Real Time Health Monitoring System using Arduino

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Abstract

The main focus of the method is to implement a prototype model for the real time patient monitoring system. The proposed method is used to measure the physical parameters like body temperature, heart beat rate, and oxygen level monitoring with the help of biosensors. Conventionally there are number of techniques available for the ICU patient's health monitoring system with wired communication technology. In the novel system the patient health is continuously monitored and the acquired data is transmitted to an using Wi-Fi wireless sensor networks. Embedded processor supports for analyzing the input from the patient and the results of all the parameters are stored in the database. If any abnormality felt by the patient indications will send to the medical officials. The implementation of the system is achieved by the advanced ARDUINO microcontroller and simulation results are obtained.

1. Introduction

Now Recently wireless sensor networks (WSN) play a vital role in the research, technological community hence resulting in the development of various high-performance smart sensing system. Many new research is focused at improving quality of human life in terms of health by designing and fabricating sensors which are either in direct contact with the human body (invasive) or indirectly (noninvasive) in contact. Health monitoring is an informal, non-statutory method of surveying your workforce for symptoms of ill health, including lower back pain. This type of occupational health management system can enable you, as an employer, to be aware of health problems and intervene to prevent problems being caused or made worse by work activities. Another important role of health monitoring is to give feedback into a system that reviews the current control methods in place.

In addition, there are specific regulations dealing with manual handling and whole body vibration in the workplace. To ensure you are complying with your duties under these regulations you should refer to HSE (health system engineering) guidance, if manual h andling or whole body vibration are risks in your workplace. Whole body vibration is particularly prevalent in those that drive industrial and parameters and the sampled parameters are wireless.

1.1 Importance of biomedical engineering

The development of biomedical engineering is responsible for improving healthcare diagnosis,

monitoring and therapy. The novel idea behind Health line is to provide quality health service to one and all. The idea is driven by the vision of a cable free biomedical monitoring system. On body sensors monitor the vital parameters (blood pressure, ECG, temperature and heart beat rate) and transmits the data to doctor's end via wireless communication network. Periodic health monitoring (or preventative care) allows people to discover and treat health problems early, before they have consequences. Especially for risk patients and long term applications, such a technology offers more freedom, comfort, and opportunities in clinical monitoring.

1.2 Use of vital signals in health analysis

Chronic diseases have a significant influence on healthcare where cost of curing chance of attack is common among people. Changes in demographic structure and lack of health and social care personnel force us to study new innovations, which could over a relief to these challenges.

Elderly people have to make frequent visits to their doctor to get their vital signs measured. Regular monitoring of vital signs is essential as they are primary indicators of an individual's physical wellbeing.

These vital signs include,

    a. Pulse rate

    b. Blood pressure

    c. Body temperature

The goal is to develop a low cost, low power, reliable, non-intrusive, and non-invasive vital signs monitor which collect different type of body and the sampled parameters are wireless.

sensing and data conditioning system to acquire accurate heart rate, ECG, blood pressure, and body temperature readings. After processing of data we have to find a proper method of transmission and signal display. Remote patient monitoring (RPM) is a technology to enable monitoring of patients outside of conventional clinical settings (e.g. in the home), which may increase access to care and decrease healthcare delivery costs.

1.3 Remote Patient Monitoring

Incorporating RPM in chronic disease management can significantly improve an individual's quality of life. It allows patients to maintain independence, prevent complications, and minimize personal costs. RPM facilitates these goals by delivering care right to the home. In addition, patients and their family members feel comfort knowing that they are being monitored and will be supported if a problem arises. This is particularly important when patients are managing complex self-care processes such as home hemodialysis.

Physiological data such as blood pressure and subjective patient data are collected by sensors on peripheral devices. Examples of peripheral devices are: blood pressure cuff, pulse ox meter, and glucometer. The data are transmitted to healthcare providers or third parties via wireless telecommunication devices. The data are evaluated for potential problems by a healthcare professional or via a clinical decision support algorithm, and patient, caregivers, and health providers are immediately alerted if a problem is detected. As a result, timely intervention ensures positive patient outcomes. The newer applications also provide education, test and medication reminder alerts, and a means of communication between the patient and the provider.

1.4 Challenges in ICU

The intensive care unit (ICU) is one of the major components of the current health care system.

The advances in supportive care and monitoring resulted in significant improvements in the care of surgical and clinical patients. Nowadays aggressive surgical therapies as well as transplantation are made safer by the monitoring in a closed environment, the surgical ICU, in the post-operative period. Several measures of ICU performance have been proposed in the past 30 years. It is intuitive, and correct, to assume that ICU mortality may be a useful marker of quality.

The complex task of collecting and analyzing data on performance measures are made easier when clinical information systems are available. Although several clinical information systems focus on important aspects as computerized physician order entry systems and individual patient tracking information, few have attempted to gather clinical information generating full reports that provide a panorama of the ICU performance and detailed data on several domains .

1.5 Gathering vital signals

Pulse is the rate at which your heart beats. Your pulse is usually called your heart rate, which is the number of times your heart beats each minute (bpm). But the rhythm and strength of the heartbeat can also be noted, as well as whether the blood vessel feels hard or soft. Changes in your heart rate or rhythm, a weak pulse, or a hard blood vessel may be caused by heart disease or another problem.

As your heart pumps blood through your body, you can feel a pulsing in some of the blood vessels close to the skin's surface, such as in your wrist, neck, or upper arm. Counting your pulse rate is a simple way to find out how fast your heart is beating.

The normal core body temperature of a healthy, resting adult human being is stated to be at 98.6 degrees Fahrenheit or 37.0 degrees Celsius. Though the body temperature measured on an individual can vary, a healthy human body can maintain a fairly consistent body temperature that is around the mark of 37.0 degrees Celsius.

The normal range of human body temperature varies due to an individual's metabolism rate, the higher (faster) it is the higher the normal body temperature or the slower the metabolic rate the lower the normal body temperature. Other factors that might affect the body temperature of an individual may be the time of day or the part of the body in which the temperature is measured at. The body temperature is lower in the morning, due to the rest the body received, and higher at night after a day of muscular activity and after food intake.

Body temperature also varies at different parts of the body. Oral temperatures, which are the most convenient type of temperature measurement, is at 37.0 °C. This is the accepted standard temperature for the normal core body temperature. Axillary temperatures are an external measurement taken in the armpit or between two folds of skin on the body. This is the longest and most inaccurate way of measuring body temperature, the normal temperature falls at 97.6 °F or 36.4 °C. Rectal temperatures are an internal measurement taken in the rectum, which fall at 99.6 °F or 37.6 °C. It is the least time consuming and most accurate type of body temperature measurement, being an internal measurement. But it is definitely, by far, not the most comfortable method to measure the body temperature

1.6 Internet of Things in health monitoring

The Internet of Things(IoT) and Smart Grid are of great importance in promoting and guiding development of information technology and economic. At Present, the application of the IoT develops rapidly, but due to the special requirements of some applications, the existing technology can not meet them very good. Much research work is doing to build IoT . WiFi-based Wireless Sensor Network(WSN)

has the features of high bandwidth and rate, non-line-transmission ability, large-scale data collection and high cost-effective, and it has the capability of video monitoring, which can not be realized with ZigBee. The research on WiFi-based WSN and its application has high practical significance to the development of the Internet of Things and Smart Grid. Based on the current research work of applications in the Internet of Things and the characteristics of WiFi-based WSN, this paper discusses the application of WiFi-based WSN in Internet of Things, which includes Smart Grid, Smart Agriculture and Intelligent environment protection.

Monitoring Systems and Sensors systems have increased in importance over the years. However, increases in measurement points mean increases in installation and maintenance cost. The development work of a Wi-Fi based Smart Wireless Sensor Network for monitoring an Agricultural Environment. The system is capable of intelligently monitoring agricultural conditions in a pre-programmed manner. The system consists of three stations: Sensor Node, Router, and Server. The system is designed for monitoring of the climate condition in an agricultural environment such as field or greenhouse, the sensor station is equipped with several sensor elements such as Temperature, humidity, light, air pressure, soil moisture and water level. In addition investigation was performed in order to integrate a novel planar electromagnetic sensor for nitrate detection. The communication between the sensor node and the server is achieved via 802.11g wireless modules.

Sensors are used for measurements and for acquisition of data but they require an effective data transfer mechanism to enable full-fledged applications that utilize the data they collect Embedded systems is one of the most important, yet overlooked subjects in the electronics world. When you think technology, mobile phones, tablets and laptops come to mind, but the devices that actually help us in our daily lives are not talked too much about. They're often confused with larger or more general purpose computers, and it's sometimes difficult to discern between one and the other.

1.7 Embedded Processors used in real time

An embedded system is a computer system, made from a combination of hardware and software that is used to perform a specific task **.**

A lot of embedded systems are created with time constraints in mind. In some situations, crossing time limits might not amount to much, but in some, it may actually be a disaster. For example, if the embedded system in a car's braking system doesn't strictly adhere to time, it may result in an accident. However, if a time limit is passed on something less severe, it may just result in reduced performance.

The processors found in common personal computers (PC) are general-purpose or universal processors. They are complex in design because these processors provide a full scale of features and a wide spectrum of functionalities. They are designed to be suitable for a variety of applications.

On the other hand, another class of embedded processors focuses on performance. These embedded processors are powerful and packed with advanced chip-design technologies, such as advanced pipeline and parallel processing architecture. These processors are designed to satisfy those applications with intensive computing requirements not achievable with general-purpose processors. Overall, system and application speeds are the main concerns.

Data storage is the process of ensuring that research data is stored, archived or disposed of in a safe and secure manner during and after the conclusion of a research project. This includes the development of

policies and procedures to manage data handled electronically as well as through non-electronic means. Proper planning for data handling can also result in efficient and economical storage, retrieval, and disposal of data. In the case of data handled electronically, data integrity is a primary concern to ensure that recorded data is not altered, erased, lost or accessed by unauthorized users.

All the above survey insist the need of real time health monitoring system which helps in critical situations.

2.Existing Methodology

Different methodologies for measuring the signals are studied and their limitations are analyzed as follows.

2.1 RFID Tag & Reader

In this method using different types of RFID tags [8] to monitor the patients' health by standing in front of the RFID reader information about the health can be measured and all the details will be collected by the concentrator and the data's will be stored in the PC database. Continuous monitoring cannot be done and it takes more period of time to measure the individual person's health.
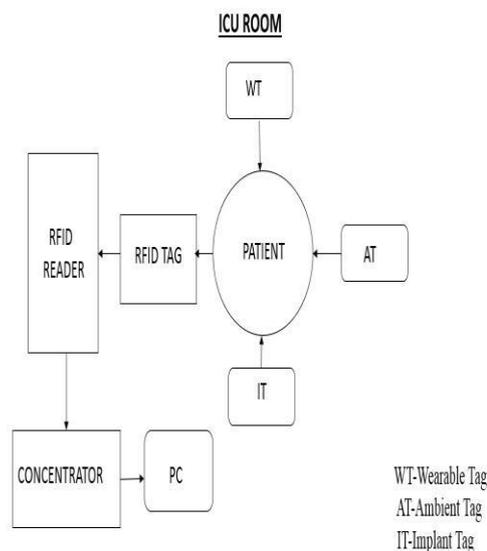

Fig 1 Block Diagram of RFID tag and Reader

There are some shortcomings present in existing system. The patient is monitored in ICU and the data transferred to the PC is wired. Such systems become difficult where the distance between System and PC is more. The available systems are huge in size. Regular monitoring of patient is not possible once he/she is discharged from hospitals. These systems cannot be used at individual level. The other problem with these systems is that it is not capable of transmitting data continuously also range limitations of different wireless technologies used in the systems.

3. Proposed methodology

The limitations in existing methodology are studied .The proposed methodology overcomes by continuous monitoring of patients, useful for multiple patients, database report maintenance and indication to concerned medical officials.

3.1 Proposed Method Description

In this method we used the system of techniques available for the ICU patient's health

monitoring system with wired communication technology. In the novel system the patient health is continuously monitored and the acquired data is transmitted to an using Wi-Fi wireless networks. In future we can expand this system by using RFID technology through this technology we can monitor the multiple numbers of patients. They are implemented in the advanced Arduino microcontroller. The below shows the block diagram of the proposed method.

The patients in the ICU room can be continuously monitored by sensing the parameters like temperature, heart beat rate, gas level with wired

The signals sensed from the patients is millivolt but the sensors volt will be 5v sensors will have the amplifiers the sensed signals is amplified and it won't cause harm to human health .then the signals are send to the Arduino .Using WI-FI module the results will be continuously transmit to internet of thing and the data will be stored directly to the database and if any abnormality the indication will be send to medical officials.

Health monitoring is an informal, non-statutory method of surveying your workforce for symptoms of ill health, including lower back pain. This type of occupational health management system can enable you, as an employer, to be aware of health problems and intervene to prevent problems being caused or made worse by work activities.
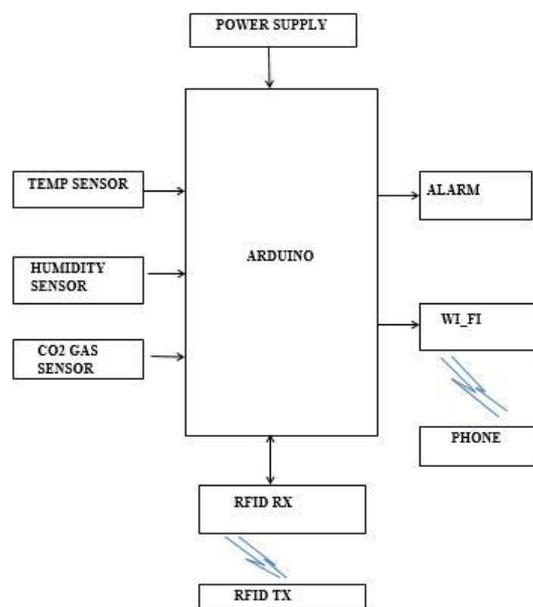

Fig 2 Block Diagram of proposed method

3.2 Block diagram descriptions Patient:

Another important role of health monitoring is to feedback into a system that reviews the current control methods in place.

In addition, there are specific regulations dealing with Manual Handling and whole body vibration in the workplace. To ensure you are complying with your duties under these regulations you should refer to HSE guidance, if manual handling or whole body vibration are risks in your workplace. Whole body vibration is

particularly prevalent in those that drive industrial and agricultural vehicles.

The novel idea behind Health line is to provide quality health service to one and all. The idea is driven by the vision of a cable free biomedical monitoring system. On body sensors monitor the vital parameters (blood pressure, ECG, temperature and heart beat rate) and transmits the data to doctor's end via wireless communication network. Periodic health monitoring (or preventative care) allows people to discover and treat health problems early, before they have consequences. Especially for risk patients and long term applications, such a technology offers more freedom, comfort, and opportunities in clinical monitoring.

Chronic diseases have a significant influence on healthcare costs and are common among people. Regular monitoring of vital signs is essential as they are primary indicators of an individual's physical wellbeing.

3.3 Temperature rate monitoring:

Temperature sensor is used to measure temperature with an electrical output proportional to the temperature (in ^{o}C). Temperature Sensor module is based on the semiconductor LM35 temperature sensor. The LM35 Linear Temperature Sensor module can be used to detect ambient air temperature. This sensor is produced by National Semiconductor Corporation and offers a functional range between -40 degree Celsius to 150 degree Celsius

3.4 Heart beat rate monitoring:

A heart beat rate monitor is a personal monitoring device that allows one to measure one's heart rate in real time or record the heart rate for later study. It is largely used by performers of various types of physical exercise. The normal resting adult human heart rate ranges from 60–100 bpm.

3.5 Gas detection:

A gas detector is a device that detects the presence of gases in an area, often as part of a safety system. This type of equipment is used to detect a gas leak and interface with a control system so a process can be automatically shut down.

Gas Sensors [7] are used to measure physical quantities such as temperature, light, pressure, sound, and humidity. They send signals to the processor.

3.6 Arduino:

Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures microcontroller-based kits for building digital devices and interactive objects that can sense and control objects in the physical world.

The first Arduino was introduced in 2005, aiming to provide an inexpensive and easy way for novices and professionals to create devices that interact using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.

3.7 Transmitting and Receiving Signal:

HT12D & HT12E is a 2^{12} series decoder IC (Integrated Circuit) for remote control applications manufactured by Holtek. It is commonly used for radio frequency (RF) wireless applications. By using the paired HT12E encoder and HT12D decoder we can transmit 12 bits of parallel data serially.

3.8 Data storage:

Data storage is the process of ensuring that research data is stored, archived or disposed of in a safe and

secure manner during and after the conclusion of a research project. This includes the development of policies and procedures to manage data handled electronically as well as through non-electronic means.

4. Results and tabulation

4.1 Results

Using Proteus software the temperature rate and heart beat rate is measured by sensing the information.

At normal condition, no indication will be produced. At abnormal condition, indication will be produced either by buzzer alert or cooling fan. If the temperature rate is upto 37^0C the result will be at normal state. Then if the temperature exceeds above or falls below 37^0C the cooling fan starts to rotate. If the heart beat rate is upto 60-100 beats /min the result will be at normal state. Then if the heart rate exceeds above 100 beats/min or falls below 60 beats/min the cooling fan starts to rotate

4.2 Tabulation

This is the tabulation results obtained using Proteus for different patient's temperature and heart rate using temperature and heart rate sensor is given by,

Table 4.1: Temperature and Heart Beat Rate

Database

No.of reading	Temperature (^{0}C)	Condition	Heart beat rate (beats/min)	Condition
1	37	Normal	51-60	Alert
2	37	Normal	60-70	Normal
3	38	Alert	70-90	Normal
4	39	Alert	100	Normal
5	38	Alert	102	Alert
6	37	Normal	67	Normal

5.Conclusion & Future Work

5.1 Conclusion

The progress in bio medical engineering, science and technology paved way for new inventions and technologies. As we are moving towards miniaturization, handy electronic components are in need. New products and new technology are being invented. ARDUINO was found to be more compact, user friendly and less complex, which could readily be used in order to perform several tedious and repetitive tasks.

Simulation is performed using Proteus software by placing appropriate sensors like temperature and heart beat rate for sensing the health condition and the results are analyzed under normal conditions and abnormality conditions.

5.2 Future Work

Real time heath monitoring system using ARDUINO can be implemented in hardware using different types of sensors to detect the health conditions of the patients in critical sites continuous monitoring of health

can be made and the data's will be stored in database.

In future, a portable health monitoring system can be designed using Arduino.

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