IMPLEMENTATION OF HEALTHCARE MONITORING SYSTEM USING IOT

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***Abstract*:** The IoT has been widely used to interconnect the available medical resources and offer smart, and effective healthcare service to the elderly people. The system would be smart to intimate the patient's family members and their doctor about the patient's current health status and full medical information in case of any medical emergency arises. The embedded microcontroller checks if the patient health status is going well or not by analysing the scanned medical signals and send the output to the system shown in thingspeak software. It shows the graph output with respect to time and date. This information can be stored on the computer and can be used to analyse the status of the patient. This project includes information about the patients: Body temperature, Heartbeat, ECG, Respiration rate, Body position, Saline level.

***Keywords*: Healthcare, IoT(internet of things), Body temperature, Heartbeat, ECG, Respiration rate, Body position, Saline level.**

I.INTRODUCTION:

Internet of things

Among the applications that IOT facilitated to the world, healthcare applications are most important. Today**,** Internet application development demand is very high. So IoT is a major technology by which we can produce various useful internet applications. The internet of things is a system consisting of computers, machines, or objects etc., provided with an IP address which has the capability to transfer data over the network. Basically**,** IoT is a network in which all physical objects are connected to the internet through network devices or routers and exchange data. IoT allows objects to be controlled remotely across existing network infrastructure. IoT is a very good and intelligent technique which reduces human effort as well as easy access to physical devices. IoT techniques can be used to promote healthcare in a better way. The health related information could be interacted with doctors who are in emergency. Even in the absence of the doctor near the patient or in the hospital, the doctor can know the patient's status so that the doctor's advice is given in critical cases[1].

II. PROPOSED SYSTEM

This project aims to design and demonstrate an innovative web based health monitoring system. Various medical sensors are used to collect patient medical data and sent it to the monitoring station for interpretation[3].

1)Body temperature 2)Heartbeat 3)3-channel ECG 4)Respiration rate 5)Body position 6) Saline level.

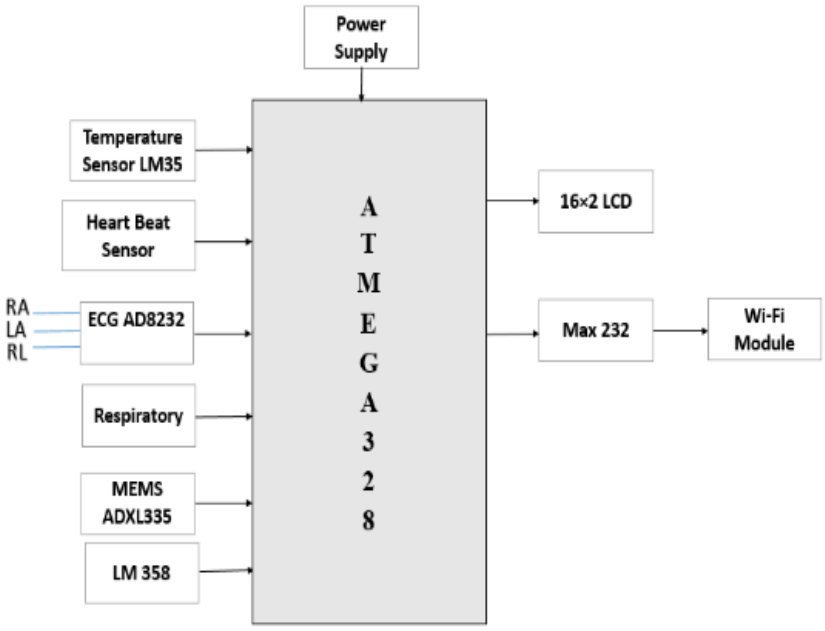


Fig 1. Block diagram of proposed system

ATmega-328 is basically an Advanced Virtual RISC (AVR) micro controller. It supports the data up to eight bits. It is mostly used in arduino. The input to the circuit is supplied from the regulated power source. The microcontroller power is of 5v. The proposed system measures the patient's body temperature, heartbeat, ECG, respiratory, body position and saline level. The process will be done from patient in ICU to sensor sense physiological parameters to AVR processor to RS232 to PC. The sensors are connected to track the status which is in turn interfaced to an LCD display as well as Wi-Fi connection in order to transmit alerts[2].

A. Temperature Sensor

Temperature is converted in to electrical signals using a transducer called Thermistor. A thermistor responds to the temperature change by changing resistance, but its response is not linear. That's why we are using linear temperature sensors like LM34 or LM35 series. The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. Its output is 10MilliVolts per degree centigrade. So if the output is 310 mV then temperature is 31^{o}C.

B. Heartbeat sensor

Heartbeat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heartbeat detector is working, the beat LED flashes with each heartbeat. Heartbeat sensor is the combination of IR Transmitter and photo diode. It works on the principle of light modulation by blood flow through finger at each pulse. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. Sensor pads are easy to stick to chest. The center is filled with fluid electrode gel for good connection [4].

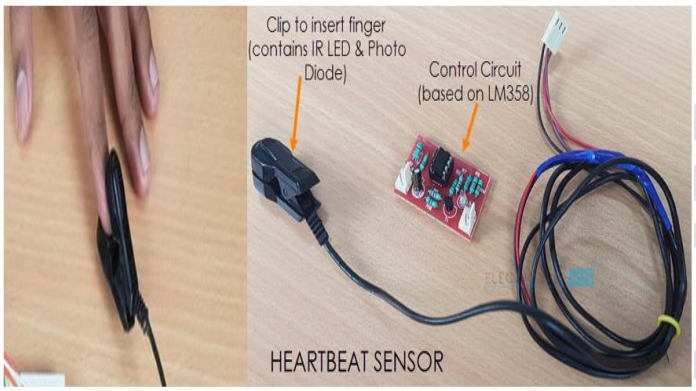


Fig 2. Heartbeat sensor

C. 3-Channel ECG

It is the process of recording the electrical activity of the heart over a period of time using electrodes placed on skin. Electrodes are placed on the right arm(RA),left arm(LA), and right leg(RL). These electrodes detect the tiny electrical changes on the skin that arise from the heart muscles electrophysiological pattern of depolarizing and repolarizing during each. The electrodes of ECG sensor will conversion heartbeat to electrical signal. There is an LED indicator light that will pulsate to the rhythm of a heartbeat.

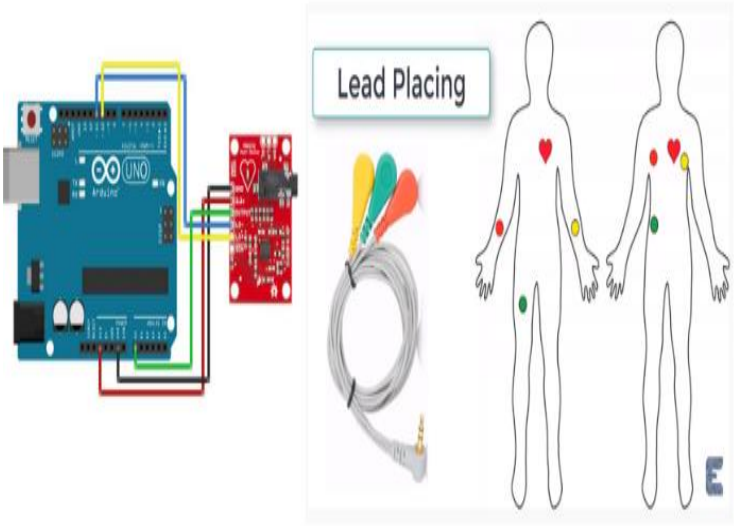


Fig 3. Placement of electrodes

D. Respiration rate sensor

MQ-2 SENSOR

For respiration a sensitive material of MQ-2 gas sensor is sno_2, with lower conductivity in clean air.MQ-2 gas sensor has high sensitivity to LPG, Propane and Hydrogen also could be used to Methane and other combustible steam, it is with low cost and suitable for different applications.

Fig 4. Respiratory sensor

E. Body position

The product measures acceleration with a minimum full-scale range of ±3 g. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration. It's powered by a 3.3v source and also generates 3.3v peak outputs. It has three outputs for each axis i.e. X, Y & Z.

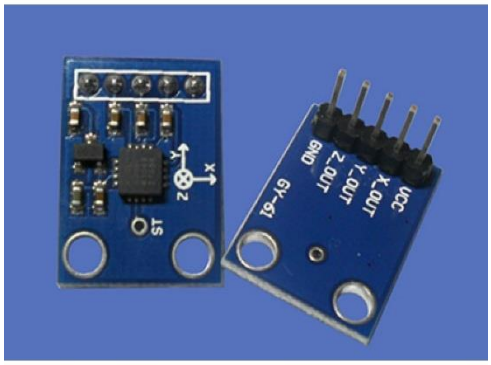


Fig 5.MEMS (ADXL335)

F. Saline level

The **LM358** IC is a great, low power and easy to use dual channel **op amp** IC. It is designed and introduced by national semiconductor. It consists of two internally frequency compensated, high gain, and independent **op-amps**. This IC is designed for specially to operate from a single power supply over a wide range of voltages.

Flow chart for proposed methodology

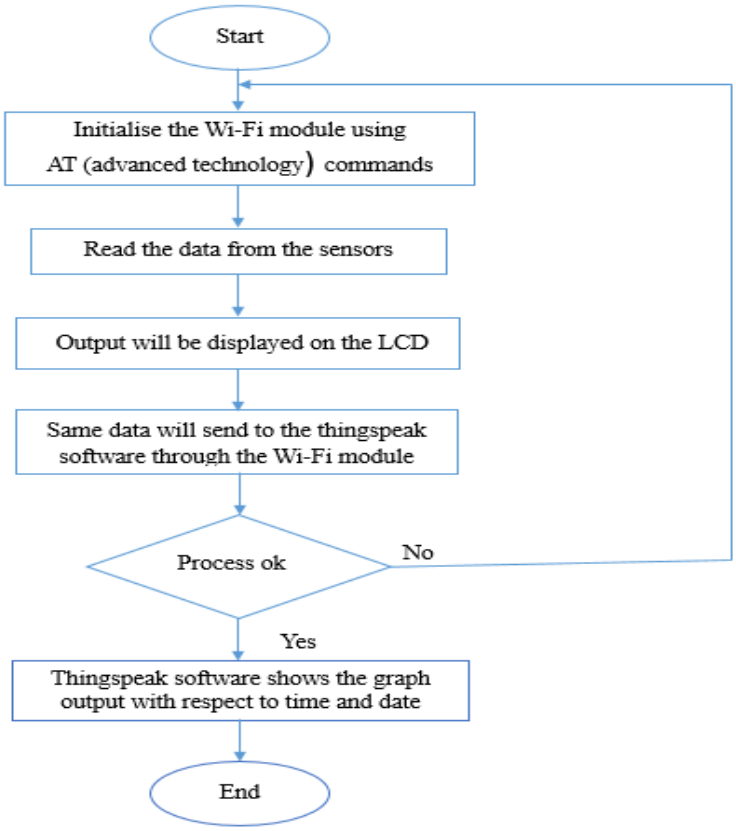


Fig 6.Flow chart for proposed methodology

III. RESULTS AND DISCUSSION

The temperature sensor LM35 output is connected to the ATmega-328. The heartbeat digital output is connected to the microcontroller directly to measure the heartbeat per minute. It works on the principle of light modulation by blood flow through finger at each pulse. The analog output of the respiration sensor is connected to the microcontroller. The sensors are connected to the patient in ICU to monitor the condition of patient body temperature, heartbeat, respiration, body position, ECG, saline level. The sensors are connected to track the patient status which is in turn interfaced to an LCD display as well as Wi-Fi connection in order to transmit alerts. The doctor can check the patient status from anywhere and give prescribe medicine to the patient. By using the thingspeak software the graph of patient body temperature, heartbeat, respiration, body position, ECG, saline level in PC with respect to time and date. This information can be stored on the computer and can be used to analyse status of the patient. The main component of the system is the ATmega328 micro controller. This microcontroller is mounted up on the circuit board. It offers many peripherals to allow for the connections of various devices and sensors. In the case of the IoT clinic circuitry, the peripherals are utilized to connect various sensors such as the ECG/Heart rate sensor, respiration sensor, MEMS accelerometer to determine the patient's body position.

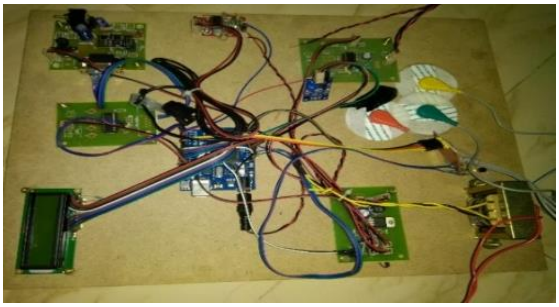


Fig 7. IoT clinic circuitry

A unique IP address is provided to the doctor and patient to access this thingspeak software .To use thingspeak software, we need to sign up and create channel. In this the IP address is "184.106.153.149". Thingspeak software is mainly used by the doctor to check the patient's current health status [3].

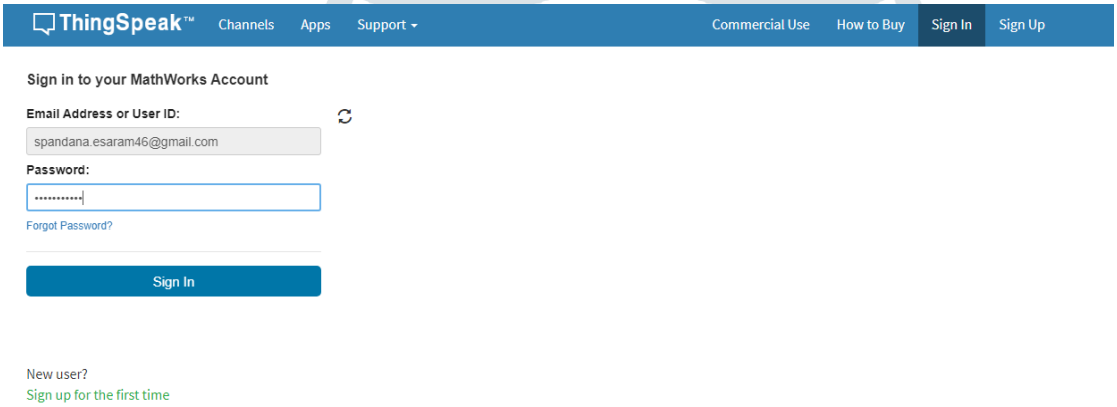


Fig 8. Login display of thingspeak software

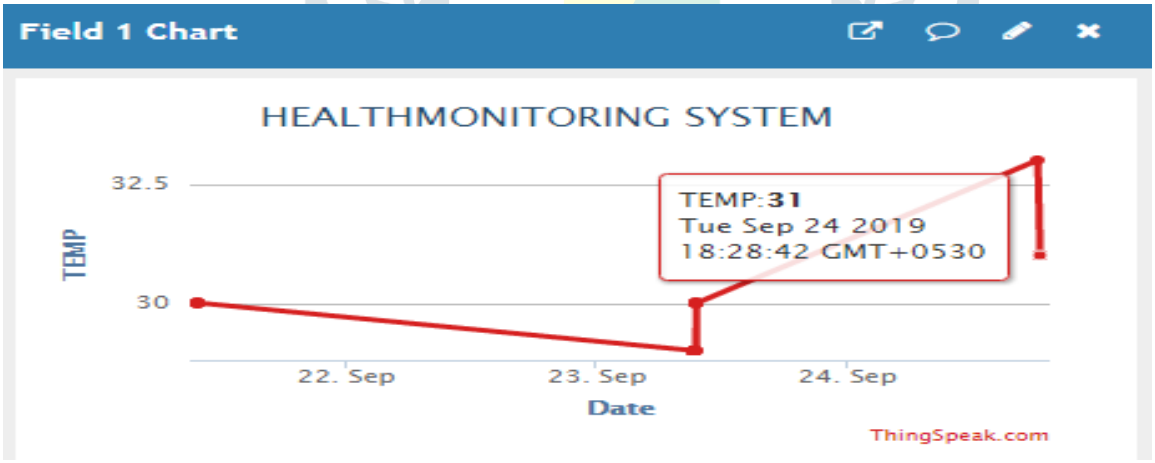
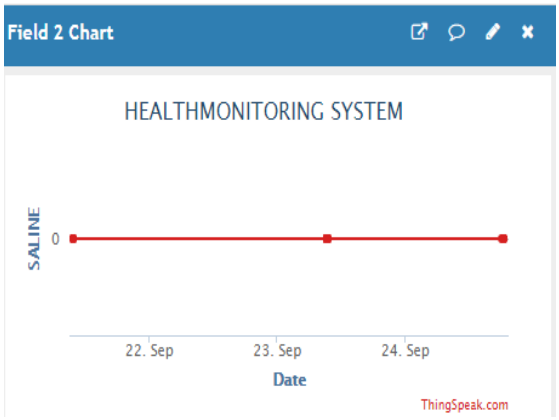
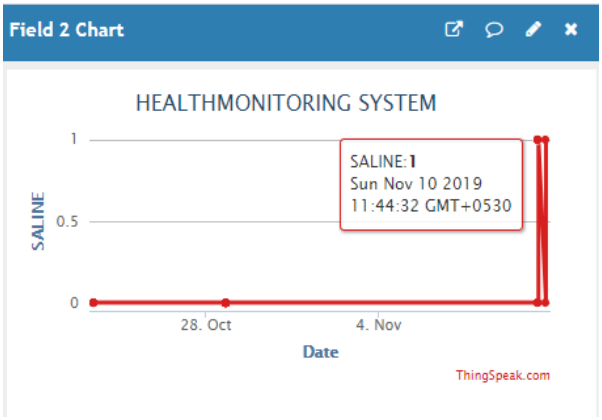


Fig 9.Output for Temperature sensor for human body



a) zero(0) indicates saline is in low level



b) one(1) indicates saline is in high level

Fig 10. Displaying the level of saline

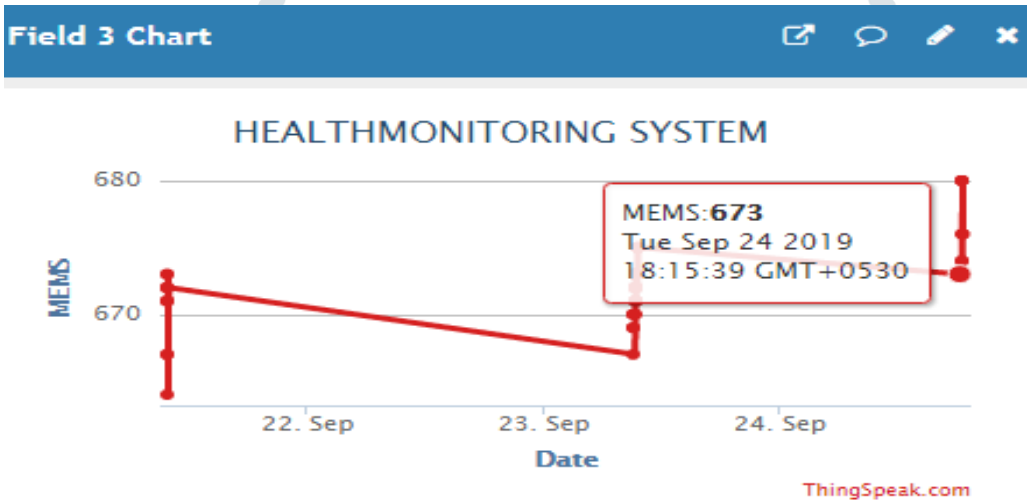


Fig 11.Displaying the position of human body

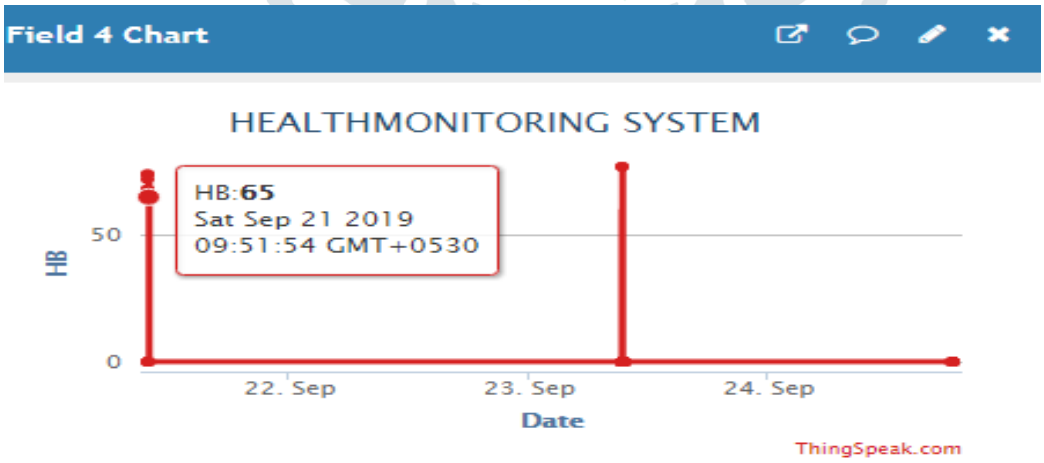


Fig 12.Displaying the output of heartbeat sensor

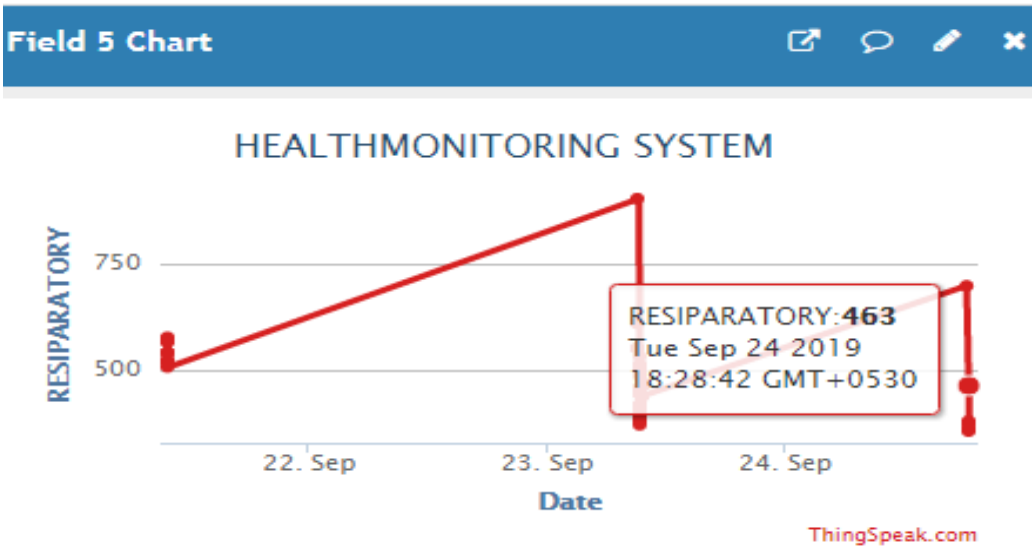


Fig 13.Respiratory sensor output

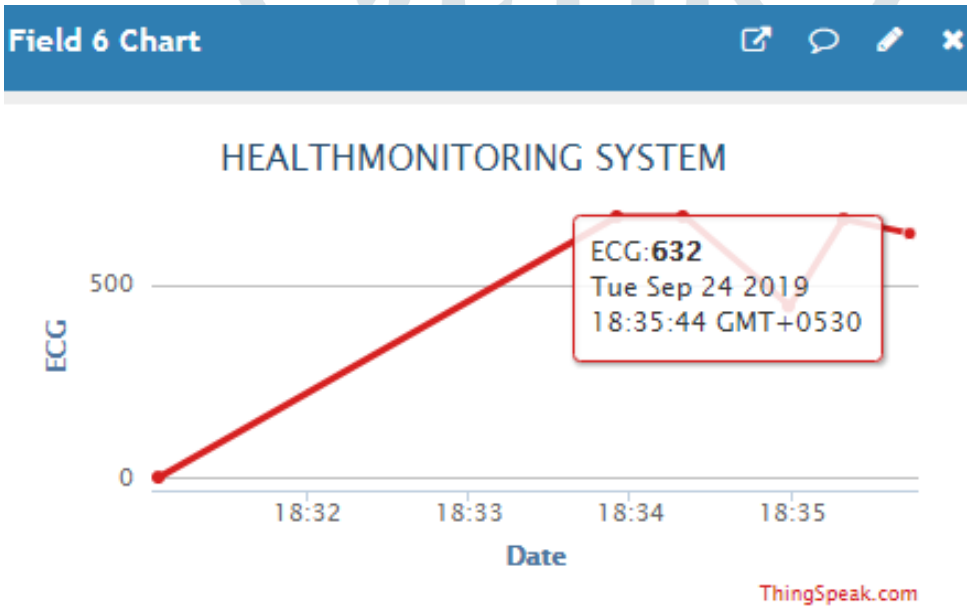


Fig 14.ECG sensor output

All the measurements are taken and displayed for the reference.

IV. CONCLUSION:

The data from remote patient is sensed and transmitted to the server pc by using wireless transmission technology using IOT. Using IOT at receiver the data is received and it is displayed on the pc of physician. By using this technology doctor can check the patient condition from anywhere and prescribe medicine to the patients. Internet of Things (IoT) based healthcare systems play a key role in the growth of medical information systems. Tracking, tracing, and monitoring of patients are essential to enhance the healthcare system. Dependency of healthcare on IoT is increasing day by day to improve access to care, enhance the quality of care, and most importantly to limit the cost of care.

V. FUTURE SCOPE

In the past, patients can be monitored only in a medical facility or under the care of family or home nurses. In this project further extended as like SMS send to the patient family members and the position of the patient can be detected using GSM & GPS. So that it could be easily to find the nearest locations of the hospitals for the emergency conditioned patients.

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