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Smart Health Box-Efficient Health Monitoring System

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ABSTRACT: A few years back one couldn't even dream about transferring money from his/her home, but with the advancement in the internet and banking systems, it is now possible to transfer money instantly avoiding standing in long queues in the bank, filling forms, and limited working hours of the bank. Analyzing this, the same implies to health care.

The use of the Internet of Things, and different health monitoring sensors makes it possible. The main objective of the paper is to describe a single system that can efficiently monitor blood pressure, body temperature, pulse, and Diabetes. The system will be designed to monitor health parameters using different health monitoring sensors and collect data. The sensors that can be added to the Smart Health Box are not restricted but there is further scope to add new sensors. The smart health box if used on a large scale can collect a lot of data that can be collected. This data can be further used to train efficient Machine Learning Models.

KEYWORDS: Health Monitoring, IOT, Remote health monitoring.

I. INTRODUCTION

In this time, during a crisis like the pandemic situation caused due by the spread of COVID19 across the globe, social distancing has been highlighted as one of the key factors trying to prevent the spread of the disease. It has been difficult to go to a doctor or hospital during this pandemic, due to the fear of being affected by the virus. The Indian Medical system is not be blamed here because, India is the second-most populous country with a population of about 138 crore, while the population in the USA is just 38 crore, it has been very difficult to diagnose other illness or disease along with the COVID19 due to lack of infrastructure. Most of the hospitals are being converted to COVID19 hospitals due to the exponential rise in the spread of the virus in the country. A few years back one couldn't even dream about transferring money from his/her home, but with the advancement in the internet and banking systems, it is now possible to transfer money instantly avoiding standing in long queues in the bank, filling forms and limited working hours of the bank. Analyzing this, the same implies to health care.

The Internet of Things (IoT) enabled connectivity has the potential to catapult this ailing health care system into an integrated and efficient. This will help in changing the current focus of curative care to wellness and well-being, thereby reducing the burden of health-care costs through holistic measures. With the integration of medical "things" — devices, smart sensors, creating medical health apps, artificial intelligence (AI), etc., via the Internet, the possibilities are endless. To mention a few, IoT can be used to track the progression and treatment of diseases, to monitor patient's health conditions and accordingly alter their medication levels, to track medicines usage data to ensure adherence to treatment plans and to provide real-time information on symptoms. With the prevalence of mobile devices across the country, digital communication is now available in the remotest of rural areas, establishing connectivity between different care settings. The use of electronic health records (EHRs) is also gaining momentum. Smartwatches, fitness bands, monitoring patches, and heart rhythm detectors can be used to serve the purpose. Along with these favorable advances, however, there are certain challenges in adopting IoT in health-care. These include storing, handling, and safeguarding enormous amounts of health data.

Using the technology it is possible to design a system that is capable of diagnosing, collect the required data, process the data, and store it for future use

II. RELATED WORK

Rasha Talal Hameed, Omar A Mohamad, Omar Hamid and Nicolae Tapus[1], in their paper "Design of e-Healthcare Management System Based on Cloud and Service Oriented Architecture Faculty of Automatic Control and Computers" had proposed a model of grouping adaptable e-healthcare services administration framework dependent on Cloud

Computing. Along these lines, this paper prescribed a model of planning adaptable e-healthcare services administration framework dependent on distributed computing. The recommended framework has been enhanced and incorporates different divisions to create healthcare services framework. Health Data Management System based on the client side, simple healthcare cloud and application side creates a readily attainable network.

Moeen Hassanalieragh, Alex Page, Tolga Soyata, Gaurav Sharma, Mehmet Aktas, Gonzalo Mateos.[5], in their paper "Health Monitoring and Management Using Internet-of-Things (IoT) Sensing with Cloud-based Processing: Opportunities and Challenges" proposed (a) facilitate an evolution in the practice of medicine, from the current post facto diagnose-and-treat reactive paradigm, to a proactive framework for prognosis of diseases at an incipient stage, coupled with prevention, cure, and overall management of health instead of disease, (b) enable personalization of treatment and management options targeted particularly to the specific circumstances and needs of the individual, and (c) help reduce the cost of health care while simultaneously improving outcomes. In this paper, we highlight the opportunities and challenges for IoT in realizing this vision of the future of health care.

III. METHODOLOGY

The solution resides in creating a health monitoring system which is used to perform biometric and medical examinations where body can be monitored using different sensors. The main purpose is to get rid of a system that performs only a single task (e.g.: Blood Sugar Meter) and instead device a system that can be used to diagnose multiple symptoms using a variety of system attached to a single interface. The system will be made simple and efficient so that it can operated by anyone.

1. **Micro controller Used:**

The NodeMCU is an open-source firmware and development kit that helps you to prototype or build IoT products. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The firmware uses the Lua scripting language. It is based on the eLua project and built on the Espressif Non-OS SDK for ESP82. The coding environment used for the project is Arduino IDE by importing Node MCU boards into it.

2. **Glucometer Sensor:** Glucometer is a medical device for determining the approximate concentration of glucose in the blood. A small drop of blood, obtained by pricking the skin with a lancet, is placed on a disposable test strip that the meter reads and uses to calculate the blood glucose level. The meter then displays the level in mg/dl or mmol/l.

3. **Thermometer:** LM35 was used to measure body temperature

4. **Pulse Oximeter and Heart Rate Measurement using MAX30100:** The MAX30100 is integrated pulse oximetry and heart rate monitor sensor solution. It combines two LEDs, a photodetector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate signals. The MAX30100 operates from 1.8V and 3.3V power supplies and can be powered down through software with negligible standby current, permitting the power supply to remain connected at all times.

5. **Blood Pressure Sensor (Digital Sphygmomanometer):** A digital BP monitor uses an inflatable air-bladder cuff, a battery-powered air pump, and a pressure sensor for sensing arterial wall vibrations to measure blood pressure in an artery. This is known as the oscillometric method. The signal from the pressure sensor is conditioned with an instrumentation amplifier before data conversion by an analog-to-digital converter (ADC). The systolic pressure, diastolic pressure, and pulse rate are then calculated in the digital domain using an algorithm appropriate for the type of monitor and sensor utilized. The resulting systolic, diastolic, and pulse-rate is got

6. **Firebase:** Firebase has a real-time database which sends sensor values from patient to doctors app within a Fraction of

7. **Android Studio:** Android app was made using Java Android studio. Android Studio is the official Integrated Development Environment (IDE) for Android app development, based on IntelliJ IDEA .

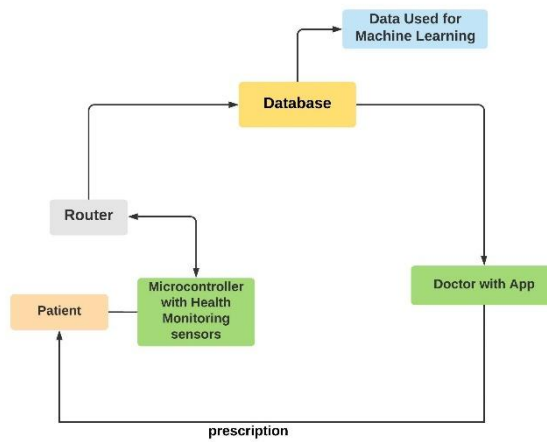


Figure 3(a): Block Diagram

Working: Figure 3(a) represents the block diagram of the project. This system will not be restricted to only a specific existing sensor, instead will give a scope to add new devices (diagnose devices) in future, hence increasing its usability and efficiency. When a patient uses this Smart Health box, the sensors take the data and send it to the Micro-controller (Node MCU), the MCU with its capabilities of connectivity with the internet sends the data to the database. The database does the required computation and sends the data to the doctor. The doctor will be able to access to the report through the mobile App. Once the doctor examines the data, he/she can prescribe the medicines online. The patient will receive an alert through the app, whether he/she needs to get a physical checkup done at the hospital or can take treatment from home. The app will also provide an interface to place the order, of the prescribed medicine by the doctor directly. All this interaction between the patient, doctor, diagnosing, medicine will help to generate data which will be can be used for future analysis using Artificial Intelligence.

IV. EXPERIMENTAL RESULTS

Figures shows the snapshot of Firebase Realtime database and the android app for the project smart health box.

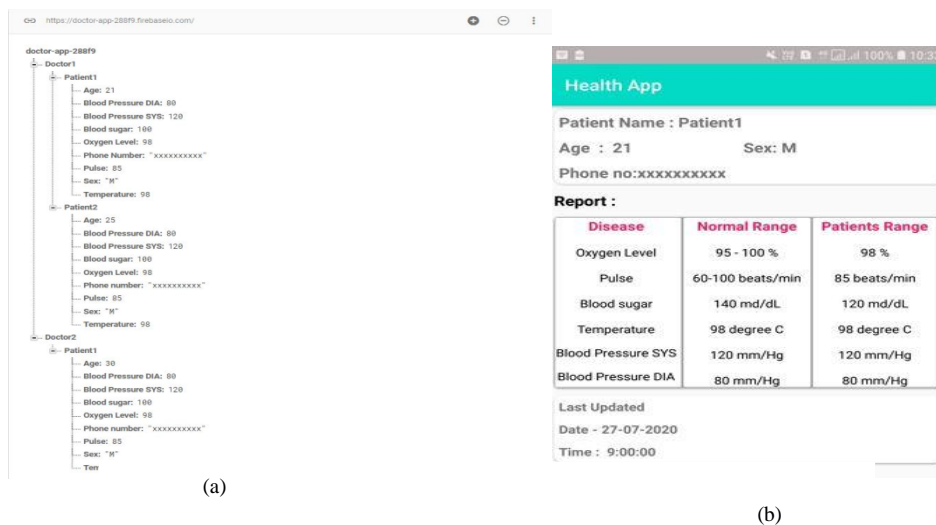


Fig. 1 (a) firebase Realtime database(b) Android app of smart health box.



V. CONCLUSION

We have implemented a Smart Health Box- Efficient Health Monitoring System. Our Project successfully gets the sensor readings from the different health monitoring sensors and sends the data into the realtime database. The data in the database can be accessed using the smart app and the report can be viewed.

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