SMART IoT GUIDE-PREINVESTIGATOR FOR ANGUISH ALLEVIATION AND EXPEDITIOUS HOSPITALIZATION FOR CONVALESCENT

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ABSTRACT

With the advancement of sensing technologies, embedded systems, wireless communication technologies, Navigation system, Nano technologies, and miniaturization makes it possible to develop smart systems to monitor activities of human beings continuously and send the bio medical (blood pressure, hemoglobin rate, brain wave readings) via IoT gateway to the cloud. In case of emergency situation, the device will report the bio medical information, personal information and GPS details to nearby hospital through IoT gateway by using Android Application. The GPS details will help to track the exact location of the patient and send the ambulance to provide immediate treatment. The sensors will monitor the condition of the patient until he/she reaches the hospital. Therefore, necessary treatment can be provided in times of dire need. It will also send an alert message (hospital name and location) to the patient's family members. This paper reviews the latest reported systems on activity monitoring of humans and provide hospitalization immediately when needed, based on wearable sensors.

Key Words: *wearable sensor, GSM, real time monitoring, LCD, Emergency alert.*

1.INTRODUCTION

The health problem is rising along with increasing population in the today's world. In hospitals, continuous monitoring is needed for heart attack, after major/minor operation, temperature related illness, physical disorders. But the 24x7 monitoring of patients is difficult and also leads to high cost. For elderly people who alone stay in home for long term monitoring without person is a complex situation. To overcome the situation without hospitalization for monitoring the patients using wearable sensors is used in this paper. Wearable sensors are popular in many applications such as entertainment, security, medical purposes. Wearable sensors are worn on the human body for MEMS, EEG, heartbeat, etc., In the medical field, sensor is collect the data about the person and send the information using wireless technology. This method reduces the health care cost of patients.

Julia Schnepper et al [1] proposed a method used to monitor the physiological parameters such as temperature, heart rate of a human body. It is an electronic device that is worn on the hand for risk person. The person is monitored wirelessly using a sensor. It detects the critical condition and intimates alarm to the receiver unit. The impact sensor finds the detection and falls of the patients, but the emergency button is to manually operate by users. Phillip A. Shaltis et al [2] proposed a new principle for blood pressure measurement by using the hydrostatic method. This technique eliminates the inflationary pressure cuff. Data are obtained using miniaturized ring BP sensor and a height estimation system. The height of the sensor is estimated by twin accelerometer. Tal Shany et al [3] proposed a system using body fixed sensors for monitoring the human movements and fall detection. It is estimated by using different accelerometer such as vibrating gyroscope, Accelerometers, magnetometers, goniometer, sole pressure sensor, pedometer, actometer etc., this paper gives the theoretic scope for physical activity monitoring. Pietro Salvo et al [4] designed a system for measuring sweat rate of the sport person using wearable sensors. On previous method, sweat rate was possible onlybased on laboratory. ZiyuLv et al [5] proposed a method for elderly people to monitor the blood pressure, ECG/accelerometer and transmit the information to the smart phone using Bluetooth module. It stores the data using icare application for future reference. Nagender Kumar Suryadevara et al [6] proposed a system to detect the abnormal behavior of the elderly person in the home. The Sensors are installed in the household appliances for monitoring the daily activities using Zigbee communication. The data are also preprocessed in the system. AmrutaChopade et al [7] proposed a system using ATMEGA controller for monitoring the heartbeat, temperature of the patients. Data are collected from many patients and display on the personal computer using communication.

The proposed system is to monitoring the patients continuously from remote areas using wearable sensors. This system consists of many sensors such as EEG, heartbeat, and MEMS. **Electroencephalography** (**EEG**) is an electrophysiological monitoring method to record electrical activity of the brain. Heart beat sensors measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (a vascular region). MEMS sensors are used to identify the fall of the patient Data are collected and analyzed using microcontroller. Based on the predefined values it compares and displays the information about the patients with stage in liquid crystal display using embedded c coding. If it exceeds that condition immediately send the information to the ambulance, nearby hospital and relatives via SMS using sGSM modem.

2. BLOCK DIAGRAM:

2.1 TRANSMITTER SECTION

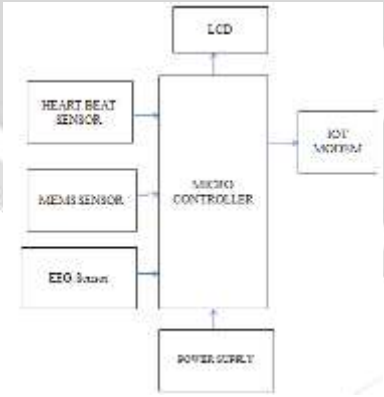

Fig – 2.1.1: Block diagram of the transmitter section

The transmitter section consists of EEG sensor, MEMS sensor, heart beat sensor, PIC microcontroller, LCD, GSM modem. The receiver section consists of android application.

2.2 RECEIVER SECTION

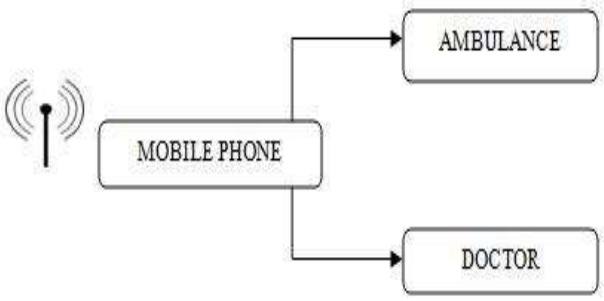

Fig – 2.2.1: Block diagram of the receiver section

In receiver section we have an android application to receive the medical records, emergency alert.

3.SENSOR DESCRIPTION

3.1EEG Sensor

An electroencephalogram (**EEG**) is a noninvasive test that records electrical patterns in your brain. The test is used to help diagnose conditions such as seizures, epilepsy, head injuries, dizziness, headaches, brain tumors and sleeping problems. EEG waveforms are generally classified according to their frequency, amplitude, and shape, as well as the sites on the scalp at which they are recorded. The most familiar classification uses EEG waveform frequency (e.g., alpha, beta, theta, and delta). Instabilities in brain rhythms correlate with tics, obsessive-compulsive disorder, aggressive behavior, rage, bruxism, panic attacks, bipolar disorder, migraines, narcolepsy, epilepsy, sleep apnea, vertigo, tinnitus, anorexia/bulimia, PMT, diabetes.,

Alpha waves

- Alpha waves generally are seen in all age groups but are most common in adults. They occur rhythmically on both sides of the head but are often slightly higher in amplitude on the nondominant side, especially in right-handed individuals. A normal alpha variant is noted when a harmonic of alpha frequency occurs in the posterior head regions. They tend to be present posteriorly more than anteriorly and are especially prominent with closed eyes and with relaxation.
- Alpha activity disappears normally with attention (e.g., mental arithmetic, stress, opening eyes). In most instances, it is regarded as a normal waveform.

Beta waves

- Beta waves are observed in all age groups.
- They tend to be small in amplitude and usually are symmetric and more evident anteriorly.
- Drugs, such a s barbiturates and benzodiazepines, augment beta waves.

Theta waves

- Theta waves normally are seen in sleep at any age. In awake adults, these waves are abnormal if they occur in excess.
- Theta and delta waves are known collectively as slow waves.

Delta waves

- These slow waves have a frequency of 3 Hz or less.
- They normally are seen in deep sleep in adults as well as in infants and children.
- Delta waves are abnormal in the awake adult.
- Often, they have the largest amplitude of all waves.
- Delta waves can be focal (local pathology) or diffuse (generalized dysfunction).

Frequency

The frequencies most brain waves range from are 0.5-500 Hz. However, the following categories of frequencies are the most clinically relevant:

- Alpha waves - 8-13 Hz
- Beta waves - Greater than 13 Hz
- Theta waves - 3.5-7.5 Hz
- Delta waves - 3 Hz or less

3.2 MEMS SENSOR:

Micro-Electro-Mechanical Systems, or **MEMS**, is a technology that in its most general form can be **defined** as miniaturized mechanical and electro-mechanical elements (i.e., devices and structures) that are made using the techniques of microfabrication. It is used for fall detection. Fall detection is a major challenge in the public healthcare domain, especially for the elderly as the decline of their physical fitness, and timely and reliable surveillance is necessary to mitigate the negative effects of falls. The system monitors the movements of human body, recognizes a fall from normal daily activities by an effective algorithm.

Fig-3.1: MEMS sensor for fall detection.

3.3. HEART BEAT SENSOR

Heart beat sensor is used to measure the pulse rate of the heart in digital output. The normal heart beat of the person is 78 bpm. It is measured based on the beats per minute. If the heart beats more than 100 BPM causes Tachycardia. If the heart beats less than 60 BPM causes Bradycardia. Figure shows the information about the hear t rate of the person with time.

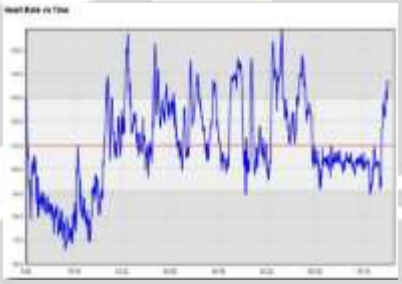

Fig-3.2: Normal heart beat rate of the person.

4.SOFTWARE DESCRIPTION

4. 1 MPLAB IDE

MPLAB IDE is a software program that runs on windows operating system. It is used for developing the application for microchip microcontrollers and digital signal controllers. MPLAB provides a single integrated environment is used to develop the code for embedded microcontroller. So, it is called as an integrated development environment. The features of MPLAB are comprehensive editor, project manager and design desktop. It is used for application development of embedded designs using Microchip PIC MCUs and dsPIC DSCs. The HI-TECH C compiler is used to build the embedded c coding in the MPLAB software.

4.2 JAVA

Java is used in a wide variety of computing platforms from embedded devices and mobile phones on the low end, to enterprise servers and supercomputers on the high end. While less common, Java applets are sometimes used to provide improved and secure functions while browsing the World Wide Web on desktop computers.

4.3 ANDROID

Android is a Linux-based operating system for mobile devices such as smart phones and tablet computers. It is developed by the Open Handset Alliance led by Google. Google releases the Android code as open-source, under the Apache License. The Android Open Source Project (AOSP) is tasked with the maintenance and further development of Android. The version used here is Android 2.2 Froyo was released, based on Linux kernel 2.6.32 is used to carry out our project work.

4.4 ECLIPSE

Eclipse is an open source community, whose projects are focused on building an open development platform comprised of extensible frameworks, tools and runtimes for building, deploying and managing software across the lifecycle. The Eclipse SDK consists of the Eclipse Platform, Java development tools and the Plug-in Development Environment.

The Apache HTTP Server is a web server software program notable for playing a key role in the initial growth of the World Wide Web. 2. MySQL 5.5.27

The cloud stores the recorded data in a SQLite database. This is needed because it is not necessary that there will always be a network available to forward the biomedical data to the server. MySQL was chosen over SQLite as database management system.

5. MODULES

5.1 HARDWARE INTEGRATION

Bio-Medical Sensor Network have the ability to diminish the workload of medical care. The introduction of Personal Area Network greatly simplifies the collection of physiological data. The patients can be engaged in their day to day life activities while being monitored. The physician can have the surveillance of patient's health condition for 24 hours using this system. Using PIC (Programmable Interface Controller), it provides a low-cost health monitoring system.PIC is an electronic circuit that can be programmed to carry out various tasks.PIC Microcontrollers are produced by Microchip technology. The Global Positioning System (GPS) is a global navigation satellite system that provides location and time information in all weather conditions. The GPS operates independently of any telephonic or internet reception, though these technologies can enhance the usefulness of the GPS positioning information. GPS satellites transmit signal information to earth. This signal information is received by the GPS receiver in order to measure the user's correct position.

5.2 GPRS AND IOT INTERFACE

With the rise of Internet of Things (IoT), standalone devices with web connectivity have become an important part of our lives. Imagine being able to connect anything to a standard framework and review that information online on a website. Using a microcontroller to acquire data and GPRS to connect the module to the web interface, we can successfully send any kind of data on a web server. Apart from the embedded device, this would certainly require network software running on the server for the reception and storage of the data. This project serves as a building block for a cloud-based data acquisition framework, which can be used with any type of data like Mems, Heart beat Sensor, or any kind of Serial Data.

5.3 WEB SERVICE INTERFACE

A web server has one role: to implement the HTTP protocol. This protocol allows a browser to issue a request to which a server will respond. Today's web is highly sophisticated, featuring elaborate graphics and streaming media, yet surprisingly, HTTP is a very simple protocol. All it does is transport requests and responses. Because HTTP is a stateless protocol, there is no intelligence in the operation: there is no decision-making or context, and there are no scripts or code to execute. There is also no concept of dynamic page creation; if a page is going to be created dynamically, some other program has to do that work and put the result where the web server expects it to be. HTTP understands only nine operations (typically called "methods" or "verbs"), of which the most important are GET and POST. GET is used to download a "resource" (typically a file) located at a specified location (the "uniform resource locator", or URL). The response to a GET request contains the resource, accompanied by

HTTP header information. When someone clicks a link in a web browser to go to a new page, they are sending a GET request to the server asking for the HTML page located at the URL they clicked.

5.4 EMERGENCY COMMUNICATION

The objective of this work is providing an effective application for Real Time Health Monitoring, Tracking. The system will track, trace, monitor patients and facilitate taking care of their health; so efficient medical services could be provided at appropriate time. By Using specific sensors, the data will be captured and compared with a configurable threshold via microcontroller which is defined by a specialized doctor who follows the patient; in any case of emergency a message will be sent to the nearby hospital along with the measured values through GSM module by using android application. The system will be able to bridge the gap between patients - in dramatic health change occasions- and health entities who response and take actions in real time fashion.

6. OUTPUT

In this paper PIC microcontroller is used for processing the data. The data from the EEG, MEMS and heart beat sensors are collected and processed to analyze the condition of the patient. The analyzed values of each sensors along with the patient unique ID is displayed on the LCD board.

Fig-6.1:PIC microcontroller

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The collected information is displayed based on the condition. On the receiver side the alert along with the GPS details, previous record, health parameters are displayed as

Fig-6.2: Emergency alert in the android application at the hospital.

7. FUTURE SCOPE:

Although wireless technology in the field of medical applications is still relatively new, commercial products are being developed by several companies to solve wide ranging problems. In some cases, these new applications are design purely social health benefits i.e. reducing interference to daily life when dealing with long term patient care.

Some of the future applications:

- Patient Homecare.
- Context-Sensitive Medicine.
- iRevive (A Prehospital Mobile Database for Emergency Medical Services).

8. CONCULSION

In our project, results are easily obtained using Eclipse software to provide the real time monitoring of the patients. We get the input from sensors and processed using microcontroller. For emergency send the intimation to the caregivers. This system is low cost, self-monitoring device and used in remote areas efficiently.

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