

# Arduino Based Health Reconnoitre System

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**ABSTRACT:** In today's scenario, health care problems are increasing at a very high pace like coronary heart diseases, obesity, lung failures causing death rate of 7.2 million people per year hence it is the need of the hour to overcome from all such problems [1]. Our health care providers have developed an intelligent and low cost health monitoring system to provide more comfortable life for people suffering from such chronic diseases using advanced technologies like wireless communications, embedded computations, wearable and portable remote health monitoring system. As a result need for repetitive doctor visits are decreased as the information reaches from everywhere. Implementation of wireless communication technologies in monitoring systems is now easier because of its patient friendly manner[4].

**KEYWORDS:** ECG, Systolic rate, Diastolic rate, IoT, GSM.

## I. INTRODUCTION

Wireless technology is ruling worldwide and has invaded the medical area with wide range of scope and capabilities. To monitor continuous medicare conditions of patient using existing wireless technologies were quite convoluted. To overcome this, we are proposing a change in wireless sensor technology by designing a biomedical monitoring device comprised of different sensors to acquire the information regarding human body temperature, heart rate, blood pressure, lung capacity which is sent to a personal vitality measurement system and further transmit this information on an IOT server which is user accessible over the internet. An online database of patient is created which can be monitored remotely and analysed to know about patient's health history, so there is no need for a doctor to visit the patient periodically. The data is saved on the server permanently which is later on beneficial too. Hence the device can be used by doctors to monitor the data being sent regularly and analyzing the patterns to alert the patient in case of any predicted anomaly This paper proposes a real time monitoring system which is capable of extracting medical information regarding multiple vitals such as, blood pressure, temperature, lung capacity and heart rate periodically and the information is further transmitted on an IOT server through GSM technology via 2G /3G. Also the proposed system has an ability to generate alerts which are automatically sent to doctors, emergency services and family members in case of any abnormal activity is detected[4].

Various Biomedical sensors have been used as AD8232 ECG sensor is used for remote ECG monitoring by connecting ECG electrodes to the recording unit with cables. Blood pressure sensor (4811) is used to measure systolic and diastolic pressure and pulse rate for few seconds. LM35 temperature sensor is used to measure skin surface temperature as it is more accurate than a thermistor and lung capacity is measured using an arrangement of fan with motor like spirometry.

## II. RELATED WORK

Current System Medical science is expanding by leaps and bounds in the last couple of decades for their considerable aim towards wireless and e-health monitoring systems providing remote monitoring of patients. But the tools used to deal with health conditions are tedious to maintain and limited to specific number of parameters. The systems being complex and laborious to operate also raise the cost of health care services and hospital expenses which is not affordable to economically challenged community.

In early 1960's, Kadish used a system, which includes several things namely glucose sensor, a processor and a pump to control glycerin in patients with diabetes. To manage complex situations, the pump will need several MEMS based sensors to monitor more parameters like glucose, heart rate, temperature and ECG etc. [5].

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Multi parameter constant vital signs monitors are available in intensive care setting since early 1960s. These medical devices are actually developed upon the introduction of microprocessor technologies in 1970s [5]

Wireless sensors and sensor networks are playing a vital role in scientific, technological and research fields. Though sensor networks have been using since several years, the wireless applications brought drastic changes in the development of sensors. Many new researches are going on to design new sensors which make direct or indirect contact with human body to improve the quality of human life.[6]

In 2011, Remya Ravindran and Pradeep Kumar Jaisal developed a concept to measure ECG, temperature of a patient and wireless ZigBee data transmission. This wireless sensor belt is used to measure ECG, respiratory rate and skin temperature. It employs ZigBee technology that is very well suitable for the transmission of small amounts of data like sampled values of ECG signals[5].

Reza S. Dilmaghani in the year 2011 described the design of Wi-Fi sensor network that is capable of monitoring patient's chronic diseases at their home itself via a remote monitoring system. By using a remote monitoring wireless system and network nodes, usage of PC can be avoided. These nodes are connected to a central node via internet connection which is located at the hospital. The captured signals are transmitted to an access point through wireless network which operates on 2.4 GHz frequency. The access point is also a small device connected to internet via asynchronous digital subscriber line (ADSL). With the help of ADSL, the data is transmitted to the hospital through internet for real time analysis and storage.[6]

Choi et al describes the development of a wearable sensor platform to monitor a number of physiological correlates of mental stress. The adjustments in both system design and sensor selection to balance information content and wearability is detailed. [8]

Jun et al also describes the architecture of a wearable ECG monitor that is patient location independent and provides continuous monitoring. The signals from the sensors are transmitted using Bluetooth to the smart phone in its area, which can in turn be send to the destination via internet[9]

Xin Liu et al proposes a power and area efficient electrocardiogram (ECG) acquisition and signal processing application sensor node for wireless body area networks (WBAN). This sensor node can accurately record and detect the QRS peaks of ECG waveform with high-frequency noise suppression. The proposed system is implemented in 0.18- $\mu\text{m}$  complementary metal-oxide-semiconductor technology with two chips: analog front end integrated circuit (IC) and digital application specific integrated circuit (ASIC). Therefore, this ECG sensor node is convenient for long-term monitoring of cardiovascular condition of patients, and is very suitable for on-body WBAN applications[10].

Otto, Jovanov and Milenkovic in their paper describe a prototype system for continual health monitoring at home. The system consists of a modest wireless body area network (WBAN) and a home health server. The sensors of the WBAN monitor user's heart rate, mobile and locomotive activity and upload the information with time-stamp to the home server at regular intervals of time. The home server may integrate this information into the local database for the user's inspection or it may forward the information further to a medical-server[11].

Bachmann et al describes the idea of low-power wireless sensor nodes for biomedical applications that are capable of operating autonomously or on very small batteries. Component level power optimization for the radio and digital signal processing is described in the paper along with a short comparison between radio power consumption and on-node processing[12].

Abdalla et al provides several solutions for improving the reliability and the power management of realtime of real-time multi-patient monitoring systems. A reliable wireless Personal Area Network based on digital signal processing has been developed using sleep strategy and other techniques like dynamic voltage and frequency scaling to achieve low power management and assisted power control. Results show that this approach has been successful in outperforming the single WPANs in terms of efficiency and reliability[13].

Raut and Giripunje give a novel wireless data collection system for health monitoring of patients based on PIC controller and wireless sensors. The exclusive characteristics of this system such as low power, low cost, and high flexibility make them ideal for this application[14].

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## III. VARIOUS BIOMEDICAL PARAMETERS

### BLOOD PRESSURE

- Blood pressure is the pressure of the blood in the arteries. The heart contracts and expands when it beats. Contraction pushes the blood through the arteries to body, and this force creates pressure on the arteries. Blood pressure is measured as high blood pressure and low blood pressure which called systolic pressure (as the heart beats) and the diastolic pressure (as the heart relaxes between beats). The unit which measures this is called Sphygmomanometer [9].
- **Classification of blood pressure for adults (18 years and older)**

	<b>Systolic (mm Hg)</b>	<b>Diastolic (mm Hg)</b>
<b>Hypotension</b>	< 90	< 60
<b>Desired</b>	90–119	60–79
<b>Prehypertension</b>	120–139	80–89
<b>Stage 1 Hypertension</b>	140–159	90–99
<b>Stage 2 Hypertension</b>	160–179	100–109
<b>Hypertensive Crisis</b>	≥ 180	≥ 110

Table-1: Standard Blood Pressure range for adult

High blood pressure (hypertension) is related to the serious heart diseases like heart attack, myocardial infraction.

- Blood pressure does not remains same the all the time. It has to be measure at regular interval specially if patient has high Blood Pressure problem, as it affected by various factors including body position, breathing or emotional state, exercise and sleep. Blood Pressure must be measure when the body is relaxed whether sitting or lying down [10].

### ECG (Electrocardiogram)

Electrocardiography (ECG or EKG\*) is the process of recording the electrical activity of the heart over a period of time using electrodes placed on the skin. These electrodes detect the tiny electrical changes on the skin that arise from the heart muscle's electrophysiologic pattern of depolarizing during each heartbeat. It is a very commonly performed cardiology test.

### LUNG CAPACITY

Lung capacity is the amount of air your lungs can hold or the combination of different lung volumes. The lung capacity is measured by blowing a fan with the maximum strength one can, and the power generated in voltage will help to let us know that with how much strength the one has blown the air fan. If the level reaches out of the prior level set, then the patient is having problem in lungs[4].

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## IV. PROPOSED IDEA

The expansion of e-Health monitoring and wireless sensor network has fabricated a meaningful belief towards better health analysis. More than millions of people face high risk of chronic 4 diseases, etc. Thus to overcome such problems, the next generation is assumed to establish an enormous growth in e-health study.

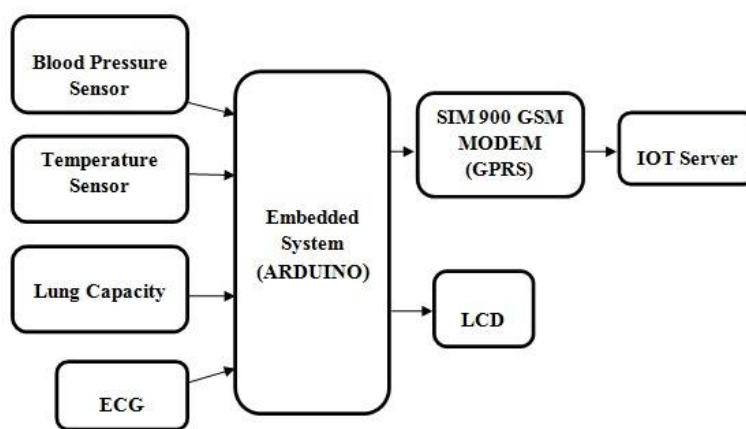


Fig-1 Block diagram of proposed idea

## V. TECHNOLOGY USED

### Processing Software

Programming languages for the visual arts which can help any digital artist create complex animations and interactive installations. Processing is a powerful and fun to use programming language that was initially created to help coding enthusiasts learn the basics of programming but since then, it has evolved into something much more elaborate[16]. Now it is an open source development tool which emphasizes on the visual representation of the code, targeting both advanced users and professionals. The language builds on the Java language, but uses a simplified syntax and graphics programming model. It has User-friendly interface, it retains the advantages of simplicity. The main window is comprised from commonly 13 found elements in any code editor, namely a toolbar, project tabs, text editor, message area and a console[16].

### Internet of Things (IoT)

The Internet of Things (IoT), also called internet of everything. The network is formed by physical objects or "things" which are implanted with electronics, software, sensors. Things or the Objects which are connect through IoT have ability to connect with the things for data exchange with the operator or any other connected devices. IoT is a International's Global Standards Initiative. The Internet of Things allows the connected things or objects to be identified and controlled remotely across the network infrastructure. It helps in creating opportunities for more direct integration between the physical world and computer-based systems.

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## Arduino AVR Microcontroller

Arduino is an open source physical computing platform based on a simple input/output (I/O) board and a development environment that implements the Processing language. Arduino can be used to develop standalone interactive objects or can be connected to software on your computer. Arduino hardware is an open-source circuit board with a microprocessor and input/output (I/O) pins for communication and controlling physical objects (LED, servos, buttons, etc.). The board will typically be powered via USB or an external power supply which in turn allows it to power other hardware and sensors[7].

### VI. EXPERIMENT RESULTS

Biomedical sensors such as LM35, the temperature sensor are used in the proposed system to measure the skin surface temperature which is better to use than a thermistor. Also AD 8232, ECG sensor is used to measure ECG using processing software for the graphical representation of ECG signals or waveforms[4].

4118 Blood Pressure (BP) sensor is used to measure pressure of blood against blood vessel walls or arteries. Not being same all the time, BP changes meeting the body's needs because of factors such as exercise, breathing, body position, sleep or emotional state. Also Heart rate is measure of pulse rate which normally lies between 60-100 beats per minute (bpm).

No Of Observations	Date	Blood Pressure Systolic	Diastolic	Heart Rate (BPM)	Temperature (Celcius)	Lung capacity
1	May 22,2016	110	81	80	29.40	30
2	May 22,2016	90	70	92	27.57	35
3	May 23,2016	120	69	70	30.58	28
4	May 24,2016	130	85	102	26.40	50
5	May 24,2016	105	78	86	28.91	52

Table-2: Observation Table for patients

If the rate crosses 100 bpm, there is production of rapid electrical signals causing CATEGORY SYSTOLIC (mm Hg) DIASTOLIC (mm Hg) Hypotension =  $180 \geq 110 \geq 38$  abnormality. If the rate drops below 60 bpm, it may cause dizziness, fatigue, weakness etc. Therefore, the classification charts of Blood Pressure and Heart Rate are given above in Table-I and II. Also there is a sample of observations taken of an anonymous person in hospital by our proposed VMS for different days and time.

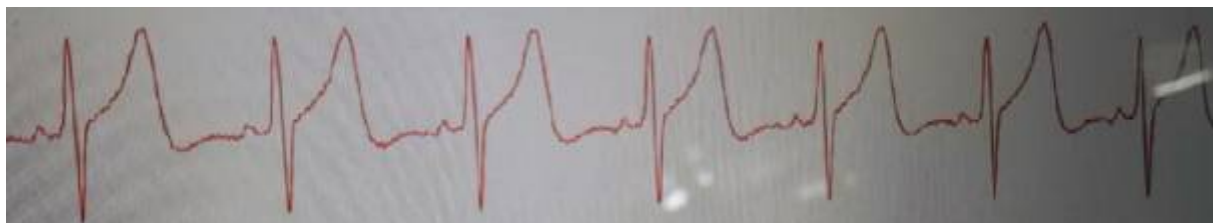


Fig-2: ECG waveform generated by proposed system

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Above figure is the ECG complete wave form which has been generated from our designed hardware. The normal component of ECG waveform are P wave, QRS complex, ST segment, T wave .PR interval, QT interval. QRS complex is the central, the most visual and informative part of ECG that corresponds to depolarization of right and left ventricle. In QRS complex the R-R interval gives idea about heart rate or beat rate.

### VII. CONCLUSION

In the above mentioned system we have proposed a health monitoring system which is GSM based .This system can detect, measure, and analyse various biomedical parameter like ECG, Lung capacity ,BP .Using this system, health care professionals can detect, monitor and prescribe the patients with treatment in real time manner from remote location. The system is simple, power efficient, user friendly and bridges gap between doctor and patients. The patient history, treat ment given and other related records are permanently stored on the server for future references. Therefore, the proposed system decreases intervention time and medical emergencies for patient and also multiple patients can be monitored simultaneously by the doctor. Practical application of the system is superfine in rural areas as there would be no need for the patients to get their continuous follow-ups.

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