

# Patient Health Monitoring System Using IOT in Remote Environments

V.Sankarnath<sup>1</sup>, J.Naveen Kumar<sup>2</sup>,

<sup>1,2</sup> Asst Professor, Department of Electronics & Communication Engineering,

<sup>1,2</sup> Geethanjali College of Engineering and Technology,

Nannur, Kurnool, Andhra Pradesh, India.

Email: [sankarnathvemugadda@gmail.com](mailto:sankarnathvemugadda@gmail.com)<sup>1</sup>, [naveenraju804@gmail.com](mailto:naveenraju804@gmail.com)<sup>2</sup>,

**Abstract:** - In the present technology embedded systems plays a privilege role. For each and every application we are using embedded concepts. Among that biomedical sensor is one of the useful components for medical applications so far. Now a days as technology increased health monitoring of a patient as well as elderly people has become easier. In this proposed paper the health conditions of a patient and elderly people will be monitored with latest technology IOT (Internet of Things). With the help of ECG, temperature and blood pressure sensors are used and the output can be transmitted to IOT through wireless communication (WI-FI). The output will be in analog form and it will be monitored with mobile phone by getting login into the web page and triggers an immediate alert will be there with the normal conditions.

**Index terms:** sensors, IOT, ARM7 LPC2148, WI-FI, GSM, health monitoring

## I. INTRODUCTION

Heart rate is a very vital health parameter that is directly related to the soundness of the human cardiovascular system. Heart rate is the number of times the heart beats per minute, reflects different physiological conditions such as biological workload, stress at work and concentration on tasks, drowsiness and the active state of the autonomic nervous system. Heart rate demonstrates the wellbeing state of a man and can give early sign of heart infections. It can be measured either by the ECG waveform or by sensing the pulse - the rhythmic expansion and contraction of an artery as blood is forced through it by the regular contractions of the heart. The pulse can be felt from those areas where the artery is close to the skin. The heart rate is a parameter of high significance to medicine, physics, and psychology and many other fields. The heart rate of a healthy adult at rest is around

72 beats per minute (bpm). Athletes normally have lower heart rates than less active people. Babies have a much higher heart rate at around 120 bpm, while older children have heart rates at around 90 bpm. The heart rate rises gradually during exercises and returns slowly to the rest value after exercise. The rate when the pulse returns to normal is an indication of the fitness of the person.

It is generally accepted that listening to heartbeats using a stethoscope, a process known as auscultation, is a more accurate method to measure the heart rate. There are many other methods to measure heart rates like Phonocardiogram (PCG), ECG, blood pressure wave form and pulse meters but these methods are clinical and expensive. Here proposed a health monitoring system for patients and to aged human beings in faraway environments based on the internet of things. It refers to the use of remote sensors to measure vital signs which include electrocardiogram, blood pressure, and temperature. The resulting data is sent thru the internet; data can be viewed on a web page with a specific interval of time, and sets an alert to the doctors and caregivers to sudden degradation in the patients' health condition.

## II. EXISTING SYSTEM

In previous methods we have used lot of techniques to monitor the health conditions of patient and elderly people. But those are permitted in hospital only and patient conditions will be monitored at hospital only and we can't monitor the health condition of patients from long distances like remote environments and there will be no alert systems is included in these existing system. To overcome these drawbacks, proposed a remote monitoring system with Internet-Of-Things (IOT) with these we can communicate wirelessly at long distances.

### III. PROPOSED SYSTEM

The proposed system is an intelligent remote monitoring system totally based on Wi-Fi sensor networks which is designed and developed to monitor and compare the health conditions of an aged people in their home itself. Wellness of an aged can be assessed for estimating unsafe conditions of all through monitoring of daily activities. The developed system does not use any digital camera or vision sensors as it encroaches privateness. Based on the survey among aged people, we discover that it has a large acceptableness to use at homes. The intelligent software, in combination with the electronic system, it can display the usage of different home equipment and recognize the activities to decide the health conditions of an aged people from the place they live. The block diagram that's illustrated in Fig.1 will supply the review of the proposed system. This system uses 3 parameters. An ECG sensor to check the electric activity of the coronary heart and we're using a three lead electrode system with AD8232. The output is monitored in both PC/mobile cell phones. Blood Pressure is detected with BP sensor; the output is displayed in LCD and in PC (web page). The temperature sensor is detected with an LM35 sensor, the output is displayed in LCD and in PC (web page). Mainly we use IOT for monitoring the health conditions.

### BLOCK DIAGRAM

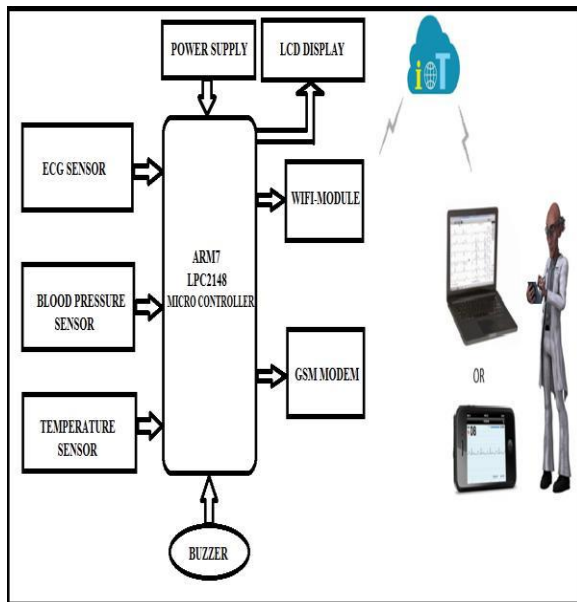


Fig.1: Health Monitoring System block diagram

### IV. SYSTEM HARDWARE

#### ARM7 LPC2148:

Arm 7 is a widely used microcontroller in embedded applications. The Arm architecture is based on Reduced Instruction Set Computer (RISC), and the instruction set and decode mechanism are considerably easier than that of micro programmed Complex Instruction Set Computers (CISC). This results in high instruction throughput and imposing real-time interrupt response from a small and cost-effective processor core. The LPC2148 is a tiny low-profile quad-flat-pack (LPQFP), which is of low cost and consumes low power. It is 16/32 bit ARM7TDMI-S CPU real-time emulation and embedded trace support, which combines the microcontroller with 64kb and 512 kb of flash, on-chip SRAM of 1/40 kilobytes. A 128-bit and accelerator architecture enable execution of 32-bit code at max clock rate will be used here. A 60 MHz CPU clock for integrated PLL. It is a 3-stage pipeline, used to increase the flow of instructions and allows multiple operations simultaneously. These instructions execute in three stages that are Fetch and then Decode and Extract. It uses advanced microcontroller bus architecture (AMBA) which is an open standard, an approach for interconnection and managing of functional blocks which makes up a system-on-chip (SoC). These LPC2148 is featured with 45 input/output pins, two 32-bit timers, a 10bit ADC of fourteen channels and a 10 bit DAC. Serial peripherals like USB 2.0 full-speed device, two UARTS, SPI of full duplex serial operation, SSP to I2C bus, various 32 bit timers are used. It supports two power modes: IDLE mode and POWER DOWN mode.

#### LCD DISPLAY:

LCD means liquid crystal display. LCD is used for displaying the digital output data. Here the output of temperature sensor and blood pressure sensor are displayed in LCD, and when degradation in health condition occurs it displays as "Blood Pressure exceeds at value" and "Temperature exceeds at value".

#### TEMPERATURE SENSOR:

The LM35 pin diagram is shown in figure 2. The LM35 is a precision integrated circuit, with an output voltage which is linearly proportional to temperature in centigrade. It contains a low voltage IC which uses +5VDC power. The circuitry of this sensor is sealed and it does not subject to oxidation. Operates temperature range at -55 °C to 150 °C.

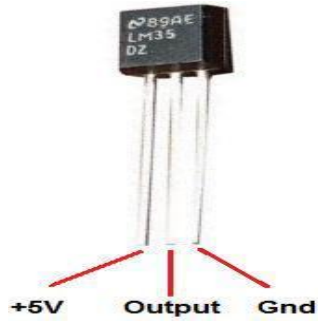


Fig.2: LM35 sensor

It has 3 pins: Vcc (3.3v), Vout (output voltage), ground (GND). Here LM35 used to measure the temperature of people. The output is shown in Fahrenheit because the body temperature is seen in Fahrenheit only.

**ECG SENSOR:**

To monitor the Electrocardiogram AD8232 sensor is used. The AD8232 is a single lead front end integrated circuit. It is designed to extract, amplify and filter electrical signals generated by cardiac in presence of noisy conditions like motion or position of electrodes. We use electrode jack for electrodes, connecting electrode pads on the skin. The led indicates rhythm of the heart. A 3.3v power supply is given as input.

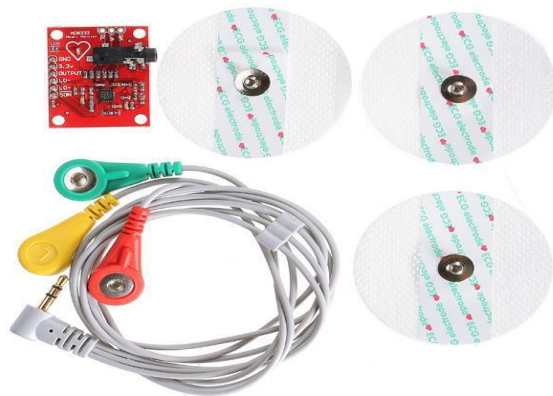


Fig.3: AD8232 ECG sensor

From above fig 3, the 3 electrodes are stick to body of the right arm (RA), left arm (LA), and right leg (RL) based on Einthoven's triangle.

**BLOOD PRESSURE SENSOR:**

To monitor the blood pressure MPX5010GSX sensor is used. MPX5010GSX is an on-chip signal

conditioned integrated silicon pressure sensor from 0 to 10kpa (0 to 1.45 psi), Temperature compensated over 40° to +125°C and Calibrated. These are a piezo resistive transducer of monolithic silicon pressure sensor.



Fig.4: Blood pressure sensor

**WIFI MODULE:**

The ESP8266 WI-FI module is one of leading platforms for Internet-Of-Things (IoT). It is an UART to WI-FI module cost is very low and easy to use. The ESP8266 WI-FI module used in this system is a self-contained SoC with a TCP/IP stack in order to use it in standalone. it gives access to any microcontroller to any Wi-Fi networks. It contains an inbuilt firmware which supports serial interface and can be controlled by attention (AT) commands. It is a 32bit processor with an 80 MHz crystal oscillator, 64KB SRAM, 96KB DRAM, 512KB SPI Flash, GPIO pins and a WI-FI transceiver.

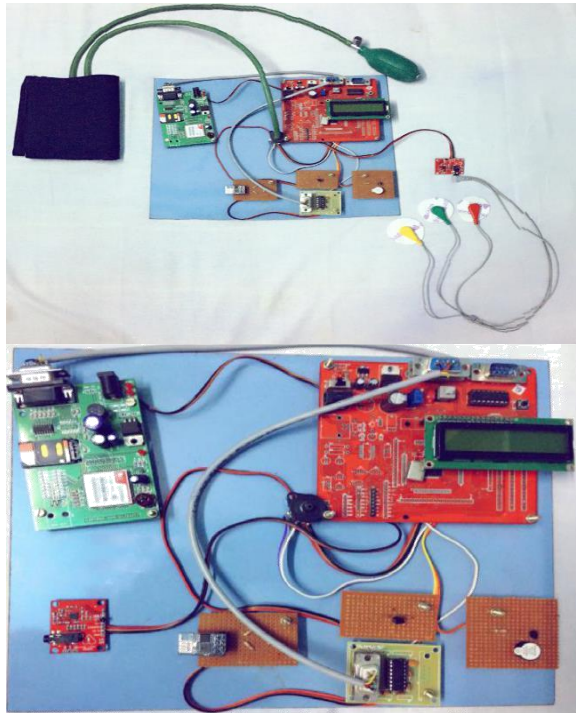
A three point three volts power supply is used and it cannot tolerate five volts power supply. The consumption of current is of eighty mA in an idle state. it incorporates eight pins such as Vcc, GND, TX (transmitting data), RX (receiving data), RST (reset), CH\_PD (chip enable), GPIO0, GPIO2. A red light emitting diode indicates the power is on and a blue light emitting diode which blinks continuously indicates the connection established and data sharing.

**GSM MODEM:**

The GSM is a wireless modem works with GSM networks. A GSM modem is similar to mobile phone which accepts sim card and operates over a subscription to the cell operator, much like a mobile phone. This includes a sim900a module. Here, it is used for sending the SMS alerts for relatives, friends, and caregivers at an emergency, when blood pressure and temperature exceeds the normal condition.

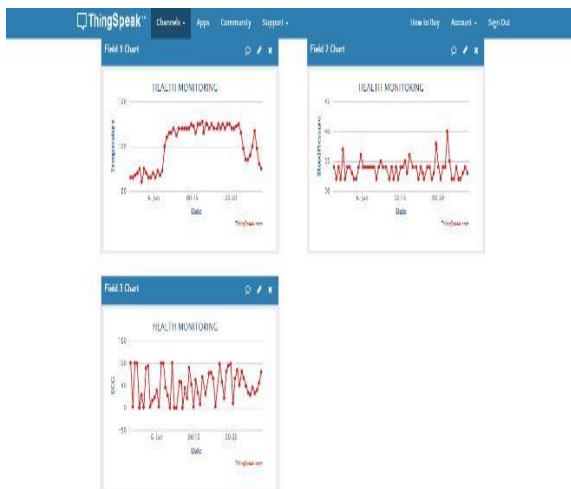
**V. RESULT & DISCUSSION**

Fig 5 is the hardware setup where different sensors and modules are attached to the microcontroller.

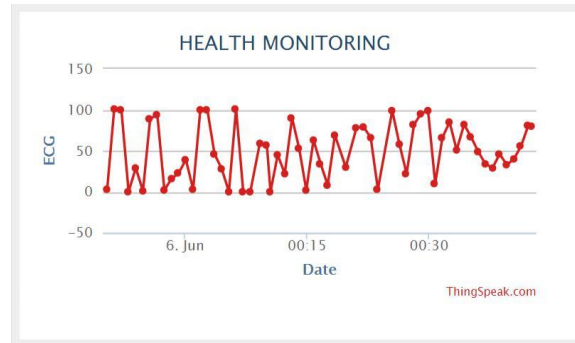


**Fig.5: Hardware setup**

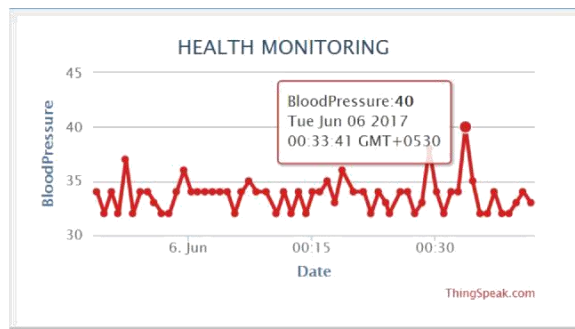
The analog output data can be monitored with pc by logging in to the THINGSPEAK, is an open source internet of things application, it offers the capabilities of real-time data collection, visualizing the collected data.



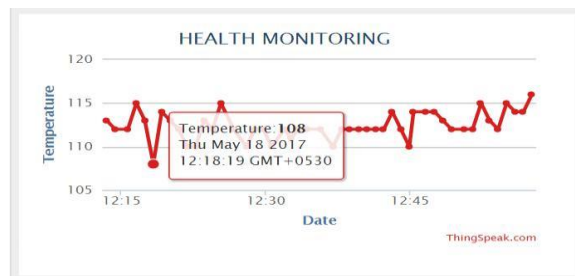
**Fig.6: Monitoring health conditions**



**Fig.7: ECG output**



**Fig.8: Blood Pressure output**



**Fig.9: Temperature output**

The digital data output will be displayed in LCD as shown below



**Fig.10: output displayed in LCD**

### SMS ALERT:

If the patient exceeds the normal range the SMS alert will be sent to the doctors and caregivers as shown below.



The buzzer is used as alert for getting the surrounding attention when the sensor value exceeds the normal range.

## VI. CONCLUSION

In this paper we presented an interactive embedded measurement of daily activities through the usage of household appliances and sensor data. Predicting the behavior of a patient was based on past sensor activity durations. The combination of a sensing system with time series data processing enabled us to measure how well the patient able to perform their daily activities in real-time. Hence in this proposed system, we monitor ECG, BP & Temperature with an alerting system. The next step will be to devise a robust forecasting method including outliers in the wellness of old and ill people measurement and alerting system.

## REFERENCES

- 1) Elisian Spano, Stefano Di Pascoli, and Giuseppe Iannaccone, "low power wearable ECG monitoring system for Multiple-Patient Remote Monitoring," in *IEEE Sensors Journal* (Volume: 16, Issue: 13, July 1, 2016).
- 2) UN, "World Population Aging 2013," 2013, pp. 8–10.
- 3) A.E. Raftery, N. Li, H. Ševčíková, P. Gerland, G.K. Heilig, "Bayesian probabilistic population projections for all countries," in *Proc. 2012 National Academy of Sciences*, vol. 109 p. 13915-139121.
- 4) G. Vincent, V. Velkoff, "The Next Four Decades: The Older Population in the United States 2010 to 2050", Washington, DC: US Census Bureau, US Government Printing Office, 2010.
- 5) European Commission, "The 2012 Ageing Report: Economic and budgetary projections for the 27 EU Member States (2010-2060)," 2012.  
L. Robert, "Vital Signs via Broadband: Remote Monitoring Technologies Transmit Savings," *Better Health Care Together Coalition*, p. 1, Oct. 2008.

- 6) IBM Institute for Business Value, "The future of connected health devices", Executive Report, 2011.
- 7) R. S. Dilmaghani, H. Bobarshad, M. Ghavami, S. Choobkar, C. Wolfe, "Wireless sensor networks for monitoring physiological signals of multiple patients.," *IEEE transactions on biomedical circuits and systems*, vol. 5, no. 4, pp. 347–56, Aug. 2011.
- 8) M. K. Delano and C. G. Sodini, "A long-term wearable electrocardiogram measurement system," in *2013 IEEE International Conference on Body Sensor Networks*, 2013, pp. 1–6.
- 9) K. Malhi, S.C. Mukhopadhyay, J. Schnepfer, M. Haefke, H. Ewald, "AZigBee-Based Wearable Physiological Parameters Monitoring System," *IEEE Sensors Journal*, vol. 12, no. 3, pp. 423–430, Mar. 2012.