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eMed , An IOT Based Remote Patient Health Monitoring Using Cloud Computing

Divya Parameswaran¹, Yadhukrishna P R²

Assistant Professor, Dept. of Computer Applications & KVM CE & IT Cherthala, Kerala, India¹

PG Student, Dept. of Computer Applications & KVM CE & IT Cherthala, Kerala, India²

ABSTRACT: Among the panoply of applications enabled by the Internet of Things (IoT), smart and connected health care is a particularly important one . The project eMed deals with the monitoring of the patient parameters such as humidity, temperature ,heart beats etc.Health care sensors are playing a vital role in hospitality. Recent years have seen a rising interest in wearable sensors and today several devices are commercially available for personal health care, fitness, and activity awareness. eMed is a major improvement in hospitality because of its advanced technology.It is also a wireless system to measure patient parameters . The specialist at a distance can monitor the patient condition so that he can save the life . The system is to be available at reasonable prices .The eMed is a very critical monitoring system , it is used for monitoring physiological signals including Heart beat , Temperature , Invasive and Non invasive Blood pressure , Humidity , and other gases.The proposed system includes : Temperature Sensor , Humidity Sensor , Patient Calling ,Alarm , Heart Beat Sensor , 16x2 LCD Display Unit ,GPS , Air Quality Sensor (MQ 135) , Camera.

KEYWORDS: Internet Of Things, Invasive blood pressure, MQ135.

I.INTRODUCTION

Recent years have seen a rising interest in wearable sensorsand today several devices are commercially available ^{[1]-[3]} for personal health care, fitness, and activity awareness. In addition to the niche recreational fitness arena catered to by current devices, researchers have also considered applications of such technologies in clinical applications in remote health monitoring systems for long term recording, management and clinical access to patient's physiological information ^{[4]-[18]}.

Healthcare is currently facing the challenge of large amount of data that is unstructured, diverse and growing at an exponential rate. Data is constantly streamed through sensors, monitors and instruments in real time that is faster than the medical personnel can keep up with. For instance, there are about 16,000 hospitals worldwide, which collect patient data and 80% of this data is unstructured ^[1]. The advanced techniques and high capacities of cloud computing, processing of a large amount of data can be performed more efficiently support big dataanalytics.

The modern visionary of healthcare industry is to provide better healthcare to people anytime and anywhere in the world in a more economic and patient friendly manner. Therefore for increasing the patient careefficiency, there arises a need to improve the patient monitoring devices and make them more mobile. Themedical world today faces two basic problems when it comes to patient monitoring. Firstly, the needs of healthcare's provider's presence near the bedside of the patient and secondly, the patient is restricted to bed and wiredto large machines. In order to achieve better quality patient care, the above cited problems have to be solved. As the bio instrumentation, computers and telecommunications technologies are advancing, it has becomefeasible to design more portal vital sign tele monitoring systems to acquire, record, display and to transmit thephysiological signal from the human body to any location. Recent works in communication technologies haveinspired the development of telemedicine to a large extent. Telemedicine benefits not only the customers whoare able to receive health care more efficiently; it also benefits the doctors who can streamline their efforts toassist more patients.

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II. PROPOSED SYSTEM

In the proposed system entitled eMED, An IOT based remote patient health monitoring using cloud computing. This application is created for the Hospital as well as Home. This application which provide high security for the patients. The system which is contain different sensors for detect the patient parameters such as temperature, heart beat, humidity etc. And which also provide the communication mechanism between patient and doctor. A Patient calling buzzer is attached for alert the doctor. In proposed system has many security measure as well monitoring of individuals by different modules attached to the system.

The system include:

- Blood pressure sensor : to know about the blood pressure rate of patient
- Heart beat sensor : to know the variations of the patient's heart beat rate
- Air quality sensor : to know about the quality of air present in the room.
- Temperature sensor : to measure the room tempetaure
- Humidity sensor : to check the humidity in the room
- Emergency Switch and Buzzer : when patient feels abnormal, he can call the doctor
- Camera : to monitor real time patients
- GPS : To know the location of different patients

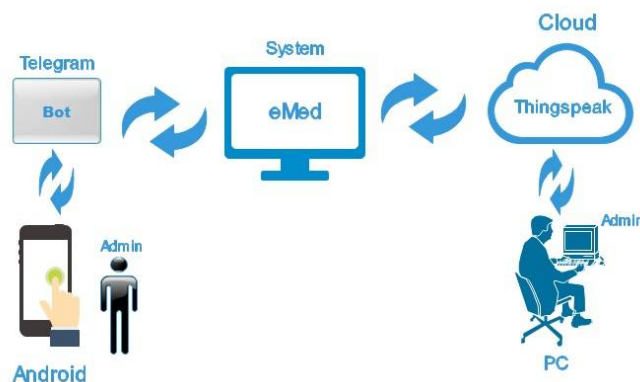


Fig 1 : The Overall system of eMED

Advantages of proposed system

As all the works are handled via this application, this will help to reduce the time. We can store all data's in the database, so that we will not lose them. By using this system, it reduce the need of nurses in the hospital. And it also alert the doctor with human parameters.

CHARACTERISTICS

The key characteristics of the proposed converter are listed as follows:

- High speed communication between doctor and patient through Telegram Bot as well as Thingspeak cloud.
- The patient can be registered with the proper details.
- The doctor can easily control on the patient through world wide, anywhere any time.
- System is completely portable.

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BLOCK DIAGRAM OF EMBEDDED PORTION

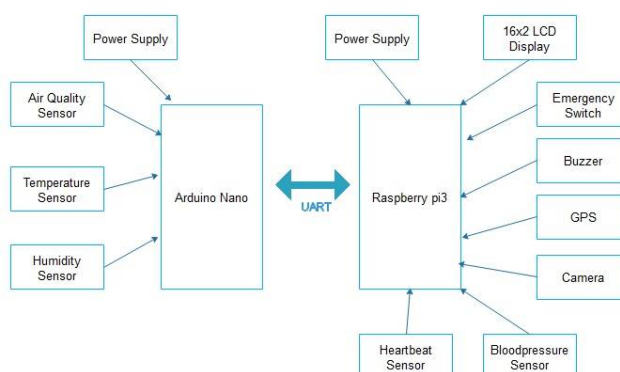


Fig 2The Block diagram that represents eMed

The Blockdiagram of eMed is shown in Fig. 1, where the connection between Arduino and Raspberry through UART protocol serial communication. The sensors are connected to these micro controller and Raspberry pi.

III.SIMULATION MODEL

THE SENSORS AND TECHNIQUES OF PROPOSED SYSTEM

If eMed could be connected to a network wirelessly, patients would be able to move around freely while their physiological signals are monitored. Thus, medical personnel could be informed about a patient's critical condition regardless of their whereabouts and they could be treated promptly if an emergency occurs. Furthermore, portable devices can be integrated into the Healthcare environment and used to develop novel applications. Thus, we developed a portable embedded device that can monitor the condition of patients in real time using four biomedical sensor network such sensor is pulse oximeter (SPO2), thermometer, respiration, blood pressure (BP), heart rate and electrocardiogram (ECG) and provide various physiological signals via wireless communication so that the physiological signals may be monitored remotely Based on the graphic display (android Smartphone) and web, using Web Server and Database subsystem we can take physiological signals data any where in the word at any time and this device detect emergencies and inform medical personnel when they occur. Thus, medical personnel could be informed about a patient's critical condition regardless of their whereabouts and they could be treated promptly if an emergency occurs



Fig 3 : The simulated model of eMed

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LIST OF TECHNIQUES AND MATERIALS

MQ 135 AIR QUALITY SENSOR

Air quality sensor for detecting a wide range of gases, including NH₃, NO_x, alcohol, benzene, smoke and CO₂. Ideal for use in office or factory. MQ135 gas sensor has high sensitivity to Ammonia, Sulfide and Benzene steam, also sensitive to smoke and other harmful gases. It is with low cost and particularly suitable for Air quality monitoring application.

Features: High Sensitivity, High sensitivity to Ammonia, Sulfide and Benzene, Stable and Long Life, Detection Range: 10 - 300 ppm NH₃, 10 - 1000 ppm Benzene, 10 - 300 Alcohol, Heater Voltage: 5.0V, Dimensions: 18mm Diameter, 17mm High excluding pins, Pins - 6mm High, Long life and low cost

Applications: Domestic air pollution detector, Industrial air pollution detector, Portable air pollution detector

HUMIDITY & TEMPERATURE SENSOR DHT 11

The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). Its fairly simple to use, but requires careful timing to grab data. The only real downside of this sensor is you can only get new data from it once every 2 seconds, so when using our library, sensor readings can be up to 2 seconds old.

TECHNICAL DETAILS : Low cost, 3 to 5V power and I/O, 2.5mA max current use during conversion (while requesting data), Good for 20-80% humidity readings with 5% accuracy, Good for 0-50°C temperature readings ±2°C accuracy, No more than 1 Hz sampling rate (once every second), Body size 15.5mm x 12mm x 5.5mm, 4 pins with 0.1" spacing

BLOOD PRESSURE AND HEARTBEAT SENSOR

- **ACCURATE AND RELIABLE** - blood pressure monitor produces highly accurate readings using advanced "intelligent" technology. This inflates the cuff to peak pressure tailored to your own blood pressure level.
- **ONE STEP MEASURING:** Advanced one step measuring technique makes blood pressure monitoring quick and simple. At the press of one button the automatic inflate technology inflates cuff to appropriate level. Get an accurate blood pressure reading in a matter of minutes. Cuff fits wrist perimeter of 13.5cm-19.5cm
- **FUNCTIONAL MEMORY RECALL:** 90 readings per user, stored data includes blood pressure, pulse rate, date and time of measurement. Memory can be cleared for new users
- **LONG TIME TO USE :** The battery can be used for a long time, 60-80 times measure, so it can save your time, and your worry of your family!

WEBCAM

A video camera that feeds or streams its image in real time to or through a computer to a computer network. When "captured" by the computer, the video stream may be saved, viewed or sent on to other networks via systems such as the internet, and emailed as an attachment. When sent to a remote location, the video stream may be saved, viewed or on sent there. Unlike an IP camera (which connects using Ethernet or Wi-Fi), a webcam is generally connected by a USB cable, or similar cable, or built into computer hardware, such as laptops. The term "webcam" (a clipped compound) may also be used in its original sense of a video camera connected to the Web continuously for an indefinite time, rather than for a particular session, generally supplying a view for anyone who visits its web page over the Internet. Some of them, for example, those used as online traffic cameras, are expensive, rugged professional video cameras

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GPS MODULE NEO-6M

GPS KICK is powered by u-blox's NEO-6M, a high performance 6 position GPS engine. The module is available in a small form factor for easy integration with Microcontroller and PC based software application. The module has all the components on-board for using it with an active antenna for better reception of data from the satellites.

Features: u-blox NEO-6M GPS Engine , Power the module using 5V, 3.3 V or a 3.7V Li-Ion Battery power supply. , UART interface with 5V and 3.3V tolerant lines to interface with microcontroller. , A mini-USB connector for interfacing with PC over Serial COM port. Yes, The device when connected to your workstation detect as Serial COM port. , Low Power consumption (<120mA) , Compatible with u-blox GPS solution for Android , Faster acquisition with Assist Now online application , Easy integration with uCenter and Google Map , Battery backup for saving GPS co-ordinates on power failure , The module is designed for use with active antenna only.

PCB MOUNT BUZZER

Piezo buzzer is an electronic device commonly used to produce sound. Light weight, simple construction and low price make it usable in various applications like car/truck reversing indicator, computers, call bells etc. Piezo buzzer is based on the inverse principle of piezo electricity discovered in 1880 by Jacques and Pierre Curie. It is the phenomena of generating electricity when mechanical pressure is applied to certain materials and the vice versa is also true. Such materials are called piezo electric materials. Piezo electric materials are either naturally available or manmade.

Piezoceramic is class of manmade material, which poses piezo electric effect and is widely used to make disc, the heart of piezo buzzer. When subjected to an alternating electric field they stretch or compress, in accordance with the frequency of the signal thereby producing sound. The piezo buzzer produces sound based on reverse of the piezoelectric effect. The generation of pressure variation or strain by the application of electric potential across a piezoelectric material is the underlying principle. These buzzers can be used alert a user of an event corresponding to a switching action, counter signal or sensor input. They are also used in alarm circuits.

16 X 2 LCD DISPLAY UNIT

A 16x2 display unlike a touch screen or a normal LCD screen is best used to display short messages or information. You will find it extremely handy when you only need to display some essential data but don't really need anything too large and expensive. This tutorial will go through the basics of getting the screen setup and is incredibly handy for anyone who is completely new to circuitry.

UART PROTOCOL

UARTs transmit data *asynchronously*, which means there is no clock signal to synchronize the output of bits from the transmitting UART to the sampling of bits by the receiving UART. Instead of a clock signal, the transmitting UART adds start and stop bits to the data packet being transferred. These bits define the beginning and end of the data packet so the receiving UART knows when to start reading the bits. When the receiving UART detects a start bit, it starts to read the incoming bits at a specific frequency known as the *baud rate*. Baud rate is a measure of the speed of data transfer, expressed in bits per second (bps). Both UARTs must operate at about the same baud rate. The baud rate between the transmitting and receiving UARTs can only differ by about 10% before the timing of bits gets too far off. Both UARTs must also be configured to transmit and receive the same data packet structure.

TELEGRAM BOT

Telegram is about freedom and openness – our code is open for everyone, as is our API. Today we're making another step towards openness by launching a Bot API and platform for third-party developers to create bots.

Bots are simply Telegram accounts operated by software – not people – and they'll often have AI features. They can do anything – teach, play, search, broadcast, remind, connect, integrate with other services, or even pass commands to the Internet of Things.

THINGSPEAK CLOUD

ThingSpeak is an IoT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak. With the ability to

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execute MATLAB® code in ThingSpeak you can perform online analysis and processing of the data as it comes in. ThingSpeak is often used for prototyping and proof of concept IoT systems that require analytics.

ThingSpeak Features

- Collect data in private channels
- Share data with public channels
- RESTful and MQTT APIs
- MATLAB® analytics and visualizations
- Alerts
- Event scheduling
- App integrations
- Worldwide community

IV.SIMULATION RESULTS

The output is obtained as shown below. The output is taken by different ways . First , The output by Admin webpage and the second From Telegram bot .The figure 4-6 shows that the output by admin webpage using php.And figure shows the output by Telegram app respectively.

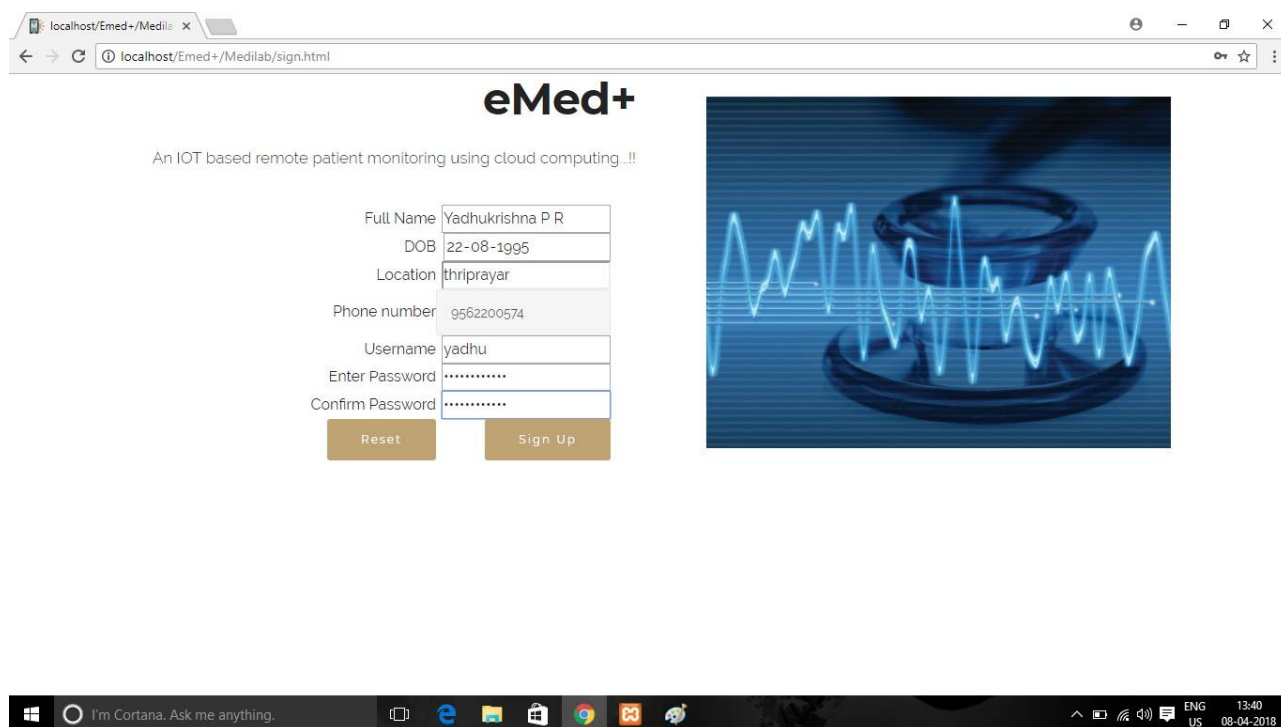


Fig 4 : The admin login / sign up with his details.

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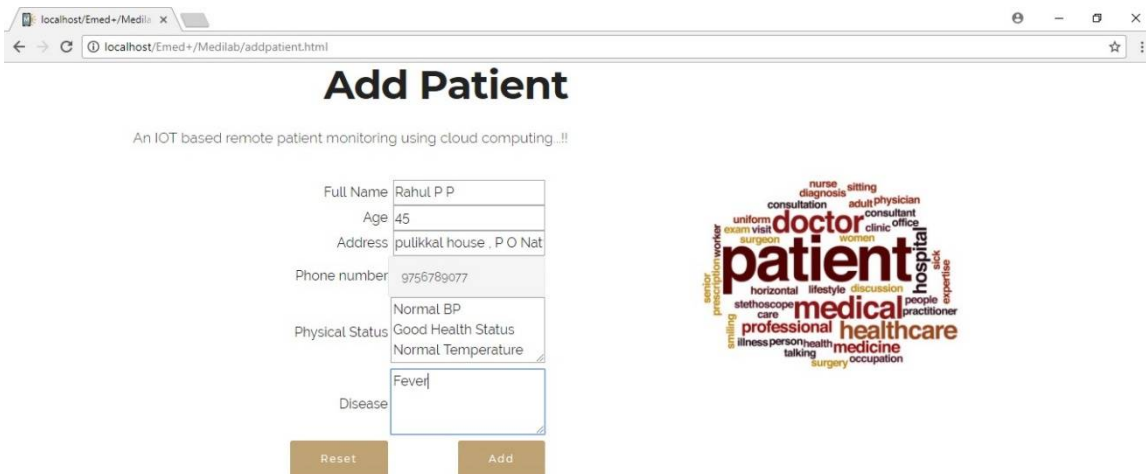


Fig 5 Adding the patient details and Registering

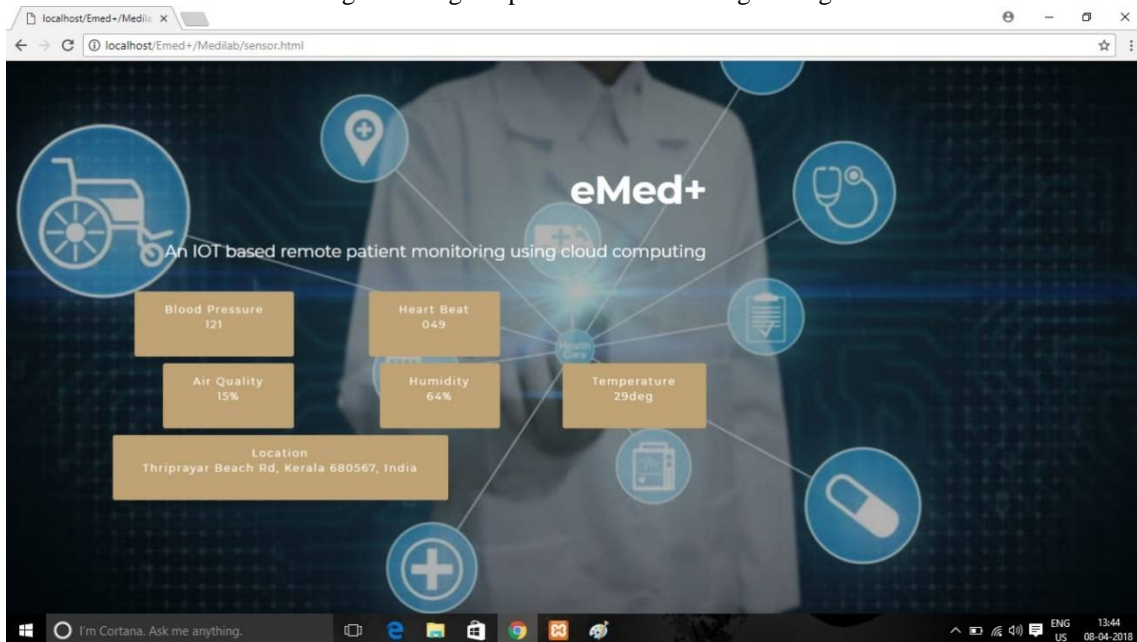


Fig 6 Monitoring patient parameters by admin

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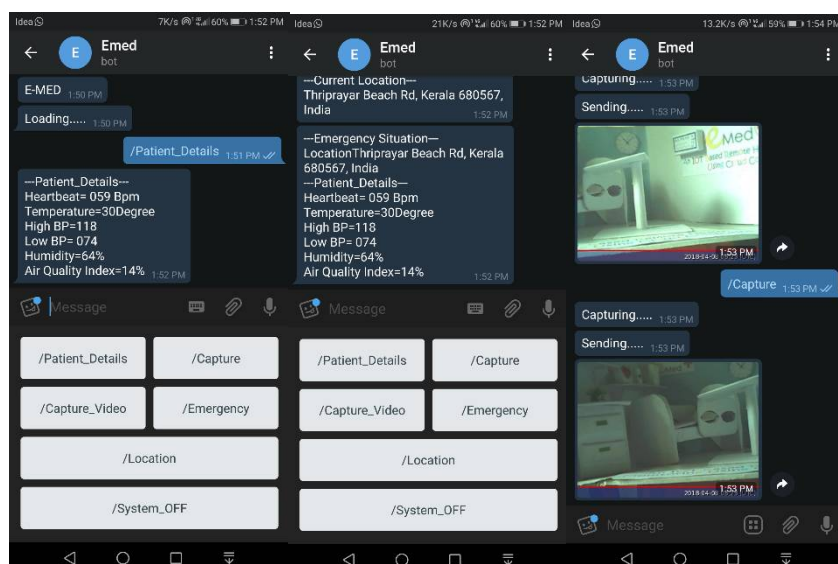


Fig 7 Monitoring patient parameter through Telegram Bot

VI.CONCLUSION

The system has been developed and is found working effectively. The developed system is flexible and changes can be made easy as and when required. I have tried to make the system maximum user friendly. Security is the main consideration in this project. All the necessary validation are carried out in this project, so that any kind of users can make use of this software and prompt warning messages make them conscious of the error they have made. This system help to provide security for the patients in the Hospital. If any fault is detected; the system will perform the corresponding operation, so the admin (Doctor) can take major decisions. By God's grace I am able to finish this project work with many advantages over existing system. I have tried my best to make this project a complete success within the prescribed time under the guidance of the institution and my teachers. Anything cannot be ended in a single step. It is the fact that nothing is permanent in this world. So eMed also has some future enhancements in the evergreen and booming IT industry. Change is inevitable. The system and the architecture of the proposed system is a compatible one, so addition of new modules can be done without much difficulty. eMed can be improved in future by adding additional functionalities like Database storing, Regular alert, Adding some extra sensors. This project can be extended to Home for caring the patient.

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