

A METHOD FOR DETERMINING AND PREDICTING HEALTH CONDITIONS AND SYSTEM THEREOF

FIELD OF INVENTION

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The invention relates to health data collection and assessment, and more particularly, the invention relates to a method for determining health conditions and providing an interactive interface for the decision support based on the determined health conditions.

10 BACKGROUND OF THE INVENTION

General health refers to the overall state of physical and mental well-being throughout a person's life. It involves monitoring and managing various health factors to ensure optimal well-being. While maintaining good health is crucial, complications can arise and affect
15 individuals. These complications may include, but are not limited to, conditions such as cardiovascular diseases, respiratory issues, digestive disorders, mental health challenges, genetic predispositions, and various other health concerns. Early identification of symptoms and risk factors is essential in preventing complications and promoting a healthier lifestyle. This proactive approach helps individuals manage their health more
20 effectively and reduces the chances of complications worsening over time.

The current approach of diagnosing the pregnancy complications is carried out by doctors or medical practitioners in a manual fashion. Such diagnostic accuracy is heavily dependent on the experience and skill sets of the doctors or practitioners, and the comprehensiveness
25 of information collected from the patients during their respective consultation sessions. Since the diagnostic approach is conducted by human doctors and practitioners, such approach is then susceptible to human errors. Furthermore, the doctors and medical practitioners are trained to diagnose patient on an average scale but the reality is that different patients would have different risk profiles and they would need customised
30 solutions to reduce their risk.

In addition, the collection of patient data often occurs with large gaps between each interval. This is due to the reality that it is not feasible for patients to attend the data collection sessions on a daily basis. Such gaps in data collection can diminish the accuracy of predictions and judgments regarding health outcomes. At times, doctors or practitioners may remain unaware of the progression of complications because of these gaps in data, potentially leading to delayed interventions or missed opportunities for timely treatment.

As technology advances, machine learning approaches to diagnosis has become increasingly accurate to an extent where its implementation in the medical field with supervision of doctors are highly probable. Over the years, there are a few patented technologies relating to systems and methods for diagnosing diseases using machine learning algorithms. An exemplary is disclosed in a United State Patent No. US 20200253547 A1. This patent discloses a system and associated method to assist with the monitoring or management of a patient's medical condition, which have one or more sensors sensing individual patient data on or near the patient. This individual patient data corresponds to at least one physiological parameter of the patient and includes a sensor that does not require the patient to apply it or activate it. The data is then transmitted to a processor for computing a risk or status signal that is based on comparison from a baseline related to a patient or related population and an alert or alarm can be generated based on the result of the signal.

The current method of determining the physiological conditions of the user involves collecting physical metrics and using them to predict emotional states. However, this approach remains predictive in nature and may not always accurately reflect the true emotional state of the individual. Moreover, the setup typically attempts to confirm emotional conditions through messaging, but during critical emotional states, patients may not respond, particularly to automated messages. This limits the system's effectiveness in providing real-time emotional status updates and interventions.

Accordingly, it would be desirable to provide a system and method which solves the abovementioned problems. This invention provides such a system and a method thereof.

SUMMARY OF INVENTION

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In one aspect of the invention, there is provided a method for determining and predicting health conditions of at least one user, the method comprises the steps in the sequence set forth: receiving, by an input module, health information of the user through one or more wearable electronic devices in real time; establishing, by a baseline module, baseline patterns of the user based on the received health information to identify abnormal patterns in real time; triggering, by a chatbot generation module, a chatbot that utilises one or more language models and one or more machine learning algorithms to communicate with the user via a user device for collecting emotional information of the user upon detection of the abnormal patterns; applying, by a prediction and classification module, one or more trained models to classify the health information and the emotional information into different categories of current physiological conditions; estimating, by the prediction and classification module, possible developments of the current physiological conditions at a predetermined future time to determine future physiological conditions; generating, by a chart generation module, a multi-dimensional chart having a plurality zones coded with one or more colours to represent various outcomes of the current and future physiological conditions; and generating, by a recommendation module, one or more proposed course of actions for the user to progress towards a specific colour-coded zone on the multi-dimensional chart.

25 Preferably, the method may further comprise the step of retrieving medical records of the user from one or more medical institution databases to aid in the establishment of the baseline patterns.

30 Preferably, the method may further comprise the step of obtaining confirmation and verification on the current and future physiological conditions from one or more healthcare

personnels if the conditions fall under category of critical physiological conditions.

Preferably, the step of establishing the baseline patterns to identify the abnormal patterns may further comprise the steps of: utilising population data, measurement data, and patient metadata to access one or more physical conditions of the user; applying population-aware features by calculating a z-score to determine an extent of a measurement value's deviation from a population average; and conducting a time-series analysis on the population-aware features using an Augmented Dickey-Fuller Test to identify whether the measurement values exhibit abnormal patterns.

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Preferably, calories variable information of the user can be collected by the wearable electronic devices and may then further pair with other variable information, including glucose rate, weight change rate, and fetus weight change rate of the user, to establish baseline patterns for these different variables.

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Preferably, the method may further comprise the step of forming adaptive thresholds to decide when to intervene in a user's physiological conditions.

Preferably, the multi-dimensional chart and the generated course of actions can be presented to the user via the chatbot.

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Preferably, the chatbot may be in the form of a virtual character that uses visual animations and expressions to simulate real human interactions.

Preferably, the virtual character may change its appearance depending on the physiological conditions of the user.

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Preferably, the chatbot may connect the user device to a communication device of a healthcare personnel.

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One skilled in the art will readily appreciate that the invention is well adapted to carry out the objects and obtain the ends and advantages mentioned, as well as those inherent therein. The embodiments described herein are not intended as limitations on the scope of the invention.

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BRIEF DESCRIPTION OF THE DRAWINGS

For the purpose of facilitating an understanding of the invention, there is illustrated in the accompanying drawing the preferred embodiments from an inspection of which when
10 considered in connection with the following description, the invention, its construction and operation and many of its advantages would be readily understood and appreciated.

FIG. 1 is a schematic block diagram illustrating a general architecture of a system for determining and predicting pregnancy health conditions which embodies
15 therein the principle features of the invention.

FIG. 2 is a block diagram illustrating a process flow of determining and predicting pregnancy health conditions.

20 **FIG. 3** is a block diagram illustrating a process flow of baseline patterns establishment and abnormal patterns identification.

DETAILED DESCRIPTION OF THE INVENTION

25 It will be understood that each block of the flowchart illustrations and/or block diagrams, and combinations of blocks in the flowchart illustrations and/or block diagrams, can be implemented by computer program instructions. These computer program instructions may be provided to a processor of a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the
30 instructions, that execute via the processor of the computer or other programmable data

processing apparatus, create means for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks.

5 These computer program instructions may also be stored in a computer-readable memory that can direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture including instruction means that implement the function/act specified in the flowchart and/or block diagram block or blocks.

10 The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer implemented process such that the instructions that execute on the computer or other programmable apparatus provide steps for implementing the functions/acts specified in the
15 flowchart and/or block diagram block or blocks.

Referring to **Fig. 1**, a system for determining and predicting health conditions as illustrated therein generally comprises a server **100** which is accessible by a plurality of user devices **200** via a communication network. The server **100** through the communication network
20 can be further connected to one or more medical institution servers **300, 400** and one or more third party entity servers **500**. The health conditions may include but are not limited to anemia, urinary tract infections, mental health conditions, hypertension, diabetes during pregnancy, obesity and weight gain, infections with HIV, viral hepatitis, STDs, and TB, hyperemesis gravidarum, and preterm birth.

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The communication network can be a wireless network connection established via a wireless protocol cloud such as Long-Term Evolution (LTE) cloud, Code Division Multiple Access (CDMA) and its derivatives, Enhanced Data Rates for GSM Evolution (EDGE), 3G protocol, High Speed Packet Access (HSPA), 4G protocol, 5G protocol and the like, in
30 accordance to the advancement of wireless technology with time. The communication

network **3** can also be a wired network in which the communication is established through a local network port.

The medical institution servers **300, 400** are preferably maintained by one or more medical institutions. The medical institutions can be any government or public funded hospitals, pharmacies, laboratories, clinics, public health centres, medical examination centres, screening centres and the like. Each medical institution server **300, 400** may comprise one or more computing devices **301, 401** and one or more medical equipment **302, 303, 402, 403**. Preferably, the medical institution servers **300, 401** can access to their respective computing devices **301, 401** and the medical equipment **302, 303, 402, 403** for the uploading of patient information. Various type of computing devices **301, 401** may include but are not limited to portable media players, cellular telephones, pocket-sized personal computers, personal digital assistants (“PDAs”), desktop computers, laptop computers, and/or tablet computers. The medical equipment **302, 303, 402, 403** may include but is not limited to electrocardiogram machines, haematology analyser, biochemistry analyser, X-ray machine, ultrasound imaging machine, patient monitor, defibrillators, ventilator, infusion pump, syringe pump, electrosurgical unit, anaesthesia machine, and sterilizer. The collected patient information is stored in their respective databases **304, 404**.

The third-party entity servers **500** are preferably maintained by one or more third-party entities. Such third-party entities may include but are not limited to product merchants and service providers. The product merchants can be any person or company that supply medical related products. The service providers can be any person or company that provide services which may improve the health conditions of the users or benefits the users in any other ways. The service providers can include but are not limited to insurance companies, advertisers, confinement centres, financial institutions and etc. Alternatively, the third-party entity server **500** can provide one or more e-commerce platforms **501** for the users to purchase the products and services. The third-party entity server **500** may also perform data mining to provide advertisement materials that are customised for each user.

For the purpose of the specification, the users can be defined as any person, organization, or company that would like to acquire the services provided by the system. The user devices **200** are personal devices of the users that may correspond to any computing device **202**, **203** which is capable of accessing to the server over the communication network. Various type of computing devices **202**, **203** may include but are not limited to portable media players, cellular telephones, pocket-sized personal computers, personal digital assistants (“PDAs”), desktop computers, laptop computers, and/or tablet computers. The user devices **200** may also include control circuitry, storage, memory, communications circuitry, input and/or output interfaces as well as any of the additional features. In addition to that, the user devices **200** can be installed with a browser application to access the server **100** through the communication network. Alternatively, the user devices **200** can also be installed with an application which is dedicated just for carrying out the operations of the server **100**. The user devices **200** can also be connected to a wearable electronic device **201** of the user such as a smart watch or a smart band that has the capability of monitoring the user’s heart rate, blood pressure, body temperature and etc. Such information on the wearable electronic device **201** can be transmitted to the user devices **200** upon a request from the server **100**. In the preferred embodiment, the wearable electronic device **201** collects the information in real time and then transmits to the server **100** via the user devices **200**. This transmission may occur either at pre-determined intervals or in real time, depending on the pre-set settings.

The server **100** can be a cloud-based web portal service, operated by one or more heavy duty computers and any known devices or group of devices to provide sufficient capacity for storing data. The server **100** is preferably stored with plurality sets of computer-implementable instructions to perform and automate the different operations of services that are provided by the server **100**, and the different sets of instructions are performed by software or hardware-based modules **101-128** of the server **100**. As shown in **Fig. 1**, Such modules **101-128** may include a graphical user interface module **101**, an input module **102**, a data retrieval module **104**, a data parsing module **106**, a prediction and classification module **108**, a confirmation module **110**, a recommendation module **112**, an advertising

module **114**, a communication module **116**, a nutrition/lifestyle feedback module **118**, an ecommerce platform **120**, databases **122**, baseline module **124**, chatbot generation module **126**, and chart generation module **128**.

- 5 Preferably, the graphical user interface module **101** is configured to provide a graphical user interface (GUI) that allows the users to interact with the server **100**. The interaction may include but not limited to receive input from, and display output to, the users. The GUI may be integrated with a plurality of buttons, icons, or widgets and being arranged in a manner where the users can easily access to the operations provided by the server **100**.
- 10 Each button, icon, or widget can be linked to their designated module for commencing their designated operations. In addition to that, the GUI can be interchangeable between a mobile-based interface and a web-based interface depending on whether the users are using the browser application or the dedicated application on the user devices **200** to access the server **100**. Outcomes from the different modules **102-128** can be converted into
- 15 infographics to be displayed on the graphical user interface. Such infographics may include but is not limited to pregnancy progress, mother weight changes rate, baby weight changes rate, prediction of normal or operation delivery, prediction of pregnancy complications, possible course of action, nutrition and lifestyle proposals, educational information relating to pregnancy of the different stages and generated user profiles. In addition, the GUI can
- 20 present a chatbot **600** and/or one or more multi-dimensional charts **610** to the user via the user device **200**. Such chatbot **600** and multi-dimensional charts **610** will be discussed in detail later part of the description.

- 25 Preferably, the input module **102** collects the necessary information for the determination and prediction of pregnancy health conditions upon receiving a health check request from the users via their respective user devices **200**. Questionnaire can be optionally generated based on user profiles to obtain health information from the user. If the request is triggered using the dedicated application, then the input module **102** may then retrieve information directly from the user devices **200**. Depending on the accessibility level set by the user in
- 30 the application, the input module **102** may retrieve user health information that is pre-stored

in the application during a new user registration process or fitness information from one or more wearable electronic devices **201** which are connected to the user devices **200**. The input module **102** may further obtain access permission for accessing the medical institution databases **304, 404**. Such accessibility of the medical institution databases **304, 404** is dependent on a level of consent chosen by the user while generating the pregnancy health check request.

Preferably, the data retrieval module **104** checks the access permission and then establish one or more communication links between the authorised medical institution databases **304, 404** and the server **100** so that the medical records of the respective users can be retrieved from the medical institution databases **304, 404**. The data can be retrieved by either a push or pull protocol once the communication links are established. The data retrieval module **104** may execute an encryption method which involves the use of public and private keys during a data transmission process.

Preferably, the data parsing module **106** checks and recognizes format of the retrieved data and then converts the retrieved data, which format cannot be executed by the prediction and classification module, into a normalised data of a standardized format. The data parsing module **106** may incorporate multiple data conversion techniques to execute the data conversion process such that data of different formats can be converted into the normalised data.

Preferably, the baseline module **124** establishes baseline patterns of the user based on the retrieved data to identify abnormal patterns. When the wearable electronic device **201** collects data continuously and transmit it in real time, the baseline module **124** can immediately process this data to establish and update baseline patterns without delay. This provides a more comprehensive and accurate picture of the user's condition and ensures that any deviations from the norm can be detected sooner. The baseline module **124** may employ a plurality of statistical algorithms, such as linear regression, clustering, and anomaly detection, to establish baseline patterns and identify abnormal patterns. For

instance, the baseline module **124** may be configured to utilise population data, measurement data, and patient metadata to assess one or more physical conditions of the user, apply population-aware features by calculating a z-score to determine how much a measurement value deviates from the population average, subsequently conduct a time-series analysis on these population-aware features using the Augmented Dickey-Fuller Test
 5 to detect whether the measurement values exhibit abnormal patterns over time.

Preferably, the chatbot generation module **126** manages one or more chatbots **600** that are respectively personalised for individual users. Each chatbot **600** may utilise one or more
 10 language models and machine learning algorithms to understand and communicate effectively with the user via the user device **200**. The chatbot **600** can be activated by the chatbot generation module **126** upon detection of abnormal patterns by the baseline module **124**. Once activated, the chatbot **600** subtly collects emotional information from the user, which can then be correlated to the abnormal patterns. While the system may be capable
 15 of predicting emotional conditions of the user based solely on the detected patterns, the information collected by the chatbot **600** is more accurate than such prediction. Alternatively, the chatbot **600** may appear as a virtual character using visual animations and expressions to simulate real human interactions to enhance user engagement. This virtual character may adaptively change its appearance based on the user's physiological
 20 conditions to provide a personalised experience. The chatbot **600** not only collects the emotional information but also offers psychological support and comfort when the user is experiencing a depressive episode. In addition, the chatbot **600** can be a more efficient way to present proposed course of actions and multi-dimensional charts to the user. In one embodiment, the chatbot generation module **126** can be coupled with the communication
 25 module **116** for connecting the user device to a communication device of a healthcare personnel so that the user can communicate with the healthcare expert directly.

Preferably, the prediction and classification module **108** develops training models using one or more machine learning algorithms. Once training models are developed, the
 30 prediction and classification module can then perform one or more feature extraction

techniques to extract key sets of attributes from the normalised data as inputs for the trained models. The extracted attributes will be classified by the trained models into different categories of pregnancy health conditions and behaviour profiles based on one or more trained thresholds. The prediction and classification module **108** then forecasts a future estimation of pregnancy health conditions using one or more neural networks. By way of example, the neural networks perform graph learning operations on past medical data to generate a trained graph for comparison with the extracted attributes and make a prediction about future performance. In a real-life circumstance where certain attributes are often difficult or impossible to be collected from the user, the prediction and classification module **108** alters the trained models with the removal of at least a partial of the missing values based on the sensitivity and impact of the missing attributes and further computes accuracy value of the outcomes.

Preferably, the chart generation module **128** creates one or more multi-dimensional charts **610** featuring several zones coded with different colours to represent various outcomes of the user's current and future physiological conditions. This colour-coded zone chart **610** visually conveys the user's health status and potential trends in an easily understandable format. Each zone on the chart is assigned with a specific colour to indicate different levels of physiological conditions, allowing for quick and intuitive assessment. By way of example, a green zone may indicate optimal or better physiological conditions, suggesting that the user's health is stable and no immediate interventions are needed. Conversely, a red zone may represent worsening conditions, signalling potential health risks that require prompt attention. Rather than focusing on a single parameter or condition, the multi-dimensional charts **610** take into consideration of a plurality of factors or variables that collectively contribute to the user's overall health assessment. These dimensions could include but are not limited to aspects such as heart rate, blood pressure, respiratory rate, glucose levels, weight, and other relevant health and emotion metrics.

Preferably, the confirmation module **110** compares the outcomes from the prediction and classification module **108** with a pre-set list of health conditions or severity factor chart to

determine whether a medical expert is needed for confirming the outcomes. If the medical expert is needed, then the confirmation module **110** shall transmit the outcomes and relevant information to the medical expert for confirmation and verification. The medical expert can be pre-assigned or being chosen by the server **100** based on the expertise and experience in their field. The chosen medical expert can also be provided with a guideline and reference for the evaluation. Alternatively, a deadline can be given for each confirmation process to ensure a clear expectation of when the confirmation should be delivered. Once the outcomes have been confirmed or verified, the confirmed results will then be transmitted to the server **100**. The confirmation module **110** may utilise communication tools such as emails, phone calls, SMS, instant messaging platforms and etc for the exchange of information.

Preferably, the recommendation module **112** compares the outcomes from the prediction and classification module **108** with a pre-set list of course of actions to generate one or more proposed course of actions that are customised for the different users. The recommendation module **112** may check whether there is conflicting action in the proposed course of action based on a non-compatible action chart to filter out the conflicting actions. In the event where proposal from the medical expert exists, the recommendation module **112** will then proceed to use the proposal from the medical expert. By way of example, the recommendation module **112** may also include recommended medical experts in the proposed course of actions. The recommendation module **112** preferably generate one or more proposed course of actions for the user to progress towards a specific colour-coded zone on the multi-dimensional chart **610**.

Preferably, the advertising module **114** compares the generated proposals from the recommendation module **112** with a list of products and/or services that are advertised by the third-party entity servers **500** to generate an advertisement that is customised for the individual user. The advertisement preferably promotes products and/or services which can improve the pregnancy health conditions of the users. The list of products and services can be pre-filtered or chosen based on the respective user profile. The advertised product and/or

services may also be filtered to remove conflicting products and/or services.

Preferably, the communication module **116** is configured to manage appointments and/or online consultations. The communication **116** module may provide alerts depending on the
5 determined and predicted pregnancy health conditions to urge the user to schedule the appointments and/or online consultations. In one embodiment, the communication module **116** provides a messaging service for the users to communicate with the medical institution personal in real time. The messaging service may include chat-boxes for displaying the transmitted messages. As such, the users can interactively make or book an appointment in
10 real time. Preferably, the medical institution personal can trigger to generate and send a confirmation message with a confirm icon and a cancel icon to the users. The users can be directed to a payment gateway or the appointment can be confirmed if they press the confirm icon, else the pressing of the cancel icon will turn down the offer. Alternatively, a counter offer icon can be provided for the users to counter offer medical institution personal
15 with an alternative arrangement.

Preferably, the nutrition/lifestyle feedback module **118** determine the possible nutrition and behaviour changes that are needed for improving the pregnancy health conditions of the respective users. The nutrition/lifestyle feedback module **118** may compare the determined
20 and predicted pregnancy health conditions with a nutrition chart and a lifestyle chart to generate a nutrition and lifestyle proposal.

Preferably, the e-commerce platform **120** facilitates at least one trading service. The trading service can be a traditional online shopping service where the user or the merchant are
25 provided with a list of products or services for the users to purchase online. Once the users selected their designated products or services, they will be directed to a payment gate which is facilitated by a payment module. The payment module is preferably configured to communicate with a plurality of third-party financial entities to provide multiple choices of payment methods for the users to select. The third-party financial entities may include
30 but not limited to PayPal, Braintree, iPay88, eGHL, Alipay, MCash, MOLPay, UnionPay,

FPX online banking, VISA and MASTER. The payment module will display to the users with a list of available payment methods and subsequently direct the users to a payment process of the selected method for the completion of the payment. The e-commerce module **120** may also include a review and rating module to provide means for collecting user reviews, ratings, trustworthiness, and user's experiences relating to each product and/or services. Each trading service can be provided with a questionnaire generated by the review and rating module to collect the relevant information upon the completion of the trading service and then it will update the databases immediately upon receiving the inputs from the users. The review and rating module may further trigger an alert to the merchants or service providers if the rating of the users is lower than a predetermined value to understand the dissatisfaction and to rectify the issues.

Preferably, the databases **122** stores and manage all information received from the server, profile of each user, service provider and merchants, product/service information and description, historical transaction, consultation/conversation records, reviews and comments of each product and service. Alternatively, the plurality sets of computer-implementable instructions to perform and automate the different operations are also stored in the databases **122**. Such instructions may include but not limited to access and manage one or more user profiles and information associated with the users. Such information may include information indicating the user credentials for authenticating the particular user. It also handles other types of operations which relate to the users such as the registration of new user, log-in of user account, and the assignment of the user account with their respective level of accessibilities to the operations of the server **100**. Preferably, the databases **122** also store warranty information of the sold products/services. Alternatively, the databases **122** can also be linked to an advertisement service to change a current displayed advertisement to one which possibly suits the users upon logged-in.

Preferably, the databases **122** can apply data mining algorithms to collect searching activity, information and/or statistics related to the user's prior purchasing history, including the user's responses to previous advertisements for particular products or services, such as

click through rates, purchase rates, view through rates, pauses at locations that provide evidence of engaging in a service or purchasing a product and etc. The collected data can be processed by different techniques, artificial intelligence, machine learning, deep learning and statistic methodology to generate useful information for advertising and marketing purposes. The processed data can also be stored in the databases **122**.

Referring to **Fig. 2**, a method of determining and predicting health conditions of at least one user is illustrated. In step **701**, the input module **102** receives health information of the user through one or more wearable electronic devices **201**. Preferably, the health information is continuously obtained by the input module **102** in a real time. Alternatively, the input module **102** may also connected to one or more medical institution databases **304**, **404** to retrieve medical records of the user to aid in the establishment of the baseline patterns. This process may involve the data parsing module **106** to normalise data retrieved from both the wearable electronic devices **201** and the medical institution databases **304**, **404**. In step **702**, the baseline module **124** establishes baseline patterns of the user based on the received health information to identify abnormal patterns. If the health information is continuously transmitted to the server **100**, the baseline module **124** can update the baseline patterns in real time. In step **703**, the chatbot generation module **126** activates the chatbot **600** to communicate with the user via the user device **200** for collecting emotional information of the user upon detection of the abnormal patterns. The chatbot **600** may adaptively change its appearance or the way it interacts with the user depending on the user's emotional conditions. For example, if the user is detected to be in a distressed or anxious state, the chatbot might adopt a more soothing and empathetic tone, using calm and reassuring language. It may also present a visually comforting virtual character with gentle animations to help alleviate the user's stress. On the other hand, if the user appears to be in a positive emotional state, the chatbot **600** might use a more neutral or funny tone and a more engaging virtual character to interact with the user. When the chatbot **600** determines that it is no longer capable of handling the situation, the chatbot **600** may then connect the user to a healthcare personnel so that the user can communicate with the healthcare personnel directly. In step **704**, the prediction and classification module **108**

applies one or more trained models to classify the health information and the emotional information into different categories of current physiological conditions. In step **705**, the prediction and classification module **108** estimates the possible developments of the current physiological conditions at a predetermined future time to determine future physiological conditions. In step **706**, the chart generation module **126** generates a multi-dimensional chart **610** having a plurality zones coded with one or more colours to represent various outcomes of the current and future physiological conditions. In the event of the physiological conditions of the user fall under the critical category, the system may obtain confirmation and verification on the current and future physiological conditions from one or more healthcare personnels if the conditions fall under category of critical physiological conditions. In step **707**, the recommendation module **112** generates one or more proposed course of actions for the user to progress towards a specific colour-coded zone on the multi-dimensional chart **610**. The system may also form adaptive thresholds to decide when to intervene in a user's physiological conditions.

Referring to Fig. 3, the processes of the baseline patterns establishment and the abnormal patterns identification are illustrated. In step 801, the baseline module 124 utilises population data, measurement data, and patient metadata to access one or more physical conditions of the user. In step 802, population-aware features are applied by calculating a z-score to determine an extent of a measurement value's deviation from a population average. In step 803, time-series analysis is conducted on the population-aware features using an Augmented Dickey-Fuller Test to identify whether the measurement values exhibit abnormal patterns. Alternatively, the calories variable information of the user is collected by the wearable electronic devices **201** and then further paired with other variable information, including glucose rate, weight change rate, and fetus weight change rate of the user, to establish baseline patterns for these different variables.

The present disclosure includes as contained in the appended claims, as well as that of the foregoing description. Although the invention has been described and illustrated in detail, it is to be understood that the same is by the way of illustration and example, and is not to

be taken by way of limitation. The scope of the present invention is to be limited only by the terms of the appended claims.

CLAIMS

1. A method for determining and predicting health conditions of at least one user, the method comprising the steps in the sequence set forth:

5 receiving, by an input module (102), health information of the user through one or more wearable electronic devices (201) in real time;

establishing, by a baseline module (124), baseline patterns of the user based on the received health information to identify abnormal patterns in real time;

10 triggering, by a chatbot generation module (126), a chatbot (600) that utilises one or more language models and one or more machine learning algorithms to communicate with the user via a user device (200) for collecting emotional information of the user upon detection of the abnormal patterns;

15 applying, by a prediction and classification module (108), one or more trained models to classify the health information and the emotional information into different categories of current physiological conditions;

estimating, by the prediction and classification module (108), possible developments of the current physiological conditions at a predetermined future time to determine future physiological conditions;

20 generating, by a chart generation module (126), a multi-dimensional chart (610) having a plurality zones coded with one or more colours to represent various outcomes of the current and future physiological conditions; and

generating, by a recommendation module (112), one or more proposed course of actions for the user to progress towards a specific colour-coded zone on the multi-dimensional chart (610).

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2. The method according to claim 1, further comprising the step of retrieving medical records of the user from one or more medical institution databases (304, 404) to aid in the establishment of the baseline patterns.

30 3. The method according to claim 1, further comprising the step of obtaining confirmation

and verification on the current and future physiological conditions from one or more healthcare personnels if the conditions fall under category of critical physiological conditions.

- 5 4. The method according to claim 1, wherein the step of establishing the baseline patterns to identify the abnormal patterns further comprises the steps of:
utilising population data, measurement data, and patient metadata to access one or more physical conditions of the user;
applying population-aware features by calculating a z-score to determine an extent of a
10 measurement value's deviation from a population average; and
conducting a time-series analysis on the population-aware features using an Augmented Dickey-Fuller Test to identify whether the measurement values exhibit abnormal patterns.

- 15 5. The method according to claim 4, wherein calories variable information of the user is collected by the wearable electronic devices (201) and then further paired with other variable information, including glucose rate, weight change rate, and fetus weight change rate of the user, to establish baseline patterns for these different variables.

- 20 6. The method according to claim 1, further comprising the steps of forming adaptive thresholds to decide when to intervene in a user's physiological conditions.

7. The method according to claim 1, wherein the multi-dimensional chart (610) and the generated course of actions are presented to the user via the chatbot (600).

- 25 8. The method according to claim 1, wherein the chatbot (600) is the form of a virtual character that uses visual animations and expressions to simulate real human interactions.

9. The method according to claim 8, wherein the virtual character changes its appearance depending on the physiological conditions of the user.

10. The method according to claim 1, wherein the chatbot (600) connects the user device (200) to a communication device (301, 401) of a healthcare personnel.