



(12) Invention Patent Application

(10) Application Publication No.: CN 104135484 A

(43) Application Publication Date: November 05, 2014

(21) Application No.: 201410389618.1

(22) Application Date: August 08, 2014

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11275

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(51) Int. Cl.

H04L 29/06 (01.2006)

H04L 29/08 (01.2006)

H04N 7/15 (01.2006)

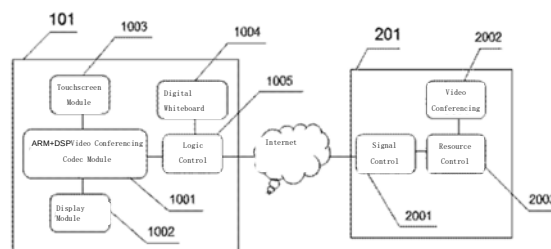
Claims, 2 pages; Specification, 5 pages; Drawings, 2 pages

(54) Name of invention

An Embedded System Integrating an Interactive Whiteboard and Video Conferencing
and a Calling Method

(57) Abstract

The present invention provides an embedded system integrating an interactive whiteboard with video conferencing and a calling method. This invention features a terminal that integrates a touchscreen, microphone, and display into a single unit; it also integrates an interactive whiteboard, enabling the direct convening of video conferences via the integrated terminal without the need to set up any auxiliary devices or connect cables. With the assistance of the interactive whiteboard, remote viewers are provided with an immersive experience.



1. An embedded system integrating an digital whiteboard with video conferencing, comprising an integrated terminal connected to the Internet and an integrated server:

The integrated terminal includes:

An ARM+DSP video conferencing codec module, which is for use in processing the transmission and reception of audio and video data streams, controlling encoding and decoding, controlling video conferencing users, controlling media capture and playback chips, and sending the audio to be played and the video to be displayed to the display module;

A display module, which is connected to the ARM+DSP video conferencing codec module, and is for use in receiving video and audio, displaying video and playing audio;

A touchscreen module, which is connected to the ARM+DSP video conferencing codec module, and is responsible for displaying the user interface and responding to user operations;

A digital whiteboard processing module, which is connected to the logic control module, and is for use in processing digital whiteboard operations and completing whiteboard data interactions, document parsing, remote control and recording functions;

A logic control module, which is connected to the ARM+DSP video conferencing codec module and the digital whiteboard processing module, and is for use in controlling the other modules of the integrated terminal;

The integrated server includes:

A signal control module, which is connected to the resource control module, and is for use in sending and receiving conference control signals between the integrated terminal and the integrated server;

A video conferencing module, which is connected to the resource control module, and is for use in responding to requests from integrated terminals. Upon receiving a video conferencing request from an integrated terminal, it decodes the video streams sent by each terminal based on the conference parameters, recombines them, encodes and packages them, and then sends them to all participating terminals;

A resource control module, which is connected to the signal control module and the video conferencing module, and is for use in processing and refining whiteboard data and sending the processed whiteboard data stream to the video conferencing module.

2. A system according to Claim 1, characterized in that the ARM+DSP video conferencing codec module further comprises:

A request generation module, which is connected to the control module, and is for use in sending video conference requests;

A media processing module, which is connected to the control module, and is for use in forwarding audio and video to the display module;

A friend management module, which is connected to the control module, and is for use in maintaining the friend list, selecting friends for video conferences, and sending and receiving conference control signals between an integrated terminal and the integrated server;

A control module, which is for use in forwarding control signals from the friend management module and sending interaction messages to other modules.

3. The system according to claim 1, characterized in that the digital whiteboard processing module further comprises:

A user interface generation module, which is connected to the scheduling module, and is for use in providing a view of user operations;

A document processing module, which is connected to the scheduling module, and is for use in displaying, browsing, zooming in and out, and turning pages in various types of documents; a remote desktop module, which is connected to the scheduling module, and is for use in capturing and sending desktop images or receiving remote desktop displays; an input processing module, which is connected to the scheduling module, and is for use in performing preliminary filtering of input to prevent interference with the data; and a scheduling module, which is for use in scheduling and controlling the other modules.

4. The system according to Claim 1, characterized in that the integrated terminal may further include a debugging module for use in outputting debug logs.

5. The system according to Claim 1, characterized in that the touchscreen module may be either a capacitive screen or a resistive screen.

6. The system according to Claim 1, characterized in that the ARM+DSP videoconferencing processing module is implemented using a TI6467 chip, the digital whiteboard processing module is implemented using an Intel chip, and the logic control module is implemented using a 15F2K60 microcontroller.

7. The system according to claim 1, characterized in that the digital whiteboard processing module may also be integrated with an office OA system.

8. A calling method for use in an embedded system as 2 described in any one of claims 1 through 7, characterized in that:

This method includes the following steps for convening a data conference:

Step 110: A user initiates a call via the touchscreen module and launches the data conferencing service;

Step 120: If the data conferencing service does not exist, the integrated server creates a data conference

and notifies the integrated terminal of the data conference information;

Step 130: The integrated terminal joins the data conference, and the integrated terminal thereby completes the joining process.

The method also includes steps for synchronized browsing of data conference documents:

Step 140: When an integrated terminal initiates synchronized browsing, it sends the synchronized browsing request to the integrated server;

Step 150: When the integrated server receives this request, it decodes the data stream sent by the integrated terminal, reassembles it, then encodes and packages it, and sends it to the other participating terminals;

Step 160: Once it is received by the other participating terminals, it is displayed in picture-in-picture mode by their display modules, with the digital whiteboard as the main view and the video conference as the smaller view.

An Embedded System Integrating an Interactive Whiteboard and Video Conferencing and a Calling Method**Technical Field**

[0001] The present invention relates to the field of video conferencing, and in particular to an embedded system integrate an interactive whiteboard and video conferencing and a calling method.

Prior Art

[0002] With the development of Internet technology, the application of distance education is becoming increasingly widespread. Currently, digital whiteboards are commonly used on the market for distance education. A digital whiteboard serves as a teacher's input window, incorporating the functions of a blackboard and chalk while also offering many features that a blackboard lacks, such as the ability to freely select from a variety of fonts, line styles, and colors; use teaching resources such as courseware PowerPoint presentations; and record or take screenshots of the teaching process, etc. All of these make teaching more efficient, more environmentally friendly, and healthier.

[0003] The current interactive digital whiteboard systems are often integrated with standard video conferencing systems to form an integrated solution, and the networking for such systems is relatively complex. Video conferencing terminals and digital whiteboards are needed in both classrooms and offices; in classrooms, a digital whiteboard is output via a projector, and the video conferencing terminal is output via a television.

[0004] Solutions that combine digital whiteboards with video conferencing are not suitable for classroom instruction. The drawback is that most video conferencing systems run on PC platforms and use USB webcams, with image quality generally around 4CIF/VGA.

[0005] In solutions that combine digital whiteboards with video conferencing, each classroom requires the installation of an expensive video conferencing terminal system—including a terminal, camera, microphone, speakers, and TV, as well as a digital whiteboard system comprising a digital whiteboard, projector, and computer, along with miscellaneous peripherals and cables. The drawbacks are obvious: a. The equipment for a single classroom is extremely expensive, which poses an obstacle to the popularization of multimedia technology in the education industry; b. There are numerous devices throughout the classroom, which requires that teacher invest time and effort in learning how to use them; at the same time, maintaining these products is also extremely difficult.

[0006] Therefore, it is necessary to research an embedded system that integrates an interactive whiteboard and a video conferencing system to enable more efficient distance education.

Content of the Invention

[0007] To address the above issues, the present invention proposes a video conferencing system capable of converting a point-to-point call into a three-way conference.

[0008] The present invention provides a terminal that integrates a touchscreen, microphone, and display into a single unit; it also incorporates an interactive whiteboard, enabling users to initiate video conferences directly without the need to configure any auxiliary devices or connect cables. With the assistance of the interactive whiteboard, remote viewers are provided with an immersive experience.

[0009] The present invention seeks protection for an embedded system integrating an interactive whiteboard and a video conferencing system, comprising an integrated terminal connected to the Internet and an integrated server:

[0010] The integrated terminal comprises:

[0011] An ARM+DSP video conferencing codec module, which is for use in processing the transmission and reception of audio and video data streams, controlling encoding and decoding, controlling video conferencing users, controlling media capture and playback chips, and sending the audio to be played and the video to be displayed to the display module;

[0012] A display module, which is connected to the ARM+DSP video conferencing codec module, and is for use in receiving video and audio, displaying video and playing audio;

[0013] A touchscreen module, which is connected to the ARM+DSP video conferencing codec module, and is responsible for displaying the user interface and responding to user operations;

[0014] A digital whiteboard processing module, which is connected to the logic control module, and is for use in processing interactive whiteboard operations and completing whiteboard data interactions, document parsing, remote control and recording functions;

[0015] A logic control module, which is connected to the ARM+DSP video conferencing codec module and the digital whiteboard processing module, and is for use in controlling the other modules of the integrated terminal;

[0016] The integrated server includes:

[0017] The signal control module, which is connected to the resource control module, and is for use in sending and receiving conference control signals between the integrated terminal and the integrated server;

[0018] A video conferencing module, which is connected to the resource control module, and is for use in responding to requests from integrated terminals. Upon receiving a video conferencing request from an integrated terminal, it decodes the video streams sent by each terminal based on the conference parameters, recombines them, encodes and packages them, and then sends them to all participating terminals;

[0019] A resource control module, which is connected to the signal control module and the video conferencing module, and is for use in processing and refining whiteboard data and sending the processed whiteboard data stream to the video conferencing module.

[0020] Furthermore, the ARM+DSP video conferencing codec module includes:

[0021] A request generation module, which is connected to the control module, and is for use in sending video conference requests;

[0022] A media processing module, which is connected to the control module, and is for use in forwarding audio and video to the display module;

[0023] A friend management module, which is connected to the control module, and is for use in maintaining the friend list, selecting friends for video conferences, and sending and receiving conference control signals between an integrated terminal and the integrated server;

[0024] A control module, which is for use in forwarding control signals from the friend management module and sending interaction messages to other modules.

[0025] Furthermore, the digital whiteboard processing module further comprises:

[0026] A user interface generation module, which is connected to the scheduling module, and is for use in providing a view of user operations;

[0027] A document processing module, which is connected to the scheduling module, and is for use in displaying, browsing, zooming in and out, and turning pages in various types of documents;

[0028] A remote desktop module, which is connected to the scheduling module, and is for use in capturing and sending desktop images or receiving remote desktop displays;

[0029] An input processing module, which is connected to the scheduling module, and is for use in performing preliminary filtering of input to prevent interference with the data;

[0030] A scheduling module, which is for use in scheduling and controlling the other modules.

[0031] Furthermore, the integrated terminal may also include a debugging module, which is for use in outputting debugging logs.

[0032] Furthermore, the touchscreen module may be either a capacitive screen or a resistive screen.

[0033] Furthermore, the ARM+DSP video conferencing processing module is implemented using a TI6467 chip, the digital whiteboard processing module is implemented using an Intel chip, and the logic control module is implemented using a 15F2K60 microcontroller.

[0034] Furthermore, the digital whiteboard processing module may also be integrated with an office OA system.

[0035] The present invention also claims protection for a calling method for an embedded system as described in any of the preceding claims:

[0036] This method includes steps for convening a data conference:

[0037] Step 110: A user initiates a call via the touchscreen module and launches the data conferencing service;

[0038] Step 120: If the data conferencing service does not exist, the integrated server creates a data conference and notifies the integrated terminal of the data conference information;

[0039] Step 130: The integrated terminal joins the data conference, and the integrated terminal thereby completes the joining process.

[0040] The method also includes steps for synchronized browsing of data conference documents:
[0041] Step 140: When an integrated terminal initiates synchronized browsing, it sends the synchronized browsing request to the integrated server;
[0042] Step 150: When the integrated server receives this request, it decodes the data stream sent by the integrated terminal, reassembles it, then encodes and packages it, and sends it to the other participating terminals;
[0043] Step 160: Once it is received by the other participating terminals, it is displayed in picture-in-picture mode by their display modules, with the digital whiteboard as the main view and the video conference as the smaller view.

Specification Drawings

[0044] Drawing 1 is a schematic diagram of an embedded system according to an embodiment of the present invention;
[0045] Drawing 2 is a block diagram of an embedded system integrating an interactive whiteboard and a video conferencing system according to an embodiment of the present invention;
[0046] Drawing 3 is a block diagram of the ARM+DSP video conferencing codec module of the present invention;
[0047] Drawing 4 is a block diagram of the digital whiteboard processing module of the present invention;

Specific Embodiments

[0048] The specific embodiments of the present invention will be described below in further detail with reference to the drawings and embodiments. The following embodiments are provided to illustrate the present invention, but are not for use in limiting the scope of the present invention.

[0049] As shown in Drawing 1, the present invention proposes an embedded system integrating an interactive whiteboard and a video conferencing system, comprising: A first integrated terminal 101 and a second integrated terminal 102, which are connected to the integrated server 201 via the Internet. Said terminals are integrated with interactive whiteboards, enabling the direct convening of video conferences without the need to set up any auxiliary devices or connect cables. With the assistance of the interactive whiteboards, remote viewers are provided with an immersive experience.

[0050] Drawing 2 provides further introduction to the embedded system of the present invention. The embedded system of the present invention, which integrates an interactive whiteboard and video conferencing, comprises an integrated terminal 101 connected to the Internet and an integrated server 201.

[0051] The integrated terminal 101 comprises:

[0052] An ARM+DSP video conferencing codec module 1001, which is for use in processing the transmission and reception of audio and video data streams, controlling encoding and decoding, controlling video conferencing users, controlling media capture and playback chips, and sending the audio to be played and the video to be displayed to the display module 1002;

[0053] In the process of building an actual system, the ARM+DSP video conference processing module is implemented using a TI6467 chip.

[0054] A display module 1002, which is connected to the ARM+DSP video conferencing codec module 1001, and is for use in receiving video and audio, displaying video and playing audio;

[0055] A touchscreen module 1003, which is connected to the ARM+DSP video conferencing codec module 1001, and is responsible for displaying the user interface and responding to user operations;

[0056] The touchscreen module 1003 may be either a capacitive screen or a resistive screen.

[0057] A digital whiteboard processing module 1004, which is connected to the logic control module 1005, and is for use in processing digital whiteboard operations and completing whiteboard data interactions, document parsing, remote control and recording functions;

[0058] In the process of building an actual system, the digital whiteboard processing module is implemented using an Intel chip. In addition, the digital whiteboard processing module 1004 may also be integrated with an office OA system.

[0059] A logic control module 1005, which is connected to the ARM+DSP video conferencing codec module 1001 and the digital whiteboard processing module 1004, and for use in controlling the other modules. The logic control module is generally implemented using a 15F2K60 microcontroller.

[0060] The integrated server 201 comprises:

[0061] A signal control module 2001, which is connected to the resource control module 2003, and is for use in sending and receiving conference control signals between the integrated terminal 101 and the integrated server 201;

[0062] A video conferencing module 2002, which is connected to the resource control module 2003, and is for use in responding to requests from the integrated terminals 101. Upon receiving a video conferencing request from an integrated terminal 101, it decodes the video streams sent by each terminal based on the conference parameters contained therein, decodes the video streams sent by each terminal, recombines them, encodes and packages them, and then sends them to all participating terminals;

[0063] A resource control module 2003, which is connected to the signal control module 2001 and the video conferencing module 2002, and is for use in processing and refining whiteboard data and sending the processed whiteboard data stream to the video conferencing module 2002.

[0064] As shown in Drawing 3, the ARM+DSP video conferencing codec module 1001 further comprises:

[0065] A request generation module 1011, which is connected to the control module 1014, and is for use in sending video conference requests;

[0066] A media processing module 1012, which is connected to the control module 1014, and is for use in forwarding audio and video to the display module 1002;

[0067] A friend management module 1013, which is connected to the control module 1014, and is for use in maintaining the friend list, selecting friends for video conferences, and sending and receiving conference control signals between an integrated terminal and the integrated server 201;

[0068] A control module 1014, which is for use in forwarding control signals from the friend management module 1013 and sending interaction messages to other modules.

[0069] To facilitate debugging of the integrated terminal 101, the terminal may also include a debugging module for use in outputting debugging logs for software engineers.

[0070] As shown in Drawing 4, the digital whiteboard processing module 1004 further comprises:

[0071] A user interface generation module 1021, which is connected to the scheduling module 1025, and is for use in providing a view of user operations;

[0072] A document processing module 1022, which is connected to the scheduling module 1025, and is for use in displaying, browsing, zooming in and out, and turning pages in various types of documents;

[0073] A remote desktop module 1023, which is connected to the scheduling module 1025, and is for use in capturing and sending desktop images or receiving remote desktop displays;

[0074] An input processing module 1024, which is connected to the scheduling module 1025, and is for use in performing preliminary filtering of input to prevent interference with the data;

[0075] A scheduling module 1025, which is for use in scheduling and controlling the other modules.

[0076] The present invention also provides a calling method suitable for an embedded system as described above.

[0077] This method includes steps for convening a data conference:

[0078] Step 110: A user initiates a call via the touchscreen module and launches the data conferencing service;

[0079] Step 120: If the data conference service does not exist, the integrated server creates a data conference and notifies the integrated terminal of the data conference information;

[0080] Step 130: The integrated terminal joins the data conference, and the integrated terminal thereby completes the joining process.

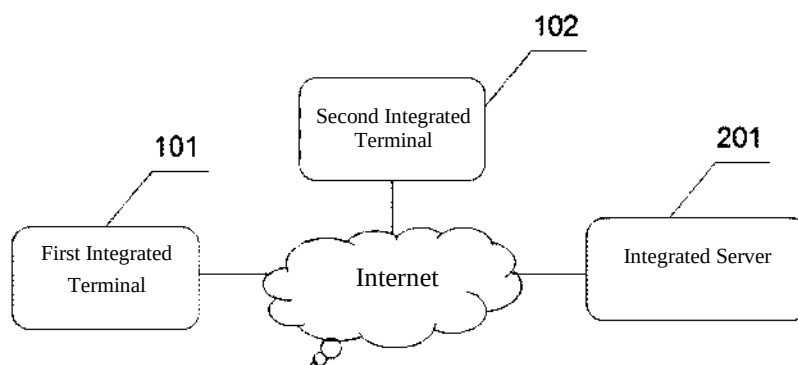
[0081] The method also includes steps for synchronized viewing of data meeting documents:

[0082] Step 140: When an integrated terminal initiates synchronized browsing, it sends the synchronized browsing request to the integrated server;

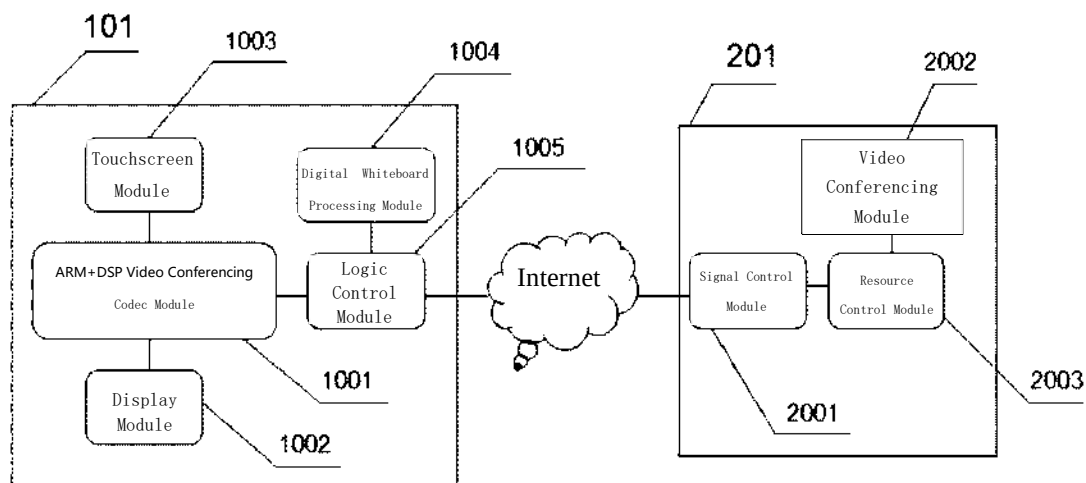
[0083] Step 150: When the integrated server receives this request, it decodes the data stream sent by the integrated terminal, reassembles it, then encodes and packages it, and sends it to the other participating terminals;

[0084] Step 160: Once it is received by the other participating terminals, it is displayed in picture-in-picture mode by their display modules, with the digital whiteboard as the main view and the video conference as the smaller view.

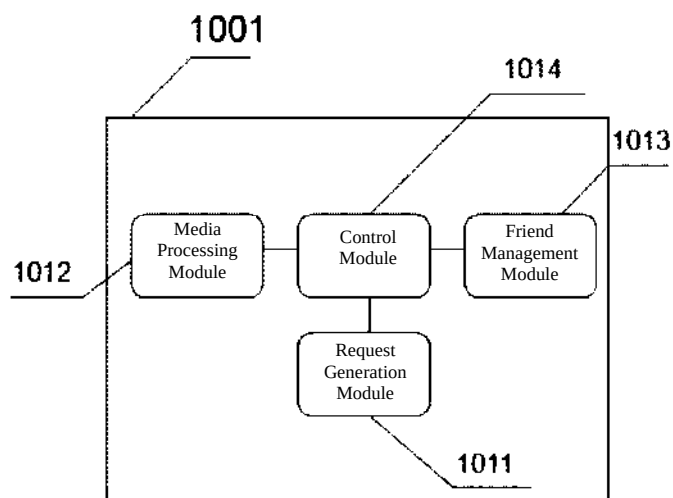
[0085] The description of the present invention is provided for illustrative and descriptive purposes and is not exhaustive, nor does it limit the invention to the forms disclosed herein. Many modifications and changes are obvious to a person having ordinary skill in the art. The embodiments have been selected and described to better illustrate the principles and practical applications of the present invention, and to enable a person having ordinary skill in the art to understand the present invention and thereby design various embodiments with various modifications suitable for specific purposes.



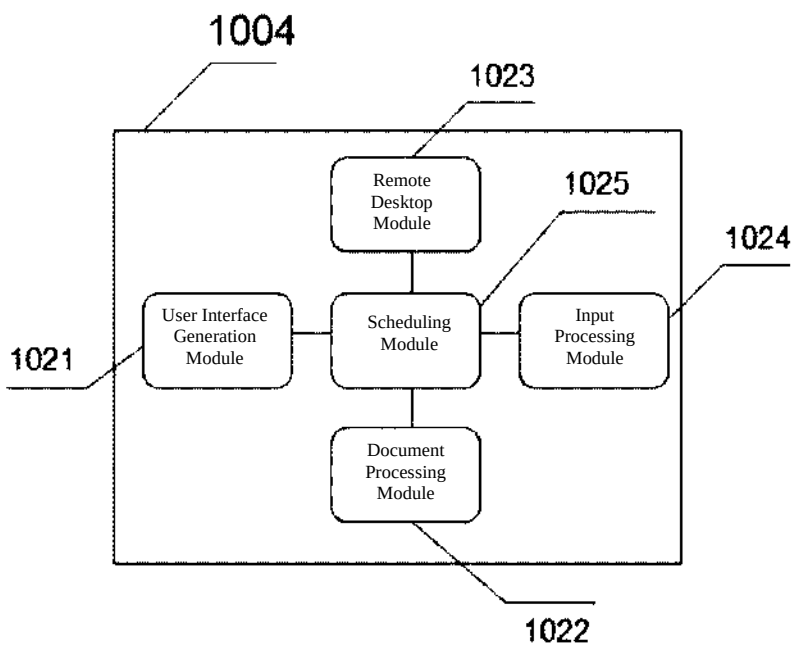
Drawing 1



Drawing 2



Drawing 3



Drawing 4

THE STATE OF Colorado }

COUNTY OF Arapahoe }

AFFIDAVIT OF ACCURACY

BEFORE ME, the undersigned authority, on this day personally appeared Carissa Fletcher who, by oath and by presentation of identification, is personally known to me to be the person subscribing her name below and, after being by me duly sworn according to law, upon her oath deposes and says in due form of law that to the best of her knowledge, information and belief:

1. My name is Carissa Fletcher and I am over the age of twenty-one years and competent to make this affidavit.
2. I have been warned that willful false statements and the like are punishable by fine or imprisonment.
3. All statements made of my own knowledge are true and that all statements made on information and belief are believed to be true.
4. I speak, read, and write fluently in the English and Chinese languages.
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Carissa Fletcher
Professional Legal Translator

Sworn to before me this 18th day of June 2026



Notary Public in and for the State of Colorado
My commission expires: 06/14/2027



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