

Patient Health Monitoring System using IOT and Android

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Abstract

As elderly population increases day by day caretaking demands are also increasing. Hence patient health monitoring systems are gaining importance these days. This paper is based on monitoring of patients. We have designed and developed a reliable, energy efficient patient monitoring system. It is able to send parameters of patient in real time. It enables the doctors to monitor patient's health parameters (temp, heartbeat, ECG, position) in real time. In the current proposed system the patient health is continuously monitored using different sensors which is connected to the Arduino board. And the acquired data is send to the server using Ethernet shield attached to the Arduino board. If any of the parameter values goes beyond the threshold value an alert is given to the doctor using an Android application installed in the doctor's smartphone.

Keywords: Internet of Things (IOT), Arduino Board, Android, Sensor, Health parameters

I. INTRODUCTION

Health is one of the global challenges for humanity. According to the constitutions of World Health Organization (WHO) the highest attainable standard of health is a fundamental right for an individual.

In hospitals there are provisions for continuous monitoring of patients. Their ECGs, heartbeat...are continuously monitored. There is no provision to check the parameters when they return to home. And hence there is a chance that the disease may return again. Patient's data (temperature, heart rate, ECG, position) will be frequently measured and sent to server. Period of sending (say every 1 min) can be set. Monitoring person learns patient specific threshold. Say the regular body temperature of a patient is 37 c whereas one person feels feverish if his body temperature is 37.0°C. By employing an averaging technique over a relatively long time, Observer can learn these thresholds for patients [1]. Using Android Application in doctor's smart phone, doctor can view his patient's health status. When any of the parameter goes beyond the threshold value he will get an alert notification.

Using Andriod Application in patient's or his caretaker's smart phone the patient can view his health status. Early detection and diagnosis of potentially fatal physiological conditions such as heart attack require continuous monitoring of patients health following transfer from hospital to home. Studies have shown that 30% of patients with a discharge diagnosis of heart failure are

readmitted at least once within 90 days with readmission rates ranging from 25 to 54% within 3 – 6 months. In response to these types of needs, health monitoring systems are being proposed as a low cost solution. Such a system consists of physiological data that stores, process and communicate through a local manner such as smart phones, personal computers. Such systems should satisfy strict safety, security, reliability, and long-term real-time operation requirements [2].

In the proposed system we present a health monitoring system that uses the sensors for collecting data from patients, intelligently predicts patient's health status and provides feedback to doctors through their mobile devices having android application. The patients will participate in the health care process by their mobile devices and thus can access their health information from anywhere any time. Today Internet has become one of the important part of our daily life. It has changed how people live, work, play and learn. Internet serves for many purpose educations, finance, Business, Industries, Entertainment, Social Networking, Shopping, E-Commerce etc. The next new mega trend of Internet is Internet of Things (IOT). Visualizing a world where several objects can sense, communicate and share information over a Private Internet Protocol (IP) or Public Networks. The interconnected objects collect the data at regular intervals, analyse and used to initiate required action, providing an intelligent network for analyzing, planning and decision making. This is the world of the Internet of Things (IOT). The IOT is generally considered as connecting objects to the Internet and using that connection for control of those objects or remote monitoring. But this definition was referred only to part of IOT evolution considering the machine to machine market today. But actual definition of IOT is creating a brilliant, invisible network which can be sensed, controlled and programmed. The products developed based on IOT include embedded technology which allows them to exchange information, with each other or the Internet and it is assessed that about 8 to 50 billion devices will be connected by 2020. Since these devices come online, they provide better life style, create safer and more engaged communities and revolutionized healthcare. The entire concept of IOT stands on sensors, gateway and wireless network which enable users to communicate and access the application/information.

II. PROBLEM DEFINITION

In today's social insurance framework for patients who stays in home during post operational days checking is done either via overseer/ medical caretaker. Ceaseless observing may not be accomplished by this system, on the grounds that anything can change in wellbeing parameter inside of part of seconds and amid that time if guardian/attendant is not in the premises causes more noteworthy harm. So with this innovation created period where web administers the world gives a thought to add to another keen health awareness framework where time to time constant checking of the patient is accomplished [2].

III. RELATED WORK

Data is to be transmitted to remote location as per our projects main requirement. There are various communication technologies used for data transmission these are ZIG-BEE, BLUETOOTH, GSM, and GPRS. ZIG-BEE is used to create personal area networks built from small, low-power digital radios. It is based on an IEEE 802.15 standard. It has Short-range wireless transfer of data at relatively low rates. It transmits data over longer distances by passing data through intermediate devices to reach more distant ones. It has Low data rate, long battery life, and secure networking applications. It's Data Rate of 250 kbit/s. but zigbee is not suitable for medical application Zig-Bee may not be suitable for transmitting vital signs, especially for emergency messages, since these messages are critical for diagnosing the illness of patients as well as providing important clues to the urgency level[1].

IV. SYSTEM AND OVERVIEW

The Block diagram of the proposed system is shown in Fig1.1. The sensors Temperature, ECG, Heartbeat and Accelerometer is connected to the Arduino board. The values from the Microcontroller is given to the Web Server using Ethernet Shield. The parameter values can be viewed by the Android Application installed in doctors and patient's smart phone.

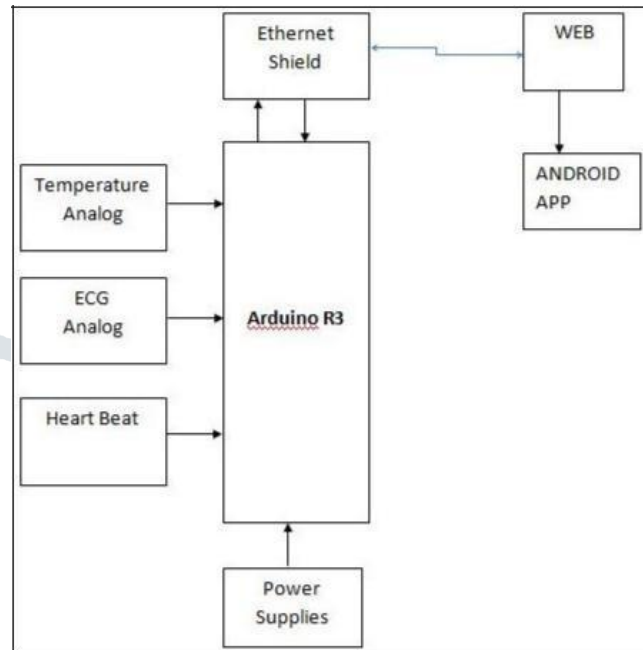


Fig. 1: Block Diagram

In our system Arduino Board is used. The microcontroller is connected with all other hardware units in the module.

A. *The Lm35 Temperature Sensor:*

The LM35 series are precision integrated circuit LM35 temperature sensors, whose output voltage is linearly proportional to the temperature in Celsius (Centigrade). The LM35 sensor thus has an advantage over linear temperature sensors, calibrated in °Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient centigrade scaling. The LM35 sensor does not require any external calibration or trimming to provide typical accuracies of $\pm 1/4^\circ\text{C}$ at room temperature and $\pm 3/4^\circ\text{C}$ over a full -55 to $+150^\circ\text{C}$ temperature range. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. As it draws only $60\ \mu\text{A}$ from its supply, it has very low self-heating, less than 0.1°C in still air.

B. *Ecg Sensor:*

ECG is primarily a tool for examination of cardiac diseases. An ECG sensing device commonly consists of a group of electrodes to detect electrical events of a heart. The ECG is the electrical manifestation of the contractile activity of the heart, and can be recorded fairly easily with surface electrodes on the limbs or chest. The rhythm of the heart in terms of beats per minute (BPM) may be easily estimated by counting the readily identifiable waves. The amplifier takes the input from 3 electrodes which are connected to the patient.

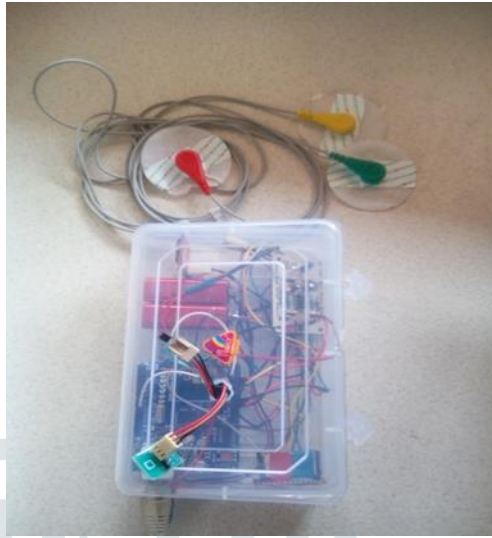


Fig. 1.2: Hardware Components

C. *Heartbeat Sensor:*

Heart beat sensor is designed to give digital output of heart beat when a finger is placed inside it. This digital output can be connected to Arduino directly to measure the Beats per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger each pulse. IC LM358 is used for this sensor. Its dual low power operational amplifier consists of a super bright red LED and light detector. One will act as amplifiers and another will be used as comparator. LED needs to be super bright as the light must pass through finger and detected at other end. When heart pumps a pulse of blood through blood vessels, finger becomes slightly more opaque so less light reach at the detector. With each heart pulse, the detector signal varies which is converted to electrical pulse [3].

D. *Accelerometer Sensor:*

For measuring the patient's activity and guarding against the possibility of falling down, an ADXL213 Accelerometer Sensor is used. It's low cost, $\pm 1.2g$ Dual and measures both static (Gravity) and dynamic acceleration (Vibration). The accelerometer is used in order to determine whether the patient is stable and is in good position (standing or sitting) or has fallen down (sudden vertical change of the position). This sensor provides a digital output. The Duty cycles of the digital signals are proportional to acceleration and the typical noise floor is 160 g/Hz.

V. CONCLUSION AND FUTURE WORK

By using the system the healthcare professionals can monitor, diagnose, and advice their patients all the time. The health parameters data are stored and published online. Hence, the healthcare professional can monitor their patients from a remote location at any time. Our system is simple.

The Future work of the project is very essential inorder to make the design system more advanced. In the designed system the enhancement would be connecting more sensors to internet which measures various other health parameters and would be beneficial for patient monitoring i.e. connecting all the objects to internet for quick and easy access. Establishing a Wi-Fi mesh type network to increase in the communication range [1].

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