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Portable IoT based health monitoring system

Bhuvaneshwari Patil

bsp14052001@gmail.com

Ramaiah Institute of Technology, Bengaluru, Karnataka

ABSTRACT

In present times, the number of patients is increasing rapidly. There are many health management systems and the systems are lacking in one or other features. One of the major issues is that not all patients are treated with utmost care which can sometimes be dangerous in case of emergency or critical patients and common people cannot be able to afford the basic health monitoring system. The lack of communication between patients and the hospital staff might be there because of the patient's health conditions, effects of medication, because they have an ongoing disability. Existing systems are digital but they aren't portable, that creates a vast problem and communication gap between hospital staff and patients. This motivates us to solve the aforementioned problems in the existing system using sensors which solve the problem of portable devices for measuring the patient health parameters and send the readings to the cloud database, these reading can be used by the doctor during patient diagnosis as the history is saved in cloud. The proposed health management system will solve the problems related to real-time monitoring of patient's conditions without being connected to the bed in the hospital all the time as it is simple to implement, use and cost effective.

Keywords: sensors, IoT, Raspberry Pie

1. INTRODUCTION

The Internet of Things is a topic of social, economic, and technical significance. Internet of Thing using sensors, Processors, and Microcontrollers with accessories are used for communication through the internet and are becoming the constitutive part of the Internet, it is built with a suitable protocol which helps them interact with each other and with the users respectively. This communication through the internet plays a major role in the Internet of things which reduces the difficulty faced by patients and doctors. The homecare [1,2] can be provided instead of the expensive clinical care. IoT technology is increasing to support the cost and quality of patient life; it also increases the life span of patients with proper medication. Undetected health problems can be solved through this IoT Technology. Further, digital identity for each patient can be maintained by which complications can be greatly reduced. The communication between the health sensor device [3] with the computer or Smartphone which has the default ability to communicate with the server makes the whole system cost-effective and the complexity of the system is also reduced. Hence, the system can also be made IoT enabled and Machine compatible.

With the new system, we have a design enabling the patients to keep track of their own data records [4]. This new system will improve the quality of life for old age people who need constant monitoring and help their family members by giving them a quick report about the patient every time they want to know as well as a notification in case of danger. We are targeting the most general use-cases related to the health of patients depend upon like heartbeat, temperature, etc. Emergency switch in the new system will reduce the dependency that the existing systems have on nurses and staff. The proposed system under this report will be a prototype of the actual full-featured system we aimed at initially. Further enhancement with new concise and better processors can be integrated to make it more reliable and faster.

The proposed model uses modern solutions to improve the current existing hospital management system. This new system will improve the quality of care resulting in obvious benefits to patient care. The benefit of this model is that it reports to the doctor and the staff about the patient's condition constantly which reduces the communication gap in case of emergency and offers patients the invaluable assurance that someone is watching out for their health and helps them recover quickly. This model increases the capacity for physicians to treat more patients. Also, it saves a lot of time and saves the cost of treatment as well as it is much cheaper to build compared to existing systems. Further enhancement can be done with new concise and better processors that can be integrated to make it more reliable and faster.

1.1 Motivation

Here the proposed project shows reliable continuous monitoring by the doctor, the solution of patients anywhere in the world based on a healthcare monitoring system can be checked. The patients carry a set of body sensors to collect their body parameters. The patients are given knowledge and information about disease diagnosis and prevention. Secondly, a reliable and readily available patient monitoring system (PMS) is required. In order to improve the above condition, we can make use of technology in a smarter way. In recent years, health care sensors along with raspberry pi play a vital role. Wearable sensors are in contact with the human body and monitor his or her physiological parameters.

1.2 Existing Models

In [1], Ravi Kishore Kodali et al, proposed the healthcare monitoring which is implemented to check the temperature of the patient and used Zig Bee mesh protocol is used where the patient 24-hour care records are being monitored. In [2], Jasmeet Chhabra et al., proposes the plan and implementation for emergency medical services based on IoT health monitoring system with reduced cost. In [3], Thirumalasetty Sivakanth et al., presents a reconfigurable sensor network for essential health checking and discussed the possibility of patients collapse and the life-threatening consequences using real-time health monitoring system. In [4], Y. T. Zhan et al, presents the implementation of tele-health systems for the elderly population and discussion on various chronic diseases and their severity. In [9], Luciano Tarricone et al., the authors suggest, IoT-aware, architecture for tracking of patients, automatic checking, and biomedical devices within nursing institutes and hospitals. In [6], Saed Tarapiah et al., presents the paper which guarantees to decrease the cost of the system and overall improvement in the quality of health care services.

2. PROPOSED MODEL

2.1 Hardware used

In this project Raspberry Pi is a micro processor as well as brain of our hardware connection. In this we have used many biomedical sensors to get the data of patient psychological parameters. We have used DHT11 consist of Humidity sensing component and NTC temperature sensor which is used to measure the temperature of a body. We have used easy pulse which is heart beat sensor used to measure heart rate through finger tip. Moisture sensor is used to measure the volumetric content of water, it sense moisture content in body. We have used Organic light-emitting diodes (OLED) to display data obtained from all the sensors in 124* 68 pixel. We have used SOS button for sending quick notification to the Medical healthcare guide through alarm. Arduino UNO is a micro-controller used to convert analog value to digital value for pulse rate sensor as the data obtained from easy pulse is in analog form. All the sensors work simultaneously to get the better accuracy of the project. The flow of signals/data exchanged between the components needed to carry out the functionality of the health management is shown in figure 1 and is typically associated with use case realizations in the Logical View of the system under development.

A health monitoring system consists of several sensors connected to a patient and they communicate the data through the processing unit. In the project, the model is used for monitoring the patient's data from the firebase cloud via an application. Raspberry Pi is used as a data aggregator as well as a processor. The patient and doctor's smartphone/ computer are used as a monitoring system. The sensors system is used to obtain the information or readings from the patient. The information is displayed on both sides of the screen of the doctor and the patient. If blood pressure sensor output is above 120 an alert mail is sent to the patient automatically to consult the doctor.

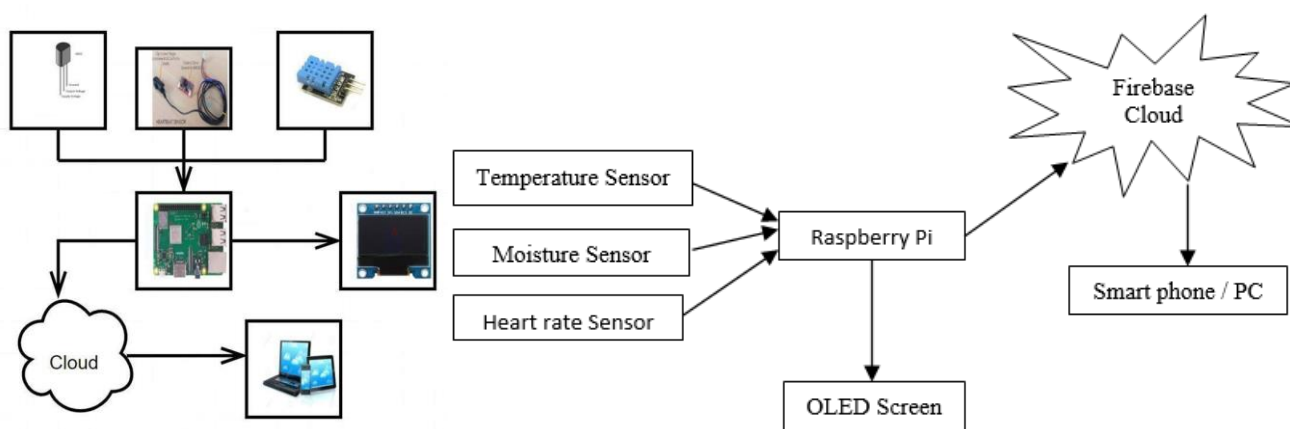


Fig. 1: Proposed model (a) Hardware used, (b) Flow diagram for the system

3. WORKING OF OUR MODEL

This is a project designed to enhance the existing health monitoring system by using of latest technology i.e. IOT-internet of things. This project uses wireless body sensor network (WSN) which is interconnected to each other. This whole device is prototype of a portable, reliable and cost-effective smart device which has capabilities to sense the patient's physiological parameters such as heartbeat, temperature, moisture, etc. Also, it has a SOS alert module installed for handling emergency for critical patients. So, this smart device continuously monitors the patient's health parameters and whenever any abnormalities detected it will alert the medical authority who is issuing these devices to patients.

Steps involved:

1. The first step is switching on the sensors and Raspberry Pie and Arduino board.
2. Connecting the sensors to the body of the patient.

3. Reading data signals from all the sensors.
4. Sending the digitally processed data from Raspberry Pie to the firebase real-time database.
5. Firebase cloud database is updated in a batch of every 100 milliseconds
6. Visualization of data retrieved from the Firebase cloud database.

3.1 Front-end

We have used pyqt designer to design the GUI for the medical authority. This GUI displays all the real-time data retrieved from the cloud-based real-time database i.e. FIREBASE. The login screen has options to validate the authorized user or medical staff. The visualization page shows the values updating in real-time for different devices issued by the authorities to the different patients.

3.2 Back-end

We have used python to integrate the different sensors to the Raspberry Pi. We have used python firebase API calls to push the data to the cloud-based database server. So at the backend python the core programming language used for coordination and working of the whole project.

4. CONCLUSION

The raspberry pi boards are used in many applications like Media streamer, Arcade machine, Tablet computer, Home automation, Internet radio, controlling robots, Cosmic Computer, hunting for meteorites, Coffee and also in raspberry pi based projects. The IoT technology helps the server to update the patient data on the website. Many future improvements can be made to this system by adding additional features with more advanced sensors. The mobile application can be enhanced with the ambulance services, doctor's list, nearby hospital details, etc. The biometric information of the patient which is stored and published online & transmit to cellular can be given to scientists and researchers in medical fields to analyze and identify the disease pattern and carry their research work.

This system can be used in the industrial and agricultural applications by adding relevant sensors like humidity sensors, fertility check sensors, etc. Future work will focus on monitoring additional health-related parameters using a broader combination of transducers, sensors, and correlation techniques on improving system reliability and robustness for patient movement and loss of connectivity.

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