

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC,
Petitioner,

v.

ALD SOCIAL, LLC,
Patent Owner.

IPR2023-01398
U.S. Patent No. 9,198,054

**DECLARATION OF STEPHEN J. GUY,
UNDER 37 C.F.R. § 1.68 IN SUPPORT OF PETITION FOR
INTER PARTES REVIEW**

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I, Stephen J. Guy, do hereby declare as follows:

I. INTRODUCTION

1. I make this declaration based upon my own personal knowledge and, if called upon to testify, would testify competently to the matters stated herein.

2. I have been asked by Apple Inc. (“Apple”) to provide my expert opinion connection with the *Inter Partes* Review of U.S. Patent No. 9,198,054 (“the ’054 patent”) to Cuff *et al.* concerning whether the ’054 patent is unpatentable over certain prior art. This declaration is a statement of my opinions on issues relating to the patentability of claims 1–14 (“the Challenged Claims”) of the ’054 patent. As I explain more fully below, it is my opinion that all the

Challenged Claims would have been obvious to a person of ordinary skill in the art (“POSITA”) at the time of the alleged invention.

3. I am being compensated for my work in this matter at my standard hourly rate. I am also being reimbursed for reasonable and customary expenses associated with my work and testimony in this investigation. My compensation is not contingent on the outcome of this matter or the specifics of my testimony.

4. I have reviewed and considered the following documents in connection with my analysis of the ’054 patent:

- a) the ’054 patent, Ex.1001;
- b) the prosecution history of the ’054 patent (“’054 File History”), Ex.1002;
- c) U.S. Published Application US2011/0040603 to Wolfe et al. (“Wolfe”), Ex.1004;
- d) U.S. Published Application US2009/0284348 to Pfeffer et al. (“Pfeffer”), Ex.1005;
- e) U.S. Published Application US2009/0222388 to Hua et al. (“Hua”), Ex.1006;
- f) U.S. Published Application US2012/0106782 to Nathan et al. (“Nathan”), Ex. 1007.
- g) US Published Application US2010/0217837 to Ansari et al.

(“Ansari”), Ex. 1008.

5. In forming the opinions expressed below, I have considered:

- a) the documents listed above;
- b) the relevant legal standards, including the standard for obviousness, and any additional authoritative documents as cited in the body of this declaration; and
- c) my own knowledge and experience based upon my work in the field of crowd analysis and location-based computing as described below, as well as the following materials.

6. Unless otherwise noted, all emphasis in any quoted material has been added.

II. QUALIFICATIONS AND PROFESSIONAL EXPERIENCE

7. My complete qualifications and professional experience are described in my Curriculum Vitae, a copy of which can be found in Exhibit 1004. The following is a brief summary of my relevant qualifications and professional experience.

8. I received a Ph.D. in Computer Science from the University of North Carolina at Chapel Hill (“UNC”) in 2012. I also received a Master of Science degree in Computer Science from the University of North Carolina at Chapel Hill in 2009, and a Bachelor of Science degree in Computer Engineering from the

University of Virginia (“UVA”) in 2006.

9. I am currently employed as an Associate Professor at the University of Minnesota, Twin Cities since 2018. I am also the director of the Applied Motion Lab at the University of Minnesota, Twin Cities. The Applied Motion Lab focuses on using computers to understand, recreate, and interact with the dynamic nature of the world including crowd simulation, virtual humans, and robot motion planning.

10. I first worked in the area of crowd analysis in 2006 as part of my doctoral research with Ming C. Lin and Dinesh Manocha as part of the Geometric Algorithms for Modeling Motion and Animation (“GAMMA”) lab at UNC, with my first co-authored academic journal article in this area being published in 2008 [“Interactive navigation of heterogeneous agents using adaptive roadmaps”, Gayle et al., 2008]. I continued to work on crowd analysis during the duration of my graduate studies (2006 – 2012), including two internships for the Intel Cooperation where I developed new techniques for high performance crowd simulation. I also performed significant synergistic work in the related areas of mobile robotics, sensor estimation, and computer vision. I was involved in several academic projects where I was responsible for gathering, analyzing, or visualizing human crowd data, which was gathered from a variety of sources including GPS tracking, external cameras, and manual annotations. My work on crowd simulation and analysis during this period had wide recognition from my peers including

publications at several highly selective academic venues and best paper awards.

11. During my Ph.D., I worked on a large variety of projects involving sensors, tracking, and networking. For example, from 2007 to 2008, I was employed as a research assistant to Henry Fuchs and Gregory Welch on a project developing Deployable Intelligent Projection Systems that wirelessly networked multiple sensor-enhanced projectors to track nearby users and objects to create large virtual environments. During the period from 2008 to 2010, I applied my expertise in mobile devices, people tracking, object tracking, and networked sensor communication to develop systems that tracked mobile robots navigating in human environments. This tracking work was incorporated into a variety of mobile robotic systems including those discussed in the journal article “The Hybrid Reciprocal Velocity Obstacle.” [Snape et al, 2011].

12. I defended and submitted my Ph.D. thesis, titled “Geometric Collision Avoidance for Heterogeneous Crowd Simulation,” in 2012. As part of my thesis research, I developed new predictive models of how human crowds move in a wide variety of indoor and outdoor scenarios. Much of my thesis work discusses calibrating and validating these predictive models using real human data. Chapter 7 of my thesis focuses on combining models of human crowd dynamics with data of “human crowd motion from videos, LiDAR, and GPS sensors” which was becoming increasingly common at the time of my thesis work. That chapter

culminates in a statistical metric that uses predictive models to robustly estimate crowd distributions and flows from noisy, real-world sensor data. Further details on this work can be found in my journal article entitled “A Statistical Similarity Measure for Aggregate Crowd Dynamics.” [Guy et al., 2012].

13. My thesis work included the introduction and refinement of a new class of predictive crowd simulation methods that leveraged the underlying geometry of collisions to better capture how humans anticipate the motion of others when walking in crowds. My work is detailed in several conference and journal articles, including three academic publications: “PLEdestrians: A Least-Effort Approach to Crowd Simulation,” [Guy et al., 2009], “Clearpath: Highly Parallel Collision Avoidance for Multi-agent Simulation,” [Guy et al., 2010], and “Reciprocal n-Body Collision Avoidance,” [Van den Berg et al., 2011]. These articles have been significantly impactful in the field with over 2,000 combined citations.

14. Since obtaining my Ph.D. in 2012, I have been employed as an Assistant Professor and then, in 2018, as an Associate professor in the Department of Computer Science & Engineer at UMN. During this time I have built a research lab focusing on novel work broadly in Artificial Intelligence with a focus on crowd analysis, human motion simulation, and autonomous mobile robotics. I, along with my Ph.D. students, have continued to developed a wide variety of systems where

multiple mobile robots locate themselves with external sensors and communicate with centralized servers over wireless networks to coordinate their motion. My most recent work is presented in the publication “NH-TTC: A Gradient-based Framework for Generalized Anticipatory Collision Avoidance,” [Davis et al., 2020], which details a decentralized coordination system appropriate for autonomous vehicles such as self-driving cars.

15. Likewise, together with the graduate and postdoctoral researchers under my direct supervision, I have continued with extensive research activity across many different areas of human crowd research including analysis, prediction, visualization, and simulation. My work includes classifying the shape and style of different crowd scenarios [“Crowd Space: A Predictive Crowd Analysis Technique,” Karamouzas et al., 2018], building new data-driven methods for automatically detecting and visualizing anomalous crowd behaviors [“A Data-Driven Framework for Visual Crowd Analysis,” Charalambous et al., 2014], modeling the effect of physical interactions in crowds such as pushing and collisions [“Velocity-Based Modeling of Physical Interactions in Multi-Agent Simulations,” Kim et al., 2013], tracking crowds in scenarios with noisy or incomplete sensor data [“BRVO: Predicting pedestrian trajectories using velocity-space reasoning,” Kim et al., 2014], and modeling the effect of stress and panic in crowds [“Interactive Simulation of Dynamic Crowd Behaviors Using General

Adaptation Syndrome Theory,” Kim et al., 2012].

16. I have also had a wide variety of external collaborations dealing with predictive crowd analysis driven by a variety of human data. For example, during my time at UNC, I was part of a team that worked with the Hajj Research Institute to combine predictive crowd models together with data from GPS devices to analyze the motion of pilgrims during the Hajj annual religious pilgrimage in Mecca. [“Virtual Tawaf: A Case Study in Simulating the Behavior of Dense, Heterogeneous Crowds,” Curtis et al., 2011]. More recently, I worked with researchers from Tesco PLC to build models of the motion of shoppers in groceries based on large datasets of motion data captured from shoppers in their stores. Details of the work can be seen in “An Information-Theoretic Law Governing Human Multi-Task Navigation Decisions.” [Sohre et al., 2021].

17. My work in crowd analysis, simulation, and related areas has broadly impacted the field and has been widely recognized by my peers. For example, I have over a dozen academic publications on crowds or closely related areas that each have over 100 citations. In 2014, my work establishing a new, fundamental statistical relationship that governs human motion [“Universal power law governing pedestrian interactions,” Karamouzas et al., 2014] was published in Physical Review Letters, a prestigious physics journal. Moreover, this work was featured on the cover of the issue, highlighted as the Editor’s Selection, and

received an APS Focus Piece explaining the work and its impact.

18. I often serve as an expert reviewer for a number of journals and peer reviewed conferences including Nature Physics, IEEE Transactions on Robotics, IEEE Computers and Electrical Engineering, and the International Conference on Autonomous Agents and Multiagent Systems. I have co-authored book chapters about crowds including “Simulating Heterogeneous Crowds with Interactive Behaviors.” [CRC Press, 2016]. I was an invited plenary speaker on the topic of crowds at the ACM Symposium on Motion in Game in 2013. I have been an invited speaker at multiple conferences and workshops on crowds and pedestrian navigation spanning both industry and academia. Additionally, I have been an invited speaker on the topics of crowds at a variety of university colloquia including at the University of Maryland, College Park (UMD), the University of Illinois Urbana Champagne (UIUC), and UC Berkeley.

III. LEVEL OF ORDINARY SKILL IN THE ART

19. I understand there are multiple factors relevant to determining the level of ordinary skill in the pertinent art, including (1) the levels of education and experience of persons working in the field at the time of the invention; (2) the sophistication of the technology; (3) the types of problems encountered in the field; and (4) the prior art solutions to those problems.

20. I understand that the '054 patent was filed on February 10, 2014 and

claims priority to U.S. Provisional Patent Application No. 61/573,112 filed September 2, 2011. My analysis reflects the views of a person of ordinary skill in the art (“POSITA”) in the field of the ’054 patent as of September 2, 2011. This would have been someone knowledgeable and familiar with the field of crowd analysis and location-based computing as pertinent to the ’054 patent. That person would have a bachelor’s degree in computer science/computer engineering, or equivalent training, and approximately two years of experience working in the field of crowd analysis and location-based computing. Lack of work experience can be remedied by additional education, and vice versa.

21. For purposes of this Declaration, in general, and unless otherwise noted, my statements and opinions, such as those regarding my experience and the understanding of a POSITA generally (and specifically related to the references I consulted herein), reflect the knowledge that existed in the field as of the earliest proper priority date of the ’054 patent (i.e., September 2, 2011). Unless otherwise stated, when I provide my understanding and analysis below, it is consistent with the level of a POSITA prior to the earliest alleged priority date of the ’054 patent.

IV. RELEVANT LEGAL STANDARDS

22. I am not an attorney. In preparing and expressing my opinions and considering the subject matter of the ’054 patent, I am relying on certain basic legal principles that counsel have explained to me. These principles are discussed

below.

23. I understand that prior art to the '054 patent includes patents and printed publications in the relevant art that predate the proper priority date of the alleged invention recited in the '054 patent.

24. I have been informed that a claimed invention is unpatentable under 35 U.S.C. § 103 if the differences between the invention 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. I have also been informed by counsel that the obviousness analysis takes into account factual inquiries including the level of ordinary skill in the art, the scope and content of the prior art, and the differences between the prior art and the claimed subject matter.

25. I have been informed by counsel that the Supreme Court has recognized several rationales for combining references or modifying a reference to show obviousness of claimed subject matter. Some of these rationales include the following: (a) combining prior art elements according to known methods to yield predictable results; (b) simple substitution of one known element for another to obtain predictable results; (c) use of a known technique to improve a similar device (method, or product) in the same way; (d) applying a known technique to a known device (method, or product) ready for improvement to yield predictable results; (e)

choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and (f) some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

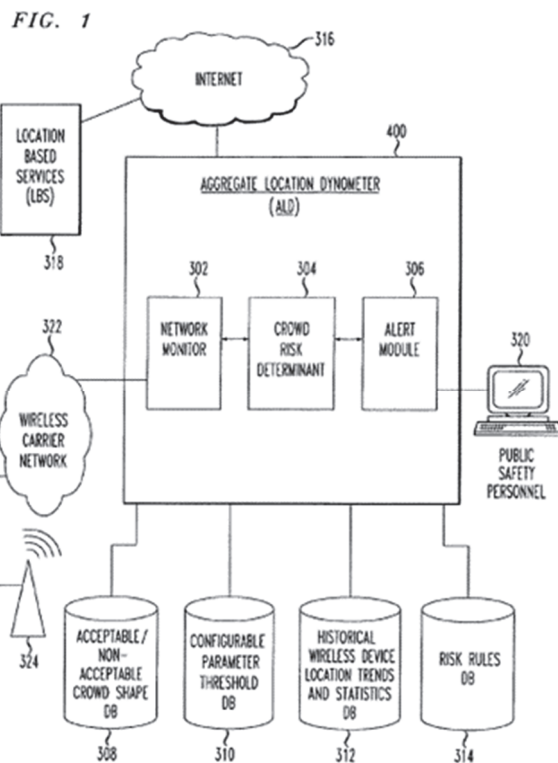
26. I further understand that certain factors may support or rebut the obviousness of a claim. I understand that such secondary considerations include, among other things, commercial success of the patented invention, skepticism of those having ordinary skill in the art at the time of invention, unexpected results of the invention, any long-felt but unsolved need in the art that was satisfied by the alleged invention, the failure of others to make the alleged invention, praise of the alleged invention by those having ordinary skill in the art, and copying of the alleged invention by others in the field. I understand that there must be a nexus—a connection—between any such secondary considerations and the alleged invention. I also understand that contemporaneous and independent invention by others is a secondary consideration tending to show obviousness.

27. I am not aware of any allegations by the named inventor of the '054 patent or any assignee of the '054 patent that any secondary considerations are relevant to the obviousness analysis of any Challenged Claim of the '054 patent.

V. OVERVIEW OF THE '054 PATENT

28. The '054 patent is generally related to “an Aggregate Location Dynamometer (ALD), an analytical server utilizing location based services (LBS) on a network to predict public safety risks, e.g., the unexpected impending formation of a flashmob, or a riot, etc.” '054 patent, 2:52-56. Through “evaluation of the positioning and movement of wireless devices” the system “predicts public safety risk in a given geographical area.” '054 patent, 2:65-67. The patent explains that the system “provides an alert of a possible impending crowd related public safety risk in real time, as the crowd risk arises, informing emergency personnel as early as possible, even before such event is consummated.” '054 patent, 3:22-26.

29. Figure 1 of the '054 patent illustrates an Aggregate Location Dynamometer (ALD) based in a server in a wireless network. The ALD is shown having (1) a network monitor, (2) a crowd risk determinant, and (3) an alert module. '054 patent, 3:33-37.



'054 patent, Fig. 1

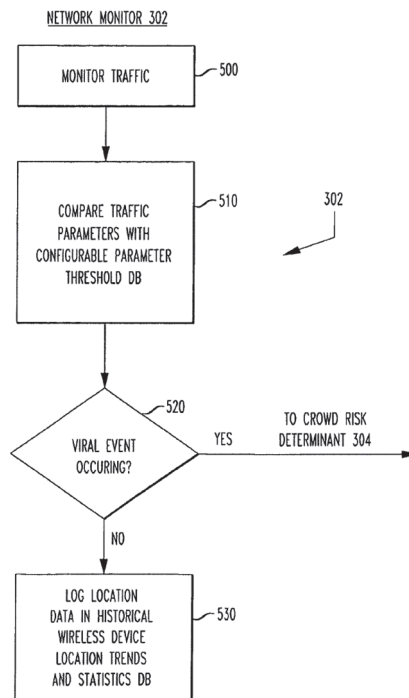
30. In the '054 patent, the “Aggregate Location Dynamometer (ALD)” predicts public safety risk in a given geographical area through evaluation of the positioning and movement of wireless devices.” '054 patent, 2:65-67.

31. The '054 patent describes three conditions for assessment with respect to the wireless device network traffic: (i) a viral event, (ii) crowd risk, and (iii) public safety risk. The '054 patent describes a “viral event” as “the first state of alarm” but “the occurrence of a viral event does not necessarily infer a definite public safety risk.” '054 patent, 4:38-44. “Crowd risk” is an analysis of the mobile devices associated with a viral event (such as a density as indicated by the number

of devices in communication with a given base station). '054 patent, 3:9-15. A “public safety risk” is a “compromise in crowd safety, e.g., the impending formation of a flash mob, or a riot, etc.” '054 patent, 4:53-55.

32. In operation, the ALD “monitors wireless device network traffic to predict an impending viral event.” '054 patent, 3:1-2. Location based services (LBS) are utilized “to obtain sets of aggregate location data corresponding to a number and pattern of wireless devices within an area, region, city, etc. of interest.” '054 patent, 2:48-51.

33. As depicted in Fig. 2, the network monitor “preferably continuously, or at least periodically or intermittently, monitors network traffic.” '054 patent, 5:65-67.



'054 patent, Fig. 2

34. The '054 patent describes monitoring “wireless data traffic ... for the presence of abnormal events.” One example of an “abnormal event” would be an “excessive volume for the time of day.” '054 patent, 6:1-3. “Configurable thresholds for the monitored parameters may be dynamic over the course of the day and even for traffic for any given tower or base station.” '054 patent, 5:66-6:5.

35. If one or more of the monitored parameters are exceeded, “a viral event may be triggered.” The Network Monitor triggers the Crowd Risk Determinant to analyze the location data of the wireless devices to “determine if a possible viral event indicates a public safety risk. A viral pattern may or may not imply public safety risk.” '054 patent, 6:34-36. If the crowd risk determinant

determines a public safety risk is occurring, it triggers the alert module “to take responsive public safety measures.” ’054 patent, 6:37-38.

36. The crowd risk determinant uses configurable parameters to determine “if location information pertaining to a viral event indicates a likely public safety risk.” ’054 patent, 7:7-8. Several factors are considered when determining if a viral event is a public safety risk. “Factors for risk determination include but are not limited to the shape a cluster of location markers representing individual wireless devices of given density is forming, whether or not markers are spreading out or coming together, and/or at what rate of change a cluster of wireless devices is moving.” ’054 patent, 7:8-13. Additional factors considered when determining if the viral event is a public safety risk “include the behavior of collective XY location coordinates of the most dense clusters of wireless devices, to where the most dense clusters of wireless devices of concern are moving, and/or whether or not a cluster of wireless devices in a particular location makes sense given the time of day.” ’054 patent, 7:14-19.

37. Motion trends of the wireless devices are also used to assess a crowd risk. The crowd risk determinant does not require precise accuracy of the location of each wireless device. Instead “focus lies in the volume, density, shape and movement of data points collected. Serving cell tower locations for each wireless device may be sufficient to satisfy initial triggering requirements for a possible

viral event.” ’054 patent, 8:25-29.

38. The shape of a cluster of mobile devices are also considered when determining whether a viral event is a public safety risk. After the location of the wireless devices is collected, “the best-fit shape of dense clusters formed by accumulation of wireless devices in a given area may be determined. The best-fit shape of a cluster of wireless devices may be compared against data contained in the historical Acceptable/Non-Acceptable Crowd Shape database 308 to determine danger potential. Different thresholds may be set for like parameters based on varying location.” ’054 patent, 7:37-43.

39. However, prior to the ’054 patent, it was well-known to POSITAs to monitor a wireless network, collect information about a wireless device’s location, and use that collected information to alert first responders and other interested parties of the movements of the monitored crowds.

VI. CLAIM CONSTRUCTION

40. It is my understanding that in order to properly evaluate the ’054 patent, the terms of the claims must first be interpreted. It is my understanding that for the purposes of this inter partes review, the claims are to be construed under the so-called Phillips standard, under which claim terms are given their ordinary and customary meaning as would have been understood by one of ordinary skill in the art in light of the specification and prosecution history, unless the inventor has set

forth a special meaning for a term. For the purposes of this declaration, it is my opinion that the claim terms should be given their plain and ordinary meaning, other than the following:

41. “*indication of a viral event*” / “*a forming viral event*”

42. These limitations are recited in independent claims 1 and 7, respectively. While the specification references “viral event” many times, the specification does not provide any definition. The specification describes an instance in which a “viral event may be occurring or impending” by virtue of an excessive number of wireless devices in a given area. ’054 patent, 5:9-15.

43. Another example is when “two highly dense clusters” of wireless devices move “toward each other at a significant rate of speed.” ’054 patent, 5:26-31. A third example is when there is a “difference in the number of wireless devices in a given area” over time. ’054 patent, 5:45-51.

44. Accordingly, a POSITA would have understood that the patent’s tracking of wireless devices for an “indication of a viral event” (or “a forming viral event”) is attempting to detect the “first state” of a crowd *before* the formation of a flash mob, a riot breaking out, or other compromise in crowd safety. In other words, the “*indication of a viral event*” and “*a forming viral event*” is an indication of a crowd’s activity before a compromise in crowd safety exists, which can be indicated by the crowd’s size, density, movement, or other characteristics.

45. Because the specification describes an indication of viral event based on characteristics of a crowd of wireless devices, such as the number of devices, density of devices, the movement of devices, and other characteristics of a crowd, a POSITA would have understood the phrase “indication of a viral event” and “a forming viral event” to comprise an indication of a crowd’s activity, including the crowd’s size, density, movement or other characteristics.

VII. CLAIMS 1-14 ARE UNPATENTABLE

46. I have been asked to provide my opinion as to whether the Challenged Claims of the ’054 patent would have been obvious in view of the prior art. The discussion below provides a detailed analysis of how the prior art references identified below teach the limitations of the Challenged Claims of the ’054 patent.

47. As part of my analysis, I have considered the scope and content of the prior art and any differences between the alleged invention and the prior art. Below, I describe in detail the scope and content of the prior art, as well as any differences between the alleged invention and the prior art, on an element-by-element basis for each Challenged Claim of the ’054 patent.

48. As described in detail below, the alleged invention of the Challenged Claims would have been obvious in view of the teachings of the identified prior art references as well as the knowledge of a POSITA. I apply the prior art as follows:

Grounds	Claim(s)	Basis
#1	1-2	35 U.S.C. § 103 over Wolfe in view of Pfeffer
#2	3-6	35 U.S.C. § 103 over Wolfe in view of Pfeffer and Hua
#3	7-14	35 U.S.C. § 103 over Wolfe in view of Hua

A. Ground 1: Claims 1-2 are obvious under 35 U.S.C. § 103 over Wolfe in view of Pfeffer.

1. Summary of Wolfe

49. Wolfe teaches a system that uses “telemetrics-based location and/or tracking technology” to determine the “locations of wireless devices.” Wolfe, [0010]. The system of Wolfe provides “details of where crowds of people are located, how the crowds are changing, where they are moving to, when they are transitioning from one activity to another, and/or what activity they are transitioning to.” Wolfe, [0011]. In one embodiment, Wolfe’s system is used so that “a police force may be informed of the distribution of people around a city and/or changes in activity levels in specific locations around a city.” Wolfe, [0014]. Using this information, “the police may better position patrol officers to locations around the city where the officers may be needed.” Wolfe, [0014].

50. Wolfe discloses using a “computing device” for “telemetrics based location and/or tracking implementations:”

With reference to FIG. 3, depicted is a block diagram illustrating an example computing device 300 that is arranged for telemetrics based

location and/or tracking implementations in accordance with at least some embodiments of the present disclosure.

Wolfe, [0068].

51. Wolfe discloses that the computing device 300 can be implemented in a “server”:

Computing device 300 may also be implemented as a personal computer including both laptop computer and non-laptop computer configurations or as a server or mainframe.

Wolfe, [0074].

52. Wolfe further describes that computing device 300 may include “one or more applications 322.” Wolfe, [0070]. The one or more applications 322 “may be arranged to operate with program data 324 on an operating system 321 to effectuate the aggregation of the mobile device data.” Wolfe, [0070].

Depending on the desired configuration, the system memory **320** may be of any type including but not limited to volatile memory (such as RAM), non-volatile memory (such as ROM, flash memory, etc.) or any combination thereof. System memory **320** may include an operating system **321**, one or more applications **322**, and program data **324**. Application **322** may include a mobile device telemetries data aggregation algorithm **323** that is implemented to add together and integrate the identities, demographic information and/or historical information related to the mobile devices within the geographic region. Program Data **324** may include historical mobile device telemetries

data **3 25**. In some embodiments, application **322** may be arranged to operate with program data **324** on an operating system **321** to effectuate the aggregation of the mobile device data.

Wolfe, [0070].

Crowd detection system implemented as computing device 300

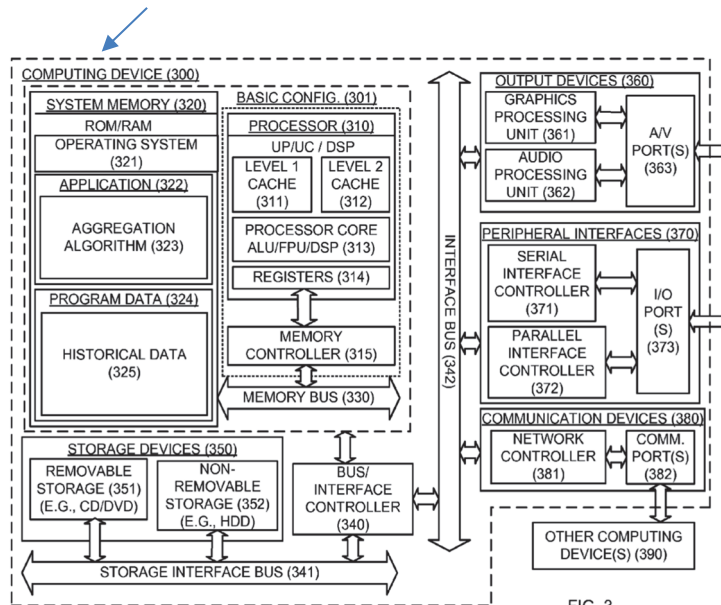


FIG. 3

Wolfe, Fig. 3 (annotated)

53. Wolfe teaches that its server and the one or more applications of the server perform “telemetrics-based location and/or tracking” using “details of where crowds of people are located, how the crowds are changing, where they are moving to.” The details about the crowds are “collected and/or integrated together” using aggregation algorithms “to create a model of the distribution of the locations of the mobile device users.” Wolfe, [0010]-[0011], [0018], [0040], [0044].

54. Wolfe further discloses an example embodiment of its system that

includes a “central office 116,” “mobile devices 112₂, 112₃ . . . , 112_n, (where n is any number),” and “a memory device 120” for storing historical information.

Wolfe, [0024].

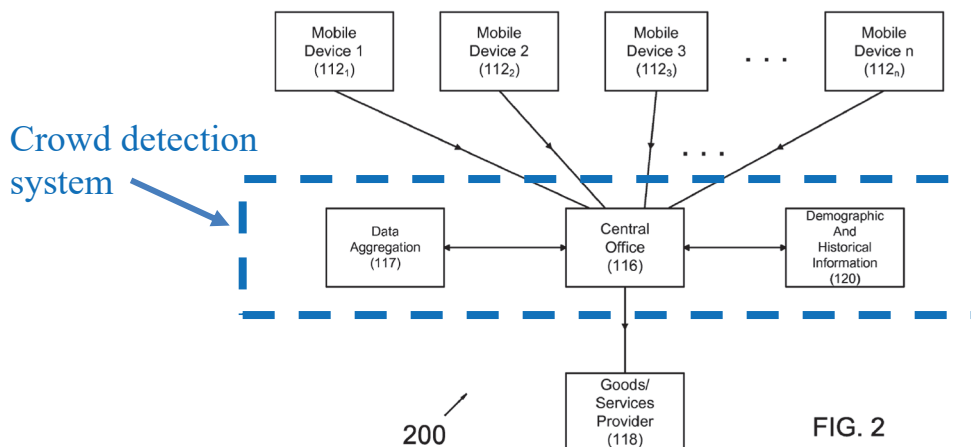


FIG. 2

Wolfe, Fig. 2 (annotated)

55. Wolfe discloses monitoring the wireless network and receiving and storing location information for each mobile device connected to the wireless network within a particular geographic region:

FIG. 1 is a block diagram of an example arrangement 100 for determining and/or collecting the location of a mobile device, which is arranged in accordance with at least some embodiments of the present disclosure. The example arrangement 100 includes a mobile device 112₁ which a user may carry with him or on his person. Mobile device 112₁ may be a cell phone and/or another form of wireless device which may include a radio receiver, radio transmitter, processor and/ or user interface. Mobile device 112₁ may include a built in GPS receiver and may be in communication with satellites 114₁, 114₂, 114₃ and 114₄.

Mobile device may determine its global geographic coordinates via communication with the satellites in conjunction with trilateration and/or other techniques. Mobile device 112₁ may then wirelessly communicate its location to a central office 116 or other centralized depository of mobile device location information. Central office 116 may be communicatively coupled to a memory device 120 which may store mobile device locations.

Wolfe, [0022].

56. A POSITA would understand that the functionality of central office 116 (i.e., monitoring the wireless network and receiving and storing location information for each mobile device) corresponds to one or more of the applications 322 executing on a computing device 300. For example, POSITAs were implementing multiple applications on a computing device providing traditional central office functionality. *See*, Ansari, [0009], [0068] (describing a gateway device having “at least one application performing traditional central office functions” and “a library of application support service processes that facilitate data collection and data distribution”).

57. The application 322 of computing device 300 (performing the functionality of central office 116) also monitors the locations of the mobile devices individually or as a crowd over time:

The changing locations of the mobile device users may continue to be monitored, and the motion of individual terminals may be aggregated

to estimate the movement of a crowd or to estimate changes in activity levels. Alternatively, the flow of terminals from one geographic cell or area to another may be used to estimate motion or activity.

Wolfe, [0019].

Instead of tracking the changing locations of individual terminals, changes in the terminal locations as a group, regardless of their individual identities or individual motions, may be monitored. Thus, "snapshots" of the group locations may be taken at periodic time intervals without regard to the identities of the individual terminals.

Wolfe, [0020].

58. Wolfe's system uses aggregation algorithms to create a model of the location distribution of the mobile devices associated with a monitored crowd to estimate crowd's size:

Once the individual location data is gathered, aggregation algorithms may be used to create a model of the distribution of the locations of the mobile device users. Population estimation models may be used to determine or estimate size and location of crowds based on this aggregated information.

Wolfe, [0018].

59. Wolfe's system uses information about the crowd to determine the crowd's activity level. As one example, Wolfe's system determines the crowd's level of conviction, as evidenced by the speed at which the crowd is moving:

Yet another operation of the population activity map process may involve using the displacement of individual customers and/or the time between measurements to determine an activity level for individual customers. For example, the current location of individual mobile devices 112 may be compared to their immediately previous locations to determine trends in where people are going. The time between measurements, coupled with the location displacement of the people, may indicate the speed and/or direction in which the people are moving, and hence the time at which they may be able to reach provider 118. The speed at which people move may also be used as an indication of their level of conviction in moving in their current direction. For instance, the faster people move, the more likely it may be that they will continue moving in same direction in which they are currently moving.

Wolfe, [0042].

60. A POSITA would understand that the functionality of central office 116 (i.e., using information about the crowd to determine the crowd's activity level) corresponds to one of the applications 322 executing on a computing device 300.

61. Using information about the crowd to determine the crowd's activity level, "the police may better position patrol officers to locations around the city where the officers may be needed." Wolfe, [0014].

In another example, a police force may be informed of the distribution of people around a city and/or changes in activity levels in specific

locations around a city. Based on this information, the police force may better position its patrol officers to locations around the city where the officers may be needed.

Wolfe, [0014].

2. Summary of Pfeffer

62. Pfeffer provides a method that “can be configured to identify incidents, develop one or more incident scenarios to resolve the incidents, and implement the one or more incident scenarios by assigning tasks to one or more responders through dispatch requests.” Pfeffer, [0028]. Example incidents that the method of Pfeffer analyzes includes “crowd control and monitoring.” Pfeffer, [0028]. The dispatch requests may be to “a police department in which one or more of the police officers are responders.” Pfeffer, [0031].

63. Fig. 5 depicts a flow diagram of one embodiment Pfeffer’s methodology for analyzing incident information and dispatching first responders:

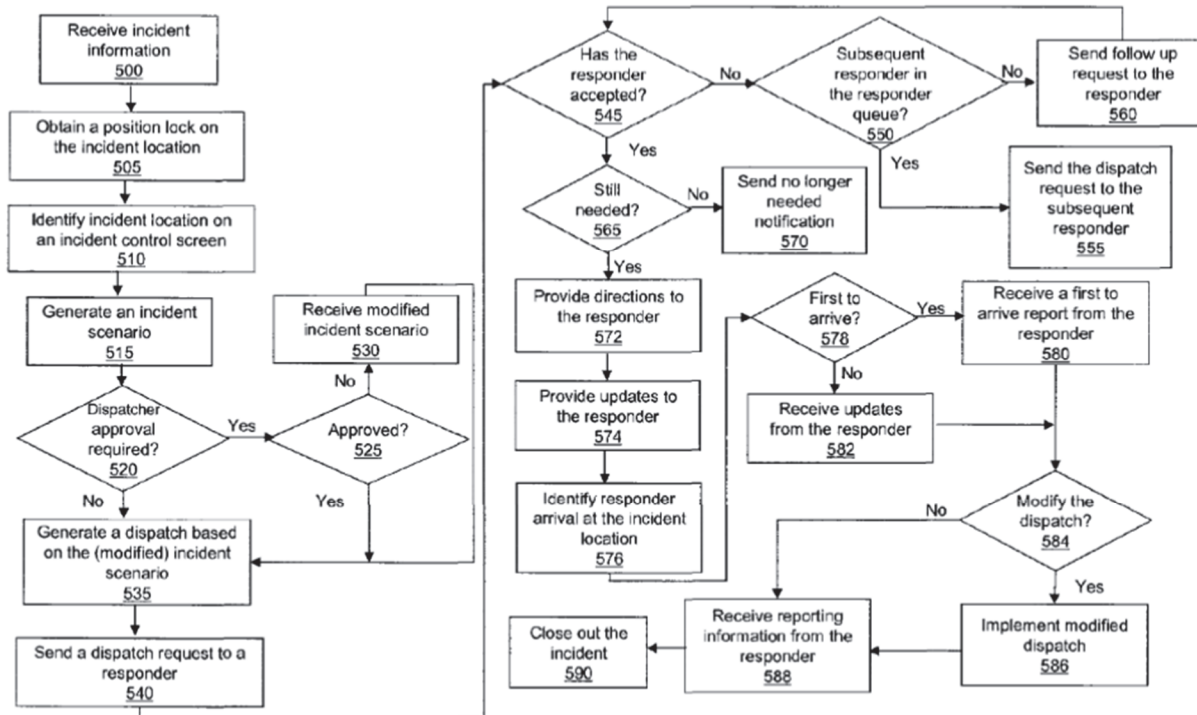


FIG. 5

64. Pfeffer's system is designed to receive incident information "from any source through any method." Pfeffer, [0037]. An incident can refer to any event for which it is desirable to have the assistance of a responder:

Exemplary incidents can include emergencies (such as car accidents, airplane accidents, boating accidents, terrorist attacks, medical emergencies, natural disasters, etc.), sporting event crowd control and monitoring, concert crowd control and monitoring, military operations, training operations, work crew allocation, roadside assistance, field technician dispatch (i.e., power company repairmen, telephone company repairmen, appliance repairmen, etc.), delivery services, surveillance, reality gaming, etc.

Pfeffer, [0028].

65. After receiving the incident information, Pfeffer teaches that it uses a scenario analysis engine to generate a detailed response plan for responding to the incident. Pfeffer, [0038]. As part of the analysis, Pfeffer's method determines a level of alert:

The level of alert can be based on the weather, the number of active incidents, the number of available resources, information received from various agencies regarding potential threats, unusual events occurring in the area that may require support (i.e., parades, sporting events, festivals, etc.), etc.

Pfeffer, [0077].

66. If the level of alert exceeds a threshold then a message is sent requesting additional first responders:

If the level of alert exceeds a predetermined threshold, the dispatcher or task management system can send out requests for additional responders to make themselves available.

Pfeffer, [0077].

67. Pfeffer's method also includes a fully customizable scenario database that provides possible responses to resolve the incident:

Scenario database 185 can include pre-programmed optimal responses based on incident information such as type of incident, location of incident, time of day, time of year, current weather, whether the incident occurred on a holiday, the number of persons involved in the

incident, the equipment needed to deal with the incident, etc. In an exemplary embodiment, scenario database 185 can be fully customizable based on the experience and knowledge of agencies, businesses, etc. using task management system 100.

Pfeffer, [0039].

68. Pfeffer discloses a method where the scenario analysis engine continuously updates the scenario database with prior incident responses and current trends. Further, the scenario database is fully customizable because the scenario analysis engine updates the scenario database with subsequent incident information and suggestions on how to more effectively deal with a similar incident should it happen again:

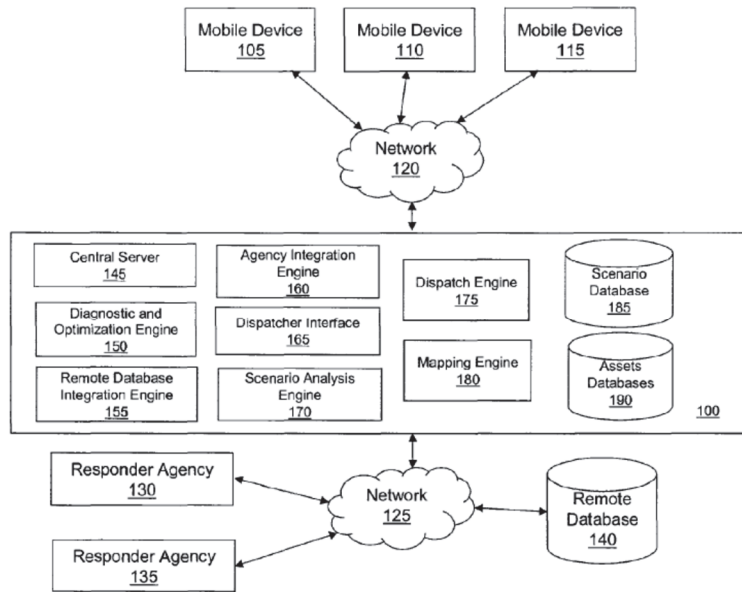
In an exemplary embodiment, scenario analysis engine 170 can continually update scenario database 185 based on the experiences of task management system 100 in dealing with previous incidents and/or current trends in incidents. For example, the incident scenario for a prior incident may have indicated that eight responders would be able to provide an optimal response. However, after responding to the incident, reports may indicate that eight responders was not enough to efficiently and effectively deal with the incident. Based on this information, scenario analysis engine 170 can update scenario database 185 to ensure that the incident scenario for a subsequent incident (similar in scope to the prior incident) recommends nine or more responders.

Pfeffer, [0040].

69. Pfeffer discloses methods for accessing additional databases that provide pertinent information and assist with resolving the incident:

Remote database integration engine 155 can be used to communicate with remote databases. For example, remote database integration engine 155 may be configured to scan available remote databases for any information relevant to an identified incident. As an example, an identified incident may be a fire in an office building ... Remote database integration engine 155 can access remote database 140 to obtain blueprints of the building which is on fire ... Remote database integration engine 155 can access a hazmat database to obtain information regarding containment and cleanup of the hazardous waste ... Remote database integration engine 155 can also access a poisons database to obtain information regarding treatment of individuals who have inhaled or come into contact with the hazardous.

Pfeffer, [0035].



Pfeffer, Fig. 1.

FIG. 1

3. Reasons to combine Wolfe and Pfeffer

70. A POSITA would have been motivated to combine the teachings of Wolfe with Pfeffer because Wolfe discloses a crowd detection system that is specifically intended to provide detailed crowd information to interested parties, e.g., the police, and Pfeffer discloses methods to receive and evaluate incident information, develop and implement a response to effectively resolve the incident, and send an alert to the police.

71. A POSITA considering the problem purportedly solved by the '054 patent would have looked to the teachings of Wolfe and Pfeffer. The field of endeavor of the '054 patent is "alerting to a problematic crowd risk in a given geographical location" by analyzing "aggregate location information pertaining to a multitude of wireless devices, to detect potential crowd risks." '054 patent, 1:31-

37. The '054 patent uses “location based services (LBS) to obtain sets of aggregate location data corresponding to a number and pattern of wireless devices within an area” to “predict public safety risks.” '054 patent, 2:49-51, 2:54-55.

72. Wolfe is analogous art because it relates to a system that uses “GPS-based location determination techniques” to “determine and/or report the locations” of mobile devices. Wolfe, [0017]. Wolfe teaches evaluating the motion trends of a crowd by aggregating the mobile devices’ location information associated with the monitored crowds in a particular area. Wolfe, [0018]. This information may be provided to first responders. Wolfe, [0014]. Further, Wolfe discloses determining a crowd’s activity level, as an “indication of their level of conviction in moving in their current direction.” Wolfe, [0042]. Pfeffer is analogous art because it provides incident resolution methods that are designed to receive incident information about an unusual event and determine the appropriate response, e.g., dispatch first responders, to effectively handle the risk to the crowd. Pfeffer, [0031], [0035], [0037], [0039], [0109].

73. A POSITA would have been specifically motivated to apply Pfeffer’s techniques for responding to incidents identified by Wolfe’s crowd detection system. For example, Wolfe’s system identifies and tracks each mobile device associated with a monitored crowd and informs first responders of crowd information associated with the crowd’s motion trends, e.g., “the distribution of

people around a city and/or changes in activity levels in specific locations around a city.” Wolfe, [0011], [0014]. Based on Wolfe’s crowd information, the police can position its patrol officers in locations around the city where the officers may be needed. Wolfe, [0014]. Although Wolfe teaches providing relevant crowd information to first responders, Wolfe does not provide the details for how to alert and notify the police.

74. Pfeffer, however, specifically teaches techniques for receiving information about crowds, evaluating the information, and alerting first responders when needed. Pfeffer, Abstract, [0006], [0040]-[0041].

75. A POSITA would have found the combination of Wolfe and Pfeffer predictable and would have had a reasonable expectation of success. First, Wolfe and Pfeffer are the same type of system, in that both systems are evaluating a particular area for safety risks and providing details about a crowd. For example, Wolfe’s system detects “a plurality of wireless mobile devices within a geographic region” and “providing details of where crowds of people are located, how the crowds are changing.” Wolfe, Abstract, [0011], [0014]. Similarly, Pfeffer is designed for “crowd control and monitoring.” Pfeffer, [0028].

76. Second, Wolfe teaches providing crowd information to first responders, e.g., police force, when the monitored crowd’s motion trends are unusual, for example, “a police force may be informed of the distribution of people

around a city ... Based on this information, the police force may better position its patrol officers to locations around the city where the officers may be needed.”

Wolfe, [0011], [0014], [0016], [0027], [0042]. Correspondingly, Pfeffer expressly teaches that first responder dispatch techniques receive incident information “from any source through any method.” Pfeffer, [0037]. In turn, Pfeffer notifies “police officers” to respond to incidents. Pfeffer, [0029], [0030], [0039], [0077], [0109].

77. Wolfe’s system would benefit from incorporating Pfeffer’s techniques for assessing and responding to incidents. Wolfe already teaches identifying crowds and providing crowd information to first responders. Wolfe, [0014], [0016]. Pfeffer provides enhanced features for a tracking system, such as continuous updates to the incident scenario model saved for future use, recommendations for the most effective methods to respond to an incident based on past responses and current trends, and determining if the incident should be elevated based on an exceeded threshold, e.g., number of people involved in the incident. Pfeffer, [0028], [0077], [0085].

78. A POSITA would have had a reasonable expectation of success when combining Wolfe and Pfeffer because Wolfe and Pfeffer are implemented in the same manner. For example, Wolfe is implemented using “one or more applications 322” in a server to analyze crowd data. Wolfe, [0070]. Similarly, Pfeffer’s techniques are described as being implemented in a “central server.” Pfeffer,

[0037]. Pfeffer describes that its dispatch engine could be “any combination of software and/or hardware that is configured to perform one or more tasks.” Pfeffer, [0032].

79. Accordingly, a POSITA would have found it obvious to apply Pfeffer’s teachings to Wolfe’s system because the combination would use known techniques (Pfeffer’s details of an incident response method implemented in a server) to improve a similar system (Wolfe’s crowd detection system implemented using one or more applications in a server) in the same way (providing crowd details and incident information to first responders so that they may better respond to the compromised crowd safety).

4. Claim 1

[1.0] *An aggregate location dynamometer in a physical wireless network server, said aggregate location dynamometer comprising:*

80. The ’054 patent describes the “aggregate location dynamometer” as “an analytical server utilizing location based services (LBS) on a network to predict public safety risks, e.g., the unexpected impending formation of a flash mob, or a riot, etc.” ’054 patent, 2:52-56. “Three main components from the Aggregate Location Dynamometer (ALD) 400: a Network Monitor 302, a Crowd Risk Determinant 304, and an Alert Module 306.” ’054 patent, 3:33-37. Based on these descriptions and the plain language of the claim (“...in a physical wireless network server”), a POSITA would understand that the aggregate location dynamometer is a

set of functional hardware or software components in a server.

81. Wolfe discloses using a “computing device” for “telemetrics based location and/or tracking implementations:”

With reference to FIG. 3, depicted is a block diagram illustrating an example computing device 300 that is arranged for telemetrics based location and/or tracking implementations in accordance with at least some embodiments of the present disclosure.

Wolfe, [0068].

82. Wolfe discloses that the computing device 300 can be implemented in a “server”:

Computing device 300 may also be implemented as a personal computer including both laptop computer and non-laptop computer configurations or as a server or mainframe.

Wolfe, [0074].

*Aggregate Location Dynamometer
implemented in a server*

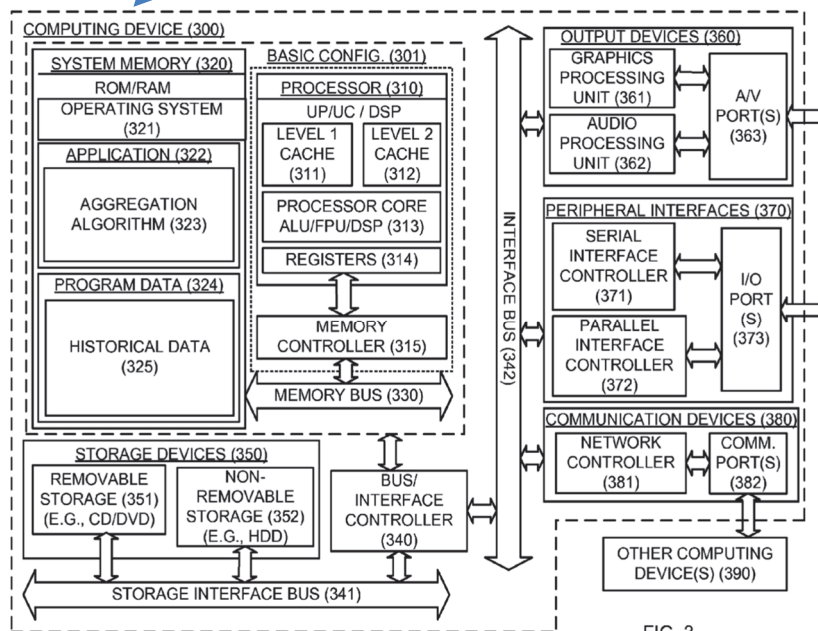


FIG. 3

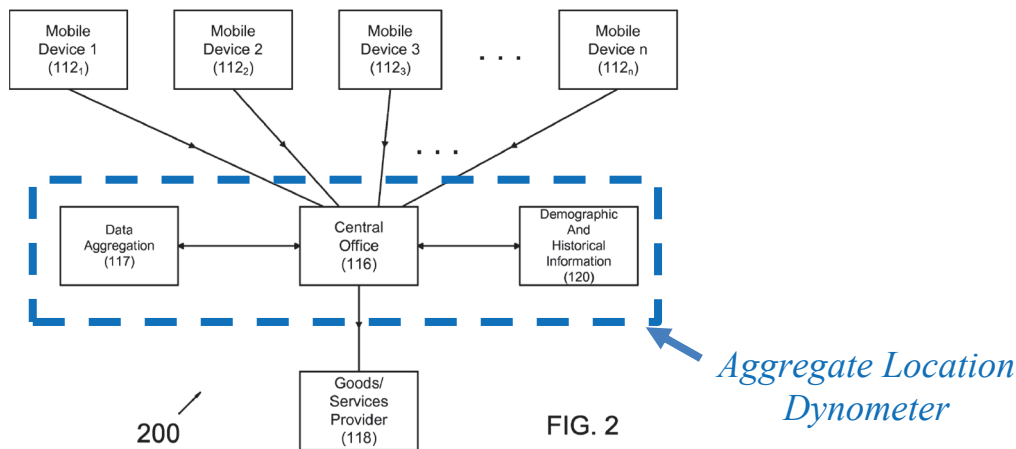
Wolfe, Fig. 3 (annotated)

83. Wolfe further describes that computing device 300 may include “one or more applications 322.” Wolfe, [0070]. The one or more applications 322 “may be arranged to operate with program data 324 on an operating system 321 to effectuate the aggregation of the mobile device data.” Wolfe, [0070].

84. Wolfe discloses “an aggregate location dynamometer” because Wolfe teaches that its server and one or more applications of the server perform “telemetrics-based location and/or tracking” using “details of where crowds of people are located, how the crowds are changing, where they are moving to.” The details about the crowds are “collected and/or integrated together” using aggregation algorithms “to create a model of the distribution of the locations of the

mobile device users.” Wolfe, [0010]-[0011], [0018], [0040], [0044]. In one embodiment, Wolfe’s system is used so that “a police force may be informed of the distribution of people around a city and/or changes in activity levels in specific locations around a city.” Wolfe, [0014].

85. Wolfe further discloses an example embodiment of its system that includes a central office 116, a data aggregation module 117, “a goods and/or services provider 118, and a memory device 120 storing demographic and historical information,” in communication with mobile devices 112₁, 112₂, 112₃ ..., 112_n, (where n is any number). Wolfe, [0024], [0027].



Wolfe, Fig. 2 (annotated)

86. Wolfe discloses that the server includes networking and communication, including wireless capabilities:

Computing device 300 may also include an interface bus 342 for facilitating communication from various interface devices (e.g.,

output interfaces, peripheral interfaces, and communication interfaces) to the basic configuration **301** via the bus/interface controller **340**. ... An example communication device **380** includes a network controller **381**, which may be arranged to facilitate communications with one or more other computing devices **390** over a network communication via one or more communication ports **382** ... **communication media may include** wired media such as a wired network or direct wired connection, and **wireless media such as acoustic, radio frequency (RF), infrared (IR) and other wireless media.**

Wolfe, [0073].

87. Wolfe further discloses that the server is connected in a network environment (“*physical wireless network server*”):

According to one embodiment, computing device 300 is connected in a networking environment such that the processor 310, application 322 and/or program data 324 may perform with or as a computer system in accordance with embodiments herein.

Wolfe, [0075].

88. Wolfe discloses that its system aggregates location information because the system, implemented in a server with one or more applications, collects and integrates “the exact locations of the mobile devices within the geographic area.” Wolfe, [0027], [0032], [0033], [0040], [0058].

As alluded to above, determining the location of each accessible phone and/or data terminal customer may possibly involve aggregating data

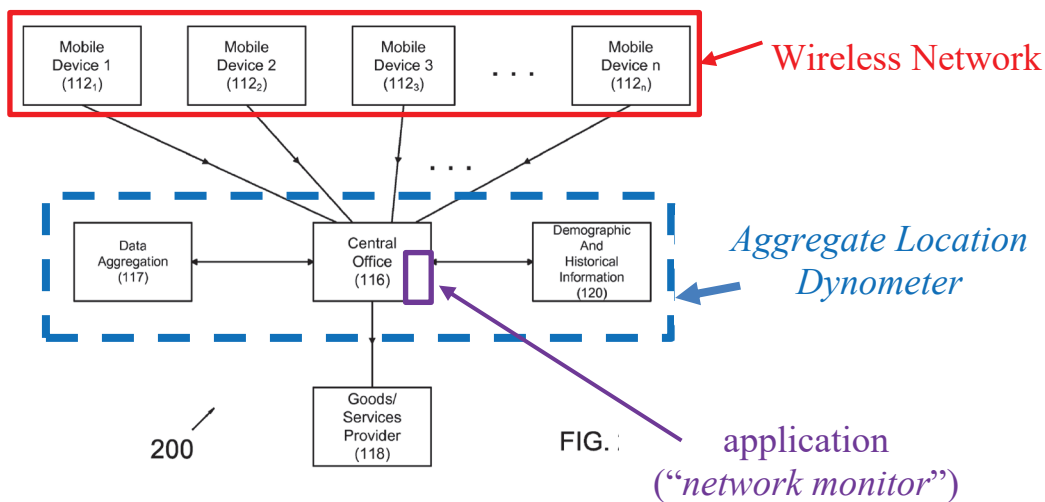
from multiple sources. For example, data from the wireless service carriers, cell phone towers, third parties connected to the wireless service carriers or cell phone towers, and/or from the mobile devices themselves may be collected and integrated together by central office 116.

Wolfe, [0033].

89. Thus, Wolfe's telemetrics-based location and tracking system implemented in a server, in a wireless network environment, using one or more applications to analyze the distribution of mobile device users based on each mobile device's location data, which is collected and integrated together, renders obvious "*an aggregate location dynamometer in a physical wireless network server.*"

[1.1] *a network monitor to monitor a wireless network for an indication of a viral event*

90. As discussed above, Wolfe teaches a computing device (a server) that executes "one or more applications" that include various algorithms. Wolfe, [0070]. Further, Wolfe teaches that its computing device "is connected in a networking environment such that that processor 310, application 322 and/or program data 324 may perform with or as a computer system in accordance with embodiments herein." Wolfe, [0075]. One such embodiment is depicted in Fig. 2.



Wolfe, Fig. 2 (annotated)

91. Wolfe discloses that its system communicates with wireless service carriers associated with mobile devices within a geographic area:

In one embodiment, central office 116 may be in communication with only mobile devices 112 that are within the geographic area with which central office 116 is associated. In another embodiment, mobile devices 112 may be in communication with their corresponding wireless service carriers, and the carriers may determine the locations of mobile devices 112. Each of the wireless service carriers may then send to each central office 116 only information about mobile devices 112 that are within the geographic area with which that particular central office 116 is associated.

Wolfe, [0030].

92. Wolfe also discloses that its system monitors wireless mobile devices, within a geographical area, by determining and continuously updating the number

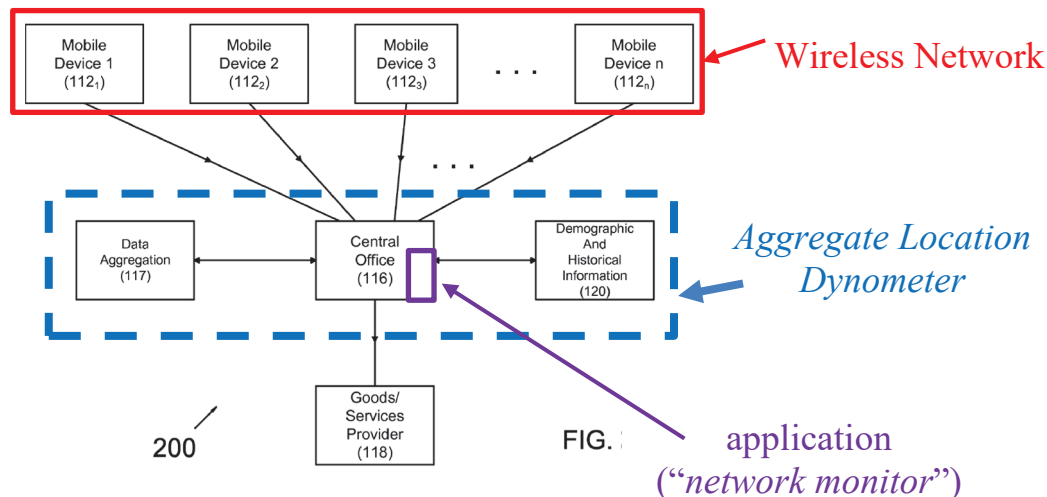
of devices in contact with a wireless access point or base station:

A first operation of this process may include determining the number of phones and/or wireless data terminals in contact with a single cell and/or access point for individual such cells and/or access points in a mapped area. For example, individual wireless access points and/or base stations in a geographic region may determine and/or continuously update the number of mobile devices that the access point is in communication with at any time.

Wolfe, [0053].

93. In considering the embodiments of Fig. 2 and Fig. 3, a POSITA would understand that the functionality of central office 116 (i.e., monitoring the wireless service carriers, access points and base stations) corresponds to one of the applications/algorithms executing on a computing device 300. For example, POSITAs knew to implement multiple functionalities on a computing device providing traditional central office functionality. *See*, Ansari, [0009], [0068] (describing a gateway device having “at least one application performing traditional central office functions” and “a library of application support service processes that facilitate data collection and data distribution”).

94. Accordingly, the application 322 of computing device 300 that performs the functionality/algorithm of central office 116 that monitors wireless service carriers is a *network monitor*.



Wolfe, Fig. 2 (annotated)

95. Wolfe also discloses that the network monitor application 322 of computing device 300 (performing the functionality of the central office) monitors “for an indication of a viral event.” First, Wolfe discloses that it determines the location of mobile devices, e.g., density of mobile devices:

This disclosure is drawn, inter alia, to methods and systems related to telemetrics-based location and/or tracking technology. An example embodiment may relate to determining the locations of wireless devices (e.g., cell phones).

Wolfe, [0010].

96. Wolfe further discloses that, using the mobile device’s location information, the system can determine the crowd’s motion trends, e.g., size and/or locations of crowds, how the crowds are changing, where the crowds are moving to, and when crowds are transitioning from one activity to another:

This disclosure may include methods and systems for providing details of where crowds of people are located, how the crowds are changing, where they are moving to, when they are transitioning from one activity to another, and/or what activity they are transitioning to.

Wolfe, [0011].

97. Wolfe discloses monitoring crowd changes as a group, rather than monitoring each wireless device associated with the monitored crowd, by using snapshots of the group's locations over time:

Instead of tracking the changing locations of individual terminals, changes in the terminal locations as a group, regardless of their individual identities or individual motions, may be monitored. Thus, "snapshots" of the group locations may be taken at periodic time intervals without regard to the identities of the individual terminals.

Wolfe, [0020].

98. Wolfe expressly teaches that first responders, e.g., the police force or ambulance service, are provided crowd details based on the crowd's motion trends in particular areas, e.g., crowd locations, how the crowds are changing, moving, or transitioning from one activity to another:

In another example, a police force may be informed of the distribution of people around a city and/or changes in activity levels in specific locations around a city. Based on this information, the police force may

better position its patrol officers to locations around the city where the officers may be needed.

Wolfe, [0014].

In yet another example, an ambulance service may be informed of the locations of people, and consequently their vehicles, on the roadways. The ambulance service may use this information to create a traffic congestion model in order to determine the best, most uncongested, and/or quickest route for an ambulance to take to the location of an emergency, and/or from the location of the emergency to a hospital.

Wolfe, [0016].

99. As discussed above, a POSITA would understand that an “*indication of a viral event*” includes an “indication of a crowd’s activity, including the crowd’s size, density, movement or other characteristics.” Accordingly, any of the crowd’s characteristics identified by the system of Wolfe would be an “*indication of a viral event*.” Examples of indicators of a viral event in Wolfe include indicating where crowds of people are located, how the crowds are changing, where they are moving to, when they are transitioning from one activity to another, and/or what activity they are transitioning to, distribution of people around a city and/or changes in activity levels.

100. Thus, the application 322 of computing device 300 (performing the functionality of the central office) that communicates with wireless carriers,

determines the number of wireless devices connected to access points and base stations within a particular area, takes “snapshots” of the group locations and analyzes crowd movements renders obvious “*a network monitor to monitor a wireless network for an indication of a viral event.*”

[1.2] *a location aggregator to obtain a location of each of a plurality of wireless devices associated with said viral event;*

101. First, as discussed above, Wolfe teaches a computing device (a server) in Fig. 3 that executes one or more applications to perform the functionality as depicted in Fig. 2. Wolfe discloses that one of the applications “may be arranged to operate with program data 324 on an operation system 321 to **effectuate the aggregation of the mobile device data.**” Wolfe, [0070]. The application 322 of computing device 300 that effectuates the aggregation of the mobile device data is a “*location aggregator:*”

Application 322 may include a mobile device telemetries data aggregation algorithm 323 that is implemented to add together and integrate the identities, demographic information and/or historical information related to the mobile devices within the geographic region. Program Data 324 may include historical mobile device telemetries data 325. In some embodiments, application 322 may be arranged to operate with program data 324 on an operating system 321 to effectuate the aggregation of the mobile device data.

Wolfe, [0070].

102. Wolfe further teaches that its location aggregator receives location information directly from the mobile devices within a geographic area and stores each mobile device's location:

Mobile device 112 may then wirelessly communicate its location to a central office 116 or other centralized depository of mobile device location information. Central office 116 may be communicatively coupled to a memory device 120 which may store mobile device locations.

Wolfe, [0022].

103. Wolfe teaches that the location of mobile devices is obtained using many techniques, such as using GPS-based location techniques (*"obtain a location of each of a plurality of wireless devices"*):

The present disclosure contemplates that a modern population of consumers may include a substantial and relatively predictable percentage of people who possess a mobile phone or other wireless device that may be in contact with a network, such as a wide area network. The disclosure may provide techniques that may be used to determine and/or report the locations of each of these terminal devices. These techniques may include GPS-based location determination techniques and/or Wi-Fi-based or cell-tower-based location determination techniques, which may involve triangulation.

Wolfe, [0017].

104. As discussed in [1.1], Wolfe discloses using the mobile devices'

information to determine the crowd's motion trends, e.g., the size and/or locations of the crowd, how the crowd is changing, where the crowd is moving to, and when the crowd is transitioning from one activity to another (indicating a "viral event"). Accordingly, because the crowd data is continuously obtained over time, each iteration of data collection about the crowd would be obtaining data about devices associated with a viral event.

105. Thus, the application 322 of computing device 300 of Wolfe that obtains and aggregates mobile device data, such as GPS-based location, of a crowd of people, where the mobile device data is associated with the crowd's movement and activity level, renders obvious "*a location aggregator to obtain a location of each of a plurality of wireless devices associated with said viral event.*"

[1.3] *a crowd risk determinant, triggered by said network monitor, to determine a crowd risk based on an aggregation of said location of each of said plurality of wireless devices associated with said viral event; and*

106. As discussed above, Wolfe teaches a computing device (a server) that executes one or more applications. Further, Wolfe teaches that its computing device "is connected in a networking environment such that processor 310, application 322 and/or program data 324 may perform with or as a computer system in accordance with embodiments herein." Wolfe, [0075]. One such embodiment is depicted in Fig. 2.

107. First, Wolfe discloses that the central office analyzes crowd

information using distribution models to estimate the size and location of crowds:

Central office 116 may store and run aggregation algorithms on the new location data from mobile devices 112 and/or on the demographic and historical data from memory device 120. The output of the aggregation algorithms may include a model of the distribution of the locations of mobile devices 112. This model may be used by central office **116** to estimate the size and/or location of crowds including the users of mobile devices **112**.

Wolfe, [0027].

108. Second, in considering the embodiments of Fig. 2 and Fig. 3, a POSITA would understand that the functionality described in Wolfe with respect to the central office of Fig. 2 (i.e., using models to estimate the size and location of crowds) corresponds to one of the applications 322 executing on a computing device 300. For example, POSITAs knew to implement multiple applications/algorithms on a computing device providing traditional central office functionality and data collection. *See*, Ansari, [0009], [0068] (describing a gateway device having “at least one application performing traditional central office functions” and “a library of application support service processes that facilitate data collection and data distribution”).

109. Accordingly, the application 322 of server 300 that performs the crowd analysis functionality (described in relation to the central office) in order to

position patrol officers where needed in the city renders obvious a *crowd risk determinant*.

110. Third, Wolfe discloses “*determin[ing] a crowd risk*” because Wolfe teaches using the application 322 of computing device 300 to analyze the movement of the crowd or changes in the crowd’s activity level (“*crowd risk*”), such as the speed at which the crowd is moving and/or level of conviction of the crowd to continue moving in the current direction:

The changing locations of the mobile device users may continue to be monitored, and the motion of individual terminals may be aggregated to estimate the movement of a crowd or to estimate changes in activity levels.

Wolfe, [0019].

For example, the current location of individual mobile devices 112 may be compared to their immediately previous locations to determine trends in where people are going. The time between measurements, coupled with the location displacement of the people, may indicate the **speed and/or direction in which the people are moving** ... used as an **indication of their level of conviction in moving in their current direction**. For instance, the faster people move, the more likely it may be that they will continue moving in same direction in which they are currently moving.

Wolfe, [0051].

111. Fourth, Wolfe discloses that the “*crowd risk*” is determined “*based on an aggregation of said location of each of said plurality of wireless devices associated with said viral event*” because as discussed in [1.2], Wolfe discloses the application 322 of computing device 300 that effectuates the aggregation of the mobile device data (“*a location aggregator*”) uses the mobile device’s location information to create a model (“*based on an aggregation*”) of the distribution of the monitored crowd’s mobile device’s location (“*of said location of each of a plurality of wireless devices associated with said viral event*”).

112. Fifth, Wolfe discloses that the crowd risk determinant is triggered by the network monitor. As discussed above, Wolfe discloses that one application/algorithm of the central office monitors the wireless carriers and mobile devices (the *network monitor*). The central office, after obtaining the “new location data” (i.e., after the *location aggregator* application has performed its process), then runs the algorithms on that new data to analyze characteristics of the crowd such as the size, location, distribution, and level of conviction of the crowd:

Central office 116 may store and run aggregation algorithms on the new location data from mobile devices 112 and/or on the demographic and historical data from memory device 120. The output of the aggregation algorithms may include a model of the distribution of the locations of mobile devices 112. This model may be used by central office **116** to estimate the size and/or location of crowds including the users of mobile devices **112**.

Wolfe, [0027].

Once the individual location data is gathered, aggregation algorithms may be used to create a model of the distribution of the locations of the mobile device users. Population estimation models may be used to determine or estimate size and location of crowds based on this aggregated information.

Wolfe, [0018].

113. In another example, Wolfe describes monitoring the number of people in a geographic region, and then, if enough people are within that geographic region, an analysis is triggered to determine the likelihood that the crowd of people will take an action:

Thus, for example, if 10,000 people are determined to be within a half-mile of the restaurant, and each person has, on average, a 0.37% likelihood of ordering a slice of pizza, then it may be estimated that 37 slices of pizza will be needed in the next ten minutes.

Wolfe, [0046].

114. Accordingly, in this example, Wolfe teaches that the network monitor functionality determines that there are 10,000 people within a geographic region. Once the analysis by the network monitor is completed (i.e., determining that there are 10,000 people in that region), then the crowd risk determinant functionality is triggered. The crowd risk determinant functionality analyzes the likelihood that the

crowd will take a particular action (i.e., determining that the crowd will likely want to purchase 37 slices of pizza within the next ten minutes). Here, the “crowd risk” is that it is likely that 37 slices of pizza will be needed. Per Wolfe’s teachings, this crowd risk could just as easily have been likelihood of needing taxis or needing police. Wolfe, [0047], [0014].

115. Because, the central office, after obtaining the “new location data,” then runs the algorithms on that new data to analyze characteristics of the crowd and determine the likelihood of the crowd’s activities, it would be obvious to a POSITA that the *network monitor* functionality triggers the *crowd risk determinant* functionality. The sequence of events described in Wolfe establishes that the network monitoring functionality causes the crowd risk functionality to execute.

116. Thus, Wolfe’s application 322 of computing device 300 that (i) is triggered by the network monitoring functionality and (ii) uses the monitored crowd’s mobile device’s current and stored location information to analyze the crowd’s activity level (such as a level of conviction) and likelihood of the crowd’s actions renders obvious “*a crowd risk determinant, triggered by said network monitor, to determine a crowd risk based on an aggregation of said location of each of said plurality of wireless devices associated with said viral event.*”

[1.4] *an alert module to initiate an alert message relating to a public safety risk determined from an analysis of said viral event.*

117. Wolfe expressly teaches that its system is specifically designed to

provide crowd information to interested parties, e.g., first responders:

In another example, a police force may be informed of the distribution of people around a city and/or changes in activity levels in specific locations around a city. Based on this information, the police force may better position its patrol officers to locations around the city where the officers may be needed.

Wolfe, [0014].

In yet another example, an ambulance service may be informed of the locations of people, and consequently their vehicles, on the roadways. The ambulance service may use this information to create a traffic congestion model in order to determine the best, most uncongested, and/or quickest route for an ambulance to take to the location of an emergency, and/or from the location of the emergency to a hospital.

Wolfe, [0016].

118. Wolfe further describes that its system that alerts first responders can be implemented on a server that includes “one or more applications 322.” Wolfe, [0070]. The application 322 that alerts first responders is the “*alert module*.”

119. Wolfe teaches alerting local first responders, e.g., police force and ambulance service, to geographical locations where the monitored crowd’s activity level may require assistance from first responders. Similarly, Pfeffer teaches a first responder dispatch method that receives incident information including crowd location information, analyzes the incident, assigns a level of alert, and acting upon

the incident should the level of alert exceed a predetermined threshold. Pfeffer further teaches a first responder dispatch methodology that receives incident information from any source using any method:

In an operation 500, incident information is received. As described with reference to FIG. 1, the incident information can be received through any method, including a telephone call, an e-mail, a text message, a satellite image, a voice message, a coded message, a distress signal from the mobile device of a responder, e-911, alarms and sensors, a witness message from the mobile device a responder, etc.

Pfeffer, [0073].

120. Information received by Pfeffer's methodology about an incident includes, among other things, the number of people involved in the incident:

[I]ncident information such as type of incident, location of incident, time of day, time of year, current weather, whether the incident occurred on a holiday, the number of persons involved in the incident, the equipment needed to deal with the incident, etc.

Pfeffer, [0039].

121. Pfeffer's first responder dispatch methodology determines the level of alert using information about the incident, including crowd information, type of incident, number of people involved in the incident. (*"determined from an analysis of said viral event"*):

FIG. 6A is a screen shot of an incident information screen 600 of a dispatcher interface ... Resource manager 601 also includes information regarding a level of alert for the geographic region, shift information relevant to responders, agencies, and/or equipment, etc. The level of alert can be based on the weather, the number of active incidents, the number of available resources, information received from various agencies regarding potential threats, unusual events occurring in the area that may require support (i.e., parades, sporting events, festivals, etc.), etc.

Pfeffer, [0077].

122. Pfeffer's first responder dispatch methodology monitors the level of alert and if it exceeds a predetermined threshold ("*public safety risk*") the system sends requests for additional first responders ("*initiating an alert message*");

If the level of alert exceeds a predetermined threshold, the dispatcher or task management system can send out requests for additional responders to make themselves available.

Pfeffer, [0077]. Consistent with the teaching from Wolfe, the '054 patent specification uniformly describe "alerts" as not communicating with the individuals that make up the crowd, but rather to relevant authorities. '054 patent, 2:1-2 and 6:60-61 ("proper authorities"), 3:22-24 ("emergency personnel"), 3:49-51 ("public safety personnel").

123. Thus, Wolfe's application 322 that sends crowd information to police

and other first responders in view of Pfeffer's first responder dispatch methodology that receives: (i) incident information, (ii) determines the level of alert, (iii) determines if the level of alert exceeds a threshold based on the received incident information, and (iv) sends a request for additional first responders because of unusual events renders obvious "*an alert module to initiate an alert message relating to a public safety risk determined from an analysis of said viral event.*"

5. Claim 2

[2.0] *The aggregate location dynamometer in a physical wireless network server, said aggregate location dynamometer according to claim 1, further comprising:*

124. This limitation is substantially similar to the limitation of [1.0], and for the same reasons as discussed above, the prior art renders this limitation obvious.

[2.1] *a historical database maintaining a geographic region associated with said viral event.*

125. First, Wolfe discloses that its system uses a memory device that stores historical information ("*a historical database*"):

System memory 320 may include an operating system **321**, one or more applications **322**, and **program data 324**. Application **322** may include a mobile device telemetries data aggregation algorithm **323** that is implemented to add together and integrate the identities, demographic information and/or historical information related to the

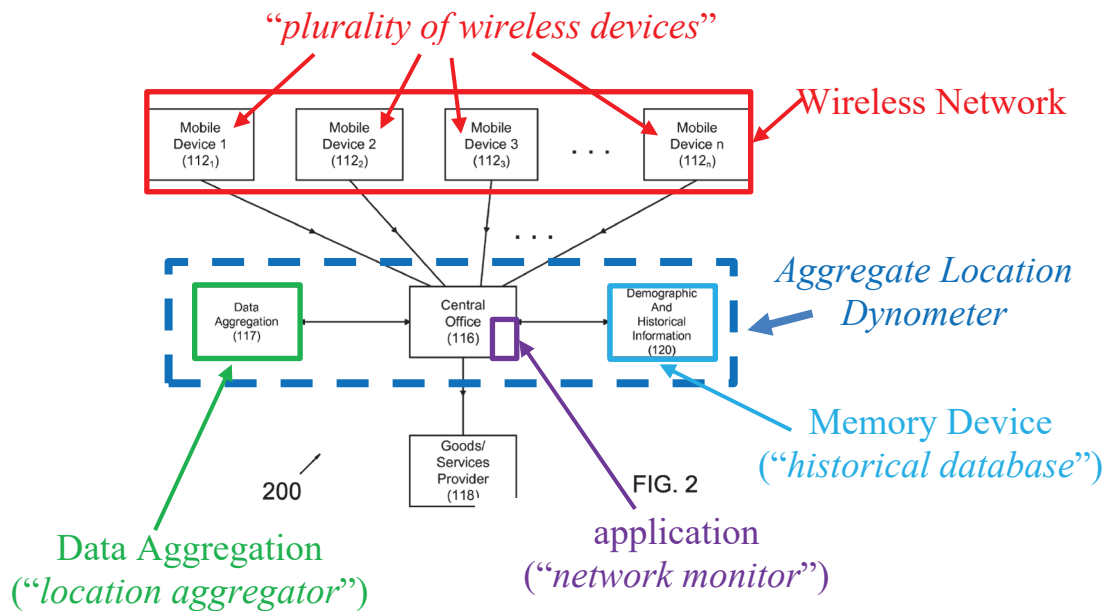
mobile devices within the geographic region. **Program Data 324 may include historical mobile device telemetries data 325.** In some embodiments, application 322 may be arranged to operate with program data 324 on an operating system 321 to effectuate the aggregation of the mobile device data.

Wolfe, [0070].

126. The location aggregator application 322 of computing device 300 (performing the functionality of central office 116) further stores received mobile device locations on the memory device:

Mobile device 1121 may then wirelessly communicate its location to a central office 116 or other centralized depository of mobile device location information. Central office 116 may be communicatively coupled to a memory device 120 which may store mobile device locations. **Central office 116 may store the received mobile device locations in memory device 120.**

Wolfe, [0022].



Wolfe, Fig. 2 (annotated)

127. Second, the location aggregator application 322 of computing device 300 (performing the functionality of central office 116) aggregates new and historical data received from the memory device:

Central office 116 may store and run aggregation algorithms on the new location data from mobile devices 112 and/or on the demographic and historical data from memory device 120 ... The demographic information retrieved from memory device 120 may be used to derive and/or estimate characteristics of the crowds represented by mobile devices 112.

Wolfe, [0027].

128. Third, Pfeffer teaches that it was known that a memory device for storing information relating to a first responder dispatch system would be a

“database”:

Task management system 100 is also in communication with a remote database 140 through network 125. Remote database 140 can be any source which can convey information to task management system 100.

Pfeffer, [0031].

129. Accordingly, a POSITA would understand that Wolfe renders obvious a “database” because Wolfe teaches the memory device (i) is “communicatively coupled” to the central office, (ii) stores historical information, and (iii) provides historical data to the aggregation algorithms. A POSITA would recognize that a memory device that stores historical data and provides data when requested teaches a “database.” Pfeffer, [0031].

130. Fourth, Pfeffer discloses a “*historical database maintaining a geographic region associated with said viral event*” because Pfeffer teaches storing information associated with the locations of previous incidents in a scenario database:

Scenario database 185 can include pre-programmed optimal responses based on incident information such as type of incident, **location of incident**, time of day, time of year, current weather, whether the incident occurred on a holiday, the number of persons involved in the incident, the equipment needed to deal with the incident, etc. In an exemplary embodiment, scenario database 185 can be fully

customizable based on the experience and knowledge of agencies, businesses, etc. using task management system 100.

Pfeffer, [0039]

In an exemplary embodiment, scenario analysis engine 170 can continually update scenario database 185 **based on the experiences of task management system 100 in dealing with previous incidents and/or current trends in incidents**. For example, the incident scenario for a prior incident may have indicated that eight responders would be able to provide an optimal response. However, after responding to the incident, reports may indicate that eight responders was not enough to efficiently and effectively deal with the incident. Based on this information, scenario analysis engine 170 can update scenario database 185 to ensure that the incident scenario for a subsequent incident (similar in scope to the prior incident) recommends nine or more responders.

Pfeffer, [0040].

131. Thus, Wolfe's system that uses historical information about incidents maintained a memory device in view of Pfeffer's teaching of a technique updating a database with data about the location of incidents, previous incidents and current trends renders obvious "*further comprising a historical database maintaining a geographic region associated with said viral event.*"

B. Ground 2: Claims 3-6 are obvious under 35 U.S.C. § 103 over Wolfe in

view of Pfeffer and further in view of Hua**6. Summary of Hua**

132. Hua provides a method for “human and crowd characterization and crowd behavioral detection ... for use with in security monitoring and crowd management.” Hua, [0002]. Hua’s methods are directed to “detecting specified behaviors of ... a crowd of people.” Hua, [0040]. Hua’s method provides additional crowd information by “identifying a user specified behavior of a crowd.” Hua, Abstract.

133. Hua’s “method further comprises receiving sensor and external data” including “GPS location, weather, date, and time data.” Hua, [0011]. Hua’s analysis uses crowd information, e.g., the motion of the crowd, as an indication of a risk to the crowd:

For example, the presence of a crowd could be an indication of a problem. The presence of a group within a park on a sunny data might be normal but the presence of a crowd on a rainy data could be an indication of an injured person. Further, on a rainy day, the mood of the people can be different, and further there could be more people running to avoid the rain.

Hua, [0011].

134. Hua teaches “detecting the formation and presence of a crowd and understanding its behavior are important to many applications in military, security,

and commercial environments.” Hua, [0003]. Hua discloses that it was known to POSITAs to extract the presence of a crowd and additional crowd information, e.g., crowd’s shape, is easily acquired from a density map of the crowd:

After getting the density map, crowd level features can be easily obtained. Each separate crowd is first obtained from the density map. Each crowd's features **such as location, shape, size and count** are then calculated **from the density map**.

Hua, [0072].

135. Hua explains that the presence of a crowd, a crowd’s behavior, or a crowd’s shape can indicate a problem with the crowd, for example, “presence of a group within a park on a sunny data might be normal but the presence of a crowd on a rainy data could be an indication of an injured person.” Hua, [0011]. Hua’s method uses crowd behavior such as “a crowd forming, a crowd dispersing, two way traffic, a waiting crowd, a quick moving crowd, a very crowded scene, a medium crowded scene, and a non-crowded scene” when assessing a possible crowd problem. Hua, [0011], [0084].

7. Reasons to combine Wolfe and Pfeffer with Hua

136. A POSITA would be motivated to combine the teachings of Wolfe-Pfeffer with those of Hua because Wolfe-Pfeffer discloses a crowd detection system which is specifically designed to provide crowd information to first responders when unusual crowd events occur, and Hua discloses a method to

provide additional crowd information known to POSITAs, e.g., the crowd's shape, when analyzing whether a risk to the crowd exists. Hua, [0011], [0072].

137. As an initial matter, a POSITA considering the problem purportedly solved by the '054 patent, would have looked to the teachings of Wolfe, Pfeffer and Hua. The field of endeavor of the '054 patent is "alerting to a problematic crowd risk in a given geographical location" by analyzing "aggregate location information pertaining to a multitude of wireless devices, to detect potential crowd risks." '054 patent, 1:31-37. The '054 patent uses "location based services (LBS) to obtain sets of aggregate location data corresponding to a number and pattern of wireless devices within an area" to "predict public safety risks." '054 patent, 2:49-51, 2:54-55.

138. As discussed previously, Wolfe is analogous art to the '054 patent because Wolfe uses GPS-based location determination techniques to obtain the mobile devices' location information, analyzes the aggregated mobile devices' location information, determines the crowd's location and activity level, and alerts first responders to unusual motion trends of the crowd within a particular area. Wolfe, [0014], [0017], [0018], [0042]. Pfeffer is analogous to the '054 patent because Pfeffer provides incident resolution methods that are designed to receive incident information about crowds associated with unusual event(s) and determine the appropriate response, e.g., dispatch first responders, to effectively handle the

risk to the crowd. Pfeffer, [0031], [0035], [0037], [0039], [0109]. Hua is analogous art because Hua is related to a method for “crowd characterization and crowd behavioral detection” that relates to “detecting specified behaviors of ... a crowd of people” for “use with in security monitoring and crowd management.” Hua, [0002], [0040].

139. A POSITA would have been specifically motivated to apply Hua’s crowd shape information to crowds identified by Wolfe-Pfeffer’s crowd detection system. For example, Wolfe-Pfeffer’s system identifies and tracks each mobile device associated with a monitored crowd and informs first responders of the crowd’s motion trends when unusual events occur, e.g., “the distribution of people around a city and/or changes in activity levels in specific locations around a city.” Wolfe, [0011], [0014]. Based on Wolfe-Pfeffer’s crowd information, the police force can position its patrol officers in locations around the city where the officers may be needed. Wolfe, [0014]. Wolfe-Pfeffer provides crowd information to first responders, e.g., locations of mobile devices associated with the crowd, the speed the crowd is moving, and a population density map of the crowd. A POSITA would understand that a crowd’s shape is implied based on the size, arrangement, and density of wireless devices plotted in the population density map. Wolfe-Pfeffer further provides information as to how the crowd’s size, arrangement, density, and therefore the crowd’s shape changes over time.

140. Hua, however, specifically discloses “detecting the formation and presence of a crowd and understanding its behavior” and it was known to POSITAs to extract the presence of a crowd and additional crowd features, e.g., crowd shape, from a density map of the crowd. Hua, [0003], [0072]. Hua explains that the presence of a crowd or a crowd’s behavior can indicate a risk to the crowd, for example, “presence of a group within a park on a sunny data might be normal but the presence of a crowd on a rainy data could be an indication of an injured person.” Hua, [0011]. Hua’s method uses crowd behavior such as “a crowd forming, a crowd dispersing, two way traffic, a waiting crowd, a quick moving crowd, a very crowded scene, a medium crowded scene, and a non-crowded scene” when assessing a possible risk to the crowd. Hua, [0011], [0084].

141. A POSITA would have found the combination of Wolfe-Pfeffer and Hua predictable and would have had a reasonable expectation of success. First, Wolfe-Pfeffer and Hua are the same type of system, in that both systems are evaluating crowd’s movement and behavior for an indication of a risk to the crowd. For example, the Wolfe-Pfeffer system detects “a plurality of wireless mobile devices within a geographic region” and provides “details of where crowds of people are located, how the crowds are changing.” Wolfe, Abstract, [0011], [0014]. Similarly, the Hua method detects “specified behaviors of ... a crowd of people” using “sensor and external data” including “GPS location, weather, date,

and time data.” Hua, [0011], [0040].

142. Second, Wolfe-Pfeffer teaches creating a population density map using the aggregated locations of mobile devices, associated with a monitored crowd, within a geographical area. Wolfe, [0082]. Hua provides additional information for characterizing the crowd, e.g., the crowd’s shape, using the density map. Hua, [0072]. Hua’s teachings about characterizing a crowd using the crowd’s shape would be desirable to combine with Wolfe’s system because the crowd information generated would aid in understanding the interest of the crowd by evaluating how the crowd’s shape changes over time. Wolfe, [0020].

143. Wolfe-Pfeffer’s system, which provides crowd information to first responders, would benefit from incorporating Hua’s techniques for further characterizing a crowd using the crowd’s shape because it would “enhance the detection of crowd features.” Hua, [0047]. Implementing Hua’s techniques of obtaining the crowd’s shape from the density map to Wolfe-Pfeffer’s system, where crowd information already includes the crowd’s population density map, would have been within the level of skill in the art. Hua specifically identifies that “crowd level features can be easily obtained” from the density map and that its “invention is intended to cover alternatives, modifications and equivalents.” Hua, [0072], [0103].

144. Accordingly, a POSITA would have found it obvious to apply Hua’s

teachings to the Wolfe-Pfeffer system because the combination would use known techniques (Hua's technique of determining crowd shapes from a density map) to improve a similar system (Wolfe-Pfeffer's system that analyzes information about crowds and how the crowds change over time) in the same way (analyzing crowds using density maps).

8. Claim 3

[3.0] *The aggregate location dynamometer in a physical wireless network server, said aggregate location dynamometer according to claim 2, wherein said historical databases comprises:*

145. This limitation is substantially similar to the limitation of [2.0], and for the same reasons as discussed above, the prior art renders this limitation obvious.

[3.1] *a plurality of acceptable crowd shapes, a crowd shape being defined by said aggregation of said location of each of said plurality of wireless devices associated with said viral event.*

146. First, as discussed in [1.0], Wolfe's location and tracking system detects a plurality of mobile devices located in a geographical area. As discussed in [1.1], Wolfe's system uses an application to monitor the crowd's motion trends and notify first responders when the crowd's motion trends are unusual in particular areas. Wolfe discloses, as discussed in [1.2], that one of the applications effectuates the aggregation of the mobile device data. As discussed in [1.3], Wolfe also discloses that the computing device (performing the functionality of the

central office) “runs the aggregation algorithms on the new location data from mobile devices 112” which outputs “a model of the distribution of the locations of mobile devices 112.” This triggers the application 322 of computing device 300 that uses a “model of the distribution of the locations of mobile devices” to analyze characteristics of the crowd. Wolfe also discloses storing “historical information.” Wolfe, [0024].

147. Second, Wolfe teaches a technique of creating a population density map using the aggregated locations of the monitored crowd’s mobile devices within a geographic area. Wolfe, [0082]. Hua teaches that, in a system using a density map (such as Wolfe’s system), it was known to track additional information for analyzing crowds, such as a crowd’s shape:

After getting the density map, crowd level features can be easily obtained. Each separate crowd is first obtained from the density map. Each crowd's features such as location, shape, size and count are then calculated from the density map.

Hua, [0072].

148. Accordingly, Wolfe (in view of Hua’s further teachings) render obvious “*a crowd shape being defined by said aggregation of said location of each of said plurality of wireless devices associated with said viral event.*”

149. Third, as discussed in [1.4], Wolfe’s system provides crowd information to first responders. Similarly, Pfeffer’s first responder dispatch

methodology receives incident information from external systems, analyzes the incident information, determines and monitors a level of alert based on the received incident information, and if the level of alert exceeds a threshold, determines the most effective response, e.g., dispatching additional first responders.

150. Pfeffer teaches that its incident detection method is configured to “develop one or more incident scenarios to resolve the incidents, and implement the one or more incident scenarios by assigning tasks to one or more responders through dispatch requests.” Pfeffer, [0028]. Pfeffer also teaches that its methodology can “adjust the response levels for each type of incident.” Pfeffer, [0039]. Pfeffer further teaches that it analyzes a level of alert to determine if the level of alert does or does not exceed a predetermined threshold. Pfeffer, [0078]. A POSITA would understand and recognize that if an incident has a level of alert that “exceeds a predetermined threshold,” thus needing additional first responders, the incident generating that level of alert would represent an unacceptable situation. Conversely, if the level of alert did not exceed the predetermined threshold, the incident generating that level of alert would represent an acceptable situation.

151. Accordingly, (i) Wolfe and Hua’s teachings of using location information to create a density map that shows the shape of a crowd for purposes

of analyzing the crowd's motion trends and level of conviction, in view of (ii) Pfeffer's teaching of using incident information to determine whether an incident is below a threshold, which does not necessitate dispatching additional police, renders obvious "*a plurality of acceptable shapes.*"

152. Further, a POSITA knew that algorithms that analyze crowds to detect abnormal events would include an analysis of the shape of the crowd:

The algorithms can also be used to calculate other abnormal events, such as speeding, no activity, loitering, abnormal path, stopped/waiting, crowd events. Crowd events may include a region that is more crowded or less crowded than that region normally is at the time of being observed; a group of people forming a specific shape, such as a line, circle, or rectangle; **a group of people forming a circle, rectangle or partial circle or rectangle, with a smaller group of people (e.g., one, two, three, or four people that are being observed) near the focus of the circle, rectangle, or other shape; and/or a group of people huddling together.**

Nathan, [0084].

153. A POSITA would have understood that pattern-based algorithms could analyze patterns in the monitored crowd's mobile device's location data to determine if the crowd pattern, e.g., indicates a crowd under duress (unsafe crowd) or not under duress (safe crowd). As one example of what POSITAs understood

Shape and pattern-recognition based algorithms. Shape and pattern-recognition based algorithms may include algorithms for recognizing patterns in optical, thermal and/or audio data indicative of an attack. The pattern recognition based algorithm may include a thermal analysis and/or audio analysis. For example, the pattern based algorithm may analyze the pattern of pixels to determine if the pattern has one or more characteristics of a person or crowd under duress.

Nathan, [0056].

154. Fourth, Pfeffer teaches a method that updates and saves incident information, e.g., crowd shapes, to the scenario database for future use:

In an exemplary embodiment, scenario analysis engine 170 can continually update scenario database 185 based on the experiences of task management system 100 in dealing with previous incidents and/or current trends in incidents. For example, the incident scenario for a prior incident may have indicated that eight responders would be able to provide an optimal response. However, after responding to the incident, reports may indicate that eight responders was not enough to efficiently and effectively deal with the incident. Based on this information, scenario analysis engine 170 can update scenario database 185 to ensure that the incident scenario for a subsequent incident (similar in scope to the prior incident) recommends nine or more responders.

Pfeffer, [0040].

155. A POSITA would have understood that information about past events,

where the crowd's shape indicated a safe crowd (*"a plurality of acceptable crowd shapes"*), may be saved and compared to current events to determine if they are similar. As one example of what POSITAs understood:

Records of past behaviors 246 may store information about behaviors as attacks are happening, which may be reviewed further at a later date to better determine the characteristics of the attacks that are specific to various individuals 108 so that system 100 may more reliably detect attacks related to the behaviors of one or more individuals.

Nathan, [0051].

156. Thus, Wolfe's telemetrics-based location and tracking system that detects a plurality of mobile devices located in a geographical area and tracks a crowd's characteristics using density maps, and which stores information in a historical database, in view of Hua's teaching that it was known to analyze the shape of a crowd using density maps, further in view of Pfeffer's methodology of identifying an acceptable or unacceptable situation based on crowd information and updating a database with incident information for future analysis renders obvious *"a plurality of acceptable crowd shapes, a crowd shape being defined by said aggregation of said location of each of said plurality of wireless devices associated with said viral event."*

9. Claim 4

[4.0] *The aggregate location dynometer in a physical wireless network server, said aggregate location dynometer according to claim 2, wherein said historical databases comprises:*

157. This limitation is substantially similar to the limitation of [2.0], and for the same reasons as discussed above, the prior art renders this limitation obvious.

[4.1] *a plurality of non-acceptable crowd shapes, a crowd shape being defined by said aggregation of said location of each of said plurality of wireless devices*

158. First, as discussed in [3.1], Wolfe's location and tracking system detects a plurality of mobile devices located in a geographical area, uses the aggregated mobile device locations to create a density map, and Hua teaches extracting the shape of a crowd from a density map.

159. As also discussed in [3.1], Pfeffer teaches determining if a level of alert indicates an acceptable situation or an unacceptable situation requiring additional first responders:

Resource manager 601 also includes information regarding a level of alert for the geographic region, shift information relevant to responders, agencies, and/or equipment, etc. The level of alert can be based on the weather, the number of active incidents, the number of available resources, information received from various agencies regarding potential threats, unusual events occurring in the area that may require support (i.e., parades, sporting events, festivals, etc.), etc. If the level of

alert exceeds a predetermined threshold, the dispatcher or task management system can send out requests for additional responders to make themselves available.

Pfeffer, [0077].

160. A POSITA would understand and recognize that if an incident has a level of alert that “exceeds a predetermined threshold,” thus needing additional first responders, the incident generating that level of alert represents an “unacceptable” situation. Conversely, if the level of alert did not exceed the predetermined threshold, the incident generating that level of alert would represent an “acceptable” situation.

161. Pfeffer teaches several examples of unsafe situations, e.g., emergencies such as car accidents, airplane accidents, terrorist attacks, medical emergencies, and natural disasters. Pfeffer, [0028].

162. Second, as discussed in [3.1], Wolfe discloses creating a population density map using the current location of each mobile device associated with the monitored crowd. Hua teaches that a crowd and crowd level features, e.g., crowd shape (“*crowd shape*”), can be easily obtained from a density map. Hua, [0072].

163. Third, as discussed in [3.1], Pfeffer teaches a method that updates and saves incident information, e.g., crowd shapes (“*plurality of non-acceptable crowd shapes*”), in the scenario database for future use.

164. As discussed in [3.1], a POSITA would have understood that pattern-based algorithms could analyze patterns in the location data to determine if the crowd pattern indicates an unsafe crowd.

165. Thus, Wolfe's telemetrics-based location and tracking system that detects a plurality of mobile devices located in a geographical area and tracks a crowd's characteristics using density maps, and which stores information in a historical database, in view of Hua's teaching that it was known to analyze the shape of a crowd using density maps, further in view of Pfeffer's teaching of identifying an acceptable or unacceptable situation based on crowd information and updating a database with incident information for future analysis, renders obvious "*a plurality of non-acceptable crowd shapes, a crowd shape being defined by said aggregation of said location of each of said plurality of wireless devices.*"

10. Claim 5

[5.0] *The aggregate location dynamometer in a physical wireless network server, said aggregate location dynamometer according to claim 2, wherein said historical databases comprises:*

166. This limitation is substantially similar to the limitation of [2.0], and for the same reasons as discussed above, the prior art renders this limitation obvious.

[5.1] *a configurable parameter defining a threshold of a crowd shape becoming unacceptable and thus said crowd risk.*

167. First, as discussed with respect to claims 3 and 4, Wolfe’s telemetrics-based location and tracking system that detects a plurality of mobile devices located in a geographical area and tracks a crowd’s characteristics using density maps, in view of Hua’s teaching that it was known to analyze the shape of a crowd using density maps, further in view of Pfeffer’s teaching of identifying an acceptable or unacceptable situation based on crowd information renders obvious that certain crowd shapes are acceptable and other crowd shapes are not-acceptable.

168. Further, Pfeffer teaches when analyzing an incident, its technique is to use a predetermined threshold to assess the level of alert:

If the level of alert exceeds a predetermined threshold, the dispatcher or task management system can send out requests for additional responders to make themselves available.

Pfeffer, [0077].

169. A POSITA would understand and recognize that if an incident has a level of alert that “exceeds a predetermined threshold,” thus needing additional first responders, the incident generating that level of alert represents an “unacceptable” situation. Conversely, if the level of alert did not exceed the predetermined threshold, the incident generating that level of alert would represent

an acceptable situation:

The algorithms can also be used to calculate other abnormal events, such as speeding, no activity, loitering, abnormal path, stopped/waiting, crowd events. Crowd events may include a region that is more crowded or less crowded than that region normally is at the time of being observed; a group of people forming a specific shape, such as a line, circle, or rectangle; a group of people forming a circle, rectangle or partial circle or rectangle, with a smaller group of people (e.g., one, two, three, or four people that are being observed) near the focus of the circle, rectangle, or other shape; and/or a group of people huddling together.

Nathan, [0084].

170. Accordingly, because Wolfe in view of Hua teaches determining a crowd risk, uses a crowd shape, and Pfeffer teaches using a threshold to determine the level of risk of an incident, a POSITA would find it obvious that the combined teachings of Wolfe, Hua, and Pfeffer disclose defining “*a threshold of a crowd shape becoming unacceptable.*”

171. Second, Pfeffer teaches that the “predetermined threshold” is part of a “scenario database 185 that can be fully customizable.” Pfeffer, [0039]. Pfeffer describes that its predetermined threshold value can be a number of people involved in the incident or the number of agencies needed to respond:

In one embodiment, a predetermined threshold value for a number of people involved in the incident or a number of agencies which need to be involved in the response may be used to determine if the incident is a complex incident. Alternatively, the type of incident (i.e, bombing) may determine whether the incident is considered to be a complex incident.

Pfeffer, [0109].

172. Pfeffer further describes that the “number of persons involved in the incident” (e.g., the predetermined threshold) is the type of data stored in the scenario database 185:

Scenario database 185 can include pre-programmed optimal responses based on incident information such as type of incident, location of incident, time of day, time of year, current weather, whether the incident occurred on a holiday, the number of persons involved in the incident, the equipment needed to deal with the incident, etc.

Pfeffer, [0039].

173. Third, Pfeffer teaches that the scenario database, providing optimal responses based on incident information, is fully customizable and continually updated:

Scenario database 185 can include pre-programmed optimal responses based on incident information ... scenario database 185 can be fully customizable based on the experience and knowledge of agencies, businesses, etc. using task management system 100.

Pfeffer, [0039].

In an exemplary embodiment, scenario analysis engine 170 can continually update scenario database 185 based on the experiences of task management system 100 in dealing with previous incidents and/or current trends in incidents. For example, the incident scenario for a prior incident may have indicated that eight responders would be able to provide an optimal response. However, after responding to the incident, reports may indicate that eight responders was not enough to efficiently and effectively deal with the incident. Based on this information, scenario analysis engine 170 can update scenario database 185 to ensure that the incident scenario for a subsequent incident (similar in scope to the prior incident) recommends nine or more responders.

Pfeffer, [0040].

174. In another example, Pfeffer teaches that if the predetermined threshold is exceeded, e.g., the number of people involved in the incident exceeds a threshold, then the type of incident is elevated to a complex incident:

In one embodiment, a predetermined threshold value for a number of people involved in the incident or a number of agencies which need to be involved in the response may be used to determine if the incident is a complex incident.

Pfeffer, [0109].

175. As discussed in [3.1], a POSITA would have understood that pattern-

based algorithms could analyze patterns in the location data to determine if the crowd pattern indicates an unsafe crowd with an unsafe crowd shape.

176. Thus, because Pfeffer teaches that the scenario database is fully customizable, a POSITA would understand that the predetermined threshold used to assess the level of alert is also customizable, and thus renders obvious a *“configurable parameter defining a threshold.”*

177. Accordingly, Wolfe’s telemetrics-based location and tracking system that detects a plurality of mobile devices located in a geographical area and tracks a crowd’s characteristics using density maps, in view of Hua’s teaching that it was known to analyze the shape of a crowd using density maps, further in view of Pfeffer’s teaching of identifying an acceptable or unacceptable situation based on crowd information by comparing against a customizable threshold, renders obvious *“a configurable parameter defining a threshold of a crowd shape becoming unacceptable and thus said crowd risk.”*

11. Claim 6

[6.0] *The aggregate location dynometer in a physical wireless network server, said aggregate location dynometer according to claim 2, wherein said historical databases comprises:*

178. This limitation is substantially similar to the limitation of [2.0], and for the same reasons as discussed above, the prior art renders this limitation obvious.

[6.1] *a plurality of crowd shape trends based on historical wireless device locations during previous viral events.*

179. First, as discussed with respect to claims 3 and 4, Wolfe’s telemetrics-based location and tracking system that detects a plurality of mobile devices located in a geographical area and tracks a crowd’s characteristics using density maps, in view of Hua’s teaching that it was known to analyze the shape of a crowd using density maps, further in view of Pfeffer’s teaching of identifying an acceptable or unacceptable situation based on crowd information renders obvious that certain crowd shapes are acceptable and other crowd shapes are not-acceptable.

180. Second, as discussed in [2.1], Wolfe and Pfeffer teach a “*historical database maintaining a geographic region associated with said viral event*” because Pfeffer teaches a scenario database for storing information about a location of previous incidents.

181. Pfeffer discloses updating the scenario database to contain information about prior incidents (“*previous viral events*”) handled by the task management systems:

In an exemplary embodiment, scenario analysis engine 170 can continually **update scenario database 185 based on the experiences of task management system 100 in dealing with previous incidents** and/or current trends in incidents. For example, the incident scenario for a prior incident may have indicated that eight responders would be

able to provide an optimal response. However, after responding to the incident, reports may indicate that eight responders was not enough to efficiently and effectively deal with the incident. Based on this information, scenario analysis engine 170 can update scenario database 185 to ensure that the incident scenario for a subsequent incident (similar in scope to the prior incident) recommends nine or more responders.

Pfeffer, [0040].

182. It would have been obvious to a POSITA that Wolfe's historical database containing demographic and historical information including mobile device locations would also contain information about crowd shape, as taught in Hua. For example, POSITAs were actively tracking and storing crowd shapes in crowd event analysis systems:

Other algorithms can be used including a combination of size, motion and shape based algorithms/methods. Motion history, size/ratios, and shape based methods can be combined intelligently to give a robust and accurate fall detector. The algorithms can also be used to calculate other abnormal events, such as speeding, no activity, loitering, abnormal path, stopped/waiting, crowd events. Crowd events may include a region that is more crowded or less crowded than that region normally is at the time of being observed; a group of people forming a specific shape, such as a line, circle, or rectangle; a group of people forming a circle, rectangle or partial circle or rectangle, with a smaller group of people (e.g., one, two, three, or four people that are being observed)

near the focus of the circle, rectangle, or other shape; and/or a group of people huddling together.

Nathan, [0084].

183. Thus, Wolfe's system providing and saving details of the crowd's movement and location within a geographical area, aggregating the mobile device's location information, and creating a population density map, in view of Hua's technique of extracting crowd information, e.g., crowd shape, from density maps, and further in view of Pfeffer's teaching of updating a scenario database to containing information about prior incidents, renders obvious the "*a plurality of crowd shape trends based on historical wireless device locations during previous viral events.*"

C. Ground 3: Claims 7-14 are obvious under 35 U.S.C. § 103 over Wolfe in view of Hua

12. Reasons to combine Wolfe and Hua

184. A POSITA would be motivated to combine the teachings of Wolfe with those of Hua because Wolfe discloses a crowd detection system that is specifically designed to provide detailed crowd information to police, and Hua discloses a method to provide additional crowd information known to POSITAs, e.g., the crowd's shape, when analyzing whether a risk to the crowd exists. Hua, [0011], [0072].

185. As an initial matter, a POSITA, considering the problem purportedly

solved by the '054 patent, would have looked to the teachings of Wolfe and Hua. The field of endeavor of the '054 patent is “alerting to a problematic crowd risk in a given geographical location” by analyzing “aggregate location information pertaining to a multitude of wireless devices, to detect potential crowd risks.” '054 patent, 1:31-37. The '054 patent uses “location based services (LBS) to obtain sets of aggregate location data corresponding to a number and pattern of wireless devices within an area” to “predict public safety risks.” '054 patent, 2:49-55.

186. Wolfe is analogous art because it relates to a system that uses “GPS-based location determination techniques” to “determine and/or report the locations” of mobile devices. Wolfe, [0017]. Wolfe teaches evaluating the motion trends of a crowd by aggregating the mobile devices’ location information associated with the monitored crowds in a particular area. Wolfe, [0018]. This information is provided to first responders. Wolfe, [0014]. Further, Wolfe discloses determining a crowd’s activity level, e.g., the crowd’s level of conviction, as an “indication of their level of conviction in moving in their current direction.” Wolfe, [0042]. Wolfe discloses creating a population activity map which involves “using the displacement of individual customers and/or the time between measurements to determine an activity level for individual customers.” Wolfe, [0042]. Changes in the crowd’s activity level may indicate a risk to the crowd. Hua is analogous art because Hua is related to a method for “crowd

characterization and crowd behavioral detection” and relates to “detecting specified behaviors of ... a crowd of people.” Hua, [0002], [0040].

187. A POSITA would have been specifically motivated to apply Hua’s crowd shape information to Wolfe’s crowd detection system. For example, Wolfe’s system identifies and tracks each mobile device associated with the monitored crowd. Wolfe, [0011]. Wolfe’s system informs first responders of crowd information, e.g., “the distribution of people around a city and/or changes in activity levels in specific locations around a city.” Wolfe, [0014], [0016]. Based on Wolfe’s crowd information, the police can position its patrol officers in locations around the city where the officers may be needed. Wolfe, [0014]. To alert the police, Wolfe describes that it analyzes size, arrangement, and density of wireless devices and creates a population density map. A POSITA would recognize that a crowd’s shape is discernable from the size, arrangement and density of devices plotted in a population density map.

188. Hua, however, specifically teaches “detecting the formation and presence of a crowd and understanding its behavior” and it was known to POSITAs to extract the presence of a crowd and additional crowd features, e.g., crowd shape, from a density map of the crowd (such as the density map from Wolfe). Hua, [0003], [0072]. Hua explains that the presence of a crowd or a crowd’s behavior can indicate a risk to the crowd, for example, “presence of a

group within a park on a sunny data might be normal but the presence of a crowd on a rainy data could be an indication of an injured person.” Hua, [0011]. Hua’s method uses crowd behavior such as “a crowd forming, a crowd dispersing, two way traffic, a waiting crowd, a quick moving crowd, a very crowded scene, a medium crowded scene, and a non-crowded scene” when assessing a possible risk to the crowd. Hua, [0011], [0084].

189. A POSITA would have found the combination of Wolfe and Hua predictable and would have had a reasonable expectation of success. First, Wolfe and Hua are the same type of system, in that both systems are evaluating crowd’s movement and behavior. For example, the Wolfe system detects “a plurality of wireless mobile devices within a geographic region” and provides “details of where crowds of people are located, how the crowds are changing.” Wolfe, Abstract, [0011], [0014]. Similarly, the Hua method detects “specified behaviors of ... a crowd of people” using “sensor and external data” including “GPS location, weather, date, and time data.” Hua, [0011], [0040].

190. Second, Wolfe teaches creating a population density map using the aggregated locations of mobile devices, associated with a monitored crowd, within a geographical area. Wolfe, [0082]. Hua provides additional information for characterizing the crowd, e.g., the crowd’s shape, using the density map. Hua, [0072]. Hua’s teachings about characterizing a crowd using the crowd’s shape

would be desirable to combine with Wolfe's system because the crowd information generated would aid the recipient with the position of the crowd and an indication of the interest of the crowd by evaluating how the crowd's shape changes over time. Wolfe, [0020].

191. Wolfe's system would benefit from incorporating Hua's techniques for further characterizing a crowd using the crowd's shape. Wolfe's system already teaches providing crowd information including "providing details of where crowds of people are located, how the crowds are changing, where they are moving to, when they are transitioning from one activity to another, and/or what activity they are transitioning to." Wolfe, [0011]. Wolfe also teaches creating a population density map using the locations of mobile devices associated with the monitored crowd within a geographical area. Wolfe, [0082]. Hua provides additional information for characterizing the crowd extracted from the density map. Hua, [0072]. Wolfe's system of analyzing the characteristics of a crowd with a density map would benefit from Hua's teachings that further a POSITA's understanding of how a crowd's shape changes over time. Hua, [0072].

192. Hua's teachings about characterizing a crowd using the crowd's shape would be desirable to combine with Wolfe's system because the crowd information generated would aid the recipient with the position of the crowd and an indication of the interest of the crowd by evaluating how the crowd's shape changes over

time. Wolfe, [0020]. Wolfe's system teaches identifying a crowd, tracking the location of the crowd, providing crowd information to interested parties, and incorporating Hua's additional information about the crowd's shape would expand the capabilities of the Wolfe system.

193. A POSITA would have had a reasonable expectation of success when combining the teachings of Hua with those of Wolfe because Wolfe already contemplates estimating the size of the crowd and using the location information of the mobile device's associated with the monitored crowd. Wolfe, [0018], [0032]-[0035]. Hua's technique of obtaining the crowd's shape from a density map. Hua, [0072]. Implementing Hua's techniques of obtaining the crowd's shape from the density map to Wolfe's system, where crowd information already includes the crowd's population density map, would have been within the level of skill in the art because Hua acknowledges that its "invention is intended to cover alternatives, modifications and equivalents." Hua, [0103].

194. Accordingly, a POSITA would have found it obvious to apply Hua's teachings to the Wolfe's system because the combination would use known techniques (Hua's technique of determining crowd shapes from a density map) to improve a similar system (Wolfe's system that analyzes about crowds and how the crowds change over time) in the same way (analyzing crowds using density maps).

13. Claim 7

[7.0] *A method of alerting to a problematic crowd risk based on location based services (LBS), comprising:*

195. First, Wolfe expressly teaches a method for informing (“*a method of alerting*”) first responders, e.g., the police force, when the crowd’s activity level changes in particular areas (“*problematic crowd risk*”):

In another example, a police force may be informed of the distribution of people around a city and/or changes in activity levels in specific locations around a city. Based on this information, the police force may better position its patrol officers to locations around the city where the officers may be needed.

Wolfe, [0014].

196. Second, Wolfe discloses monitoring changes in the crowd’s activity level (“*problematic crowd risk*”), compared against a threshold. Wolfe, [0043] (“only those mobile devices 112 moving at at least a minimum threshold speed”).

197. Third, as discussed in [1.1], the application 322 of computing device 300 (performing the functionality of central office 116) of Wolfe monitors a wireless network by determining the number of wireless devices connected to access points and/or base stations within a particular area.

198. Fourth, Wolfe discloses a method of informing (“*a method of alerting*”) the system’s client about changes in the crowd’s activity level

(“*problematic crowd risk*”), e.g., crowds begin to move toward a particular area, based on the mobile device’s location information (“*location based services (LBS)*”):

In another example, a police force may be informed of the distribution of people around a city and/or changes in activity levels in specific locations around a city. Based on this information, the police force may better position its patrol officers to locations around the city where the officers may be needed.

Wolfe, [0014].

199. Thus, Wolfe’s method for monitoring a wireless network by monitoring the wireless access points and/or base stations, providing alerts and the crowd’s location information to first responders based on changes in the crowd’s activity level, providing alerts about changes in the crowd’s activity level, based on mobile device location information, renders obvious “*a method of alerting to a problematic crowd risk based on location based services (LBS).*”

[7.1] *monitoring wireless traffic for a forming viral event associated with a plurality of physical wireless devices within a given region;*

200. Wolfe discloses “*monitoring wireless traffic... associated with a plurality of physical wireless devices within a given region*” because Wolfe teaches a method for “detecting a plurality of wireless mobile devices within a geographic region.” Wolfe, Abstract.

201. Wolfe discloses a method where the application 322 of computing device 300 (performing the functionality of central office 116) monitors a wireless network. A POSITA would find it obvious that the application 322 of computing device 300 (performing the functionality of central office 116) is monitoring the network for traffic (“*monitoring wireless traffic*”) when it determines the number of mobile devices connected to the network’s wireless access points or base stations:

As alluded to above, determining the number of phones and/or wireless terminals in a mapped area may possibly involve aggregating data from multiple sources. For example, data from individual wireless access points and/or base stations within the mapped area may be gathered by a central office 116.

Wolfe, [0030].

202. Wolfe discloses that it detects “*a forming viral event associated with a plurality of physical wireless devices within a given region*” because Wolfe discloses a method that uses the mobile device’s location information to determine the crowd’s motion trends, e.g., size and/or locations of crowds, how the crowds are changing, where the crowds are moving to, and when crowds are transitioning from one activity to another:

This disclosure may include methods and systems for providing details of where crowds of people are located, how the crowds are changing,

where they are moving to, when they are transitioning from one activity to another, and/or what activity they are transitioning to.

Wolfe, [0011].

203. Wolfe discloses monitoring crowd changes as a group, rather than monitoring each wireless device associated with the monitored crowd, by using snapshots of the group's locations over time:

Instead of tracking the changing locations of individual terminals, changes in the terminal locations as a group, regardless of their individual identities or individual motions, may be monitored. Thus, "snapshots" of the group locations may be taken at periodic time intervals without regard to the identities of the individual terminals.

Wolfe, [0020].

204. Wolfe teaches that first responders, e.g., the police force or ambulance service, are provided crowd details based on the crowd's motion trends in particular areas, e.g., crowd locations, how the crowds are changing, moving, or transitioning from one activity to another:

In another example, a police force may be informed of the distribution of people around a city and/or changes in activity levels in specific locations around a city. Based on this information, the police force may better position its patrol officers to locations around the city where the officers may be needed.

Wolfe, [0014].

In yet another example, an ambulance service may be informed of the locations of people, and consequently their vehicles, on the roadways. The ambulance service may use this information to create a traffic congestion model in order to determine the best, most uncongested, and/or quickest route for an ambulance to take to the location of an emergency, and/or from the location of the emergency to a hospital.

Wolfe, [0016].

205. As discussed above, a POSITA would understand that an “*a forming viral event*” includes an “indication of a crowd’s activity, including the crowd’s size, density, movement or other characteristics.” Accordingly, any of the crowd’s characteristics identified by the system of Wolfe would be a “*a forming viral event*.” Examples of a forming viral event in Wolfe include indicating where crowds of people are located, how the crowds are changing, where they are moving to, when they are transitioning from one activity to another, and/or what activity they are transitioning to, distribution of people around a city and/or changes in activity levels.

206. Thus, Wolfe’s teaching of the method of monitoring base stations and access points for connected wireless mobile devices, receiving each mobile device’s location information within a geographic region, identifying a crowd based on the received mobile device’s locations, and identifying the distribution of people around a city and/or changes in activity levels of the crowd, renders

obvious “*monitoring wireless traffic for a forming viral event associated with a plurality of physical wireless devices within a given region.*”

[7.2] *initiating location requests to a physical location server to obtain a current location of each of said plurality of physical wireless devices;*

207. First, as discussed in [1.0], Wolfe discloses that its system can be implemented in a server that collects and integrates mobile device location data. Wolfe teaches that, in its method, the application 322 of computing device 300 (performing the functionality of central office 116) stores each received mobile device’s location information “within the geographic area with which central office 116 is associated.” Wolfe, [0030], [0022]. The method includes the location aggregator application 322 of computing device 300 collecting the wireless device’s current location using “GPS-based location determination techniques, Wi-Fi-based or cell-tower-based location determination techniques, including triangulation.” Wolfe, [0017]

208. Second, Wolfe teaches a method in which one central computer pulls data from a plurality of central offices (each, a server that obtains location data about mobile devices):

For example, each central office 116 may be associated with one or more respective geographic regions, such as an area in which potential common customers and/or clients of retailers within the geographic region may be congregated. However, it is to be understood that one central computer system may be arranged to create the maps and the

associated data structures for many or all of the regions. Such a central computer system may be communicatively coupled to each of a plurality of central office's 116.

Wolfe, [0034].

209. A POSITA would understand that the central computer system that is arranged to analyze data from a plurality of central office servers would initiate requests to those servers to obtain the data.

210. Thus, Wolfe's method in which a central computer system requests, from a central office server, continuously updated location information about each mobile device within a geographic area renders obvious "*initiating location requests to a physical location server to obtain a current location of each of said plurality of physical wireless devices.*"

[7.3] *forming a crowd shape based on an aggregation of said current location of each of said plurality of physical wireless devices;*

211. First, Wolfe teaches that it creates a population density map using the aggregated locations of the monitored crowd's mobile devices within a geographic area. Wolfe, [0082].

212. Second, Wolfe discloses monitoring crowd changes as a group by using snapshots of the group's locations over time:

Instead of tracking the changing locations of individual terminals, changes in the terminal locations as a group, regardless of their

individual identities or individual motions, may be monitored. Thus, “snapshots” of the group locations may be taken at periodic time intervals without regard to the identities of the individual terminals.

Wolfe, [0020].

213. Third, Hua teaches that, in a system using a density map (such as Wolfe’s system), it was known to track additional information for analyzing crowds, such as a crowd’s shape. Hua, [0072].

After getting the density map, crowd level features can be easily obtained. Each separate crowd is first obtained from the density map. Each crowd's features such as location, shape, size and count are then calculated from the density map.

Hua, [0072].

214. Accordingly, a POSITA would have understood that, in Wolfe’s system, which teaches monitoring snapshots of group locations at periodic time intervals, in view of Hua’s teaching of detecting crowd shapes would disclose detecting the formation of a shape of a crowd. POSITAs were already doing such an analysis of crowds and crowd shapes. See, for example, Nathan, which describes “[c]rowd events may include ... a group of people forming a specific shape, such as a line, circle, or rectangle; a group of people forming a circle, rectangle or partial circle or rectangle over time.” Nathan, [0084].

215. Fourth, as discussed in [7.1], Wolfe teaches a method for providing

crowd details based on the crowd's motion trends in particular areas. Wolfe discloses a method which uses the mobile device's location information to create a model ("*based on an aggregation*") of the distribution of each of the monitored crowd's mobile device's location ("*of said current location of each of said plurality of physical wireless devices*"):

Once the individual location data is gathered, aggregation algorithms may be used to create a model of the distribution of the locations of the mobile device users. Population estimation models may be used to determine or estimate size and location of crowds based on this aggregated information.

Wolfe, [0018].

216. Thus, Wolfe's teaching of a method for creating a population density map using the aggregated locations of the monitored crowd's mobile devices using snapshots over periodic intervals, in combination with Hua's method that crowd shape is derived from a density map, renders obvious "*forming a crowd shape based on an aggregation of said current location of each of said plurality of physical wireless devices*"

[7.4] *determining a crowd risk of said crowd based on said crowd shape of said current location of each of said plurality of physical wireless devices; and*

217. First, as discussed in [3.1], Wolfe discloses creating a population density map using the current location of each mobile device associated with the

monitored crowd.

218. Second, as discussed in [1.3], Wolfe discloses analyzing the characteristics of the crowds, such as the size and location, to determine a crowd risk. Wolfe, [0034], [0042]. Wolfe also discloses informing the police based on “changes in activity levels” of the crowds. Wolfe [0014].

219. As discussed in [7.3], Hua teaches that it was known that a crowd’s shape is easily obtained from a density map such as the density maps of Wolfe.

220. As also discussed in [7.3], a POSITA would have understood that, in Wolfe’s system, which teaches monitoring snapshots of group locations at periodic time intervals, in view of Hua’s teaching of detecting crowd shapes would disclose detecting the formation of a shape of a crowd. POSITAs were already doing such an analysis of crowds and crowd shapes. See, for example, Nathan, which describes “[c]rowd events may include ... a group of people forming a specific shape, such as a line, circle, or rectangle; a group of people forming a circle, rectangle or partial circle or rectangle over time.” Nathan, [0084].

221. Accordingly, a POSITA would have understood that, in Wolfe’s system, which determines a crowd risk by analyzing characteristics of the crowd, in view of Hua’s teaching of detecting crowd shapes would disclose determining the crowd risk by taking into account the shape of the crowd. POSITAs were already doing such an analysis of crowds and crowd shapes. See, for example,

Nathan, which describes:

The algorithms can also be used to calculate other abnormal events, such as speeding, no activity, loitering, abnormal path, stopped/waiting, crowd events. Crowd events may include a region that is more crowded or less crowded than that region normally is at the time of being observed; a group of people forming a specific shape, such as a line, circle, or rectangle; a group of people forming a circle, rectangle or partial circle or rectangle, with a smaller group of people (e.g., one, two, three, or four people that are being observed) near the focus of the circle, rectangle, or other shape; and/or a group of people huddling together.

Nathan, [0084].

222. Thus, Wolfe's teaching of determining a crowd risk based on the characteristics of the crowd based on the current location of the mobile devices in a density map, in combination with Hua's method that crowd shape is derived from a density map render obvious "*determining a crowd risk of said crowd based on said crowd shape of said current location of each of said plurality of physical wireless devices.*"

[7.5] *triggering a crowd alert message when said determined crowd risk is above a given threshold.*

223. First, as discussed in [7.4], Wolfe in view of Hua render obvious that the risk of a crowd can be determined and assessed by taking into account the shape of the crowd.

224. Second, Wolfe teaches that when the activity levels of the crowd changes, the police force may be informed so that patrol officers can be sent to needed locations:

In another example, a police force may be informed of the distribution of people around a city and/or changes in activity levels in specific locations around a city. Based on this information, the police force may better position its patrol officers to locations around the city where the officers may be needed.

Wolfe, [0014].

225. Consistent with the teaching from Wolfe, the '054 patent specification uniformly describe “alerts” as not communicating with the individuals that make up the crowd, but rather to relevant authorities. '054 patent, 2:1-2 and 6:60-61 (“proper authorities”), 3:22-24 (“emergency personnel”), 3:49-51 (“public safety personnel”).

226. Wolfe further discloses another example of the method for providing alerts about changes in the crowd’s activity level:

There are many example applications of the present disclosure which may enable goods and services to be provided in a better and/or more responsive fashion by virtue of having determined and/or reported a crowd's location, pattern of movement, and/or activity level. In one example, a taxi service may be informed of when and how many passengers will be arriving, are arriving, and/or have arrived at an

airport, bus station or train station so that the taxi service may dispatch an appropriate number of taxis at an appropriate time to the airport, bus station or train station. The taxi service may be informed of how many passengers are arriving, how many passengers are exiting the airport, bus station or train station as opposed to making connections, and/or which exits the passengers are using.

Wolfe, [0012].

227. Third, as discussed in [7.0], Wolfe teaches using a threshold because Wolfe discloses monitoring changes in the crowd's activity level, e.g., crowd's speed, compared to a threshold, such as monitoring "only those mobile devices 112 moving at at least a minimum threshold speed." Wolfe, [0043].

228. It was known to POSITAs that the need for triggering an alert would be predicated upon a crowd's activity level exceeding a threshold. For example, Pfeffer discloses:

If the level of alert exceeds a predetermined threshold, the dispatcher or task management system can send out requests for additional responders to make themselves available.

Pfeffer, [0077].

229. Thus, sending a message due to changes in the crowd's activity levels exceeding a threshold renders obvious "*triggering a crowd alert message when said determined crowd risk is above a given threshold.*"

14. Claim 8

[8.0] *The method of alerting to a problematic crowd risk with location based services (LBS) according to claim 7, wherein:*

230. This limitation is substantially similar to the limitation of [7.0], and for the same reasons as discussed above, the prior art renders this limitation obvious.

[8.1] *said crowd risk of said crowd is further determined based on a movement of said crowd shape.*

231. As discussed in [7.0], Wolfe expressly teaches a method for informing first responders, e.g., the police force, when the crowd's activity level changes in particular areas so that patrol officers can go to needed locations.

232. As discussed in [1.2], the application 322 of computing device 300 (performing the functionality of central office 116) monitors the locations of the mobile devices individually or as a crowd over time:

The changing locations of the mobile device users may continue to be monitored, and the motion of individual terminals may be aggregated to estimate the movement of a crowd or to estimate changes in activity levels. Alternatively, the flow of terminals from one geographic cell or area to another may be used to estimate motion or activity.

Wolfe, [0019].

233. As discussed in [7.3], a POSITA would have understood that, in Wolfe's system, which teaches monitoring snapshots of group locations at periodic

time intervals, in view of Hua's teaching of detecting crowd shapes would disclose detecting the formation of a shape of a crowd. POSITAs were already doing such an analysis of crowds and crowd shapes. See, for example, Nathan, which describes "[c]rowd events may include ... a group of people forming a specific shape, such as a line, circle, or rectangle; a group of people forming a circle, rectangle or partial circle or rectangle over time." Nathan, [0084].

234. As discussed in [1.2], the monitored crowd's mobile device's movement can be monitored over time:

The changing locations of the mobile device users may continue to be monitored, and the motion of individual terminals may be aggregated to estimate the movement of a crowd or to estimate changes in activity levels.

Wolfe, [0019].

235. Accordingly, a POSITA would have understood that, in Wolfe's system, which teaches monitoring the movement of a crowd over time, in view of Hua's teaching of detecting crowd shapes would disclose monitoring the shape of the crowd as the crowd moves. POSITAs were already doing such an analysis of crowds and crowd shapes. See, for example, Nathan, which describes:

Other algorithms can be used including a combination of size, motion and shape based algorithms/methods. Motion history, size/ratios, and shape based methods can be combined intelligently to give a robust and

accurate fall detector. The algorithms can also be used to calculate other abnormal events, such as speeding, no activity, loitering, abnormal path, stopped/waiting, crowd events.

Nathan, [0084].

236. Thus, Wolfe's teaching of determining a compromise to crowd safety using the crowd's motion trends, such as monitoring the movement of the crowd's characteristics over time, in view of Hua's teaching of detecting crowd shapes, renders obvious "*said crowd risk of said crowd is further determined based on a movement of said crowd shape.*"

15. Claim 9

[9.0] *The method of alerting to a problematic crowd risk with location based services (LBS) according to claim 7, wherein said monitoring wireless traffic comprises:*

237. This limitation is substantially similar to the limitation of [7.0], and for the same reasons as discussed above, the prior art renders this limitation obvious.

[9.1] *monitoring wireless traffic at a given point in a wireless network; and*

238. First, as discussed in [1.1], the application 322 of computing device 300 (performing the functionality of central office 116) of Wolfe monitors a wireless network, by determining and continuously updating the number of wireless devices connected to access points and/or base stations within a particular

area.

239. Further, Wolfe discloses a method of the application 322 of computing device 300 (performing the functionality of central office 116) monitoring wireless traffic at access points and base stations (“*monitoring wireless traffic at a given point*”) within a particular region:

As alluded to above, determining the number of phones and/or wireless terminals in a mapped area may possibly involve aggregating data from multiple sources. For example, data from individual wireless access points and/or base stations within the mapped area may be gathered by a central office 116.

Wolfe, [0049].

240. Second, as discussed in [1.0], Wolfe’s system is implemented in a server in a wireless network environment.

241. Thus, Wolfe’s teaching a method in which the system monitors the wireless network by determining and continuously updating the number of mobile devices connected to wireless access point(s) and base station(s) within a particular region renders obvious “*monitoring wireless traffic at a given point in a wireless network.*”

[9.2] *comparing a given traffic parameter associated with said obtained current location of each of said plurality of physical wireless devices, with a historical traffic parameter associated with a previous problematic crowd formation.*

242. First, Wolfe discloses a number of methods for obtaining “*a given*

traffic parameter.” For example, Wolfe discloses a method for determining and continuously updating the number of wireless devices in contact with access point(s) and base station(s) in a particular area:

A first operation of this process may include determining the number of phones and/or wireless data terminals in contact with a single cell and/or access point for individual such cells and/or access points in a mapped area. For example, individual wireless access points and/or base stations in a geographic region may determine and/or continuously update the number of mobile devices that the access point is in communication with at any time.

Wolfe, [0053].

243. Another example is Wolfe discloses a method for determining the activity level of a region by using the flow information of each mobile device into and out of that region:

Yet another operation of the population activity map process may involve using the flow information within each region to determine an activity level for that region. For example, the average location, and/or center of gravity, of the group of mobile devices 112 may be compared to a previous (such as its immediately previous) average location to determine trends in where people are going.

Wolfe, [0056].

244. Second, Wolfe discloses using these traffic data points (such as

number of phones or flow information) by comparing the current value against a previous value (“*historical traffic parameter*”):

Yet another operation of the population activity map process may involve using the flow information within each region to determine an activity level for that region. For example, **the average location, and/or center of gravity, of the group of mobile devices 112 may be compared to a previous (such as its immediately previous) average location** to determine trends in where people are going.

Wolfe, [0056].

245. Third, Wolfe discloses a method of informing first responders of the locations of each mobile device within an area due to (1) the number of mobile devices in a particular area or (2) the changes in the activity levels of the mobile devices in a particular area (“*problematic crowd formation*”):

In another example, a police force may be informed of the distribution of people around a city and/or changes in activity levels in specific locations around a city. Based on this information, the police force may better position its patrol officers to locations around the city where the officers may be needed.

Wolfe, [0014].

246. Third, Wolfe discloses a “*historical traffic parameter*” because Wolfe teaches a method where the application 322 of computing device 300 (performing the functionality of central office 116) stores, in the memory device, each mobile

device's location located "within the geographic area with which central office 116 is associated." Wolfe, [0030], [0022].

247. Further, Wolfe discloses a method for retrieving historical data, e.g., number of mobile devices or the changes in the activity levels of the mobile devices from the memory device:

Central office 116 may be communicatively coupled to a data aggregation module 117. Central office 116 may store and run aggregation algorithms on the new location data from mobile devices 112 and/or on the demographic and historical data from memory device 120.

Wolfe, [0027].

248. Fourth, Wolfe discloses monitoring changes in the crowd's activity level in a particular area and "*comparing a given traffic parameter*" against a threshold. Wolfe, [0043] ("only those mobile devices 112 moving at at least a minimum threshold speed").

249. A POSITA would have understood comparing current incident information with prior incident information from a problematic crowd:

For example, the **incident scenario for a prior incident** may have indicated that eight responders would be able to provide an optimal response. **However, after responding to the incident**, reports may indicate that eight responders **was not enough to efficiently and effectively deal with the incident. Based on this information,**

scenario analysis engine 170 can update scenario database 185 to ensure that the incident scenario for a **subsequent incident (similar in scope to the prior incident) recommends** nine or more **responders**.

Pfeffer, [0040].

250. A POSITA would have known to compare one or more parameters of the current crowd information to previously saved crowd information from when a problematic crowd event (*previous problematic crowd formation*) occurred:

As shown in FIG. 13, the methods may involve detection of a chemical, biological, and/or radiological attack, by the following steps: collecting data related to behavior associated with one or more persons (step 1305); analyzing the data collected to determine one or more values characterizing the behavior (step 1310); **comparing the one or more values characterizing the behavior to one or more values characterizing behavior** of one or more persons **during a** chemical, biological or radiological **attack** (step 1320); determining whether an attack has occurred based on the comparing (step 1330); and activating an alert that an attack has occurred (step 1340), if as a result of the determining it is determined that an attack has occurred.

Nathan, [0191].

251. Thus, determining and continuously updating the number of wireless devices in contact with access point(s) and base station(s) in a particular area, comparing the current crowd information, e.g., the current number of mobile devices in a particular area or the changes in the activity levels of the mobile

devices in a particular area, with the same type of saved historical crowd information from a prior event renders obvious “*comparing a given traffic parameter associated with said obtained current location of each of said plurality of physical wireless devices, with a historical traffic parameter associated with a previous problematic crowd formation.*”

16. Claim 10

[10.0] *The method of alerting to a problematic crowd risk with location based services (LBS) according to claim 9, wherein:*

252. This limitation is substantially similar to the limitation of [9.0], and for the same reasons as discussed above, the prior art renders this limitation obvious.

[10.1] *said given point is at a given base station in said wireless network.*

253. This limitation is substantially similar to the limitation of [9.1], and for the same reasons as discussed above, the prior art renders this limitation obvious.

17. Claim 11

[11.0] *The method of alerting to a problematic crowd risk with location based services (LBS) according to claim 9, further comprising:*

254. This limitation is substantially similar to the limitation of [9.0], and for the same reasons as discussed above, the prior art renders this limitation obvious.

[11.1] *logging a snapshot formation created by said current location of each of said plurality of physical wireless devices.*

255. Wolfe discloses a method of tracking changes of the monitored crowd as a group using snapshots over time (“*logging a snapshot formation*”):

Instead of tracking the changing locations of individual terminals, changes in the terminal locations as a group, regardless of their individual identities or individual motions, may be monitored. Thus, “snapshots” of the group locations may be taken at periodic time intervals without regard to the identities of the individual terminals.

Wolfe, [0020].

256. Thus, tracking location changes of the monitored crowd as a group using snapshots over time renders obvious “*logging a snapshot formation created by said current location of each of said plurality of physical wireless devices.*”

18. Claim 12

[12.0] *The method of alerting to a problematic crowd risk with location based services (LBS) according to claim 7, wherein said initiating location requests comprises:*

257. This limitation is substantially similar to the limitation of [7.0], and for the same reasons as discussed above, the prior art renders this limitation obvious.

[12.1] *initiating a location request for each of said plurality of physical wireless devices.*

258. This limitation is substantially similar to the limitation of [1.2], and

for the same reasons as discussed above, the prior art renders this limitation obvious.

19. Claim 13

[13.0] *The method of alerting to a problematic crowd risk with location based services (LBS) according to claim 7, further comprising:*

259. This limitation is substantially similar to the limitation of [7.0], and for the same reasons as discussed above, the prior art renders this limitation obvious.

[13.1] *comparing a viral pattern of respective locations of said plurality of wireless devices to predetermined risk rules.*

260. First, as discussed in [1.0], Wolfe teaches a system that detects a plurality of mobile devices located in a geographical area. As discussed in [1.1], Wolfe's system tracks the monitored crowd's motion trends and transmits crowd information to first responders when the crowd's motion trends are unusual in particular areas.

261. Second, Wolfe systems compares snapshots of a group's locations over time:

Instead of tracking the changing locations of individual terminals, changes in the terminal locations as a group, regardless of their individual identities or individual motions, may be monitored. Thus, "snapshots" of the group locations may be taken at periodic time intervals without regard to the identities of the individual terminals.

Wolfe, [0020].

262. Wolfe discloses that the application 322 of computing device 300 (performing the functionality of central office 116) is communicatively coupled to a data aggregation module that aggregates the mobile device's location information to create a model of the distribution of the monitored crowd's mobile device's location associated with the crowd's motion trends. Wolfe, [0027].

263. Third, as discussed in [7.0], Wolfe teaches using a threshold because Wolfe discloses monitoring changes in the crowd's activity level, e.g., crowd's speed, compared to a threshold, such as "only those mobile devices 112 moving at at least a minimum threshold speed." Wolfe, [0043].

264. Wolfe teaches that when the activity levels of the crowd changes, the police force may be informed so that patrol officers can be sent to needed locations:

In another example, a police force may be informed of the distribution of people around a city and/or changes in activity levels in specific locations around a city. Based on this information, the police force may better position its patrol officers to locations around the city where the officers may be needed.

Wolfe, [0014].

265. A POSITA would have understood that monitoring a crowd's activity by using snapshots of the mobile device locations within that crowd (i) to detect a

change in activity level that warrants police officers and/or (ii) to detect that a characteristic exceeds a threshold, as taught by Wolfe, discloses comparing a viral pattern of activity of the location of mobile devices against “predetermined risk rules.” For example, Pfeffer describes:

If the level of alert exceeds a predetermined threshold, the dispatcher or task management system can send out requests for additional responders to make themselves available.

Pfeffer, [0077].

266. Thus, Wolfe’s system that monitors a crowd’s activity by using snapshots of the mobile device locations within that crowd (i) to detect a change in activity level that warrants police officers and/or (ii) to detect that a characteristic exceeds a threshold, as taught by Wolfe, renders obvious “*comparing a viral pattern of respective locations of said plurality of wireless devices to predetermined risk rules.*”

20. Claim 14

[14.0] *The method of alerting to a problematic crowd risk with location based services (LBS) according to claim 13, further comprising:*

267. This limitation is substantially similar to the limitation of [13.0], and for the same reasons as discussed above, the prior art renders this limitation obvious.

[14.1] *logging said viral pattern.*

268. As discussed in [13.1], Wolfe discloses monitoring a crowd's activity by using snapshots of the mobile device locations within that crowd (i) to detect a change in activity level that warrants police officers and/or (ii) to detect that a characteristic exceeds a threshold ("*a viral pattern of respective locations of said plurality of wireless devices*").

269. As discussed in [2.1], Wolfe further discloses using a database to store historical information. The historical information may include "historical information about mobile devices," which may include the number of times and frequency that a device visited a particular location. Wolfe, [0035]. The "historical data" is later used by the aggregation algorithms to estimate the characteristics of the crowd. Wolfe, [0027].

270. Accordingly, because Wolfe's system (i) detects the movement patterns of crowds by tracking the location information of mobile devices, (ii) uses a historical database to store information about the location of the mobile devices, and (iii) uses the historical information to estimate crowd characteristics, it would have been obvious to a POSITA that Wolfe is storing information about the mobile device's movements in the historical database, i.e., "*logging said viral pattern*". Pfeffer provides an example description showing that logging such information was known to POSITAs:

Based on this information, scenario analysis engine 170 can update scenario database 185 to ensure that the incident scenario for a subsequent incident (similar in scope to the prior incident) recommends nine or more responders.

Pfeffer, [0040].

271. Thus, Wolfe's system that (i) detects the movement patterns of crowds by tracking the location information of mobile devices, (ii) uses a historical database to store information about the location of the mobile devices, and (iii) uses the historical information to estimate crowd characteristics renders obvious *"logging said viral pattern."*

VIII. CONCLUSION

272. This declaration and my opinions herein are made to the best of my knowledge and understanding, and based on the material available to me, at the time of signing this declaration. I 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 or Title 18 of the United States Code.

Date: 9/7/23

A handwritten signature in cursive script, appearing to read "Stephen J. Guy", is written over a horizontal line.

Stephen J. Guy