2024 陽明交大與台大生醫電資創新設計競賽構想書

計畫主題
英文： VitalCare 365: Perpetual smart healthcare monitoring at home
中文： 健康守護者 365：居家全年智慧健康監測程式
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Narrative summary (250 words)

Current practices often fail to provide adequate support for patients at home, particularly in rural areas. Our app aims to continuously record patients' health conditions outside the clinical setup and enhance their health awareness. The app can record vital signs and medication usage in real-time, and transform physiological data into actionable insights. Key features include photo recognition for analyzing physiological data, customizable monitoring modules for specific health conditions, seamless integration with smart devices, and a user-friendly interface with adjustable settings and offline functionality, enabling users to record data without Internet access and data sync will be performed later.

With premium features for comprehensive health analyses and exploring partnerships with insurance companies to enhance user engagement and provide personalized health management, the app has its commercial potential. This integrated approach aims to bridge the gap between patients and healthcare providers, ultimately improving patient outcomes and promoting patient autonomy.

Objectives of this proposal and challenges to be solved

● CHALLENGE 1: when patients are out of the clinic

When visiting a doctor, patients' vital signs are measured and delivered to the doctor. However, when patients are at home, their vital signs are not continuously recorded, and doctors cannot keep monitoring patients' health conditions. For example, the "722 Protocol" for hypertension management is complicated and thus confusing and ineffective to common patients, especially seniors. Notably, healthcare in rural areas is limited, which makes it challenging for doctors to

stay informed about patients' conditions at home. For instance, what patients perceive as taking their medication on time may differ from the doctor's understanding.

OUR GOAL1: Our application aims to give patients continuous healthcare outside the clinic. By interactive and convenient interface, patients and caregivers will enhance their willingness to record health physiological measurements outside the hospital, as well as their regular medication usage, allowing doctors to provide expert guidance and timely care based on the most accurate and real-time information.

● CHALLENGE 2: Patients may lack awareness of being a "patient"
For most patients (especially in the early stages), "disease" may just be an invisible and intangible "diagnosis report." Daily life continues unaffected by the disease, yet an unhealthy lifestyle continues to wear down the body's health. Patients are unaware of their physical condition, do not understand their physiological data, and do not know how or what lifestyle adjustments to make. They take their medication, but may not understand what they are taking, may not know how to take it properly, or may not take it on time, often forgetting it on the dining table. Patients may also lack the awareness of being a "patient" and do not carry the mission of "getting better" simply due to lack of understanding.

OUR GOAL2:
Through our software, we aim to transform physiological data into charts, clearly highlighting unhealthy areas and providing lifestyle recommendations. By visualizing medication information and the trends in physiological data, patients can gain a clear understanding of their physical condition, acknowledge their illness, and actively work towards improving their health. We hope not only to prevent disease but also to help people reconnect with their bodies, becoming their own personal "healers."

● Philosophy: Be your own health guardian
Whether or not a patient takes their medication on time and cares for their own health is a personal responsibility—no one else can intervene. Adlerian psychology suggests: "You can lead a horse to water, but whether it drinks is up to the horse." Similarly, as people who care about the well-being of patients, the most we can do is to ensure that doctors clearly understand the patient's health at all times and provide professional knowledge and technical support as much as possible. Hence, patients themselves can fully understand their bodies, learn how to care for themselves, and even prevent potential future diseases. The goal is to achieve high patient autonomy and contribute to the realization of holistic care.

1. Narrow the communication gap between healthcare providers and patients: When visiting a doctor, patients' vital signs are comprehensively measured and delivered to the doctor; however, when patients stay at home, their vital signs are not well recorded. Thus, we decided to design a handy application combining multiple functions to accurately record vital signs at home and deliver data to doctors when visiting. These integrated data can help doctors to evaluate changes in the patient's condition over time.

2. Optimize data quality: James Clear explains in Atomic Habits, "The more friction there is between you and the behavior, the less likely you are to do it" (2018, p. 82). The application aims to increase patients' willingness to track their vital signs and health metrics. By uploading pictures of data presented on medical instruments, the app can make sure patients' vital signs are monitored on time and the data are not concocted.

3. Promote continuous care and proactive health management in daily lives: By tracking long-term physiological data, the app aims to help personalized medicine. Besides, in rural areas with insufficient medical care, patients may find it inconvenient to frequently visit doctors. With the app, patients can record their regular physiological data for doctors to reference during their next appointment.

Optimization and promotion

1. Visualization: Through charts and animations, users can see trends in their physiological data and disease progression. It helps to reduce the knowledge and information gap between doctors and patients. To encourage users to record their medication dosage and frequency, there are some interactive mini-games, such as a system where recording medication times results in an animated interface displaying clear and understandable visuals, like the reduction of viral levels or the patient's recovery progress. As users take medication on time, they accumulate points, further motivating adherence. Additionally, patients can easily provide their recorded physiological data to doctors during follow-up visits through a convenient QR code.
2. Medication Effect Visualization: Accurately tracking medication times allows users to receive reminders for taking their medication. The effects of the medication can be visualized through graphical representations. For example, antibiotics can be shown with a gradient chart displaying their effectiveness over time, while sleep aids like sleeping pills or melatonin can be visualized with the user's sleep cycle, highlighting the correlation between medication timing and sleep patterns. It can even be used to monitor the medication habits of patients with depression.
3. Bridging the Information Gap Between Doctors and Patients: Doctors can gain a clearer understanding of the patient's medication usage, while patients can better understand the medication's details, and how and when to take it. Through the use of animations and charts, patients can also gain a deeper understanding of their condition and treatment, making it easier to follow their prescribed medication plan.
4. Design customized data monitoring combinations based on individual needs: Create different physiological data monitoring modules for users to choose from, such as diabetic patients can select the blood glucose monitoring module, cardiovascular disease patients can select the blood pressure monitoring module, and those with autonomic nervous system disorders can select the heart rate monitoring module, etc.

Smartphone screen mock-up:

Blood Glucose Monitoring Module
Blood Pressure Monitoring Module

Sleep Cycle Monitoring Module
Heart Rate Monitoring Module
Post-medication Physiological Data Monitoring Module
Daily Emotion

Literature review

The book "AI 快思你慢想" by Wayne Huey-Herng Sheu, the pre- Vice President of Taichung Veterans General Hospital.
The book also introduce the systems: "雲端醫療資訊查詢系統", "智慧化病人用藥整合決策支援資訊平台", and "創新智慧糖尿病照護 APP" developed by the hospital. They can help people record their vital signs and send the data back to the hospital; however, those systems are restricted to single function and disease, and the data can only be received by Taichung Veterans General Hospital.
Also, App such as "Max" remind users to take medicine, "智抗糖" record their vital signs of blood , "超慢跑節拍器" is for jogging , and "健保快易通" record patients' medicine usage and medical record. People have to download a bunch of apps, which is inconvenient. Thus, we decided to invent an app that combines various functions with different disease modes. After the data was collected, it generated QRCode for doctors, with no restriction to specific hospitals.
Common Health Magazine No. 306 mentioned that, compare to a 28% of people under 30 uninterested in intellectual tools, elder people over 60 has a higher interest in intellectual tools including smartwatch and health management APP, with only 11% of people uninterested in; however, data shows that 40% of elder generation interested in the intellectual tools do not clearly know how to use them, which means an APP with convenient interface is demanded.
The Magazine also mentioned spillover insurance. It aims to set a healthcare goal, if the goal is reached, discounts and benefits are given to the users. The app can combine with spillover insurance, so users will positively record their vital signs and medical data; simultaneously, commercialize the app.
"AI 快思你慢想" also describes Mrs. Lin, a 40-year-old diabetic patient who had long ignored her doctor's advice, resulting in poor blood sugar control. Her condition worsened due to a lack of exercise and unhealthy eating habits.
When she started using a blood sugar management system designed by Dr. Shen, the visual data from the system allowed her to see her blood sugar levels in real time. This created a sense of urgency, prompting her to take her health seriously.
Therefore it inspires us that we can demonstrate people's vital signs in an easily understood figure, which will hopefully arouse people's health awareness. What's more, only the individuals themself promote their own health, rather than doctors, caregivers and more…… In conclusion, we hope to develop the App with the following functions to help increase people's health awareness, help optimize the process of recording vital signs and somehow combine functions so people with different demands can use it conveniently.
The major innovations of this project

Traditional healthcare often lacks long-term observation and recording due to high costs. Differing from previous applications and wearable devices that simply record physiological data, our app integrates functions and enhances interactivity.

1. Patient self-monitoring

Smart pillboxes record the time when patients take medicine; patients should monitor their psychological values at home, take pictures, and upload them. Our app can smartly recognize the physiological data in the image, record the measurement time and values, and generate long-term charts to display trends.

2. QR codes for doctors

The convenience and security of QR codes enable doctors to quickly access patients' physical information and short-term physiological fluctuations without involving risks to medical data security. Continuous objective data not only shortens consultation time but also decreases the negative impact of patients' imprecise expressions of their conditions.

3. Integrate wearable devices and instrument

It is a new idea that integrates data from different sorts of wearable devices and instruments to customize the presentation of collected data based on the patient's condition. Additionally, it enhances readability and interactivity by incorporating animations, charts, and mini-games.

Technical advantage of this project

1. Photo recognition: Identify and analyze physiological values in images (blood oxygen, blood sugar, body temperature, etc.), keep a long-term record, create charts, and generate QR codes.

2. Disease module selection: Establish different physiological data monitoring modules for users to choose from, such as a blood glucose monitoring module for diabetes patients, a blood pressure monitoring module for cardiovascular disease patients, and a heart rate monitoring module for those with autonomic nervous system disorders.

3. Hardware connectivity: Connect smart pillboxes and wearable devices for recording data.

4. Response robot: Answer basic questions and provide suggestions, with preset responses to avoid confusion. It should offer objective physiological data and consultation recommendations. (Basic voice input option available.)

5. Physical data integration: Record and consolidate various physiological data on a single platform, making it convenient for users to understand their personal health status. Long-term recorded data can also be brought to medical consultations for doctors to evaluate and reference.

6. User-friendly interactive interface: To accommodate different user needs, offer various font sizes and a visualized interface.

7. Personal data protection system: Store personal information in a secure system (such as accessing data through blockchain).

8. Offline recording function: To accommodate regional user differences, provide offline usage capability. Users can still record their physiological data while offline and upload it to the cloud system once internet connectivity is restored.

Feasibility of clinical use and potential impact

1. "722 Protocol" for blood pressure monitoring
Taiwan Society of Cardiology and the Taiwan Hypertension Society issued guidelines for hypertension management have recommended that individuals should follow the "722 Protocol" at least once a year, which refers to measuring the blood pressure continuously "7" days, "2" times a day (after waking up and before going to bed), and take the average of "2" measurements each time.
Our application can help individuals record their blood pressure regularly by notifying users to measure on time, graphing blood pressure charts, recommending users to visit a doctor if needed, and generating QRCode for doctors.
2. Healthcare data at home will be generated into QRCode for doctors, which summarizes patients' vital sign data. These data can help doctors well understand patients' health conditions at home. In the long term, it could be used in personalized medicine.
Integration of your project team

Name expertise
張雅安 creativity and idea generation, data science
陳紫瑜 Hardware device and fluent presentation ability
覃柏鈞 Healthcare experience and scenarios for physiological data use
夏心謙 software design and experiment of implementation
池旻柔 logical thinking and programming

Potential of commercialization and business model
1. Premium: As the user base grows, premium features can be introduced, allowing users to input more personal information such as medical history, chronic conditions, and daily habits. With these detailed inputs, the system can provide more accurate and comprehensive physiological predictions and health analyses. Additionally, users will have the ability to store their physiological records indefinitely, connect with OpenAI's API for basic medical Q&A, and access an automatic appointment system tailored to their health conditions. The system will also offer detailed information on vaccine appointments and health checkups.
2. Overflow Insurance Policies: This application can partner with insurance companies to serve as a platform for tracking users' exercise, health checkups, and overall health management. For "exercise-based," "health checkup-based," and "health management-based" overflow insurance policies, the app will provide user-friendly, built-in tools for data logging and integration. This can significantly boost user engagement and increase their willingness to purchase policies. Developers can also benefit by earning a share of the revenue based on the growth of the user base, creating a win-win situation.
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