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IOT - Based Smart ICU with Alert

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Abstract: ***An intensive care unit is where the patient who has sarcastic illness is admitted for doctoring; in this condition, those patients are to be scanned continuously. To monitor victims perpetually is strenuous. In the case of a cartel, it is really unthinkable to monitor them mutually. But by employing IOT automation, anyone can keep track of patients anytime anywhere. As soon as the trenchant stage reaches, medication is provided according to the physician's advice. It can retain doctors updated all pace over internet. The proposed system observes some physical criteria like throb, thermal reading of human body and pressure level of blood. These data are collected continuously and uploaded in database between certain intervals. Sensors play a vital role thus the data from patient's body are collected via some specialized sensors. Those data are passed to cloud through GSM. Using IOT the above-mentioned values can be viewed anytime by the users. Pressure can notice both in systolic and diastolic ranges. Acute ranges are allotted for each sensor, if panorama exceeds an alert will be generated, and correct decisions are taken under doctors' advice. And an indication of emergency is also available at webpage. IOT based patient care unit gives flashing and unfailing results, which benefits lot to the society. Along with some vital signs of physical body trip level and level of oxygen in the cylinder can also be indicated with the help of optical sensors. Proposed system is most conducive, well organized and ultra precise. This system not only serves single person, many persons can be monitored and alert will be given to all at emergency conditions. Such that an efficient monitoring can be done by health care professionals.***

Keywords: IOT patient monitoring, intensive care automation, real-time health tracking, medical sensor technology, emergency alert system

1. Introduction

ICU cater to patient with severe and life - threatening illness and injuries, which require constant, close monitoring and support from specialist equipment and medications in order to ensure normal body functions. They are staffed by highly trained doctors and nurses who specialize in caring for critically ill patients. [6] By using this technology, medical specialists can check complete subtle elements of a patient from a remote area and can prescribe. The basic motivation of this innovation to provide doctors stress free job and to reduce the work load. Implementation of this system made the traditional requirements of a nurse to inform the condition of a patient and checking them continuously. Health facilities of a remote area can be also be monitored using this technology. [8] However modern updates in IOT, cloud computing, mobile and web development and computer vision technology are offering us a wider scope in providing effective health care systems to everyone. This includes automation in systematic monitoring of patients, transmission of medical data at real time, and storing of those data in database. [11] And the data are displayed in LCD. Once the threshold is reached an alarm is generated both in webpage and in personal server. Thereby medical advices can be given at correct time without delay. [1] the most promising application of IOT is in the health care sector. In certain foreign countries people still do not have good medical counseling. IOT based systems reduce the distance between patients and doctor. MQTT (Message Queuing Telemetry Transport) system helps to connect many applications with devices. Thus, it collects all data from victim continuously and uploaded in cloud for every five seconds interval. ECG of a patient is continuously monitored and reports are sending to cloud for further process.

Indoor ECG monitoring is developed by some designers, but the main drawback of this system is Bluetooth ranges up to some meters. The distance is too short and persons in long distance cannot be monitored. Android based monitoring systems also developed; it gathers data and stores in SD card, so real time data passage cannot be done by this system. [3] This system involves remote monitoring of people's health based on some physiological parameters using IOT. [4] This system presents the design and implementation of IOT based health monitoring unit for emergency conditions, which can demonstrate, collect and interoperation of data from patient body. Then these data are passed on to the controller and via IOT services it can be monitored anytime by anyone. [7] Information communication technology (ICT), especially IOT has received many attentions from many researches. In healthcare IOT has proven in improving the quality of healthcare services. Many IOT based digital systems, such as Wi - Fi digital thermometer, telemetry digital parameter and remote digital blood pressure have been developed recently.

Many developing countries have reduced the mortality of children in recent years. This is possible by injecting many vaccines between the age group of 1 - 10 years. For instance, in Bangladesh during 1991 - 2011 mortality of children decreased at a rate of 150 - 151 for every 1000 children. However for adults no results are found. Development in patient health care monitoring using some technologies has made a drastic decrease in mortality rate of adults. The increased patient diagnostic tool and technology help us to achieve this goal. This system gives an effective treatment at time and allocates resources. It will be very useful for patients at ICU, at homes, and elderly people those who are lonely. This technology does not need any doctors help every time. And patient itself can monitor himself and take correct measures at time. Advantage of this system is that many patients can be observed one time from any place. [10] Pillow type PPG sensor protects the patients from respiratory illness. This type of devices gives accurate and efficient operation thus preventing patients from death. Stroke patients have respiratory problems during night time by using these pillows, serious effects can be reduced and medication can be provided at correct time.

2. Proposed System

Proposed system deals with the continuous monitoring of patients and giving alert during emergency conditions. This can be achieved by using IOT and cloud platform. The major components required here are sensors specialized for monitoring vital signs of patients. Those sensor data are collected and send to a central controller, through max232 IC data from Arduino will be passed on to GSM. Then through internet connections data will be stored in database for further operation. IOT based monitoring system helps to fetch data from database anytime, only the users can observe the data at time. No stranger can do a work on that. The webpage has an http request; it is encrypted by security conditions. Data are secured and no theft of data can be occurred. Thus the IOT based monitoring system is used worldwide. Recent advances in technology made our life easier and more comfortable. Receiving medical advices at correct time makes the mortality rate reduced. The advantage of this system is that during emergency conditions alert will be produced and both in the webpage and server it is displayed. Not only doctors even patient can prevent themselves by affecting very serious. Usage of Bluetooth, GSM services made a certain range of frequency and inefficient operation. Zigbee and fuzzy based logic also a drawback because their data handling capacity is very low and range of frequency is also at a small range. But IOT based systems has a range of 2.4GHz to about 60GHz. An accessible internet connection made the data to be transferred to cloud and fetched anytime. Data send at previous sections also stored in the database for future usage. Alert will be in mail or message format. It gives flashing and efficient results. Nanoseconds of operation save life of a human. Operation is explained as flowchart format.

Block diagram for the proposed system explains the data transfer from human body to database. Thus the sensors gather data from human body and those data are to be transferred to Arduino. Using max232 data from Arduino are transmitted to cloud database. The values are also stored in that database. Using IOT automation, fetching of data can be achieved. The system is very fast and efficient. Telecommunication plays an important role in our day to day life. It benefits a lot to our society. Health care centers are increasing widely, but by starting smart health care centers time saving and money saving are executed. Not only patients from ICU can be monitored, if any one wants to take treatment at their homes also benefits a lot. Old people without any caring persons can take smart ICU treatments.

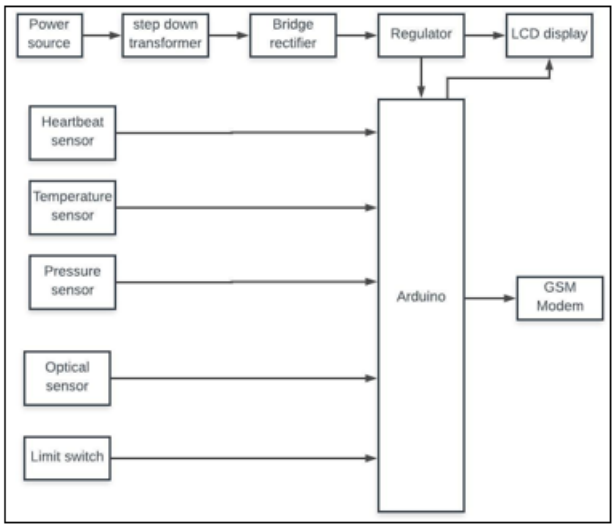

Figure 1: Block diagram of proposed system

3. Framework of IOT Based Smart ICU

As technology booming in every sector, implementation of IOT in ICU converts ICU into smart ICU. The hardware architectonics of smart ICU is given below;

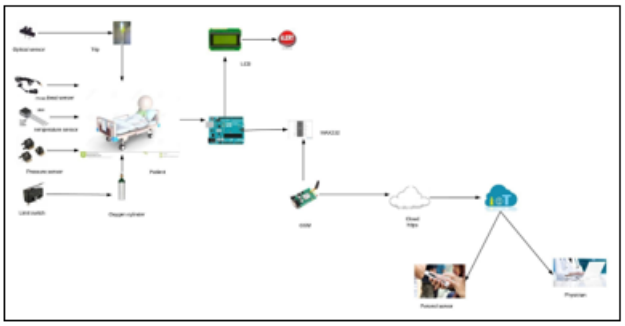

Figure 2: Architecture for smart ICU

Peripherals of this system implicate sensors, Arduino, LCD, GSM, max232 and a personal server (mobile or laptop). Vital signs of patient's body are deliberated. Heartbeat can be timed by adopting sufficient sensor. Thermal readings are calibrated using temperature sensors in degree Celsius. Pressure can be gauged with the help of pressure sensor. Calibers stockpile by the sensors are cruise to the central controller which is Arduino. Arduino then gives the calibrated values to GSM (Global Systems for Mobile Communication) via max232. Max232 is an integrated chip. It is used to transfer data for serial communication. It connects with data terminal equipment. DTE is GSM here. GSMSIM800 modem remits data to database. Data from cloud can be generated during emergency conditions both in webpage and server. These sensors benefit a lot such as low power consumption, accuracy, easy process etc.

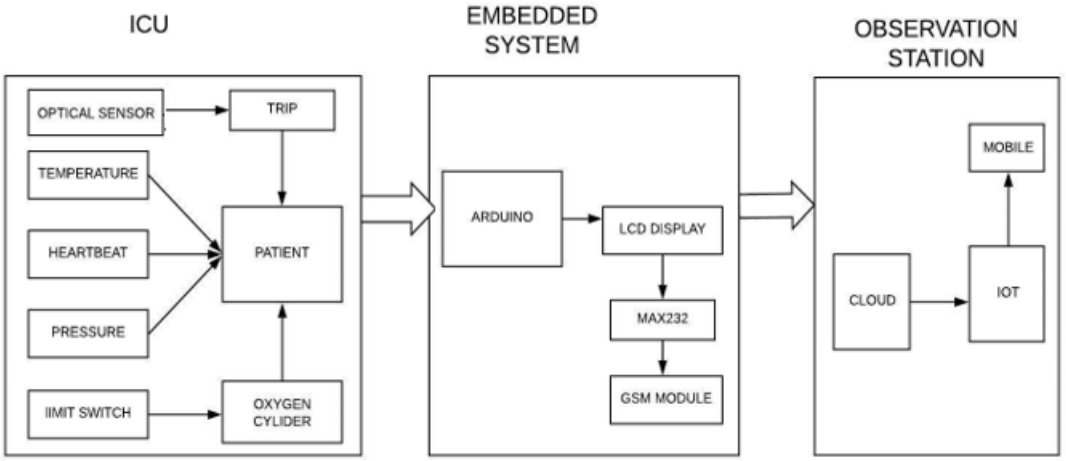

Figure 3: Data flow

1) ARDUINO:

Arduino AT mega328 is a tangible micro controller based kit. It enclosed 32 pins and 8 bytes. Arduino inherently uses Harvard architecture where the program code and program data have sundered memory. Precedence of Arduino is that, it does not need any hardware programmer. In this system the spinoff from sensors are send to Arduino. These analog dossiers are connected into digital outcome to LCD display and via max232 transferring occurs. Max232 transfers dope to the GSM module. A very small and simple web server runs on Arduino accepting http request.

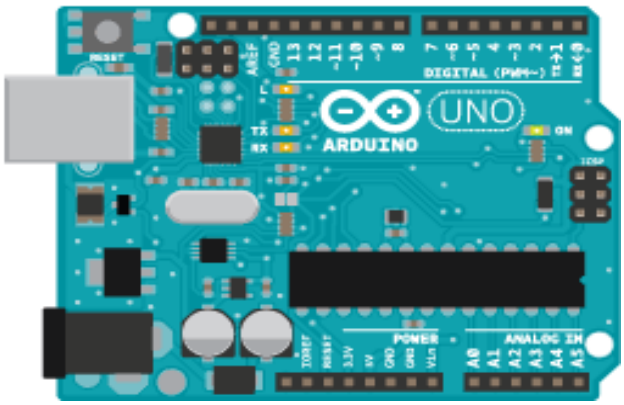

Figure 4: Arduino unor3

2) Global Systems of Mobile Communication:

Delegate system for wireless transmission of data from systems is GSM. GPRS is an endeavoring service for GSM. GPRS is an encapsulation of general pocket radio service. Data transmission can be facilely done through GPRS. Without exception it uses all networks Sims for data transmission. It performs as a mobile phone responding to all Sims. RS232 dispatch dopes to GSM from Arduino. With the help of modem, data rush off to the database.

Figure 5: GSM modem

Internet of Things:

Internet of things is an emerging paradigm. It is used worldwide for quick updating of any results. IOT is rationalized as network of supplanting data from physical devices to network connectivity. IOT benefits more as, huge amount of data can be fetched at any time, financially low, time reserving, regimate and record can be performed readily. The most challenging part is creating a server with http request. The user just needs a working internet connection to view data.

3) Cloud Computing:

Cloud computing is naught working in the internet. It hosts all programs what user needs. Cloud is a server which enclosed all contexts. Data from GSM send to cloud and anyone can buck the information from cloud with the help of IOT. Paltry way of data live checking and deposition is done with cloud. It access digital resources over the internet from just about anywhere in the world that has connectivity.

Flowchart

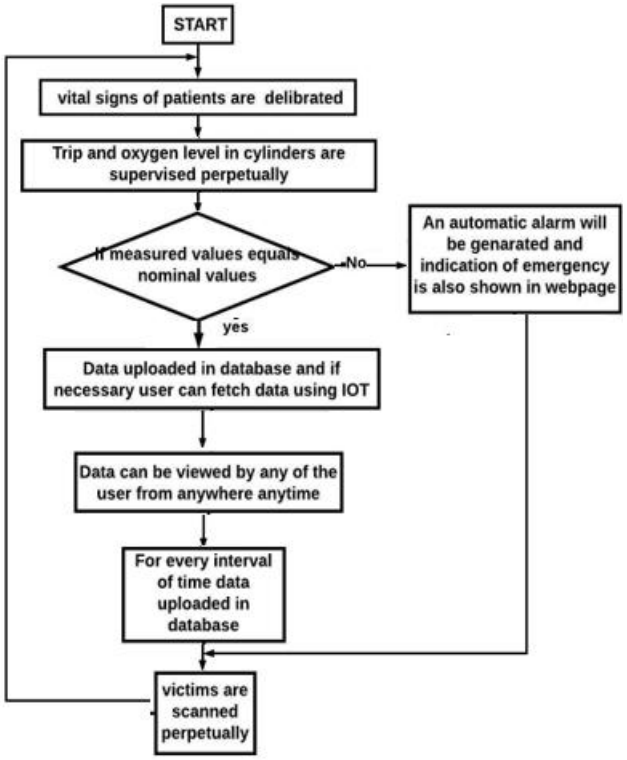

Figure 6: Flowchart of proposed system

Flowchart explains the operation of smart ICU. Sensors are given acute values, if those values go beyond or above acute values. An emergency alert will be given in webpage and email or message alert is given to user's personnel server. This process continuous tills the patient in ICU.

Performance Evaluation:

The proposed system's architecture, data flow and flowchart are described above. Working and results are discussed in this section; parameters of human body such as heartbeat, temperature and pressure are measured using specialized sensors. Pressure level is noted both in systolic and diastolic ranges. Data from sensors are passed to Arduino the central controller. Along with that trip and oxygen level in cylinders are also noted. Arduino controller then gives its data to max232. max232, an interfacing IC that passes data to a database via GPRS modem. The user just needs a website and an accessible internet connection. Data from the database is shown in the webpage via IOT. IOT is a booming technology which gives data at a speed of 60GHz frequency. As mentioned earlier the results from sensors are viewed in LCD. Webpage also contains an emergency alert system. The results from sensors are displayed in LCD are shown below.

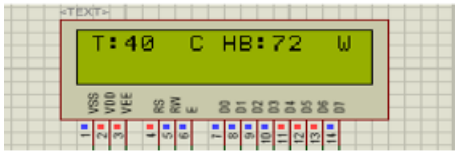

Figure 7: Normal condition of patient parameter

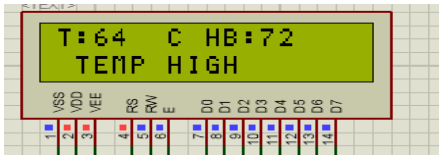

Figure 8: Abnormal condition of patient parameters

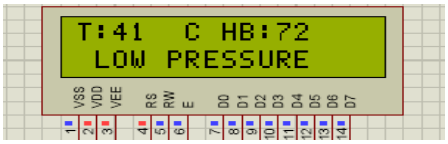

Figure 9: Abnormal condition of pressure

Figure 10: Abnormal condition of oxygen level

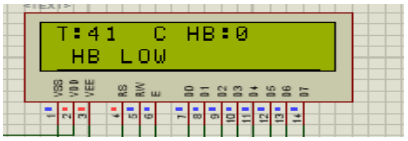

Figure 11: Abnormal condition of heart beat

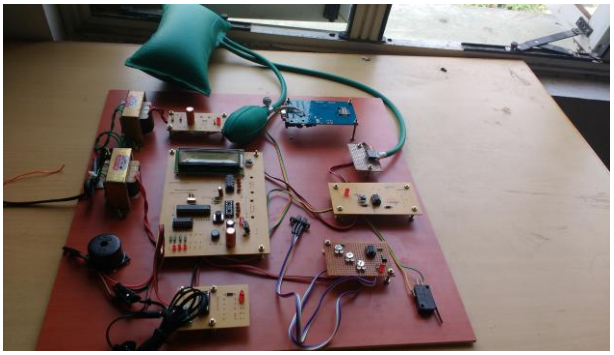

Figure 12: Experimental setup for proposed system

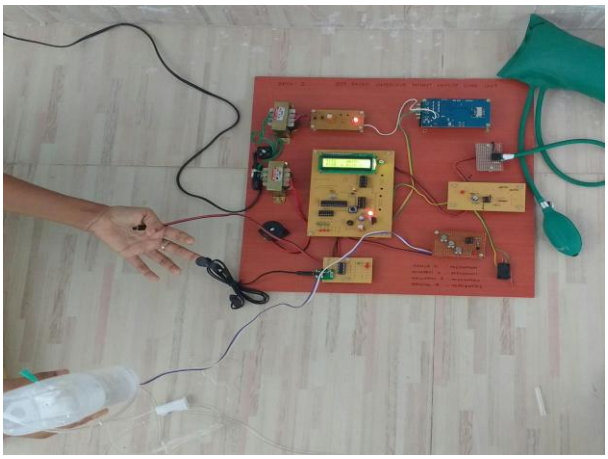

Figure 13: Measuring all parameters of patients

This image shows patient body parameters such as heart beat, temperature, pressure and drip level.

Figure 14: Webpage of our system showing patient history

Figure 15: Front page of our website

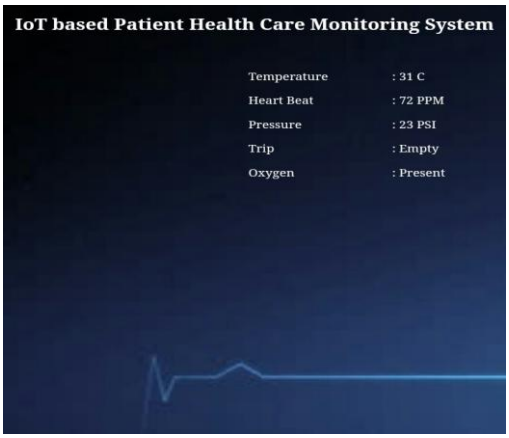

Figure 16: Results of patient

In this webpage patient's data such as temperature, heartbeat, pressure level, trip and oxygen levels are shown. Continuous monitoring of patients is achieved here. Updation of results are fast and effective results are gained.

4. Conclusion

In this paper a smart ICU system has been casted and resolved to amplify the physical parameters of patients. In a shrewd idiosyncrasy the compiled data transmitted to doctor - pc and database using telecommunication based on IOT and WSN. By implementing this system the traditional engrossment of a nurse or caretaker to illuminate the condition of patient can be fend off. The proposed framework has discovered the energy spent through testing. In the aforestated work we proposed a salubrity care system consisting of IOT, cloud computing, sensors, software and web. In this system a new method was proposed to measure trip and oxygen level in their cylinders. Usage of data mining technique to know the health status of a patient without medical professionals help is ascendancy. Data retrieval process is also handled. The proposed system is very cheap, light weighted it can easily carried and low power consumption.

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