



An IoT-Based Framework for Health Monitoring System

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Abstract

Presently nowadays health problems like cardiovascular failure, lung failure & heart maladies expanding step by step because the population increase. Because of these issues time to time health tacking is extremely vital. a wise idea is health observance of patient wirelessly. This paper proposes a health observance System that monitors important parameters of the patient like temperature and pulse utilizing sensor likewise as fitbit that are associated with raspberry pi board. This undertaking includes cautioning the specialists through SMS if any essential parameters of the patient strays from the typical esteem. Raspberry Pi is not as a detector node however additionally a controller here. The Raspberry Pi acts as a individual server that logs the small print of the patient's prescription. The patient is shipped reminders to require the medicines through SMS in keeping with prescribed by doctor.

Keywords – Raspberry Pi, Internet of Things, Health monitoring system.

Introduction

Technology has invariably been there to change and makes the human life a lot of easier. It affected the assorted areas of life; the medical field is one amongst them. It advantages by the innovation in numerous ways; currently it's easier to diagnose internal diseases mistreatment some digital devices. The health care sector goes through a large modification, with digital capabilities dynamic the method doctors act with their patients. These days, patients have the tools to look at their key organ themselves and facilitate doctors to own immediate access to patient information on-the-go. in a very kind of wearable devices for example Apple watches[1]. IoT makes a coordinated correspondence condition of interconnected devices and platforms by participating each virtual and physical world along[2]. This development permits a lot of frequent and contextually made interactions with individuals and therefore the encompassing surroundings. Moreover, these environments became really increased with quickly growing obtainable sensing and propulsion devices[3]. The idea of the IOT involves the utilization of electronic devices that catch or screen information and are associated with a private or open cloud, empowering them to naturally trigger certain occasions. Medicinal information, for example, blood pressure and pulse rate are gathered by sensors on peripheral devices; these information are transmitted to social insurance suppliers or outsiders via wireless

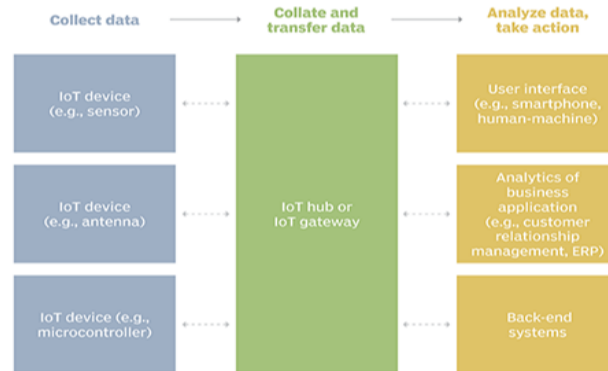
telecommunication devices. The information are assessed for potential issues by a health-care skilled and health suppliers are promptly alarmed if an issue is identified[4]. The World Health Organization (2016) indicates that aged folks, WHO oftentimes suffer from chronic unwellness, need a extremely effective and economical provision of care[5]. According to the National Broadband set up (2015) by the Federal Communications Commission (FCC), the utilization of remote patient observation underneath IOT technology can save the care trade \$700 billion over fifteen to twenty years[6]. Then it's necessary to specialise in the IOT technology to profit from the latest technology.

Bluetooth, ZigBee, and Wi-Fi are the basic remote advancements for remote patient observation. Be that as it may, their appropriateness and ease of use for this task are broadly changing. Therefore, there square measure important issues whereas choosing a technology for IoT medical devices; you would like to bear in mind of what their characteristics for specific needs. The planned system will help patients in remote spots (for example home medicinal services) and that isn't just about checking a constant infection state however about keeping patients from getting to that state. By implementing this project, it'll provide an affordable system for remotely patient's health observation, which might save their lives by giving emergency alert in period. In this paper we will talking about the different health parameters ,studying and analyzing the prevailing devices and coming up with our approach towards creating a tool that fulfills the drawbacks of the prevailing ones at a similar time.[7]

HP did a little survey within which they calculable the increase of connected devices over the years and therefore the outcomes are amazing. It is safe to say that we are moving towards a completely computerized world?

YEAR	NUMBER OF CONNECTED DEVICES
1990	0.3 million
1999	90.0 million
2010	5.0 billion
2013	9.0 billion
2025	1.0 trillion

Example of an IoT system



Literature Review

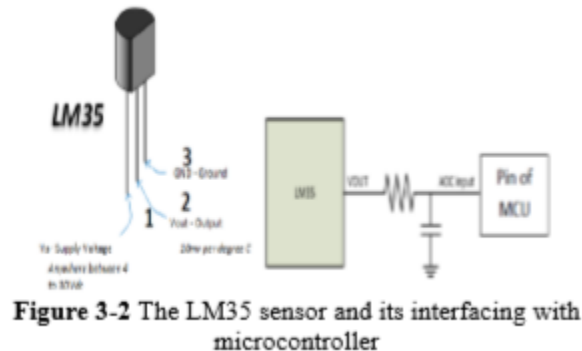
Health Care System is roughly classified into 2 basic types- wearable's and medical devices. wearable devices area unit a lot of centered on watching daily health conditions of a lively one that needs very little or no medical attention. On alternative way medical devices performs additional crucial task of observance patients in medical care units World Health Organization need constant medical attention. Wearable devices facilitate proactive health watching which can play a significant role in early diagnosing of illness. Medical IoT devices specialise in watching patients below essential health conditions. Wireless communication procedure holds a vital portion in effectiveness of medical IoT devices. Bluetooth, ZigBee and Wi-Fi are the the common wireless technologies for remote patient observance system. Wireless device networks integrated with web will be one answer for Medical IoT[8]. Areas that has mobile network coverage 3G/4G/4.5G communication links will be helpful for reliable association. For zones that has no mobile network like remote territory Lora WAN can be an answer in long separation correspondence scheme. In the present system, different health parameters sensors are utilized rather than labels which can not have an effect on health of patient.

Components Used in Implementation
For implementing the health designation system, there's a necessity of essential parts that ar appropriate and manipulate health issues. The elements use typically includes temperature device LM-35, pulse, heartbeat device, ECG sensor, raspberry pi and GSM module.

Temperature Sensor LM-35-

The most generally estimated physical parameters is body temperature, it can be determined by putting the sensor in touch with human body. LM35 is associate degree IC detector that is utilized to gauge temperature with a yield voltage straightly relative to the Centigrade temperature. The LM35 device has favorable position over linear temperature device, because the user has to not build the conversion of Kelvin to Centigrade. this can be major significance of LM-35 that it calibrate directly in Celsius and it's conjointly appropriate for remote applications. It has higher

proficiency than thermal resistor. The LM35 device has additional options that attracted us to decide on it, like graduated directly in centigrade, Linear + 10-mV/degree Celsius scale factor; it measures temperatures from -55 degree to +150 degree with an accuracy of plus minus 0.5 degree Celsius. [10]



3.2 Heartbeat Sensor :

It is utilized to measure the heartbeat of the patient. Fitbit is a wearable gadget that is utilized to quantify pulse. We utilized the Bluetooth module within the fitbit device to transfer pulse rate data to the raspberry pi. The Raspberry Pi 3 has Bluetooth practicality on board. we needed to set up Bluetooth on the Raspberry Pi so as to receive pulse rate information from the fitbit device.

3.3 ECG Sensor :

Electrodiagram is most outstanding strategy for staring at electrical movement of heart. ECG need to be checked for a Cardiovascular disorder (CVD). Electrocardiography (ECG) is that the method of recording the exercise of the heart for a duration utilizing electrodes set on the skin. The essential component of ECG is the Instrumentation Amplifier, which is in charge of taking the voltage difference between leads and amplifying the signs. ECG are often obtained the various ways. we've got used AD8232 that is price effective and comparatively high accuracy solution for ECG.

3.4 Raspberry Pi

The Raspberry Pi could be a single board, low price high performance pc. The raspberry pi board contains a program memory (RAM), processor graphics chip CPU, GPU, Ethernet port, GPIO pins, UART, power supply connection and varied interfaces for alternative external devices. It has conjointly on-board WiFi, Bluetooth and USB boot capabilities [11]. The essential benefit of Raspberry Pi is that it has a massive variety of applications. It additionally has four pole stereo output and composite video port. Video processing functions are additionally viable the use of raspberry pi like video compression. Compressed video can effectively minimize the bandwidth required to transmit the video via terrestrial broadcast, cable TV, or satellite TV servicest [12]. The Raspberry-Pi keeps running on Linux based OS, an open source working framework. In this

framework we utilized Raspbian OS which is Linux based OS. The programming language for the Raspberry-Pi for the framework execution is Python.



Fig 1 Raspberry Pi Kit

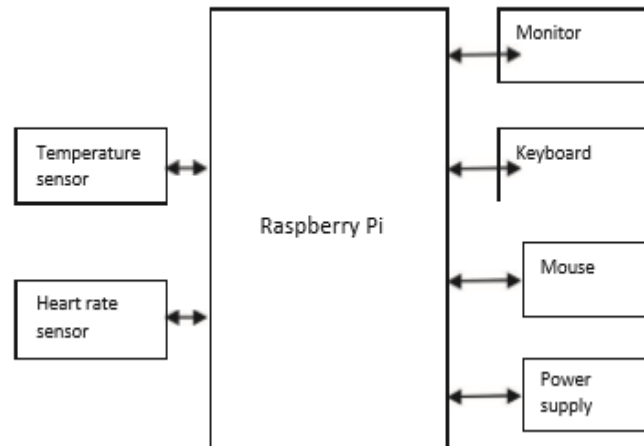
3.5 Communication Network

In health observance system, wireless network is employed to forward activity through a entry towards cloud. the most network used here is IoT. The that means of IoT is net of Things, just called as Internet of everything. Different wireless conversation technologies can be used for (i) connecting the IoT device as nearby networks, and (ii) connecting these local networks (or person IoT devices) to the Internet. The connectivity technologies are NFC, Bluetooth, zigbee, mobile network and many others. during this paper, we tend to use cellular network property as a result of it's widespread mobile networks like 3G and LTE offer reliable high-speed connectivity to the web. However, they need a high power consumption profile and that they aren't appropriate for M2M or local network communication[13-20].

4.Proposed Method

Providing the health care services is extremely vital for individuals particularly who have chronic diseases. These individuals would like continuous health care that can not be provided outside the clinic. There area unit several reasons that inspire to complete the work:(1) creating the health care additional accessible for all the those that don't have access to health care suppliers and for those that don't have access to public transportation so as to travel to hospitals.(2) giving medical employees longer to attend the patients who need more consideration; (3) preventing the delays in arrival of the patients' medical data to the aid suppliers, notably in any accident or emergency

situations; and(4) reducing manual data entry for patients' data which approves scientific personnel to reveal their patients efficaciously [20-28].



The planned health observation system has three functionalities:

Estimating body temperature of the patient: The DS18B20 temperature sensor associated with the Raspberry pi is utilized to check the patient's body temperature. On the off chance that the temperature of the patient is better than average, the specialist is alarmed through a SMS right away.

Measuring pulse rate of the patient: A lot of analysis is going down within the wearable detector field in recent years. We utilize a fitbit wearable detector module for pulse rate sensing. From the pulse estimated utilizing the fitbit, if any abnormality is found, the doctor is alerted regarding the patient through SMS right away.

Patient medication details: We utilize the structures appeared at information the patient's prescription subtleties. The information is put away in the raspberry pi which goes about as an individual server. We get to the patient's therapeutic database and remind the patient to take medicine as indicated by remedy through SMS [28-34].

Activities - Firefox Web Browser | 11:03:22

Activities - Firefox Web Browser

Firefox Details

10.10.10.10:8080/medialite.php

Enter name

Enter phone number

Enter number of pills

Submit

Fig1: User details to be stored in database

Activities - Firefox Web Browser | 11:03:22

Activities - Firefox Web Browser

Firefox Details

10.10.10.10:8080/medialite.php

Enter morning time

Enter morning time

Enter afternoon time

Enter afternoon time

Enter evening time

Enter evening time

Submit

Fig2: Details regarding frequency of pills to be stored in database

The doctor's details are in a similar way entered in a structure and are used to alert the health practitioner to abnormalities in the patient's necessary parameters.

5. ALGORITHM

Raspberry pi is introduced with a linux based working framework, Raspbian. The code is actualized in Python. The capacity of the calculation is to distinguish the body temperature of the human just as the pulse and alarm the specialist by means of SMS if there should arise an occurrence of any distortion. The temperature is distinguished utilizing the DS18B20 sensor. The pulse is distinguished by utilizing a fitbit module which exchanges information utilizing a Bluetooth module. The Raspberry pi additionally works as a tablet reminder, whereby it reminds the individual to take his every day pills at the occasions recorded by him in the database. The Algorithm is done as follows:

Step 1: every body records his details within the information, mentioning his doctor's Contact number, quantity of tablets to be taken daily and their respective times.

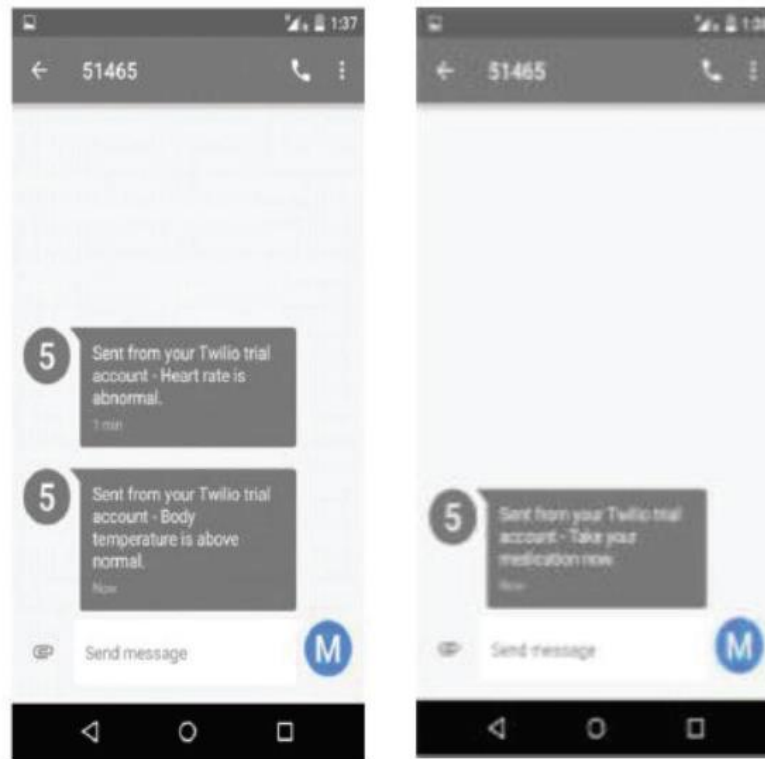
Step 2: Raspberry pi constantly gets the information from Fitbit and extract the heart beat.

Step 3: The program checks if the heart beat falls in the ordinary acknowledged range. if the heart beat is recognized as unusual , alarms the specialist by means of sms and records the peculiar incentive in the database.

At the same time, the individual can test his physique temperature the usage of the temperature sensor and if unwell, the raspberry pi will alert the individual as properly as the doctor. The raspberry pi also serves as a pill reminder; fetches the timings at which the man or women should eat pills from the database and reminds the person to take them.

The pulse was recorded for various patients and arranged dependent on the quantity of occurrences as appeared.

SMS ALERTS ARE SENT AS SHOWN BELOW:



A lot of information can be gathered utilizing this system. This could fill in as an expectation displaying framework ; for instance if a patient's fitness parameters are changing in a similar example as a past patient in the database , the idea of the infection/medical issue can be effectively distinguished and can help in finding the cure quicker.

6. Conclusion

The IoMT technology is still in a growing stage of development, however, the connected devices in healthcare can improve the lifecycle of treatment, enhance operational accuracy and efficiency, enable real-time response from remote locations, thus saving lives now more than ever before. We have discussed various aspects for the designing of health monitoring system, the growth of IoMT, major players in IoMT and hardware standards. The important factors related to system are discussed with various challenges that are ongoing issue.

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