

Remote Patient Monitoring System

S. Mathumetha¹ V. Menaka² R. Jeevagan³ V. Menaka⁴ R. Jeevagan⁵

^{1,2,3,4,5}Department of Computer Science & Engineering

^{1,2,3,4,5}Kongu Engineering College, Perundurai

Abstract— The aim of this project is to give an ergonomically efficient product to patients with an affordable cost and easily maintainable manner. This project concentrates on the patient health monitoring and giving alert to the patient's relatives and doctor in case of emergency. The two sensors namely heart rate sensor and pressure sensor will continuously monitor the patient and record the observation in the database so that they can go through the data whenever needed. It saves time and effort of the care taker and an immediate response given by the sensors is very useful and can react on the situation more effectively than the manual procedure. At abnormal conditions, an alarm will be generated in the form of buzzer. Also based on the severity of the patient, alert is given in the form of text message by using the GSM module. It is a user friendly, cost effective and an efficient method to monitor patients continuously. An Android application is developed to view the status of the patient health and report is generated in the form of graph.

Key words: Remote Patient Monitoring System, GSM module, Sensor Module

I. INTRODUCTION

Data analysis, also known as analysis of data or data analytics, is a process of inspecting, cleansing, transforming, and modelling data with the goal of discovering useful information, suggesting conclusions, and supporting decision-making. Data analysis has multiple facets and approaches, encompassing diverse techniques under a variety of names, in different business, science, and social science domains. Analysis refers to breaking a whole into its separate components for individual examination. Data analysis is a process for obtaining raw data and converting it into information useful for decision-making by users. Data is collected and analyzed to answer questions, test hypotheses or disprove theories.

Data Analytics have become vital for the growth and development of the companies of today. Large investments are being made in big data analytics to make better business decisions from past data. This past data is being generated by different sources such as business people, marketing, education, engineering, medicine, social media, on-line transactions, call centers, sensors, web logs and telecommunications.

The data is necessary as inputs to the analysis are specified based upon the requirements of those directing the analysis or customers who will use the finished product of the analysis. The general type of entity upon which the data will be collected is referred to as an experimental unit.

Data is collected from a variety of sources. The requirements may be communicated by analysts to custodians of the data, such as information technology personnel within an organization. The data may also be collected from sensors in the environment, such as traffic cameras, satellites, recording devices, etc. It may also be obtained through

interviews, downloads from online sources, or reading documentation.

Data initially obtained must be processed or organized for analysis. For instance, these may involve placing data into rows and columns in a table format (i.e., structured data) for further analysis, such as within a spreadsheet or statistical software.

II. LITERATURE REVIEW

In [1] D.Chandana and B. Hema Latha presented patient monitoring system by continuous observation. They have implied that weather a person is at home, on a trip, or at his work place, he/she can stay connected with the doctor and he can take immediate action if necessary. They stated that the Telemedicine system for doctors provides solution for their project. In [2] Mayank Kothari described the development of a heart beat monitor system based on a microcontroller. They explained how a single-chip microcontroller can be used to analyze heart beat rate in real-time. It can also be used to control patients or athletic person over a long period. The system reads stores and analyses the heart beat repetitively in real-time. The hardware and software design are oriented towards a single -chip microcontroller-based system, hence minimizing the size.

III. PROPOSED METHOD

This project is for monitoring the passive patient's health by continuous observation by sensors. The two sensors used are heart rate sensor and pressure sensor. They are embedded as a smart band and continuous monitoring is done. The results are calculated each and every day and are compared and the health rate of the patient will be predicted. In case of abnormal condition of the patient, an alarm will be generated in the form of buzzer and a message will be sent to the patient care taker through GSM module. Based on the severity level, message will be sent to patient's care taker or doctor or ambulance. If the severity is low, medium and high, message will be sent to care taker, care taker and doctor and care taker, doctor and ambulance respectively. Android application is developed to keep in track of the patient report in weekly, monthly and yearly basis and it will be viewed as graphs.

IV. SYSTEM REQUIREMENTS

A. Software Requirements

- Operating System – Windows 7.0
- Arduino 1.8.4
- Android

B. Hardware Requirements

- Heart Rate Sensor
- Pressure Sensor
- Arduino UNO Board
- Micro-controllers
- LCD Display

V. SYSTEM BLOCK DIAGRAM

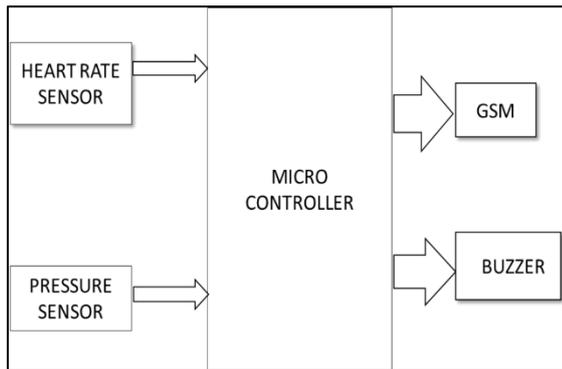


Fig. 1: Block Diagram

VI. SENSOR MODULE

A. Herat Rate Sensor

Heartbeat sensor provides a simple way to study the function of the heart which can be measured based on the principle of psycho-physiological signal used as a stimulus for the virtual-reality system. A heart beat is detected a radio signal is transmitted, which the receiver uses to determine the current heart rate. This signal can be a simple radio pulse or a unique coded signal from the chest strap (such as Bluetooth, ANT, or other low-power radio link); the latter prevents one user's receiver from using signals from other nearby transmitters (known as cross-talk interference). Newer versions include a microprocessor, which is continuously monitoring the EKG and calculating the heart rate, and other parameters.

Target Zone	Training Recommended
Normal (72 BPM)	Normal Rate
Low (60-70 BPM)	Low Heart Rate
High (>72 BPM)	Indicates the person is in abnormal state

Table 1: Heart Rate Values

B. Pressure Sensor

Pressure sensor usually involves a cuff which is activated every 15 minutes over several hours and compresses the upper arm, a cumbersome measuring device on the body, or in some cases even invasive monitoring, in which a catheter is inserted into the artery. To avoid this inconvenience blood pressure sensor is also embedded in the band for easy use and continuous monitoring. The measurement is carried out by several sensors which simultaneously measure the contact pressure, pulse and blood flow on the surface of the skin in the vicinity of the wrist.

Pressure level	Systolic (mmHg)	Diastolic(mmHg)
Normal	90 - 130	60 - 80
Low	< 90	< 60
High	>140	>140

Table 2: Pressure Values

C. Arduino Uno Interface

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz

quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

Arduino controls the process of whole system like reading pulses form Heart beat and pressure sensor module, calculating heart rate and sending this data to database. Both the sensor modules are controlled by Arduino interface and the collected data from the Arduino is stored and analyzed. The data retrieved from the Arduino will be checked for the threshold value and if the limit exceeds, indication through GSM will be given to the doctor.

D. GSM

GSM (Global System for Mobile Communications, originally Group Special Mobile), is a standard set developed by the European Telecommunications Standards Institute (ETSI) to describe technologies for second generation (2G) digital cellular networks. Developed as a replacement for first generation (1G) analog cellular networks, the GSM standard originally described a digital, circuit switched network optimized for full duplex voice telephony. The standard was expanded over time to include first circuit switched data transport, then packet data transport via GPRS (General Packet Radio Services). Packet data transmission speeds were later increased via EDGE (Enhanced Data rates for GSM Evolution) referred as EGPRS. The GSM standard is more improved after the development of third generation (3G) UMTS standard developed by the 3GPP. GSM networks will evolve further as they begin to incorporate fourth generation (4G) LTE Advanced standards. "GSM" is a trademark owned by the GSM Association.

VII. RESULTS

A. Snapshots



Fig. 2: Heart Rate Sensor Output

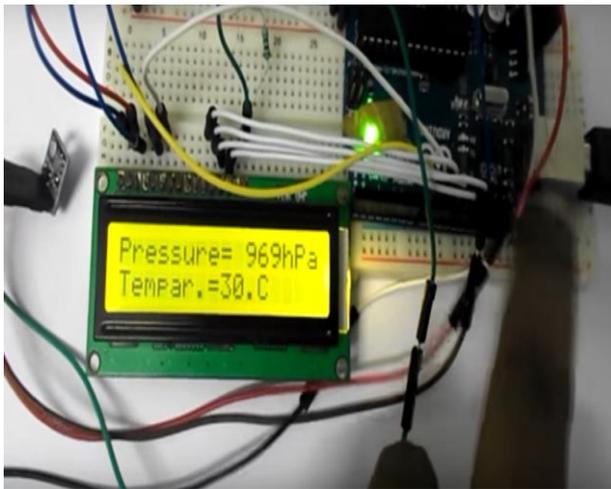


Fig. 3: Pressure Sensor Output

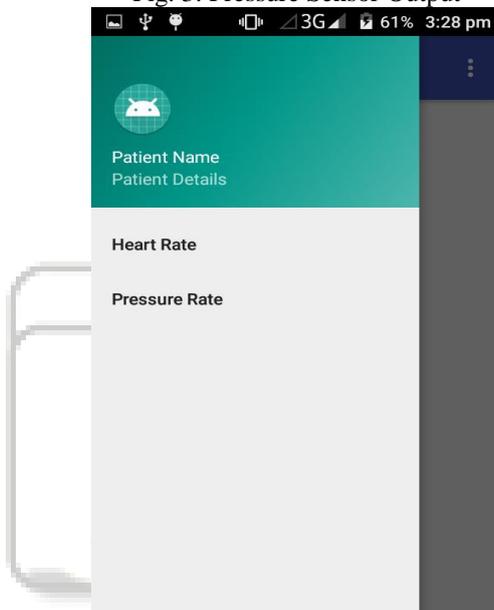


Fig. 4: Android App

VIII. CONCLUSION

The system is developed in such a way that it can be implemented for monitoring heart beat and pressure level of patients in real time. It is helpful for Monitoring Heart beat and pressure especially for bed ridden patients. Immediate alert will be given to the care taker, doctor and ambulance based on the severity level of the patient. It reduces manual work and results can be predicted effectively. It is ergonomic and cost effective when compared to manual work in taking care of the patients. The status of the patient can be viewed with the help of the android application.

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