HEALTH CARE ASSETS BASED ON AN IOT AND GPS TECHNOLOGIES

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Abstract— In this paper, a healthcare monitoring system is proposed which works on the basis of patient's location and the nearby emergency assistance services like hospitals and ambulance services. The system can monitor the health of the patients using body sensors like Pulse sensor, temperature, MEMS sensors and incorporate that data with the location of the person and can Healthcare systems are generally referred as the preventive measures to avoid fatal health related issues like heart attack or any sort of cardiac impacts which need to be prevented or cured in a specific amount of time. Preventing some health related issues is a better way of avoiding any fatal instances as we can insure health by preventing. Curative measures can also be taken to prevent the fatal instances but those measures have a time factor which affects the treatment of the patient. The emergency system must work according to the location of the patient as the time factor is very important in emergency situations.

Index terms: **Raspberry Pi3 Model B, Sensors.**

INTRODUCTION

Now a Days Health is the Universal Challenges for Human beings. Health monitoring systems often need to track, monitor, and analyze moving data objects, such as humans, vehicles, mobile devices, and satellite images, and find relationships between patients' environmental exposures and their diseases in order to delineate the causes and prevent environmental diseases. However, these systems present significant challenges in terms of data size, data scales, complex structures and relationships, uncertainty, and space and time constraints. Tracking moving objects has been a prominent issue recently due to the large number of applications that depend heavily on it. Continued advances and cost reduction in personal mobile devices such as smart phones made them widely used in daily-life practices such as en route navigation and vehicle tracking. However, monitoring of individual exposure to environmental conditions did not follow the same pace despite its great impact on public health; the general effect of environment and climate has more been the concern. Limited research has been done on techniques for retrieving, storing and analyzing real-time data of patients' trajectories along with the environmental conditions patients are exposed to Since exposures vary across locations and time intervals, the exposure dataset is often managed by geographic information systems (GIS).

RELATED WORKS

(Yi, Won-Jae *et al.*, 2013) proposed Smartphone system for BSN health monitor remotely. Here, some sensors attached on human body to collect patient's vital signal and communicate with gateway through different wireless communication protocols (Bluetooth, NFC, Zigbee) to transferred sensed data. Smartphone used as a bridge between sensors and remote storage cloud to provides analysis, process, store data and also used to relay data from sensors to cloud from where specialists access [1].

Bhoomika.B.K, Dr. K N Muralidhara developed a system monitoring the patients over internet. The model consists of PIC18F46K2 Microcontroller Temperature sensor, Pulse Oximeter Sensor (TCRT1000), Liquid Crystal Display (16x2), GSM MODEM, Piezo Electric Buzzer, Wi-Fi Module, Max232, GSM Modem, and Regulated Power Supply. In this system PIC18F46K22 Microcontroller collects the data from the sensors and sends the data through Wi-Fi Protocol. The Protected data sent can be accessed anytime by the doctors by typing the corresponding unique IP address in any of the Internet Browser at the end user device [2].

The design consists of a microcontroller (MCU), AD8232 Heart monitor, three-lead electrode pads, HC-06 Bluetooth module, and a 0.1uF capacitor. The given system just uses heart rate sensors as the monitor and sends the data to ADC which then is converted to the digital form and sent to dragon board and the design is easily controlled by a smart phone application. The

monitor used in this system is a very efficient sensor which works as the heart monitor for the system. It is an integrated signal conditioning block for ECG and other biopotential signals in the presence of noisy conditions, such as those created by motion or Remote electrode placement. This design allows for ultra low power analog-to-digital converter (ADC) or embedded microcontroller to acquire the output signal easily [3].
Many other fields are using Wi-Fi signals in addition to Other technologies such as Bluetooth or RFID for location tracking, such as parking management system [4] or a low cost IoT system to enhance the transit bus system [5]. Bahl et al [6] proposed the use of a radio-frequency based system for locating and tracking users, by recording and processing signal strength information at multiple base stations positioned to provide overlapping coverage in the area of interest. An industry implementation of 802.11 based RTLS system is the Aero Scout system which requires the use of proprietary Wi-Fi enabled locator tags and a "location grade" wireless infrastructure that can support the accurate localization of tags throughout the structure. This system also requires ultrasonic emitters to increase the accuracy of the system to room-level [7].

SYSTEM DESCRIPTION

The problem found in the existing wireless monitoring system is due to lack of doctors and the electronic devices. The doctor asses the patient's condition by measuring the parameters such as temperature, Pulse sensor, Moments etc. In case of emergencies, the nurse intimates the doctor through some means of communication like mobile phone etc. Usually the medical center could allocate some medical staff to examine on-site for elderly people regularly, but with increased number of older persons in the community, If the patient is discharged but they need monitoring for few days that situation there is no possibility of continues monitoring of patient if any problem occurred intimation to doctor and also tracking of the patient is critical. And also on-site service is becoming increasingly costly. Therefore, we need to design a family telemedicine system to having wearable sensor circuit, which will enable the residents for continues monitoring of patient data along with location it will be updated to doctor server for taking necessary action. Not only the patient, but also their families will benefit from these.

Proposed Methodology

The main aim of this proposed system is to monitor the patient's health during critical situation and tracking the patient. So to save the life of a patient who is in critical position, we use embedded technology which plays an important role in monitoring.
The System Architecture has two sections. They are:
1. Hardware Designing
2. Software coding

Hardware Designing

In this Hardware designing we are making two sections
1. Patient Section,
2. Monitor Section

Patient Section:

In this section we are performing Data Acquisition. It is performed by multiple wearable sensors that measure physiological biomarkers, such as, skin temperature, Pulse rate, and moments. The sensors connect to the ADC IC chip for converting information from Analog to Digital. The converted Data will be given to Raspberry board for analysis which is shown in Fig. 1. Components of a remote patient monitoring system. After getting data from the sensors Raspberry Pi analyze the data and send to the doctor or Monitoring section by using IOT Module it is interfaced to the UART through USB of the Raspberry Pi.

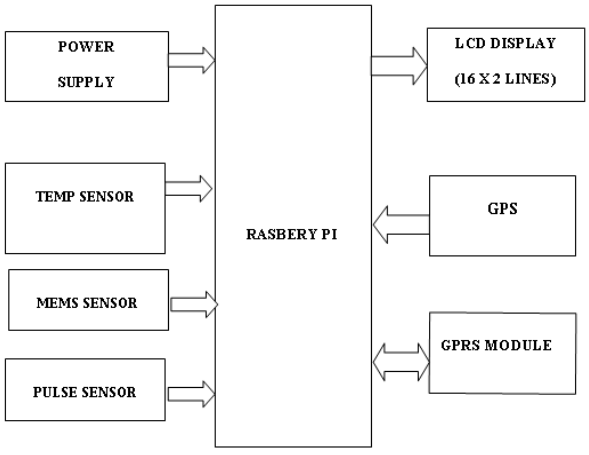


Figure1. Patient Section

Monitor Section:

Web server will be act as a Monitoring section. This web server will be created by installing Windows Server pack OS in a System, along with install Apache TomCat Server pack. And run the Web page in this Pc

it will be act as a Web server. The output will be displayed in the monitoring section as shown in fig2.

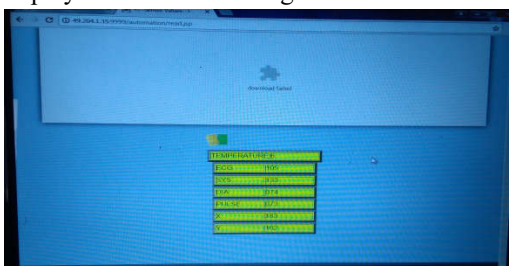


Figure.2 .Monitor Section

Modules Used In the Project:

To get effective data regarding patients' health we use the following modules:

Pulse sensor

Pulse sensor is also called as Heart Beat Sensor. This heart beat sensor is designed to give digital output of heat beat when a finger is placed inside it. When the heart detector is working, the top-most LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

Figure.3.Pulse Sensor

Thermistor:

A thermistor is a type of resistor whose resistance varies significantly with temperature, more than in standard resistors. The word is a portmanteau of thermal and resistor. Thermistors are widely used as inrush current limiters, temperature sensors, self-resetting over current protectors, and self-regulating heating elements. Thermistors differ from resistance temperature detectors (RTD) in that the material used in a thermistor is generally a ceramic or polymer, while RTDs use pure metals. The temperature response is also different; RTDs are useful over larger temperature ranges, while thermistor typically achieve a higher precision within a limited temperature range, typically −90 °C to 130 °C.

Figure.4.Temperature sensor

Raspberry Pi3 Model B:

Raspberry pi3 Model B is a single board computer developed in United Kingdom by raspberry pi foundation. The raspberry pi3 model B is designed on Broadcom BCM2837 processor which include ARM Cortex-A53 based quad core processor which runs on 1200 MHz and has RAM capacity of 1GB.It requires 5V 2A power supply. It has graphic processing unit Dual Core Video Core IV multimedia Co-Processor. It provides Open GL.ES-2.0, accelerated-hardware Open-VG, also it has 1080p30 H.264 high-profile decode Capable of 1Gpixel/s, 1.5Gtexel/s or GFLOPs 24, with texture filtering and DMA infrastructure. It also has four USB connectors, one audio output, camera connector, 40 GPIO connector, one display serial interface and one High-Definition Multimedia Interface.

Figure.5.Raspberry Pi 3 Model B Board

GPS:

Global Positioning System (GPS) technology is changing the way we work and play. You can use GPS technology when you are driving, flying, fishing, sailing, hiking, running, biking, working, or exploring. With a GPS receiver, you have an amazing amount of information at your fingertips. Here are just a few examples of how you can use GPS technology.

GPS technology requires the following three segments.

- Space segment.
- Control segment.
- User segment

Space Segment

At least 24 GPS satellites orbit the earth twice a day in a specific pattern. They travel at approximately 7,000 miles per hour about 12,000 miles above the earth's surface. These satellites are spaced so that a GPS receiver anywhere in the world can receive signals from at least four of them.

Control Segment

The control segment is responsible for constantly monitoring satellite health, signal integrity, and orbital configuration from the ground control segment includes the following sections: Master control station, Monitor stations, and Ground antennas.

User Segment

The GPS user segment consists of your GPS receiver. Your receiver collects and processes signals from the GPS satellites that are in view and then uses that information to determine and display your location, speed, time, and so forth. Your GPS receiver does not transmit any information back to the satellites.

Figure.6.GPS Receiver

MEMS:

Micro electro mechanical systems (MEMS) are small integrated devices or systems that combine electrical and mechanical components. Their size range from the sub micrometer (or sub micron) level to the millimeter level and there can be any number, from a few to millions, in a particular system. MEMS extend the fabrication techniques developed for the integrated circuit industry to add mechanical elements such as beams, gears, diaphragms, and springs to devices. These systems can sense, control and activate mechanical processes on the micro scale and function individually or in arrays to generate effects on the macro scale. The micro fabrication technology enables fabrication of large arrays of devices, which individually perform simple tasks, but in combination can accomplish complicated functions.

Figure.7. MEMS

MEMS are not only used for any one application or device, or they are not defined by a single fabrication process or limited to a few materials. They are a fabrication approach that conveys the advantages of miniaturization, multiple components and microelectronics to the design and construction of integrated electromechanical systems. MEMS are not only about miniaturization of mechanical systems but they are also a new pattern for designing mechanical devices and systems.

In this application we are using ADXL335 sensor is used for collecting the Human movements the pin configuration showed in fig 8, In this we are giving 5V Dc for operating and we get the 3-axis analog output range of 3.3v that will be given to ADC for further operations.

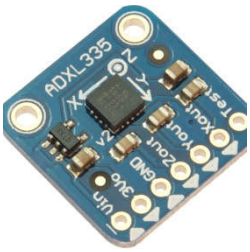


Figure.8. ADXL335

MCP3208

The Raspberry Pi computer does not have a way to read analog inputs. It's a digital-only computer. So we need analog to digital converter circuit in our application so we are Prefers MCP3208. It is a successive approximation 12-bit Analog to-Digital (A/D) Converters with on-board sample and hold circuitry. It converts analog values into digital and that output will be given in communication format. Communication with the device is accomplished using a 4-wire SPI compatible interface.

Figure.9. MCP3208

SOFTWARE DESCRIPTION

In order to use Raspberry Pi, we need to install an Operating System (OS) in to an SD card. An Operating System is the set of basic programs and utilities that allow your computer to run; Examples include Windows on a PC or OSX on a Mac. These instructions will guide you through installing a recovery program on your SD card that will allow you to easily install different OS's and to recover your card if you break it.

1. Insert an SD card that is 4GB or greater in size into your computer
2. Format the SD card so that the Pi can read it.

QT Creator:

Qt Creator provides a cross-platform, complete integrated development environment (IDE) for application developers to create applications for multiple desktop, embedded, and mobile device platforms, such as Android and iOS. It is available for Linux, MAC OS and Windows operating systems. *Qt Creator* is the integrated development environment (IDE) of choice for Qt. It provides good support for developing for embedded systems, including cross-compiling, deploying to a target system, debugging and profiling.

Here are the key steps:

1. Install Qt Creator.
2. Get a Linux image running on the target system.
3. Set up the tool chain/SDK.
4. Build a cross-compiled Qt and configure it.

In this methodology, QT Creator is used for writing and executing CPP program code. Initially all the header files, ports, variables and the input devices such as ADC (temp, Pulse, MEMS), sensors have to be declared. The data can be collected from those sensors and it can be send to the monitoring section. If the data is not displayed in the server, again data collection step has to be repeated. This is how the flow of code execution takes place.

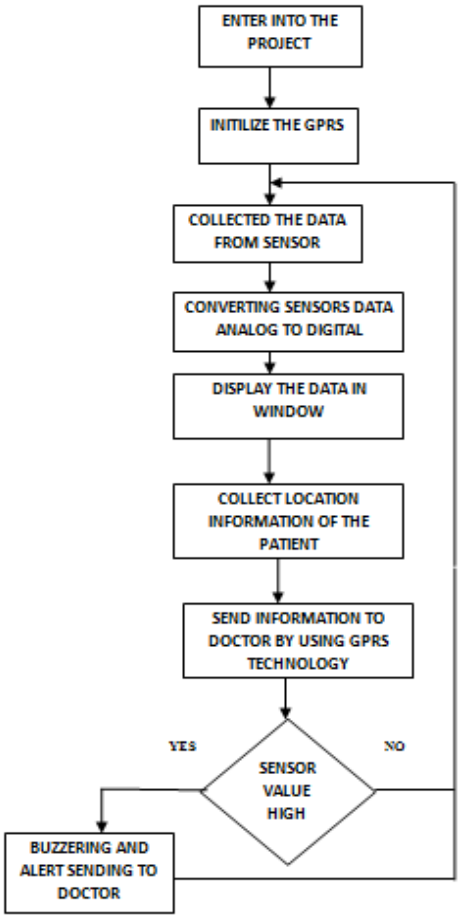


Figure.10. Flow Chart

The figure 10 shows that how the code runs by collecting data from the ADC (Temp, MEMS) and pulse sensors. The collected data is displayed in a Patient health monitoring window.

Working Model:

The block diagram of the project consists of Raspberry Pi3 Model B, sensors, Zigbee module, and power supply which is shown in Figure 1.In case of emergency and dangerous situations we have to alert the doctor immediately along with patient location. For this we are using a Wireless network for doctor to patient communication in the hospital. This way of communication is actually done with Zigbee module.

Each patient will be given this module and with the help of this module the patient health condition is monitored.

In this raspberry pi3 model B plays a major role of data collection from the sensors and the analyzed data will be passed to the monitoring section.

In this first we are connecting the sensors to the patient's body. In this Temperature, MEMS sensors are producing analog outputs but our Pi reads only digital outputs. So we are using MSP3208 for converting sensors information. This MSP3208 interface to the Raspberry Pi using 4-wired SPI protocol. Pulse sensor data collection we are using IR based sensor it produces digital output. It is interfaced

to the Pi using GPIO pins. After collecting the data from all the sensors Pi board analyze the data and send that data to the Monitoring section by using Zigbee module interfaced to the Pi board using UART.

RESULTS

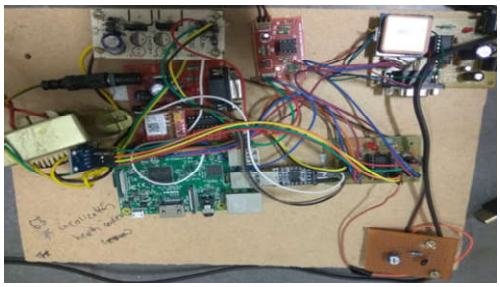
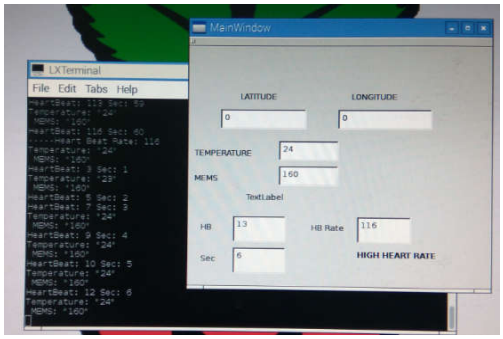
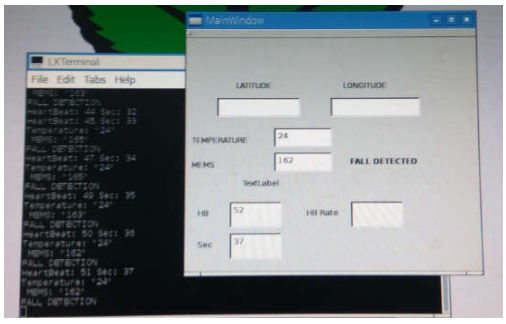


Figure.11. Hardware Model for Patient Monitoring system



(a)



(b)

Figure.12. (a), (b) Ui Window RPi shows Patient data

CONCLUSIONS

We develop a prototype model for smart health monitoring system that constantly monitors the patient health with the help of the sensors. The proposed system here has tried to solve problems which make remote patients fuss for checking their health condition and getting accurate diagnosis. This has led to increased development of embedded systems that the healthcare specialists are adopting.

FUTUREENHANCEMENTS

Research & development is an endless process. There is always chance to improve any system.

We add extra sensors like blood glucose level sensors, Physiological data collection, Brain signal monitoring, Tumor detection and EEG sensors for better monitoring of patient condition.

Allow two way communications between doctors and patients will be beneficiary in many cases where patient needs to communicate directly to the doctor. This will allow doctors to send messages to the patients, and thus make the consultation and service provision more transparent and effective.

REFERENCES

[1] Yi, W. J., & Saniie, J. (2013, May). Smart mobile system for body sensor network. In Electro/Information Technology (EIT), 2013 IEEE International Conference on (pp. 1-4). IEEE.

[2] Bhoomika.B.K MTech in VLSI and Embedded systems PES college of Engineering, Mandya Dr. K N Muralidhara Professor and Head of the Department Electronics and communication "Secured Smart Healthcare Monitoring System Based on IOT" International Journal on Recent and Innovation Trends in Computing and Communication Volume: 3 Issue: 7.

[3]. Rajib Chandra Das and T. Alam, "Location based emergency medical assistance system using Open street Map," 2014 International Conference on Informatics, Electronics & Vision (ICIEV), Dhaka, 2014, pp. 1-5.

[4] Rahman, Mohammad Shaifur, Youngil Park, and Ki-Doo Kim. "Relative location estimation of vehicles in parking management system." In Advanced Communication Technology, 2009. ICACT 2009. 11th International Conference on, vol. 1, pp. 729-732. IEEE, 2009.

[5] El-Tawab, Samy, Raymond Oram, Michael Garcia, Chris Johns and Byungkyu Brian Park. “Data Analysis of Transit Systems Using low cost IoT Technology,” In Pervasive Computing and Communications Workshops (PERCOM Workshops), 2017 IEEE International Conference on, IEEE, 2017.

[6] Bahl, Paramvir, and Venkata N. Padmanabhan. "RADAR: An inbuilding RF-based user location and tracking system." In INFOCOM 2000. Nineteenth Annual Joint Conference of the IEEE Computer and Communications Societies. Proceedings. IEEE, vol. 2, pp. 775-784.IEEE, 2000.

[7] Swedberg, Claire. “Aero Scout RTLS Helps The Valley Hospital's Staff Feel Safer.” ww.rfidjournal.com/articles/view?15022. (accessed April8, 2017).