

# **To Design and Develop Smart First Aid System for Preliminary Health Care Using IoT**

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**ABSTRACT:**As the world is going for Digital Development, converting all traditional system to IoT based one is major task. When it comes to the health care, bulk of trends are the concern. In many organizations, companies and Government Agencies, first aid kit is use on daily basis. First Aid system are of very basic use .Making advancement in the First Aid system using IoT based health care sensor and to verify the quantity of tools available in the First Aid box is the need of an hour. Smart First Aid System is defined as the integration of multiple health care sensors such as temperature, ECG, blood pressure , heart rate etc into a single assembled pack along with load cell to notify the quantity of the First Aid care available in the kit. As First Aid treatment need more concern due to increasing theft to human health the Many in one approach in this system will help at extent in health care domain. In the field of Artificial Intelligence, scientists have made many enhancements that helped a lot in the development of millions of smart devices. On the other hand, scientists brought a revolutionary change in the field of healthcare and IoT and one of the biggest challenges in it is to provide better first aid treatment. So, having a system which can make this task automated and efficient is the actual need.

## **I. INTRODUCTION**

Use of IoT based devices and sensor is flourishing now a days in almost every vital domain including health care. Increasing demand for preliminary action on daily check up's such as blood pressure ,heart rate, fever ,urgent ECG monitoring due to increase in Heart Attack and other theft to human health need to be diagnose like a First aid treatment. Moreover, to justify the quantity of the Kit material available in First Aid and to continuously monitor that, use of sensor can be implemented.

## **II. PROBLEM DEFINITION**

To Design Smart First Aid System to check Heart Rate, Body Temperature, Blood Pressure, ECG and Quantity of Medicines inside First-Aid system using IOT.

## **III. LITERATURE REVIEW**

At present, the recent technologies for measuring heart rate are consists of several methods using optical and electrical methods. Casually electrical method provides a bulky strap around one's chest

But the optical method requires no such strap and it can be used more effectively. M. M. A Hashem et al. developed a device which uses infrared technology to measure heart rate and use analog temperature sensor to measure body temperature. The main drawback of this approach is that it needs a computer to send data to the web server through the internet.

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Sr No.	Paper Title	Author Details	Technical Details	Remark
1	An IoT-Cloud based smart healthcare monitoring system using container based virtual environment in Edge device	KavitaJaiswal, SrichandanSobhanayak, Ashok Kumar Turuk, BibhudattaSahooL, 2018.	Temperature, ECG, Blood Pressure Sensor, Raspberry Pi, Docker container.	<ul style="list-style-type: none"> <li>- Cost-effective, scalable and supports interoperability and lightweight access.</li> <li>- No user authentication for system security.</li> </ul>
2	Load Cells in Force Sensing Analysis– Theory and a Novel Application.	Ivan Muller, Renato Machado de Brito, Carlos Eduardo Pereira, and ValnerBrusamarello, 2015	Load cells, Arduino, Strain gauge cells	<ul style="list-style-type: none"> <li>(a) Measures accurate weight of system.</li> <li>(b) Suffers from some limitations in and complexity.</li> </ul>

## IV. EXISTING SYSTEM

In the existing system there is no such completeness. It comprises of IoT(Internet Of Things) based sensor in healthcare. Assemblance of system is not present. Sensor like Fingertip, LM35, Blood pressure monitoring ,EGC sensor are not integrated. Load cell is not use in any of First Aid kit system.

Comprises of robust healthcare monitoring system that monitors the patient. Sufficient integrity is the main drawback.

## V. PROPOSED SYSTEM

Use of IoT based devices and sensor is flourishing now a days in almost every vital domain including health care. Increasing demand for preliminary action on daily check up's such as blood pressure ,heart rate, fever ,urgent ECG monitoring due to increase in Heart Attack and other threat to human health need to be diagnose like a First aid treatment. Moreover, to justify the quantity of the Kit material available in First Aid and to continuously monitor that, use of sensor can be implemented.system implements a low cost heart rate and body temperature monitoring system. As well as the quantity of medicines inside a Smart First-Aid System. This system is implemented in Android platform since Android devices are available. The device is portable and light weight so that it can be carried easily anywhere. Through this system it is possible to monitor the heart rate and body temperature continuously It is assumed that all the user of the system have a generalized knowledge to operate the First Aid System without harming it.

### 1. Functional Requirements

Sense the multiple organs of a user through particular sensor as input value.Preprocessing the health related data collected from all of the sensors inside the system.Extract and store the results of the sensors in the Database for further processing and operations.Analyze accuracy of measured data and generate correct and immediate results.Store the converted reading in database for further analysis and report generation.Measure the quantity of the medicines inside the First Aid System.Display the result in the form of Values, Graphs, etc comparing measured data versus expected data.

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Notify the respective Doctor or Guardian about the Health status for instant appointment and treatment.

### 3.5.3 Hardware Requirement

**3.5.3.1 Load Cell** - A load cell is a transducer that is used to create an electrical signal whose magnitude is directly proportional to the force being measured. The various load cell types include hydraulic, pneumatic, and strain gauge.

**3.5.3.2 Arduino** - The Arduino UNO is a widely used open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board features 14 Digital pins and 6 Analog pins. It is programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable.

**3.5.3.3 Strain Gauge Load Cells**- Strain gauge load cells are the kind most often found in industrial settings. This kind of load cell is ideal as it is highly accurate, versatile, and cost-effective. Structurally, a load cell has a metal body to which strain gauges have been secured. The body is usually made of aluminium, alloy steel, or stainless steel which makes it very sturdy but also minimally elastic. This elasticity gives rise to the term "spring element", referring to the body of the load cell. When force is exerted on the load cell, the spring element is slightly deformed, and unless overloaded, always returns to its original shape. As the spring element deforms, the strain gauges also change shape. The resulting alteration to the resistance in the strain gauges can be measured as voltage. The change in voltage is proportional to the amount of force applied to the cell, thus the amount of force can be calculated from the load cell's output.

**3.5.3.4 Fever Click Sensor** - Fever click features a specially designed sensor, which is capable of accurate measurement of human body temperature. This Click board uses the MAX30205 human body temperature sensor with the accuracy rating that complies with the clinical thermometry specifications of the ASTM E1112 standard. The main active component of Fever click is the MAX30205, an integrated human body temperature sensor from Maxim Integrated. This sensor is specifically designed to be used as the human body temperature sensor, featuring accuracy that complies with the clinical thermometry specifications of the ASTM E1112 standard.

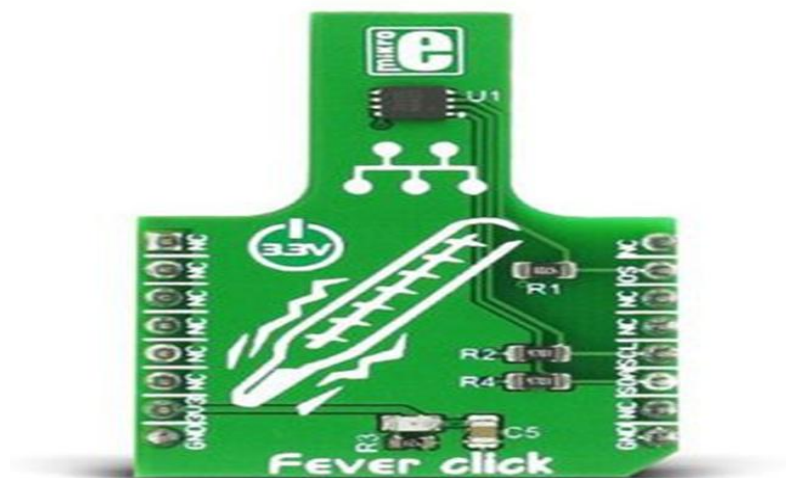


Fig. 3.5.3.4 Fever Click Sensor

### 3.5.3.5 Heartbeat Sensor

The principle behind the working of the Heartbeat Sensor is Photoplethysmograph. According to this principle, the changes in the volume of blood in an organ is measured by the changes in the intensity of the light passing through that organ. Usually, the source of light in a heartbeat sensor would be an IR LED and the detector would be any Photo Detector like a Photo Diode, an LDR (Light Dependent Resistor) or a Photo Transistor. With these two i.e. a light source and a detector, we can arrange them in two ways: A Transmissive Sensor and a Reflective Sensor

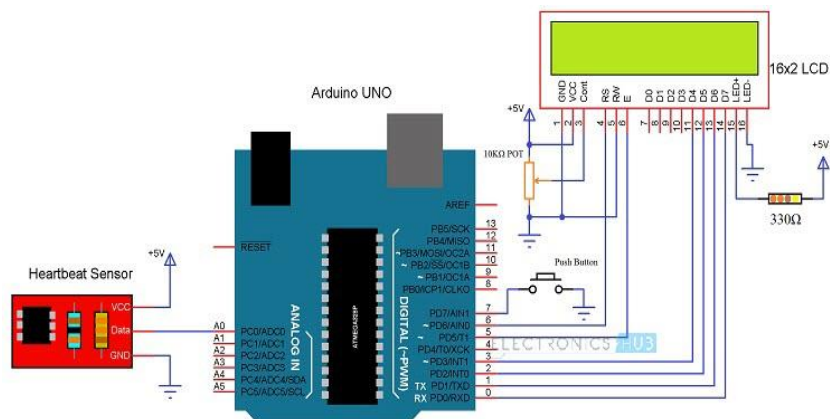


Fig.3.5.3.5 Circuit diagram of Heartbeat sensor

### 3.5.3.6 AD8232 ECG Sensor

The AD8232 Single Lead Heart Rate Monitor is used to measure the electrical activity of the heart. This electrical activity can be charted as an ECG or Electrocardiogram and output as an analog reading. The AD8232 is an integrated signal conditioning block for ECG and other bio-potential measurement applications. It is designed to extract, amplify, and filter small bio-potential signals in the presence of noisy conditions, such as those created by motion or remote electrode placement.

#### PR Interval

The PR interval is the initial wave generated by an electrical impulse traveling from the right atrium to the left. The right atrium is the first chamber to see an electrical impulse. This electrical impulse causes the chambers to "depolarize". This forces it to contract and drain deoxygenated blood from both the Superior and Inferior vena cava into the right ventricle. As the electrical impulse travels across the top of the heart it then triggers the left atrium to contract. The left atrium is responsible for receiving newly oxygenated blood from the lungs.

#### QT Interval

During QRS both ventricles begin to pump. The right ventricle begins to pump de-oxygenated blood into the lungs through the left and right pulmonary arteries. The left ventricle is also beginning to pump freshly oxygenated blood through the aorta and into the rest of the body. After the initial contraction comes the ST segment. Finally the T wave becomes present to actively "re-polarize", or relax the ventricles. This relaxation phase resets the ventricles to be filled again by the atriums.

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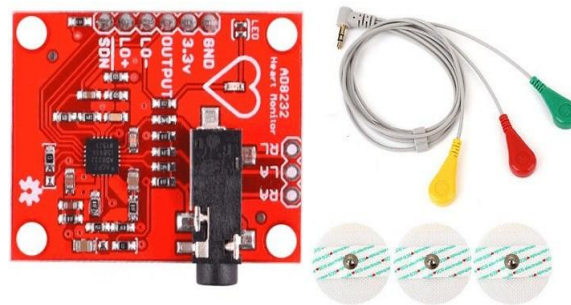


Fig. 3.5.3.6 AD8232 ECG

Sensing attribute that returns the highest information gain (i.e., the most homogeneous branches). This attribute selection methods will play vital role in prediction of crop.

### BP02 Blood Pressure Sensor

Dr Morepen BP-02 Blood Pressure Monitor is a medical device that incorporates new capabilities, enabling users to improve the ease and accuracy of blood pressure monitoring and management for self-care purpose by patient. Uses: Measure Blood pressure of Human body.

Fully automatic blood pressure monitor is a home blood pressure monitor that measures blood pressure, pulse rate and store the result in memory Offers high end technology measures blood pressure on inflation Offers Measurement accuracy of Pressure:  $\pm 3$  MmHg, Pulse:  $\pm 5\%$ . Even useful for patients with larger sized arms



Fig. 3.5.3.7 Blood Pressure Sensor

#### 4. System Design 4.2. Block Diagram

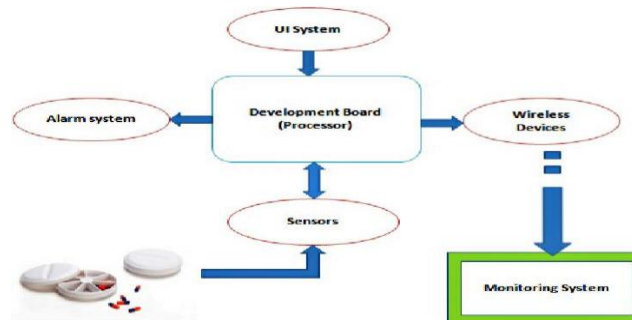


Fig. 4.2 Block Diagram

#### 4.3 System Modules

**4.3.1 Authentication Module** - An authentication module is a plug-in that collects user information such as a user ID and password, and compares the information against entries in a database. If a user provides information that meets the authentication criteria, the user is validated and, assuming the appropriate policy configuration, granted access to Smart First Aid System. If the user provides information that does not meet the authentication criteria, the user is not validated and denied access to the System.

**4.3.2 Data Collection** - A robust and real-time data collection and processing is an essential step to gather data sensed through various Sensors in the System. This parameter.

**4.3.3 Data Acquisition** - **Data acquisition** is the process of sampling signals that measure health conditions and converting the resulting samples into digital numeric values that can be manipulated by an Android Device. Data acquisition systems, typically convert analog results from sensors like AD8232 ECG Sensor into digital values for processing. The components of data acquisition systems include:

- II. Sensors, to convert physical parameters to electrical signals.
- III. Signal conditioning circuitry, to convert sensor signals into a form that can be converted to digital values.
- IV. Analog-to-digital converters, to convert conditioned sensor signals to digital values.

4.3.4 Data Processing –

*[1] Input*

Input is the first stage of the data processing cycle. It is a stage in which the collected data is converted into a machine-readable form so that a computer can process it. This is a very important stage since the data processing output is completely dependent on the input data (“garbage in – garbage out”).

*[2] Processing*

In the processing stage, the Smart First Aid System transforms the raw data collected via sensors into information. This collected data is compared with the standard values to identify any threat to the health of a user.

*[3] Output*

In the last stage, output is received. This is the stage where the processed data is converted into human-readable form and presented to the end user as useful information. If the sensed value exceeds the threshold value then ill health is identified. For example: Human Body temperature exceeding 37.5 and 38.3 °C is condition of Fever.

**4.3.5 Report Generation** – This module allows users to generate reports and graphs at once the data is stored in the database. This report compares standard values of health parameters with the measured values of a user. Graphs can be



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generated to represent this comparison to make it more readable. Based on the measured data and previously recorded data, system will provide suggestions to the user.

**4.3.6 Notify respective Doctor/Guardian** – In any case of emergency identified an instant notification is sent to respective Doctor or Guardian. This notification is sent as an Email or SMS to the registered Email address or Phone number. This feature reduces the amount of time of user and helps to get treatment instantly. Also, Doctor's appointment is taken for immediate diagnosis and to avoid any serious threat

## 5. Other Specification

### 5.1 Advantages

- A. The system will help everyone who need urgent First Aid treatment
- B. Government Centers, Educational Institutes, Companies can easily get their documents on computer in editable form.
- C. Different handwriting styled documents can also easily be recognized without spending much human efforts

### 5.2 Limitations

1. The system will recognize only body temperature ,heart rate, blood pressure, ECG
2. As readings may vary of same person is not same all the time, accurate prediction is a challenge.

## VI. CONCLUSION AND FUTURE WORK

In this project, we implement an IoT based smart first aid system that performs monitoring of patients' health data collected from various wireless sensors. The sensors used in this system include Body temperature sensor, Pulse rate sensor, ECG sensor and Blood pressure sensor. Also Load cell to monitor the quantity of medicines inside the first aid system. The proposed architecture is cost-effective, scalable and supports interoperability and lightweight access with the help of Raspberry pi and Arduino. This system is with the advancement in the traditional First aid system with accurate and instant treatment. The inclusion of feature to monitor the weight of first aid system is helpful to maintain the system more accurately. The ability of this system to send an instant notification and make an appointment is very beneficial for immediate treatments on the identified health issues. Further work might include biometric user authentication and face authentication to make the system more secure And deploying the platform in the real healthcare environment for assessing the framework with respect to user acceptability and performance.

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