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(54) Title: AUGMENTED AND VIRTUAL MIXED REALITY METHODS AND SYSTEMS FOR PHARMACEUTICAL RESEARCH, DEVELOPMENT, AND EDUCATION



FIG. 1

(57) Abstract: Systems and methods to provide augmented and virtual reality implementations of information sources useful as learning and discovery tools are disclosed. A computer implemented method and programming product which provides enhanced visualization of various information resources useful for at least teaching and learning, drug research and discovery, and precision and personalized medicine. A computer-implemented method and programming product for providing medication and/or appointment reminder, alerts, and education is also provided. These cross platform software applications use graphic processing unit (GPU) accelerated big data analysis algorithms, and innovative natural language processing (NLP) algorithms to improve user experiences and access to the information resources.

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**AUGMENTED AND VIRTUAL MIXED REALITY METHODS AND
SYSTEMS FOR PHARMACEUTICAL AND MEDICAL RESEARCH,
DEVELOPMENT, AND EDUCATION**

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Application No. 62/550,268 filed on August 25, 2017 entitled “Augmented and Virtual Reality Methods and Systems for Medical Research, Development, and Education” and U.S. Provisional Application No. 62/550,162 filed on August 25, 2017 entitled “Personalized Medical Tracking and Reminder Application,” both of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] This invention pertains generally to interactive learning, and pharmaceutical and medical health care tools, and more specifically to software applications that may provide augmented reality assisted learning aids and personalized medication scheduling, information, and education.

BACKGROUND

[0003] Modern electronic devices are becoming increasingly powerful and sophisticated. Not only are these devices running faster central processing units (CPUs), they are also equipped with enhanced graphics abilities through faster graphic processing units (GPUs) and often include sensors such as global positioning systems (GPS), gyroscopes, and accelerometers that are making these devices more versatile and have opened up a world of applications that did not seem possible before.

[0004] One example is virtual reality (VR), which is a computer technology that uses software-generated realistic images, sounds, and other sensations to replicate a real environment or an imaginary setting, and simulates a user's physical presence in this environment to enable the user to interact with this space. Another example, augmented reality (AR), provides live direct or indirect viewing of a physical real-world environment whose elements are augmented (or supplemented) by virtual computer-generated sensory input such as sound, video, graphics, or GPS data. And finally, mixed Reality (MR) is the merging of real and virtual worlds to produce new environments and visualizations where physical and digital objects co-exist and interact in real time.

[0005] Virtual, augmented and mixed reality applications have traditionally been limited to expensive custom computer setups generally used only in universities and academia. With the advent of modern devices that include powerful embedded processors, many of the algorithms that were once confined to large static computer setups are becoming a part of the mobile world. All of these new technologies, however, are CPU and GPU intensive.

[0006] As such, there exists a need in the art for augmented and virtual reality implementations of information resources on mobile devices, and improvements in the computational and graphics speeds and capabilities of such implementations.

[0007] These modern electronic devices may also provide a platform for other expanded capabilities previously restricted to static computer setups. For example, there exists a need in the art for improved methods of managing medication and medical appointments and for providing increased access to medical news and information.

[0008] Avoiding unnecessary medical complications or death by ensuring a drug is efficacious for the patient and that the patient is compliant and persistent with their prescription(s) represents a major unmet need. According to Express Scripts, the largest pharmacy benefit manager in the United States, only 25 to 30 percent of medications are taken according to the prescriber's instructions, and of those taken, only 15 to 20 percent are refilled according to the prescriber's instructions. This lack of adherence and persistence is estimated to result in excess of \$300 billion being wasted annually for the treatment of unnecessary medical complications in the United States.

[0009] Periodic evaluation of a patient's drug regimen is an essential component of medical care. However, a survey of Medicare beneficiaries found that more than 30 percent of patients reported they had not talked with their doctor about their different medications in the previous 12 months. Furthermore, when these reviews are done, they often ignore over-the-counter medications and supplements, herbal medications, and recreational drugs that are being taken by the patient.

[0010] Multiple factors contribute to the appropriateness and overall quality of drug prescribing. These include avoidance of inappropriate medications, appropriate use of indicated medications, monitoring for side effects and drug levels, avoidance of drug-drug interactions, and involvement of the patient and the patient's biometric and health values. Current measures of the quality of prescribing generally focus on one or some of these factors, but rarely on all.

[0011] Thus, a software application accessible on a mobile electronic device that may educate and assist in managing a patient's medications and medical appointments would fulfill an unmet need in the art.

SUMMARY

[0012] The presently disclosed invention is related to software applications that expand upon prior art methods of delivering and interacting with information resources. To overcome the hardware challenge in computing "big-data" type databases or libraries, the present invention may incorporate programming of the GPU (e.g., CUDA, DirectX, or OpenCL) to enhance the computational performance over CPU code alone. Moreover, the present invention may provide software applications that work across a range of platforms (i.e., cross platform software applications).

[0013] The presently disclosed invention provides a software application that delivers various information and data sources as augmented and virtual reality implementations of learning and discovery tools. The presently disclosed invention also provides a software application that delivers information and data sources useful as reminder tools, providing enhanced means to receive, interact with, and manage various medical and medication related information. For example, the presently disclosed invention provides a software application useful to remind a user to take and refill medications learn about current news regarding their medications, and/or schedule and attend medical appointments in a timely manner

[0014] According to its major aspects, and briefly stated, the presently disclosed invention includes a computer-implemented method for providing an augmented or virtual reality learning tool. The presently disclosed invention also includes a method for providing an augmented or virtual reality learning application, wherein the application may be executed by one or more processors. The presently disclosed invention also includes a method for providing an augmented or virtual reality learning application, wherein the application is stored on a non-tangible computer readable medium tangibly embodying non-transitory computer-executable program instructions thereon that, when executed, cause a computing device to execute or perform the method.

[0015] The method may comprise decoding a request for a data set related to a target stored on an information server; accessing, by a mobile internet device via a wired or a wireless network, the information server; importing the data set from the information server; extracting

spatial information from the data set; and displaying a spatial image on the mobile internet device, wherein the spatial image is based on the spatial information.

[0016] According to certain aspects, the spatial information may comprise a digital representation of an arrangement of the target in a physical environment. The target may be an organ, a skeleton, a body, a nervous system, a digestive system, a circulatory system, or a combination thereof. The target may be a molecule, such as a protein molecule, a DNA molecule, a peptide, a drug, or a combination thereof. The target may be an organ comprising a single organ, multiple organs, or an entire body.

[0017] According to certain aspects, exemplary mobile internet devices include at least: a game device, a smart phone, a tablet, a camera, a robot, an augmented or virtual reality viewer, and a watch. The data set may be imported to the mobile internet device, or the data set may be imported to a server which carries out the step of extracting the spatial information from the data set. The extracted spatial information may be sent to the mobile internet device via either a push or pull from the server.

[0018] According to certain aspects, the method may further comprise altering the spatial image on the mobile internet device based on user commands, wherein the user commands comprise moving the spatial image, resizing the spatial image, rotating the spatial image, deleting part of or all of a spatial image, and stretching the spatial image, and combinations thereof.

[0019] According to certain aspects, a spatial image may be generated for a second target, and the method may further include altering the spatial image of the first and second targets on the mobile internet device based on user commands. Such may be done to dock molecules relative to one another, such as a drug molecule docked within a binding site on a protein, or to dock an organ within a larger system of a body, such as docking internal organs in their proper locations in a body cavity.

[0020] The presently disclosed invention further includes a system for providing an augmented or virtual reality learning tool, the system comprising a processor and a memory containing instructions that, when executed by the processor cause the processor to execute or perform the methods for providing an augmented or virtual reality learning tool disclosed herein. According to certain aspects, the processor and/or memory may be part of a virtual reality

device, or may be part of a mobile electronic device configurable to display or interact with a display or virtual reality device.

[0021] The presently disclosed invention further includes a computer implemented program product for providing an augmented or virtual reality learning tool, comprising a non-tangible computer readable medium tangibly embodying non-transitory computer-executable program instructions thereon that, when executed, cause a computing device to execute or perform the methods for providing an augmented or virtual reality learning tool disclosed herein.

[0022] According to its major aspects, and briefly stated, the presently disclosed invention also includes a computer-implemented method for providing a medication and/or appointment reminder, and/or medication educator. The presently disclosed invention also includes a method for providing a medication and/or appointment reminder and/or medication education application, wherein the application may be executed by one or more processors. The presently disclosed invention also includes a method for providing a medication and/or appointment reminder and/or medication education application, wherein the application is stored on a non-tangible computer readable medium tangibly embodying non-transitory computer-executable program instructions thereon that, when executed, cause a computing device to execute or perform the method.

[0023] The method may comprise connecting to an information server via an internet protocol network; acquiring stored patient information from the information server, wherein the stored patient information comprises a medication to be taken by a patient and a dose schedule; starting a timer associated with the dose schedule; and activating an alert or alarm at a time interval defined by the dose schedule.

[0024] The stored patient information may comprise a set of patient specific data, wherein the set of patient specific data may comprise at least a patient name, a medication identification, and a medication dosing schedule. The patient specific data may be obtained via direct input by the patient or user, and/or from a medical database maintained by the patient's or user's pharmacy or medical facility (e.g., primary care physician, hospital or medical facility, etc.), or may be information encoded on the medication (e.g., barcode or QRcode). The set of patient specific data may further comprise a patient age, a patient weight, a patient height, a patient blood pressure, a patient cholesterol, a patient insulin level, a patient blood sugar level, a patient heart rate, a patient temperature, or any combination thereof.

[0025] The method may further comprise acquiring the stored patient information from a second server having stored thereon current values for a patient age, a patient weight, a patient height, a patient blood pressure, a patient cholesterol, a patient insulin level, a patient blood sugar level, a patient heart rate, a patient temperature, or any combination thereof. This set of patient specific data may be used to determine a change to the dose schedule, or a health message regarding the dose schedule.

[0026] According to certain aspects, the stored patient information may further comprise an appointment schedule; and the method may further comprise starting a timer associated with the appointment schedule; and activating an alert or alarm at a time interval defined by the appointment schedule.

[0027] The presently disclosed invention also provides a system for providing a medication and/or appointment reminder, the system comprising a processor; and a memory containing instructions that, when executed by the processor, cause the processor to perform the method as detailed above.

[0028] The presently disclosed invention also provides a computer implemented program product for providing a medication and/or appointment reminder, the program product comprising a non-tangible computer readable medium tangibly embodying non-transitory computer-executable program instructions thereon that, when executed, cause a computing device to execute the method steps as detailed above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] Aspects, features, benefits and advantages of the embodiments herein will be apparent with regard to the following description, appended claims, and accompanying drawings. In the following figures, like numerals represent like features in the various views. It is to be noted that features and components in these drawings, illustrating the views of embodiments of the presently disclosed invention, unless stated to be otherwise, are not necessarily drawn to scale.

[0030] FIG. 1 illustrates a screen shot taken from a VR/AR/MR application portal according to certain aspects of the present invention in pharmaceutical and medical R&D and education;

[0031] FIG. 2 illustrates a screen shot of a three-dimensional molecular model of a drug as displayed using a GPU-accelerated drug design and pharmaceutical application according to certain aspects of the present invention;

[0032] FIGS. 3A-3C are photographs of a user interacting with a GPU-accelerated drug design VR/AR/MR pharmaceutical applications according to certain aspects of the present invention;

[0033] FIGA. 4A-4F illustrate screen shots taken from a VR/AR/MR visualization application for drug cardiovascular pharmacokinetic analysis in the heart according to certain aspects of the present invention;

[0034] FIGS. 5A-5B illustrate screen shots taken from a VR/AR/MR quantum chemistry application according to certain aspects of the present invention;

[0035] FIGS. 6A-6B illustrate screen shots of a VR/AR/MR organ/skeleton application according to certain aspects of the present invention.

[0036] FIGS. 7A-7B illustrate screen shots taken from a VR/AR/MR “Holographic & Interactive 3D Diabetic” module for novel training and teaching in accordance with certain aspects of the presently disclosed invention;

[0037] FIGS. 8A-8C illustrate exemplary screen views (iPhone) of a medication and appointment reminder interface of a software application in accordance with certain aspects of the presently disclosed invention;

[0038] FIGS. 9A-9F illustrate exemplary screen views of a calendar interface of a software application in accordance with certain aspects of the presently disclosed invention;

[0039] FIGS. 10A-10B illustrate exemplary screen views of a barcode/QRcode scan interface of a software application in accordance with certain aspects of the presently disclosed invention;

[0040] FIG. 10C illustrates an exemplary screen view of a news and information interface of a software application in accordance with certain aspects of the presently disclosed invention; and

[0041] FIG. 11 illustrates an exemplary screen view of a health data, health tracker input/review interface of a software application in accordance with certain aspects of the presently disclosed invention.

DETAILED DESCRIPTION

[0042] In the following description, the present invention is set forth in the context of various alternative embodiments and implementations involving augmented and virtual reality methods and systems which provide novel learning and discovery tools. The present invention is also set forth in the context of various alternative embodiments and implementations involving a personalized medical tracking and reminder software application. While the following description discloses numerous exemplary embodiments, the scope of the present patent application is not limited to the disclosed embodiments, but also encompasses combinations of the disclosed embodiments, as well as modifications to the disclosed embodiments.

[0043] Various aspects of the systems and methods may be illustrated by describing components that are coupled, attached, and/or joined together. As used herein, the terms “coupled”, “attached”, and/or “joined” are interchangeably used to indicate either a direct connection between two hardware components, or two software modules, or, where appropriate, an indirect connection to one another through intervening or intermediate components or modules. In contrast, when a component is referred to as being “directly coupled”, “directly attached”, and/or “directly joined” to another component or module, there are no intervening elements shown in said examples.

[0044] Various aspects of the systems and methods may be described and illustrated with reference to one or more exemplary implementations. As used herein, the term “exemplary” means “serving as an example, instance, or illustration,” and should not necessarily be construed as preferred or advantageous over other variations of the devices, systems, or methods disclosed herein. “Optional” or “optionally” means that the subsequently described event or circumstance may or may not occur, and that the description includes instances where the event occurs and instances where it does not. In addition, the word “comprising” as used herein means “including, but not limited to”.

[0045] It must also be noted that as used herein and in the appended claims, the singular forms “a”, “an”, and “the” include the plural reference unless the context clearly dictates otherwise. Unless defined otherwise, all technical and scientific terms used herein have the same meanings as commonly understood by one of ordinary skill in the art.

[0046] The present invention provides software applications configured to work across many platforms (e.g., Android, iOS, Microsoft Windows, etc.) to provide (1) augmented and

virtual reality implementations of information resources useful as learning and discovery tools, and (2) personalized medical and medication tracking, e.g., remind a user to take and refill medications, or to schedule and attend medical appointments in a timely manner. The presently disclosed software applications may use programming of the graphics processing unit (e.g., CUDA, DirectX or OpenCL) to enhance the computational performance over CPU code alone. Moreover, an innovative natural language processing (NLP) algorithm may be included which may assist the user to interface with the software applications. For example, the NLP may assist the user to educate themselves with the latest news regarding their medications, medical conditions, and healthcare advances in general, as well as common information on drug use and abuse.

[0047] The information displayed may be used for educational purposes. For example, medical information such as images of organs, body systems, or even whole bodies may be used in medical training and education applications. Three-dimensional structural information of molecules, such as proteins, peptides, DNA molecules, drugs, etc., may be used for educational or research and development purposes. Structural three dimensional (3D) representations of the human body, or body systems or organs, may be useful in precision and personalized medicine.

[0048] In conjunction with pharmacy, insurance, medical, or IT facilitates and/or companies, the presently disclosed software applications may be configured to accept and utilize updated information sources, programming algorithms, and patient output formats to provide an enhanced user experience.

[0049] According to certain aspects, the presently disclosed software application may facilitate the Pharmacy-to-Patient process. For example, the barcode or QRcode commonly incorporated into the packaging of a medication or supplement may include additional information with encryption algorithms that can be either pushed to or scanned by a patient's or user's mobile device to manage (pick up, take, refill, etc.) their medications. Moreover, the patient or user may use the software to consult with the Pharmacy regarding requests for additional information, scheduling changes and/or advice, refill requests, etc.

[0050] The presently disclosed software applications may further be used to assist in drug abuse avoidance. For example, based on the big data analysis algorithm which is part of the disclosed software application, the software application may suggest the optimum plan to the patient or user. Patients or users may also be provided with, or actively seek out through a search

function, the latest news and/or common information on drug abuse to avoid such a problem through the natural language processing (NLP) algorithm.

[0051] The presently disclosed software applications may further be able to accelerate and strengthen the evolution of media and human communication. For example, according to certain aspects, the application may function across many platforms, and may be connectable to external devices, such as health and/or fitness trackers (Apple Watch, Jawbone, Fitbit, Body Cardio, etc.) for health data access and management. The presently disclosed software applications may be used to obtain first-hand health data from the health or fitness tracker for the patient or user which may include, but is not limit to, a user id (generated by the external device health or fitness tracker application), age, sex, medications, weight, temperature, heart rate, blood pressure (Body Cardio, Nokia), etc.

[0052] Following is a description of the various components and potential uses of the methods and systems of the present invention. While specific examples of information resources are provided, such should not be taken as a limitation on the range or scope of the type of information that may be displayed or presented using the systems and methods of the presently disclosed invention.

[0053] I. VR/AR/MR applications for modeling, education, and training

[0054] Data loading and organization/arrangement: According to certain aspects, a system and method of the presently disclosed invention may be generally described as an innovative three-dimensional (3D) computing program platform which is powered by virtual reality/augmented reality/mixed reality (VR/AR/MR) devices. The program is generated using a suite of scripts/codes to load and visualize a range of information subject(s), such as a biological molecule from a file format, such as including PDB, mol/mol2, and others; and chemical molecules or atoms (orbital and electronics), etc.; and organs or whole bodies, such as a human vasculature or set of organs.

[0055] As used herein, the term “biological molecule” refers to the sequence of nucleotide or amino acid residues of a biological molecule (e.g., a DNA molecule, an RNA molecule, a polypeptide, a carbohydrate, or a lipid). A biological molecule or sequence can be graphically represented structurally, such as a chemical structure, a ball-and-stick model, a ribbon diagram, a space-filling model, an electrostatic model, etc.; or any combination thereof.

[0056] Further, data associated with organs, such as 3D imaging data (e.g., data from MRI, CAT scan, ultrasound, tomography, etc.), may be used as input. Such a process is accelerated by the GPU-computing algorithms of the presently disclosed software application.

[0057] The programs may generally be configured to (1) decode the subject(s)/data (molecules, atoms, organs, etc.); (2) import basic information/subject(s) (including but not limited to atom, chain, molecule, organ, etc.); (3) extract useful information/subject(s) (including but not limited to protein sequence, residue, α -helix, β -sheet, and random coil, ligand/inhibitor/substrate etc.); (4) organize/arrange/select the info/subjects and properties in hierarchy so that the program can display the subject(s) properly, such as 3D structure of protein/DNA/small molecule/other object correctly.

[0058] For protein targets, for example, the "PDB" (protein data bank) may store data sets related to the spatial information for individual protein chains, molecules, subunits, etc. The PDB is actually the primary repository for all published protein and nucleic acid (macromolecular) 3D structures. Parsing code for PDB structures may be found in different open resources, and may be included in the present GPU-accelerated platform along with computing algorithms, program functions/codes to enhance visualization of the targets. For small molecules, data sets related to the spatial information for individual atoms may be found, for example, in a number of chemistry databases, including NCI Web-Accessible Data; Computational Chemistry Comparison and Benchmark DataBase (CCCBDB); ChemIDplus; SOLV-DB; Common Compound Library; ChemFinder; etc.

[0059] Moreover, the data sets for biological molecules or certain small molecule targets may be derived from spatial data from structure prediction algorithms. Certain of these structures are calculated and stored in additional repositories, such as SWISS-MODEL which is a Repository is a database of protein structure homology models generated by the fully automated SWISS-MODEL modeling pipeline; or the Protein Model Portal which provides access to structural information for a protein - both experimental structures and theoretical models (Protein Model Portal is a component of the Nature PSI Structural Biology Knowledgebase); or any of the other databases or prediction algorithms disclosed in the ExpASy Bioinformatics Resource Portal.

[0060] According to certain aspects, the software application of the presently disclosed invention, the data sets for certain objects (i.e., organs, body systems, or a body) may be derived

from optical images, or alternatively may be captured by means of an alternative non-optical imaging modality, such as but not limited to X-ray, magnetic resonance imaging (MRI), ultrasound or the like, that allows for capturing one or more images of a portion of the object or the object in its entirety (including, for example, any portions that may be embedded within the object). The imaging modality through which the 3D model is reconstructed may be a tomographic imaging modality such as but not limited to a CT scan, a PET scan, a tomographic MRI, an ultrasound tomography or the like. According to certain aspects of the invention, the 3D model may be periodically updated, with imaging sessions interspersed between, or performed concurrently with, viewing using the methods and system of the present disclosure. Periodically updating the construct model may be advantageous in cases where the shape or other features of the object changes over time, for example through manipulation of the object by a person.

[0061] Alternatively or additionally, 3D model may include added visual content that is not a representation of physical features of a corresponding object (e.g., biological molecule, organ, body, etc.) or region thereof, but provides information about the object or region. The visual content may be, for example, a piece of text such as a symbol, a name, a description, or a parameter (for example, binding site on a protein for a drug, name of region on the protein, name of an organ, etc.). Alternatively or in addition, the added visual content may be a graphic, for example an expected trajectory of the object, a planned placement or path of a non-existing object, a flashing circle highlighting the object/region or the like. Alternatively or in addition, the added visual content may be a video stream, for example show binding of a drug to a protein, dissipation of a drug within an organ, etc. Many other added types of visual content may occur to a person skilled in the relevant art.

[0062] According to certain aspects, the software application of the presently disclosed invention executing upon a computing device may access a remote server (e.g., via a network) to conduct a portion of the operations to achieve the augmented or virtual display presented within the display of the AR/VR/MR device. For example, the software application executing upon the computing device may receive all or a portion of the data (data sets related to the spatial information of the target) from a remote server. The software application may then pass all or a portion of the data (data sets related to the spatial information of the target) to another remote server, or may process the information on a local server.

[0063] According to certain aspects, the software application executing upon the computing device may pass user configuration settings (e.g., as saved in a configuration data storage), user inputs, or other data to the server. Configuration settings may include any or all of a user identification, user preferences regarding sizing, color, orientation, etc. of a displayed model, user preferences regarding devices and output characteristics, user preferences regarding manipulation means, speeds, types, etc. for the displayed model, etc.

[0064] **Subject visualization:** Information sources which may be displayed using the systems and methods of the presently disclosed invention include at least protein or peptide/DNA or RNA/small molecule visualization, atomic orbital/electron cloud visualization, and organ or whole body visualization.

[0065] For example, the program may display biological or small molecules in different ways (“Wireframe”, “Stick”, “ball”, “Ball-Stick”, “Cartoon”, “Surface”, “Sequence”, etc.), which may be attached with the name/selection of each component, using VR/AR/MR devices and a downloaded version of the presently disclosed software application, which may function on various computer platforms, such as Mac, Window, Android, iOS, etc.

[0066] A Function/Subject Selection Panel may be included to allow users to change or combine the display modes. The software application may be configured to visualize the interactions between receptors and ligands (such as H-bonding, van der Waals interactions, charge interaction and hydrophobic interactions). Multiple display modes may be used at one time in order to present different functions/attributes of a molecule or a portion of a molecule. Basic 3D operation (Translate/Rotate/Scale/MousePick) may be supported. In addition, the software application may be configured to provide analysis and display of Pocket(s) and Pharmacophore(s) of the molecule, and display in solid, transparent, or dotted modes.

[0067] Medical information such as images of organs, body systems, or even whole bodies may be displayed based on 3D imaging data. This data may include single organs, clusters of organs, specific systems of the body or graphic models stored on an information server (circulatory system, digestive system, nervous system, skeletal system, etc.), or the whole body. Thus, information may be displayed singly, may be overlaid, and/or may be highlighted per the user’s request, and based on the specific functionality of the application (e.g., discovery, education, mock surgery, etc.).

[0068] The various application programs of the present invention may be accessible via an internet connection on a remote server, or may be converted to user applications which may be downloadable to allow usage by various platforms, including but not limited to PC/Mac/Unix/Linux computers/workstations, phones (iPhone, google and Android) and iPad or other tablet or portable device usages

[0069] The presently disclosed invention further provides for integration of basic and advanced functions and algorithms of the VR/AR/MR devices (basic gaze, gesture, sound such as voice, spatial mapping). For example, the VR/AR/MR devices generally have functions which include, but are not limited to: i) Use of a cursor to display the user's gaze (cursor on/off holograms, directional indication, etc.); ii) Gesture for hand detected feedback (zoom in/out, rotation, hand manipulation, etc.); and iii) Spatial sound and Spatial mapping (Scan the environment and transfer data from HoloLens to computer, etc.). The presently disclosed invention integrates all of or a subset of these functionalities.

[0070] Thus, the presently disclosed invention may provide methods for drug discovery and education, which may be compatible to VR/AR/MR devices; and/or mobile devices such as mobile phones. The presently disclosed invention may also provide methods for discovery and education in the area of surgery and body function/structure, which may be compatible to VR/AR/MR devices; and/or mobile devices such as mobile phones.

[0071] In order to direct dynamic selection and/or visualization of the user selected data set (e.g., protein), the VR/AR/MR device may track the user's view position in which an imaginary ray is projected that corresponds to the user's line of sight (i.e., the direction in which the user is looking). The tracked view position is utilized to determine whether the user is interacting with a virtual display or making additional selections. The VR/AR/MR device may be configured to control the virtual display responsive to audible commands recognized via a microphone, and/or hand gesture commands recognized via a camera, and/or eye gesture commands recognized via a camera.

[0072] The types of commands and the way that such commands control the 3D model may vary without departing from the scope of this disclosure. To create a virtual display for dynamic interaction with the 3D model, for instance, a forward-facing camera may recognize a user's left and/or right hands, and certain gestures that a user may make with their hand(s). These gestures may translate to certain responses from the software application. For example, the

user may make a stop-sign hand gesture to pause playback, swipe a hand from left to right to fast forward, or twist an outstretched hand to change a channel. The user may grasp regions of the displayed model to move, rotate, or resize the model. These hand gestures may be combined or used in addition to certain vocal commands. For example, a user may speak commands such as "pause," "fast forward," "rotate," "shrink," etc. to control display of the 3D model, or a rate of rotation or movement of the 3D model. As another example, a user may speak "split" or make a karate chop gesture to split a single virtual monitor into two virtual monitors.

[0073] Testing on various devices: The presently disclosed invention underwent beta-version testing and user evaluation on a HoloLens device. Users were presented with subjects such as biological molecules (e.g., protein/DNA/small molecules), inorganic molecules, atoms/electrons, and human body/organs, in a 3D scene through HoloLens glasses and were allowed to dynamically operate (move, rotate, etc.) each molecule through gaze or gesture. The presently disclosed application may be installed and run on multiple different platforms (cross-platform), including mobile devices such as iOS, Android, Microsoft windows phone, etc.

[0074] The HoloLens device is a head mounted VR/AR/MR display device operable by a user in a physical environment. Such devices generally comprise a display configured for rendering a VR/AR/MR environment to the user, wherein a view position of the user for the rendered VR/AR/MR environment may be variable depending at least in part on a pose of the user's head in the physical environment. According to certain aspects, the VR/AR/MR display device may include one or more processors; a sensor package; and one or more memory devices storing computer-readable instructions which, when executed by the one or more processors, perform a method comprising the steps of: rendering a three-dimensional (3D) virtual display. According to certain aspects, the processors and memory may be part of a secondary computing device, such as a user's mobile electronic device, or may be part of a static computing device configured to communicate with the VR/AR/MR display device via a wired or wireless communication. Thus, the VR/AR/MR display device may further include a network interface for receiving data from a remote computing platform over the network interface. As such, the VR/AR/MR display device may act as a display device only, or may include computing capability.

[0075] According to certain aspect, the method may include rendering the 3D model as a hologram in the display of the VR/AR/MR device. In another example, the method further

includes dynamically updating the rendered hologram on the VR/AR/MR device responsively to the user inputs. In another example, the method further includes obtaining sensor data from a sensor package of the VR/AR/MR device, the sensor data associated with a physical environment adjoining a user of the VR/AR/MR device; and, using the sensor data, reconstructing a geometry of the physical environment including any real world object located therein.

[0076] In another example, the sensor data includes depth data and the sensor data is generated using a depth sensor and surface reconstruction techniques are applied to reconstruct the physical environment geometry. A further examples includes a method performed by the VR/AR/MR device supporting a mixed-reality environment including virtual objects and real objects, the method comprising implementing a virtual 3D space or environment on a display of the VR/AR/MR device into which the 3D model of the target is positioned or displayed.

[0077] Examples: With reference to **FIGS. 1-7B**, the presently disclosed invention may provide a VR/AR/MR software application based on an innovative means to display and interact with a range of different information sources. Following is a list of specific examples of the systems and methods of the presently disclosed invention.

[0078] (1) GPU accelerated cloud computing big/health data technology for cross-platform innovative discovery applications:

[0079] The presently disclosed invention may provide a comprehensive drug discovery platform that includes integrated GPU accelerated cloud computing big/healthy data technology. Shown in **FIG. 1** is an exemplary portal to the software application that may be provided to a user on a VR/AR device or standard display for a computing device. The presently disclosed cross-platform software application may provide users with a variety of information sources and means to interact with the information sources. For example, with reference to **FIG. 1**, the portal may provide 3D visualization of organs or portions of a human body, as shown at left; or proteins and 3D models for drug discovery, drug pharmacokinetics, etc., as shown in the center; or molecules or atoms as shown at right; or specific disease models and information, as shown at the far right.

[0080] (2) VR/AR/MR drug discovery application:

[0081] With reference to **FIG. 2**, the presently disclosed software application may provide 3D visualization, such as similar to PyMol, homology modeling, such as 3D structures,

prediction of binding site(s), generating of pharmacophore models and pharmacophore filtering/screening, such as NCI molecular database (which includes 210,000 small molecules, screening completed within 1.5 hours), and protein - protein / protein - small molecule / protein - DNA docking, etc. This cross-platform application is developed based on the GPU accelerated technique of the present invention. Such visualization may assist in various aspects of drug discovery.

[0082] With reference to **FIGS. 3A-3C**, the presently disclosed invention may provide a VR/AR/MR software application based on an innovative means to display and interact with medical information, such as images of organs, body systems, or even whole bodies. In addition to 3D representations of proteins, DNA, small molecules such as drugs, etc., this software application may be designed to display data that includes 3D representations of single organs, clusters of organs, specific systems of the body (circulatory system, digestive system, nervous system, skeletal system, etc.), or the whole body.

[0083] The presently disclosed invention may provide a VR/AR/MR software application based on an innovative drug discovery platform with GPU-accelerated big data technology. The presently disclosed invention may be configured to function cross-platform. That is, the systems and methods may function on devices or platforms which include AR/MR devices (Microsoft HoloLens, Google Glass), VR devices (e.g., Oculus Rift), iOS, Android, and Microsoft Windows platforms. Users may be allowed to load, move, resize, rotate, delete, and stretch the holographic images by keyword commands or gestures (see **FIGS. 3A-3C**).

[0084] The software application may provide users with interactive operation. For example, the user may be provided with a view of another user's operation (e.g., a teacher or instructor), in addition to being allowed to operate/manipulate the 3D model under the authorization of the other user.

[0085] (3) VR/AR/MR precision medicine application:

[0086] The presently disclosed methods and systems provide a VR/AR/MR software application for a variety of precision medicine topics. For example, as shown in **FIGS. 4A-4F**, the presently disclosed systems and methods may provide drug pharmacokinetic and pharmacokinetic analysis in the heart and kidney. The software application includes VR/AR/MR visualization and big data mining and analysis, which may include: (i) applying software tools that predict potential pharmacological properties of compounds, (ii) carrying out molecular

similarity searches, in which more than 75% similarity to the known drug(s) is considered as a potential small molecule with therapeutic potential, and (iii) performing in-silico high-throughput docking and evaluation. Positive results may be visualized on a VR/AR device such as HoloLens, or Google Glass, etc. **FIGS. 4A-4F** illustrate findings for a novel small molecule with potential therapy for heart disease, where individual panels show progress of the small molecule within the heart, as visualized on a VR/AR device using methods of the presently disclosed invention. Prediction of drug pharmacokinetics and pharmacokinetics in various other body organs and systems is also provided by the systems and methods disclosed herein.

[0087] (4) VR/AR/MR quantum chemistry application:

[0088] The presently disclosed methods and systems provide a VR/AR/MR software application that may (i) display the elementary electron orbital, (ii) display the shared electrons between different atoms as a function of time, (iii) calculate the chemical properties for various compounds, (iv) show the difference between the -S or -R configurations, and (v) display the chemical reaction safe with games, etc. For example, **FIG. 5A** shows the electron orbit of H and O, as well as their crystal structure, and **FIG. 5B** shows the difference between the -S or -R configurations of a small molecule.

[0089] (5) VR/AR/MR Organ (Skeleton) application:

[0090] As discussed above, the presently disclosed methods and systems provide a VR/AR/MR software application to display medical information such as images of organs, body systems, or even whole bodies based on data 3D imaging data (see **FIGS. 6A-6B**). The system may function to allow a user to: (i) select any organ/skeleton, (ii) move the organ/skeletons to the correct location, (iii) learn about the roles and functions of the various organs and systems, etc. The 3D imaging data may be collected from a range of medical technologies known in the art, such as magnetic resonance imaging (MRI), CAT scans, tomography, ultrasound, etc. This imaging data may be retrieved from an information server, or may be accessed in real time from an imaging procedure. The 3D imaging data may also be provided from computer graphic generated images based on known 3D information of organs, or other body systems.

[0091] (6) VR/AR/MR games, tutorials, learning applications:

[0092] The presently disclosed invention also provides software applications that may utilize any of the previously indicated 3D data or imaging methods, such as according to any of the systems and methods disclosed herein, configured as games. For example, the VR/MR/AR

organ application may be configured as a game where the user receives points for correctly locating, identifying, placing the various organs or systems of the body in 3D space. The VR/MR/AR organ application may be configured to provide a means for practice surgery, so that a medical student may practice and/or a specific surgical technique. The presently disclosed invention envisions that any or all of the systems and methods disclosed herein may be configured as tutorials or exams. For example, the VR/MR/AR molecule application may be configured as an exam where the user receives points for correctly locating and identifying the various atom types, binding sites, -S or -R configurations, etc.

[0093] (7) VR/AR/MR “Holographic & Interactive 3D Diabetic” for novel training and teaching:

[0094] The presently disclosed methods and systems also provide virtual reality and mixed reality 3D diabetic training and teaching applications (see **FIGS. 7A-7B**). **FIG. 7A** illustrates a virtual scenario that provides an electronic medical record which shows past medical records of a virtual patient, and the diagnosis results show the different indicators of the current virtual patient (derived from the virtual device test) and the results obtained therefrom. **FIG. 7B** illustrates a scenario wherein according to the previous results, it is concluded that the virtual patient was diagnosed as type II diabetes (with an A1C of 7% and a BMI greater than 25 kg/m², etc.), and the treatment plan was: metformin + lifestyle management. These virtual scenes (people, equipment, furniture, etc.) can be directly touched, moved or otherwise manipulated. Teacher or students can act as a doctor during the simulation, and they can interact with the virtual patient, equipment, furniture, etc.

[0095] As detailed in the examples detailed above, the methods of the presently disclosed invention include a method for providing an augmented or virtual reality learning application, wherein the application may be executed by one or more processors. For example, the method may be embodied on a non-tangible computer readable medium tangibly embodying non-transitory computer-executable program instructions thereon that, when executed, cause a computing device to carry out the methods steps of the present invention.

[0096] Generally described, the method may decode a request for a data set related to a first target stored on an information server. As detailed, this data set generally includes information regarding spatial information of an arrangement of the first target in a physical environment, such as a three dimensional (3D) structure of the target. In addition to 3D structural

information, the data set may include color, texture, and other information regarding a surface appearance of the target, such as for a target that is an organ or other body part. The method may then access, by a mobile internet device via a wired or a wireless network, the information server on which the 3D and other information may be stored. This information may be imported from the information server, and spatial information may be extracted from the data set. A 3D spatial image may then be displayed on the mobile internet device, wherein the spatial image is based on the spatial information.

[0097] According to certain aspects, the spatial information comprises a digital representation of an arrangement of the first target in a physical environment, such as in a current physical location of the user, or in a graphically generated environment.

[0098] According to certain aspects, a spatial image may be generated for one or more additional targets, and the method may further include altering the spatial image of the first and second, or additional, targets on the mobile internet device based on user commands. Such may be done to dock molecules relative to one another, such as a drug molecule docked within a binding site on a protein, or to dock an organ within a larger system of a body, such as docking internal organs in their proper locations in a body cavity.

[0099] II. Personalized Medical Tracking and Reminder Applications

[0100] The presently disclosed methods and systems also provide personalized medication scheduling, medical appointment scheduling, supporting holographic and interactive 3D representations of data sources. According to certain aspects, the software applications are configured to work across many platforms (e.g., iOS, Android, Microsoft Windows, etc.) to remind a user thereof to take and refill medications, or to schedule and attend medical appointments in a timely manner

[0101] The presently disclosed software applications may use artificial intelligence (AI) and/or big data analysis algorithms for precision/personalized medication. Additionally, in conjunction with other technology and/or health companies, educational and/or medical institutions, the presently disclosed software application may import data which may be used to fine tune and improve the prescribing and other information sources.

[0102] The presently disclosed software application may further analyze the health data using an artificial intelligence (AI) and clinical data mining algorithm, which may include, but is not limit to: (i) recording, comparing, and analyzing the patient or user data before drug and after

drug (long term) use, before and after different drugs or dosages, etc. The analysis may further compare the patient or user data with that of a population in order to provide and/or refine the schedule/plan for the patient or user medication dosage, dose schedule, and even drug type. As such, the presently disclosed software application may help the patient or user to manage their health data and plan.

[0103] Thus, the present invention includes a computer implemented method for providing a medication and/or appointment reminder. According to certain aspects, the method may comprise connecting to an information server via an internet protocol network; acquiring stored patient information from the information server, wherein the stored patient information comprises a medication to be taken by a patient and a dose schedule; starting a timer associated with the dose schedule; and activating an alert or alarm at a time interval defined by the dose schedule.

[0104] Acquiring the stored patient information may comprise accessing the information server having stored thereon a set of patient specific data. The set of patient specific data may comprise at least a patient name, a medication identification, and a medication dosing schedule. The set of patient specific data may further comprise a patient age, a patient weight, a patient height, a patient blood pressure, a patient cholesterol, a patient insulin level, a patient blood sugar level, a patient heart rate, a patient temperature, or any combination thereof.

[0105] The patient specific data may be obtained via direct input by the patient or user, and/or from a medical database maintained by the patient's or user's pharmacy or medical facility (e.g., primary care physician, hospital or medical facility, etc.), or may be information encoded on the medication (e.g., on a barcode or QRcode, such as on the label of the medication container).

[0106] Acquiring the stored patient information may further comprises accessing a second server, such as a server associated with a health or fitness tracker which may store thereon current values of a patient age, a patient weight, a patient height, a patient blood pressure, a patient cholesterol, a patient insulin level, a patient blood sugar level, a patient heart rate, a patient temperature, or any combination thereof. As such, the set of patient specific data may further comprise information stored on the second server.

[0107] The patient specific data may be used to determine a change to the dose schedule, or a health message regarding the dose schedule.

[0108] The method may further comprise sending reminders regarding an appointment schedule. As such, the stored patient information may further comprise an appointment schedule, and the method may further comprise starting a timer associated with the appointment schedule; and activating an alert or alarm at a time interval defined by the appointment schedule.

[0109] According to certain aspects of the method, the stored data may only comprise an appointment schedule, and the method may focus solely on alerts regarding that appointment schedule. That is, acquiring stored patient information from the information server, wherein the stored patient information comprises the appointment schedule; starting a timer associated with the appointment schedule; and activating an alert or alarm at a time interval defined by the appointment schedule.

[0110] The present invention further includes a system comprising a processor; and a memory containing instructions that, when executed by the processor cause the processor to execute any of the methods described herein.

[0111] The present invention further includes a computer implemented program product for providing a medication and/or appointment reminder, comprising a non-tangible computer readable medium tangibly embodying non-transitory computer-executable program instructions thereon that, when executed, cause a computing device to execute any of the methods described herein.

[0112] With reference to **FIGS. 8A- 8C** (a prototype, named “MediEye”), the presently disclosed software application may provide medication (drug and diet) and appointment reminders. For example, if the current date and time are as shown in **FIG. 8A** (1:04 PM on Monday 08/16/2018), it may be time for a specific patient or user to take their medication, Ambroxol in this example. When the patient or user clicks the Ambroxol region on the screen of a mobile device, with application “MediEye”, for example, MediEye may redirect to detailed information as shown in **FIG. 8B**. The information may include a description of the “Dosage” (1 to be taken daily, 6 tablets, refill 1 time), “Schedule” (reminders for 10:00 AM), “Statistic” (0/12 doses, 0/1 refills {6 doses in box}), and “Up next” (now). The patient or user can click the “Take”, “Refill” or the “Dismiss” button. “Refill” is to remind the patient or user to fill or refill this medication.

[0113] As used herein, the term “click” may be taken to indicate that a user of the application makes a selection by any of the known means in the art, such as direct contact with a

button on a mouse or a portion of the screen that indicates the user's selection of a specific option (by touching the region on a touch sensitive screen, or by pointing at the region on the screen using the mouse, for example, and pushing the button on the mouse). The term "click" may also be taken to mean that the user has made a selection using eye or hand movements, such as eye movements when using a VR/AR device.

[0114] As shown in **FIG. 8C**, the patient or user may also be able to "Edit" the information stored in the software application MediEye. The contents available to the patient or user to change include "Dose" (how many tablets, pills, sprays, etc.), "Total Dose", "Refill times", "Frequency", "Custom Schedule" (on/off), "Alert time", etc.

[0115] With specific reference to **FIGS.9A-9F**, events may be added/removed/edited on a "Calendar" which may be shown in a main ("Home") screen of the software application or may be shown on a separate screen of the application. For example, as shown in **FIG. 9A**, the current date/time is listed as "Today is 08/16/2018 (Thursday)". The software application may highlight that date on a calendar as a default. The patient or user may be able to "Scroll left" the screen, at which point the software application may show an earlier month or week. The patient or user may also be able to "Scroll right" the screen to show a later month or week.

[0116] The patient or user may be able to add/edit/remove the new event(s)/reminders on today or a day in the future by selecting a specific day, as shown in **FIG.9B**. For example, the patient or user may want to add a new appointment for body check on 08/19/2018 at 1:40P.M. The patient or user would first click the "Edit" logo on the right top of the screen, and then click the "Appointment" button.

[0117] As show in **FIG.9C** to **FIG.9E**, screen shots of the software application MediEye, as installed on a smart phone, allow the patient or user may add the detailed information for this coming appointment (e.g., appointment on 08/19/2018 at 1:40P.M.). When done, the patient or user may click the "✓" button on the right top, which redirects the application to the "Calendar" page, at which point the patient would select the day (e.g., click "19") assuming the correct month is selected (e.g., swipe right or left to select the appropriate month). The newly entered appointment is now visible on the calendar, as shown in **FIG.9F**.

[0118] The software application of the present invention may also provide a means to set-up reminders for things such as medical appointments and/or drug schedules. For example, the presently disclosed software application may provide the patient or user with two ways to set

up their reminders. In a first method, when a patient or user picks up their medications in the pharmacy, a pharmacy generated barcode or QRcode which may incorporate information specific to that patient or user may be included on the medication. Shown in **FIG. 10A** is an interface that may allow a patient or user to scan the barcode or QRcode.

[0119] The information from the scanned barcode or QRcode may include the patient's or user's name, date of birth, full list of medications or supplements, dosage, usage, etc. The barcode or QRcode, which may provide the additional information in an encrypted state which may use the patient's or user's date of birth and family name as the key (e.g., in an encryption algorithm) may be pushed to or scanned by patient's or user's mobile device using the presently disclosed software application. Moreover, the software application may provide the detailed information of the prescription on the patient's or user's mobile device, as shown in **FIG.10B**. For example, information for Morphine, including chemical structure, definition ("what is morphine"), side effects, warnings, instructions, drug to drug interactions, etc. may be provided. The software application may parse this patient or user information and the big data analysis algorithm may assist or help to set up the reminders.

[0120] Alternatively, the patient or user may manually set up the reminders. For example, the software application may set "August 16 (today)" as the default day, such as shown in **FIG. 9A**, but a patient or user may select any day they like. The presently disclosed software application may provide the medication/supplement names to avoid the wrong spelling, and the patient or user may be allowed to select various additional scheduling options. For example, one option may be to "avoid bed time" to take a medication, and the schedule may incorporate that scheduling restriction into the overall drug/appointment schedule. The presently disclosed invention further provides several optimum plans after analysis of all of the data and restrictions using the big data analysis.

[0121] With specific reference to **FIG. 10C**, the patient or user may view the latest news and information on drug use and/or abuse in "Discover". For example, the patient or user may use the expanded NLP portion of the presently disclosed software application to display the latest news on drug use and/or abuse. This may be for the drugs currently prescribed to the patient or user, or for drugs which are closely related. Moreover, the patient or user may request such information on any drug or supplement of interest. Such may be accomplished via a web crawler

program which may be integrated with, or may be a component of, the presently disclosed software application.

[0122] This news content may be vetted for reliability and/or priority may another program component which may be integrated with, or may be a component of, the presently disclosed software application. Additionally, the NLP algorithm may be used for abstractive sentence summarization. The presently disclosed software application may display the news or information as shown in **FIG. 10C**.

[0123] The presently disclosed software application may also provide a means to input patient or user profile information. This information may be entered directly by a user through interactions with the application. For example, at the beginning of a session (e.g., first use of the application), the patient or user may or may not be required to create an account. When required to create an account, such as when the presently disclosed software application has acquired enough users, each patient or user may enter specific personal information. Several different interfaces related to “Profile”, such as “Sign in”, “Create an Account”, “Account Finder”, “Profile Manage”, “Name”, “Image”, “Allergic History”, “Sleep Quality”, “Health Condition”, “Medication Summary”, etc., may be a part of the presently disclosed software application.

[0124] Alternatively, or in addition, the patient or use information may be obtained from a data source, such as a health care provider. This information may be provided via the health care provider’s servers.

[0125] With reference to **FIG. 11**, the presently disclosed software application may also provide a patient or user with the ability to connect with a variety of resources. For example, beyond the medication and appointment reminders, the presently disclosed software application may connect to the patient’s or user’s fitness or health trackers (e.g., Apple Watch, Jawbone, Fitbit, Body Cardio, etc.). The patient or user may be allowed to sync their data to the presently disclosed software application, such as by “clicking” or “selecting” or touching that portion of the display (e.g., by clicking “sync devices”), after which their data may be synchronized through Wi-Fi or Bluetooth. The health data may include, but is not limit to, a user id (generated by the software application of the fitness or health tracker device), the patient or user age, sex, weight, temperature, heart rate, blood pressure (Body Cardio, Nokia), etc., in addition to the medication data already resident in the presently disclosed software application. In order to be

compatible with more devices, the presently disclosed software application may utilize algorithms which may be designed to deal with different data with different formats.

[0126] The presently disclosed software application may assist the patient or user in generating (e.g., new users/patients) or refining their plan. As such, the patient or user data may be synced (automatically or by the patient or user to a server (e.g., cloud or server associated with the software application). The patient or user health data may be submitted and analyzed by an artificial intelligence (AI) segment of the presently disclosed software application, and/or clinical data mining algorithms.

[0127] The server may provide functions which include, but are not limit to: recording, comparing, and/or analyzing the patient or user data. The presently disclosed software application may first compare the patient's data between "before drug" and "after drug" (long term), including heart rate, blood pressure, temperature etc. Statistics may be generated which may show the patient's values versus those of the population (e.g., general population or the population on the same drug). If the patient's values are found to be outside of a standard range (e.g., higher than the maximum value in a population; or lower than a minimum value in a population), or to have varied greatly from a previously recorded value, the presently disclosed software application may provide the patient or user with a recommendation, such as "You may overdose, contact you doctor(s)", "You may see your doctor to change the dosage or add other medications", or the software application may show you some alternative dosing times/schedules by searching trends in similar patient(s).

[0128] While specific embodiments of the invention are described in detail within this document, it should be appreciated by those skilled in the art that various modifications and alternations and applications could be developed in light of the overall teachings of the disclosure. Accordingly, the particular arrangements, systems, apparatuses, and methods disclosed are meant to be illustrative only and not limiting as to the scope of the invention.

CLAIMS

What is claimed is:

1. A method for providing an augmented or virtual reality learning application, the application executed by one or more processors, the method comprising:
 - decoding a request for a data set related to a first target stored on an information server;
 - accessing, by a mobile internet device via a wired or a wireless network, the information server;
 - importing the data set from the information server;
 - extracting spatial information from the data set; and
 - displaying a three-dimensional (3D) spatial image on the mobile internet device, wherein the spatial image is based on the spatial information.
2. The method of Claim 1, wherein the spatial information comprises a digital representation of an arrangement of the first target in a physical environment.
3. The method of Claim 1, wherein the first target is an organ, a skeleton, a body, a nervous system, a digestive system, a circulatory system, or a combination thereof.
4. The method of Claim 3, wherein the organ may comprise a single organ, multiple organs, or an entire body.
5. The method of Claim 1, wherein the first target is a molecule.
6. The method of Claim 5, wherein the molecule is a protein molecule, a DNA molecule, an RNA molecule, a peptide, a carbohydrate, a lipid, a drug, or a combination thereof.
7. The method of Claim 1, wherein the data set related to the first target is a crystallographically determined 3D structure of a protein molecule, a DNA molecule, an RNA molecule, a peptide, a carbohydrate, a lipid, a drug, or a combination thereof.

8. The method of Claim 1, wherein the data set related to the first target is a reconstruction from an imaging method selected from the group consisting of: a CT scan, a PET scan, a MRI, a tomographic MRI, an ultrasound, and an ultrasound tomography.
9. The method of Claim 1, wherein the mobile internet device comprises at least one of the following: a game device, a smart phone, a tablet, a camera, a robot, an augmented or virtual reality viewer, and a watch.
10. The method of Claim 1, wherein the data set is imported to the mobile internet device.
11. The method of Claim 1, wherein the data set is imported to a cloud server which carries out the step of extracting the spatial information from the data set.
12. The method of Claim 1, further comprising:
 - altering the spatial image on the mobile internet device based on user commands, wherein the user commands comprise moving the spatial image, resizing the spatial image, rotating the spatial image, deleting part of or all of a spatial image, and stretching the spatial image, and combinations thereof.
13. The method of Claim 1, further comprising:
 - decoding a request for a data set related to a second target stored on an information server;
 - accessing, by the mobile internet device, the information server;
 - importing the data set related to the second target from the information server;
 - extracting spatial information from the data set related to the second target; and
 - displaying a second 3D spatial image of the second target on the mobile internet device.
14. The method of Claim 13, further comprising:
 - altering the spatial image of the first and second targets on the mobile internet device based on user commands, wherein the user commands comprise moving the

spatial image, resizing the spatial image, rotating the spatial image, deleting part of or all of a spatial image, and stretching the spatial image, and combinations thereof.

15. A system for providing an augmented or virtual reality learning tool, the system, comprising:
a processor; and
a memory containing instructions that, when executed by the processor cause the processor to:
 decode a request for a data set related to a target stored on an information server;
 access, by a mobile internet device, via a wired or a wireless network, the information server;
 import the data set from the information server;
 extract spatial information from the data set; and
 display a spatial image on the mobile internet device, wherein the spatial image is based on the spatial information.
16. A computer implemented program product for providing an augmented or virtual reality learning tool, comprising a non-tangible computer readable medium tangibly embodying non-transitory computer-executable program instructions thereon that, when executed, cause a computing device to:
 decode a request for a data set related to a target stored on an information server;
 access, by a mobile internet device, via a wired or a wireless network, the information server;
 import the data set from the information server;
 extract spatial information from the data set; and
 display a spatial image on the mobile internet device, wherein the spatial image is based on the spatial information.
17. A computer-implemented method for providing a medication and/or appointment reminder, the method comprising:

connecting to an information server via an internet protocol network;
acquiring stored patient information, wherein the stored patient information
comprises a medication to be taken by a patient and a dose schedule;
starting a timer associated with the dose schedule; and
activating an alert or alarm at a time interval defined by the dose schedule.

18. The computer implemented method of Claim 17, wherein acquiring the stored patient information comprises accessing the information server having stored thereon a set of patient specific data.
19. The computer implemented method of Claim 17, wherein acquiring the stored patient information comprises accessing information from a QRcode or barcode on a medication container or pamphlet having stored thereon a set of patient specific data.
20. The computer implemented method of Claims 18 or 19, wherein acquiring the stored patient information further comprises accessing a second server having stored thereon a current value of a patient age, a patient weight, a patient height, a patient blood pressure, a patient cholesterol, a patient insulin level, a patient blood sugar level, a patient heart rate, a patient temperature, or any combination thereof.
21. The computer implemented method of Claims 18 or 19, wherein the set of patient specific data comprises a patient age, a patient weight, a patient height, a patient blood pressure, a patient cholesterol, a patient insulin level, a patient blood sugar level, a patient heart rate, a patient temperature, or any combination thereof.
22. The computer implemented method of Claim 17, wherein the set of patient specific data obtained from the second server are used to determine a change to the dose schedule, or a health message regarding the dose schedule.
23. The computer implemented method of Claim 17, wherein the stored patient information comprises an appointment schedule.

24. The computer implemented method of Claim 23, wherein the method further comprises:
starting a timer associated with the appointment schedule; and
activating an alert or alarm at a time interval defined by the appointment schedule.
25. A system for providing a medication and/or appointment reminder, the system, comprising:
a processor; and
a memory containing instructions that, when executed by the processor cause the processor perform the method for providing a medication and/or appointment reminder according to any of Claims 17 - 24.
26. A computer implemented program product for providing a medication and/or appointment reminder, comprising a non-tangible computer readable medium tangibly embodying non-transitory computer-executable program instructions thereon that, when executed, cause a computing device to perform the method for providing a medication and/or appointment reminder according to any of Claims 17 - 24.

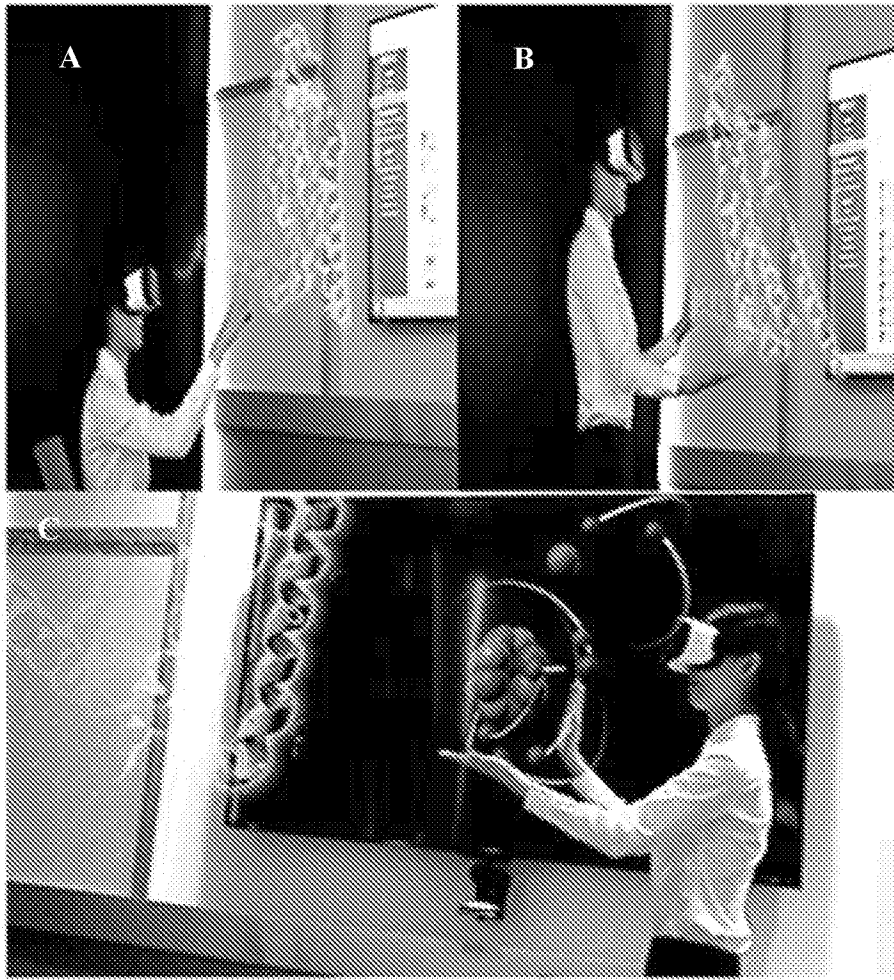


FIG. 3

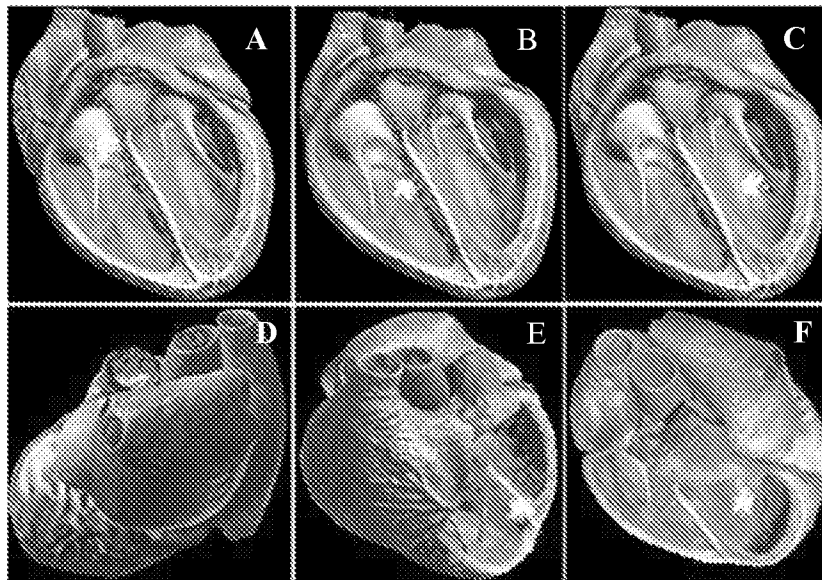


FIG. 4

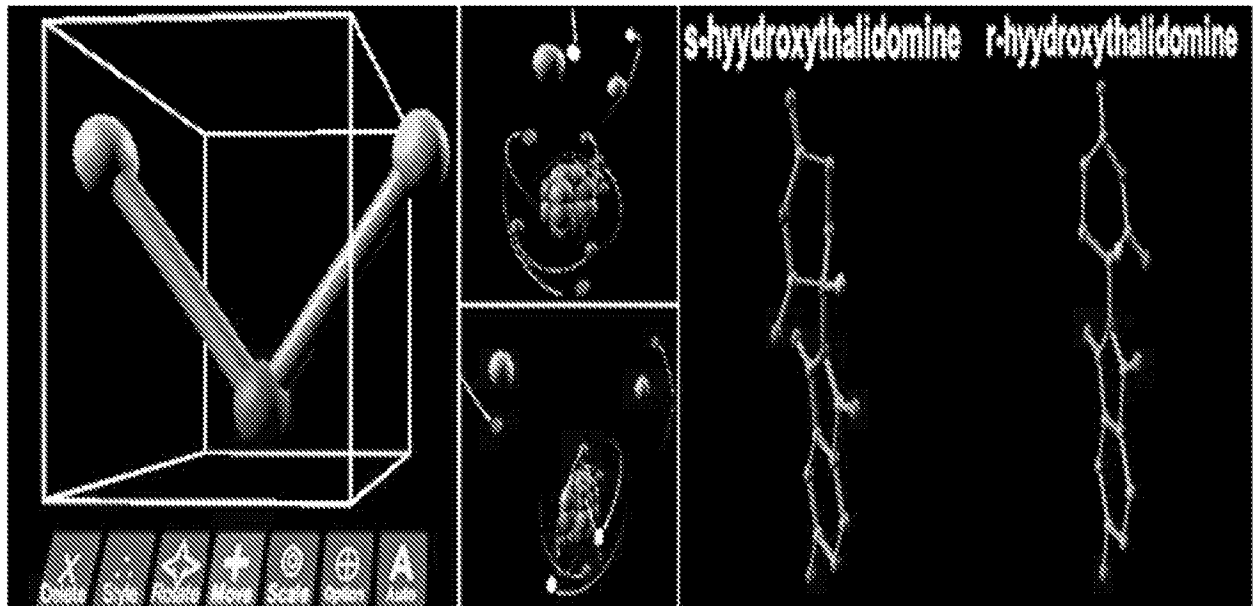


FIG. 5A FIG. 5B

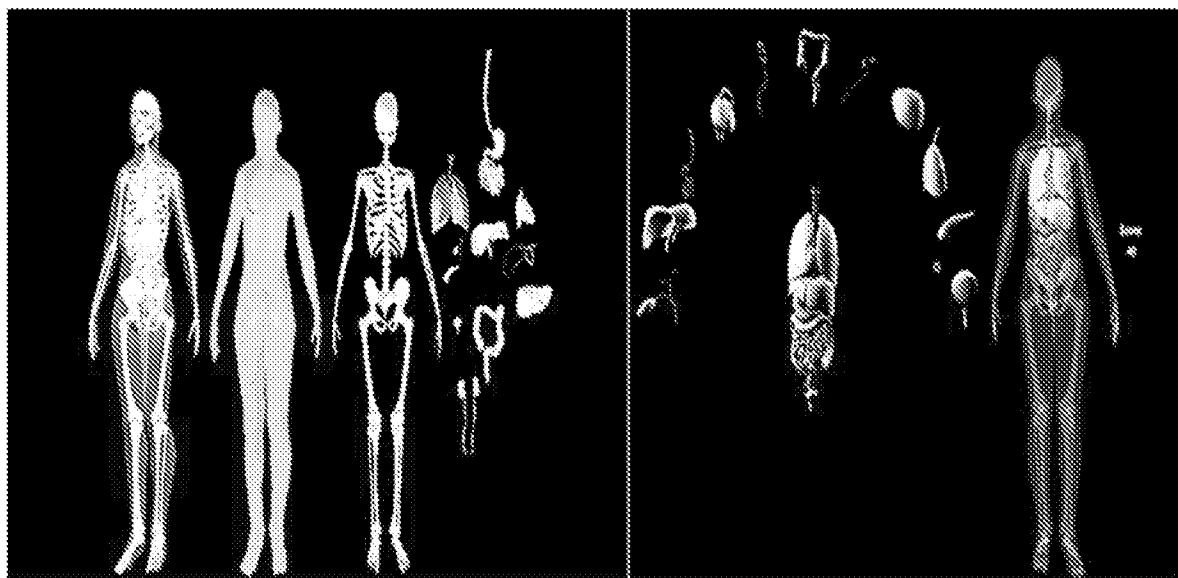


FIG. 6A FIG. 6B

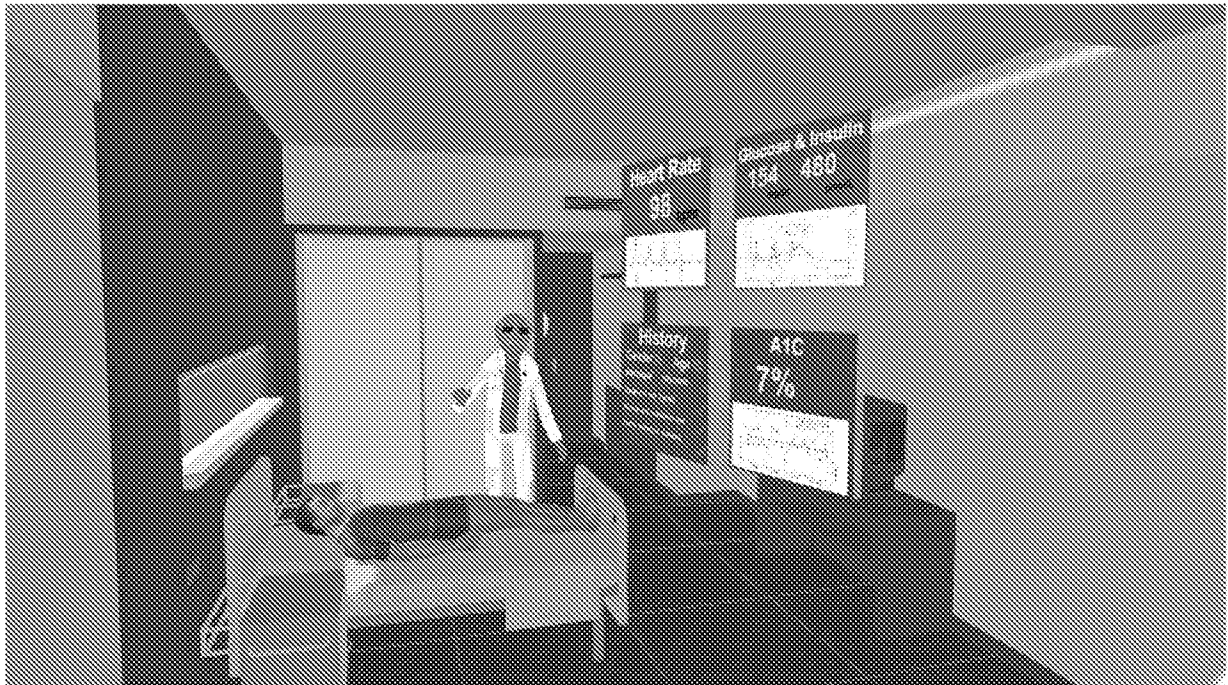


FIG. 7A



FIG. 7B

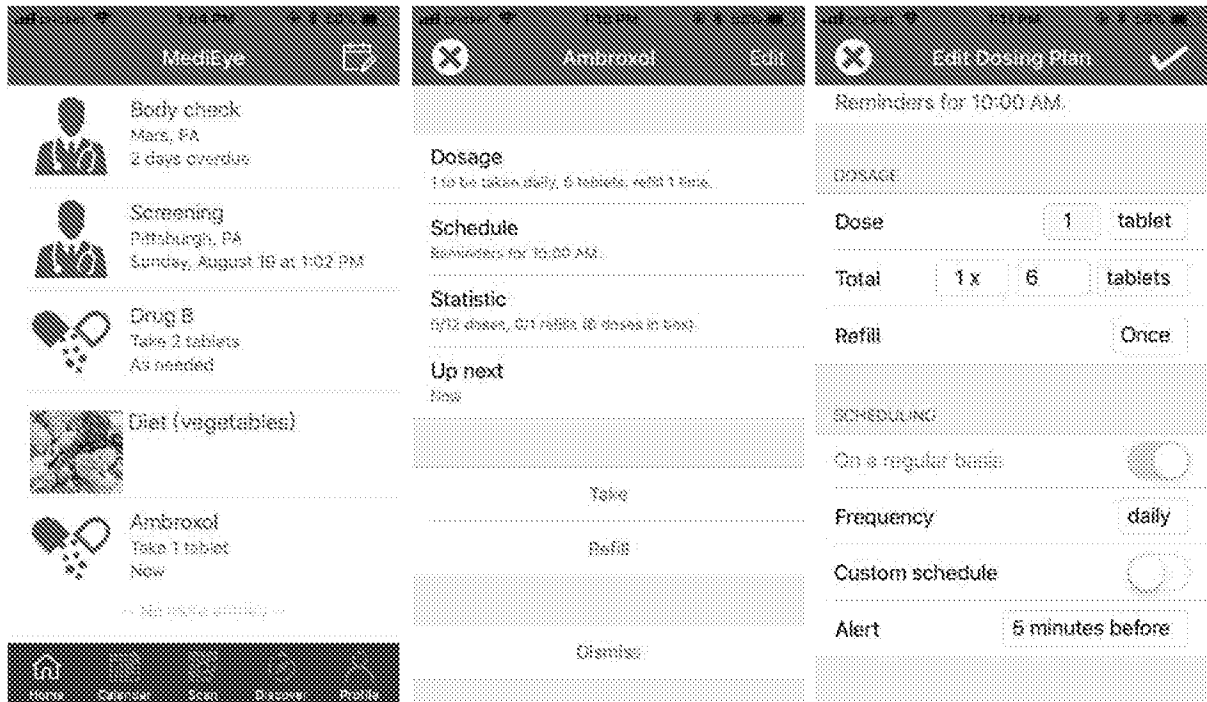


FIG. 8A FIG. 8B FIG. 8C

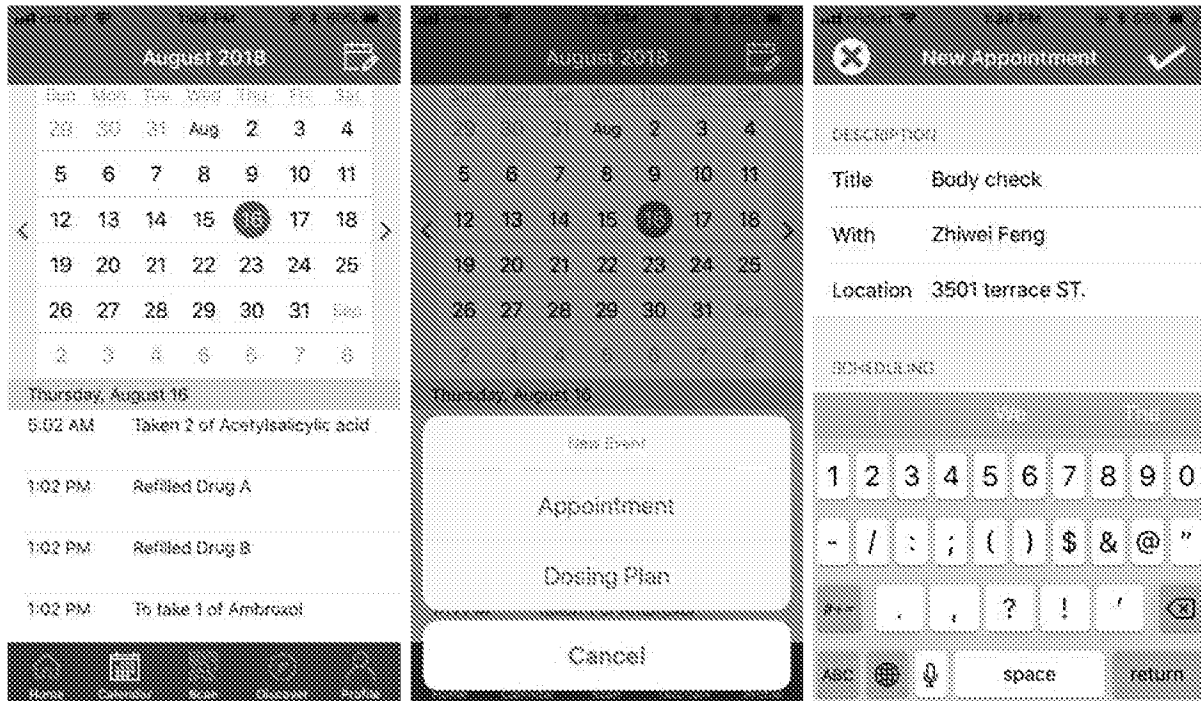


FIG. 9A FIG. 9B FIG. 9C

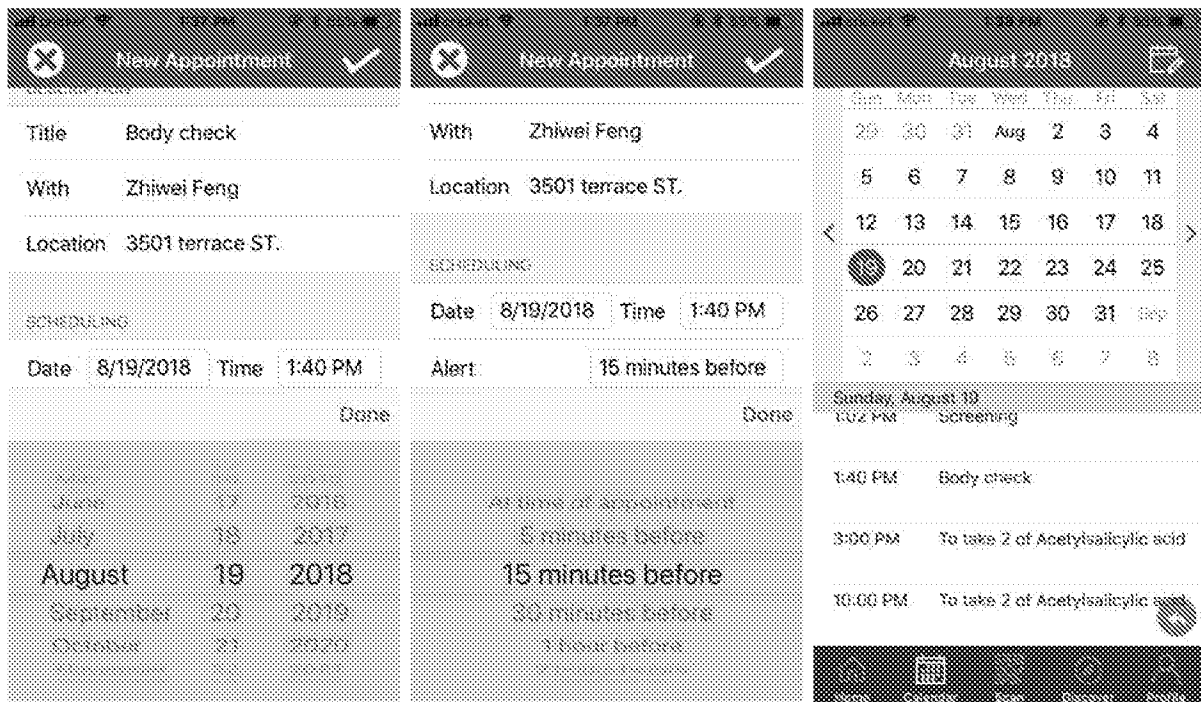


FIG. 9D FIG. 9E FIG. 9F

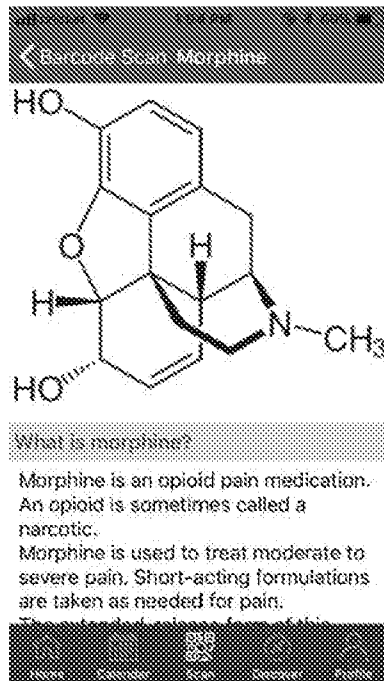
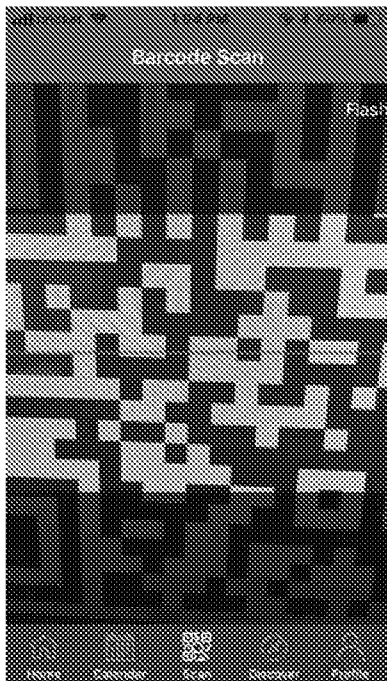


FIG. 10A FIG. 10B FIG. 10C



FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 18/48139

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H04N 13/02 (2018.01)
CPC - A61B 5/0064, A61B 6/022

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History Document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

See Search History Document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History Document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2016/0249989 A1 (Aris MD, Inc.) 01 September 2016 (01.09.2016), entire document especially para [0033], [0037]-[0060], [0084]-[0088], [0163], [0168], [0183], [0237], [0239]	1-16
Y	US 2015/0269855 A1 (Digizyme, Inc.) 24 September 2015 (24.09.2015), entire document especially para [0012], [0016], [0018], [0064], [0086], [0095], [0097], [0099], [0113], [0143], [0151], [0336]	1-16

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 06 December 2018 (06.12.2018)	Date of mailing of the international search report 09 JAN 2019
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 18/48139

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.: 25, 26
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

--PLEASE SEE EXTRA SHEET--

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-16

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions that are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group I: Claims 1-16 directed to a method/system/computer implemented program product for providing an augmented or virtual reality learning application on a mobile internet device by accessing/importing the target data set from the information server, extracting the spatial information and displaying a three-dimensional (3D) spatial image on the mobile internet device.

Group II: Claims 17-24 directed to a computer-implemented method/system/computer implemented program product for providing a medication and/or appointment reminder by acquiring stored patient information comprising medication and dose schedule from an information server via an internet protocol network and activating an alert or alarm based on the dose schedule.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The special technical feature of the Group I invention is directed to a method/system/computer implemented program product for providing an augmented or virtual reality learning application on a mobile internet device by extracting the spatial information from the data set and displaying a three-dimensional (3D) spatial image on the mobile internet device not required by Group II.

The special technical feature of the Group II invention is directed to a computer-implemented method/system/computer implemented program product for providing a medication and/or appointment reminder by activating an alert or alarm based on the medication dose schedule not required by Group I.

The only common technical feature shared by the above groups is accessing/importing/acquiring the stored data-set/information from the information server.

The common technical feature does not represent an improvement over the prior art of US 2016/0034042 A1 to SAMSUNG ELECTRONICS CO., LTD (published on 04 February 2016) that discloses accessing/importing/acquiring the stored data-set/information from the information server in para [0096]-[0100] ('content corresponding to a notification event' may include at least one of schedule notification content (e.g., medication notification comment, schedule notification comment, etc.) - wearable glasses 100 may display notification content on a display in the form of augmented reality (AR), mixed reality (MR) or virtual reality (VR)), in para [0140]-[0146] (wearable glasses 100 may be communicatively connected to the mobile terminal 200 or the server 300 - server 300 may be a cloud server that controls the wearable glasses 100. Also, the server 300 may be a content provider providing a notification message), and in para [0209]-[0213] (user may set the mobile terminal 200 such that a schedule notification message notifying "medication at 7 pm" is output by the wearable glasses 100).

As the above technical feature of accessing/importing/acquiring the stored data-set/information from the information server as taught by SAMSUNG ELECTRONICS CO., LTD was known, this cannot be considered a special technical feature that would otherwise unify the groups.

Therefore, the inventions of Groups I-II lack unity of invention under PCT Rule 13 because they do not share a same or corresponding special technical feature.