Measurement of Vital Parameter for Health Care using Internet of Things in Ambulance

Sakthivel Sankaran[1], Divyasri Chandrasekaran[2], Poornima Devi Muthukrishnan[3] and Preethika Immaculate Britto[4]

[1]*Assistant Professor- Kalasalingam Academy of Research and Education*
[2nd] *Year Biomedical Engineering-Kalasalingam Academy of Research and Education*
[3]*Final Year Biomedical Engineering- Kalasalingam Academy of Research and Education*
[4]*Assistant Professor, Department of Biomedical Engineering, College of Engineering (Women), King Faisal University*
E-mail: [1]sridivya0226@gmail.com, [2]sakthivel@klu.ac.in,
[3]mspoornimadevi@gmail.com, [4]pbritto@kfu.edu.sa

Abstract—*The Ambulance services in transporting pregnant women, children and those that require emergency medical attention remains a challenge in India even after 50 years of public health care provision. Transmitted information is usually sparser. There have also been numerous limitations associated with voice transmission. This might due to the lack of technological implementation at ground zero. For addressing, this issues in this paper introducing measuring a vital parameter for health care using IoT in ambulance. This is used to communicate the vital parameters of the patient to the hospital. IoT can be used widely in large number of system where a large amount of data can be accessed and processed easily. The possible medical data of the patient will be transmitted prior to the doctors table within the reaching time to the hospital. This done by upgrading technology called IoT. The internet of things is a system of interrelated logical devices and digital machines, objects, animals or people that provided with unique identifiers which has the ability to transmit data over a network without requiring human-to-human or human-to-computer interaction. The new system will be implemented in which there all vital body test report will sent to the hospital. This telemetry system focuses on the measurement and evolution of major vital parameters such as ECG, Temperature, Blood pressure, & Diabetes. The proposed methodology presents individual health care system that is both flexible and scalable.*

Keywords:-*IoT, Temperature, ECG, Ambulance, Personal Healthcare System.*

Introduction

Today's ambulances are often custom built, and as well as the special medical equipment now built into the ambulances, industry huge improvement in vehicle design have had an impact, including improvements in audible and visual warning devices to help protect crews in vulnerable times (such as at a road traffic collision), and general improvements which are particularly valuable for ambulances, due to the speeds reached and the weight carried. There have also been developments to help safeguard the health and welfare of ambulance crews. In India large numbers of patients are graved because of heart attack and reason behind that, they are not getting at an accurate time should be easy to use, portable, light weighted, small size. This device that is a heartbeat sensor would help to keep track on heartbeat counts of patient and check for any abnormalities. If any changes takes place it is intimated. This notification would help to take an appropriate move at a fraction of time. This would save patient from the future health problem which would arise. To provide them help first we want regular monitoring the patient health. Normally it is tough to keep track on abnormalities in heartbeat sounds for patient himself. The average heartbeat of 25years old ranges between 140 to 170 beats and for60 years old, it is typically between115to140 beats per minute. The body temperature is 37 degree Celsius or 98.6F. There are various instruments feasible in the market to keep track on inner body changes but there on many limitation towards their maintenance due their heavy capital, size of instruments and mobility of patients.

To overcome this limitation a device used to keep track on heartbeat count on patients being calculated, recorded and those data along with other parameters will be transmitted to the receiver end. The up grading technology used here is the Internet of things. Internetworking of devices, physical objects integrally embedded with sensors actuators, software, electronics and network connectivity that enable these objects to collect & exchange data. IoT was first emerged in1990's, discovered by Kevin Aston. IoT is also called automation.

Most common medical equipment's used inambulances are

1. Portable and fixed suction apparatus with the regulator.
2. Portable and fixed oxygen supply equipment capable of metered flow with adequate tubing.
3. Pulse oximeter with pediatric and adult probes.
4. Automated external defibrillator(AED)with pediatric and adult sized pads
5. Portable and battery operated defibrillator.

6. Sphygmomanometer: It is also known as simply blood pressure meter.

7. Transcutaneous cardiac pacemaker: To measure the effectiveness of the heart, there is a cardiac pacing device, which is temporarily used during caution situations. Pulses of electric current are given through patient' schest, which will help to stimulate their heart.

8. Nebulizer: when it essential to monitor medication as quickly as possible to the patient, a nebulizer is used to administer in the form of mist inhaled in to the lungs. It is similar to inhaler used for asthma patients and is very effective for sudden relief. It is required to be inside the ambulance.

9. Immobilization equipment some of electronic equipment used in ambulances is jump bag, bag value mask medications bag, trauma and spinal board, ECG display with defibrillator, incubators, ventilators and infusion pumps.

Literature survey

Mostproposedframeworksforremotehealthmonitoringadvantag ethreetier architectures: a wireless body are a network with we arable sens ors as the data acquisition's unit communicator and networking and service layer. For instance, prescribes a system that recruits wearable sensors to me a sure various vital physiological parameters such as blood pressure, body temperature, blood sugar level and ECG sensor communicate the gathered data to a gateway server through a Internet of things board connection. The gateway server turns the data into an observation and measurement file and stores it on a remote server for retrieval by clinicians through the internet. A device utilizing the IoT scheme is uniquely addressed and denotable at anytime and anywhere through the internet. IoT based devices in remote health care monitoring systems are only capable of the conventional sense tasks but can also exchange information with each other automatically connect to and exchange the information with health villages through the internet.ECG is the measure of electrical activity of heart within the cardiac cycle. ECG tracing- the diagnostic tool that manipulates the electrical function of the heart and measuring voltage versus time can be confusing. So some steps are involved to identify the rhythm. The QRS segment represents the depolarization (electrical charging of cells) within the ventricles, the two lower chambers of the heart that gather and blow blood towards the body and lungs. R wave is the positive wave above the base line. Using a six-second strip, R-R intervals between QRS segments is measured to determine if the rhythm is normal or abnormal. Some irregularity in the ECG will be associated with some symptoms such as C.H.A.P.S – chest pain, hypotension, altered mental status, poor perfusion, or shortness of breath. The QRS complexes are counted and multiplied them by 10 to arrive heart rate per minute. With this the patient's heart rate can be discriminated as *bradycardic* (less than 60 beats per minute) and *tachycardic* (ranges from100 to 150bpm) where the normal range is between 60bpm-100bpm.Blood pressure measurement is traditionally done in brachial artery. The systolic and diastolic pressures vary substantially in different parts of the artery which increases with systolic pressure and decreases in diastolic pressure. In auscultatory method of blood pressure measurement uses mercury sphygmomanometer. It listens to the korotkoff sounds using stethoscope. In the oscillometric method of measurement, the oscillation of pressure in the sphygmomanometer cuff are recorded during the gradual deflation. The point of maximum oscillation or responds to the mean intra-arterial pressure. the oscillations origins at approximately systolic pressure and continue below diastolic, so the diastolic pressure can only be evaluated indirectly. Body temperature is a measure of the body's ability to make and get rid of heat. This measurement made on the forehead or in the mouth, or in the rectum, or in the armpit or in the ear. Usually a thermometer used to measure the body temperature. The average normal temperature is 98.6-degree Fahrenheit or 37-degree Celsius.

The blood sugar level is the quantity of glucose present in the blood of humans. The body tightly regulates blood levels as part of metabolic hemostasis. The measure of blood sugar level can be invasive or non- invasive. The non-invasive method can be done by using near infrared spectroscopy, polarized light (optical method), and multisensory- based glucometer. The normal range of blood sugar level ranges from 79 to 110 mg/dL (fasting blood glucose level), and 70-100mg/dL (while fasting).Such vital parameters, which are measured, accordingly, are being send to the arudino development board. Itis a microcontroller based on the Atmel ATmega32u4. It has 20 digital input/output pins (ofwhich7PWM outputs and 12 analog inputs), a 16 MHz crystal oscillator, a micro USB connection, ICSP header and a rest button.

Methodology

"Measurement a Vital parameters for health care using IoT" refers to connected system of device and applications that collect data then to the health care and it is through an online computer network. This medical device equipped with wifi allow the machine-to-machine communication that is the basic of IoT in health care. The IoT device linked to cloud platform such as web service and it capture the data can be stored and analysed. It is used to provide remote health monitoring and emergency notification system at frequency of 100MHz to 5.8GHz which could allow sufficient data in lower frequency. It is divided in to two parts hardware and software. Hardware unit is further classified into two units' transmitter and receiver. Transmitter unit is consisting of raspberry pi and sensor part as health sensors like heart beat sensor, temperature sensor, blood pressure sensor. Sensors that are wearable placed on the patient's body sensing the vital parameters. The sensed data are node that is transmitted to the

raspberrypi. This analogsignal is transmit to the Arduino board to convert the analog signal to digital signal. These digital signals produced at Arduino are received at raspberry pi, which cannot process theanalog signal. Raspberry pi does not have inbuilt ADC. Therefore, those analog signalsfrom the sensor are manipulating into digitalsignal using Arduino controller and then sent to the raspberry pi. Raspberry pi willsend the received signal data to website.
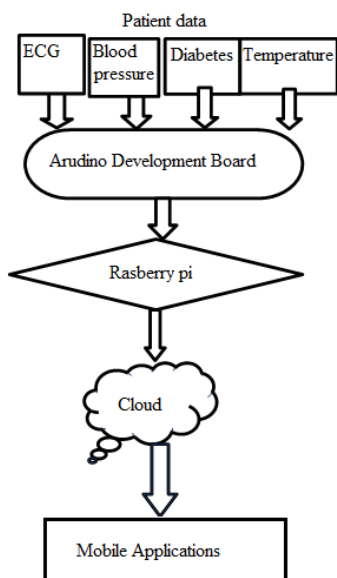
Methodology flowchart

Fig. 1: Methodology diagram

Results obtained:

The process for acquiring data from ECG sensor and temperature sensor were done and are discussed with the appropriate guidance. The interpretations are given below.
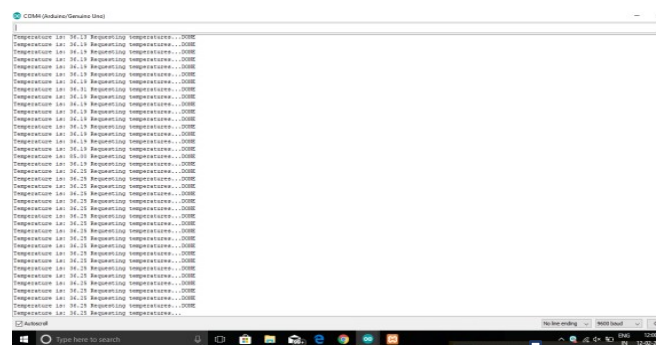

Fig. 1: Result 1

Fig. 2: Result 2

Fig. 3: Obtained data

Future work

The further proceeding of this project includes the measurement and transmission of blood pressure of the patient. It also includes the non-invasive measurement of blood sugar level and transmitting those data to the receiver end via Raspberry pi with the help of Arudino. In further aspects the other parameters such as EEG, EMG, evoked potential, EOG, ECOG etc., could also be involved in this project.

Conclusion

This work lends credence to the patients and families should ask for an ambulance, as opposed to driving them to the hospitals, like experiencing heart attack symptoms. By reducing any existing communication barriers and cutting the time a patient spends in emergency triage system, the ambulance team can wirelessly save their lives. This project will be very much useful in reducing the maternal and infant death by providing the patient's medical data to the physician as soon as possible before reaching the hospital.

References

[1] VeeramuthuVenkatesh, Pethuru Raj, Kaushik Gopalan and Rajeev.T, " Healthcare Data Fusion and Presentation using Service-Oriented Architecture (SOA) Orchestration Mechanism, " IJCA Special Issue on Artificial Intelligence Techniques - Novel Approaches & Practical Applications, Vol.2, pp. 17-23, June 2011.

[2] Ruihua Zhang and Dongfeng Yuan, "A Health Monitoring System for Wireless Sensor Networks, " in Proc. Of 2ed IEEE Conference on Industrial Electronics and Applications(ICIEA), pp.1648-1652, Harbin, China, May 2007.

[3] Luca Catarinucci, Danilo de Donno, Luca Mainetti, Luca Palano, Luigi Patrono, Maria Laura Stefanizzi and Luciano Tarricone, "An IoT-Aware Architecture for Smart Healthcare Systems.", IEEE INTERNET OF THINGS JOURNAL, VOL. 2, NO. 6, DECEMBER 2015.

[4] Andrea Zanella, Senior Member, IEEE, Nicola Bui, Angelo Castellani, Lorenzo Vangelista, Senior Member, IEEE and Michele Zorzi, Fellow, IEEE "Internet of things for Smart Cities" IEEE INTERNET OF THINGS JOURNAL, VOL. 1, NO.1, FEBRUARY 2014.