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IoT Based Intelligent Healthcare Kit

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Abstract: ***The paper aims to monitor the real time health status of a patient by using INTEL GALILEO 2nd generation board based on IoT. It senses the health status by collecting the data of patient's heart rate, temperature, ECG, blood pressure by using different sensors and then sends the collected data to the server by IoT and also gives an emergency warning to doctor if any. Health status in monitored and updated to the server using the application of IoT and warns the doctor about the status in emergency from microcontroller using the IoT. It reduces the informing time and risk to the doctor and alerting nurses using buzzer who are near by the patient.***

Keywords: IoT, Intel Galileo, ECG, Blood Pressure

1. Introduction

The IoT is a phenomenon where a large number of embedded devices employ communication services offered by the Internet protocols. Many of these devices, often called "smart objects", are not directly operated by humans, but exist as components that are spread out in the environment, such as buildings or vehicles.

The Internet of Things is an emerging topic of technical, social, and economic significance. Consumer products, durable goods, cars and trucks, industrial and utility components, sensors, and other everyday objects are being combined with Internet connectivity and powerful data analytic capabilities that promise to transform the way we work, live, and play. Projections for the impact of IoT on the Internet and economy are impressive, with some anticipating as many as 100 billion connected IoT devices and a global economic impact of more than $11 trillion by 2025.

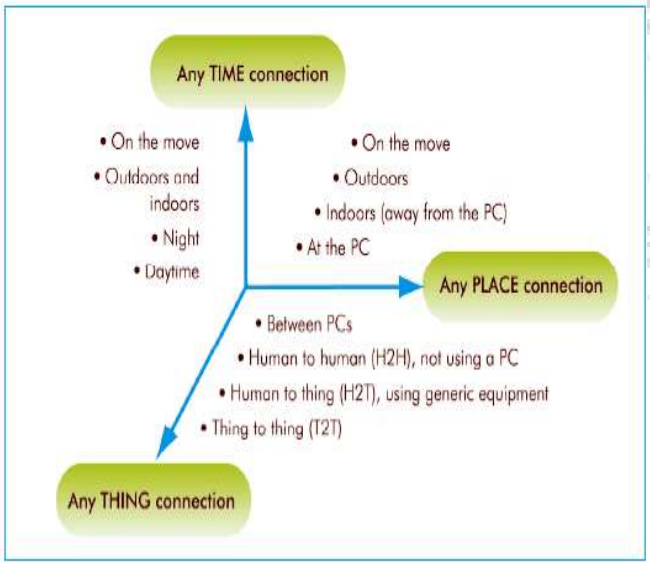

Figure 1: Internet of Things

The interconnected nature of IoT devices means that every poorly secured device that is connected online potentially affects the security of the Internet globally. This challenge is amplified by other considerations like the mass-scale deployment of homogenous IoT devices, the ability of some devices to automatically connect to other devices, and the likelihood of fielding these devices in unsecure environments.

2. Existed Work

Previously a lot of work is done in the field of IoT based health care based on PIC microcontroller, raspberry pi board and also on arduinio board. But in existing methods processing speed is low, noise effect is high, power consumption and complexities are also high. The existing methods are used to monitor blood pressure, heart beat rate and temperature values only.

3. Proposed Method

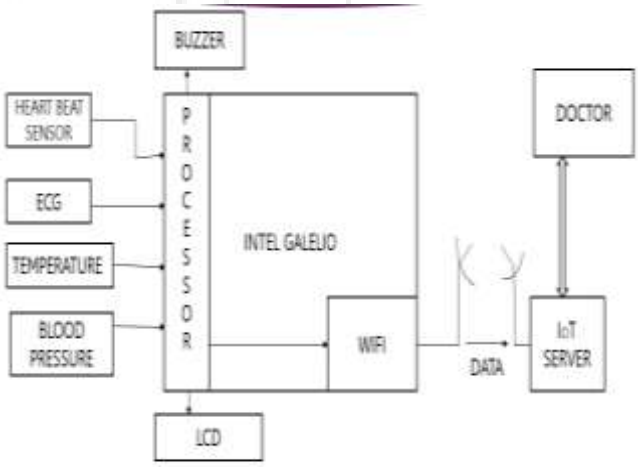

Figure 2: Block Diagram

The intel Galileo board collects the different health parameters of a patient by connecting different sensors like heart beat sensor, ECG sensor, temperature sensor and blood pressure sensor to the patient body. Then it sends the collected data to the IoT server by using Wi-Fi and also gives emergency warning to doctor if any abnormal condition will arise.

3.1 Intel Galileo Gen2

Intel Galileo is the first Arduino-certified development boards based on Intel x86 architecture and is designed for the maker and education communities. Two versions of Galileo released by Intel are, 1. Gen 1 and 2. Gen 2. Intel

Galileo combines Intel technology with support for Arduino ready-made hardware expansion cards (called "shields") and the Arduino software development environment and libraries. The development board runs an open source Linux operating system with the Arduino software libraries, enabling re-use of existing software, called "sketches". Intel Galileo can be programmed through OS X, Microsoft Windows and Linux host operating software. The board is also designed to be hardware and software compatible with the Arduino shield ecosystem.

Figure 3: Intel Galileo Gen2 Board

3.2 Sensors

3.2.1 ECG Sensor

The process of recording electrical activities of heart is known as ECG. It is very commonly performed cardiology test. Electrode detect the tiny electrical changes on the skin that arise from the heart muscle's. The AD8232 Single Lead Heart Rate Monitor and it act as an Operational amplifier.

The AD8232 is an integrated signal conditioning block for ECG and other bio-potential measurement applications. It is designed to extract, amplify, and filter small bio-potential signals in the presence of noise, such as those created by motion or remote electrode placement. This design allows for an ultralow power analog-to-digital converter (ADC) or an embedded microcontroller to acquire the output signal easily.

Figure 4: ECG sensor

3.2.2 Blood Pressure Sensor

Blood pressure is defined as the pressure of the blood in the arteries as it is pumped around the body by the heart. When the heart beats, it contracts and pushes blood through the arteries to the rest of the body. This force creates pressure on the arteries. Blood pressure is recorded as two numbers, 1.The systolic pressure (as the heart beats) 2.The diastolic pressure (as the heart relaxes between beats). Monitoring of blood pressure at home is very important for many people, especially for the people having high blood pressure.

Blood pressure does not stay the same all the time. It changes to meet the body's needs. It is affected by various factors including body position, breathing or emotional state, exercise and sleep. It is better to measure blood pressure when the body is in relaxed condition and sitting or lying down. High blood pressure (hypertension) can lead to serious problems like heart attack, stroke or kidney disease. High blood pressure usually does not have any symptoms, so we need to check our blood pressure regularly.

Figure 5: Blood Pressure Sensor

3.2.3 Heart Beat Sensor

Figure 6: Heart Beat Sensor

Heart Bear Sensor is a well-designed plug-and-play heart-rate sensor for Arduino. It can be used by students, artists, athletes, makers, and mobile game developers who wants to easily incorporate live heart rate data into their projects. The sensor clips onto a fingertip or earlobe and plugs right into Arduino. It also includes an open-source monitoring app that graphs the pulse in real time. The front of the sensor is the pretty side with the Heart logo, shown in figure 6. This side makes contact with the skin. On the front there is a small round hole, where the LED shines through from the back, and there is also a little square just under the LED. The square is an ambient light sensor, just like the one used in

cell phones, tablets, and laptops, to adjust the screen brightness in different light conditions. The LED shines light into the fingertip or earlobe, or other capillary tissue, and sensor reads the amount of light that bounces back. The rest of the parts are mounted on the other side of the sensor. We put them there so they would not get in the way of the of the sensor on the front.

3.5.4 Temperature Sensor

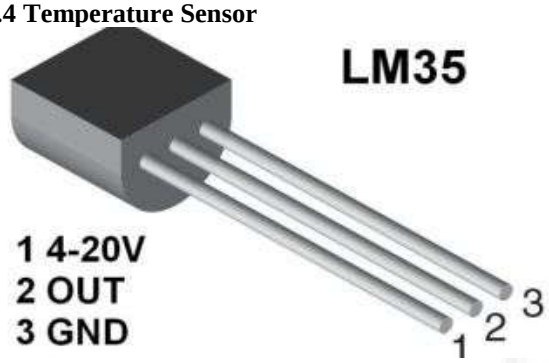

Figure 7: Temperature Sensor

The LM35(Linear Monolithic 35) series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, is that it is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range.

4. Experimental Results

4.1 Plant Setup

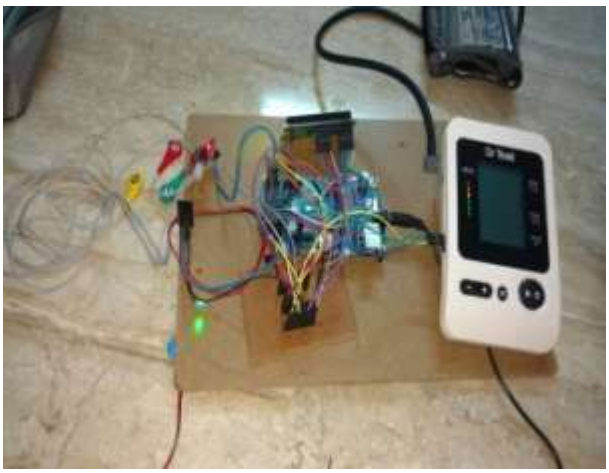

Figure 8: Plant Setup of Proposed Method

The above fig 8 shows the overall view of the health monitoring system by using IoT.

Under the working mode we get different sensor results. They can be seen from the below obtained screen shots

Figure 9: Temperature and Heartbeat Sensor Output

The fig 9 shows that the LCD displays the data collected from different sensors like heart beat sensor, temperature sensor and ECG sensor.

Figure 10: Blood Pressure Sensor Output

Here is the result of the blood pressure sensor monitor when connected to me (M.Sivalingamaiah), is as shown in above fig 10

Figure 11: ECG waveforms

The above graph (fig 11) shows the patient live ECG waveform is being traced in real time.

The system architecture of the proposed model is explained by the given below figures. Which includes a server connected intel Galileo board that uploads the data received by the sensors on to the data base and statistical graphs are being plotted for further analysis and recording.

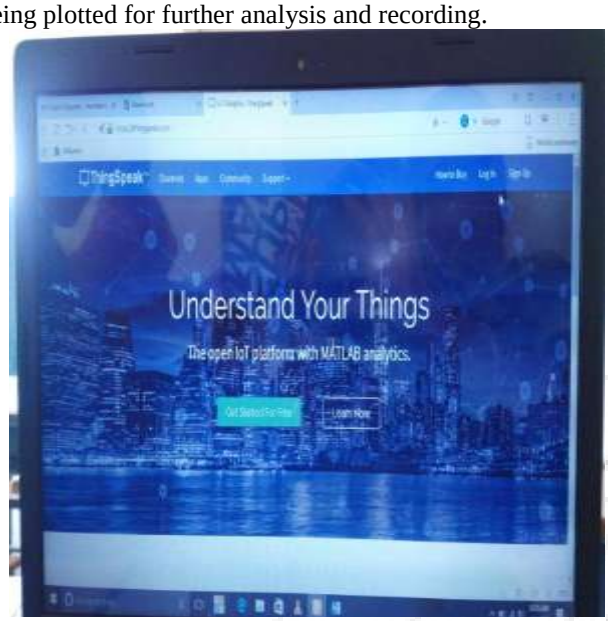

Figure 12: System web portal design

In the login tab (fig 13), the user can login into the web portal as patient or the doctor as per the credentials given

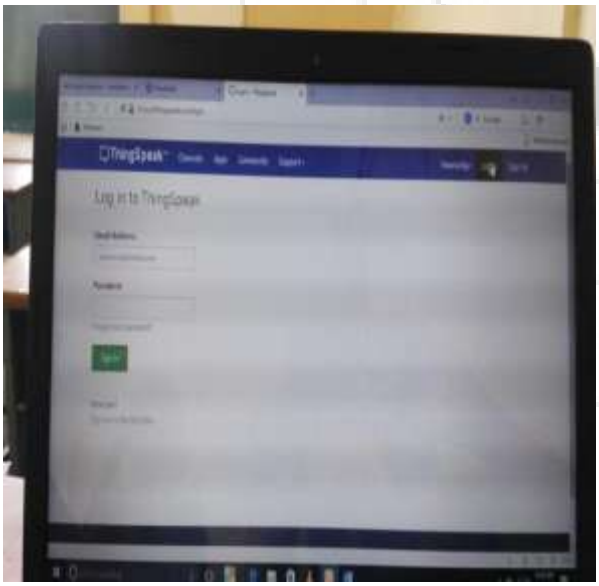

Figure 13: System Web Portal Login Page

The fig14 shows the full structure of the database which is being hosted currently on the local host and further will be connected to the whole world via IoT. The database has full details and record history of each and every patient through which a statistical graph is plotted in real time which is used for patients further analysis and tracking

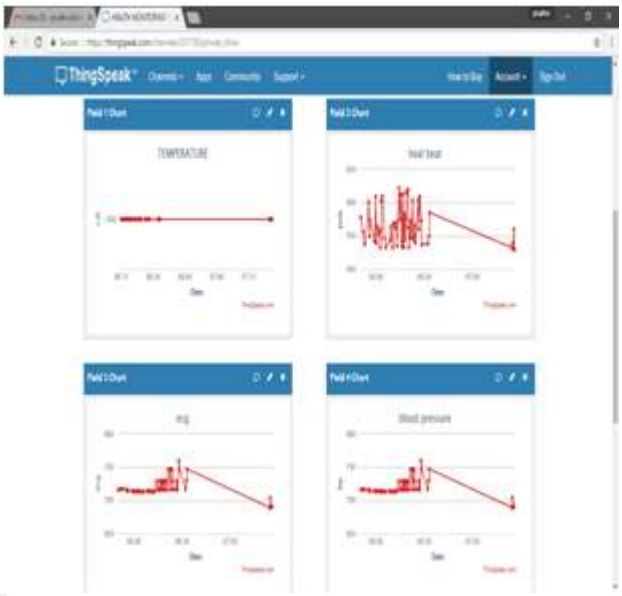

Figure 14: System Web Portal Database Sever

The model is finally deployed over a normal fit person and her heart rate sensor, temperature sensor, ECG sensor, Blood pressure sensor details are plotted on a real time graph

5. Conclusion

The proposed system collects the health status of a patient by connecting the different sensors to the body. The collected data is displayed in LCD and also stored in IoT server. The doctor can view the patients health condition by login into the web portal. From the evaluation and the result obtained from analysis, the system is better for patients and the doctor to improve their patients' medical evaluation.

6. Future Scope

The system can be extended by adding more features to the mobile application like linking the ambulance services, leading doctor's list and their specialties, hospitals and their special facilities etc., Doctors can create awareness about diseases and their symptoms through the mobile application.

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