Body Area Network Based Patient Monitoring System

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Abstract- *Nowadays Medical Environment has developed knowledge supported Wireless-Sensing node Technology. Patients face a critical situation because of the nonexistence of fine medical maintenance to patients at the needed time. This can be for especially monitoring the patient's health supported by their historical medical data. To trace the patient health micro-controller is interfaced with a Wi-Fi connection to send the information to the web-server (wireless sensing node). This technique also shows patients temperature, heartbeat, ECG, and pressure tracked live data with timestamps over the Internetwork. The target of the paper is to realize efficient transmission of knowledge from source to destination by the data aggregation and data dissemination. Data aggregation means collection or gathering of knowledge in such a way to extend the efficiency and Data dissemination to route the information in a sensor network to scale back delay of transmission of knowledge from source to destination. The health condition of the patient may be analyzed through unique id using IoT for diagnosis.*

Keywords- IoT, WBAN, Health monitoring, Medical sensors.

I. INTRODUCTION

WBAN sensors collect large amounts of bio-signal data from a patient for long periods. These bio-signal data must be efficiently managed and stored for further processing and future reference. This article reviews and compares the frameworks and also evaluates the variety of methods used to manage WBAN data. We aim to identify the best method of managing WBAN data and present an enhanced architectural platform. It is intended to help researchers and practitioners to further study, modify, and develop quality-of-service (QoS)-based WBAN health-care systems. The Internet of Things (IoT) plays a vital role in health monitoring since it enables us to attach medical sensors to gather patients' health data and process it to hopefully prevent critical events. The main focus on physiological sensors, low-power integrated circuits, and wireless communication has enabled a replacement generation of wireless sensor networks, now used for purposes like monitoring traffic, crops, infrastructure, and health.

Fig1.1 Shows the Cloud access on internet

The body area network field is an interdisciplinary area that could allow inexpensive and continuous health monitoring with real-time updates of medical records through the net. Various types of intelligent physiological sensors are integrated into a wireless body area network, which can be used for computer-assisted rehabilitation or early detection of medical conditions. This device will instantly transmit all information in real-time to the doctors throughout the realm.

Other various applications of this technology are in the stream of sports, military, or security. Extending the technology to new areas could also assist communication by seamless exchanges of data between individuals, or between individuals and machines.

II. LITERATURE SURVEY

[1]*IoT-based-health-monitoring-via-LoRaWAN:*

This paper collects the medical sensor data and sends it to an analysis module. This is proposed only in the areas where the cellular network is absent. The LoRaWAN network which is used as the transmission module covers only 33 km2 of the area when placed at an altitude of 12 meters. In this the distance of transmitting data is limited. It cannot transmit the data continuously in real-time. It cannot monitor or store the ECG signals. It does not maintain any previous medical history of the patient.

[2]*Real-time- patient –monitoring- system- based -on – Internet- of- Things:*

Various sensors are used for collecting the biological behaviors of a patient. The meaningful biological data are then forwarded to the IoT cloud. The system is more intelligent that can able to detect the critical condition of a patient by processing sensors data and instantly provides push notification to doctors or nurses as well as hospital in-charge personal. But the humidity and ECG signals cannot be sensed by this system. In this constant monitoring, facilities are not available.

[3]*Predictive-Monitoring-of-Mobile-Patients-by-Combining-Clinical-Observations-with-Data-from-Wearable- Sensors*:

Most current devices generate such lots of false-positive alerts that devices cannot be used for routine clinical practice. This paper explores principled machine learning approaches to interpreting large quantities of continuously acquired, multivariate physiological data, using wearable patient monitors, where the goal is to provide early warning of serious physiological determination, such that a degree of predictive care is additionally provided Advances in principled approaches to predictive patient monitoring is limited by the matter of collecting physiological data from a mobile population of patients Data dropout was an enormous challenge, mainly due to infrastructure problems (interruptions within the hospital Wi-Fi service) or expired batteries.

[4]*Cloud-Based-Wireless-Body-Area-Networks*:

This article reviews and compares the frameworks and evaluates the varied methods to manage WBAN data. WBAN sensors collect vast amounts of bio-signal data from a patient for long periods. This technology has played a serious role as a foreign monitoring health-care system. These challenges include data management, data processing, wireless communication, sensor heterogeneity, privacy and security, data validation and consistency. Due to population increases and also the emergence of assorted diseases, the quantity of medical practitioners available to fulfill the health needs of the patient is commonly insufficient. These techniques require efficient management in power consumption, processing delay, interference, and network congestion while transmitting large non-urgent packets over the network.

[5]*An-Efficient-Wireless-Health-Monitoring-System*:

The Health Monitoring system is to monitor the heartbeat, temperature, blood pressure at particular time intervals and every second oxygen saturation level in a continuous manner. The benefits of this system are it allows sending data from patients to doctors immediately without any delay so that it allows doctors to reach out to the patients quickly. By implementing the IoT (Internet of Things) concept, the health monitoring systems become more flexible as they transmit monitored medical data with doctors or with any other medical organizations automatically through the internet. The healthcare system based on WSN must support for ad-hoc networks. Reliability of data communication is an important factor for dependability and quality-of-service (QoS). This is mainly applicable to the uninterrupted monitoring of a patient whose health condition is critical.

[6]*IOT-based-Patient-Health-Monitoring-System-with-Nested-Cloud-Security*:

This paper proposes an idea of Health Monitoring System which monitors the physiological parameters of the patient which uses sensors and micro-controllers that transmits the information to a server. This provides security to the patient's data during which Secret key Sharing Algorithm is utilized during which data and keys get split and to retrieve them threshold cryptography is utilized. This helps the physicians in right analysis and remedy. Accuracy and price of the device are equally emphasized.

Remote Sensing wearability, accuracy, low Power and low cost. The value of prediction are in binary form if prediction value is zero then a patient won't have any heart problem but if prediction value is one then that patient will have a heart problem.

III. HARDWARE COMPONENTS

1. ARDUINO UNO

The Arduino Uno is an open-source microcontroller board supported the Microchip ATmega328P microcontroller and developed by Arduino.cc. The Arduino Uno are going to be equipped with 14 digital I/O pins , 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a sort B USB cable.

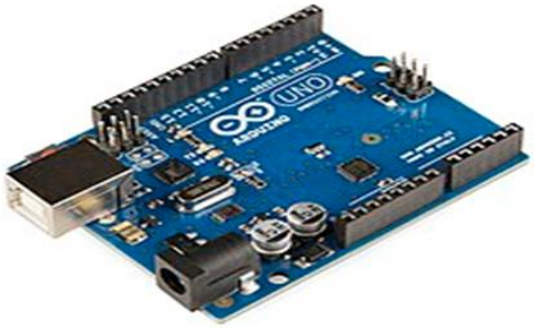

Fig 3.1 shows the structure of Arduino UNO

It is powered by the USB cable or by an external 9-volt battery. The hardware reference design is distributed under an ingenious Commons Attribution Share-Alike 2.5 license and is on the market on the Arduino website. Layout and production files for a few versions of the hardware areavailable.The ATmega328 on the board comes preprogrammed with a boot loader that permits uploading new code thereto without the utilization of an external hardware programmer. The Uno communicates using the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

2. HEARTBEAT SENSOR

Heart rate could be a window into your muscles and lungs because it reveals how hard they're working! The necessity for an accurate, affordable cardiac monitor is important to confirm one's health quality. Therefore the heart beat sensor will provide an accurate reading of one's vital sign.

Fig3.2 shows the structure of Heartbeat sensor

Our vital sign could be a superb indicator of your physical condition! Vital sign is measured in several ways. The most common techniques are electrical and optical methods. Within the optical method measures the center rate by sensing changes in blood flow through the index. A plot for this modification recorded against the clock is called as photoplethysmographic (PPG) waveform.

3. ECG

This sensor is employed to live the electrical activity of the center. This electrical activity could even be defined as an ECG or Electrocardiogram and output as an analog reading. ECGs could even be extremely noisy, the AD8232 Single Lead rate Monitor acts as an op amp to induce a transparent signal from the PR and QT Intervals easily.

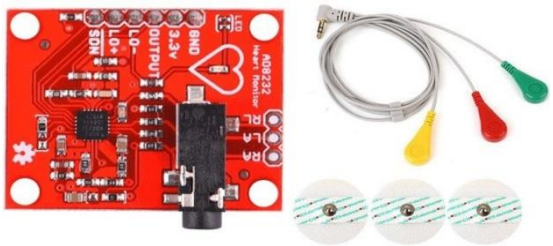

Fig 3.3 shows the structure of ECG sensor

These sensors are designed to derive, amplify, and filter small bio potential signals within the presence of noisy conditions, which are created by motion or remote electrode placement. Also provided on this board are RA (Right Arm), LA (Left Arm), and RL (Right Leg) pins to connect and use your own custom sensors and there's an LED indicator light which is ready to pulsate to the rhythm of a heartbeat.

4. TEMPERATURE SENSOR-DHT11

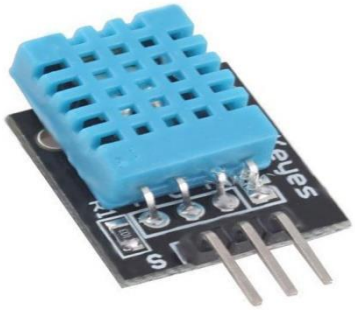

Fig 3.4 shows the structure of Temperature sensor

The digital temperature and humidity sensor DHT11 could be a composite sensor that contains a calibrated digital signal output of temperature and humidity. The technology of a passionate digital modules collection and therefore the temperature and humidity sensing technology are applied to make sure that the merchandise has high reliability and excellent long-term stability. These sensor acts as a barrier for the wet component and an NTC temperature measurement device. They are connected with a high performance 8bit microcontroller.

5. NODEMCU

NodeMCU could also be a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was supported the ESP-12 module.

Node MCU is an open source firmware that open source prototyping board designs are available. The firmware and prototyping board designs are open source. It is used to send the data to the cloud for storage.

Fig 3.5 shows the structure of Node MCU

The prototyping hardware used could also be a computer circuit functioning as a dual in-line package (DIP) which integrates a USB controller containing the MCU and antenna. The choice of the DIP format allows for straightforward prototyping on breadboards. The design was initially was supported the ESP-12 module of the ESP8266, which can be a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely utilized in IoT applications.

IV. PROPOSED WORK

Various intelligent physiological sensors are accustomed do the Hardware Setup. Initially, of these sensors are attached to the patient body to sense their physiological parameters. The output of those sensors is given to Arduino UNO board for further transmission. We have used an Arduino UNO (IoT development board) as a principle controller of our proposed monitoring system. The Arduino board collected the data about patient health parameter from various sensors like heartbeat sensor, ECG sensor, temperature sensor and pressure level sensor which were directly connected with principle controller. The next device that's employed in the planning is Node MCU which is employed to transmit the data from Arduino UNO to Ubidots cloud.

Node MCU uploads the physiological monitoring data and implements health archives management in health cloud. Health cloud holds health archives and private physiological data. When the power is switched ON, the sensors connected to pin A0 and A1 will read temperature, pulse rate and ECG. NodeMCU is connected with pins A4 and A5that enables the pathway between hardware connection and cloud.

The cloud will have a unique user ID and password for every patients and hospitals. Since we need security for patient records and to avoid editing of records hospitals are provided only access to upload a report or go through previous records. Patients are provided only view access. The health connected info might be interacted with doctors. Even within the absence of the doctor close to the patient or within the hospital; the doctor will grasp the patient's problems so the doctor's recommendation is given in crucial cases.

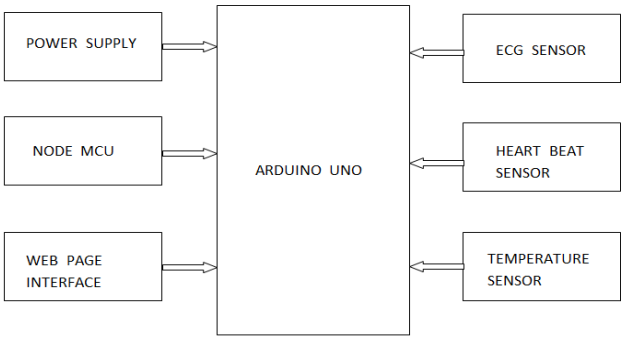

Fig 4.1 Portrays the Block Diagram

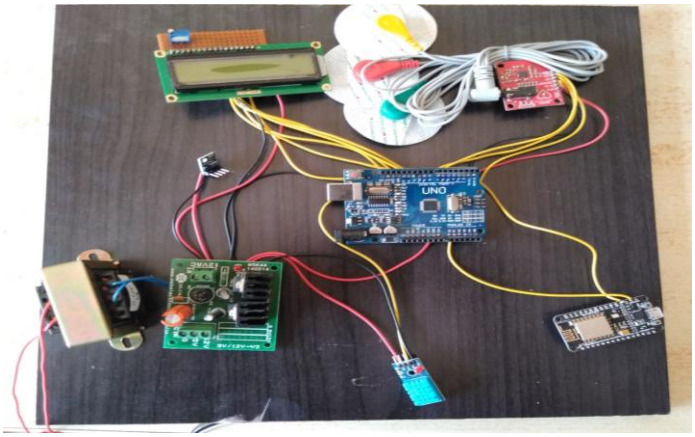

Fig.4.2. Shows the Hardware implementation

Cloud storage could be a model of computer data storage during which the digital data is stored in logical pools. Cloud storage relies on highly virtualized infrastructure and is like broader cloud computing in terms of accessible interfaces, near-instant elasticity and scalability, multi-tenancy, and metered resources. Cloud storage services are often utilized from an off-premises service (Amazon S3) or deployed on-premises (ViON Capacity Services).

UBIDOTS technology and engineering stack was developed to deliver a secure white glove experience. Device friendly APIs (accessed over HTTP/MQTT/TCP/UDP Protocols) provide a straightforward and secure connection for

sending and retrieving data to from our cloud service in real-time. UBIDOTS exists to empower your data from device to visualization.

V. RESULTS

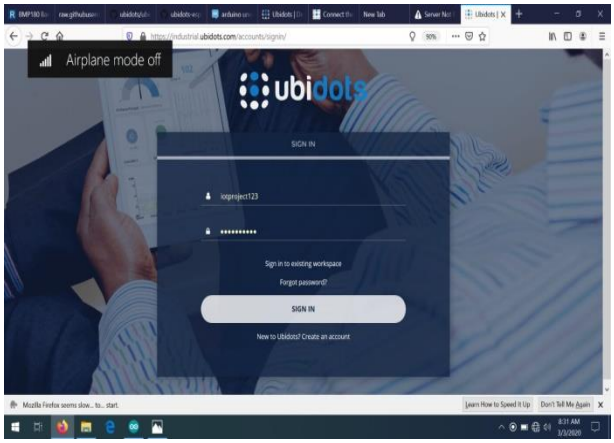

Fig 5.1 Portrays the Login page

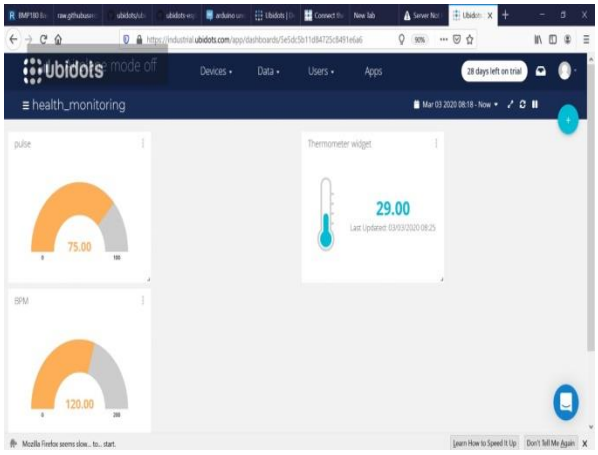

Fig 5.2 Shows Output view through Cloud access

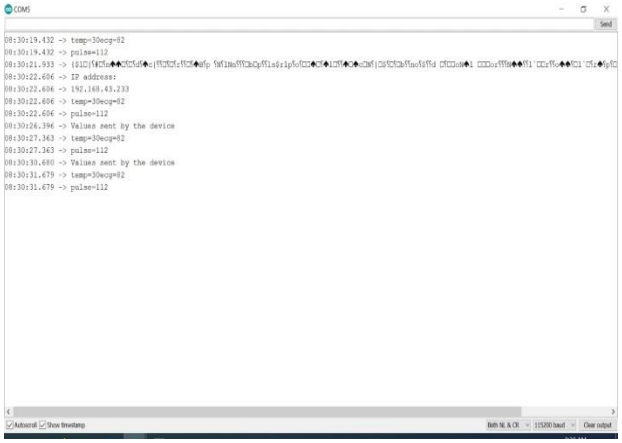

Fig5.3 Shows the Serial Output

VI. CONCLUSION AND FUTURE WORKS

In this paper, Body Area Network combined with IoT (Internet of things) helps in detecting the bio-signals received from the sensors. The sensors like heartbeat, temperature, ECG, and pressure are interfaced with a microcontroller for measuring the physical parameters of a patient. The data received from the sensors are transferred to the cloud by using Node MCU. The readings from the sensors have timestamps that help in managing the report of the patients. The primary purpose of this prototype is to maintain the medical records of the patient safely in the cloud. It also helps the doctors to look through patients' previous medical records easily. The future advancement of this prototype is to improve the security for the access of the files by using fingerprint access or by OTP sent to the mobile. This system is cost-efficient and helpful to the medical organization, doctors and patients.

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