A SECURE IOT BASED MODERN HEALTHCARE SYSTEM BY USING BODY SENSOR NETWORK(BSN)

[1]Dr. Nilesh N. Kasat, [2]Mr. Akhilesh S. Bharatiya
[1]Professor,[2] M.E. student
[1]Electronics and Telecommunication engineering
[1] Sipna college of Engineering and Technology Amravati, India.

Abstract : Biomedical field serves as the benefit for human society. But in today's reckless running world people are casual about their health. Cases of heart attacks and deaths due to lack of help are increasing rapidly. For this purpose A secure IOT based modern healthcare system is best solution. In this project we will be monitoring the human health parameters such as blood pressure, body temperature, posture and heartbeat rate using body sensor network. This information will be provided to family members,local physician, and emergency care unit depending on the condition of patient through IoT. This will be helpful in medical health care by providing exact position of human who is in emergency to the nearest healthcare and for getting as early as possible local treatment.

Key words- IOT, BSN, Arduino uno, ESP Wi-Fi module , GSM

I. INTRODUCTION

Internet of Things (IOT) has become one of the best communication way of the 21th century. In the IOT environment, objects in our daily life become part of the internet due to their communication and computing capabilities. IOT extends the concept of the Internet and makes it more widespread. IOT allows seamless interactions among various types of devices such as medical sensor, monitoring cameras, computing capabilities, home appliances so on. Because of that reason IOT has become more valuable in several areas such as healthcare system. In healthcare system IOT involves many kinds of cheap sensors (wearable, implanted, and environment) that enable aged person to enjoy modern medical healthcare services anywhere, any time. Besides, it also greatly improves aged peoples quality of life. [1][2]

The body sensor network (BSN) technology is best imperative technologies used in IOT-based modern healthcare system. It is basically assembly of low-power and lightweight wireless sensor nodes that are used to supervisor the human body functions and surrounding environment. Since BSN nodes are used to collect touchy (lifestyles-important) data and may function in adverse environments, for that reason they require strict protection mechanisms to keep away from malicious interaction with the gadget. Body Sensor Network (BSN) allows the integration of intelligent, miniaturized low-power sensor nodes in, on or around human body to supervisor body functions and the surrounding environment.

Generally, BSN contain in-body and on-body sensor networks. An in-body sensor network allows intercommunication between invasive/implanted devices and base station. On the other hand, an on-body sensor network allows intercommunication between non-invasive/wearable devices and a coordinator. In this project BSN architecture composed of wearable and implantable sensors. Each sensor node is integrated with bio-sensors such as Accelerometer, Blood Pressure (BP), Thermometer,etc. These sensors collect the physiological parameters and forward them to a coordinator called Local Processing Unit (LPU), which can be a portable device such as PDA, smart-phone etc. The LPU works as a router between the BSN nodes and the central server called BSN-Care server, using the wireless communication mediums such as mobile networks 3G/CDMA/GPRS. Besides, when the LPU detects any abnormalities then it provides immediate alert to the person that wearing the bio-sensors.

II. LITRETURE REVIEW

The advancement of BSN in healthcare applications have made patient monitoring more feasible. Recently, several wireless healthcare researches and projects have been proposed, which can aim to provide continuous patient monitoring, in-ambulatory, in-clinic, and open environment monitoring (e.g. athlete health monitoring). This segment describes few popular studies projects related with healthcare system by using body sensor networks CodeBlue [3], [4] is a popular healthcare research project based on Body sensor network developed at Harvard Sensor Network Lab. In this architecture, several bio-sensors are placed on patient‘s body. These sensors sense the patient body and send it wirelessly to the end-user device (PDAs, laptops, and personal computer) for further analysis. The main idea of the CodeBlue is straightforward, a doctor or physicians issues a query for patient health data using their personal digital

assistant (PDA), which is based on a published and subscribed architecture. Besides, CodeBlue‘s authors acknowledge the demand of security in medical applications, but until now security is still pending or they intentionally left the security aspects for future work.

BSN based healthcare gadget UbiMon [5] was proposed within the branch of computing, Imperial College, London. The objective of this model was to address the issues associated with usage of wearable and implantable sensors for distributed mobile monitoring. Although Ng et al. recommended and demonstrated the ubiquitous healthcare monitoring architecture, it is generally approved that without consider the security for wireless healthcare monitoring, which is a prime requirement of healthcare packages, in line with authorities legal guidelines [6].

MobiCare offers a huge-area cell affected person monitoring gadget that enables continuous and timely tracking of the patients physiological repute. Although, Chakravorty diagnosed the safety problems in MobiCare, however handiest addressing protection problems are not enough for real-time healthcare packages. Thus, protection and confidential remains now not applied in MobiCare healthcare tracking or might also were disregarded for future work. Still, there are numerous protection problems consisting of secure localization, anonymity, and many others, have no longer even noted in MobiCare gadget.

Recently, a system designed at Johns Hopkins University named Median, mainly designed for person‘s monitoring in hospital and during disaster events was reported [8]. It comprises many physiological monitors (called PMs), which is battery powered motes and equipped with medical sensors for gathering person‘s physiological health information‘s (e.g. blood oxygenation, pulse rate, blood pressure etc.). In their description of Median its author recommended the need for encryption for PMs, however they did not mention which crypto-system has been used for data confidential and how they have checked the integrity of the received data.

The study of a Wireless Multimedia Sensor Network (WMSN) and Radio Frequency Identification (RFID) based u-Healthcare system. The system [9] is capable of monitoring the patient‘s medical status by using RFID body sensor and wirelessly transmits the medical data to a local workstation (WMSN gateway) before transmitting it to the central database server. Due to the patient‘s moves, WMSN node‘s actions may be patterned with the capability of the Mobile IPv6. Sufferer may be inform in case of emergency through their wearable tool and also can get hold of messages with their mobile.

The proposed system is designed [10] to measure and monitor important physiological data of a patient in order to accurately describe the status of her or his health and fitness proposed a system is designed to measure and monitor important physiological data of a patient in order to accurately describe the status of her or his health and fitness. The patient‘s temperature, heart beat rate, muscles, blood pressure, blood glucose level, and ECG data are monitored, displayed, and stored by their system. To ensure reliability and accuracy the proposed system has been field tested. The test results show that their system is able to measure the patient‘s physiological data with a very high accuracy.

Proposed system comprises [11] the design and implementation with subsystems. Information is sent via IP to a database server containing clinical data, which can be accessed on the smart phone and can also be shared with the physician anytime to seek medical advice when needed. Two wireless protocols were investigated: a Bluetooth (IEEE 802.15.1) ad-hoc network and a Wi-Fi (IEEE 802.11) ad-hoc network. To do so, two subsystems were designed: a sensor system and a display system. The sensor system consists of two thermometers and a wireless transmitter/receiver. The data will be communicated to the display system wirelessly. The display consists of a wireless transmitter/receiver and an iOS mobile device. The results concerning the efficacy and practicability of the designed system and the integration with a radiometer will be presented. The tracking gadget has the functionality to monitor physiological parameters from multiple patient our bodies. In their proposed system , a coordinator node has attached on affected person body to accumulate all the alerts from the wireless sensors and sends them to the base station. The connected sensors on affected person‘s frame shape a wi-fi frame sensor community (WBSN) and they are able to sense the coronary heart rate, blood pressure and so on.. This system can detect the abnormal conditions, issue an alarm to the patient and send a SMS/E-mail to the physician. Designed and developed body temperature measurement device[12] that can be observe by the doctor in real time as well as history data via internet with an alarm/indication in case of abnormalities. The temperature sensors will send the readings to a microcontroller using Zigbee wireless communication. To send the real-time data to health monitoring database, wireless Local Area Network (WLAN) has been used. Arduino with Ethernet shield based on IEEE 802.11 standard has been used for this purpose.

III. SYSTEM WORK

A. Hardware Implementation

BSN architecture composed of wearable, implantable sensors and clouding of storage data, shows in fig 1. Each sensor node is integrated with bio-sensors such as Temperature measurement, heart bit rate, Blood Pressure (BP), etc. These sensors collect the physiological parameters and forward them to a microcontroller called arduino uno. Arduino uno forward data to Wi-Fi module known as ESP8266.Further Wi-Fi module transmits data to doctor server through antenna. The doctor server receives data of a person (who wearing several bio sensors) from Arduino uno, then server feeds the BSN data into its database and analyzes those data. All parameters are display on LCD screen. When body temperature exceeds 108°F, GSM module send the emergency message to doctor. Project model also contain speaker & mike through which patient can communicate with doctor.

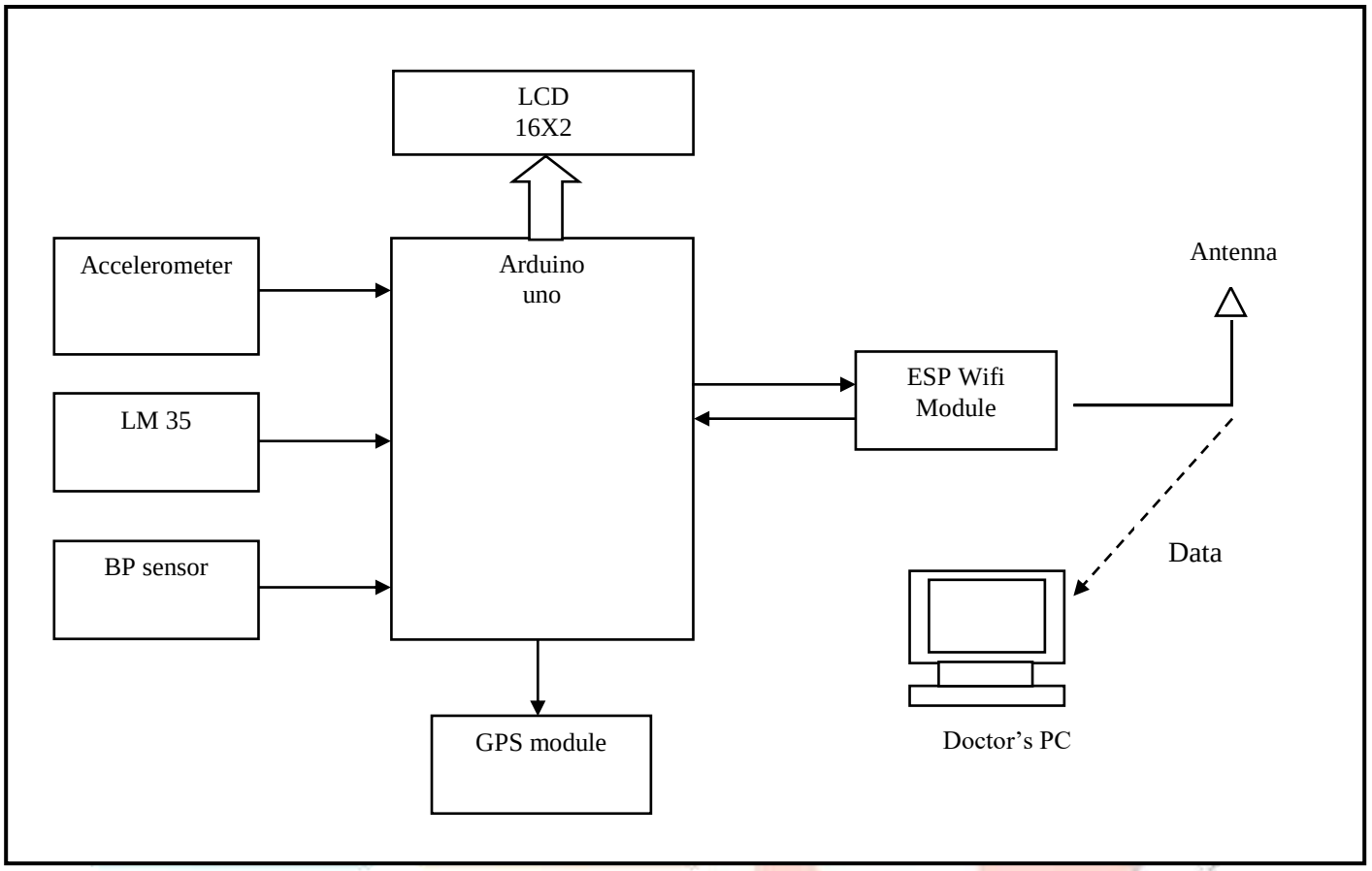

fig.1 BSN architecture

1. Arduino Uno : The Arduino Uno is a microcontroller board based on the ATmega328 . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

2. LM 35 : LM 35 has an output voltage that is proportional to the Celsius temperature. The scale factor is .01V/oC The LM35 does not require any external calibration or trimming.

3. Blood pressure sensor : The normal blood pressure of a human being is 120/80-140/90 MMHG. The sensor used in this proto type is Vernier Blood Pressure Sensor. It measures arterial blood pressure means both high and low pressure of a human being.

4. ESP Wi-Fi module: ESP-12E WiFi module is developed by Ai-thinker Team. core processor ESP8266 in smaller sizes of the module encapsulates Tensilica L106 integrates industry-leading ultralow power 32-bit MCU micro, with the 16-bit short mode, Clock speed support 80 MHz, 160 MHz, supports the RTOS, integrated Wi-Fi MAC/BB/RF/PA/LNA, on-board antenna.

5. LCD: Liquid Crystal Display screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits.

6. Power Supply: The power supply of 230 V is converted into 5V DC by using step down transformer.

7. GSM modem: Mini GSM / GPRS breakout board is based on SIM800L module, supports quad-band GSM/GPRS network, available for GPRS and SMS message data remote transmission.

8. Accelerometer: The ADXL345 is well suited for mobile device applications. It measures the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion or shock. Its high resolution (4 mg/LSB) enables measurement of inclination changes less than 1.0°.

B. Software Implementation :

After measuring all medical parameters of patient it will send by ESP Wi-Fi module to Thingres.io site. There is one cloud name as 'Healthiot' in Thingres.io where all data safely store. Following figure shows cloud storage. Fig. 2 shows cloud storage technique.

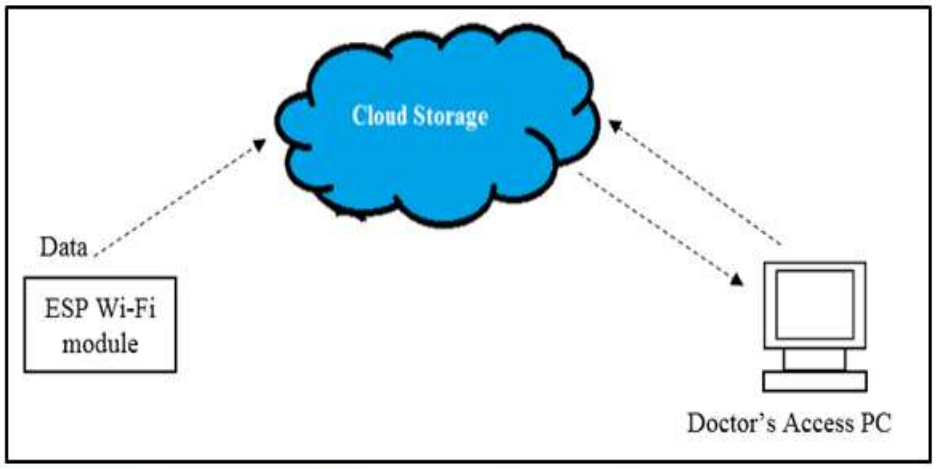

fig. 2 cloud storage

1. **Cloud Storage:** Cloud storage is a model of data storage in which the digital data is stored in logical pools, the physical storage spans multiple servers (and often locations), and the physical environment is typically owned and managed by a hosting company. These cloud storage providers are responsible for keeping the data available and accessible, and the physical environment protected and running. People and organizations buy or lease storage capacity from the providers to store user, organization, or application data.

2. **Thingres.io:** In this project we used thingrs.io as a cloud storage. Thinger.io is a Spanish start up established in 2015 who intend to empower any designer or association to create IoT applications over a scope of divisions, with illustrations including shrewd urban communities, Industry 4.0 and vitality checking. Thinger.io has officially developed to have 10,000 enrolled clients of their stage yet with such developing interest, they required a speedier method to convey their frameworks and applications. With a reasoning of utilizing adaptable and open advancements, Thinger.io found snaps as their optimal arrangement. Utilizing Snapcraft.io for building snaps has diminished their advancement time drastically and streamlined the time taken to discharge new bundles.

IV. RESULTS :

Fig.3 shows hardware implementation of project . In LCD display, T represents temperature of the patient. X represents posture of patient. S represents systolic , B represents heart bit rate & D represents diastolic. When the cloud storage receives data of a person (who wearing several bio sensors) from ESP Wi-Fi module, then it feeds the BSN data into its database and analyzes those data. After measuring medical parameters within a few seconds doctor gets all values on his computer. Thinger.io cloud storage keeps records of medical parameters of patient. Fig.4 shows cloud storage of medical parameters.

Subsequently, based on the degree of abnormalities', it may interact with the family members of the person, local physician, or even emergency unit of a nearby healthcare center. Precisely, considering a person (not necessarily a patient) wearing several bio sensors on his body and the doctor receives a periodical updates from these sensors through ESP Wi-Fi module. Now, Arduino uno maintains an action table for each category of BSN data that it receives from sensors. Following Table 1 denotes the action table based on the data received from BP sensor, where we can see that if the BP rate is less than 115 than the arduino does not perform any action. Now, when the BP rate becomes greater than 115, then it informs family members of the person. If the BP rate becomes greater than 140 then the arduino uno will contact the local physician amd family member. Furthermore, if the BP rate of the person cross 160 then arduino uno will inform an emergency unit of a healthcare center , local physician , family member.

Table 1. Arduino action table

BP Data	**Action**
BP <115	No action
BP >115	Inform family member
BP >140	Inform Local physician , family member
BP >160	Inform emergency , Local physician , family member

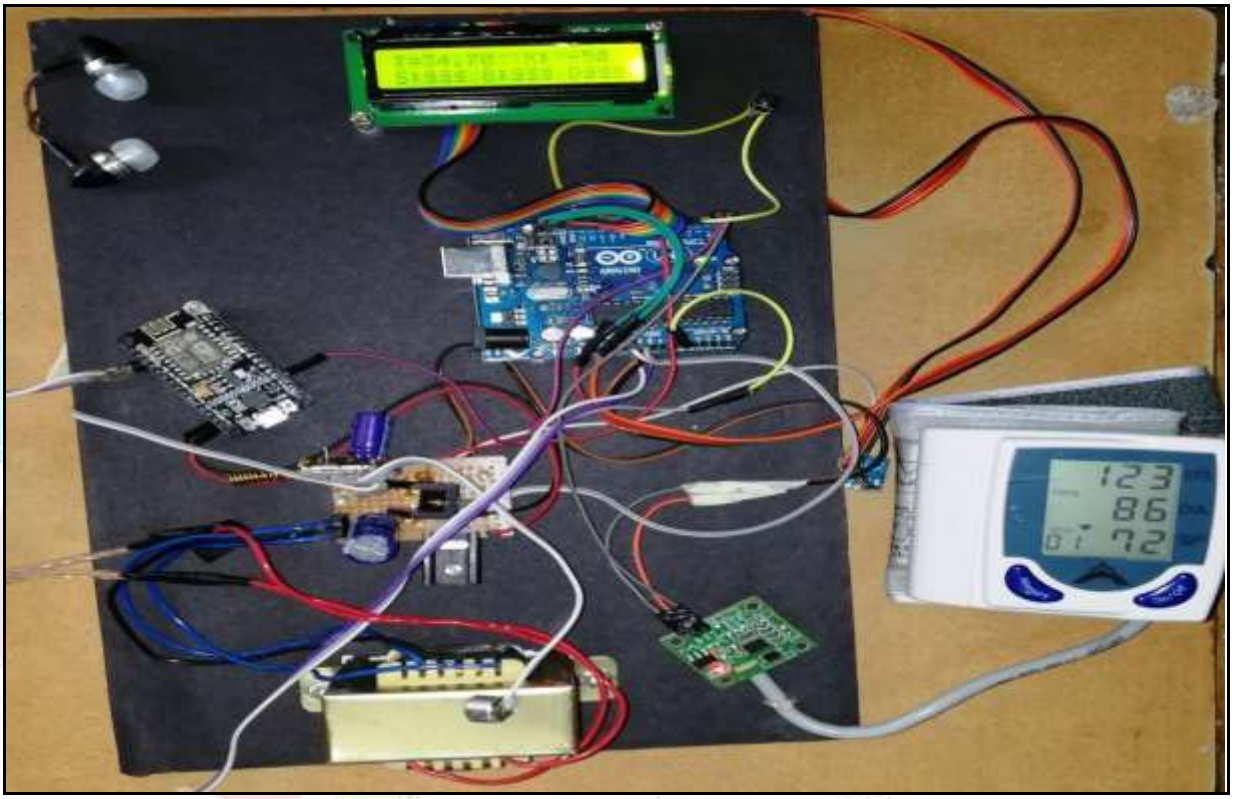

Fig.3 project hardware and result

fig. 4

V. ADVANTAGES :

- Patient monitoring becomes more feasible.
- Doctor able to continuous monitor the patient.
- Doctor able to communicate to the patient and examine his patient from anywhere and anytime.
- Because of cloud storage technique Doctor able to keep the patient's medical history.
- Patient can be communicate with doctor through mike and speaker.
- Exact data of patient's health parameter is obtained & man made error reduces.
- After measuring all parameters within a few seconds doctor gets all records on his computer.
- In case of emergency SMS will be send to doctor.
- Due to LCD display Doctor obtain exact readings of patient's health parameters.

VI. CONCLUSION :

By implementing 'A Secure IOT Based Modern Healthcare System By Using Body Sensor Network (BSN)'.The main idea of the proposed system is to monitor patient's health parameter such as blood pressure, temperature, heart bit rate, etc. And provide better and efficient health services to the patients. Doctor collect all information about patient's health parameter at regular interval of time so that the doctors could make use of this data and provide a fast and an efficient solution. Due to this model doctor can communicate to patient and examine his patient from anywhere and anytime. Emergency scenario to send a message to the doctor with patient's current status.

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BIOGRAPHIES :

- DR. NILESH N. KASAT
- DOB: 27th April, 1975.
- Professor in the Department of Electronics and Telecommunication Engineering, Sipna College of Engineering and Technology, Amravati, India.

- Mr. AKHILESH S. BHARATIYA
- DOB: 5TH November 1992
- B.E. (Electronics and Telecommunication Engineering),Sipna College Of Engineering And Technology, Amravati, India.
- M.E. (Digital Electronics), Sipna College Of Engineering And Technology, Amravati, India.