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Research Article

Low-cost Real Time Parameterized Monitoring System for Aged People using Virtual Instrumentation

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Abstract:

Due to the rapid change in the socio-economic condition and various health issues, elderly people need continuous monitoring and thus reliant on care takers. However, in real time continuous monitoring of an aged person by care takers is not possible all the time due to human errors. Towards this, there has been plethora of research done to monitor home alone elderly with wide range of smart technologies. Nevertheless, identifying abnormal conditions due to sudden fall is still a challenging issue. Thus in this work, a low cost real time parameterized monitoring and fall identification system using LabVIEW is proposed. With the help of smart technology using Labview, we can measure those parameters by using sensors like Accelerometer, ECG sensor, Temperature sensor, spo2 sensor. In this system, the accelerometer will help us in fall detection. Whereas ECG, temperature and SPO2 sensors are used to measure the heart rate, temperature and oxygen levels of a person. In addition, an Arduino UNO is also used for further processing like, storing the measured values in the cloud and to notify concerned persons through GSM module in case of abnormality of any parameter is detected. Finally, entire readings of the sensors can be displayed in LabVIEW and published in ThingSpeak.

Keywords: ECG, Spo2, GSM, LabVIEW

I. Introduction

This paper introduces the new approach to monitor parameterized people. Under a severe situation, some patients need continuous observation so this type of system is really helpful for the people who cannot monitor the patient continuously. So if there is any abnormality then the caretaker receives the acknowledgment about the present status of the person. So the caretaker gets alerted and can help the parameterized person.

The parameterized monitoring system will monitor the parameters of a person like oxygen levels, fall detection, heart rate, and the temperature of an individual patient. This parameterized monitoring system will help elderly people by continuously monitoring them. As their age increases their strength will be decreasing so, they might need some help from an external person to do their daily chores. Mostly they have to depend on their family members. Sometimes, a caretaker must be needed to look after them. Every time presence of a person to take care of them might not be possible. So, this will become a deal for them.

This system will help us find out the health condition of the elderly people without depending on any other for taking care of them. With the help of smart technology using LabVIEW, we can measure those parameters by using sensors like Accelerometer, ECG sensor, Temperature sensor, spo2 sensor. In this system, the accelerometer will help us in fall detection. When they walk and stand there are more chances of falling as they have less muscle strength. So, this sensor will detect the fall of an individual. ECG sensor will help in finding the heart rate of the person. The heart rate will be displayed in the form of graphs. The temperature sensor will measure the temperature and display the values on the screen. SPO2 sensor will find the oxygen levels in the body and give an alert to the person by displaying it on the screen. The sensor values will be displayed on the screen by using LabVIEW.

All these sensor values are given as input to the Arduino UNO for further processing. Arduino will take this input and process it and then the data will be stored in the cloud so that every parameter value of a person will be saved. Along with this, whenever the parameter values reach the threshold value, the person will be notified via SMS. This paper presents the architecture of Parameterized monitoring system where it describes various parameters and methods used. The simulations used along with the learning process are also described.

II. **Literature Survey**

In [1] [2] authors have established wearable health care system using smart technologies for real-time monitoring and remote diagnosis of elderly people. On the other side, authors in [3] have proposed an additional feature like, alerting concerned person through GSM module to their monitoring system during any sort of irregularity in ECG signals. Similarly, for fall detection of aged persons, authors in [4-7] have developed various types of fall detectors for supporting the elderly people. In [8-10], authors have given a systematic review of fall detection and developed devices for different aged people based on several perceptions, including background, objectives, data sources, eligibility criteria. In addition, authors have considered the different categories of fall detections like, forward, backward, left-side, right-side, blinded-forward, and blinded-backward. [11] Li et.al. have focused on fusion of gyroscope and accelerometer data for the classification of falls and non-falls. In addition, authors have established how a fusion-based method triggered in a more robust classification.

In [12] authors have developed a fuzzy based algorithm to determine the various biological parameters specified by the sensors and monitored using LabVIEW. [12]. Pulse oximetry has become the standard way to measure the oxygen levels in the patient’s blood and heart rate [13-14]. In [15] authors have employed a temperature control system for controlling the temperature of a semiconductor processing apparatus comprising a process chamber having external surface. [16] Humidity sensing is very important in the fields of environmental control, process monitoring and bio medical analysis. Silicon containing micro structured humidity sensor is made-up at small distance above the surface of glass substrate as the movable electrode of a capacitor. Temperature sensing is done by the thin film platinum resistors [17]. As for the union by visual sensors and the combination of other non-wearable sensors, it becomes quite hard to acquire genuine data in real life. There was one group which tried to collect real data by visual sensors, but only nine real falls by elderly (Demiris et al., 2008) [18] were captured during several years. The availability of only nine falls is too limited to train a meaningful model. As a substitute, Stone and Skubic (2015) [19] hired skilled stunt actors to simulate different kinds of falls and made a benchmark data set with 454 falls including 9 real falls by elderly. For the measurement of temperature of patient's body here Thermister is used. The working principle in that is the resistance changes with the changes in temperature [20]. In GSM module when signal goes beyond the threshold limit then, gsm sends a text message[21][22].

III. Proposed System:

The Proposed system needs basic hardware and software requirements for continuous monitoring human body biomedical parameters and also publishing in the cloud. For hardware implementation Arduino ATmega328 Development Board, Accelerometer sensor, ECG sensor, Temperature Sensor, SPO2 Sensor are required. For software implementation Windows Operating System, National Instruments LabVIEW software, Web Browser, Arduino Sketch Software are required.

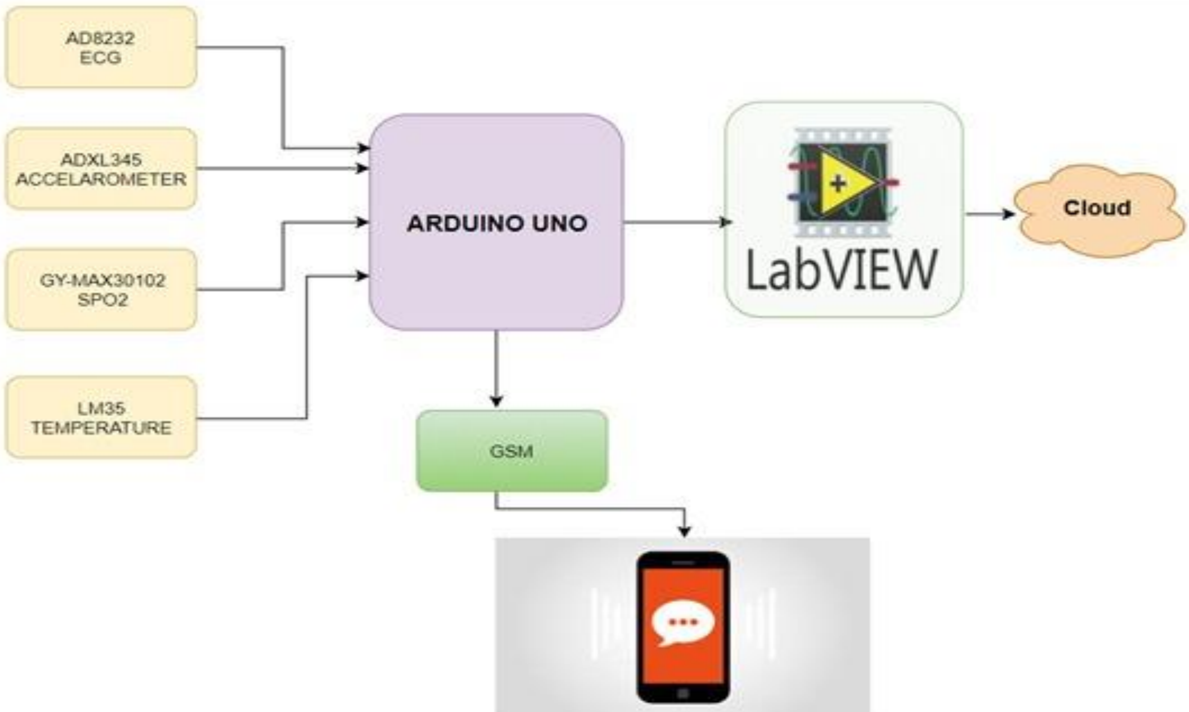

Fig.1. Block Diagram

For hardware implementation different stages are implemented. In this system first stage has different sensors like Accelerometer sensor, Temperature Sensor, ECG sensor and SPO2 sensor. LM35 sensor is used as a temperature sensor which gives analog values according to current temperature. This analog value is given to Arduino ATmega328 ADC channel for digital conversion. The ADC value is to be converted into the Celsius scale, to do that we scale up 0 to 1023 range into 5000milli volts range and then we convert into Celsius by dividing with 10 since every 10mv represent one degree Celsius. This will give output in Celsius form but we generally measure human body temperature in Fahrenheit so, temperature readings are converted into Fahrenheit.

ADXL345 accelerometer sensor is used to capture the position of the body. Here the outputs of the accelerometer are used to detect the fall of an elderly people. ADXL345 is communicated by Arduino UNO through I2C communication. Accelerometer acts as a slave and it is triggered via its device address. SDA and SCL pins of the accelerometer are connected to the A4 and A5 pins of the Arduino. We get the 3 axis output representing the x, y, z alignment. We can trigger the fall whenever a sudden change is observed in the consecutive readings of the any of the respective axes by fixing one axis.

SPO2 sensor is also called Pulse Oximeter. It is used to measure oxygen level in blood as well as heart beat rate of human body. AD8232 sensor used for obtaining the ECG of the heart. We have used three electrodes as input parameters and these were multiplexed as a single input through the jack present for the module. The two pins L0+ and L0- will be used to take the stable output when the electrodes beat become stable. These were placed on right hand, left hand and left leg of the body. There is also an inbuilt amplifier present in the module makes the output amplified and can be plotted easily in a waveform chart. The sensor is very sensitive to the power

A. Workflow of the proposed system:

Fig.2. shows the overall flow chart of the project. Initially, the patient has to check the parameter values using this system. The sensor values will be sent to Arduino for further processing. The oxygen levels, heart rate, fall

detection and temperature values will be displayed in the screen using LabVIEW and then stored into cloud. If the values reach a threshold limit, then the caretaker will be notified through SMS.

Connect the sensors like accelerometer (ADXL345), ECG sensor(AD8232),Temperature sensor(LM35), SPO2 sensor(MAX30100) to the Arduino UNO which is connected to the system via com port. Then, upload the LIFA Firebase in the Arduino UNO to establish the communication through the LabVIEW.

Now upload the code that is configured in the VI through LabVIEW into the Arduino uno. If there are any errors occur while running the code, please check the connections between the sensors and the Arduino UNO. Now, connect the GSM module(SIM900A) to the Arduino(make sure not to connect the GSM module while dumping the code to the Arduino).

If there are any sensor values are to be triggered that were included in the code, like, if there is any fall is detected then the abnormalities in the heart pulse and also the spo2 levels are checked immediately. If anything found beyond the thresholds configured, immediately the GSM module is triggered to send a SMS to the caretaker. The entire readings of the sensors are continuously updated in the cloud, here we used Thingspeak for better visualizations. The data in the cloud can be viewed by the doctor and respond to the abnormalities and advice the medical treatments if any.

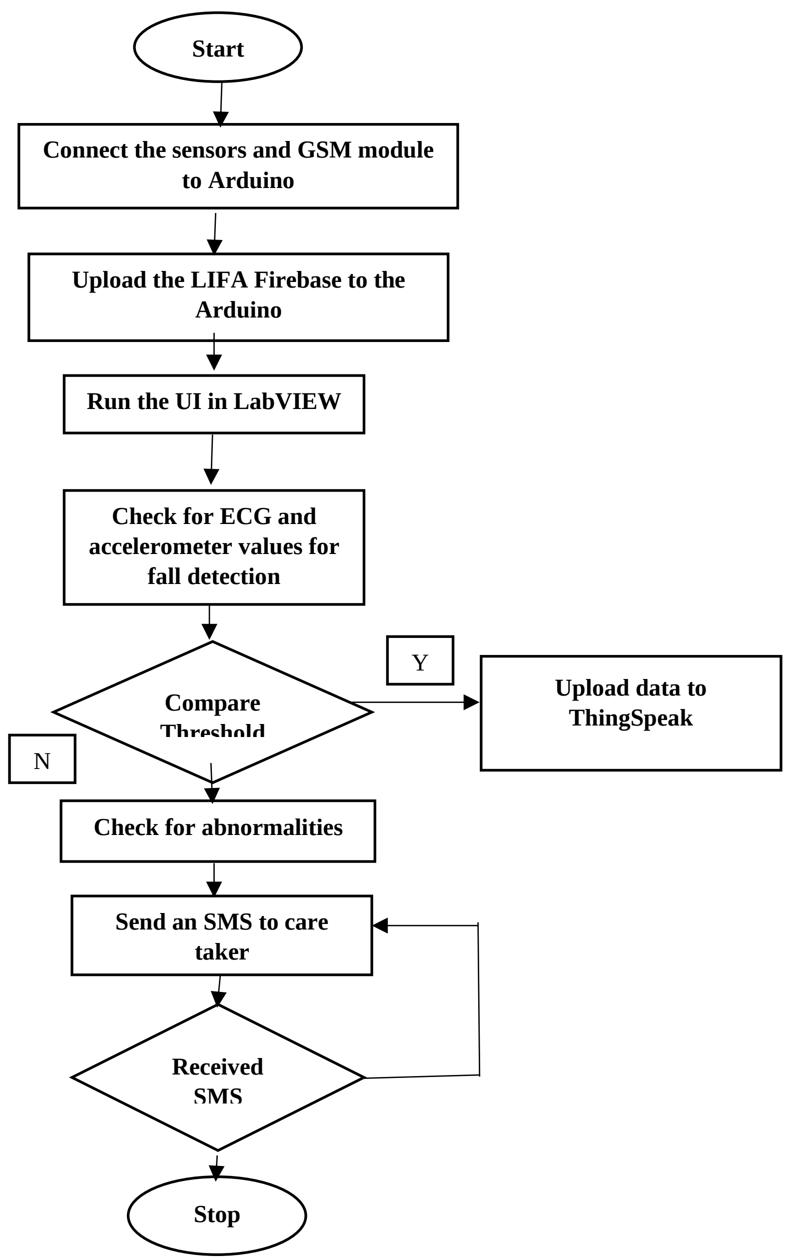

Fig.2. Overall workflow

This all data is serially transmitted over serial port for LabVIEW GUI display through com port of the Arduino. In LabVIEW screen live biomedical parameters of the person are displayed. To display current temperature readings, ECG wave form, SPO2 and BPM in the cloud ThingSpeak, web-based protocol HTTP is used. We have created an account in ThingSpeak and created fields to be updated and captured from the LabVIEW. In the LabVIEW we publish the data through HTTP get/post request by giving input the API key which is unique for individual user for the ThingSpeak. The data is updated for every time frame, we choose in the cloud.

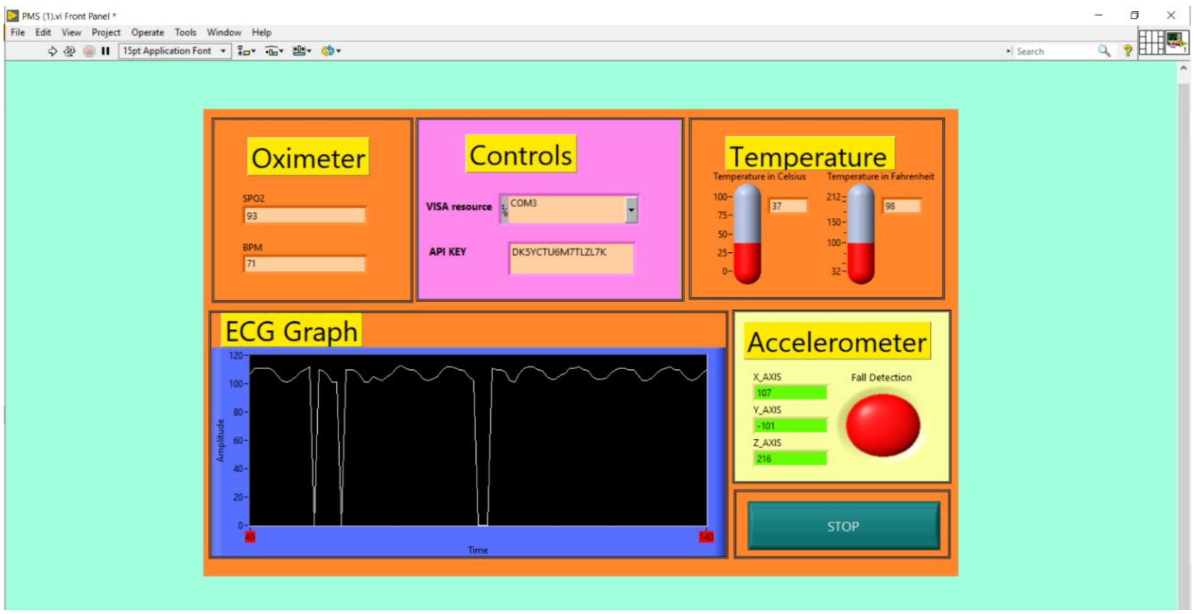

Fig.3. Control Screen

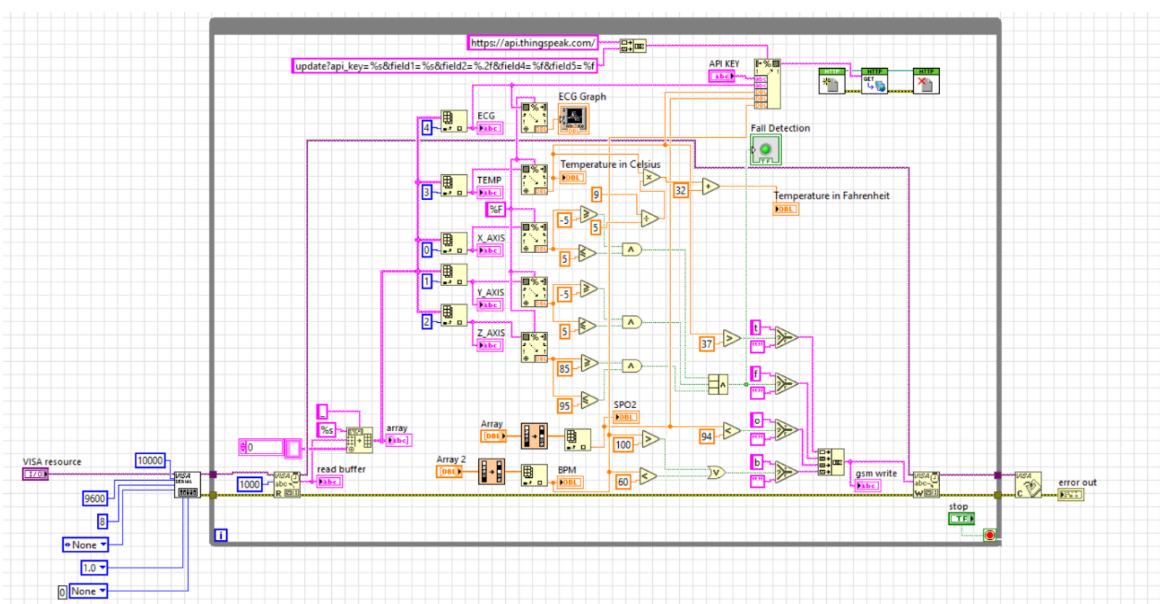

Fig.4. LabVIEW schematic Diagram

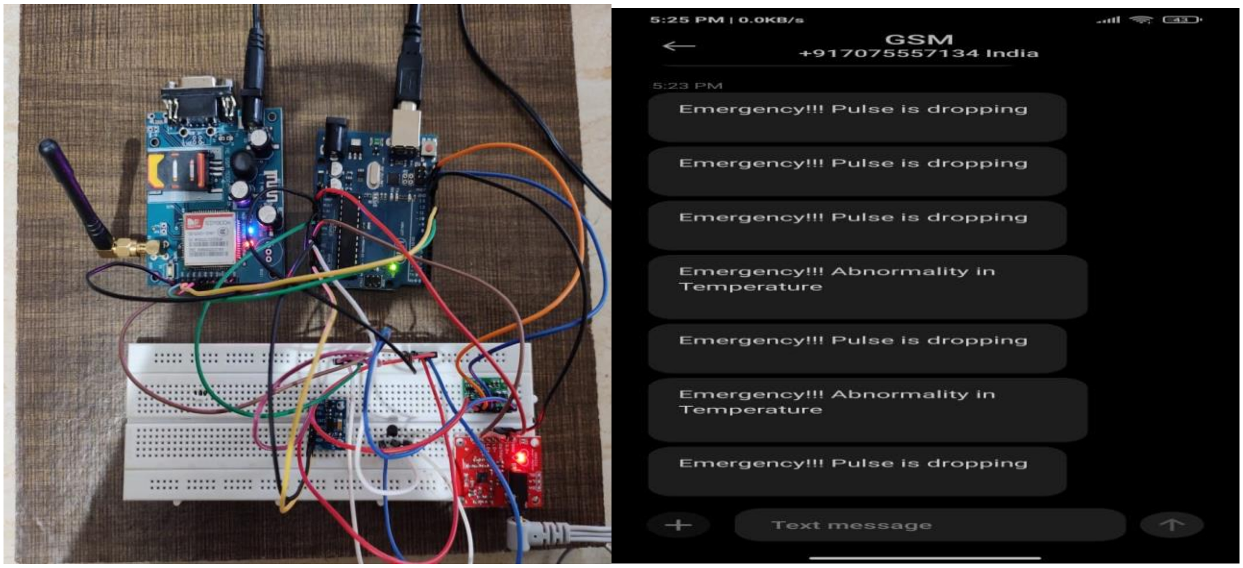

Fig.5. Hardware Connections and GSM Message

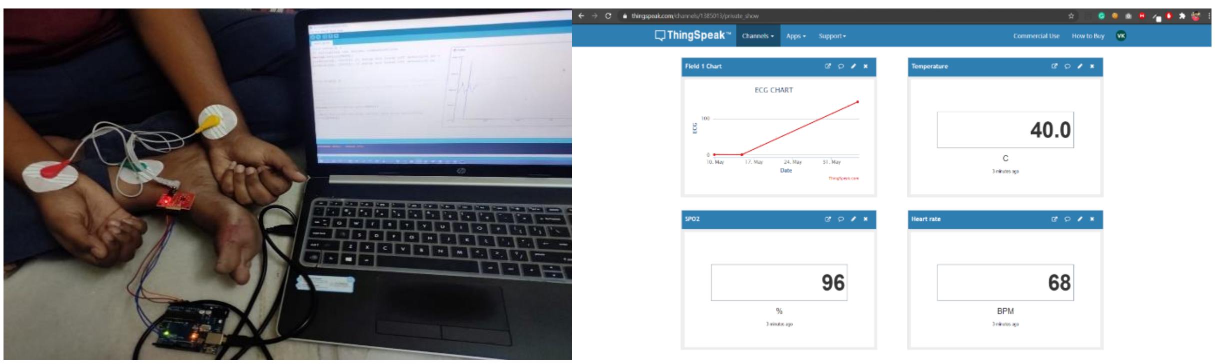

Fig.6. Implementation and ThingSpeak Interface

IV. Conclusion

This project attempts to stress on an IoT-Cloud empowered medical care framework and the improved medical services administrations. We have proposed a cloud-IoT system in which clinical data can be moved, with the assent of the patients or his close relative. Through our proposed framework we might want to assemble an organization among every one of the elements (emergency clinics, specialists, patients, Labs, Nurses) taking an interest in medical care which unquestionably prompts the improvement in correspondence and coordinated effort among these elements giving better consideration and administrations to the patients. The proposed IoT-Health Cloud addresses an empowering innovation for some medical care suppliers to confront numerous difficulties, for example, rising medical care conveyance costs, data sharing, and lack of medical care experts better consideration and improved administrations for the patients. Nonetheless, the advantages acquired are balanced by issues of trust, protection, and security notwithstanding a few specialized issues that should be tended to before medical care suppliers can completely receive and confide in the IoT-Health Cloud. A total model for executing the security is as yet required. The upset in the Web of Things (IoT) is overhauling and reshaping the medical services framework mechanically, monetarily and socially.

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