome of this case, and I have no financial interest in the outcome.

3. In preparing this Declaration, I considered the following materials, the subject matter of which are all within the scope of my education and professional experience:

- The '167 Patent, Ex. 1001;
- The Petition for *Inter Partes* Review of U.S. Patent No. 7,314,167 ("Pet.");
- the Declaration of Thomas Purves (Ex. 1002) filed with the Petition and the First Supplemental Declaration of Thomas Purvis (Ex. 1036);
- U.S. Patent No. Publication No. 2002/0023215 (Ex. 1004)("Wang");
- Take an Order (Ex. 1005)("TAO");
- Palm Treo Manual (Ex. 1006);

- U.S. Patent No. Publication No. 2003/0217005 (Ex. 1008)("Drummond");
- U.S. Patent No. Publication No. 2004/0193538 (Ex. 1009)("Raines");
- Patent Owner's Response;
- the Institution Decision; and
- any other exhibits referred to in my Declaration.

II. PROFESSIONAL BACKGROUND

4. Based on my qualifications, education, knowledge, expertise, experience, and work background, I believe I am qualified to offer opinions relating to the technology described in the '167 Patent. Exhibit 2030 is a copy of my current *curriculum vitae* ("CV"), detailing my education and experience. Additionally, the following overview of my background pertains to my qualifications for providing expert testimony in this matter.

5. I received a Bachelor of Science degree in Industrial Technology from Ohio University in 1994. While at Ohio University, I took a number of computer science courses. Computer science courses I took included Introduction to Computing (FORTRAN), Computer Programming I, Computer Programming II and Unix & C in addition to an automatic identification class. A degree in Industrial Technology (now often called Engineering Technology) prepares the graduate to integrate various components to solve problems. Students are introduced to both

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manufacturing and business processes, allowing them to quickly internalize current activities and be able to provide value-added improvements.

6. I received a Master of Science in Industrial Technology degree from Indiana State University in 1996. While at Indiana State University, I worked extensively with automation equipment and barcode equipment and continued to develop my programming and database background. A Master of Science in Industrial Technology can be best described as a refinement of the Bachelor of Science in Industrial Technology. The emphasis is on the application of standard manufacturing and business processes. Classes included advanced statistics, creativity and ideation, production planning, and automation integration. For my MS degree, I elected to do a major project which integrated barcoding as a method for the automatic routing of bins on a conveyor line.

7. I received a Doctorate of Philosophy in Technology Management from Indiana State University in 2003. While at Indiana State University, I continued to work with automation equipment, automatic identification equipment, and programming. I developed various small software solutions, worked with various programming environments, and continued to engage in various small consulting projects. A Doctorate of Philosophy in Technology Management with a Manufacturing Systems concentration focuses on the implementation and application of appropriate technologies to a given business challenge.

8. My Ph.D. dissertation addressed the ability of coordinate measuring machines (robotic measuring equipment) to repeatedly obtain measurements from a part that is placed in any orientation within the measurement envelope.

9. From 1996 to 1998, I worked for Applied Tactical Systems ("ATS") of New Jersey doing barcode systems integration. ATS served Fortune 500 companies, providing them with custom warehouse management software. The software was used to ship, receive, count, move, and process materials within a company, often reporting the aggregate results to backend enterprise wide systems such as SAP. Activities included software programming, project management, system design, database design and management, system testing, technical support, and end-user training. With respect to system design, I was often responsible for converting business processes into functional program and database designs. As a part of this process, I would interact with customer representatives, obtaining needs directly from them in support of the agreements that were signed by both parties. From the database side, I often made recommendations and updates to the database designs, both during development and in the field. In terms of equipment, I would often determine the hardware needs for any changes in deliverables or for new enhancements that were requested.

10. In 1998, I joined Delphi Automotive (then a part of General Motors) as a manufacturing engineer. My job responsibilities included building machines for

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manufacturing car batteries. As a part of this job, I was responsible for the evaluation of appropriate technologies, the design and building of the equipment, and the testing and training on the use of the equipment.

11. Over the years I have taught a wide range of topics including automatic identification (barcoding, magnetic stripe, biometrics, radio frequency identification, etc.), facilities layout, computer programming (Visual Basic, C#, Java), database design, data structures, computer usage (computer hardware, MS Word, MS Excel, MS Access, etc.), robotics, industrial automation (programmable logic controllers – PLCs), and industrial organization. During many of these classes I have included barcoding and RFID as topics, going as far back as when I taught the Industrial Organization class while working on my MS from Indiana State University. As a part of the robotics and automation class at Central Missouri State University (now the University of Central Missouri), I began development of an automatic identification lab (where AutoID is the primary research and/or educational objective) obtaining equipment and software from various companies. As can be seen from my CV, I have secured numerous hardware and software donations from a wide variety of companies allowing me to become familiar with a variety of software and products currently used in the industry.

12. In addition to my academic experience, I have a long history of consulting work. Since graduating from Ohio University in 1994, I have been

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involved in industrial training and systems development. While working on my master's degree at Indiana State University, I engaged in computer aided design training and contract work. While working on my Ph.D., I engaged in various Automatic Identification and Data Capture ("AIDC") consulting opportunities including the development of custom AIDC based software. I performed computer programming training while working at Delphi Automotive.

13. Beginning when I returned to Ohio University in 2005, I became even more involved in consulting and technology transfer activities with a wider range of companies – providing information on barcode symbology selection, system design, and the integration of barcodes and radio frequency identification with external sensors and actuators.

14. I have authored numerous custom applications including standardized software packages that center on RFID. I wrote a software development kit ("SDK") – the software library that allows programs like Visual Basic and C# to talk to RFID hardware – for Microelectronics Technology Incorporated's ("MTI") RFID ME™ family of readers. As a part of this development, I was required to review and sign a licensing agreement that included both a non-disclosure provision and a derivative works provision. I have also authored custom translation software that allowed older, less sophisticated software that only works with COM objects to access current .NET libraries. More recently, I have developed software to help assign, track, encode, and

print enhanced tribal identification cards for the Native American tribes. As a part of this process, I was required to review and sign a Personal Services Agreement that specifically included a confidentiality agreement.

15. As of the writing of this report, I have developed AIDC solutions using multiple hardware vendors (Intermec, Matrix/Symbol Technology/Motorola Solutions, Alien Technology, MTI, Feig, Zebra, Honeywell) for a wide range of situations that range from simple data collection tools and asset tracking to RIFD race management and tag validation. I have developed these solutions in various programming languages, and in some cases have developed solutions for customers in multiple programming languages. These solutions have saved data to databases as well as text and Excel files, and some have had the ability to generate complex reports showing trends and exceptions.

16. I have also written software to convert the GS1 EPCglobal[1] encoded data back to its base GS1 data (GTIN, serial number, etc.) that works in both

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[1] GS1 EPCglobal is a suite of RFID based standards that are managed by GS1 (the group that is responsible for assigning UPC codes). This collection of standards includes how the RFID tags communicate, how to format (encode) the data, and how to share the data between business partners. EPCglobal is a collection of standards initially proposed by the Auto-ID Lab at MIT, which has become a driving reason for the low cost passive solutions that are currently available. GS1 owns the EPCglobal standard, which encompasses many of the GS1 standards that are often the key to successful retail and business-to-business relationships. In terms of RFID, the EPCglobal standard encompasses multiple frequencies and other supply chain

Microsoft Excel and in stand-alone applications. My software has been used by GS1 to demonstrate RFID functionality and has been part of a featured hardware demonstration on RFID.NET.

17. Furthermore, I have developed multiple electro-mechanical systems that have incorporated various sensors and vision systems. Specifically, I developed the image capture and motion control system for a 2D matrix symbology verification system that included NIST traceable reflectance and measurement capabilities in 2007 and then developed and programmed a NIST traceable linear barcode scanning verification system that scanned EAN/UPC and Code 128 barcodes in 2016.

18. In 2003, I began my official teaching career (as compared to teaching as a graduate student or short term instructor) at the University of Central Missouri (called Central Missouri State University at the time) where I taught automation and began my efforts at developing an AutoID Lab of my own.

19. In 2005, I returned to Ohio University and took over the Automatic Identification and Data Capture (AIDC) Lab. I was the Director of the AIDC Lab from 2005 until the spring of 2013, when I left Ohio University. The AIDC Lab engaged in education, research and technology transfer activities related to the

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related tools, concepts and standards. However, it cannot be emphasized enough that EPCglobal is not a specific technology, but is instead a set of standards.

automatic identification industry. In addition to an automatic identification class and a radio frequency identification class, the AIDC Lab offered a week-long crash course into all of the AIDC technologies. While the director of the AIDC Lab, we conducted multiple barcode and RFID based tests. These tests included performance testing of multiple brands of RFID readers, testing various types of RFID tags, and testing RFID tag performance at -100 F°. Among the tested performed, I conducted testing on QR Code symbols that have been artistically modified to determine if they perform sufficiently such that an average smart phone equipped consumer would still be able to scan the symbol and performance testing on the Interleaved 2 of 5 barcode symbology, looking for the how often the symbology would potentially generate invalid data. Additional topics included a software programming, robotics class, and an industrial automation class.

20. In 2013, I moved to the University of Memphis where I currently teach automation classes, an automatic identification class, an advanced quality class, statistics, and the senior design class. I have also taught a database and data structures class (which includes programming in Java) and basic electronics. I also brought the AIDC lab from Ohio with me. The AutoID Lab at the University of Memphis has the same goals and activities that were done in Ohio. Current research areas have included big data, EPCIS, Bluetooth Low Energy, and the Internet of Things, passive real time locating systems (think in-door GPS), as well as

involvement with the RAIN RFID industry alliance (a group whose goal is to "drive[s] awareness and fosters market adoption of RAIN technology and supports the development of the RAIN brand.")[2], the AIM RFID Experts Group (REG), and the AIM Technical Symbology Committee (the group that is involved with barcode standards). As a part of my research agenda, I conducted tests on 2D matrix symboliges, generating more than 23 million scans resulting in over 2.3 billion characters using various 2D barcode imagers. I also conducted work on a newer symbology called DotCode where I scanned over 12.6 million images using 2D barcode imagers as a part of a study that ultimately resulted in an update to the DotCode ISO/IEC specification.

21. In 2012, my work in Auto ID was honored by the automatic identification community as a whole through the presentation of the Ted Williams award. This award is given annually by AIM Global to a professor or student in recognition of innovative and exceptional contributions that can further the growth of the industry through his or her work as a teacher, researcher, and entrepreneur. In 2013, my efforts within the automatic identification industry were again recognized with my induction into the AIDC 100. The AIDC 100 is "a not-for-profit, self-

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[2] RAIN Alliance FAQ. Available https://rainrfid.org/mission-vision/, last accessed Oct 15, 2023.

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sustaining, non-political, international organization of automatic identification and data capture (AIDC) professionals and others who have significantly contributed to the growth and advancement of the industry."[3] Most of the members of this organization have been involved in the industry for over 30 years – and many have founded their own AIDC companies or developed technologies that are in use today.

22. My AutoID class is a combination of AutoID theory and practice. Lectures range from a technical discussion of how linear barcodes are read, how 2D matrix symbologies are read, how both are verified (graded), to when/where each should be used and how to store the information contained in databases. Lectures then continue onto the topics of radio frequency identification (RFID), biometrics, touch memory, and other AutoID technologies. Class activities include the configuration of various types of bar code scanners (linear, rastering, omni-directional, imaging), various RFID readers, and the development of applications for the consumption of the data being produced by the hardware that is worked with. As I was able to acquire various pieces of equipment that became surplus (due to age), I was able to add industrial barcode scanning solutions to class that included high-end laser and 2D image scanning solutions that were designed for high-speed object motion (high speed conveyors).

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[3] http://www.aidc100.org/.

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23. The automation classes I have taught, going as far back as 1995 during my MS degree work, have included the use of machine vision solutions for the capturing of images for use by the robots or PLCs for anything from metrology to physical location or even the reading of barcodes. As mentioned above, with access to older high-end laser and 2D image scanning solutions, I was able to integrate barcodes into my robotics and automation classes, requiring students to scan box identifiers for tracking and diversion purposes. As a result of this, I often included barcode discussions in my robotics and automation classes, ensuring that the students not only understood the AutoID technology, but how to use it to improve processes and accuracy.

24. I have served as an expert witness in 8 other automatic identification cases, in one industrial automation case, and am involved with various national and international technology committees.

III. RELEVANT LEGAL STANDARDS

25. I have been asked to provide my opinion as to whether: (i) Claims 1, 4, 5, 7, 12, 17, 23, 26, 27, 29, 34, and 43 of the '167 Patent are anticipated by Wang and obvious over Wang in view of Drummond as alleged in Ground 1 of the Petition; (ii) Wang anticipates Claims 1, 2, 4, 7, 12, and 17 of the '167 Patent as alleged in Ground II of the Petition; (iii) Claims 19-21 and 39-41 are obvious over Wang in view of Drummond as alleged in Ground III of the Petition; (iv) Claims 8 and 30 are obvious

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over Wang and Denso as alleged in Ground IV of the Petition; (v) Claim 13 is obvious over Wang and Raines as alleged in Ground V of the Petition; and (vi) Claims 1, 4, 5, 7, 23, 26, 27, 29, and 43 are obvious over TAO in view of PTM and Wang as alleged in ground VI of the Petition.

26. The opinions I am expressing in this report involve the application of my knowledge and experience to the evaluation of certain references with respect to the '167 patent. My formal knowledge of patent law is no different than that of any lay person. Therefore, I have requested the attorneys from Volpe Koenig, who represent Intellectual Ventures, to provide me with guidance as to the applicable patent law in this matter. The paragraphs below express my understanding of how I must apply current principles related to patent validity to my analysis.

27. I understand that an IPR is a proceeding before the USPTO for evaluating the patentability of an issued patent's claims based on prior-art patents and printed publications.

28. I understand that the claims of a patent are reviewed from the point of view of a hypothetical person of ordinary skill in the art ("POSITA") at the time of the filing of the patent. The "art" is the field of technology to which a patent relates.

29. I understand that in determining whether a patent claim is anticipated or obvious in view of the prior art, the Patent Office must apply the *Phillips* standard to

construe the claims. Under that standard, the words of a claim are generally given their ordinary and customary meaning, which is the meaning that the term would have to a person of ordinary skill in the art at the time of the invention. I understand that inventors are typically persons skilled in the field of the invention and that patents are addressed to and intended to be read by others of skill in the pertinent art. The person of ordinary skill in the field of the invention through whose eyes the claims are construed is deemed to read the words used in the patent documents with an understanding of their meaning in the field, and to have knowledge of any special meaning and usage in the field. Because the meaning of a claim term as understood by persons of skill in the art may not be immediately apparent, and because patentees frequently use terms idiosyncratically, claim interpretation can involve looking to those sources available to the public that show what a person of skill in the art would have understood disputed claim language to mean. Those sources include the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art.

30. I understand that, in this proceeding, Petitioners have the burden of proving that the challenged claims of the '167 Patent are unpatentable by a preponderance of the evidence. I understand that "preponderance of the evidence" means that a fact or conclusion is more likely true than not true.

31. I understand that there are two ways in which prior art may render a patent claim unpatentable. First, the prior art can "anticipate" the claim. Second, the prior art can render the claim "obvious" to a POSITA. I understand that for an invention claimed in a patent to be patentable, it must not be anticipated and must not be obvious based on what was known before the invention was made.

32. I understand that a patent claim may be invalid as "anticipated" under 35 U.S.C. § 102 if each and every limitation of the claim as construed by the court is found, either expressly or inherently, in a single prior art reference, such as a publication or patent, that predates the claimed subject matter. I understand that the mere fact that a certain thing may result from a given set of circumstances is not sufficient to establish inherency. Rather, the limitation at issue necessarily must be present in order to be inherently disclosed by the reference. Therefore, inherency cannot be established by the mere fact that something may happen. Instead, to be inherent, the alleged feature must necessarily be present in the cited reference.

33. I also understand that a patent claim may be invalid as obvious under 35 U.S.C. § 103 if the differences between the subject matter claimed and the prior art are such that the claimed subject matter as a whole would have been obvious to a POSITA at the time the invention was made. I also understand that several factual inquiries underlie a determination of obviousness. These inquiries include (1) the scope and content of the prior art, (2) the level of ordinary skill in the field of the

invention, (3) the differences between the claimed invention and the prior art, and (4) any objective evidence of non-obviousness (i.e., "secondary considerations").

34. I also understand that, when a party alleges obviousness based on a combination of references, that party should identify a reason why a POSITA would have been motivated to combine the asserted references in the manner recited in the claims and to explain why a POSITA would have had a reasonable expectation of success in making such combinations.

35. I understand that an obviousness analysis permits the application of "common sense" in examining whether a claimed invention would have been obvious to a POSITA. For example, I understand that combining familiar elements according to known methods and in a predictable way may suggest obviousness when such a combination would yield nothing more than predictable results. And I understand a party asserting obviousness should still provide a specific motivation to combine the references as recited in the claims and explain why one would have reasonably expected to succeed in doing so.

36. I understand that one indicator of non-obviousness is when a prior art reference leads in a different direction or discourages that combination, recommends steps that would not likely lead to the patent's result, or otherwise indicates that a seemingly inoperative device would be produced.

IV. TECHNOLOGY FOR SCANNING BAR CODES AND CAPTURING IMAGES OF BAR CODES

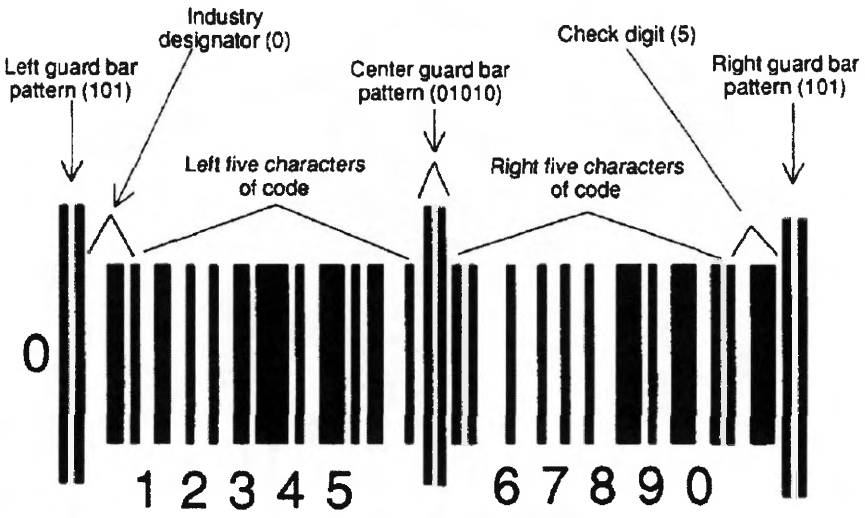
A. One-Dimensional Bar Code Formats

37. The '167 Patent identified two bar code formats including a "one-dimensional barcode, such as a linear barcode, or a multi-dimensional barcode, such as a 2D barcode." Ex. 1001, 5:25-27. The most well-known one-dimensional (or linear) barcode symbology at the time the '167 Patent was filed (March, 2005) was the Universal Product Code (UPC), which was originally developed in the 1970s to identify retail items, such as items in a supermarket. "The bar code of a supermarket item consists of 11 digits and a check digit, which represent an identifying number but not a description of the product. For example, the price look-up must be accessed in a database keyed to the number in the bar code." Ex. 2020, 1.

38. A one-dimensional barcode (like the UPC) stores "information along one dimension with intervals of alternating diffuse reflectivity, usually black and white color. The intervals are actually stored as rectangles .... The term bars denotes the rectangles with the foreground color while the term spaces denotes the intervals with the background color between the bars." Ex. 2020, 2. In a one-dimensional barcode such as the UPC, the interval occupied by the barcode is subdivided into modules and each module is assigned a 1 or a 0. Modules assigned a 1 are "painted"

(typically in black) and form the bars, while modules assigned a 0 correspond to spaces. Ex. 2020, 2.

39. An exemplary UPC barcode is shown below:



Ex. 2020, 4. The UPC barcode includes a left guard pattern 101, six digits of odd parity (including one digit denoting the industry type such as 0 for grocery or 3 for pharmaceutical), a center guard pattern, and six digits of even parity (including five digits with the item code and one check digit), and a right guard pattern 101. Ex. 2020, 3.

B. Bar Code Laser Scanners

40. At the time of the '167 Patent (March 8, 2005), bar code laser scanners were ubiquitous in supermarkets and other retail stores, where they were used, *inter alia*, for scanning UPC codes on products as part of the store checkout process.

41. Below is an example of a classic hand-held barcode laser scanner from the time:

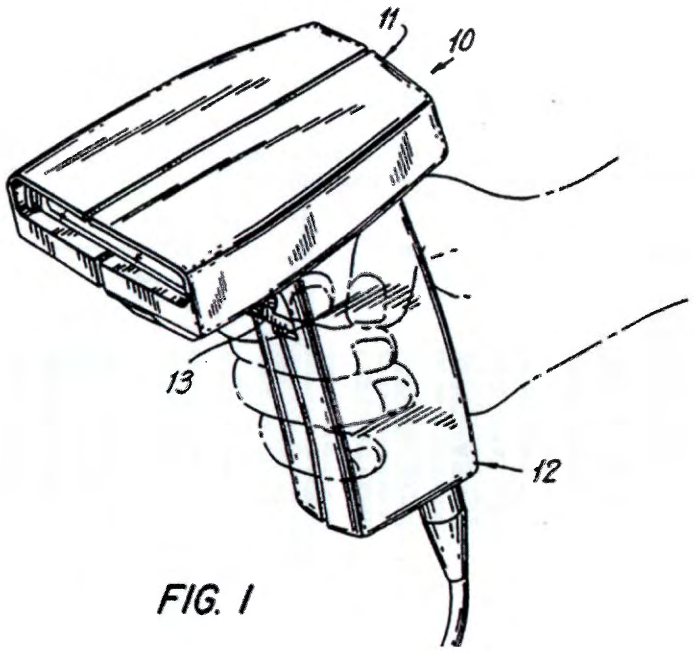
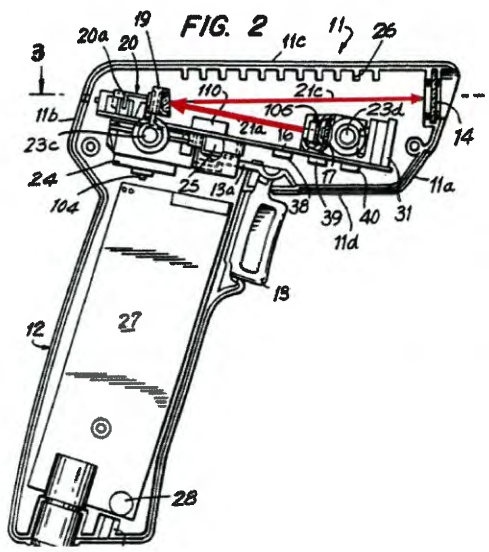


FIG. 1

Ex. 2021, Figure 1. In order to use the device, an operator points the hand-held scanner at a barcode and depresses the manual trigger 13 to actuate the device. *Id.*, 7:16-17.

42. As shown in the cross-sectional diagrams of the hand-held scanner reproduced below, the laser scanner includes a laser light source 33 (red box below) that is actuated by the trigger. *Id.*, 7:40-43. The laser beam emitted by the source has "a beam cross-section resembling an oval." *Id.*, 7:46-51. Light emitted from the laser diode follows the optical path represented by the red arrows, and exits the front of the hand-held scanner through window 14. *Id.*, 7:61-63.



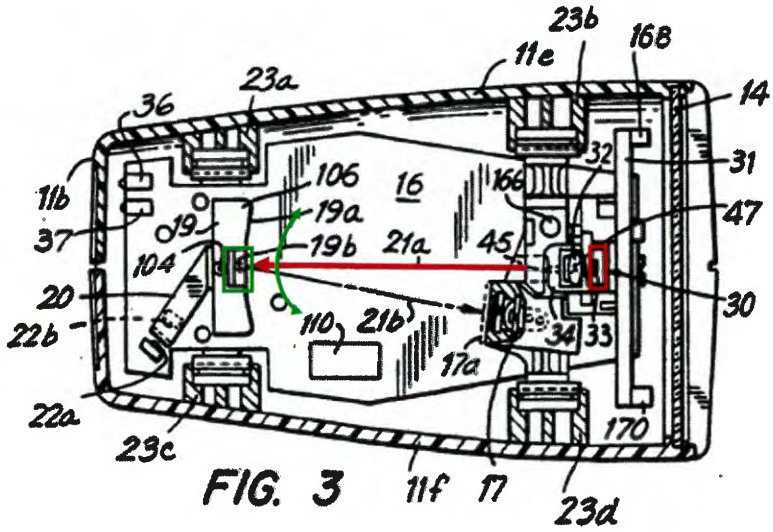


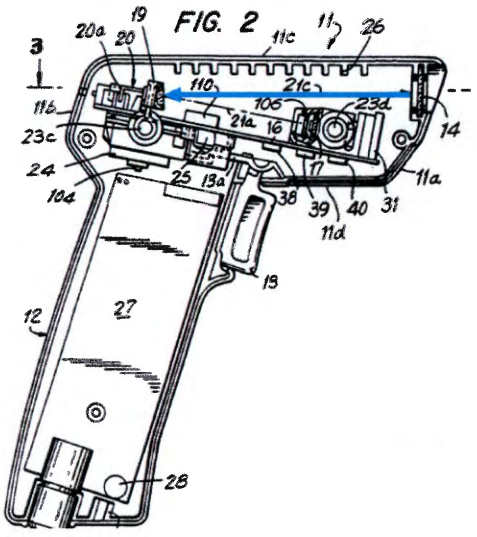
FIG. 3

Ex. 2021, Figures 2 and 3 (annotations added). The laser beam emanating from the laser light source 33 (red box above) is initially directed toward a scanning mirror (green box above). A high-speed motor causes the mirror to oscillate about an arc such that that the scanning mirror sweeps the laser beam reflected by the mirror through (and exiting window 14) an angular arc of about 30° (corresponding to the green arc above) at a rate of about 20 scans or 40 oscillations per second. *Id.*, 8:63-9:14. The swept laser beam exits the laser scanner through the window 14, and is visible on the barcode being scanned, as shown below:



Although the laser beam corresponds to a singular oval-shaped spot on the barcode, the sweeping of laser beam back and forth across the barcode as a rate of 40 oscillations per second results in the appearance of a solid red line across the barcode during scanning.

43. Laser light hitting the barcode symbol reflects off the symbol as a specular component in one direction and as a scattered component in many directions. *Id.*, 8:6-10. The portion of the scattered laser light which returns along the optical path corresponding to the blue arrow (below) impinges upon a spherical collecting mirror (blue box below), which directs the returning light along the path corresponding to the orange arrow to a photosensor (orange box below). *Id.*, 9:15-27.



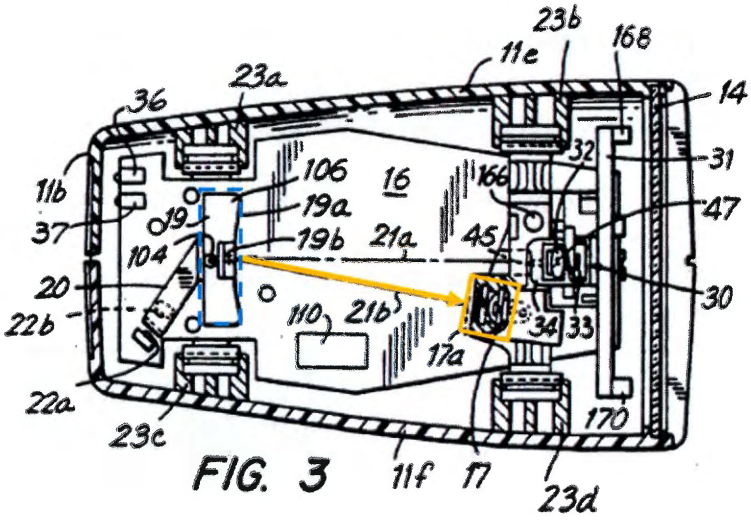
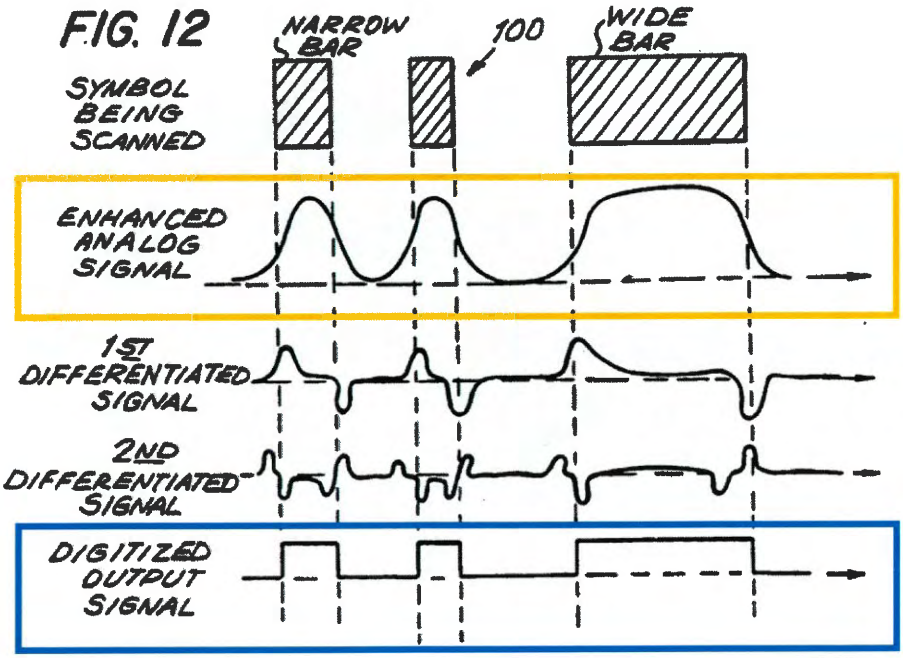


FIG. 3

The photosensor (orange box above) detects the intensity of the collected laser light (which varies depending upon whether the laser light is reflecting off of a bar or a space in the bar code) and generates an electrical analog signal indicative of the detected variable light intensity, as illustrated in the orange box below. *Id.*, 9:27-32.

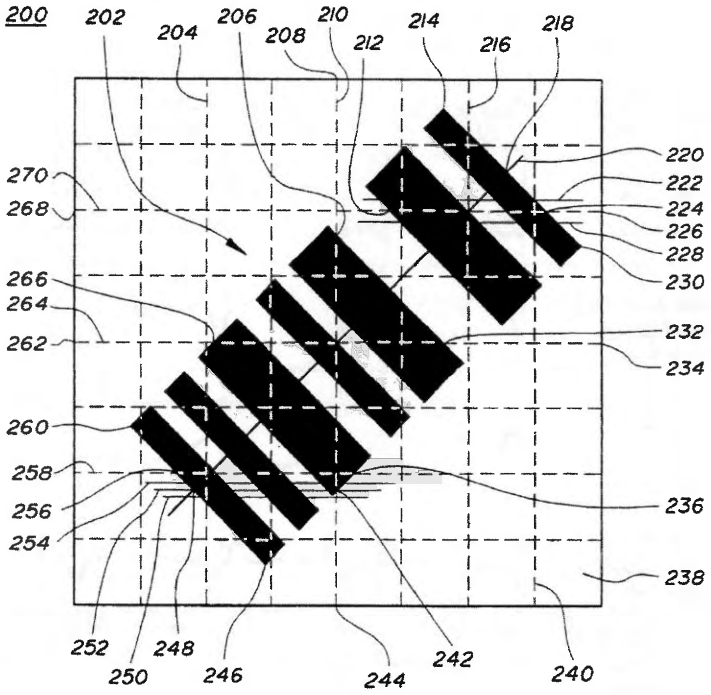


Id., Figure 12. The analog signal is processed and digitized to generate an electrical signal that corresponds to the bars and spaces in the barcode being scanned. *Id.*, 14:18-21.

C. Image Capture Devices For Scanning One-Dimensional Barcodes

44. In contrast to barcode laser scanners, image capture devices for scanning barcodes use a 2D CCD, or other sensor technology such as CMOS, camera

system to capture a pixel image that includes an image of a barcode. Ex. 2022, 1:23-25. An example of such a pixel image is reproduced below:



Ex. 2022, Figure 2. In a typical example, the pixel image shown above represents an imaged area that is 5.12 inches wide and 5.12 inches high, with each pixel representing an area that is 0.01 inch by 0.01 inch in size. *Id.*, 4:12-15. After the pixel image is captured by the CCD camera, an image processing system locates the corners of the bar code within the pixel image. *Id.*, 10:11-15. The four corners indicate the angular orientation of the barcode within the pixel image. The image processing system then decodes the bar code by stepping along the pixels forming

the image in a reference line crossing through the bars and spaces in the barcode represented in the image, and determining the alphanumeric characters represented by the bars and spaces. *Id.*, 8:23-33.

45. In contrast to a barcode laser scanner which simply sweeps a laser beam across the barcode itself and analyzes the intensity of the returned light, bar code image capture devices use a camera to first capture a pixel image containing the barcode and subsequently apply image processing to identify the location of barcode within the image. Image-based devices then step along pixels in the image representing the bars and spaces of the barcode to determine the information stored in the barcode.

46. Significantly, at the time of the '167 Patent, bar code *image capture* devices were used to read *one-dimensional bar codes*. Ex. 2022, Figure 2. As discussed more fully below, bar code *image capture* devices were also used at the time of the '167 Patent to read 2D barcodes.

D. It Was Well Accepted That Barcode Laser Scanners And Barcode Image Capture Devices Were Different

47. At the time of the '167 Patent, it was well accepted by those in the field of automatic identification that bar code laser scanners (on the one hand) and imaging (or image-based) barcode readers (on the other hand) operated differently and represented fundamentally different types of barcode readers. For example, one

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group of inventors practicing in the area at the time of the '167 Patent characterized the state of the art as follows:

> Most, if not all, conventional barcode readers use one of *two general approaches* to gathering data: either by using a *flying-spot laser scanning technique*, or by using an *imaging technique*. In flying-spot laser scanning systems, a beam of light is swept across a target barcode, and the reflected and/or refracted light from the target is detected and processed to decode the barcode. In *imaging barcode readers*, an image of the barcode is typically captured using an array of pixels (CCD or CMOS, for example), and the *captured image* is processed to decode the barcode. ...
>
> Because both *flying-spot* and *imaging readers* have drawbacks, *neither type* is optimum for all situations. For example, *imaging readers* are best suited for situations in which the imaging head can be positioned very close to the target bar code. ...
>
> On the other hand, a drawback of handheld flying-spot *laser readers* is that the scan line (i.e., the path traveled by the scanning spot across the target) must usually be aimed manually at the target barcode, with a relatively high degree of accuracy, for each scan.
>
> A further drawback of flying-spot *laser scanners* is that it can be very difficult or even impossible to read two-dimensional barcodes. ... Reading a two-dimensional code with a flying-spot *laser scanner* is *difficult or impossible*. ... Ex. 2024, 1:19-2:9 (emphasis added).

48. The authors of the above, who were practitioners in the field, clearly understood that were significant differences between barcode laser (flying- spot) scanners and imaging readers (based on image capture), referring to them as *different types* of barcode readers. Moreover, as set forth above, such practitioners referred to the "*captured image*" as the image captured by imaging bar code readers.

49. Others in the field at the time of the '167 Patent likewise identified the significant differences between "laser scanning based" barcode readers and "imaging-based" barcode readers:

> *Imaging-based bar code symbol readers* have a number advantages over *laser scanning based bar code symbol readers*, namely: they are more capable of reading stacked 2D symbologies, such as the PDF 417 symbology; more capable of reading matrix 2D symbologies, such as the Data Matrix symbology; more capable of reading bar codes regardless of their orientation; have lower manufacturing costs; and have the potential for use in other applications, which may or may not be related to bar code scanning, such as OCR, security systems, etc. ...
>
> Prior art *imaging-based bar code symbol readers* generally require *capturing* multiple frames of *image data* of a bar code symbol, and special apparatus for synchronizing the decoding process with the *image capture* process within such readers ...
>
> Prior art *imaging-based bar code symbol readers* generally require large arrays of LEDs in order to flood the field of view within which a bar code symbol might reside during *image capture* operations, ...
>
> Prior art *imaging-based bar code symbol readers* generally require processing the entire pixel data set of *capture images* to find and decode bar code symbols represented therein. ... Ex. 2025, 3:4-49 (emphasis added).

50. Again, the authors of the above, who were practitioners in the field, clearly understood that laser based scanning barcode readers and imaging-based bar code readers were different types of devices, and referred to "*image capture*" (or

"*capturing ... image data*" or "*image capture operations*") solely in connection with imaging-based bar code readers.

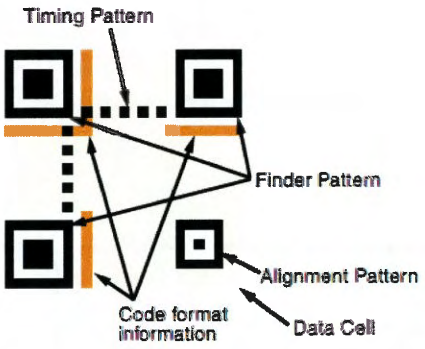
51. Still others in the field at the time of the '167 Patent referred to "laser scan engine" based readers and "image sensor based" barcode readers as different classes of barcode readers:

> Optical readers tend to fall into one of three *classes*: wand readers, *laser scan engine optical readers* and *image sensor based optical readers*. ...
>
> *Laser scan engine based optical readers* comprise a laser diode assembly generating a laser light beam, a moving mirror for sweeping the laser light beam across a decodable symbol and a signal is generated corresponding to the decodable symbol.
>
> *Image sensor based optical readers* comprise multielement image sensors such as CID, CCD, and CMOS image sensors and an imaging optic for focusing an image onto the image sensor. ... Image sensor based optical readers are more durable and offer additional features relative to laser scan engine based bar code readers. One function which has been incorporated into image sensor based optical readers is a picture taking function. Optical readers have been developed which can both take pictures and decode decodable symbols represented in *captured image* data. Ex. 2026, 1:19-47.

52. Again, it is clear that practitioners in the field at the time of the '167 Patent understood that laser based scanning barcode readers and imaging-based bar code readers were different classes of devices, and referred to a "*captured image*" solely in connection with image-based readers.

E. Two-Dimensional (2D) Barcode Formats

53. In addition to one-dimensional barcodes like the UPC code described above, the '167 Patent identified "a multi-dimensional barcode, such as a 2D barcode." Ex. 1001, 5:26-27. The most ubiquitous 2D barcode format at the time of the '167 Patent was the QR Code, examples of which were depicted in, e.g., Figures 3-6 of the '167 Patent. An example of a QR Code is reproduced below:

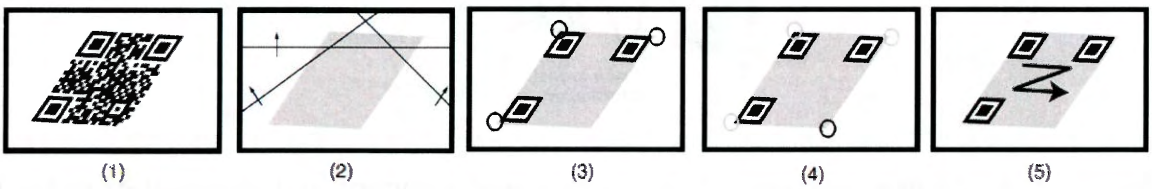


Ex. 2023, 3. A QR Code typically includes a finder pattern for locating the QR Code within a 2D pixel image, a timing pattern, format information and an alignment pattern. Ex. 2023, 2-3.

54. Barcode laser scanners "are ill-suited for reading two dimensional codes" such as a QR Code. Ex. 2022, 1:16-18; Ex. 2024, 2:8-9 ("Reading a two-dimensional code with a flying-spot *laser scanner* is *difficult or impossible*....") In fact, to my knowledge, at the time of the '167 Patent, there was no commercially available laser scanner with the capability of reading 2D codes such as the QR Codes illustrated in Figures 3-6 of the '167 Patent. Rather, an image capture device is

required to read a 2D code such as a QR Code. Such devices first capture a 2D pixel image containing the QR Code and subsequently apply image processing to identify the location and orientation of the QR Code within the image and scan pixels in the image representing the code.

55. A typical image capture device for reading QR Codes begins by using a camera to capture a 2D pixel image (which may be skewed) that includes an image of the QR Code. Ex. 2023, 3. The input image (leftmost image, below) is then processed in the five steps illustrated below so that the decoder can correctly process the potentially skewed image:



Ex. 2023, Figure 4. In step (1), preprocessing is applied to the input image. Next, an image processing algorithm performs rough corner detection (step (2)) and the three marked corners of the QR Code as shown in step (3) are defined. In step (4), the fourth corner is detected. Finally, in step (5), the area that the QR Code occupies is scanned and a normalized version of the QR Code is generated for decoding. After step (5) the QR Code is decoded in accordance with the ISO/IEC standard. *Id.*

56. Again, in contrast to a barcode laser scanner which simply sweeps a laser beam across a one-dimensional barcode and analyzes the intensity of the

returned light, image capture devices use a camera to first capture a pixel image containing the code (e.g., a QR Code) and subsequently apply image processing to identify the location of QR Code within the image and step along pixels in the image representing the cells of the code to determine the information stored in the code.

V. SPECIFICATION OF '167 PATENT

57. The first paragraph of the Summary of the '167 Patent recites an *image capture device*:

> An apparatus for providing a secure transaction is disclosed. In one embodiment, the apparatus includes *an image capture device configured to capture an image having information embedded* therein, a memory configured to store predetermined information, an input unit configured to receive input information provided by a user, a processor configured to: verify the user based on the input information to ensure that the user is authorized to use the apparatus, and generate an output based on the information embedded *in the image* and the predetermined information, and an output unit configured to forward the output generated by the processor. Ex. 1001, 3:17-28 (emphasis added).

58. The general embodiment depicted in Figure 1 of the '167 Patent (shown below) illustrates the basic components of the secure device 100 disclosed in the specification. "The secure device 100 may include a processor 100, *an image capture device or circuit 120*, an input unit 130, an output unit 140 and a memory 150." Ex. 1001, 5:8-11 (emphasis added).

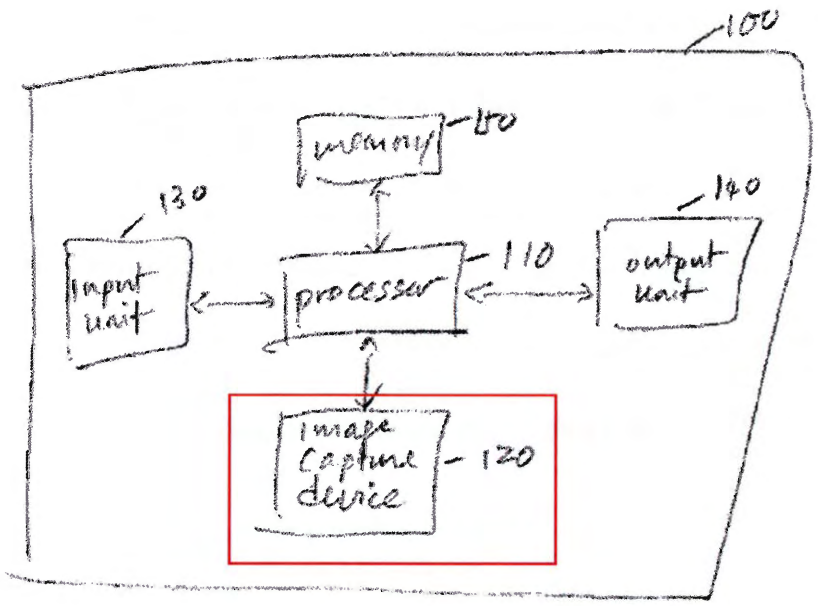


FIG. 1

Ex. 1001, Figure 1 (red annotation added).

59. The '167 Patent went on to describe the image capture device (or circuit) 120 as follows:

> The image capture circuit 120 may include a *digital camera* or other types of *image capturing devices*. The image capture circuit 120 is used to *capture image* and/or video information. *The captured image and/or video information may include a barcode* including an one-dimensional bar code, such as a linear barcode, or a multi-dimensional barcode, such as a 2D barcode, multiple barcodes in a *single image* or multiple barcodes in *multiple images* where multiple images form a stream of images or a video. As will be further described below, *the captured image and/or video information is used and processed for a number of different purposes*. Ex. 1001, 5:21-32 (emphasis added).

60. Next, in describing the general embodiment of the invention, the '167 Patent explains that the image capture circuit 120 captures either a *still image* or *a moving stream of images*.

> The secure device 100 generally operates in the following manner, as shown in FIG. 2. At block 200, the secure device 100 via the *image capture* circuit 120 *captures* information on *a still or moving image or a stream of images*. ...
>
> At block 220, the secure device 100 via the processor 110 decodes the *captured image* or video and extracts the relevant embedded information. Ex. 1001, 5:47-50 and 6:8-10.

61. *Every* barcode illustrated in the figures of the '167 Patent is a 2D barcode in the format of a QR Code:

Figure of '167 Patent	Illustrated code(s)
3	
4	
5	
6	
7	

Figure of '167 Patent	Illustrated code(s)
9	
10	
11	
12	

62. As explained above, it was understood by those of skill in the art at the time of the '167 Patent that it was impossible to read 2D codes like the QR Codes

illustrated in the '167 with laser-based barcode scanners. Ex. 2022, 1:16-18 (Bar code laser scanners "are ill-suited for reading two dimensional codes"); Ex. 2024, 2:8-9 ("Reading a two-dimensional code with a flying-spot *laser scanner* is *difficult or impossible*....") Unsurprisingly, the '167 Patent *never* mentions *laser-based* barcode scanners. In fact, the term "laser" is completely absent from the entirety of the '167 Patent.

63. A person of ordinary skill in the art at the time would have understood the disclosure in the '167 Patent of an "*image capture device*" for capturing "*a still or moving image*" and a processor that "*decodes the captured image*" corresponded to an *imaging-based bar code reader*, which was different from a *laser-based barcode scanner*. Ex. 1001, 3:17-19; 5:47-50; 6:8-10. As noted above, practitioners in the field at the time of the '167 Patent understood that imaging-based bar code readers and laser-based scanning barcode readers were *different* classes of devices, and referred to a "*captured image*" solely in connection with image-based readers. Ex. 2024, 1:19-2:9; Ex. 2025, 3:4-49; Ex. 2026, 1:19-47.

VI. CLAIMS OF '167 PATENT

64. Claim 1 of the '167 Patent recites as follows:

> 1. An apparatus for providing a secure transaction, the apparatus comprising:
> *an image capture device configured to capture an image*, the image having information embedded therein including information relating to a transaction;

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a memory configured to store predetermined information;
an input unit configured to receive input information provided by a user;
a processor configured to:
verify the user based on the input information to ensure that the user is authorized to use the apparatus; and
generate an output *based on the information embedded in the image* and the predetermined information; and
an output unit configured to forward the output generated by the processor, wherein
the output includes a digital signature to be used to signify authorization by the user with respect to the transaction.

65. Independent claim 1 recites an "*an image capture device configured to capture an image*," and a processor configured to "generate an output *based on the information embedded in the image*." Like the image-based bar code readers discussed above, claim 1 contemplates a process where *an image capture device initially captures an image* containing the code after which image processing is applied to the *captured image* in order to *generate an output*.

66. A person of ordinary skill at the time of the '167 Patent reading the claims in light of the specification would have understood the recitation in claim 1 of an "*image capture device configured to capture an image*" in combination with a processor configured to "generate an output *based on the information embedded in the image*," to be referring to an *imaging-based bar code reader* and not a *laser-based barcode scanner*. Practitioners in the field at the time of the '167 Patent used the terms "*image capture*" and "*captured image*" as recited in claim 1 only in

connection with image-based readers. Ex. 2024, 1:19-2:9; Ex. 2025, 3:4-49; Ex. 2026, 1:19-47.

67. Like claim 1, independent claim 19 similarly recites "an *image capture device* configured to *capture an image*" and a processor configured to "generate an output *based on the information embedded in the image*." Independent claims 23, 39 and 43 recite comparable limitations in method format, namely, "configuring a portable device to ... *capture an image*" and "generate an output *based on the information embedded in the image*."

VII. PERSON OF ORDINARY SKILL IN THE ART

68. A person of ordinary skill in the art ("POSITA") pertinent to the '167 Patent would have had at least a bachelor's degree in the field of computer science and/or electrical engineering, engineering technology/industrial engineering, together with at least 2-3 years of experience in the use of Automatic Identification (Auto ID) technology and, in particular barcode technology, in connection with financial transactions.

VIII. CLAIM CONSTRUCTION

A. "*image capture device configured to capture an image*" (claims 1 and 19) and "configuring a portable device to ... *capture an image*" (claims 23, 29 and 43)

69. A person of ordinary skill at the time of the '167 Patent reading the claims in light of the specification would have understood the recitation in claims 1

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and 19 of an "*image*[4] *capture device configured to capture an image*" in combination with a processor configured to "generate an output *based on the information embedded in the image*," to be referring to an *imaging-based bar code reader* and not a *laser-based barcode scanner*. Similarly, a person of ordinary skill at the time of the '167 Patent reading the claims in light of the specification would have understood the recitation in claims 23, 29 and 43 of "configuring a portable device to ... *capture an image*" and "generate an output based on the information embedded in the [*captured*] image" to be referring to an *imaging-based bar code reader* and not a *laser-based barcode scanner*.

70. At the time of the '167 Patent, it was well accepted by those in the field of automatic identification that bar code laser scanners (on the one hand) and imaging (or image-based) barcode readers (on the other hand) operated differently and represented fundamentally different types of barcode readers. One group of

---

[4] An image is "a visual representation of something: such as (1) a likeness of an object produced on a photographic material [or] (2) a picture produced on an electronic display (such as a television or computer screen)." Ex. 2012, Merriam Webster. The dictionary definition of image is consistent with the usage of the term in the '167 Patent which states that "the image capture circuit 120 captures information on a still or moving image or a stream of images." Ex. 1001, 5:49-50 (emphasis added).

practitioners at the time of the '167 Patent characterized the state of the art as follows:

> Most, if not all, conventional barcode readers use one of *two general approaches* to gathering data: either by using a *flying-spot laser scanning technique*, or by using an *imaging technique*. In flying-spot laser scanning systems, a beam of light is swept across a target barcode, and the reflected and/or refracted light from the target is detected and processed to decode the barcode. In *imaging barcode readers*, an image of the barcode is typically captured using an array of pixels (CCD or CMOS, for example), and the *captured image* is processed to decode the barcode. ...
>
> Because both *flying-spot* and *imaging readers* have drawbacks, *neither type* is optimum for all situations. For example, *imaging readers* are best suited for situations in which the imaging head can be positioned very close to the target bar code. Ex. 2024, 1:19-39 (emphasis added).

71. These practitioners clearly understood that were significant differences between barcode laser (flying- spot) scanners and imaging readers (based on image capture). In fact, the authors referred to barcode laser scanners and imaging readers as *different types* of barcode readers, and referred to the "*captured image*" as the image captured by imaging bar code readers.

72. Others practitioners at the time likewise discussed that "laser scanning based" barcode readers were different from "imaging-based" barcode readers:

> *Imaging-based bar code symbol readers* have a number advantages over *laser scanning based bar code symbol readers*, ...

> Prior art *imaging-based bar code symbol readers* generally require *capturing* multiple frames of *image data* of a bar code symbol, and special apparatus for synchronizing the decoding process with the *image capture* process within such readers ...
>
> Prior art *imaging-based bar code symbol readers* generally require large arrays of LEDs in order to flood the field of view within which a bar code symbol might reside during *image capture* operations, ...
>
> Prior art *imaging-based bar code symbol readers* generally require processing the entire pixel data set of *capture images* to find and decode bar code symbols represented therein. ... Ex. 2025, 3:4-49 (emphasis added).

73. Again, these practitioners understood that laser based scanning barcode readers and imaging-based bar code readers were different types of devices, and referred to "*image capture*" (or "*capturing ... image data*" or "*image capture operations*") solely in connection with imaging-based bar code readers.

74. Still other practitioners referred to "laser scan engine" based readers and "image sensor based" barcode readers as *different classes* of barcode readers:

> Optical readers tend to fall into one of three *classes*: wand readers, *laser scan engine optical readers* and *image sensor based optical readers*. ...
>
> *Laser scan engine based optical readers* comprise a laser diode assembly generating a laser light beam, a moving mirror for sweeping the laser light beam across a decodable symbol and a signal is generated corresponding to the decodable symbol.
>
> *Image sensor based optical readers* comprise multielement image sensors such as CID, CCD, and CMOS image sensors and an imaging optic for focusing an image onto the image sensor. ... Image sensor based optical readers are more durable and offer additional

features relative to laser scan engine based bar code readers. ... Ex. 2026, 1:19-47.

75. Thus, it is clear that practitioners in the field at the time of the '167 Patent understood that laser based scanning barcode readers and imaging-based bar code readers were different classes of devices, and referred to a "*captured image*" solely in connection with image-based readers.

76. Accordingly, a person of ordinary skill at the time of the '167 Patent reading the claims in light of the specification would have understood the recitation in claims 1 and 19 of an "*image capture device configured to capture an image*" in combination with a processor configured to "generate an output *based on the information embedded in the image*," to be referring to an *imaging-based bar code reader* and not a *laser-based barcode scanner*. Similarly, a person of ordinary skill at the time of the '167 Patent reading the claims in light of the specification would have understood the recitation in claims 23, 29 and 43 of "configuring a portable device to ... *capture an image*" and "generate an output based on the information embedded in the [*captured*] image" to be referring to an *imaging-based bar code reader* and not a *laser-based barcode scanner*.

B. "the image having information embedded therein" (claims 1, 19, 23, 39 and 43)

77. In the Institution Decision, the Board determined that the term "embedded" should be given its "plain and ordinary meaning," but did not articulate

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the specifics of what constitutes the plain and ordinary meaning of "embedded" to a person of ordinary skill at the time of the '167 Patent reading the claims in light of the specification. Institution Decision, at 17. However, the Board credited Mr. Purves testimony that "the transaction information *derived from the barcode*" constitutes "embedded information." *Id.*, at 15 (emphasis added). In this regard, Mr. Purves testified that "it is my opinion that the plain and ordinary meaning of "embedded" includes *information contained in any barcode*." Ex. 1036, ¶8 (emphasis added). I understand that Patent Owner accepts Mr. Purvis's opinion that "embedded" information includes *information contained in any barcode*." However, a person of ordinary skill in the art at the time of the '167 Patent would have understood that *human readable text* information in the form of unencrypted human-readable alphanumeric characters is outside the scope of "embedded" information.

78. The understanding of a person of ordinary skill in the art at the time of the '167 Patent that human readable text is not "embedded" information is consistent with the specification of the '167 Patent, which never uses the term "embedded" to refer to human readable text. This position is also consistent with the dictionary definition of "embedded," which defines something as being "embedded" when it is "*incorporated into something else* as an essential characteristic." Ex. 2021, 1 and *see also* Ex. 2022, 1 (defining "embedded" as functioning *as part of a larger device* rather than as an independent unit or system.") In this respect, Mr. Purvis's opinion

that "embedded" information includes information *contained in any barcode* is in keeping with dictionary definition which defines something (e.g., information) as being "embedded" when it is "*incorporated into something else*" (e.g., a barcode). Ex. 1036, ¶8 (emphasis added).

79. Unlike a barcode where information is *embedded into the bars and spaces* of a barcode, human readable text in the form of unencrypted human readable alphanumeric characters is *not* embedded into (or incorporated into) something else. Accordingly, a person of ordinary skill at the time of the '167 Patent reading the claims in light of the specification would have understood that human readable text in the form of unencrypted human readable alphanumeric characters is not "embedded" information.

IX. THE PRIOR ART RELIED ON IN THE PETITION

A. Wang

80. Grounds I-V rely on Wang (Ex. 1004) as either the sole or primary reference. Wang discloses "a portable electronic authorization device (PEAD) carried by a user." Ex. 1004, Abstract. In one embodiment (the one relied on in the Petition), the PEAD is used as a "self-checkout terminal." Ex. 1004, [0115]; Pet., 33-34. In this embodiment, the PEAD includes a barcode scanner for scanning UPC barcodes:

> Another implementation of Point-of-Sale Transaction is to use PEAD as self checkout terminal. By entering *the UPC code or barcode using keypad on the PEAD or scanning in the UPC code or barcode using the input device built into the PEAD such as a barcode scanner or OCR reader*, the PEAD can generate the receipt with the list of item prices through the wireless network and Internet by querying the item price using the barcode as the index for price lookup table which is stored in a server system. The PEAD user can sign the receipt electronically using PEAD ... . Ex. 1004, [0115] (emphasis added).

81. In the emphasized language from the paragraph above , Wang distinguishes "the UPC code" and "a barcode," stating that the user could either enter the "UPC code" *or* a "barcode." Below is an example of a "UPC code or barcode" as described in paragraph [0115] of Wang:



As shown above, a standard UPC barcode typically include bars and spaces (green box above), as well as numeric characters in human readable text form (red box) positioned below the bars and spaces. A POSITA reading [0115] of Wang would have understood that it discloses that the "UPC code" (human readable text) can be

entered by (i) entering the UPC code (human readable text) using a keypad, or (ii) scanning the UPC code (human readable text) with an OCR (optical character recognition) reader. A POSITA reading [0115] of Wang would not only have also understood that the only method disclosed in [0115] for reading the "barcode" (bars and spaces) was to scan the barcode with a barcode scanner, but would instinctively have used a linear barcode scanner. To the POSITA, the explicit discussion of "point of sale" and UPC would drive them to the use of a linear barcode scanner, and the intentional avoidance of a barcode imager due to the cost differences between the two devices. The POSITA would read the Wang patent and would instinctively look to include a linear barcode scanner due to their knowledge of the types of barcodes being used on retail items - UPC/EAN barcodes, which are linear, one dimensional barcodes.

With respect to the barcode scanner, Wang does not disclose the type or class of barcode scanner used for scanning the barcode.

B. Take An Order (TAO)

82. Ground VI relies on Take An Order (Ex. 1005) as the primary reference. TAO describes point-of-sale software for the Palm devices whereby a vendor can take orders from customers at, for example, a trade show. Ex. 1005, 1-2. Certain PalmOS devices compatible with the TAO software included a bar code scanner that the vendor could use to scan items to generate an order. *Id.* The software includes a

popup which lets the vendor key in the customer's name, credit card number and expiration date. *Id.*, at 2. The software includes the capability to print receipts, quotations, invoices and delivery reports by connecting to a variety of printers. *Id.*, at 3.

83. The Petition (at 65) relies on TAO's barcode scanning capability, which TAO describes as follows:

> **Point-of-sale Software for the Palm Computing Platform**
>
> Are you selling products at trade shows or expos? Taking orders from customers in their home or office? Submitting bids or issuing quotations in a field situation? Delivering product and need to issue a receipt? For all these situations and more, **Take An Order! is the handheld tool you need.** Combined with any Palm Computing platform handheld device including barcode scanning SPT units from Symbol Technologies and a portable printer like the Canon BJC-55 or Brother MPrint, **Take An Order!** gives you an office that travels with you.
>
> * * *
>
> If you're equipped with a Symbol SPT PalmOS handheld with its built-in barcode scanner, it's even easier! Just point the scanner at the product, press the scan button, and the item is added to the order!

Ex. 1005, at 1-2 (red underlining added). The SPT units from Symbol Technologies identified in TAO are *barcode laser scanners*. *See*, e.g., Ex. 2009, Symbol SPT 1800 Series Product Reference Guide, at 109 ("The SPT 1800 has an integrated bar code laser scanner"); Ex. 2010, Symbol SPT 1700 Series Product Reference Guide, at 108 ("The SPT 1800 has an integrated bar code laser scanner.")

C. Drummond

84. The Petition relies on Drummond as disclosing that, in addition or alternatively to receiving paper receipts, electronic receipts may be sent to one or more devices via e-mail and/or text message. Pet., 28; *citing* Ex. 1008, [0246]-[0251], [0301] and [0307].

D. Palm Treo Manual (PTM)

85. The Petition relies on the Palm Treo Manual (PTM) to show that Palm Treo devices included an internal memory, a processor, a keyboard and system locks that required a password to be entered on the device prior to accessing data stored on the device. Pet., 27, *citing*, Ex. 1006 at 24, 97, 109, 112, 129 and 173.

X. GROUND I FAILS TO DEMONSTRATE THAT ALL OF THE ELEMENTS OF THE CHALLENGED CLAIMS ARE MET BY THE RELIED ON REFERENCES

86. Ground I alleges that claims 1, 4, 5, 7, 12, 17, 23, 26, 27, 29, 34 and 43 are anticipated by Wang and obvious over Wang in view of Drummond.

87. In Ground I, the Petition relies on paragraph [0115] of Wang with respect to the claim limitations reciting an "*image capture device configured to capture an image*" and a processor configured to "generate an output *based on the information embedded in the image* as recited in independent claim 1, and "configuring a portable device to ... *capture an image*" and "generate an output *based on the information embedded in the image*" as recited in independent claims

23 and 43. Pet., 33 and 35 (claim 1 mapping); 38 and 40 (claim 23) and 43 (claim 43).

88. As explained above, a person of ordinary skill at the time of the '167 Patent reading the claims in light of the specification would have understood the recitation in claim 1 of an "*image capture device configured to capture an image*" in combination with a processor configured to "generate an output *based on the information embedded in the image*," to be referring to an *imaging-based bar code reader* and not a *laser-based barcode scanner*. Similarly, a person of ordinary skill at the time of the '167 Patent reading the claims in light of the specification would have understood the recitation in claims 23 and 43 of "configuring a portable device to ... *capture an image*" and "generate an output based on the information embedded in the [*captured*] image" to be referring to an *imaging-based bar code reader* and not a *laser-based barcode scanner*. Practitioners in the field at the time of the '167 Patent used the terms "*image capture*" and "*captured image*" and "*capture an image*" as recited in such claims only in connection with image-based readers. Ex. 2024, 1:19-2:9; Ex. 2025, 3:4-49; Ex. 2026, 1:19-47.

89. Wang at [0115] fails to expressly or inherently disclose an *imaging-based* barcode reader. While Wang at [0115] discloses a barcode scanner, Wang is wholly silent as to the type or class of barcode scanner used for scanning the barcode. Thus, Wang does not expressly disclose an *imaging-based* barcode reader. Nor is

an imaging-based barcode reader inherent in Wang, as Wang's barcode scanner could have been implemented with a barcode laser scanner (which is not an imaging-based barcode reader.) Simply put, since there is no requirement in Wang that its barcode reader *must* be an imaging-based barcode reader, an imaging-based barcode reader is not inherently disclosed in Wang.

90. The OCR reader disclosed in Wang also fails to meet the claim language. As explained above, Wang discloses the use of an OCR (optical character recognition) reader for scanning the UPC code *human readable text* positioned below the bars and spaces in the barcode. Also as set forth above, such human readable text does *not* constitute *embedded information*. By contrast, independent claims 1, 23 and 43 all require generation of "an output *based on the information embedded in the image*." Therefore, even if Wang's OCR device functioned to capture an image of the human readable test under the bars and spaces, the captured image would still fail to meet the claim limitation requiring that there be "*information embedded in the image*."

91. Each of the remaining claims challenged in Ground I depends from either independent claim 1 or 23. Under Ground I, the Petition has failed to demonstrate that all of the claim limitations are met by the cited references with respect to any these dependent claims because the Petition has failed to demonstrate

that all of the claim limitations of the independent claim from which each such dependent claim depends are met by the cited references.

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XI. GROUND II FAILS TO DEMONSTRATE THAT ALL OF THE ELEMENTS OF THE CHALLENGED CLAIMS ARE MET BY THE RELIED ON REFERENCES

92. In Ground II, the Petition alleges Wang anticipates Claims 1, 2, 4, 7, 12, and 17. In Ground II, the Petition again relies on paragraph [0115] of Wang with respect to the claim limitations reciting an "*image capture device configured to capture an image*" and a processor configured to "generate an output *based on the information embedded in the image* as recited in independent claim 1. Pet., 45-46. For the reasons discussed in connection with Ground I above, Wang at [0115] fails meet the claim language because Wang at [0115] fails to expressly or inherently disclose an *imaging-based* barcode reader that captures an image with *information embedded in the image*.

93. Each of the remaining claims challenged in Ground II depends from independent claim 1. Under Ground II, the Petition has failed to demonstrate that all of the claim limitations are met by the cited references with respect to any these dependent claims because the Petition has failed to demonstrate that all of the claim limitations of the independent claim from which each such dependent claim depends are met by the cited references.

XII. GROUND III FAILS TO DEMONSTRATE THAT ALL OF THE ELEMENTS OF THE CHALLENGED CLAIMS ARE MET BY THE RELIED ON REFERENCES

94. In Ground III, the Petition alleges that claims 19-21 and 39-41 are obvious over Wang in view of Drummond. In Ground III, the Petition again relies on paragraph [0115] of Wang with respect to the claim limitations reciting an "*image capture device configured to capture an image*" and a processor configured to "generate an output *based on the information embedded in the image* as recited in independent claim 19, and "configuring a portable device to ... *capture an image*" and "generate an output *based on the information embedded in the image*" as recited in independent claim 39. Pet., 52-53. For the reasons discussed in connection with Ground I above, Wang at [0115] fails meet the claim language because Wang at [0115] fails to expressly or inherently disclose an *imaging-based* barcode reader that captures an image with *information embedded in the image*.

95. Each of the remaining claims challenged in Ground 3 depends from either independent claim 19 or 39. Under Ground III, the Petition has failed to demonstrate that all of the claim limitations are met by the cited references with respect to any these dependent claims because the Petition has failed to demonstrate that all of the claim limitations of the independent claim from which each such dependent claim depends are met by the cited references.

XIII. GROUND IV FAILS TO DEMONSTRATE THAT ALL OF THE ELEMENTS OF THE CHALLENGED CLAIMS ARE MET BY THE RELIED ON REFERENCES

96. In Ground IV, the Petition alleges that Claims 8 and 30 are obvious over Wang and Denso. Ground 4 fails to explain how the elements in the base claims (i.e., claim 1 is the base claim for claim 8, and claim 23 is the base claim for claim 30) are being mapped to the cited references. For example, it is not apparent whether the Petition is relying on its mapping of claim 1 as set forth Ground I or its mapping of claim 1 as set forth in Ground II in connection with the mapping of claim 8 in Ground 4. To the extent the Petition intended to rely on the analysis of claims 1 and 23 set forth in Ground I for the limitations in the base claim for claims 8 and 30, respectively, in Ground 4, the confusion is further complicated by the fact that the analysis of claims 1 and 23 in Ground 1 relies in part on *Drummond, which is absent from Ground 4*. Ground 4 fails to set forth with clarity how it is mapping the claims to the prior art.

97. To the extent that the Petition is using only its citations to Wang (and not Drummond) for claims 1 and 23 from Ground I for the limitations in the base claim for claims 8 and 30, respectively, the Petition fails to demonstrate that all of the claim limiations are met by the cited references in Ground 4 because, as explained above, Wang at [0115] fails to expressly or inherently disclose an

imaging-based barcode reader that captures an image with *information embedded in the image*.

98. Claim 23 is not the subject of Ground II, so there are no mappings to Wang in Ground II for the limitations in the base claim (claim 23) for dependent claim 30. To the extent the Petition is using its citations to Wang from claim 1 from Ground II for the limitations in the base claim (claim 1) for claim 8, the Petition again fails to demonstrate that all of the claim limitations are met by the cited references in Ground IV because, as explained above, Wang at [0115] fails to expressly or inherently disclose an *imaging-based* barcode reader that captures an image with *information embedded in the image*.

XIV. GROUND V FAILS TO DEMONSTRATE THAT ALL OF THE ELEMENTS OF THE CHALLENGED CLAIMS ARE MET BY THE RELIED ON REFERENCES

99. In Ground V, the Petition alleges that claim 13 is obvious over Wang and Raines. In Ground V, the Petition appears to rely on its mapping to Wang from Ground II for the limitations of the base claim (claim 1) from which claim 13 depends. Pet., at 57 ("As discussed in Ground 2, Wang discloses all of the features of Claim 1.") Here again, the Petition fails to demonstrate that all of the claim limitations are met by the cited references in Ground V because, as explained above, Wang at [0115] fails to expressly or inherently disclose an *imaging-based* barcode reader that captures an image with *information embedded in the image*.

XV. GROUND VI FAILS TO DEMONSTRATE THAT ALL OF THE ELEMENTS OF THE CHALLENGED CLAIMS ARE MET BY THE RELIED ON REFERENCES

100. In Ground VI, the Petition alleges that claims 1, 4, 5, 7, 23, 26, 27, 29, and 43 are obvious over TAO in view of PTM and Wang. In Ground VI, the Petition relies on TAO's barcode scanning capability with respect to the claim limitations reciting an "*image capture device configured to capture an image*" and a processor configured to "generate an output *based on the information embedded in the image* as recited in independent claim 1, and "configuring a portable device to ... *capture an image*" and "generate an output *based on the information embedded in the image*" as recited in independent claim 23. Pet., 65 and 68.

101. As explained above, a person of ordinary skill at the time of the '167 Patent reading the claims in light of the specification would have understood the recitation in claim 1 of an "*image capture device configured to capture an image*" in combination with a processor configured to "generate an output *based on the information embedded in the image*," to be referring to an *imaging-based bar code reader* and not a *laser-based barcode scanner*. Similarly, a person of ordinary skill at the time of the '167 Patent reading the claims in light of the specification would have understood the recitation in claim 23 of "configuring a portable device to ... *capture an image*" and "generate an output based on the information embedded in the [*captured*] image" to be referring to an *imaging-based bar code reader* and not

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a *laser-based barcode scanner*. Practitioners in the field at the time of the '167 Patent used the terms "*image capture*" and "*captured image*" and "*capture an image*" as recited in such claims only in connection with image-based readers. Ex. 2024, 1:19-2:9; Ex. 2025, 3:4-49; Ex. 2026, 1:19-47.

102. As explained above, the barcode readers disclosed in TAO were SPT units from Symbol Technologies, which are *barcode laser scanners*. *See*, e.g., Ex. 2009, Symbol SPT 1800 Series Product Reference Guide, at 109 ("The SPT 1800 has an integrated bar code laser scanner"); Ex. 2010, Symbol SPT 1700 Series Product Reference Guide, at 108 ("The SPT 1800 has an integrated bar code laser scanner.") Thus, TAO fails to disclose an *imaging-based* barcode reader.

103. Each of the remaining claims challenged in Ground VI depends from either independent claim 1 or 23. Under Ground VI, the Petition has failed to demonstrate that all of the claim limitations are met by the cited references with respect to any these dependent claims because the Petition has failed to demonstrate that all of the claim limitations of the independent claim from which each such dependent claim depends are met by the cited references.

XVI. DECLARATION

104. I, Dr. Kevin Berisso, declare that all statements made herein on my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: May 9, 2025 By: Kevin Berisso
Dr. Kevin Berisso

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image 1 of 2 noun

im·age 'i-mij

Synonyms of *image*

1 a : a visual representation of something: such as

(1) : a likeness of an object produced on a photographic material

(2) : a picture produced on an electronic display (such as a television or computer screen)

b : the optical counterpart of an object produced by an optical device (such as a lens or mirror) or an electronic device

2 a (1) : a mental picture or impression of something
had a negative body *image* of herself

(2) : a mental conception held in common by members of a group and symbolic of a basic attitude and orientation
a disorderly courtroom can seriously tarnish a community's *image* of justice
Herbert Brownell

b : IDEA, CONCEPT

3 : a popular conception (as of a person, institution, or nation) projected especially through the mass media
promoting a corporate *image* of brotherly love and concern
R. C. Buck

4 a : exact likeness : SEMBLANCE
God created man in his own *image*
Genesis 1:27 (Revised Standard Version)

b : a person strikingly like another person
she is the *image* of her mother

5 a : a tangible or visible representation : INCARNATION
the *image* of filial devotion

b archaic : an illusory form : APPARITION

6 : a vivid or graphic representation or description

7 : a reproduction or imitation of the form of a person or thing
especially : an imitation in solid form : STATUE

8 : FIGURE OF SPEECH

9 : a set of values given by a mathematical function (such as a homomorphism) that corresponds to a particular subset of the domain

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DATALOGIC™

DATALOGIC AUTOMATION

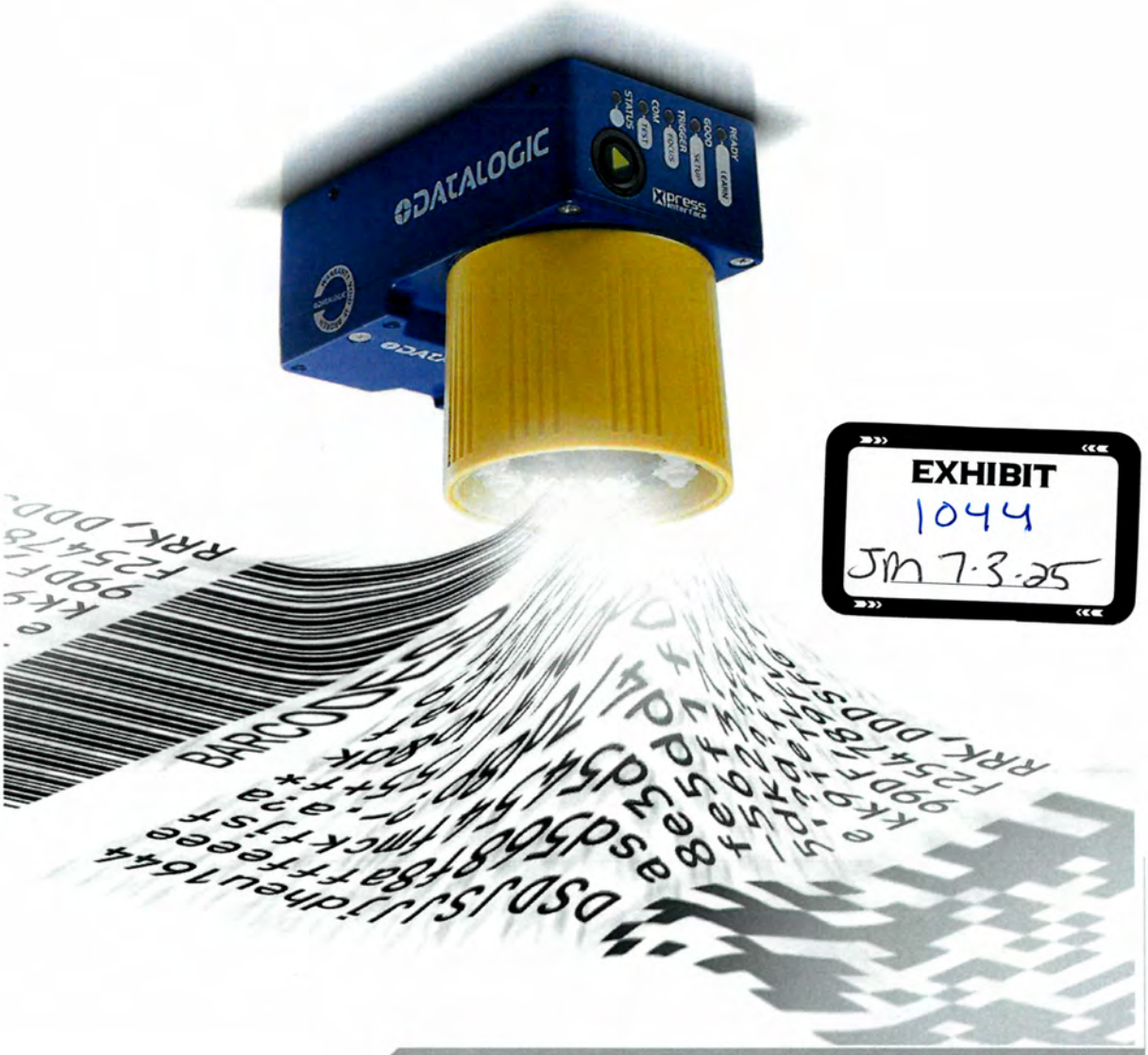


EXHIBIT
1044
JM 7.3.25

Vision

OCR and OCV Application Guide 1.00

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General considerations on OCR

Encoded information into text and codes can be automatically extracted through a 2D imager device. The intrinsic structure of the encoding methods is a crucial factor affecting the readability and the technical approach for the automatic reading, since the existence of different constraints.

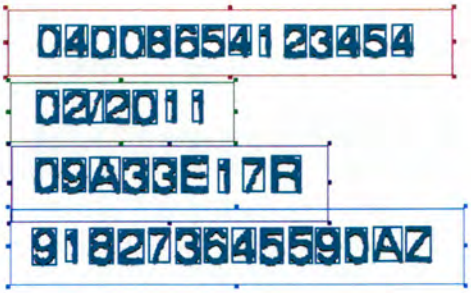
A primary advantage of OCR is that encoded information is simultaneously machine-readable and human-readable, while a code, 1D and 2D, is only machine-readable.
On the other side, data encoded in linear and 2D symbols is considerably more reliable for the intrinsic level of information redundancy and protection, being more resistant to quality variation and degradation.



Additionally, both the orientation and the positioning of a code, 1D or 2D, into the scanning area do not affect the correct reading: a 2D barcode reader always features omni-directional reading with also unpredictable code positioning.
Conversely, the automatic character recognition must respect some constraints in relation to the text position and rotation, that are required to be known or should be calculated at run time. In more detail, text can be located through the usage of anchors, that could be barcodes or reference edges.

Unlike codes, having standardize symbols and patterns, the text recognition requires a learning phases where the reader has to be trained over the whole alphabet. The training is a crucial activity since it sets the base patterns that will be used to match the run-time characters. The reading performance is so considerably depending on the quality of the learning phase.

GTIN: 040086541234 54
EXP: 02/2011
LOT: 09A33E17R
SN: 918273645590AZ



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STEPPING THROUGH OCR APPLICATIONS

The proper setup of OCR system permits to achieve optimal level of the readability, top reliability and maximum stability of the performance during the life-cycle.

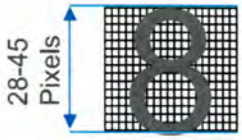
The following part reports the main sequence of operations and crucial hints for an optimal setup.

1. Application Setup

The optical positioning and the setup of the reading head are to be taken into high consideration since their combination determines the system performance and its reliability in the time.

The first consideration is based on the image resolution in relation to the height of the characters. In order to provide an optimal balance between robustness and speed, the resolution in Pixels should meet the condition:

28-45 Pixel/Char height



Increasing the resolution over the recommended range does not increase OCR readability; conversely, larger characters have a negative impact on the decoding time.

Repeatability is a crucial aspect for OCR. Unlike barcode reading, OCR is based on the comparison of run-time character patterns against references, acquired during the initial learning phase.
So, higher the **repeatability** of the characters pattern and features, better and easier the reading.
The variability of the features can derive from many aspects: both the unpredictability of the marking quality and the perspective distortions are typical factors increasing variations respect to the reference condition.

Repeatability also improves with a correct training of the alphabet, that should be based on real operative conditions.

Flat surfaces and **predictable positions** of the scanned text surely help in making easier the configuration and to achieve higher level of performance.

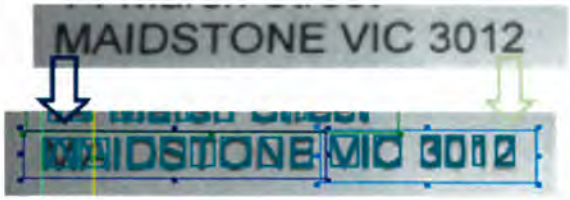
2. Lighting

The lighting selection plays a crucial role in OCR applications.
A proper lighting makes predictable the features of the captures and definitively increases the stability of the reading performance.

As basic and general guideline, **even lighting** improves the quality of the captures and permits an optimal photometrical setup, fundamental condition to boost the contrast of the marked patterns.
Conversely, **"hot", "cold" spots** or **shadowing** intrinsically create variations and make patterns irregular, with the result of processing time increase.



Multiple regions of interest could be defined in order to group parts of the text with homogeneous characteristics and uniform illumination level.
Into a ROI, segmentation algorithms self tunes on average text features, mainly contrast or spacing. For this reason, an optimal setup is achieved while text fields have features as uniform as possible.



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Multiple ROI should be also used when the character set for a certain field is limited, for instance numeric or alphanumeric characters. It helps to enhance decoding time thanks to a reduce subset of the alphabet.

3. Locators

Unlike barcode reading, OCR uses ROI to perform researches and the text must be located into the configured ROI. Small variations of the text position and orientation can be automatically managed by the algorithms without applying location tools.
Small variation are to be intended into the range of:

- Rotation: ±2°
- Horiz/Vert offsets ½ Char Dimens.

Outside the mentioned range, text anchors have to be applied as pre-processing to the normal text recognition.
1D or 2D barcode can be used as text anchors.

4. Character Segmentation

Once the text region is correctly located, the OCR steps through the **segmentation process**, in order to identify each single character instance that graphically results with the assignment of a rounding box around the character.



The segmentation process depends on:

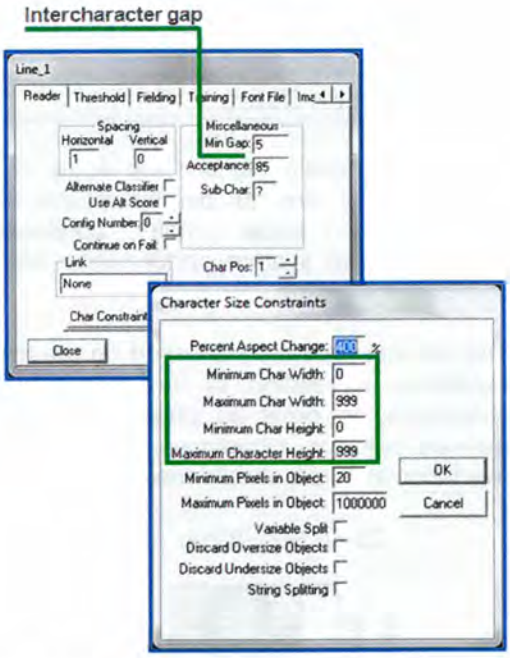
- Characters font
- Character spacing and quite zones around the text field
- Printing quality
- Patterns repeatability

The easiest ways to improve the segmentation process, in robustness and speed, is routing the algorithm through constrains on the research parameters.



Bounds can be introduced on:

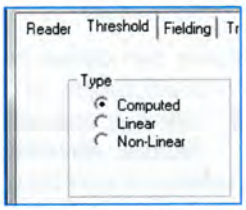
- Characters **Height**
- Characters **Width**
- Characters **Spacing**

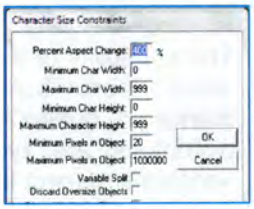


Min Gap parameter defines the minimum gap between characters; it is important to enhance the speed of the segmentation process.

In addition to the standard **linear segmentation** method, expected to manage a large part of cases, other two segmentation methods are implemented, based on **non-linear and compounded** algorithms.

The variable split of characters can be applied to critical cases where the spacing between characters cannot be fixed or predictable.





Touching characters generally increase the complexity and the setup time.

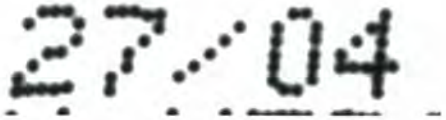


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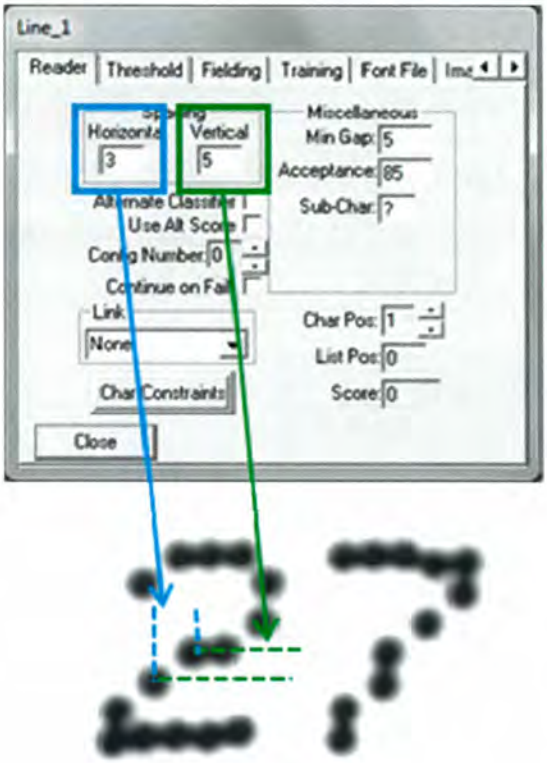
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As general rule, OCR algorithms are much more reliable and faster when a good separation between character is guaranteed. Touching characters increase the risk of un-decoded cases or even of character substitution.

Dot printed characters are present in many application, especially in the Food and Beverage industry.



The segmentation for dot printing charcacrtes must be improved applying constraints to characters features:



The orizontal and vertical spacing constraints permit a proper character segmentation, since they lead the algorithms to group and split patterns depending on the real features of the font in use.

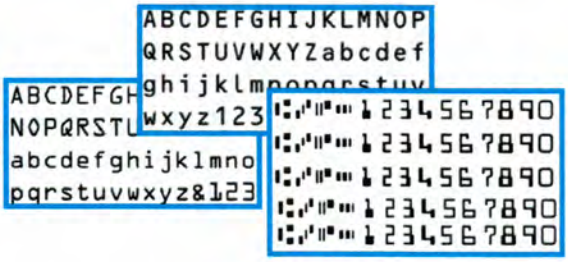
5. TRAINING

The font of the text is a fundamental aspect affecting both the readability and the reliability of the reading.

During the training, the reference characters patterns will be fixed and then used to match run-time characters. As consequence, the reading performance depends on the quality of the learning, that should be based on the real production characters variety.

OCR function of MATRIX is really performing and flexible: it supports true types fonts for a broad range of applications.

Nevertheless, OCR fonts remarkably simplify the segmentation setup and process: OCR fonts guarantee a better level of readability and also contrast character substitution, an occurrence increasing while coping with poor printing quality or life-time degeneration.



Whether the variability of character features is high and it gets complicate to address with a single pattern for character, the easiest way is to train multiple instances of the same character pattern.
On the other side, the over-training must be avoided since larger the reference set, higher the decoding time.

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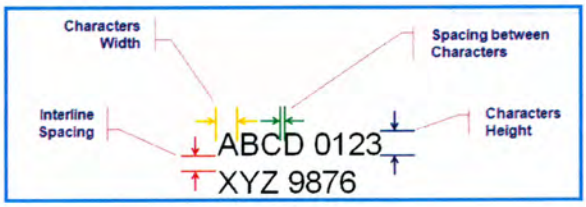
PHARMACEUTICAL PACKAGING

Description

New standards are being progressively adopted for the traceability of pharmaceutical goods. Crucial data as product Identifier, serial ID number, lot code and expiration date are encoded into a Data Matrix 2D code. Such information is also replicated into 3 or 4 human readable text fields.
Track and trace applications require reading the complete set of data, both the barcode and the text fields.



Main Requirement



Font	OCR –B,
Printing Method	Ink Jet Dot Printing
Char Spacing	1 mm
Line Spacing	2 mm
Char Height	4 mm
Char Width	2 mm



Typical constraints

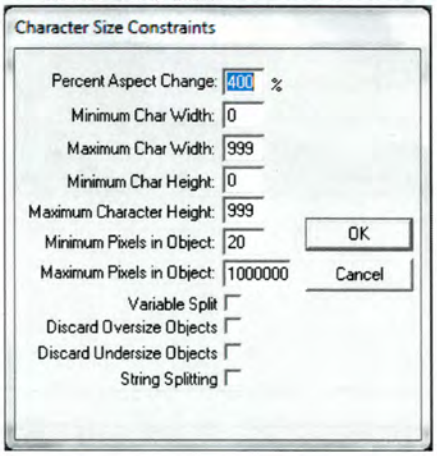
- Low printing quality or degradation in time
- Dot printing
- Small spacing between lines
- Character distortion for high line speed
- Ink reflection just after printing

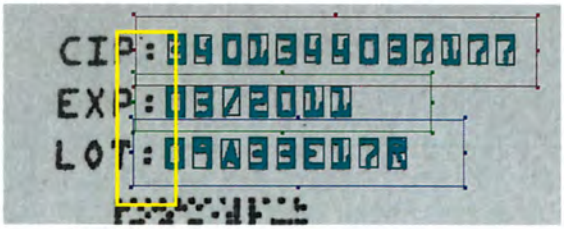
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DLReader parameter Setup

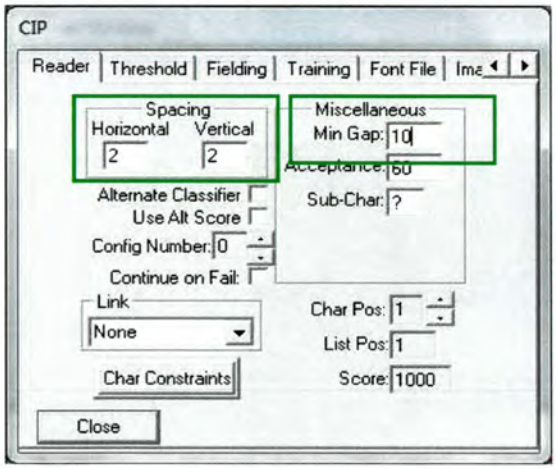
Symbols can be filtered out introducing bounds on the accepted dimensions

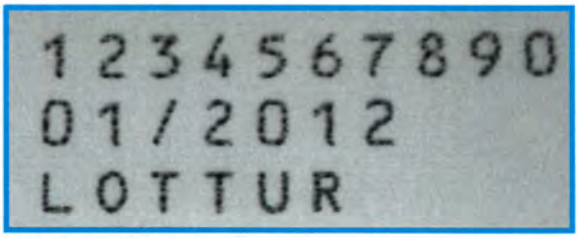






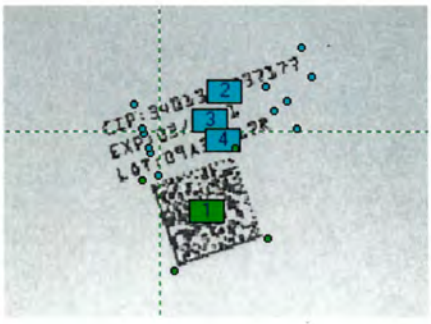






The **Horizontal and Vertical spacing** improves the robustness against printing holes.

The **Min gap between characters** helps to skip the inspection in the inter-character areas and hence improves the speed.



The text location is operated through the 2D code, that is used to retrieve the positional information of the text on the scanned plane.

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DOCUMENT HANDLING

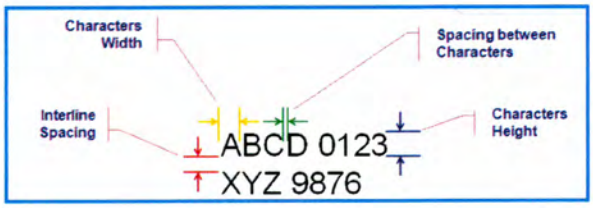
Description

The application requires the reading of the text in order to identify wrong sequence number before folding the sheet into the envelope.

The processing speed is demanding for this type of applications and represents a relevant constraint on the computational time for the identification system.



Main Requirement:



Font	OCR-B True type
Printing Method	Laser Printing
Char Spacing	0.5 mm
Char Height	3 mm
Char Width	3 mm



Typical constraints

- High Speed / High throughput
- Good printing quality
- Verification Text vs Barcode

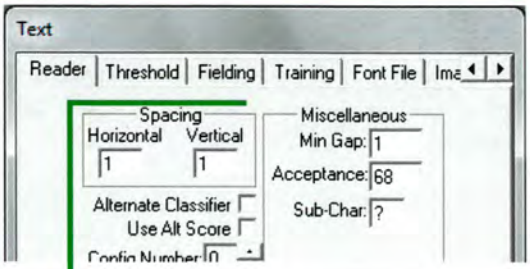
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DLReader parameter Setup

When the quite zone around the text is limited, the characters segmentation must be configured in order to avoid the merging of external patterns into valid characters.



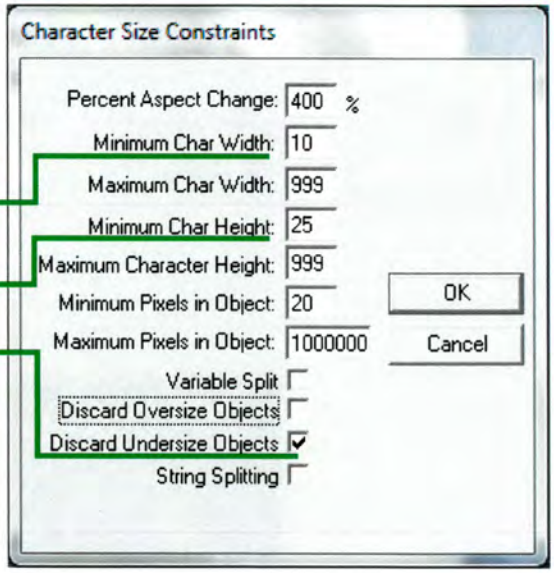




The vertical spacing parameter defines the maximum number of pixels between black patterns to aggregate into a character. it helps to filter out black spots not belonging to the character, along the vertical scan.



The introduced constraints, on the min/max width and height, make the bars not considered as potential characters.
The Discard options must be enabled in order to make effective the rejection of the patterns violating the conditions.





When the image contains only one barcode, 1D or 2D, and a text string, the match can be enabled. The OCR bases the recognition on the code content, so improving the robustness and the speed respect to the normal OCR decoding.



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AUTOMOTIVE - WIP

Description:

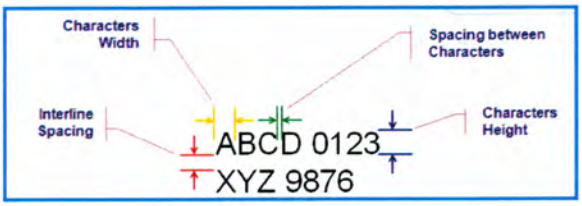
The application requires to read the car identifier reported on a label.

The text is coupled with a DataMatrix code, that can be used to locate the text into the area.

Both barcode and text must be identified.



Main Requirements



Font	True type
Printing Method	Laser Printing
Char Spacing	1 mm
Char Height	4 mm
Char width	3 mm
Text Orientation	Horiz. And Vert.



Typical constraints

- Horizontal and vertical text simultaneously
- Good character definition
- Label printing
- Background Texture

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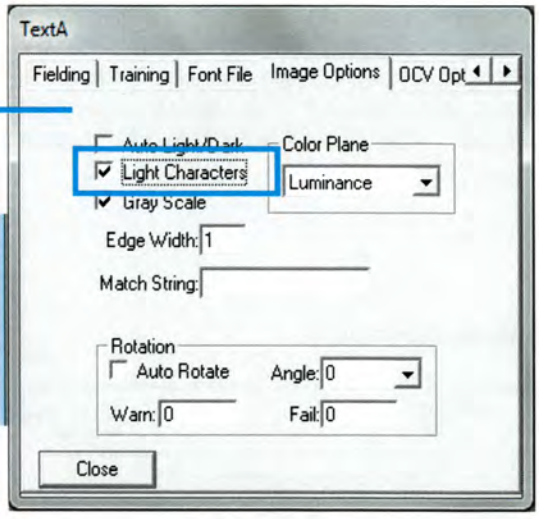
DLReader parameter Setup



The default parameter configuration is unable the manage the case of light text on a dark background.

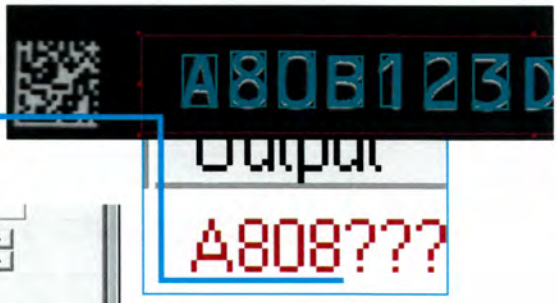
White text on a dark background can be managed through the Light Characters Option.

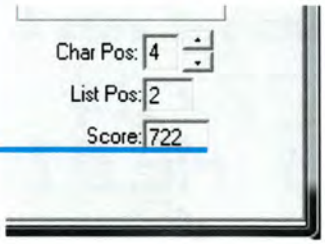




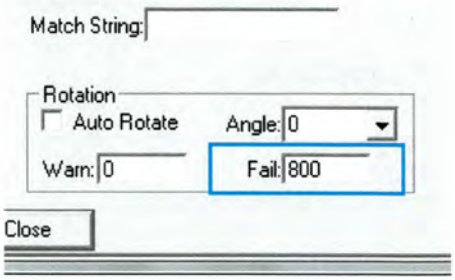
When characters have similar patterns, the risk of substitution increases.

In the reported example the comparison of the character 'B' against the character '8' pattern produces an high correlation score.





The recognition score threshold can be adjusted in order to properly discriminated between different patterns. The threshold value should not be too high since it affects the correct algorithm selectivity and it may result in discarding valid characters when small acceptable variations respect to the reference pattern occur.



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FOOD - Packaging

Description:

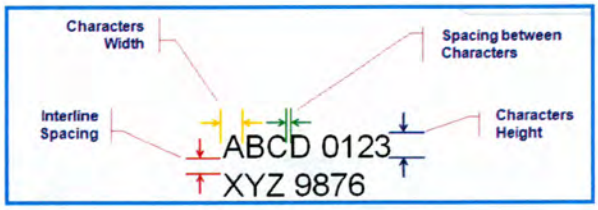
The expiration date must be inspected and verified along the production process.

Though the low line speed, the text font and the marking method (dot printing) require a specific and accurate reading setup.

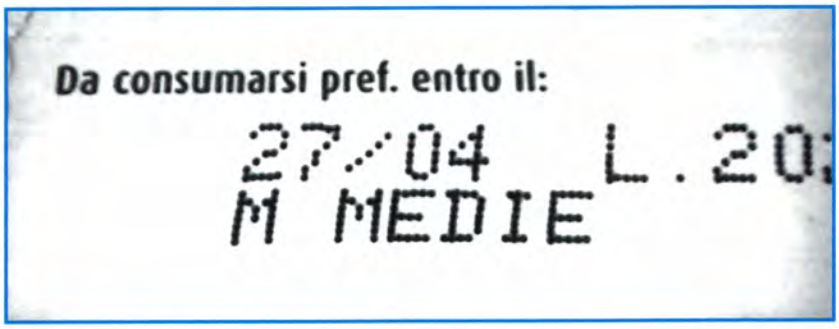
The text field can horizontally shift, in the range of 10 mm around the average triggering position; no barcode is available to be used as text anchor.



Main Requirement:



Font	True type
Printing Method	Ink Jet Dot Printing
Char Spacing	0.5 mm
Line Spacing	0.5 mm
Char Height	3 mm
Char width	2 mm



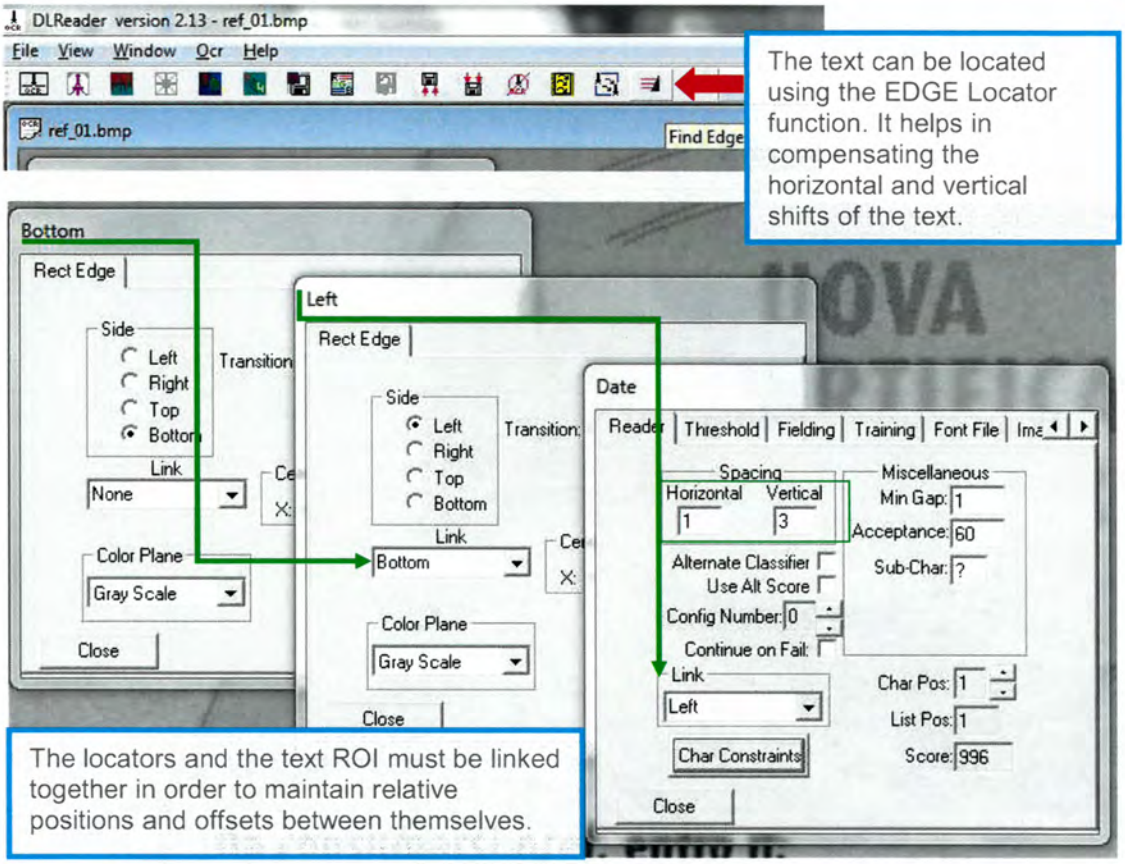
Typical constraints

- Text shifts
- Dot printing
- Printing contrast degradation

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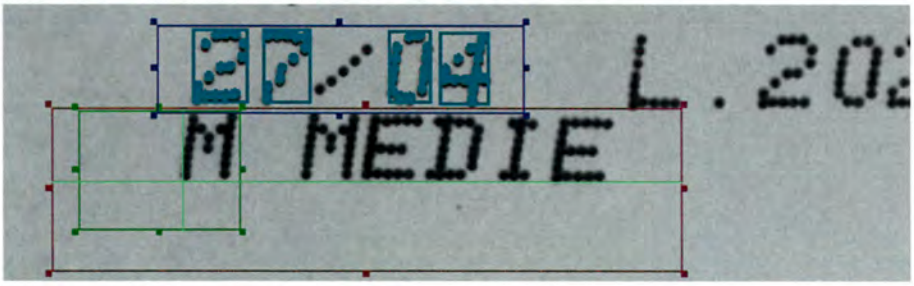
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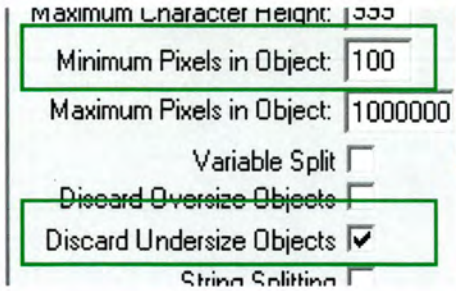
DLReader parameter Setup



The text can be located using the EDGE Locator function. It helps in compensating the horizontal and vertical shifts of the text.

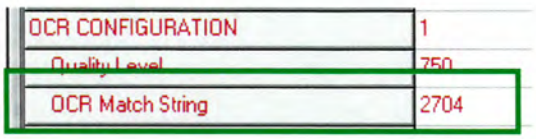
The locators and the text ROI must be linked together in order to maintain relative positions and offsets between themselves.





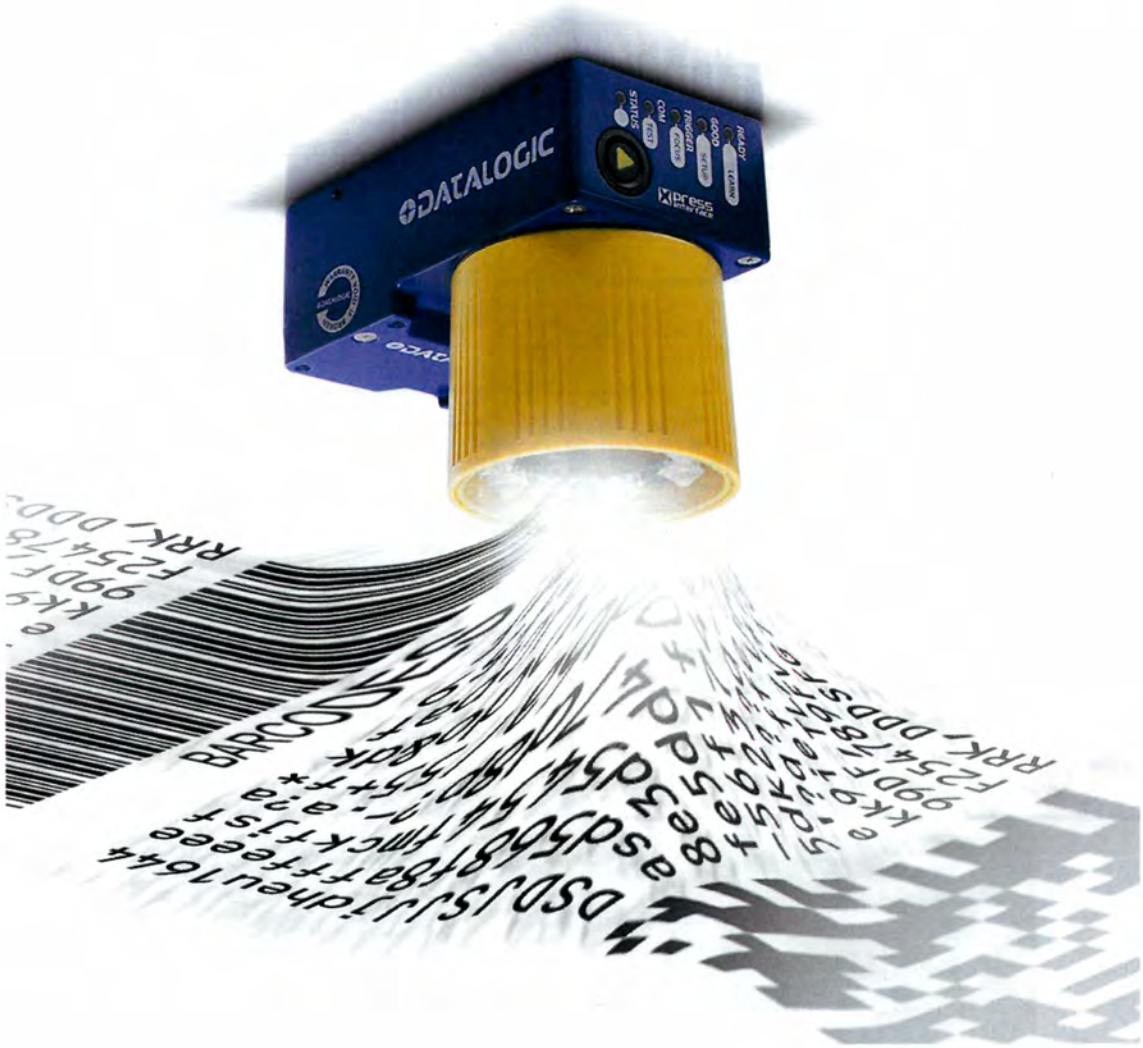
The slash symbol can be filtered out of the recognition using a bound on the minimum number of pixels/character accepted.

The verification on the deciphered text against the expected data content is integrated as a standard functionality.



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DATALOGIC™



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The Wayback Machine - https://web.archive.org/web/20040825011003/http://www.stevenscreek.com:80/palm/takeanorder....

Stevens Creek Software

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Products

Purchase

Download

Support

Take An Order!

Point-of-sale Software for the Palm Computing Platform

Are you selling products at trade shows or expos? Taking orders from customers in their home or office? Submitting bids or issuing quotations in a field situation? Delivering product and need to issue a receipt? For all these situations and more, **Take An Order! is the handheld tool you need.** Combined with any Palm Computing platform handheld device including barcode scanning SPT units from Symbol Technologies and a portable printer like the Canon BJC-55 or Brother MPrint, **Take An Order!** gives you an office that travels with you.

New Features!!!

- **Support (via the separately sold "plug-in" application "MSR") for the Symbol Magnetic Stripe Reader MSR 3000, capable of reading credit card information directly into a Symbol SPT 17xx or SPT 18xx.**
- **PalmOS 5.x compatibility**

Take An Order! starts with your own product catalog, downloaded from your PC, with dozens, hundreds, or even tens of thousands of items. Select items from the catalog by scrolling down the list, or use our **IntelliScroll** (tm) technology to scroll right to the item you want just by tapping on the first letter of the item - no Graffiti (tm) required!



If you're equipped with a Symbol SPT PalmOS handheld with its built-in barcode scanner, it's even easier! Just point the scanner at the product, press the scan button, and the item is added to the order!

Once you've put together your order, quotation, or delivery report, you can refine it. Add a discount for the order from a pop-up list (you can even add positive "discounts" for "cost-plus" pricing), add tax or shipping as appropriate. Mark the order as a cash, check, or credit card sale, or as an quotation, invoice, or purchase order.



For credit card sales, you'll even get a popup form which lets you key in the customer's name, credit card number and expiration date so you don't need to carry a credit card imprinting machine. For sales by check or purchase order, the same form lets you record the relevant number.

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If you're dealing with an existing customer base, just tap on the "Sold To" button and you'll see your entire Palm Address Book. Our unique **IntelliScroll** technology lets you scroll right to the name you're looking for without needing to use Graffiti.Just tap on the customer and their name and address is added to the receipt or quotation you'll be printing out. If that customer has a standard discount, the order will be automatically set to indicate that.



Ready to print? Just point your unit at an appropriate printer and away you go! **Take An Order!** is configured to print receipts (quotations, invoices, delivery reports) on plain paper (either full width or receipt printer paper), as well as on pre-printed forms which already have your company logo, terms and conditions, etc. for a more formal appearance. **Take An Order!** uses our **PalmPrint** software to do its printing, which means it will print via infrared (IrDA) and serial (or parallel) technology, and will print to a wide variety of printers - HP, Lexmark, Epson, Canon, Citizen, or any PostScript printer.

```
                  Stevens Creek Software
                   www.stevenscreek.com
                     1-800-823-4279

Order#:  1000
Date:    10/19/98 1:32 pm
Sold to: John Smith
         General Widget Co.
         300 Main St.
         Cupertino, CA 95014
Payment: Purchase Order #345167


 #                 Description                    Price@ Total$
== ============================================== ====== ======
 5 PalmPrint                                      39.95 199.75
 5 Take An Order!                                 79.95 399.75
 2 SnailMailer                                    19.95  39.90
                                          Tax:          $19.77
                                        TOTAL:         $659.17

                  Thank you for your order!
```

At the end of the day, one tap and the day's sales



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are summarized and displayed and/or printed.



Ready to upload the data to your desktop? One touch of the HotSync button and the order and summary information are transferred to your desktop into tab-delimited or comma-separated text files, ready to be imported into your desktop accounting software. **Windows (95/98/NT) and Macintosh conduit software are both included with your purchase of Take An Order!** You can upload all the orders on your handheld unit to the desktop, or only the orders which are new or modified since the last HotSync. At the same time, you can download new catalog items into your handheld unit.

More Information...

Want to learn more about Take An Order!?

We've tried to keep this page simple, but the complete manual for **Take An Order!** is part of the download when you download the software (see below). Even if you don't have a Palm, there are plenty of screen shots, so you can see everything the software can do, and how easy it is to use.

Want to try Take An Order! yourself?

You can download **Take An Order!** and put it through its paces without a Serial Number (password). There are some limitations (you can only select from the first ten items in your product catalog, and your receipts will have on them a notice that your copy of the software is unlicensed), but you'll be able to fully evaluate what **Take An Order!** can do for you and your business. Download now.

Want to learn more about PalmOS handhelds?

Our software runs on the Palm operating system (PalmOS). PalmOS is developed by **PalmSource**, and is licensed for use on handheld devices made by **palmOne** (including the Treo, Zire, and Tungsten lines), Handspring (now part of palmOne), Sony, Symbol (some models), Kyocera, Samsung, and others. A complete, current list of licensees, with links to their respective websites, can be found here.

Take An Order! is enhanced to take advantage of barcode-scanning capability, which means that if you have a PalmOS handheld equipped with a barcode scanner, the software will operate even more efficiently (although it definitely works without barcode scanning on "normal" PalmOS handhelds). There are a variety of options for barcode scanning using PalmOS handhelds; you can read all about them here.

Who we are...

Stevens Creek Software LLC has been developing and marketing software for Macintosh, Windows, DOS, and PalmOS since 1988. We have been developing PalmOS software since the beginning of the Palm platform in 1997, and are one of the leading developers of software for PalmOS. Learn more...

Ready to order?

Single Licenses

You can license a copy of **Take An Order!** for just $119.95. **And your purchase includes with it a license for PalmPrint, a $39.95 value.**

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Most users download the software from our Web site; for a small charge we can send you the software on a disk via regular mail instead. You can order in a number of ways:

Online:	Order Form
Phone:	North America: 1-800-823-4279 Elsewhere: 1-408-725-0424
Fax:	1-603-698-4777
Mail:	Stevens Creek Software P.O. Box 2126 Cupertino, CA 95015

We accept Visa, MasterCard, and American Express credit cards, and checks made out in U.S. funds. If ordering via fax, e-mail, or mail, be sure to include credit card type, number, and expiration date (if using a credit card), mailing address, e-mail address, and daytime phone number. We do not accept purchase orders for single licenses.

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DECLARATION OF NATHANIEL E FRANK-WHITE

1. I am a Records Request Processor at the Internet Archive. I make this declaration of my own personal knowledge.

2. The Internet Archive is a website that provides access to a digital library of Internet sites and other cultural artifacts in digital form. Like a paper library, we provide free access to researchers, historians, scholars, and the general public. The Internet Archive has partnered with and receives support from various institutions, including the Library of Congress.

3. The Internet Archive has created a service known as the Wayback Machine. The Wayback Machine makes it possible to browse more than 450 billion pages stored in the Internet Archive's web archive. Visitors to the Wayback Machine can search archives by URL (i.e., a website address). If archived records for a URL are available, the visitor will be presented with a display of available dates. The visitor may select one of those dates, and begin browsing an archived version of the Web. Links on archived files in the Wayback Machine point to other archived files (whether HTML pages or other file types), if any are found for the URL indicated by a given link. For instance, the Wayback Machine is designed such that when a visitor clicks on a hyperlink on an archived page that points to another URL, the visitor will be served the archived file found for the hyperlink's URL with the closest available date to the initial file containing the hyperlink.

4. The archived data made viewable and browseable by the Wayback Machine is obtained by use of web archiving software that automatically stores copies of files available via the Internet, each file preserved as it existed at a particular point in time.

5. The Internet Archive assigns a URL on its site to the archived files in the format http://web.archive.org/web/[Year in yyyy][Month in mm][Day in dd][Time code in hh:mm:ss]/[Archived URL] aka an "extended URL". Thus, the extended URL http://web.archive.org/web/19970126045828/http://www.archive.org/ would be the URL for the record of the Internet Archive home page HTML file (http://www.archive.org/) archived on January 26, 1997 at 4:58 a.m. and 28 seconds (1997/01/26 at 04:58:28). The date indicated by an extended URL applies to a preserved instance of a file for a given URL, but not necessarily to any other files linked therein. Thus, in the case of a page constituted by a primary HTML file and other separate files (e.g., files with images, audio, multimedia, design elements, or other embedded content) linked within that primary HTML file, the primary HTML file and the other files will each have their own respective extended URLs and may not have been archived on the same dates.

6. Attached hereto as Exhibit A are true and accurate copies of browser screenshots of the Internet Archive's records of the archived files for the URLs and the dates specified in the attached coversheet of each printout.

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Ex. 1010-1



7. Attached hereto as Exhibit B are true and accurate copies of the Internet Archive's records of the archived files for the URLs and the dates specified in the following table.

Folder	URL
001	https://web.archive.org/web/20040327010849/http://www.palmone.com:80/us/support/handbooks/treo/treo600gsm_UG.pdf
002	https://web.archive.org/web/20040612215717/http://www.palmone.com:80/us/support/handbooks/treo/treo600gsm_UG.pdf

8. I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

DATE: July 16, 2024

Nathaniel E Frank-White

Nathaniel E Frank-White

EXHIBIT A

https://web.archive.org/web/20040609082330/https://www.stevenscreek.com/palm/scanners.html

INTERNET ARCHIVE Wayback Machine https://www.stevenscreek.com/palm/scanners.html Go APR JUN JUL
137 captures 16 Aug 2001 - 25 Feb 202 09 2002 2004 2005 About this capture

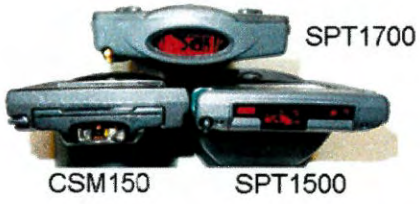
Barcode Scanning Options for PalmOS Handhelds



We get many calls from users with Palm handheld devices wanting to "do barcode scanning with their Palm." Here is the situation:

- **"Normal" Palm handhelds do not do barcode scanning.** Many people think that because a Palm has infrared (IR) it can do barcode scanning, but this isn't the case - the two are very different. Realize, just for example, as you should from your trips to the supermarket, that barcode scanning involves a visible (red) beam of light, whereas IR beaming of information from your Palm (e.g., to another Palm or to a printer with our PalmPrint software) is totally invisible to the naked eye.
- **There are four options for laser barcode scanning using PalmOS handheld devices** (handheld computers which run the Palm operating system and hence all standard Palm software, but which are not manufactured by Palm, Inc., but instead by licensees of the PalmOS). All of our barcode-enabled software (On Hand for simple inventory and asset tracking applications, CatScan for more complex data collection and data lookup needs, and Take An Order! for mobile POS applications) supports all of these options. Three of these options are products of Symbol Technologies, the leading company in barcode scanning technology. The fourth is a product of PSC.





1. The **SPT1500/SPT1550** from Symbol Technologies (pictured below in front and end views) is the original option for PalmOS barcode scanning. As is evident from the picture, this is essentially a Palm III which is extended by about 3/4"; in that extra space is a built-in barcode scanner. Note the dedicated scan buttons (the large green buttons on both sides). This unit sells for around $500 (depending on configuration). The serial connector on this unit is a standard Palm III connector, which means it can share various options (including, for example, the serial to parallel converter cable we sell with our printing software, and a modem sold by Palm).
2. The **SPT1700 and SPT1800** series from Symbol Technologies (also pictured below) is a "higher-end" option, which sells for $1000 up. Unlike standard Palms, this is a ruggedized unit designed to pass "drop tests". It is quite a bit bigger than a regular Palm, and definitely won't fit in your shirt pocket, but does come with a handstrap on the back for convenience in holding it. Aside from its ruggedized nature, the 1700/1800 are distinguished from the 1500 because it comes with a variety of options - 2D barcode scanning (our software does NOT support this at this time), an attachable credit card swiper (also not supported by our software at this time), WLAN (802.11b) and WWAN (CDPD and GSM) options. The connector on the 1700/1800 is unique to that unit, so options available for the Palm III (such as a modem) are not compatible with the 1700/1800.
3. The **CSM150** from Symbol Technologies is a plug-in scanner (a "Springboard" module) for the Handspring Visor, pictured below. It is a much lower cost option (the scanner itself sells for around $150) and, especially for users with only occasional barcode scanning needs, may well be the perfect choice. Its major drawback is that, unlike the SPT1500 and SPT1700, it does not have a physical "scan button." Our software recognizes the presence of the CSM150, and uses the MemoPad button (the one on the extreme right end below the screen) to trigger the scanner (as well as an on-screen button you can tap).
4. The **Momentum** from PSC is also a plug-in scanner for the Handspring Visor, and is virtually identical in appearance to the CSM150. The original Momentum was significantly inferior to the CSM150 in terms of scanning quality, and we do not recommend it. There is now a new version (the Momentum II) which is reputed to have improved performance, but we have not yet tested this version. The Momentum sells for considerably more than the CSM150.

- **There is another scanner you can plug into any Palm which has an SDIO slot, the SDIO Barcode Scanner** from Socket Communications.



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Socket SDIO Scanner
Left, inserted in a Tungsten|T3; Right, separately (image enlarged)

This plug-in scanner can be plugged into any Palm device with an SDIO slot, which includes the following Palm devices as of this writing: (see here for an updated list) Zire 31, Zire 71, Zire 72, Tungsten C, Tungsten E, Tungsten T, Tungsten T2, Tungsten T3, Tungsten W, Treo 600, m125, m130, m500, m505, m515, and i705 (device must be running PalmOS 4.1 or higher). The advantages of the SDIO scanner are just that - it can be used on the most recent, most powerful, fastest Palm devices like the Tungsten|T3, and can be transferred from one Palm to another as you update your Palm to the latest model as the months and years go by. It can be used on a Palm device which also includes other desirable features, for example, you can use it to collect inventory on a Tungsten|C and then perform a wireless (WiFi) HotSync to send the collected data back to a central computer. Or you could use it on a Treo 600 to take orders via barcode scanning, and then have them remotely transmitted back to the office using the WAN connectivity of the Treo. PalmOS 5.x devices like the Tungstens are also better suited than the older, slower Symbol models to deal with large databases containing tens of thousands of items. However, there is also a major disadvantage - the Socket SDIO scanner is a "camera" scanner, not a laser scanner. Whereas the laser scanner above can go "zap zap zap" and scan a series of barcodes in quick succession, the SDIO scanner can take a second or two to successfully scan. Furthermore, it doesn't have the resolution of the laser scanners, so while you can scan most typical UPC barcodes, when it comes to the tiny lines found, for example, in the barcodes which are used for serial numbers, the SDIO scanner will often simply not scan them. So the bottom line is that you really need to evaluate the SDIO scanner to see if it meets your needs. If it does, it's an excellent choice. We have used it at trade shows recently with completely satisfactory results. It is doesn't, then the more expensive dedicated laser scanners from Symbol are the recommended choice.

As of this writing, virtually all of our products have been enhanced to support the Socket Communications scanner - **Take An Order!**, **On Hand**, **CatScan**, and **Handy Label**. Only our scanner configuration software ScanConfig is not compatible with the Socket device.

- **There is another scanner you can attach to a variety Palm**, the "Grabba". Due to its price, however, it is not particularly competitive with the options described above, and, for the moment at least, it is not supported by any software of ours (or any that we know of, for that matter). If we receive sufficient demand, we will consider supporting the Grabba, but in the meantime, we recommend the options above.

- We (**Stevens Creek Software**) do not sell hardware; we recommend you purchase these products from one of the many VARs around the world who sell products from Symbol Technologies or PSC. For more information about our software products which are compatible with these hardware products, visit the appropriate web pages:
  - **On Hand** - Inventory and Asset Tracking
  - **CatScan** - Data Collection and Data Lookup
  - **Take An Order!** - mobile POS
  - **ScanConfig** - Allows complete user-configurability of Symbol scanners
  - **Handy Label** - Barcode label printing (requires special barcode label printers, does not require but can take advantage of barcode scanning capability)

Handheld Solutions to Real-World Problems.™

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UNITED STATES PATENT AND TRADEMARK OFFICE

_____

BEFORE THE PATENT TRIAL AND APPEAL BOARD

_____

EARLY WARNING SERVICES, LLC
Petitioner

v.

INTELLECTUAL VENTURES II LLC
Patent Owner

_____

IPR2024-01221

U.S. Patent No. 7,314,167

_____

DECLARATION OF THOMAS PURVES

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I, Thomas Purves, declare as follows:

I. BACKGROUND AND QUALIFICATIONS

1. I am over eighteen years of age, and I am competent to testify as to the matters set forth herein if I am called upon to do so.

2. I have prepared this Declaration for consideration by the Patent Trial and Appeal Board in an Inter Partes Review of U.S. Patent No. 7,314,167 ("the '167 patent") (Ex. 1001).

3. I have written this Declaration at the request of Kilpatrick Townsend & Stockton, LLP, which represents Early Warning Services, LLC ("Petitioner") in connection with the above-captioned Inter Partes Review. My compensation is hourly and unaffected by the substance or outcome of my opinions.

4. In forming my opinions, in addition to my knowledge and experience, I have considered the Petition filed by Petitioner and the Exhibits listed in Appendix B. I agree with all factual assertions contained in the Petition.

5. All statements in my Declaration, unless indicated otherwise, are based on my knowledge and experience in the field.

6. I have over 25 years of experience in the fields of payment transaction systems and secure digital banking. I have developed a robust expertise in designing and implementing secure electronic transaction solutions. Currently, I serve as an independent fintech consultant and expert advisor at Lahave

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Technologies Inc., where I leverage my extensive background to advise innovative financial services companies in technical product design and commercialization strategy.

7. I received a BSc in Computer & Electrical Engineering in 1998 from Queen's University, Kingston, Ontario, Canada. My degree studies included microprocessor design, computer architecture, computer programming, computer vision, and image processing, which provided a solid technical foundation for my subsequent work in secure electronic transactions and digital banking.

8. From May 1997 to October 2000, I was employed by TD Bank Product Designer, Online Services. At TD Bank, I led the product and user experience design for "TD WebBanking," at the time recognized as Canada's most award-winning online banking service by third parties such as Gomez and Quicken.ca. I was responsible for designing secure online banking services, including loan and account applications over encrypted channels, secure authentication, and everyday banking transactions. Additionally, I researched and prototyped solutions for delivering WAP-based mobile banking services to early cell phones and PDAs.

9. From December 2000 to November 2002, I was employed as a CertaPay Product Manager. At CertaPay, a fintech SaaS startup, I led product development, launch, and growth of "EmailMoney Transfers"—the world's first real-time inter-bank person-to-person payment platform. This service, built as a SaaS solution,

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was ultimately adopted by all Canadian financial institutions and processes over $40 billion in annual payment volume today. While at CertaPay, I also was responsible for designing the user experiences and technical specifications for an online commerce payment scheme Interac Online.

10. In the 2002-2003 time frame, I made critical technical and design contributions to the creation of multiple secure domestic payment schemes still ubiquitously used in Canada: Interac E-Transfers, and Interac Online Debit. In 2003, as a consultant to Visa Inc., I contributed a whitepaper on the technical design for the 3D Secure technical standard for secure electronic transactions. This contribution helped shape the development of secure payment protocols that are still in use today.

11. From February 2003 to February 2006, I was employed as a Group Manager, New Product Development, for CIBC Bank in Toronto, Canada. In this role, I led product innovation initiatives, researching, evaluating, and developing new payment products for CIBC Bank. I led the CIBC program that implemented the new ecommerce payment scheme Interac Online, a system that required sophisticated methods for users to remotely, and securely, authenticate themselves to their financial institution and authorize access to deposit account, while shopping at an ecommerce merchant. This project also depended on encryption technologies and digital signatures for secure communication and relied on pre-

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determined information such as pre-established online-banking passwords for authentication. While at CIBC, I was instrumental in the development of digital e-money products such as transit payment smart cards, and secure portable payment devices such as nearfield-wireless fob devices.

12. From June 2007 to Sept. 2011, I served as Business Leader, Product Innovation, for Visa Canada Inc. As Visa Canada's Innovation and New Products Specialist, I adapted and launched multiple new products in the market including world-first NFC mobile payments pilots. These projects involved the development and testing of encrypted payment credentials stored within mobile phones. This work also involved the development and testing of new payment standards and messaging protocols for communicating transaction data between mobile devices and point of sale terminals.

13. From October 2011 to April 2021, I was employed in various positions as Vice President, Global Digital Products in San Francisco, California. My two main roles between 2011 and 2021 were Visa Checkout, and Global Product Architecture. At Visa Inc., I led the product and engineering teams responsible for building the Visa Checkout digital wallet and checkout button. Visa Checkout has been used by over 45 million global users and the digital checkout button was integrated into hundreds of thousands of web and smartphone mobile applications. I was able to lead this role thanks to my established deep technical expertise in

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secure electronic transaction systems, mobile devices and related technologies. During my tenure at Visa Inc., I was a prolific inventor and solution innovator, with over 80 global patent grants in fields of mobile payments, QR code payments, digital wallets and transaction processing. These patents underscore my contributions to the advancement of secure payment systems, as well as the constituent security, encryption and authentication sub-components that are essential to the functional those systems.

14. As the head of the Buyer Digital Enablement Team at Visa Inc., I created and commercialized products that facilitated the secure encryption and storage of credit card payment credentials in mobile digital wallets such as Apple ApplePay, Google AndroidPay and Samsung's SamsungPay.

15. With 25+ years in payment transaction systems and secure digital banking, I have consistently been at the forefront of technological advancements in secure electronic transactions. At TD Bank, I developed systems and user experiences for secure online banking, including loan and account applications over encrypted channels and secure authentication for everyday banking transactions. I also researched and prototyped solutions for delivering WAP-based mobile banking services to early cell phones and PDAs.

16. During my time at CertaPay, I designed secure methods for person-to-person money transfers using advanced cryptography, protected by pass-codes and

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passwords, which also relied on commonly available message protocols of email and SMS for communicating transaction data from sender to recipient.

17. With a career spanning over two decades, I have demonstrated a consistent ability to innovate and lead in the field of secure electronic transactions. My extensive experience, coupled with a strong technical background and numerous contributions to industry standards, positions me as a leading expert in this domain.

18. My *Curriculum Vitae* is appended hereto as Appendix C.

II. LEVEL OF SKILL IN THE ART

19. I understand that a person of ordinary skill in the art ("POSA") is a hypothetical person presumed to be aware of all pertinent art, to think along with the conventional wisdom in the art, and to have ordinary creativity. It is my opinion that, for the '167 patent, a POSA is a person with a relatively high level of skill, such as having at least a bachelor's degree in the field of computer science and/or electrical engineering, together with 2-3 years in the financial technology sector. The POSA would have knowledge of the commercial and scientific literature pertaining to securing transactions, before the priority date. A POSA would also have knowledge of processing devices.

20. As of the earliest priority date of the '167 patent, I met and, in fact, exceeded the standard for a POSA. I am an expert in the relevant field.

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III. LEGAL STANDARDS

A. Anticipation

21. I am not an attorney and have no formal legal training. But I have been advised by the Kilpatrick attorneys that a claim is anticipated if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.

22. I understand that a prior art reference that fails to expressly set forth a particular element of a claim still anticipates the claim if that element is "inherent" in the disclosure. I understand that this principle applies even if the inherent feature would not have been recognized by a POSA. Thus, a limitation claiming the "natural result" flowing from the prior art's limitations is considered disclosed in the prior art.

B. Obviousness

23. I further understand that a claim is obvious in light of the prior art if the difference or differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious, at the time the invention was made, to a person having ordinary skill in the art.

24. I understand that several factual inquiries underlie a determination of obviousness. These inquiries include (1) scope and content of the prior art, (2) the

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level of ordinary skill in the field of the invention, (3) the differences between the claimed invention and the prior art, and (4) any objective evidence of non-obviousness. Such objective evidence of non-obviousness include the invention's commercial success, commercial acquiescence (i.e., licensing), a long felt but unresolved need, the failure of others, skepticism by experts, praise by others, teaching away by others, recognition of a problem, laudatory statements by the infringer, and copying of the invention by others.

25. I have been advised that it is against this backdrop that the obviousness or non-obviousness of the subject matter is determined. The party challenging the patent must also show that one of ordinary skill in the art would have a reason to combine the elements as recited in the claims. A claim is unpatentable if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Furthermore, I understand that there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.

26. I understand that the obviousness analysis does not require express teachings but may be based on the common sense, inferences, and creative steps expected of a person of ordinary skill in the art. I understand that this expansive and flexible approach, not only permits, but requires, consideration of common

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knowledge and common sense. Additionally, I understand that when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. I understand that the inquiry is whether the improvement is more than the predictable use of prior art elements according to their established function.

27. I understand the test for obviousness is an expansive and flexible approach using common sense. I also understand that any need or problem known in the field of endeavor at the time of invention can provide a reason for combining the elements in the manner claimed. I further understand that certain factors may show obviousness:

a. a combination of known elements with no change in their respective functions is likely to be obvious when the combination does no more than yield predictable results,
b. a predictable variation of a work in the same or a different field of endeavor is likely to be obvious if a person of ordinary skill would be able to implement the variation without undue experimentation,
c. an invention is likely obvious if it is the use of a known technique to improve a similar device in the same way, unless the actual

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application of the technique would have been beyond the skill of the person of ordinary skill in the art,

d. an invention is likely obvious if there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims,
e. inventions that were "obvious to try" — chosen from a finite number of identified, predictable solutions, with a reasonable expectation of success — are likely obvious, and
f. an explicit teaching, suggestion, or motivation in the art to combine references, while not a requirement for a finding of obviousness, remains "a helpful insight" in determining upon which a finding of obviousness may be based.

28. Finally, I understand that in determining whether a claim is obvious, obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.

C. Printed Publication Prior Art

29. I understand that prior art may come in different forms, one of which is a printed publication. I have been told that public accessibility is the "touchstone" of whether a reference constitutes a printed publication. I understand that determining whether a reference is publicly accessible and thus qualifies as a printed publication requires a case-by-case inquiry into the facts surrounding the

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reference's disclosure to members of the public. I understand that this factual inquiry broadly considers whether the reference was disseminated or otherwise made available such that the POSA, exercising reasonable diligence, would have been able to find the reference. I understand that an important factor in determining whether a document is a printed publication is the perceived purpose of the document.

30. I also understand that establishing a specific date of public accessibility of a printed publication, although helpful, is not necessary for a document to qualify as a printed publication. For example, evidence of routine business practices regarding accessibility is sufficient to establish an approximate date when a reference became accessible. This is especially persuasive, I understand, where the approximate accessibility date is well in advance of the effective filing date.

D. IPR Standard

31. I have been advised that an IPR petition must demonstrate "a reasonable likelihood that the petitioner would prevail with respect to at least one of the claims challenged in the petition." It is my opinion that the Petition exceeds that threshold.

IV. THE '167 PATENT

32. The '167 patent is directed to an apparatus for providing a secure transaction. Ex. 1001, abstract. The apparatus includes an image capture device

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configured to capture an image, the image having information embedded therein. *Id.* The apparatus also comprises a memory configured to store predetermined information, an input unit configured to receive input information provided by a user, a processor, and an output unit. *Id.* The processor is configured to verify the user based on the input information to ensure that the user is authorized to use the apparatus, and generate an output based on the information embedded in the image and the predetermined information. *Id.* The output unit is configured to forward the output generated by the processor. *Id.* Each component of this apparatus, as well as the combination and use of these components, was known in the art prior to the priority date of the '167 patent.

33. Challenged claim 1 is illustrative of the apparatus claimed in the patent and is comprised exclusively of conventional components:

> 1. An apparatus for providing a secure transaction, the apparatus comprising:
>
> an image capture device configured to capture an image, the image having information embedded therein including information relating to a transaction;
>
> a memory configured to store predetermined information;
>
> an input unit configured to receive input information provided by a user; a processor configured to:
>
> verify the user based on the input information to ensure that the user is authorized to use the apparatus; and

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generate an output based on the information embedded in the image and the predetermined information; and

an output unit configured to forward the output generated by the processor,

wherein the output includes a digital signature to be used to signify authorization by the user with respect to the transaction.

34. U.S. Patent No. 7,314,167 ("the '167 patent") is entitled "Methods and Apparatus for Providing Secure Identification, Verification and Authorization." Ex. 1001. The '167 patent issued on January 1, 2008 from Application No. 11/075,493, which was filed on March 8, 2005. *Id.* The '167 patent is thus subject to pre-AIA § 102 and § 103 and is eligible for IPR.[1]

35. It is my understanding that Petitioner requests cancellation of Claims 1, 2, 4, 5, 7, 8, 12, 13, 17, 19-21, 23, 26, 27, 29, 30, 34, 39-41, and 43 ("Challenged Claims") of the '167 patent.

36. The Challenged Claims are directed to an apparatus and a method for providing a secure transaction. Each apparatus claim recites well-known features,

[1] I understand that the "critical date" for prior art for purposes of this IPR is one year prior to the date for which the claim is entitled to priority. I also understand that any publicly available document that existed before the priority date can constitute prior art.

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such as: 1) a device configured to capture an image, the image having information embedded therein (e.g., a bar code), 2) a memory, 3) an input unit, 4) a processor, and 5) an output unit. Ex. 1001 at 16:22-38. Each method claim similarly recites: 1) capturing an image having information embedded therein, 2) storing information, 3) receiving an input, 4) verifying the input, and 5) generating an output. The ’167 patent describes common components and methods well known in the art, and the prior art anticipates or renders obvious each of the Challenged Claims.

V. TECHNICAL BACKGROUND

A. Wang et al. (Ex. 1004)

37. U.S. Patent Publication No. 2002/0023215 to Wang et al. (“Wang”) was published on February 21, 2002, more than a year before the priority date of the ’167 patent and is thus prior art. Wang is directed to systems and methods of conducting secure transactions and is therefore in the same field of endeavor as the ’167 patent.

38. Wang discloses a portable apparatus (a “PEAD”) that is usable to perform secure transactions. Ex. 1004 at [0002]. The PEAD includes a barcode scanner or optical character recognition (OCR) reader, two types of image capture devices, that read information from a barcode or UPC code to select an item for a transaction. *Id*. at [0115]. The PEAD also includes a memory that stores various

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data (e.g., predetermined information), such as user identification data and a user's private key. *Id.* at [0044], [0115]. The apparatus generates transaction approval data and digitally signed receipts (e.g., outputs) based on the information from the barcode and the stored predetermined information. Ex. 1004 at [0051], [0055], [0085], [0115]. Wang also describes that accessing the user's predetermined private key to sign the output also depends on the apparatus verifying the user based on user inputs (e.g. passcode). The apparatus then forwards the transaction approval data and digitally signed receipts. Ex. 1004 at [0055], [0115].

B. Take an Order (Ex. 1005)

39. Take an Order ("TAO") is a prior art printed publication. TAO is directed to systems and methods of conducting financial transactions and is therefore in the same field of endeavor as the '167 patent.

40. TAO is a prior art printed publication in the form of a product advertisement which was generally available and known to the relevant technical community more than six months before the earliest possible priority date of the '167 patent. Ex. 1034 at 1-7.

41. Ex. 1034 is an Internet Archive declaration relating to an Aug. 25, 2004 capture of the TAO website. Ex. 1005 contains the same TAO capture and is a

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true and accurate copy of the TAO web page as captured by the Internet Archive as of that date. Ex. 1034 at 1-7.

42. A reference is publicly available (and therefore, constitutes a prior art publication) if it is disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art exercising reasonable diligence can locate it. A POSA would have easily been able to access TAO using reasonable diligence to locate it.

43. Stevens Creek software was a well-known vendor of Palm software. A POSA of mobile device software of the era would recognize them as a leading developer of Palm software given their association with Palm's developer program and awards at Palm-sponsored developer conferences. *See* Ex. 1013 (https://web.archive.org/web/20050402014734/http://stevenscreek.com/palm/custom.html ("1998 - Stevens Creek Software wins programming contest at Palm Developer's Conference," "1999 – Stevens Creek Software wins programming contest at Palm Developer's Conference!," "2001 - Stevens Creek Software's President, Steven Patt, becomes one of the first 'Palm-Powered Certified Developers,'")). *See also* Ex. 1028 at 2 (indicating "Stevens Creek Software is one of the premier software developers for the Palm Computing platform" and directing users to their website); Ex. 1029 at 1-2 (touting the TAO app, stating "Stevens Creek Software…is one of the leading developers of software for Palm,"

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and directing those interested in such software to www.stevenscreek.com). As evidenced by the foregoing, a POSA would have known that Stevens Creek Software was a leading provider of software solutions for the Palm Computing Platform, and a POSA searching for Palm software solutions would have known to access the Stevens Creek website to learn about their software products.

44. Also, since the website was indexed and searchable, a POSA conducting a simple internet search using terms such as "Palm Treo," "taking orders," and "point of sale software" would be expected to return the Take and Order! website at the top of their internet search results. In fact, the Stevens Creek Software homepage was one of the top three search results when I conducted this search strategy. Once at the website, a POSA would be easily able to access TAO from the Stevens Creek Software home page with only one mouse click: Home Page→Take An Order! Ex. 1034 at 8-10 (Home Page) → Ex. 1034 at 4-7 (Take An Order!).

45. Additionally, TAO is a website advertisement that, by its very nature, is a public-facing document, further supporting that it is a printed publication. The totality of the evidence supports that TAO was publicly accessible to those skilled in the art and constitutes a printed publication at least as of August 2004.

46. TAO discloses software that is executable on a Palm Treo device. Ex. 1005, 1-3. The software enables the Palm Treo device to scan a barcode of an item to

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add an item to an order (e.g., an output). *Id*. For existing customers having a standard discount (e.g., predetermined information), the order is automatically updated to reflect the discount. *Id*. at 1-2. Thus, the orders are generated based on both (i) barcode image information and (ii) predetermined discount information. TAO discloses that the order is forwarded to the user's desktop computer. *Id*. at 3.

C. Palm Treo Manual (Ex. 1006)

47. Palm Treo Manual ("PTM") is a user manual for the Palm Treo 600 device and was published as early as June 2004, i.e., before the priority date of the '167 patent. The PTM bears all of the hallmarks of a printed publication, including the indicia: "Copyright (c) 2004 palmOne, Inc. All rights reserved." Ex. 1006 at 2. As a publicly traded company with sales in the millions of devices (Ex. 1011), Palm would have been considered a reputable publisher for its product literature.

48. PTM is a prior art printed publication that was generally available, known, and accessible to the relevant technical community before the earliest possible priority date of the '167 patent. Ex. 1010 (confirming that PTM was available on the Palm webpage as indexed by the Internet Archive on June 12, 2004).

49. A POSA would have known that Palm was a leading provider of mobile devices such as the Palm Treo 600. In 2005, a person of ordinary skill in the art would recognize Palm Inc. as a leading vendor of mobile devices due to their significant market share. Through its history, Palm developed multiple popular

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product lines, such as the PalmPilot (1996) and Treo 650 (2005) series, which were widely reviewed and acknowledged for having strong smartphone capabilities. Palm's devices were frequently reviewed and recommended in industry publications for their reliability and user-friendly interfaces. In 2005, New York Times columnist David Pogue wrote about the Palm Treo 650. In that column he described in 1996 how "Palm Computing developed the smash-hit Pilot organizer." Pogue, "The Awkward Smart Phone Grows Up," *New York Times* (June 30, 2005). Ex. 1025 at 1. In that article, he praised specific features of the model as "At 320 by 320 pixels, the bright, gorgeous color screen offers higher resolution than most rivals, meaning supersharp (if tiny) text and graphics. It's also a touch screen -- a skinny stylus tucks into the back of the phone -- which is handy if you install any of the thousands of Palm-compatible programs available online." *Id*. at 3.

50. In view of the notoriety of the Palm system, a POSA would have known that Palm was a leading provider of mobile devices such as the Palm Treo 600 and would have been able to easily access the PTM at least by conducting an internet search or accessing the Palm website. For example, since the Palm website was indexed and searchable, a POSA conducting a simple internet search using terms such as "Palm Treo 600" and "user manual" would be expected to return the PTM at the top of their search results. In fact, when I conducted such a search, the PTM

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was the top search result. Moreover, a POSA would expect that they could access user manuals such as PTM on the Palm website as was the common practice in the industry. Specifically, a POSA would be easily able to access the PTM from the PalmOne home page (http://www.palmone.com/us) with only 4 mouse clicks: Home Page→Support→choose your model→Treo 600 (GSM)→User Guide. Ex. 1010 at 15→13→17→17→119-199.

51. Additionally, the PTM is a user manual that, by its very nature, is a public-facing document distributed with the smartphone packaging itself, further supporting that it is a printed publication. Ex. 1010 at 8 ("Inside the Treo 600 box is a…fairly thick user manual…."). The totality of the evidence supports that the PTM was publicly accessible to those skilled in the art and constitutes a printed publication at least as of June 2004.

52. PTM discloses that Palm Treo devices included internal memory and a processor. Ex. 1006 at 97, 109, 112, 173. PTM also discloses that the Palm Treo devices had keyboards and system locks that required a password to be entered on the device prior to accessing data stored on the device. Ex. 1006 at 24, 129.

D. Drummond (Ex. 1008)

53. U.S. Patent Publication No. 2003/0217005 to Drummond et al. ("Drummond") was published on November 20, 2003, more than a year before the priority date of the '167 patent. Drummond is directed to systems and methods of

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conducting secure transactions and is therefore in the same field of endeavor as the ’167 patent.

54. Drummond discloses that in addition or alternatively to receiving paper receipts, electronic receipts may be sent to one or more devices. Ex. 1008 at [0246], [0247]. The electronic receipts are sent via e-mail and/or text message (e.g., SMS), which enables the customer to: (1) choose to receive the receipt at a computer, such as their home or work computer, mobile phone, pager, PDA, other hand-held or portable computing device, or another device capable of receiving a message, (2) determine the level of information in the receipt, and (3) send additional receipt copies to additional selected systems and system addresses (e.g., a receipt may be sent to an associate or a party to a business transaction as an indication that a deposit or payment on a loan was made). Ex. 1008 at [0247]-[0251], [0301], [0307].

E. Raines (Ex. 1009)

55. U.S. Patent Publication No. 2004/0193538 to Raines (“Raines”) was published on September 30, 2004, before the priority date of the ’167 patent. Raines is directed to systems and methods of conducting secure transactions and is therefore in the same field of endeavor as the ’167 patent. Raines discloses that transaction data in a credit card transaction includes an account number and credit card expiration data. Ex. 1009 at [0008].

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F. Denso (Ex. 1026)

56. Japanese Patent Publication No. JP 2002-109420 to Denso Co. Ltd. ("Denso") was published on April 12, 2002, more than a year before the priority date of the '167 patent and is thus prior art under pre-AIA 35 U.S.C. § 102(b). Denso is directed to systems and methods of data communication, and in particular, data communication using two-dimensional matrix codes, and is therefore in the same field of endeavor as the '167 patent. Ex. 1026 at [0019].

VI. CLAIM CONSTRUCTION

57. I understand that claims are construed in IPRs under the so-called *Phillips* standard in which claim terms are given their ordinary and customary meaning as understood by a POSA in view of the patent specification and prosecution history. I understand that an applicant's statements characterizing its invention during prosecution may give rise to a disclaimer.

A. "Forward"

58. Independent claims 1 and 14 recite "an **output unit** configured to **forward** the output generated by the processor." Ex. 1001 at 16:34-25; 17:10-11. Independent claims 23, 39, and 43 each recite "**forward** the generated output to the user…." Ex. 1001 at 17:61, 18:60, 20:3. I have been asked to provide my view of the meaning of the term "forward," as that term is used in the '167 patent. The specification does not define "forward" but provides several examples using the

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term “forward.” In some instances, the term “forward” is used in referring to sending the output to another device, e.g., to a secure device or server. *Id.* at 8:45-51,[2] 10:24-33, 12:48-58, 14:23-30, and 14:57-62. In Claim 5, the ’167 patent claims that the output unit, which forwards the output, “is a display.” Thus, Claim 5 expressly indicates that the display of the output on a display constitutes “forwarding,” at least as that term is used in the ’167 patent. Thus, consistent with the intrinsic evidence, it is my view that the term “forward” should be construed as either sending the output to another device or displaying an output on a display.

B. “Image capture device”

59. Independent claims 1 and 19 recite “an image capture device configured to capture an image…” *Id.* at 16:24, 19:29. I have also been asked to provide my view of the meaning of the term “image capture device,” as it is used in the ’167 patent. Although the specification does not define this term, it indicates that the image capture device or circuit 120 may include a digital camera or other type of image capturing device that is used to capture an image and/or video information. *Id*. at 5:8-11, 5:21-29. The patent also indicates that the image may be a barcode. *Id*. The term “image capture device” should therefore be construed as any device that can capture an image, such as a barcode scanner. Notably, an image capture device is any device capable of capturing and converting optical information into

[2] As used herein, the notation X:Y-Z refers to column X, lines Y-Z.

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digital information or electronic signals. Examples of such devices include laser-based barcode scanners, QR code scanners, document scanners, and camera devices. Laser barcode scanners work by self-emitting a laser light across a code to be scanned, with a sensor tuned to capture the reflected light from the laser, rather than relying on ambient or external light sources in the case of a camera type device. It was well known in 2005 that mobile and smart phone devices could be configured with image capture devices including either digital cameras or laser barcode scanners for the purpose of scanning QR and/or Barcodes. For example, in 2005, the Steven's creek website provided content explaining between using a general-purpose digital camera, or a specialized laser scanner for the application of capturing barcode images. Here, the “Socket SDIO” in this context refers to an example “SDIO In-Hand Scan Card” made by Socket Communications for PalmOS units with an "SDIO" slot. Per Steven's Creek:

> [T]he Socket SDIO scanner is a “camera” scanner, not a laser scanner. Whereas the laser scanner above can go “zap zap zap” and scan a series of barcodes in quick succession, the SDIO scanner can take a second or two to successfully scan….So the bottom line is that you really need to evaluate the SDIO scanner to see if it meets your needs. If it does, it’s an excellent choice.

Ex. 1010 at 5-6. A POSA would understand from the above that barcode scanners and digital cameras are both categories of image capture device, specifically

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within the context of the ’167 patent for capturing images with digital information embedded therein. OCR readers are additional a category of image capture devices that perform Optical Character Recognition (OCR). The term refers to a device capable of capturing an image of printed text and converting visible text into digital information that can be stored and processed as text by a computer. OCR readers rely on a digital camera to scan images and OCR software algorithms to extract the textual information from the image. A New York Times article of December 2004 (Keeping Track of Business Cards, Simplified: A Scanner to Digitize Them) describes one such device (“CardScan Executive from Corex Technologies”) as a device that scans business cards capturing both the image as well as extracting the data from the captured image, with this data able to be synchronized to mobile devices and smart phones of the era.

> Using proprietary optical-character-recognition software, the CardScan Executive can store a faithful image of the card, extract its data and place it in a searchable databank. The CardScan information can be synchronized with other devices, like Pocket PC and Palm organizers, BlackBerrys.

Ex. 1035 at 1 (<https://www.nytimes.com/2004/12/09/technology/circuits/keeping-track-of-business-cards-simplified-a-scanner-to.html>).

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C. "Predetermined Information"

60. Independent claims 1 and 19 recite "a memory configured to store **predetermined information**." *Id.* at 16:27, 17:31. Independent claims 23, 39, and 43 recite "store **predetermined information**…" *Id.* at 17:55, 18:54, 19:6. I have been asked to provide my view of the meaning of the term "predetermined information," as it is used in the '167 patent. Although the specification does not define "predetermined information," it does disclose that predetermined information is stored in memory and may include, for example, address information, personal profile information, and payment account information. *Id*. at 6:17-22. The specification further discloses that the predetermined information may be used to generate an authentication code (e.g., an output). *Id*. at 6:55-66. This usage of the term "predetermined" is consistent with its definition, which is "established or decided in advance." Ex. 1007. Based on its usage in the specification and definition, the term "predetermined information" should be construed as any information that is established and stored in memory in advance of generating the output.

VII. INVALIDITY ANALYSIS

A. Overview

61. I have reviewed Claims 1, 2, 4, 5, 7, 8, 12, 13, 17, 19-21, 23, 26, 27, 29, 30, 34, 39-41, and 43 of the '167 patent and the prior art cited in this report, and I

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have concluded that these claims are anticipated or obvious over the prior art. A summary of my conclusions is provided in the below table and the detailed bases for my opinion are provided thereafter.

Ground	35 U.S.C.	Claims	Basis
I	§§ 102/103	1, 4, 5, 7, 12, 17, 23, 26, 27, 29, 34, 43	Anticipated by Wang. Obvious over Wang in view of Drummond.
II	§ 102	1, 2, 4, 7, 12, 13, 17	Anticipated by Wang.
III	§ 103	19-21, 39-41	Obvious over Wang in view of Drummond.
IV	§ 103	8, 30	Obvious over Wang in view of Denso.
V	§ 103	13	Obvious over Wang in view of Raines.
VI	§ 103	1, 4, 5, 7, 23, 26, 27, 29, 43	Obvious over TAO in view of PTM and Wang.

A. Ground I: Claims 1, 4, 5, 7, 12, 17, 23, 26, 27, 29, 34, and 43 are anticipated by Wang and obvious over Wang in view of Drummond.

62. I have reviewed Wang (Ex. 1004). I also have compared the features of the Claims 1, 4, 5, 7, 12, 17, 23, 26, 27, 29, 34, and 43 of the '167 patent with Wang and reached the conclusion that each of these claims in anticipated by Wang. Although Wang discloses an "output unit configured to forward the output generated by the processor" (as claimed in claim 1) in the form of a display and forwarding to a printer and hence anticipates these claims, I have additionally provided an obviousness position in Ground 1 based on Wang in view of Drummond in view of the fact that it would have been obvious to the POSA to

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modify Wang to forward an output via conventional email or text messaging, as described in Drummond, and as discussed in the below claim chart. As such, I have determined that these claims are obvious over Wang in view of Drummond. My alternative invalidity position based on obviousness over Wang in view of Drummond applies to all claims in Ground 1.

Motivation to Combine Wang and Drummond

To the extent Wang does not disclose an output unit configured to "forward" an output generated by the processor, it would have been obvious to modify Wang to forward receipts via email or a text message, as explained by Drummond. Drummond discloses that it was known to forward receipts using conventional output units to notify users of the status of a transaction. Ex. 1008 at [0246]-[0251], [0301], [0307]. A POSA would understand, for example, that by forwarding receipts via emails or SMS, the receipts can be sent to their personal devices for record keeping purposes, which could be important to cross-reference transactions against payment account statements such as credit card statements and/or retaining such documents for tax purposes. Additionally, users would be able to forward electronic copies of receipts to the merchant and/or to other interested individuals, for example, to another individual responsible for processing invoices or obtaining reimbursements. Drummond discloses that electronic receipts may be forwarded using message delivery protocols such email

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and SMS. Ex. 1008 at [0248]. Use of such message delivery protocols would enable any mobile phone, including those disclosed in Wang, to forward the receipts. Further, Drummond indicates that the use of electronic receipts that are forwarded to another device provides several benefits over hard copy receipts, such as by enabling the customer to: (1) choose to receive the receipt at a computer, such as their home computer (e.g., pc), work computer, mobile phone, pager, PDA, other hand-held or portable computing device, or another device capable of receiving a message; (2) determine the level of information in the receipt; and (3) send additional receipt copies to additional selected systems and system addresses (e.g., a receipt may be sent to an associate or a party to a business transaction as an indication that a deposit or payment on a loan was made). *Id*. at [0246]-[0251], [0301], [0307]. For at least these reasons, a POSA would be motivated to modify Wang to forward its receipt outputs via email or SMS as taught by Drummond and would have had a reasonable expectation of success in doing so.

63. Like challenged Claim 1, Wang describes an apparatus and method for performing secure transactions. Ex. 1004 at [0002]. After authenticating a cell phone user, Wang describes that the cell phone may be used to scan barcodes to lookup prices from a lookup table for items to be purchased. *Id*. at [0072], [0115]. An output, such as an electronically signed receipt, may be generated based on the

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information from the lookup table and from predetermined information stored on the cellular phone. *Id*. These outputs may be forwarded to a user and may be digitally signed. *Id*. at [0108], [0112], [0115], [0123]. Wang also describes (i) the use of memory for storing program data, and (ii) the use of predetermined information in the form of private keys that are used to digitally sign the outputs. *Id*. at [0050], [0085], [0115]. Wang anticipates claim 1. For the reasons I explain in the following claim charts, all of the features of the challenged claims are disclosed by Wang. As I show below, Claim 1 is anticipated by Wang and obvious over Wang in view of Drummond.

Independent Claim 1

Claim 1	**Wang (Ex. 1004)**
[Preamble 1][3] 1. An apparatus for providing a secure transaction, the apparatus comprising:	Wang discloses an apparatus for providing a secure transaction. "portable electronic authorization devices (PEADs) which eliminate the **security risks** associated with... approving **transactions**...." [0002]. An "Internet enabled cellular telephone...may be used to implement a...PEAD." [0108].
[1a] an image capture device configured to capture an image, the image having information embedded therein including	Wang discloses an **image capture device** (e.g., a barcode or OCR scanner) that **captures an image** (e.g., a barcode or OCR image) that has **information embedded therein** (e.g., index data for price lookup) that is usable for generating an electronically signed receipt relating to a purchase **transaction**. [0115].

[3] The various claim elements have been numbered in brackets in the claim charts and are listed for all claims in a Claims Appendix at Appendix A.

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Claim 1	Wang (Ex. 1004)
information relating to a transaction;	"Another implementation of the…**transaction** is to use the PEAD as [a] self checkout terminal." [0115]. This includes "scanning in the...barcode using the input device built into the PEAD such as a **barcode scanner** or **OCR reader**...generate the **receipt** with the list of item prices by querying the item price using the barcode as the index for price lookup table…." *Id*.
[1b] a memory configured to store predetermined information;	Wang discloses storing "the user's private key" (**predetermined information**) in "**memory** portion 304," [0050] and discloses "the PEAD user can sign the receipt electronically using PEAD as described in U.S. Pat. No. 5,917,913."[4] [0115]. Wang discloses that "the PEAD may be employed to 'sign' any computer file for authentication purposes" and indicates that authentication is based on encryption "using the user's private key."[5] [0085]. The private key is predetermined information since it is stored in the PEAD memory prior to initiation of any secure transactions.
[1c] an input unit configured to receive input information provided by a user;	"**user authentication mechanism** 612 may require **the user to enter a password**, to furnish fingerprints or a voice print, or other biometrics" [0073]. A password or fingerprint constitutes **input information**. Thus, a "user authentication mechanism…to enter a password…" is an **input unit**

[4] Wang repeatedly refers to U.S. Pat. No. 5,917,913, which is effectively an internal cross-reference to Wang itself since the '913 patent is related to Wang and includes generally the same disclosure as Wang paragraphs [0002]-[0011] and [0018]-[0085]. *See* Ex. 1012.

[5] *See* paragraphs 64 - 73.

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Claim 1	Wang (Ex. 1004)
	configured to receive input information provided by a user.
[1d] a processor configured to:	"A **microcontroller…**executes codes stored in flash memory…and employes [RAM]…for the execution." [0074]. A microcontroller is a **processor**, and a POSA would appreciate that the Wang microcontroller is configured to perform elements 1e-g. as claimed.[6]
[1e] verify the user based on the input information to ensure that the user is authorized to use the apparatus; and	"require the user to **enter a password**, to furnish fingerprints or a voice print, or other biometrics and/or identifying characteristics specific to the **authorized user** before PEAD 200 can be activated…." [0072].
[1f] generate an output based on the information embedded in the image and the predetermined information; and	Wang describes digitally signed "receipts" as **outputs**, which are based on image information (data from barcodes) and predetermined information (private key). After "agree[ing] to pay for the item, the user can approve the transaction by pressing the button on the phone…." The device then generates a digitally signed receipt as an output: "[T]he PEAD can **generate the receipt**...." [0115]. The digitally signed receipt is based on **information embedded in an image** (barcode information): "[T]he PEAD can generate the receipt...by querying the item price using the **barcode** as the index for price lookup table...."[7] *Id*. The digitally signed receipt is also based on the **predetermined information** (private key): "[T]he

[6] *See* paragraphs 74 - 77.

[7] *See* paragraph 78.

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Claim 1	Wang (Ex. 1004)
	PEAD user can sign the receipt electronically using PEAD…." [0115]. "[T]he PEAD may be employed to 'sign' any computer file for authentication purposes" and indicates that authentication is based on encryption "using the user's **private key**." [0085]. Thus, the private key (predetermined information) is utilized to digitally sign the receipt.[8]
[1g] an output unit configured to forward the output generated by the processor,	**Anticipation** Wang discloses two types of output devices, a display and a "local wireless communication port," both of which "**forward**" the output (digitally signed receipt), as properly construed in Section VI.A. (Section VI.B.1. of the Petition). 1. "presenting the electronic receipt over the phone" [0115]. 2. "establishing the connection between the cellular phone and the receipt printer." *Id*. **Obviousness** Additionally, it would have been obvious to modify Wang to send or "forward" the digitally signed receipt, e.g., to the user, in an email or text for the purpose of memorializing the transaction, as shown by Drummond, Ex. 1008, at [0246]-[0251], [0301], [0307].[9]
[1h] wherein the output includes a digital signature to be used to signify authorization by the user with respect to the transaction.	"The PEAD user can **sign the receipt electronically** using PEAD." [0115]. The output (digitally signed receipt) is electronically signed. An electronic signature as disclosed in Wang is a digital signature.[10] Ex. 1004 at [0108], [0112], [0123].

[8] *See* paragraphs 79 - 81.

[9] *See* paragraphs 62, 82 - 84.

[10] *See* paragraphs 85 - 88.

Element 1b: Private Keys

64. As indicated above with respect to element 1b, Wang discloses the use of **private keys**. A person skilled in the art would understand that a public/private key pair is a fundamental component of asymmetric cryptography, a system where two keys are used: a public key, which can be freely distributed, and a private key, which is kept secret. The public key is used to encrypt data, while the private key is used to decrypt it. This ensures that even if the encrypted data is intercepted, it cannot be read without the private key.

65. In the Wang patent, the user's private key is stored in "memory portion 304." Ex. 1004 at [0050]. This private key enables generating digital signatures. The digital signature provides an additional factor of authentication for transactions performed by a user of a device. When a transaction is initiated, the mobile device uses its private key to sign the transaction data. This signature can be verified by the recipient using the corresponding public key, helping to ensuring the authenticity and integrity of the transaction. This method is consistent with the established principles of public/private key cryptography.

66. Wang discloses that authentication is based on encryption "using the user's private key." *Id*. at [0085]. This aligns with the use of asymmetric encryption, where the private key encrypts a hash of the transaction data to create a digital signature, and the public key decrypts it for verification. This process ensures that

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only the holder of the private key (the user) could have generated the signature, thereby authenticating the transaction. By including transaction data, such as amount, time, or other odder details in the hash, the signature certifies what specifics of the transaction the user authorized.

67. Digital signatures use asymmetric cryptography to verify the authenticity and integrity of a message or document. A digital signature is created by generating a hash of the message and then encrypting it with the sender's private key. The recipient can decrypt this signature using the sender's public key and compare it to a hash of the received message. If the hashes match, the signature is verified, ensuring that the message has not been altered and confirming the sender's identity.

68. Wang describes that "the PEAD user can sign the receipt electronically using PEAD as described in U.S. Pat. No. 5,917,913" and that "the PEAD may be employed to 'sign' any computer file for authentication purposes." *Id*. at [0115], [0085]. This process involves the user's private key stored on the device, which is used to generate the digital signature.

69. At the time of Wang, various well-known standards existed for the employ of encryption and digital signatures for the facilitation of secure electronic transactions. In 2003, Visa described two such standards:

> There are currently two protocols for Authenticated Payment:

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> 3-D Secure™ – Leverages Transport Layer Security (TLS) technology, which is incorporated in most browsers currently in use. Provides confidentiality of information, ensures payment integrity, and authenticates cardholders. Note: TLS is the successor to Secure Sockets Layer (SSL).
>
> SET Secure Electronic Transaction™ – Uses cryptography to provide confidentiality of information, ensure payment integrity, and authenticate both merchants and cardholders.

Ex. 1014 at 11 (accessible at <https://web.archive.org/web/20060314195418/http://partnernetwork.visa.com/pf/3dsec/download/trk_3dsec_system_overview_v102.pdf>).

70. Visa also states that 3-D secure "[i]s extensible into emerging channels such as mobile telephones, PDAs, and digital TV". *Id*. at 12. A POSA would understand that devices described by Wang, TAO, and PTM would all fall under this definition. The 3-D in this framework stands for "Three Domains." The "Three Domain Model enables issuers to authenticate their cardholders during online purchases. Acquirers and merchants have a flexible framework that can embrace a variety of technical approaches." *Id*. at 22. In this protocol, the issuer has flexibility to implement a system to directly communicate with and authenticate their cardholders in the course of an electronic transaction initiated by the merchant. The issuer implements a system known as an Access Control Server

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(ACS): "The ACS authenticates the cardholder by causing an authentication dialog to be displayed to the cardholder asking for password, or by some other authentication method, such as a Visa chip card. The ACS formats and digitally signs the authentication response, then returns it." *Id*. at 28.

71. The Wang patent describes a method for approving transaction requests using a portable electronic authorization device (PEAD). This method involves receiving transaction data, decrypting the user's private key with a decryption key from a remote server, and then using the private key to sign the transaction data. The critical aspect here is that a secret private key has been previously configured by a verifying party onto the PEAD device by a certifying authority (e.g. a card network or the user's financial institution). The certifiable presence of that secret key provides an additional second physical factor of authentication. Transaction authentication is made more secure by the fact that an attacker would need to compromise both the user's password, as well as the physical device in order to falsely authenticate a transaction. In this example, the PEAD device would perform the analogous function to a "Visa chip card" as described in the Visa 3-D secure protocol.

72. A POSA would recognize the value of utilizing a device as described by Wang to "sign any computer file for authentication purposes." Ex. 1004 at [0085]. Wang's method of decrypting and using the user's private key to generate a digital

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signature could be applied to the cardholder verification process in the 3D Secure protocol. By using the PEAD to sign transaction data, the card issuer's system could provide strong authentication of the cardholder's identity. The use of encryption and digital signatures would ensure that the transaction data is uniquely tied to the cardholder, providing a mechanism for verifying both the authenticity of the transaction and the identity of the user.

73. A POSA would be motivated to use the Wang device for cardholder verification due to the increased security it offers. The ability to securely sign transaction data using a private key that is only decrypted on-demand mitigates the risk of key compromise and aligns with the goals of the 3D Secure protocol to reduce fraud and enhance transaction security.

Element 1d: Microcontrollers

74. Concerning the microcontrollers discussed by Wang, it is well known that a microcontroller is a term to describe a processor as well as certain supporting hardware when packaged together for embedding in a small or low-power device. *See, e.g.*, Predko, M., *Programming and Customizing the 8051 Microcontroller* (1999), Ex. 1015, at 3 ("microcontroller (as I define it) is a chip which has computer processor with all its support functions (clocking and reset), memory (both program storage and RAM) and I/O (including bus interfaces) built into the device").

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75. In view of this understanding of the term, a POSA would understand that when Wang is describing a microcontroller, that this device would principally contain a computer processor. Further, that microcontroller would need to be configured to run any general purpose software applications or to perform input/output (I/O).

76. The configuration of the microprocessor would include hardware and software level configurations. Necessary hardware configuration would include selecting sufficient memory for storage, and hardware bus interfaces for input and output (e.g. for the microcontroller to be able to interact with camera device, networking chips, display screen etc. also included onboard PEAD). Software configuration would include preconfigured operating system software (e.g., in the way that Palm devices of the era were configured with PalmOS software, whereas other smartphone devices of the era might have been configured with RIM BlackberryOS or Nokia SymbianOS etc.). These operating systems would be configured in the microprocessor's memory prior to shipping the device to the user.

77. Finally, the microprocessor would rely on specific application software (as described in Wang) which would also be stored in the microprocessor's configured hardware memory. And applications would in turn be understood to store in memory preconfigured information (as described in Wang) such as a

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user's private cryptographic key. A private cryptographic key would typically be configured by a relevant authority, for example, the user's financial institution as means of confirming the indented user's identity in authorizing future transactions or system access requests etc.

Element 1f: The receipt is linked to the barcode.

78. Wang explicitly describes two scenarios where the barcode data is directly linked to (and required for) initiating a transaction that results in a receipt output:

A) It is common knowledge that common transaction receipts may include itemized purchase information. Wang describes how item-specific transaction data being retrieved via a barcode "scan in the merchandise barcodes and generate transaction information as well as generate a unique transaction number (which contains the store number+counter number+transaction number for example)….It is also possible to enter the merchandise bar code number to the PEAD through the keypad or scanner…." Ex. 1004 at [0113]. Wang then describes that "the PEAD can generate the receipt…using the barcode" *Id*. at [0115].

B) Wang describes how the scanner can be used to create a trusted synchronous connection between a mobile device and point of sale system. A person skilled in the art of payments would obviously understand that explicitly identifying the buyer and the seller is necessary step initiating a transaction. Wang describes a common method used by payment schemes of the day to assign a

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globally unique alias to one party of the transaction (e.g. a user's phone number, or a merchant Point of sale terminal ID) that can then be read or scanned via a bar code, to connect the two parties to begin exchanging transaction information. When a receipt is created at the end of the transaction, the creation of that receipt depends on successful initiation and authorization of a transaction between the explicitly identified parties, a process that was initiated by data linked to the barcode. *Id*.

Element 1f: How the Private Key is used for authentication.

79. Using a predetermined private key to sign transaction data provides a method for ensuring the authenticity and integrity of transaction data. When a private key, known only to the authorized user, is used to create a digital signature, it binds the transaction data to the user, making it verifiable by anyone with access to the corresponding public key. This process guarantees that the transaction data has not been tampered with and confirms the identity of the signer. According to Schneier (1996), digital signatures created with private keys provide non-repudiation, meaning that the signer cannot later deny having signed the data, which is valuable for secure financial transactions and legal accountability. Ex. 1017 at 62-72.

80. According to Schneier: "In practical implementations, public-key algorithms are often too inefficient to sign long documents. To save time, digital

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signature protocols are often implemented with one-way hash functions. Instead of signing a document, Alice signs the hash of the document. In this protocol, both the one-way hash function and the digital signature algorithm are agreed upon beforehand." *Id*. at 68 (internal citations omitted). Additionally, "[t]here are many digital signature algorithms. All of them are public-key algorithms with secret information to sign documents and public information to verify signatures. Sometimes the signing process is called encrypting with a private key…." *Id*.

81. Schneier further explains that "[b]y combining digital signatures with public-key cryptography, we develop a protocol that combines the security of encryption with the authenticity of digital signatures. Think of a letter from your mother; The signature provides proof of authorship and the envelope provides privacy." *Id*. at 71.

Element 1g: Obviousness over Drummund

82. Although I have formally construed the term "forward" above, additional background concerning this term is warranted in view of my obviousness analysis. In 2005, "forwarding" in the context of secure transactions could be taken to mean the process by which a device or system sends data from one point to another. This process includes transmitting generated output, such as digital signatures or authentication codes, from the device where the output was created to another device or system where it can be used or verified. In the context of payment

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processing, there are commonly a chain of entities (e.g. a payment device (such as a payment card, smart card, or electronic wallet) merchant point of sale system, payment processor, a merchant acquiring bank, a payment network, a card issuing bank and a payor). Each of these parties would be responsible for sequentially responsible for receiving and forwarding payment authorization requests and authorization responses. A purchase transaction is generally only considered complete once an acknowledgment of the payment authorization is forwarded to the purchasee.

83. In the context of electronic communications of 2005. Forwarding was also commonly used in the context of email forwarding. For example, it was common for ecommerce merchants to forward purchase receipts, purchase orders or receipts by email to buyers.

84. In the context of mobile devices of 2005, two widely compatible methods of pushing a notification to a user of smart mobile device would be by SMS to a standard cell phone, or by email message to a smart phone capable of email. Examples:

- Email Forwarding: In 2005, a common method of forwarding would be through email. For instance, after capturing an image and generating a digital signature, the mobile device would send this information via email to a recipient, e.g., for order fulfillment or for record keeping.

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- SMS Forwarding: Another prevalent method was through SMS (Short Message Service). The device could forward the generated output, such as an authentication code, via SMS to a verifier or a user's phone number for completing a secure transaction.
- Display Forwarding: The output unit might also be a display on the mobile device itself, showing the generated digital signature or authentication code that the user would then manually input into another system or provide to a verifier.
- API Call Forwarding: Mobile applications could forward transaction data by making API calls to remote servers. For example, after capturing a QR code and generating a digital signature, the mobile application would use an HTTP POST request to send this data to a server endpoint for validation. In 2005, it was commonly understood that application software installed on certain mobile phones and devices could make network calls over data connections to nearby devices or remote computers. Wang describes forwarding user-inputted passcodes to a remote server for validation as an additional level of security to access private keys required to sign a transaction. Ex. 1004 at [0121]. For the reasons explained above, it would have been obvious to modify Wang to forward receipts via email or SMS, as described by Drummond.

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Element 1h: The electronic signature in Wang is a digital signature

85. It was well known at the time that the term "digital signature" includes cryptographic mechanisms used to verify the authenticity and integrity of a message, transaction, or digital document. Digital signatures ensured that the message was created by a known sender (authentication) and that it had not been altered (integrity). Digital signatures were known to be created through the use of private and public cryptographic keys. In the context of secure payment transactions, standards were well established by 2005 for creating digital signatures using pre-determined public and private keys stored on a trusted device such as a smart card or merchant terminal.

86. In 2005, a POSA would be familiar, for example, with this contemporaneous description of digital signatures and electronic at the time:

> Digital signature (or public-key digital signature) is a type of method for authenticating digital information analogous to ordinary physical signatures on paper, but implemented using techniques from the field of public-key cryptography. A digital signature method generally defines two complementary algorithms, one for signing and the other for verification, and the output of the signing process is also called a digital signature.
>
> The term electronic signature, although sometimes used for the same thing, has a distinct meaning in common law: it refers to any of several, not necessarily cryptographic, mechanisms for identifying

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> the originator of an electronic message. Electronic signatures have included cable and Telex addresses, as well as FAX transmission of handwritten signatures on a paper document.

Ex. 1018 at 1.

87. Notably, the ’167 patent does not define the term “digital signature,” but it does state in its claims that the digital signature is “used to signify authorization by the user with respect to the transaction.” Ex. 1001 at 16:22.

88. Wang indicates that “[t]he PEAD user can sign the receipt electronically using PEAD as described in U.S. Pat. No. 5,917,913.” Ex. 1004 at [0115]. The reference to the ’913 patent is effectively a cross-reference to an earlier portion of Wang as previously mentioned. This earlier portion of Wang states that “a transaction embodied in the transaction request from the electronic transaction system may be appended with data representative [of] an ‘electronic signature’ prior to being encrypted and retransmitted back to the electronic transaction system.” Ex. 1004 at [0051]. This description is consistent with the Wang electronic signature being “used to signify authorization by the user with respect to the transaction” as claimed in the ’167 patent. Additionally, this description is consistent with the well-understood meaning of the term “digital signature.” Thus, it is my view that the claim term “digital signature” in the ’167 patent reads on the electronic signature in Wang.

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89. As I show below, Claim 4 is anticipated by Wang and obvious over Wang in view of Drummond.

Dependent Claim 4

Claim 4	**Wang (Ex. 1004)**
4. The apparatus of claim 1 wherein the input information includes one of a personal identification number and biometric information.	"require the user to enter a password, to furnish **fingerprints or a voice print, or other biometrics**..." [0072], [0045].

90. As I show below, Claim 5 is anticipated by Wang and obvious over Wang in view of Drummond.

Dependent Claim 5

Claim 5	**Wang (Ex. 1004)**
5. The apparatus of claim 1 wherein the output unit is a display.	"presenting the electronic receipt over the phone" [0115]. Presenting the electronic receipt over the phone equates to displaying the receipt (i.e., the output).

91. As I show below, Claim 7 is anticipated by Wang and obvious over Wang in view of Drummond.

Dependent Claim 7

Claim 7	**Wang (Ex. 1004)**
7. The apparatus of claim 1 wherein the image includes a barcode.	"scanning in the...**barcode.**" [0115].

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92. As I show below, Claim 12 is anticipated by Wang and obvious over Wang in view of Drummond.

Dependent Claim 12

Claim 12	**Wang (Ex. 1004)**
12. The apparatus of claim 1 wherein the transaction includes an online transaction.	"employ the PEAD to perform any type of **authentication tasks online**." [0084]. The transaction is described as being performed "through the wireless network and Internet…" i.e., online. [0115].

93. As I show below, Claim 17 is anticipated by Wang and obvious over Wang in view of Drummond.

Dependent Claim 17

Claim 17	**Wang (Ex. 1004)**
17. The apparatus of claim 1, wherein the apparatus is a cellphone.	"Internet enabled **cellular telephone**...may be used to implement a...PEAD." [0108].

94. As I show below, Claim 23 is anticipated by Wang and rendered obvious over Wang in view of Drummond.

Independent Claim 23

Claim 23	**Wang (Ex. 1004)**
[Preamble 23] 23. A method of providing secure transaction, the method comprising:	Wang discloses a method for providing a secure transaction. *See* Preamble 1 analysis.

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Claim 23	Wang (Ex. 1004)
[23d] configuring a portable device to:	Wang discloses a PEAD (a **portable device**) having a microcontroller and memory configured to perform the steps described in Wang and outlined in this claim chart. [0074], [0115]. For the PEAD to perform the functions described in Wang, it must have been configured to do so.[11] *See* also Element 1d analysis.
[23a] capture an image, the image having information embedded therein, the information embedded in the image including information relating to a transaction;	Wang discloses an **image capture device** (e.g., a barcode or OCR scanner) that **captures an image** (e.g., a barcode or OCR image) that has **information embedded therein** (e.g., index data for price lookup) that is usable for generating an electronically signed receipt relating to a purchase **transaction**. [0115]. "Another implementation of the…**transaction** is to use the PEAD as [a] self checkout terminal." [0115]. This includes "scanning in the...barcode using the input device built into the PEAD such as a **barcode scanner** or **OCR reader**...generate the **receipt** with the list of item prices by querying the item price using the barcode as the index for price lookup table" *Id*.

[11] *See* paragraphs 74 - 77.

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Claim 23	Wang (Ex. 1004)
[23b] store predetermined information;	Wang discloses storing "the user's private key" (**predetermined information**) in "**memory** portion 304," [0050] and discloses "the PEAD user can sign the receipt electronically using PEAD as described in U.S. Pat. No. 5,917,913."[12] [0115]. Wang discloses that "the PEAD may be employed to 'sign' any computer file for authentication purposes" and indicates that authentication is based on encryption "using the user's private key." [0085] The private key is predetermined information since it is stored in the PEAD memory prior to initiation of any secure transactions.[13]
[23c] receive input information provided by a user;	"**user authentication mechanism** 612 may require **the user to enter a password**, to furnish fingerprints or a voice print, or other biometrics." [0072]. A password or fingerprint constitutes **input information**. Thus, a "user authentication mechanism…to enter a password…" is an **input unit configured to receive input information provided by a user**.
[23e] verify the user based on the input information to ensure that the user is authorized to use the portable device;	"require the user to **enter a password**, to furnish fingerprints or a voice print, or other biometrics and/or identifying characteristics specific to the **authorized user** before PEAD 200 can be activated…." [0072].

[12] Wang repeatedly refers to U.S. Pat. No. 5,917,913, which is effectively an internal cross-reference to Wang itself since the '913 patent is related to Wang and includes generally the same disclosure was Wang paragraphs 1-85. *See* Ex. 1012.

[13] *See* paragraphs 64 - 73.

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Claim 23	Wang (Ex. 1004)
[23f] generate an output based on the information embedded in the image and the predetermined information; and	Wang describes digitally signed "receipts" as **outputs**, which are based on image information (data from barcodes) and predetermined information (private key). After "agree[ing] to pay for the item, the user can approve the transaction by pressing the button on the phone…." The device then generates a digitally signed receipt as an output: "[T]he PEAD can **generate the receipt**..." [0115]. The digitally signed receipt is based on **information embedded in an image** (barcode information): "[T]he PEAD can generate the receipt...by querying the item price using the **barcode** as the index for price lookup table...."[14] *Id*. The digitally signed receipt is also based on the **predetermined information** (private key): "[T]he PEAD user can sign the receipt electronically using PEAD…." *Id*. "[T]he PEAD may be employed to 'sign' any computer file for authentication purposes" and indicates that authentication is based on encryption "using the user's **private key**." [0085]. Thus, the private key (predetermined information) is utilized to digitally sign the receipt.[15]

[14] *See* paragraph 78.

[15] *See* paragraphs 79 - 81.

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Claim 23	Wang (Ex. 1004)
[23g] forward the generated output to the user,	Anticipation *See* Element 1g analysis. Notably, displaying the receipt by the user would necessarily require forwarding (e.g., displaying) the receipt **to the user**. Similarly, the act of sending the receipt to the printer, the printout of which would be accessed *by the user*, constitutes forwarding the receipt **to the user**.[16] Obviousness *See* Element 1g analysis.
[23h] wherein the output includes a digital signature to be used to signify authorization by the user with respect to the transaction.	"The PEAD user can **sign the receipt electronically** using PEAD." [0115]. The output (digitally signed receipt) is electronically signed. An electronic signature as disclosed in Wang is a digital signature.[17] [0108], [0112], [0123].

Element 23g: Forwarding "to the user"

95. Although I formally construed the term "forward" above, additional discussion is warranted concerning how displaying the receipt on the display screen and forwarding the receipt to the printer is the same as forwarding "to the user." "Forwarding" is not a specific term of art in the relevant fields of mobile devices, computer science or transaction processing. It is a common term to which multiple definitions can apply. Looking textually at the '167 patent, the term is

[16] *See* paragraphs 95 - 96.

[17] *See* paragraphs 85 - 88.

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used in the context of "an output unit configured to forward the output generated by the processor." Ex. 1001 at 16:34.

96. Taking the '167 contextual use of the word "forward," the term is suggested to apply to the function performed by any output unit connected to a computer processor. Again, from the specific definition suggested by '167, any of the configured output options specified by Wang including a screen for display, or a printer for printing a receipt would fit the definition of forwarding output. Further, the device user would be a recipient of information displayed on the user's device screen—specifically because it is displayed on the user's device. The commonly understood intended recipient of purchase receipts is also the purchaser who authorized the transaction. Additionally, the '167 patent indicates that the user prints the receipt, and so the act of forwarding the receipt to the printer is the same as forwarding the output to the user, in the sense as the term as used in the '167 patent. *See* Ex. 1004 at [0115] ("The user can then walk out the store by presenting the electronic receipt over the phone or goes to the receipt printer to print out the hardcopy."). Thus, the displaying of the receipt on the user's screen and the printing the receipt are the same as forwarding the receipt "to the user."

97. As I show below, Claim 26 is anticipated by Wang and obvious over Wang in view of Drummond.

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Dependent Claim 26

Claim 26	Wang (Ex. 1004)
26. The method of claim 23 wherein the input information includes one of a personal identification number and biometric information.	*See* Claim 4 analysis.

98. As I show below, Claim 27 is anticipated by Wang and obvious over Wang in view of Drummond.

Dependent Claim 27

Claim 27	Wang (Ex. 1004)
27. The method of claim 23 further comprising: configuring the portable device to display the output.	*See* Claim 5 analysis. To display the receipt image as taught by Wang, the PEAD must be **configured** to do so.[18]

The Wang PEAD is configured to display an output

99. A POSA would understand that Wang is indicating that the PEAD of Wang must be configured to display the receipt in order to do so. That configuration would consist of: at the hardware level, specifying and assembling the device to contain a screen output device connected to the processor; at the software application level, to provide instructions to the processor to visually format and display the receipt output on the screen.

[18] *See* paragraph 99.

100. As I show below, Claim 29 is anticipated by Wang and obvious over Wang in view of Drummond.

Dependent Claim 29

Claim 29	**Wang (Ex. 1004)**
29. The method of claim 23 wherein the image includes a barcode.	*See* Claim 7 analysis.

101. As I show below, Claim 34 is anticipated by Wang and obvious over Wang in view of Drummond.

Dependent Claim 34

Claim 34	**Wang (Ex. 1004)**
34. The method of claim 23 wherein the transaction includes an online transaction.	*See* Claim 12 analysis.

102. As I show below, Claim 43 is anticipated by Wang and obvious over Wang in view of Drummond.

Independent Claim 43

Claim 43	**Wang (Ex. 1004)**
Preamble 43	*See* Preamble 23 analysis.
Elements 43a-g	*See* Elements 23a-g analysis.
Element 43h	"Internet enabled **cellular telephone**...may be used to implement a...PEAD." [0108].

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B. GROUND II: Wang anticipates Claims 1, 2, 4, 7, 12, and 17.

103. From my review of Wang, it was apparent that Wang describes multiple types of predetermined information and outputs. In addition to the "private key" predetermined information discussed in Ground 1, Wang discloses the use of predetermined information in the form of "user identification data," which may include, for example, "the user's name, his birth date, [or] his social security number,…. " Ex. 1004 at [0045]. Likewise, in addition to an output in the form of a digitally signed receipt, as discussed in Ground 1, Wang discloses generating "transaction approval data" as an output. *Id*. at [0075]-[0083], [0115]. As shown in FIG. 3B, reproduced below, the transaction approval data 350 contains:

> transaction data 352, representing a portion of or the entire transaction request received…appended with certain user identification data 354…. Once appended, the transaction approval data 350 is then encrypted prior to being retransmitted back to the electronic transaction system.

Id. at [0051].

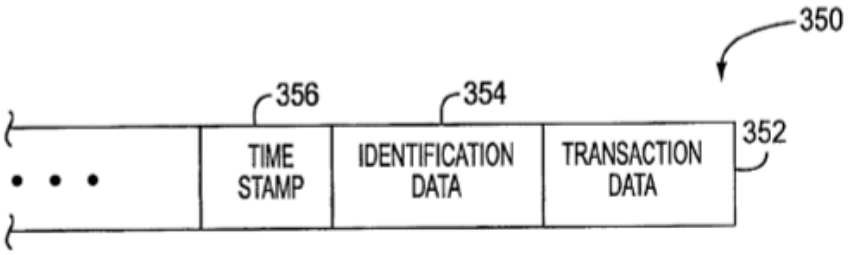


FIG. 3B

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Wang's use of "user identification data" as predetermined information and "transaction approval data" as an output forms the basis of Ground 2.

104. Wang describes a PEAD apparatus (optionally a cellular phone) and method for performing secure transactions. *Id*. at [0002]. After authenticating a user of the cellular phone, Wang describes that a barcode scanner of the PEAD may be used to scan barcodes to select and lookup prices for items for a purchase transaction from a lookup table. *Id*. at [0072], [0115]. Outputs, such as transaction approval data, may be generated based on scanned barcode information (information embedded in an image) and on the user identification data (predetermined information) stored on the PEAD. *Id*. at [0075]-[0083], [0115]. These outputs may be forwarded to a server of a transaction approval network and may be digitally signed. *Id*. at [0047]-[0051], [0108], [0112], [0115], [0123]. Wang discloses all features of Claims 1, 2, 4, 7, 12, and 17 for the reasons discussed below.

105. As I show below, Claim 1 is anticipated by Wang.

Independent Claim 1

Claim 1	**Wang (Ex. 1004)**
[Preamble 1] 1. An apparatus for providing a secure transaction, the apparatus comprising:	*See* Ground 1, Preamble 1 analysis.
[1a] an image capture device configured to	*See* Ground 1, Element 1a analysis.

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Claim 1	Wang (Ex. 1004)
capture an image, the image having information embedded therein including information relating to a transaction;	
[1b] a memory configured to store predetermined information;	"[**U]ser identification data**…are always kept secure within the PEAD 200." [0044]. "the [transaction program]...receives user's data from the user (e.g., the **user's identification data**, any data which may be required for the proposed transaction such as the address information, quantity information, size information, method of payment, credit card number, account number, and the like)" [0093]. "[I]f the user has already supplied the vendor with some of the requested data in the past (such as the user's address), the TP may not ask for the same data again" indicating that it is stored in memory. [0094]. "**Program/data memory**" [0062]. "[A]ny of the required…user-supplied data may be stored in the PEAD" [0098]. The user's data is predetermined information stored in memory.[19]
Element 1c-e	*See* Ground 1, Elements 1c-e analysis.
[1f] generate an output based on the information embedded in the image and the predetermined information; and	Wang describes that the PEAD can generate "transaction approval data" (an output) in response to the user agreeing to a transaction. [0075]-[0083], [0115]. The output is based on information embedded in the image:

[19] *See* paragraph 106.

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Claim 1	Wang (Ex. 1004)
	To approve and complete a transaction, the price of the item being purchased is required. [0115]. The price of the item is generated based on barcode data (information embedded in an image): "The cellular phone would display the price of the item the user entered (or **scanned in**). If the user agrees to pay for the item, the user can **approve** the **transaction** by pressing the button on the phone." Id. Such approval, which is based on the embedded barcode image information, results in the generation of "transaction approval data." [0076], [0115] (stating that "the approval process…is described in [related] U.S. Pat. 5,917,913,"[20] which describes the generation of "transaction approval data" in response to approval of a transaction). Thus, the transaction approval data (output) is based on price information embedded in a barcode image.[21] The output is based on predetermined information: The transaction approval data is also based on predetermined information—specifically "user identification data." Wang indicates that transaction approval data includes "transaction data," and "user identification data." [0051], FIG. 3B. The user identification data may include "the user's name, his birth date, [or] his social security number…" [0045]. Thus, the transaction approval data (output) is based on user identification data (**predetermined information**).
[1g] an output unit configured to forward the output generated by the processor, wherein	"**data path** 212 is provided for **transmitting** [i.e., forwarding] **transaction approval data**" [0047]-[0048]. The data path is an output unit used to transmit

[20] *See supra* note 4.

[21] *See* paragraph 78.

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Claim 1	Wang (Ex. 1004)
	(forward) the transaction approval data. .
[1h] the output includes a digital signature to be used to signify authorization by the user with respect to the transaction.	"the transaction approval data...**may be appended with data representative if** [sic: of] **an 'electronic signature'**" [0051]. "The PEAD user can **sign the receipt electronically** using PEAD." [0115]. When the output is transaction approval data, the output may be electronically signed. A POSA would understand that an electronic signature is a digital signature in view of Wang's disclosure.[22] [0108], [0112], [0123].

Element 1b: User data must be stored in the PEAD's memory

106. Wang's PEAD is a computing device, and a POSA would interpret Wang as saying that, when the predetermined information is stored in the PEAD, that would mean it is stored in the device's computer memory. In mobile device architectures of the time, that storage medium would consist of re-writable non-volatile storage such as internal flash memory modules, removable memory cards such as SD of CF card memory standards, or electrically programable memory (EPROM). It was well known in the art that computing devices used these types of memory for long term storage of data. Ex. 1004 at [0062] ("Program/data memory 504 is preferably implemented using some form of non-volatile memory (NVM) such as flash memory, electrically programmable read-only memory

[22] *See* paragraphs 85 - 88.

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(EPROM), electrically erasable, programmable read-only memory (EEPROM), or the like. Temporary memory 506 serves as a scratch pad for calculation purposes and for the temporary storage of data, and may be implemented using some form of random access memory (RAM) such as static RAM or dynamic RAM, which are known in the art.").

107. As I show below, Claim 2 is anticipated by Wang.

Dependent Claim 2

Claim 2	**Wang (Ex. 1004)**
2. The apparatus of claim 1 wherein the processor is further configured to generate the output using the input information.	Wang discloses that the transaction approval data (output) includes "user identification data." [0051]. The user identification data may include a password, "unique biometrics or unique identifying data such as fingerprint…." (input information). [0045].

108. As I show below, Claim 4 is anticipated by Wang.

Dependent Claim 4

Claim 4	**Wang (Ex. 1004)**
4. The apparatus of claim 1 wherein the input information includes one of a personal identification number and biometric information.	*See* Ground 1, Claim 4 analysis.

109. As I show below, Claim 7 is anticipated by Wang.

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Dependent Claim 7

Claim 7	Wang (Ex. 1004)
7. The apparatus of claim 1 wherein the image includes a barcode.	*See* Ground 1, Claim 7 analysis.

110. As I show below, Claim 12 is anticipated by Wang.

Dependent Claim 12

Claim 12	Wang (Ex. 1004)
12. The apparatus of claim 1 wherein the transaction includes an online transaction.	*See* Ground 1, Claim 12 analysis.

111. As I show below, Claim 17 is anticipated by Wang.

Dependent Claim 17

Claim 17	Wang
17. The apparatus of claim 1, wherein the apparatus is a cellphone.	*See* Ground 1, Claim 17 analysis.

C. GROUND III: Claims 19-21 and 39-41 are obvious over Wang in view of Drummond.

112. Claims 19-21 and 39-41 are obvious over Wang (Ex. 1004) in view of Drummond (Ex. 1008), as shown below.

113. As discussed above in Ground 1, Wang describes an apparatus and method for performing secure transactions. After authenticating a user of the cellular phone, Wang describes that a barcode scanner of a cellular phone may be used to

scan barcodes to select and lookup prices for items for a purchase transaction from a lookup table. *Id*. at [0072], [0115]. Outputs, such as digitally signed receipts, may be generated based on user identification data and a private key (both predetermined information) stored on the cellular phone prior to scanning the barcodes. *Id*. at [0064], [0072], [0115]. The receipts may be forwarded to a user. *Id*. at [0115]. Although implied, Wang does not expressly disclose that the output unit includes control logic configured to forward the output using a message delivery protocol. It would have been obvious, however, to modify Wang to include an output unit that includes control logic configured to forward the receipts using well-known email and SMS message delivery protocol as taught, for example, by Drummond, thereby rendering the challenged claims obvious. Ex. 1008 at [0246]-[0251], [0301], [0307].

Motivation to Combine Wang and Drummond

114. A POSA would understand certain advantages and be motivated to use established message delivery protocols (e.g. email or SMS) to deliver transaction information such as receipts. Doing so, for example, would eliminate the need or labor required for creating novel or specialized software on the transmitting or receiving device. Using well-established protocols and associated control logic would ensure broader compatibility with devices in the field in 2005, ease of use

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for users as well as flexibility (e.g. the ability to re-forward receipts to additional recipients, like for group purchases, or for financial accounting or tax purposes).

115. Drummond discloses that it was known to use message delivery protocols (such as SMS and email) to forward receipts using known output units to notify users of a status of a transaction. Ex. 1008 at [0246]-[0251], [0301], [0307]. Forwarding the receipt using a message delivery protocol (such as SMS or email) would enable any number of devices, including computers, cellular phones, and the like, to receive such outputs using standard delivery protocols without modification, as the email and SMS message delivery protocols were common data formats that were already supported by a large array of devices, including cellular phones, such as those disclosed in Wang. Thus, email and SMS communications constitute a finite number of identified, predictable solutions for cellular communications under *KSR*. A POSA would further be motivated to use message delivery protocols such as email and SMS to forward the receipts of Wang to eliminate the need to install any specialized software on either the transmitting or receiving device. Additionally, by modifying Wang to forward the receipt using a message delivery protocol as taught by Drummond, the end user may send a record of the transaction (e.g., the receipt) to any number of conventional devices for storage and later reference. This could be helpful, for example, for tax purposes or to save receipts on a business trip for later

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reimbursement. Forwarding receipts via SMS may be particularly desirable if the system employs a firewall, as described by Drummond. Ex. 1008 at [0301].

116. Further, Drummond indicates that the use of electronic receipts that are forwarded using a message delivery protocol provides several benefits over hard copy receipts, such as by enabling the customer to: (1) choose to receive the receipt at a computer, such as their home computer (e.g., pc), work computer, mobile phone, pager, PDA, other hand-held or portable computing device, or another device capable of receiving a message; (2) determine the level of information in the receipt; and (3) send additional receipt copies to additional selected systems and system addresses (e.g., a receipt may be sent to an associate or a party to a business transaction as an indication that a deposit or payment on a loan was made). *Id*. at [0246]-[0251], [0301], [0307]. For at least these reasons, a POSA would be motivated to modify Wang to forward its receipt outputs using a message delivery protocol as taught by Drummond.

117. As I show below, Claim 19 is obvious over Wang in view of Drummond.

Independent Claim 19

Claim 19	**Wang (Ex. 1004) and Drummond (Ex. 1008)**
[Preamble 19] 19. An apparatus for providing a secure transaction, the apparatus comprising:	*See* Ground 1, Preamble 1 analysis.
[19a-f]	*See* Ground 1, Elements 1a-f analysis.

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Claim 19	Wang (Ex. 1004) and Drummond (Ex. 1008)
[19g] an output unit configured to forward the output generated by the processor, wherein	Drummond discloses output units configured to forward the output (receipts) generated by the processor via email or SMS. Ex. 1008 at [0247] (e.g., "host computer"), [0301], FIG. 65 (e.g., device 912).
[19h] the output unit includes control logic configured to forward the output using a **message delivery protocol**.	"presenting the electronic receipt over the phone" Ex. 1004 at [0115]. "establishing the connection between the cellular phone and the receipt printer" *Id*. "The receipt may be...in the form of an e-mail message sent to one or more e-mail addresses...[and] may also be a text message sent to a phone number of a mobile phone, pager, PDA, or other portable computing device." Ex. 1008 at [0247], [0301]. A POSA would understand that an output unit for sending email or text would require "control logic."[23] A POSA would understand that sending e-mail and text messages requires using **message delivery protocol**.[24]

Element 19h: A POSA would understand that an output unit for sending email or text requires "Control Logic"

118. A POSA familiar with computer architecture design in 2005 would be familiar with how computing devices operate using control logic. In the context of computing devices, control logic is a familiar term for the functionality responsible for managing the execution of instructions and the overall operation of

[23] *See* paragraphs 118 - 123.

[24] *See* paragraphs 124 - 126.

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the processor. Control logic interprets commands from the software and translates them into actions performed by the hardware components of the device.

119. Under one commonly understood definition, control logic can take the form of Microcode: a layer of hardware-level instructions or data structures involved in the application of higher-level machine code instructions in many computers. In the context of computing devices, control logic is a familiar term for the functionality responsible for managing individual execution units within a processor. For example, control logic governs the functionality of processor ALU (Arithmetic Logic Unit) or of a branch control unit that tells a processor when to continue with the next sequential instruction or conditionally branch to another instruction. Control logic is used to create low-level type of programming instructions for these functional units known as microcode or microinstructions. The control logic itself translates low-level instructions into specific electrical signals (known as control signals) that activate the respective digital circuits. In the well-known computing textbook *Computer Organization and Design: the Hardware/Software Interface*, Patterson and Hennessy explain:

> [T]hink of the set of control signals that must be asserted in a state as instructions to be executed by the datapath…called *microinstructions*….
>
> …

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> Designing the control as a program that implements the machine instructions in terms of simpler microinstructions is called *microprogramming*….The microprogram is a symbolic representation of the control that will be translated by a program to control logic.

Ex. 1019 at 3-4.

120. A POSA familiar with computer architecture design in 2005 would be familiar with how all computer processors are managed, at the most fundamental level, by control logic. In the book *Elements of Computing Systems* (2005), Noam Nisan explains that a CPU design is incomplete without control logic, stating:

> [T]he CPU's control logic [is] designed to perform the following tasks:
>
> Instruction decoding: Figure out what the instruction means (a function of the instruction).
>
> Instruction execution: Signal the various parts of the computer what they should do in order to execute the instruction (a function of the instruction).
>
> Next instruction fetching: Figure out which instruction to execute next (a function of the instruction and the ALU [Arithmetic Logic Unit] output).

Ex. 1033 at 3. *See also* Ex. 1019 at 3-4. In view of the foregoing, a POSA would also understand that arithmetic operations are essential to a processor's ability to perform encryption functions to create digital signatures or to tabulate prices in the generation of a receipt.

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121. Further to the application of control logic in Wang. The Wang patent discloses that "[i]f access to user identification data 302 is desired, e.g., to approve a transaction, the access can only be made by encryption logic block" and describes how the user can "sign the receipt electronically." Ex. 1004 at [0050], [0115]. While Wang does not explicitly mention control logic, a POSA would understand that any computing device executing such processes inherently relies on control logic. Simply put, there is no way for a computing device to function without control logic.

122. A POSA would appreciate that the Control logic in the context of Wang would be responsible for:

1. Executing Instructions: Performing the necessary steps to encrypt and sign the receipt using the user's private key.
2. Managing Data Flow: Ensuring that the digitally signed receipt is correctly processed and forwarded.
3. Interfacing with Output Units: Handling the communication between the processor and the output units (e.g., for forwarding the signed receipt).

123. Wang discloses that an output, e.g., a digitally signed receipt, may be forwarded. Ex. 1004 at [0115]. As a practical matter, in view of the foregoing, a POSA would appreciate that computing devices operate using control logic. Thus, a POSA would understand that the output unit of Wang includes control logic for implementing the forwarding of the output. *Id*. A POSA would similarly

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understand that to send email or SMS receipts, as described by Drummond, would similarly require control logic with instructions for doing so. Ex. 1008 at [0246]-[0251], [0301], [0307].

Element 19h: Sending an email/text requires message delivery protocol

124. In 2005, the SMS was explained as follows: "Short message service (SMS) is a service available on most digital mobile phones that permits the sending of short messages (also known as SMSes, text messages, messages, or more colloquially texts or even txts) between mobile phones, other handheld devices and, even, fixed-line phones." Ex. 1030 at 1. SMS relies on an underlying protocol that constrains the length of text messages: Messages are sent with a "message payload is 140 bytes: either 160 7-bit characters, 140 8-bit characters, or 70 2-byte characters." *Id*.

125. Email was and remains an alternate form of messaging protocol available to popular mobile devices of the era. E-mail messaging from phones, as popularized by NTT Docomo's i-mode and the RIM BlackBerry, also typically use standard mail protocols such as SMTP over TCP/IP.

126. Email and text messaging (SMS) are two examples of message delivery protocols implemented at the application layer of communication networks. Sending email depends on an implementation of the internet standard SMTP email protocol as originally described in RFC 788 (November 1981) by J. Postel: "The

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objective of Simple Mail Transfer Protocol (SMTP) is to transfer mail reliably and efficiently. SMTP is independent of the particular transmission subsystem and requires only a reliable ordered data stream channel." Ex. 1032 at 3.

127. As I show below, claim 20 is obvious over Wang in view of Drummond.

Dependent Claim 20

Claim 20	**Wang (Ex. 1004) and Drummond (Ex. 1008)**
20. The apparatus of claim 19 wherein the message delivery protocol includes the Short Message Service.	*See* Ground 3, Elements 19g-h. "electronic receipt may also be a text message sent to a phone number of a mobile phone" Ex. 1008 at [0247], [0301]. The receipt may be sent "using the SMS protocol." *Id*. at [0301].

128. As I show below, Claim 21 is obvious over Wang in view of Drummond.

Dependent Claim 21

Claim 21	**Wang (Ex. 1004) and Drummond (Ex. 1008)**
21. The apparatus of claim 19 wherein the message delivery protocol includes email.	*See* Ground 3, Elements 19g-h. "receipt may be...in the form of an e-mail message sent to one or more e-mail addresses" Ex. 1008 at [0247].

129. As I show below, Claim 39 is obvious over Wang in view of Drummond.

Independent Claim 39

Claim 39	**Wang (Ex. 1004) and Drummond (Ex. 1008)**
39. A method of providing secure transaction, the method comprising:	*See* Ground 1, Preamble 23 analysis.

Claim 39	Wang (Ex. 1004) and Drummond (Ex. 1008)
Elements 39a-f	*See* Ground 1, Elements 23a-f analysis.
forward the generated output to the user using a message delivery protocol.	*See* Ground 3, Elements 19g-h. "receipt may be...in the form of an e-mail message sent to one or more e-mail addresses...may also be a text message sent to a phone number of a mobile phone, pager, PDA, or other portable computing device." Ex. 1008 at [0247], [0301].

130. As I show below, Claim 40 is obvious over Wang in view of Drummond.

Dependent Claim 40

Claim 40	Wang (Ex. 1004) and Drummond (Ex. 1008)
40. The method of claim 30 wherein the message delivery protocol includes the Short Message Service.	*See* Ground 3, Claim 20.

131. As I show below, Claim 41 is obvious over Wang in view of Drummond.

Dependent Claim 41

Claim 41	Wang (Ex. 1004) and Drummond (Ex. 1008)
41. The method of claim 39 wherein the message delivery protocol includes email.	*See* Ground 3, Claim 21.

D. GROUND IV: Claims 8 and 30 are obvious over Wang and Denso.

132. It is my opinion that Claims 8 and 30 are obvious over Wang (Ex. 1004) in view of Denso (Ex. 1026) for the reasons that follow.

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133. As discussed above in Grounds 1 and 2, Wang describes an apparatus and method for performing secure transactions. Ex. 1004 at [0002]. After authenticating a user of the cellular phone, Wang describes that a barcode scanner of a cellular phone may be used to scan barcodes to select and lookup prices for items for a purchase transaction from a lookup table. *Id*. at [0072], [0115]. Outputs, such as electronically signed receipts (Ground 1) and transaction approval data (Ground 2) may be generated based on the information from the lookup table and from predetermined information stored on the cellular phone prior to scanning the barcodes. *Id.* at [0072]-[0083], [0115]. These outputs may be forwarded to a user and may be digitally signed. *Id*. at [0108], [0112], [0115], [0123]. Wang does not, however, disclose that the barcode is a multi-dimensional barcode. It would be obvious, however, to modify Wang to use a multi-dimensional barcode as taught by Denso for the reasons discussed below. Ex. 1026 at [0013].

Motivation to Combine Wang and Denso

134. Both barcodes and QR codes rely on an optical sensors ability to detect visible 1 or 2 dimensional patterns, and decode those patterns, via a predetermined protocol to a string of numeric or alphanumeric characters. The larger or more detailed the pattern, or the more dimensions, the more characters can be encoded. A barcode enables the display of a single row of symbols, whereas a 2-

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dimensional encoding such as a QR code format, enables multiple rows of symbols, enabling more information to be encoded and conveyed to a reader. The most common well-known standard of barcodes is the UPC code which enables the representation of 12 numerical digits. The digits in industry standard barcodes are typically mapped to specific product SKU numbers. A POSA implementing any scheme where additional information beyond product SKUs, such as customer information, storeID, or other more detailed transaction data, would be motivated to choose a multi-dimensional barcode as taught by Denso.

135. Wang discloses that a barcode may be used to store information useable as an index to lookup an item price. Ex. 1004 at [0115]. Denso discloses that it was well known to use barcodes and multi-dimensional barcodes interchangeably to serve as an information code. Ex. 1026 at [0013]. The use of a two-dimensional barcode in place of a standard barcode would enable more data to be encoded within the same space, as the use of two-dimensions increases the data density of the image. The additional data capacity would not only support a greater amount of data, but would also support additional types of data, such as uniform resource locators (URLs), binary codes, and structured data. Multi-dimensional barcodes provide other benefits over standard barcodes, such as supporting error-correction that enables the multi-dimensional barcode to be read even if a portion of the barcode is stained or missing and the ability to be read at various angles. For at

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least these reasons, a POSA would be motivated to modify Wang to use a multi-dimensional barcode as the barcode as taught by Denso.

136. The following claim charts demonstrate how Claims 8 and 30 are obvious over Wang in view of Denso.

Dependent Claims 8, 30

Claims 8, 30	**Wang (Ex. 1004) and Denso (Ex. 1026)**
8. The apparatus of claim 7 wherein the barcode includes a multi-dimensional barcode. 30. The method of claim 29 wherein the barcode includes a multi-dimensional barcode.	"**barcode**" Ex. 1004 at [0115] **"an information code such as a barcode or a two-dimensional code**." Ex. 1026 at [0013].

E. GROUND V: Claim 13 is obvious over Wang and Raines.

137. Claim 13 is obvious over Wang (Ex. 1004) in view of Raines (Ex. 1009), as explained below.

138. As discussed in Ground 2, Wang discloses all of the features of Claim 1. Wang discloses that the transaction approval data (output) includes user identification data and transaction data. Ex. 1004 at [0045], [0051]. Wang does not, however, explicitly disclose that the transaction approval data includes information relating to a payment card account. It would have been obvious, however, to modify Wang to include an account number and expiration date of a

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credit card in its transaction approval data as taught, for example, by Raines, thereby rendering the challenged claims obvious.

Motivation to Combine Wang with Raines

139. Wang discloses that transaction approval data (e.g., an output) is generated based on and includes user identification data and transaction data. Ex. 1004 at [0051]. Wang discloses that user's data from the user (e.g., user-supplied data) includes a credit card number and that the user-supplied data may be stored on the PEAD. Ex. 1004 at [0093]. Raines discloses that it was known to include the account number and expiration date of the credit card in transaction information, as this information is necessary for a credit card transaction to be processed. Ex. 1009 at [0008].

140. Credit card numbers and expiration data are included in transaction approval when authorization requests are sent by a merchant to a card network for approval (ISO 8583, message type 0100). Ex. 1020 at 83. The credit card number (Primary Account Number or PAN) is part of the information required for a credit card processing network like Visa or Mastercard to route an authorization request to the cardholder's appropriate card-issuing bank for authorization. *Id*. A card-issuing bank uses the credit card number to identify their specific cardholder's account in question for the transaction. A card-issuing bank will also validate the provided expiration date as a factor in verifying the legitimacy of the transaction.

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141. In response to an authorization request message (ISO 8583 message type 0110), a merchant would receive back a transaction message including data indicating an approval or a decline but not including an expiration date. *See* ISO 8583-1:2003 (now withdrawn), Ex. 1020 at 83, Table 28.

142. Without the inclusion of the credit card number in the transaction data, the purchase transaction using the PEAD could not be completed. Therefore, a POSA would be motivated to modify Wang to include the previously stored credit card number as transaction data in the transaction approval data (output) as taught by Raines to enable the transaction to be completed.

143. The following claim chart shows how the features of Claim 13 are disclosed or rendered obvious by Wang in view of Raines.

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Dependent Claim 13

Claim 13	Wang (Ex. 1004) and Raines (Ex. 1009)
13. The apparatus of claim 1 wherein the predetermined information includes information relating to a payment card account; and	Wang recognizes that credit cards may be used for the transaction. Ex. 1004 at [0093]. Wang states that the transaction approval data includes "transaction data." *Id*. at [0051]. A POSA would appreciate that transaction data would include information relating to a payment card account to the extent a card was used for the transaction. *Id*. Wang discloses that "user's data from the user" (e.g., user-supplied data) includes "a credit card number" and that "user-supplied data may be stored on the PEAD." *Id*. at [0093], [0098]. "[A] merchant must collect a variety of data associated with the transaction" including "the account number and expiration date of the credit card" and "the merchant transmits the transaction data." Ex. 1009 at [0008].
wherein the output further includes some or all of the information relating to the payment card account to be used for payment with respect to the transaction.	A POSA would recognize that for a transaction funded with a card account, the transaction approval data (output) in Wang would include some or all such credit card information as relevant "transaction data."[25] Ex. 1004 at [0051].

Wang's transaction approval data would include credit card information as relevant "transaction data."

144. Wang describes a transaction program (TP), provided by a merchant, installed and running on a user's device. Ex. 1004 at [0088]-[0102]. Wang describes the TP application as performing functions "for the user's input approval, and/or authentication." *Id*. at [0091]. A POSA would understand this as

[25] *See* paragraph 144.

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a case where a merchant app, running on a user's phone, authenticates the legitimate identity of the user and solicits the approval of the user to a transaction. A POSA would understand that these actions would be sufficient to initiate a purchase but that further steps would be required to initiate and complete a corresponding credit card transaction. Initially, only the merchant's mobile app itself (e.g., Wang's TP), running locally on the user's device would be aware that the user had authorized a transaction and the specific order details. A POSA would find it obvious that the TP would need to generate an external output to inform the merchant of the successful authentication and user approval. Further, that output would need to include sufficient transaction data (such as specific order details or unique order identifier) for the merchant to know what order details would need to be fulfilled. To process a credit card transaction, additional transaction data required would include a credit card number and expiration date. These data elements were required by credit card networks for credit card authorization requests. *See generally* Ex. 1020. For these reasons, Wang's transaction approval data would include credit card information as relevant "transaction data."

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F. GROUND VI: Claims 1, 4, 5, 7, 23, 26, 27, 29, and 43 are obvious over TAO in view of PTM and Wang.

145. Claims 1, 4, 5, 7, 23, 26, 27, 29, and 43 are obvious over TAO (Ex. 1005) in view of PTM (Ex. 1006) and Wang (Ex. 1004), as explained below and in the following claim charts.

146. As discussed above, TAO describes an apparatus and method for performing secure transactions. Ex. 1005 at 1-3. A user may scan in products using a barcode scanner of a cellular phone, such as the Palm Treo, which may add the products to an order. *Id*. Predetermined information about standard discounts is stored on the cellular phone and may be selected and added to the order. *Id*. The order may be generated by the cellular phone and forwarded to a user. *Id*. TAO does not expressly disclose that the cellular phone includes a memory, a processor, or an input device for verifying the user based on input information, or that the output includes a digital signature to be used to signify authorization by the user with respect to the transaction. It would have been obvious, however, to modify TAO to include such features—which were well-known to be present on the Palm Treo device—for the reasons discussed below, thereby rendering the challenged claims obvious.

Motivation to Combine TAO with PTM and Wang

147. Although it suggests it, TAO does not explicitly disclose a memory that stores predetermined information. Instead, TAO discloses that standard discounts

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may be stored on the device and that its software may be used on the Palm Treo cellular phone. Ex. 1005 at 1-3. PTM indicates that the Palm Treo includes internal memory, which may store various information. Ex. 1006 at 112. A POSA would recognize that a cellular phone as disclosed by TAO would require a memory to properly function, to store the software for use by the cellular phone, and to store the standard discounts referenced in TAO. Additionally, the use of an internal memory would enable the software to store standard discounts and customer data, such as the name and address, on the internal memory to enable quicker order generation by eliminating the need to enter such data by hand. For at least these reasons, a POSA would be motivated to modify TAO to store the predetermined information in the memory of a cellular phone as taught by PTM.

148. TAO also fails to explicitly disclose an input device for receiving input information and verifying the user based on the input information, but TAO discloses that its software may be used on the Palm Treo cellular phone, which includes a keyboard (an input device). PTM indicates that the Palm Treo includes a keyboard and a system lock that requires input of a password to verify the user to access data on the device. Ex. 1006 at 24, 129. Use of a keyboard to enter a password for a system lock as taught by PTM would enable the user to restrict access to the handheld device to only authorized users, thereby enhancing security and protecting customer data stored on the device. More specifically, the use of a

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password would prevent unauthorized users from attempting to generate unauthorized orders using the cellular phone. Additionally, the requirement of a password to access TAO's device would add a level of trust between the merchant and customer, as both parties would have assurance that the user conducting the transaction on the handheld device was an authorized user. For at least these reasons, a POSA would be motivated to modify TAO to include a keyboard (e.g., input device) and require a password for authentication as taught by PTM.

149. TAO also fails to explicitly disclose a processor. Here too, TAO discloses that its software may be used on the Palm Treo cellular phone. Ex. 1005 at 1-3; Ex. 1034 at 5-6. PTM indicates that the Palm Treo includes a processor. Ex. 1006 at 173. A POSA would recognize that the cellular phone disclosed by TAO would require a processor to properly function and to execute the software installed on the cellular phone to facilitate the generation of orders (outputs). For at least these reasons, a POSA would be motivated to modify TAO to include a processor as taught by PTM.

150. TAO also fails to explicitly disclose that the output includes a digital signature to be used to signify authorization by the user with respect to the transaction. A POSA would understand that there are multiple senses in which signatures are essential to the workflow involved in order processing and completing transactions.

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151. For example, manual signatures were a standard requirement for the approval of purchase orders and payments before the widespread adoption of digital signature technology. The practice of requiring signatures ensured that transactions were authorized by the correct responsible parties, maintaining the integrity and accountability of financial operations.

152. By 2005 a POSA would be motivated to employ digital signatures to these workflows. By enabling electronic approvals, businesses could reduce the need for physical paperwork, and expediting the procurement process. As documented in "Applied Cryptography" by Bruce Schneier, digital signatures not only facilitate secure transactions but also provide a legal framework for electronic commerce by ensuring that signed documents are legally binding and enforceable. Ex. 1017 at 74-73.

153. Digital signatures were valuable in common purchasing workflows due to their ability to ensure the authenticity, integrity, and non-repudiation of electronic documents. Digital signatures provided a secure and efficient method for verifying the identity of the signer and confirming that the contents of the purchase order had not been altered after signing. According to the National Institute of Standards and Technology (NIST) in their Digital Signature Standard (DSS) publication, digital signatures authenticate the signer and bind their identity to the document, which is crucial for the approval process of purchase orders. (NIST FIPS PUB

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140-2 SECURITY REQUIREMENTS FOR CRYPTOGRAPHIC MODULES, Ex. 1031 at 5 (2000)).

154. In 2005 it was well understood by the general public as well as by persons skilled in the art, that retail transactions performed with credit cards required the user to sign a receipt. According to one source: "When a purchase is made, the credit card user indicates his/her consent to pay, usually by signing a receipt with a record of the card details and indicating the amount to be paid." Ex. 1024 at 1.

155. Addressing the prior art, TAO discloses outputting an electronic order (e.g., a record of a purchase transaction, or a receipt), while Wang discloses that electronic receipts may include electronic signatures. Ex. 1004 at [0115]. Wang discloses that electronic signatures may be generated by appending identification data (such as private keys) onto the receipt. *Id*. at [0051], [0108], [0112], [0123]. The inclusion of an electronic signature on a receipt would allow the receiving party, such as a merchant, to identity and authenticate the party sending the order. As taught by Wang, access to private keys for electronic signatures may be accessed only after successful authentication of the user. *Id*. at [0123]. The authentication of the user and subsequent electronic signature accompanying the receipt therefore provides assurance of the identity of the device user to other parties (including a payment processor) in e-commerce transactions who

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otherwise cannot verify the identity of the device user due to the online nature of the purchase.

156. The same purpose and benefit would apply to digitally signing the orders described in TAO. Thus, for at least these reasons, a POSA would be motivated to modify TAO to modify the order (output) to have a digital signature as taught by Wang, i.e., to verify that the order was created by an authorized user.

157. Concerning Claims 4 and 26, TAO fails to explicitly disclose that the input information includes one of a personal identification number and biometric information. TAO discloses that its software may be used on cellular phones, such as the Palm Treo cellular phone, which includes a system lock that requires input of a password to access data on the device, as evidenced by PTM. Ex. 1005 at 1-3; Ex. 1006 at 129. Wang discloses that it was known to use biometrics (such as fingerprints, voice prints, or other biometrics) to authenticate a user of a cellular phone. Ex. 1004 at [0072]. Use of biometrics, rather than just a password, would enhance the security of the device and transactions performed using the device. More specifically, as disclosed in Wang, the use of biometrics provides more complicated and elaborate authentication data than a simple password and make it harder for an unauthorized user to access and utilize the TAO device. *Id*. at [0045]. Biometrics, such as voice prints, would be possible using existing hardware of a cellular phone, such as a Treo, and would also provide enhanced

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security over a password alone. For at least these reasons, a POSA would be motivated to modify TAO to utilize a biometric as input information as taught by Wang.

158. As I show below, Claim 1 is obvious over TAO in view of PTM and Wang.

Independent Claim 1

Claim 1	**TAO (Ex. 1005), PTM (Ex. 1006), and Wang (Ex. 1004)**
[Preamble 1] 1. An apparatus for providing a secure transaction, the apparatus comprising:	"the **handheld tool**" is an apparatus. Ex. 1005 at 1. "**Taking orders from customers**...." is a transaction. *Id*. "Our software runs on…PalmOS…and is licensed for use on **handheld devices made by palmOne (including the Treo…).**" Ex. 1005 at 3. The Treo "[r]equires a password to see any data…" indicating that it is **secure**. Ex. 1006 at 24, 129. Wang discloses an apparatus for providing a **secure** transaction. "portable electronic authorization devices (PEADs) which eliminate the **security risks** associated with…approving **transactions**..." Ex. 1004 at [0002].
[1a] an image capture device configured to capture an image, the image having information embedded therein including information relating to a transaction;	"**barcode-scanning capability**..., a PalmOS handheld equipped with **a barcode scanner**." Ex. 1005 at 3. "**point the scanner at the product, press the scan button**, and the item is added to the order!" *Id*. at 2. A barcode scanner is an image capture device. TAO discloses an image capture device that captures an image (e.g., a barcode) that has information embedded therein (e.g., a pointer that identifies an item of a product catalog) that is usable for a purchase transaction.
[1b] a memory configured to store	"Our software runs on the Palm operating system….and is licensed for use on handheld devices made by palmOne **(including the Treo…).**" Ex. 1005 at 3.

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Claim 1	TAO (Ex. 1005), PTM (Ex. 1006), and Wang (Ex. 1004)
predetermined information;	"If that customer has a standard discount, the order will be automatically set to indicate that." *Id*. at 2. The standard discount is "predetermined information." The Palm Treo has an "**internal memory"** and a POSA would understand that the standard discount information is stored in memory in order to be "automatically set to indicate that" as indicated by TAO.[26] Ex. 1006 at 97, 109, 112.
[1c] an input unit configured to receive input information provided by a user;	"use on handheld devices made by palmOne (including the Treo" Ex. 1005 at 3. The Treo has a "**keyboard**," which is an input unit, and "[r]equires a password to see any data…." Ex. 1006 at 24, 129. A password is input information.
[1d] a processor configured to:	"use on handheld devices made by palmOne (including the Treo" Ex. 1005 at 3. "144 MHz Texas Instruments OMAP (ARM) **processor**." Ex. 1006 at 73. The Treo has a processor and a POSA would recognize that, like other handheld devices, the processor is configured to perform the various functions of the device.
[1e] verify the user based on the input information to ensure that the user is authorized to use the apparatus; and	"use on handheld devices made by palmOne (including the Treo…." Ex. 1005 at 3. "Requires a **password to see any data….**" Ex. 1006 at 129.
[1f] generate an output based on the information embedded in the	"point the scanner at the product, **press the scan button, and the item is added to the order**!" Ex. 1005 at 1.

[26] *See* paragraphs 159 - 162.

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Claim 1	TAO (Ex. 1005), PTM (Ex. 1006), and Wang (Ex. 1004)
image and the predetermined information; and	"If that customer has a standard discount, the order will be automatically set to indicate that…." *Id*. at 2. The order is an output generated by the handheld device based on the information embedded in the image (e.g., the barcode), which is used to add items to the order and the predetermined information (e.g., the standard discount).
[1g] an output unit configured to forward the output generated by the processor, wherein	"the order and summary information are transferred to your desktop…." Ex. 1005 at 3. The order (e.g., output) is forwarded by an output unit of the handheld device to a desktop computer.
[1h] the output includes a digital signature to be used to signify authorization by the user with respect to the transaction.	"As a further example, the PEAD may be employed to 'sign' any computer file for authentication purposes (e.g., to authenticate the date or the user)." Ex. 1004 at [0085]. A POSA would understand from TAO in view of Wang that the order of TAO may include a digital signature, as described in Wang, to provide verification that the order was created by an authorized user.[27]

The standard discount information would be stored in internal memory.

159. A POSA would appreciate that for the software on the Palm Treo to have been configured ("automatically set") to perform discount calculations, the instructions to do so must have been previously stored on the internal memory. A POSA would understand that the pricing and discount data also would also be stored in advance on the device. At a minimum, however, the processing instructions must have been stored locally in memory in advance. Those

[27] *See* paragraphs 150 - 156.

instructions would include control logic for the device processor to look up discount data from local memory storage or to dynamically look up the same data from a remote computer database.

160. Pre-storing discount information on the device would have the advantage of enabling calculation of pricing quickly and locally on the mobile device, with or without the availability of a reliable network connection. *See* Oracle Mobile Application Foundation (2003), Ex. 1021, at 11-12. A person experienced in developing mobile software in 2005 would understand that network coverage is not always reliable in speed or availability. Therefore, pre-storing information on devices adds user reliability and user convenience. Alternately, pricing or pricing discounts could be looked up dynamically from a central database managed by the merchant. This look up approach adds convenience for a merchant by helping to ensure that devices are referring to most current pricing or discount tables, or to enable more dynamic pricing. A POSA also would understand that these two approaches are not mutually exclusive, and that in either case the instructions and control logic on how, where, and when to look up discount data would have to have been preconfigured and stored locally on the device, in order for this process to be able to execute "automatically."

161. In mobile devices, applications are typically stored in flash memory, a type of non-volatile storage that retains data even when the device is powered off.

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Flash memory offers the durability and reliability needed for mobile environments, allowing applications and system software to be stored persistently. Flash memory provides a stable storage medium that can withstand numerous read and write cycles, making it ideal for storing applications that need to be readily accessible on a mobile device. *See* US Pat. No. 5,404,485 (Ban), Ex. 1022, at Abstract, 3:51-4:10.

162. At runtime, the processor accesses these stored applications by loading the necessary instructions and data from flash memory into short-term memory or RAM (Random Access Memory). This process is necessary for execution, as the processor operates much faster when using data stored in RAM. Programming instructions are themselves a form of stored short data sequences which can be decoded by the processor into individual instructions. As detailed by Hennessy and Patterson (1990), the fetch-decode-execute cycle begins with the processor fetching instructions from memory, which, in the case of mobile devices, involves reading from flash memory initially and transferring the data to RAM for quicker access. Ex. 1023 at 3. This allows the device to execute the applications efficiently, leveraging the faster access speeds of RAM while maintaining the persistent storage benefits of flash memory. In view of the foregoing, a POSA would appreciate that the discount information disclosed in TAO would be stored in its internal memory. To the extent that this feature is not expressly disclosed in

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TAO, it would be obvious to modify TAO to store the discount information in the Palm Treo internal memory for the reasons discussed above.

163. As I show below, Claim 4 is obvious over TAO in view of PTM and Wang.

Dependent Claim 4

Claim 4	**TAO (Ex. 1005), PTM (Ex. 1006), and Wang (Ex. 1004)**
Element 4	"use on handheld devices made by palmOne (including the Treo" Ex. 1005 at 3. "Requires a **password** to see any data…." Ex. 1006 at 129. "require **the user to enter a password, to furnish fingerprints or a voice print, or other biometrics**" Ex. 1004 at [0073].

164. As I show below, Claim 5 is obvious over TAO in view of PTM and Wang.

Dependent Claim 5

Claim 5	**TAO (Ex. 1005), PTM (Ex. 1006), and Wang (Ex. 1004)**
5. The apparatus of claim 1 wherein the output unit is a display.	"the day's **sales are summarized and displayed and/or printed**." Ex. 1005 at 2-3. The day's sales (e.g., orders) is an output that is presented on a display.

165. As I show below, Claim 7 is obvious over TAO in view of PTM and Wang.

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Dependent Claim 7

Claim 7	TAO (Ex. 1005), PTM (Ex. 1006), and Wang (Ex. 1004)
7. The apparatus of claim 1 wherein the image includes a barcode.	"**barcode-scanning capability**...a PalmOS handheld equipped with **a barcode scanner…."** Ex. 1005 at 3. "point the scanner at the product, press the scan button, and the item is added to the order!" *Id*. at 1.

166. As I show below, Claim 23 is obvious over TAO in view of PTM and Wang.

Independent Claim 23

Claim 23	TAO (Ex. 1005), PTM (Ex. 1006), and Wang (Ex. 1004)
[Preamble 23] 23. A method of providing secure transaction, the method comprising:	*See* Ground 6, Element 1 preamble. TAO discloses a method for providing a secure transaction.
[23d] configuring a portable device to:	TAO discloses a handheld device configured to perform the steps described in TAO and outlined in this claim chart. For the device to perform the functions described in TAO, it must have been configured to do so.[28] *See also* Ground 6, Element 1d analysis. "**software runs**... **on handheld devices made by palmOne (including the Treo…)**" Ex. 1005 at 3. Software is used to configure the Palm Treo portable device to perform the various functions recited in TAO and Wang.
Element 23a-c,e,f	*See* Ground 6, Elements 1a-c,e,f analyses.

[28] *See* paragraph 167.

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Claim 23	TAO (Ex. 1005), PTM (Ex. 1006), and Wang (Ex. 1004)
[23g] forward the generated output to the user,	"the **order and summary information are transferred to your desktop**" Ex. 1005 at 3. The use of "your" indicates the output is forwarded "to the user."[29] The order (e.g., output) is forwarded by an output unit of the handheld device to a desktop computer.
[23h] wherein the output includes a digital signature to be used to signify authorization by the user with respect to the transaction.	*See* Ground 6, Element 1h.

Element 23d: The cited art discloses "configuring a device" to perform the recited steps.

167. A POSA would understand that TAO, PTM, and Wang indicate that the Palm Treo device mentioned in Take and Order and described in PTM must be configured to display the order for it to do so. That configuration would consist of: at the hardware level, specifying and assembling the device to contain a screen output device connected to the processor; at the software application level, providing instructions to the processor to visually format and display the order output on the screen.

[29] *See* paragraph 168.

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Element 23g: TAO discloses forwarding the output "to the user."

168. In the case of the TAO sales literature, the literature is drafted in the second person, with the use of "you" indicating the user of the TAO software, i.e., the merchant who is "selling products at a trade shows or expos…." Ex. 1005 at 1. To be clear, the user in TAO is the merchant—not the customer. Further, the context of TAO makes clear that the "you" or "your" in their literature refers to the seller in a merchant transaction as the user and operator of the device running their software. Thus, by indicating that "the order and summary information are transferred to <u>your</u> desktop," (emphasis added) TAO is indicating that the order is forwarded to the merchant's desktop computer. Ex. 1005 at 3. That is, the use of "your" in this passage of TAO indicates the output is forwarded "to the user."

169. As I show below, Claim 26 is obvious over TAO in view of PTM and Wang.

Dependent Claim 26

Claim 26	**TAO (Ex. 1005), PTM (Ex. 1006), and Wang (Ex. 1004)**
26. The method of claim 23 wherein the input information includes one of a personal identification number and biometric information.	*See* Ground 6, Claim 4 analysis.

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170. As I show below, Claim 27 is obvious over TAO in view of PTM and Wang.

Dependent Claim 27

Claim 27	**TAO (Ex. 1005), PTM (Ex. 1006), and Wang (Ex. 1004)**
27. The method of claim 23 further comprising: configuring the portable device to display the output.	*See* Ground 6, Claim 5 analysis. To display the order as taught by TAO, the device must be **configured** to do so.

171. As I show below, Claim 29 is obvious over TAO in view of PTM and Wang

Dependent Claim 29

Claim 29	**TAO (Ex. 1005), PTM (Ex. 1006), and Wang (Ex. 1004)**
29. The method of claim 23 wherein the image includes a barcode.	*See* Ground 6, Claim 7 analysis.

172. As I show below, Claim 43 is obvious over TAO in view of PTM and Wang.

Independent Claim 43

Claim 43	**TAO (Ex. 1005), PTM (Ex. 1006) and Wang (Ex. 1004)**
Preamble 43	*See* Ground 6, Preamble 23 analysis.
Elements 43a-g	*See* Ground 6, Elements 23a-g analysis.
Element 43h	"**software runs on...handheld devices made by palmOne (including the Treo…).**" Ex. 1005 at 3.

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Claim 43	TAO (Ex. 1005), PTM (Ex. 1006) and Wang (Ex. 1004)
	The Palm Treo is a cellular phone as indicated by its full name "Treo 600 Smartphone by PalmOne". Ex. 1006 at 1.

VIII. Conclusion

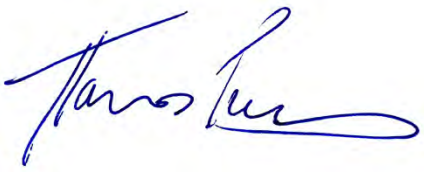
173. For the foregoing reasons, it is my opinion that Claims 1, 2, 4, 5, 7, 8, 12, 13, 17, 19-21, 23, 26, 27, 29, 30, 34, 39-41, and 43 of U.S. Patent No. 7,314,167 are neither novel nor non-obvious over the prior art of record.

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I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed on: July 29, 2024



By: _____

(Signature)

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Appendix A

U.S. PATENT NO. 7,314,167 CLAIM APPENDIX

1. An apparatus for providing a secure transaction, the apparatus comprising:	Preamble 1
an image capture device configured to capture an image, the image having information embedded therein including information relating to a transaction;	Element 1a
a memory configured to store predetermined information;	Element 1b
an input unit configured to receive input information provided by a user;	Element 1c
a processor configured to:	Element 1d
verify the user based on the input information to ensure that the user is authorized to use the apparatus; and	Element 1e
generate an output based on the information embedded in the image and the predetermined information; and	Element 1f
an output unit configured to forward the output generated by the processor, wherein	Element 1g
the output includes a digital signature to be used to signify authorization by the user with respect to the transaction.	Element 1h
2. The apparatus of claim 1 wherein the processor is further configured to	Element 2

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generate the output using the input information.	
3. The apparatus of claim 1 wherein the processor is further configured to decode the information embedded in the image for use in generating the output by using a decryption algorithm.	Element 3
4. The apparatus of claim 1 wherein the input information includes one of a personal identification number and biometric information.	Element 4
5. The apparatus of claim 1 wherein the output unit is a display.	Element 5
6. The apparatus of claim 1 wherein the output is provided to a verifier, the verifier having access to the information embedded in the image.	Element 6
7. The apparatus of claim 1 wherein the image includes a barcode.	Element 7
8. The apparatus of claim 7 wherein the barcode includes a multi-dimensional barcode.	Element 8
9. The apparatus of claim 1 wherein the image includes a set of barcodes.	Element 9
10. The apparatus of claim 9 wherein the set of barcodes includes a set of multi-dimensional barcodes.	Element 10
11. The apparatus of claim 1 wherein the output includes an authentication code to be used to authenticate the user with respect to the transaction.	Element 11

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12. The apparatus of claim 1 wherein the transaction includes an online transaction.	Element 12
13. The apparatus of claim 1 wherein the predetermined information includes information relating to a payment card account; and	Element 13a
wherein the output further includes some or all of the information relating to the payment card account to be used for payment with respect to the transaction.	Element 13b
14. The apparatus of claim 1 wherein the information embedded in the image includes information relating to a password to be used to unlock a secured document; and	Element 14a
wherein the output includes the password to be used to unlock the secured document.	Element 14b
15. The apparatus of claim 1 wherein the information embedded in the image includes information relating to a challenge; and	Element 15a
wherein the output includes a password to be used to satisfy the challenge and unlock a secured document.	Element 15b
16. The apparatus of claim 1 wherein the information embedded in the image includes information provided by a vendor relating to a pending transaction; and	Element 16a

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wherein the output includes some or all of the information provided by the vendor to be used to alert the user with respect to the pending transaction.	Element 16b
17. The apparatus of claim 1, wherein the apparatus is a cellphone.	Element 17
18. The apparatus of claim 1, wherein the apparatus includes a smartcard claim 1.	Element 18
19. An apparatus for providing a secure transaction, the apparatus comprising:	Preamble 19
an image capture device configured to capture an image, the image having information embedded therein;	Element 19a
a memory configured to store predetermined location;	Element 19b
an input unit configured to receive input information provided by a user;	Element 19c
a processor configured to:	Element 19d
verify the user based on the input information to ensure that the user is authorized to use the apparatus; and	Element 19e
generate an output based on the information embedded in the image and the predetermined information; and	Element 19f
an output unit configured to forward the output generated by the processor, wherein	Element 19g

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the output unit includes control logic configured to forward the output using a message delivery protocol.	Element 19h
20. The apparatus of claim 19 wherein the message delivery protocol includes the Short Message Service.	Element 20
21. The apparatus of claim 19 wherein the message delivery protocol includes email.	Element 21
22. The apparatus of claim 19 wherein the message delivery protocol includes the Extended Message Service.	Element 22
23. A method of providing secure transaction, the method comprising:	Preamble 23
configuring a portable device to:	Element 23d[30]
capture an image, the image having information embedded therein, the information embedded in the image including information relating to a transaction;	Element 23a
store predetermined information;	Element 23b
receive input information provided by a user;	Element 23c

[30] In the claim appendix and claim charts, sub-elements a-h of claim 23 are out of order so that the claim 23 sub-elements correspond to similar sub-elements of claim 1.

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verify the user based on the input information to ensure that the user is authorized to use the portable device;	Element 23e
generate an output based on the information embedded in the image and the predetermined information; and	Element 23f
forward the generated output to the user,	Element 23g
wherein the output includes a digital signature to be used to signify authorization by the user with respect to the transaction.	Element 23h
24. The method of claim 23 further comprising: configuring the portable device to generate the output using the input information.	Element 24
25. The method of claim 23 further comprising: configuring the portable device to decode the information embedded in the image for use in generating the output by using a decryption algorithm.	Element 25
26. The method of claim 23 wherein the input information includes one of a personal identification number and biometric information.	Element 26
27. The method of claim 23 further comprising:	Element 27

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configuring the portable device to display the output.	
28. The method of claim 23 wherein the output is provided to a verifier, the verifier having access to the information embedded in the image.	Element 28
29. The method of claim 23 wherein the image includes a barcode.	Element 29
30. The method of claim 29 wherein the barcode includes a multi-dimensional barcode.	Element 30
31. The method of claim 23 wherein the image includes a set of barcodes.	Element 31
32. The method of claim 31 wherein the set of barcodes includes a set of multi-dimensional barcodes.	Element 32
33. The method of claim 23 wherein the output represents an authentication code to be used to authenticate the user with respect to the transaction.	Element 33
34. The method of claim 23 wherein the transaction includes an online transaction.	Element 34
35. The method of claim 23 wherein the predetermined information includes information relating to a payment card account; and	Element 35a
wherein the output further includes some or all of the information relating to the payment card account to be used	Element 35b

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for payment with respect to the transaction.	
36. The method of claim 23 wherein the information embedded in the image includes information relating to a password to be used to unlock a secured document;	Element 36a
and wherein the output includes the password to be used to unlock the secured document.	Element 36b
37. The method of claim 23 wherein the information embedded in the image includes information provided by a vendor relating to a pending transaction; and	Element 37a
wherein the output includes some or all of the information provided by the vendor to be used to alert the user with respect to the pending transaction.	Element 37b
38. The method of claim 23 wherein the information embedded in the image includes information relating to a challenge;	Element 38a
wherein the output includes a password to be used to satisfy the challenge and unlock a secured document.	Element 38b
39. A method of providing secure transaction, the method comprising:	Preamble 39
configuring a portable device to:	Element 39a
capture an image, the image having information embedded therein;	Element 39b

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store predetermined information;	Element 39c
receive input information provided by a user;	Element 39d
verify the user based on the input information to ensure that the user is authorized to use the portable device;	Element 39e
generate an output based on the information embedded in the image and the predetermined information; and	Element 39f
forward the generated output to the user using a message delivery protocol.	Element 39g
40. The method of claim 30 wherein the message delivery protocol includes the Short Message Service.	Element 40
41. The method of claim 39 wherein the message delivery protocol includes email.	Element 41
42. The method of claim 39 wherein the message delivery protocol includes the 5 Extended Message Service.	Element 42
43. A method of providing secure transaction, the method comprising:	Preamble 43
configuring a portable device to:	Element 43a
capture an image, the image having information embedded therein;	Element 43b
store predetermined information;	Element 43c
receive input information provided by a user;	Element 43d

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verify the user based on the input information to ensure that the user is authorized to use the portable device;	Element 43e
generate an output based on the information embedded in the image and the predetermined information; and	Element 43f
forward the generated output to the user,	Element 43g
wherein the portable device includes one of a cell phone, a personal digital assistant, and a smartcard.	Element 43h

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APPENDIX B

Exhibit	Description
1001	U.S. Pat. No. 7,314,167 B1
1002	Declaration of Thomas Purves
1003	Prosecution History of the ’167 Patent
1004	Wang (US Pub. No. 2002/0023215 A1)
1005	Take an Order (TAO)
1006	Palm Treo Manual (PTM)
1007	Oxford Dictionary: “predetermined”
1008	Drummond (US Pub. No. 2003/0217005 A1)
1009	Raines (US Pub. No. 2004/0193538 A1)
1010	Internet Archive Declaration (July 16, 2024)
1011	Palm Sales Article
1012	Comparison of Wang Ex. 1004 to US Pat. No. 5,917,913
1013	Stevens Creek Software Awards website
1014	Visa 3-D Secure System Overview
1015	Predko, Programming and Customizing the 8051 Microcontroller (1999).
1016	Reserved
1017	Schneier (1996), “Applied Cryptography”
1018	2005 Wikipedia entry: “Digital Signature”
1019	Patterson, “Computer Organization and Design: The Hardware/Software Interface” (1993)

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1020	ISO 8583-1:2003
1021	Oracle Mobile Application Foundation (2003)
1022	Ban (US Pat. No. 5,404,485)
1023	Hennessy, *Computer Architecture: A Quantitative Approach* (2003)
1024	2005 Wikipedia entry: "Credit Card"
1025	Pogue, "The Awkward Smart Phone Grows Up," *New York Times* (June 30, 2005)
1026	JP4396018B2 (Denso) (with translation)
1027	US Pat. No. 5,917,913 (Wang II)
1028	"Seiko Instruments…" *Business Wire* (2000)
1029	"SiPix's Pocket Printer…" *PR Newswire* (2001)
1030	2005 Wikipedia entry: "Short Message Service (SMS)"
1031	NIST Security Requirements for Cryptographic Modules (2001)
1032	Postel, J., Simple Mail Transfer Protocol (1981)
1033	Nisan, "Elements of Computing Systems" (2005)
1034	Internet Archive Declaration (July 26, 2024)
1035	Marriott, "Keeping Track of Business Cards…," *New York Times* (Dec. 9, 2004).

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APPENDIX C

TOM PURVES

Digital Payments and Technology Consultant, ex. VP Global Product Architecture @ Visa, Startup CTO & CPO, Angel and advisor. Author of 80+ patents in mobile wallets, secure payment technology and cryptography.

SKILLS

Product & Technology partnerships, Scaling Teams, Scaling Products, Fintech SaaS, digital commerce, Card Products, Portfolio Management, Digital Issuance, AI, Generative AI, ML, Data Products, Open Banking, Embedded Finance, tokenization, digital wallets, compliance tech, fraud, AML/KYC, UI/UX, Experience Design, analytics, mobile commerce, GTM, mobile banking apps & SDKs

PROFESSIONAL EXPERIENCE

LaHave.io Product Strategy and AI Transformation Consulting, Seattle, WA, April 2021 – Present

Co-founder

Strategic Product Consulting – Enabling fintechs and large Fis to launch and scale embedded fintech partnerships, AI Operations transformation and implementation

Fractional Startup CPO – product strategy, distribution strategy and executive coaching for diverse clients: global Cloud & AI startups Pingme & OkHi (alternative credit data for Sub-Saharan Africa); Grabbi (food service mobile checkout), and Flow Networks (payment engagement experiences), BizFi (AI-optimized B2B lending)

MainStreet, San Jose, CA, Mar 2022 – April 2023

CTO & Chief Product Officer

Enable thousands of SMB customers to unlock billions in eligible tax credits, B2B procurement and commercial banking products with easy-to-use AI & ML powered workflows build on top of data partnerships with platforms including Plaid, Stripe, Codat and Rippling

Led Product, Design and Engineering orgs, 75 directs. Navigated Mainstreet through 2022 fintech downturn, from blitz-scale growth to cashflow-positive.

Visa, San Francisco, CA, April 2011 – April 2021

VP, Global Digital Products

Conceived and led Visa's product portfolio for fintech partners, open banking and digital issuance solutions. Launched multiple products generating +40M ARR in <2 yrs. Unlocked distribution to many of the world's largest banks and fintechs, super-apps and digital banks through developer-friendly API & mobile SDK designs as well as first-time re-seller partnerships with processors and banking-as-a-

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service vendors. Products including Visa Transaction Controls, In-app card provisioning, FX & currency services, card enrollment & lifecycle management and risk/fraud management and loyalty value add services.

Led a successful digital transformation of Visa's global Account Level Management (ALM) and Rewards Program Management (RPM) platforms. From batch-only legacy processes to rich new UI tools and real-time APIs enabling instant digital card activation and personalized card loyalty and benefits. And, for portfolio managers ability to view, manage and control rewards programs, spend tracking and card benefits across 1Trillion+ global Visa Credit, Charge and Commercial card volume.

Led Visa's global checkout products from 2011 to 2018. Scaled Visa Checkout from 400k to 45M registered users across 25 countries and 300,000 integrated merchants. Enabled easy 2-click checkout buttons across web and native apps, backed by Visa security and tokenization. Established Visa Checkout as a now-multi-brand global standard as SRC/Click-to-pay.

Prolific innovator with over 80+ global patents in checkout experiences, digital wallets, push payments, fraud/risk, identity and more.

EARLY CAREER

Trulioo, SF Vancouver Feb 2014 – Mar 2018
Advisory Board, Investor
Leading global vendor or KYC and identity verification services critical for digital services worldwide

Visa, Toronto Jun 2009 – Sep 2011
Business Leader, Product Innovation
Led North America-first commercialization deals for Visa Direct, and NA-first mobile NFC pilots

CIBC, Toronto Feb 2003 – Feb 2006
Group Manager, New Card Products
Led Canada-first launch of Visa prepaid, Visa Debit products and mobile money transfers

Certapay, Inc., Toronto – Acquired by Interac Association Dec 2000 – Nov 2002
Product Manager – Payments Startup
Co-inventor of Interac E-Transfers [Canada's Zelle] & Interac Online Debit: today 100's B GPV

EDUCATION

Master of Business Administration University of Toronto, Toronto, CA

Bachelor of Science in Computer & Electrical Engineering Queen's University, Kingston, CA

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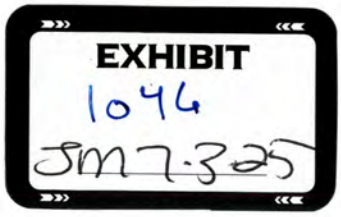
STARTUP & INDUSTRY LEADERSHIP

Tompurves.ai (AI, Fintech & Product Management)
Actionable AI in Banking (2024 CLA Bankers Summit)
DemoCamp Toronto – Event Organizer and Community Leader (2006-2011)
MEIC – Mobile Incubation Lab Board (2005-2007)
Advisory Board – Trulioo 1.8B fintech unicorn (2014-2018), BizFi Commercial lending (2024-current)
Fintech Investor – Trulioo, Clarity Money, Rebel Mail, Maybe, Asaak, Eco, Zama (2012-current)

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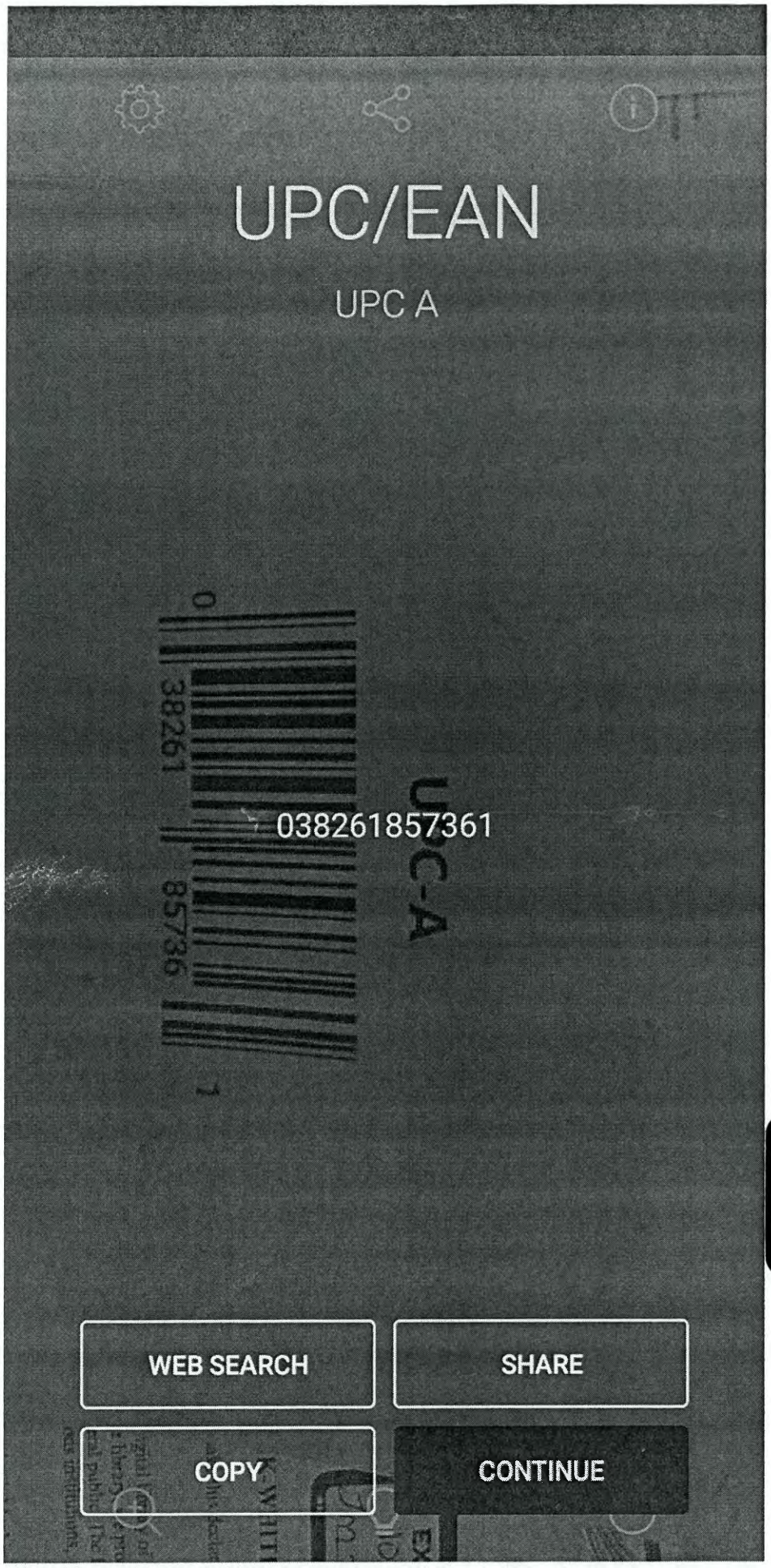


EXHIBIT
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