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Development of Fall Detection and Alerting System for Elderly People Using Iot

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Abstract **–**Fall isdangerous, especially for elder people and patients. Elder people undergo the risk of serious harm due to fall. There may be absence of any safety system to detect fall. Thus, this proposed system gives a better solution for older people and patientsand eases their lives. The system uses tri axial accelerometer MEMS sensor mainly, which is fixed to the person's body. This is to detect the movements of the person by considering the values reckoned by the sensor. Other sensors used in the system measure some health parameters of the person such as body temperature, heart beat and respiratory levels. These sensor inputs are fed into microcontroller for further processing.Once the sensor values crosses the threshold fixed intimation to the care taker is sent through IOT. On observing poor breath level automatic ventilator support mechanism is activated to help the elder people. The system will also alert the care taker with buzzer alert.

Keywords - sensors, IOT, microcontroller, MEMS accelerometer, ventilator.

I . INTRODUCTION

Accidental fall is known to be a common cause for injury in elderly people. By developing a small, non-invasive sensor along with a wireless network, this methodology provides a path towards more self-governing system for the elderly people and also for normal people. Using this device fixed in the body of the person, an instances of a fall can be detected and notified to the care takers. Low-cost and low-power MEMS accelerometer is utilized in thismodel to detect the fall while IOT is employed to alert the individualvia a message and upload the data of fall occurrences.It is estimated that adult ages 65 years and above fall frequently in a year . In addition to this this,the system also has health parameters monitoring sensors like temperature, heart beat and respiratory sensors. This system is also capable of providing first aid safety measure like ventilator mechanism on the detection of abnormal breath level.

II . LITERATURE SURVEY

In recent years, the amount of elder people is increasing with the senior of population. In this situation, most of the older people are suffered by falls every year. By keeping such situation in mind, several methods have been proposed to intimate others about fall to make them aware. Therefore, in this system fall detection methods using various sensors and controller was proposed. Fall detection at places such as home or hospital room is assumed here and wearing anything to prevent it is required. In this paper, we have proposed a fall detection technique using IR array sensors and controller. The method is inexpensive and can do of privacy protection also in a non-wearable method. We also analyze temperature distributions method using machine learning to empower earlier and more exact fall detection. Here, We have evaluated multiple algorithms of machine learning to select the best among them. We also

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calculated and compared the accuracy of these classifiers. For every 0.1 second the temperature readings is attained by IR array sensors and also with controller. We have also prepared 1600 learning data for better improvement [1] **I**n older age people falls are considered as the major reason of hip fractures and also for health injuries. This kind of fractures take a lot of time to recover even after a surgery is done to them. Furthermore to this, the majority of this kind of injuries has been proven to be major cause to the dearth of quick statement and sudden medical response. This situation is considered as the common issue in today's situation because the older are most of the time staying at home. Because of this, this device has been built to identify falls using a 32-bit simple microcontroller with machine learning and signal processing algorithms mounted. We use the individual data collection of different types of cascades and also for other repetitive operations to achieve greater and improved precision. If a decline is observed, the device alerts the close relatives via a GSM module. Our proposal aims primarily at detecting a failure and speeding up the warning systems and taking prompt action[2]. Falling from a place when sleeping or lying is has become a global common health problem for older adults that may causeminor serious injuries such as fracture and also even demise. Many falls have been established in recent years to identify early detection and prompt response and warning to remove serious imports. This technique assesses the use of smartphones for the identification of falling conditions in particular. In this, we collect the acceleration date using two smartphones. Initial methods to data gathered for the detection of dropping events are applied. The evaluation results have been shown at the right thresholds and the research algorithm for fall detection is much higher than other programs. [3] The monitoring of core body temperature is imperative for various hospitals and patients at home, mainly for those who undergone for surgical operations. To provide a better and suitable of core body temperature, the last modules have focused on embedding sensors and also designing some head oriented patches which uses single or dual heat flow. Our proposed system proposes a system which has foam-based Y-shaped sensor that has flexible electronics. We have developed a prototype setup to calibrate the heat-flow parameters and also tested for various results. The forehead and behind their ear (mastoid area) is covered here. The sensor will have an average heat-up time of 7.7 . This kind of sensor has the witness of core body temperature measurement for remote patients. [4] Now-a-day's person data monitoring is a leading issue for health and disease management. Since the future trend in Healthcare domain method using IOT is implemented here. This system is implemented to be used in various hospitals for monitoring and updating various health parameters like temperature, heartbeat and fall detection. The health records of the patient can be considered with threshold values and if there present any variations immediate alert messages could be sent to the doctor and caretaker. The file in the Raspberry Pi will have all the sensor values and that file will be uploaded to the cloud through internet. The developed system consists of three main components. Fall method is comprehended inside a tiny wearable device which is categorized by low costs and low-energy consumption. The heart beat sensor, temperature sensor & accelerometer is connected with MCP 3008 IC, which is connected with raspberry pi. Fall detection is detected with help of machine learning technique and then GPS location send to the care taker/hospital/ambulance.[5]Unobserved human falls can be dangerous and can badly affect health. Falls can do loss of liberation and can also make fear among the older people. Sometimes it also even the reason for demise. So, there are so many fall detecting systems have been developed in the recent years. This method explains the study on many of the systems. This may have camera and sensors for fall detection [6] We all know that falling from one place is considered as treacherous, especially for older age people. Older people are the people who have

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the high risk of death. This paper proposes an IOT based patient specific fall detection prototype system for elderly people. This device that uses a single tri axial accelerometer sensor attached to the user's body to separate between the activities falling condition and normal condition. Some sensors used in this system also measure some parameter of the person. They are body temperature, pulse rate, ECG etc. The design and implementation of the product combines both hardware and software that work continuously in detecting and reporting a fall.[7] The system was designed based on data analysis, in order to select the optimal parts for monitoring human moving condition and it also checks for the procedure performance for different parts which is compared by engaging the sub-algorithm. A wearable system which will capture the motion was used here to collect the motion data. Then the results are made according to the data obtained[8]. To protect the patient, it is not sufficient to identify the individual as a high fall risk patient. Therefore, a decentralized on-site decision[9] provides reliable ongoing monitoring. Several researchers have suggested various methods of detecting a slip, but very few forecast the fall case in advance [10].

LIMITATIONS OF THE EXISTING SYSTEM

- There is no immediate alert mechanism so as to provide instant help.
- Here the monitored health parameters cannot be stored for further access.
- A fall will be detected only up to a certainrange since sensor is placed in a specificposition in a closed environment.

III . PROPOSED SYSTEM

In the healthcare department fall is considered as the main problem. Elderly people have higher chance to fall than others. Money-making fall detecting devices are considered as very expensive and they also charged for their services based on month or year wise. A more affordable and adaptable system is necessary forretirement homes and clinics to build a smart city powered by IOT

The problems mentioned in the existing system can be overcome using this proposed system. This system provides an alert to the care takers or other people about the fall occurrence of the elderly people or person who needs to be monitored. Here micro controller is known as the heart of the entire system. In this system an MEMS Accelerometer is used, which will detect the fall of elderly person. The Accelerometer is abletomeasure the static acceleration and dynamic acceleration of gravity in sensing applications and shock or vibrationrespectively. Here we have used the ADXL335 is a 3-axis accelerometer sensor which has analog output with ±3g measurement range. It also has pre-determined threshold axis values. If the acceleration of the body condition exceeds the threshold value, the system will recognize the fall condition.

On detecting the fall of the person, an intimation message can be sent through IOT module implemented with controller. Once the system is implemented, the care taker will get the user name and password for IOT data access. Intimation message will be sent to the care taker mobile number which is dumped already with the controller code.

The Temperature Sensor which is used in this proposed system is LM35 which can be operate over a -55ºc to 150ºc temperature range. People who are all having fall impact will definitely involve in temperature variation also. Thus, this LM35 detects that variation when fall detected.

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Along with this, the system also has heart beat sensor and respiratory sensor to monitor the patient body condition. Once the respiratory level is found abnormal the system will activate the ventilator mechanism to provide immediate first aid for the person which will help the person to breath easily. The prototype proposed design is also capable of alerting the care takers when poor health records found by the controller. Thus, this will not detect the fall condition but also help them to monitor their wellness when needed. It also has the capability of risk avoidance. It also reduces time allocation between position and alert to care takers, that means the care taker will know situation as immediately it happens. This Heart Beat sensor is built on the photo plethysmography concept. The blood flow difference and any disorder of the body that changes the light intensity of this area are found (a vascular region). The difference may be observed if the person's finger is put to the heartbeat sensor. This can be added as advantage in this system

ADVANTAGES

- Immediate fall alert can be given.
- Continuous Health condition monitoring system is available.
- Alert message is given through IOT
- Date and time will be uploaded to cloud for future reference
- Normal SMS alert can also be given

IV.FLOW CHART

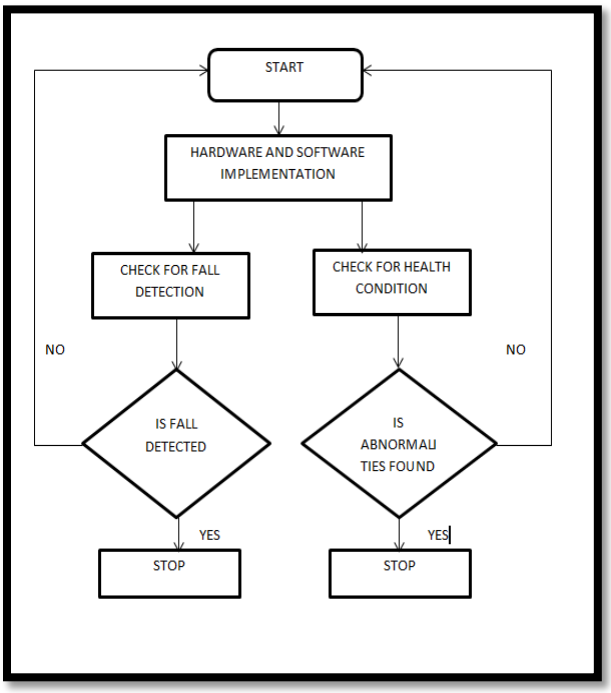

FIGURE 1: Flow chart for the proposed system.

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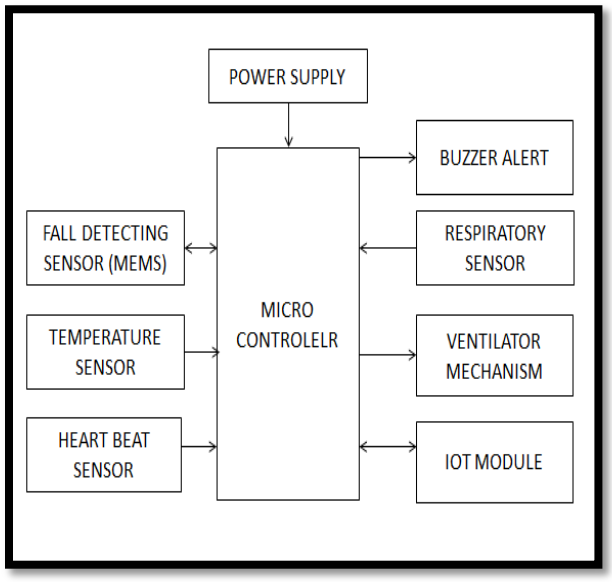
The flow chart for entire proposed system is shownin figure 1. This will explain the complete working flow of the system which will be very easy for better understanding.

The process is started and implementation of hardware testing and coding is done. Then it checks for fall condition and checks the health parameters simultaneously. There are two conditions, if a fall is detected the process will involve in sending alert message to care takers. Else the process will continue from the start. The same procedure applies for checking the health condition of the elderly people.

V. BLOCK DIAGRAM:



The block diagram for the proposed system consists of all the sensors and the ventilator mechanism along with IOT module.

VI. HARDWARE REQUIREMENTS

1.ARDUINO UNO

Arduino is an open-source project that created micro controller-based for constructing the digital devices and also this can be interacted with other objects which can sense and control any physical devices connected with it. The model done with this controller is based on board designs, and this is produced by several hawkers, by using different controllers. Sets of digital and analog pins that can also be interfaced with different panels (termed shields) and other sensors are provided by this controller. The boards provide serial interfaces to load programs from personal computers, including the Universal Serial Bus (USB) on some versions. The Arduinoproject offers a programming language built on an integrated development environment (IDE) called processing that also supports C and C++ language for the programming of microcontrollers.

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- The controller used in this Arduino UBO development board is ATMEGA328P.
- It has 13 digital pins and 6 analog pins
- It has one inbuilt Serial communication pin and 2,3and 9,10 can be used as the Serial pins by using the Software Serial in the programming
- Mainly the power supply given is 5v or 12v. It also has the inbuilt voltage regulator
- Serial communication is used for the connection of other sensors.
- Here the flash memory used is 13 kb.
- The controller used here is 8 bit.

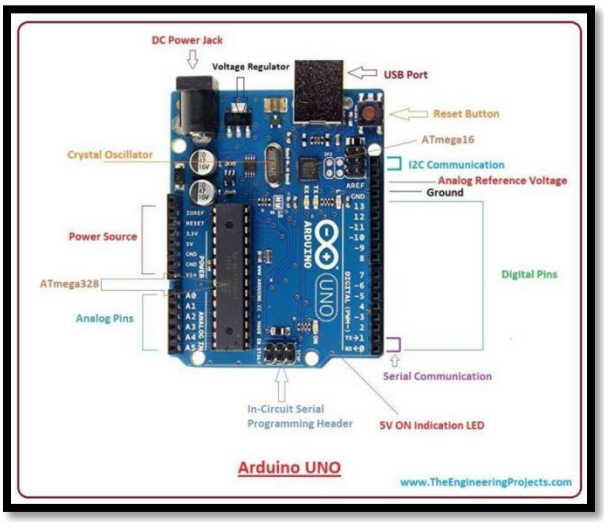

FIGURE 2: Arduino UNO

FEATURES

- The controller used is ATmega328P.
- It is operated in 5v.
- We can give input of 7-12v.
- It has 32KB of flash memory.

2. DIFFERENT TYPES OF SENSOR USED IN PROPOSED SYSTEM:

2.1MEMS SENSOR:

The fig 3 shown below is the MEMS Accelerometer sensor. Accelerometer are very useful for sensing vibrations in the projects and also or for orientation applications. MEMS Accelerometer can measure acceleration on one, two, or three axes. 3-axis units are considered as the most common as the cost is low for that. Here we have used accelerometer's ability to sense acceleration that will measure a variety of things which is very useful to electronic and robotic projects.

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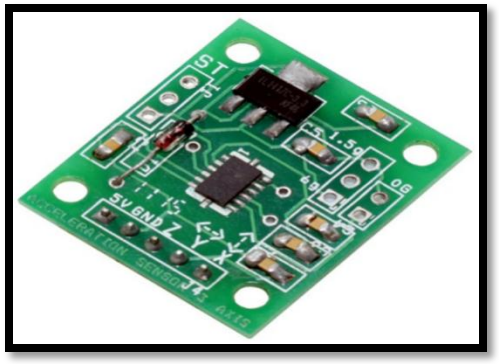

FIGURE 3: MEMS sensor

2.2 HEART BEAT SENSOR:

The Heart Beat sensor is intended to send the digital heat beat output to the finger. When the LED flashes it is considered as heart detector is working in union along with each heartbeat. This output produced can be given to controller for further process such as Beats per Minute (BPM) rate calculation. It operates on the theory of regulation of light by blood supply at each pulse through the finger. Figure 4 below shows the heart-beat sensor.

FEATURES:

- Here heart beat is indicated by LED
- Compact Size
- Working Voltage is +5V DC

FIGURE 4: Heartbeat Sensor

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2.3TEMPERATURE SENSOR

The temperature sensor used here is LM35. It is a IC temperature sensor which gives output in degree celsius. Here thermistor is used to measure the temperature. It will not cause more than 0.1 ^{0}C temperature rise in still air. Input voltage given is 5 volt and also operated at same voltage. The LM35 device gives −55°C to 150°C temperature range. Fig 5 shows the temperature sensor used.

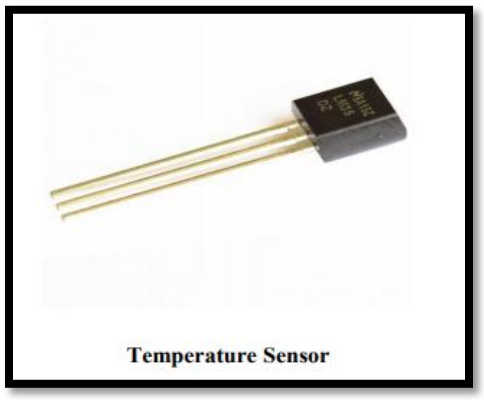

FIGURE 5: Temperature sensor

2.4RESPIRATORY SENSOR:

The first sensor developed for area of breathing and respiration is this sensor. This will calculate the respiratory level based on voltage values. This can also connected to analog or digital port of Arduino. When the breath level changes the sensor will provide values according to that. If there is no breath then it will give low value. According to this we can predict the breath condition of the user. Fig 6 shows the respiratory sensor secured inside a mask.

FEATURES

- Input voltage is 5v here
- Output voltage depends upon breath level
- Output can be Analog or digital

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FIGURE 6: Respiratory sensor fitted inside a mask.

3. BUZZER

A buzzer is an audio signal providing device. This may be mechanical, electromechanical, or piezoelectric. The main uses of buzzers and beepers are alarm devices or keystroke. It generates sound tone by applying D.C voltage to it. It is connected at digital side of Arduino in-out system for giving alert in case of emergency. Fig 7 shows the buzzer used.

FIGURE 7: Buzzer

FEATURES

- Input supply given is 5 VDC
- Current consumption for this device is 9.0 mA max.
- Oscillating frequency may be from 3.0 ±0.5 KHz

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VII.RESULTS AND DISCUSSION

In this modelthe Arduino UNO microcontroller is used which is known to be the heart of the embedded system. All the sensors are connected to the micro controller and the values of the sensors are shown in web page on detection of fall.

Once we switch on the system the readings will be automatically monitored and displayed. The results are seen in the webpage as shown below. Here the health parameter valuesare displayed through LCD. To view the results through IOT the system will ask the caretaker or health care centre to enter the user name and password.In web page,

Sensor 1 indicates temperature condition, sensor 2 shows respiratory level(breath level), sensor 3 specifies heart rate, sensor 4 denotes fall detection, sensor 5 and 6 mentions latitude and longitude values respectively. The data can also be filtered by date and time. Here, through the web page the user can view the health status and also the fall detection along with date and time.

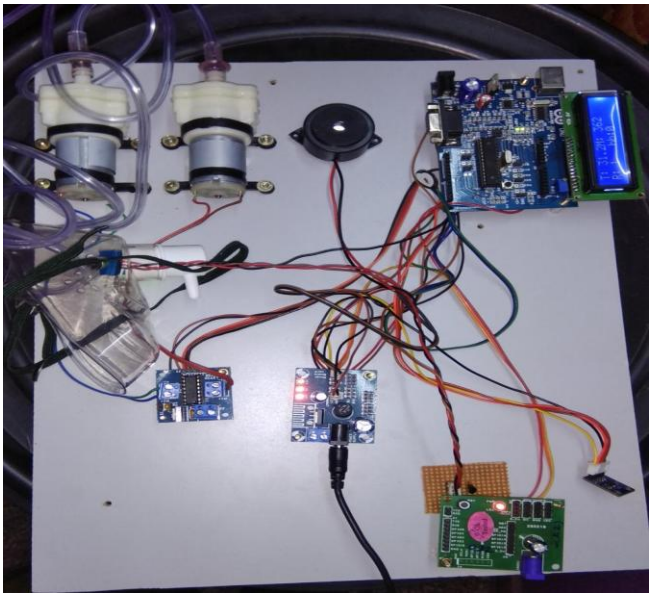

FIGURE 8: Hardware setup of the proposed system.

The hardware setup of the proposed prototype is shown in the fig.8.In this system, temperature sensor,heart beat sensor, respiratory sensor and MEMS accelerometer sensor are utilized. All these sensors are used to monitor health parameter and detect the fall of elderly people.

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FIGURE 9: LCD display of results

The fig.9 shows the LCD display of the proposed model wherein the temperature, respiratory, heart beat and MEMS values are displayed.

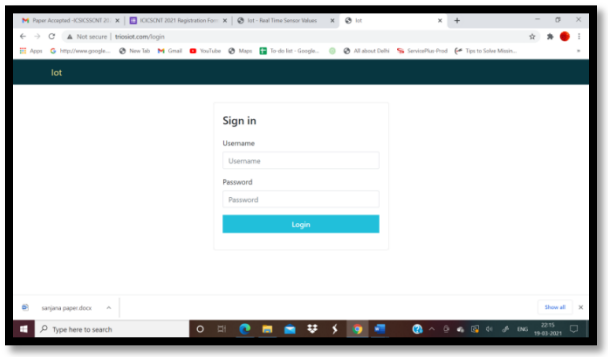

FIGURE 10: Webpage Login

The figure 10 shows the login page of the website. Here,the caretakeris asked to enter the user ID and password.

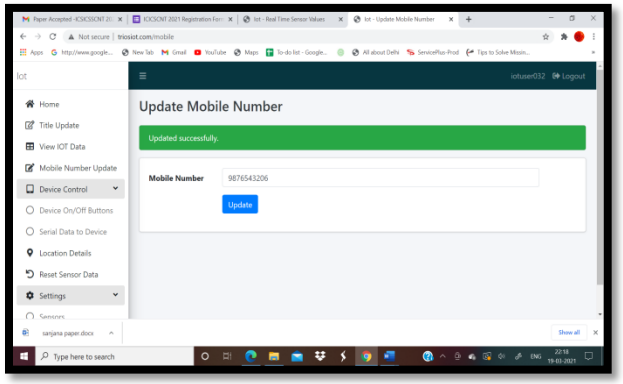

FIGURE 11: Mobile number updation.

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On successfully entering the username and password, the caretaker is directed to the page wherein the mobile number of the caretaker is to be updated for receiving the alert message. Fig 11 shows the successful updation of the mobile number.

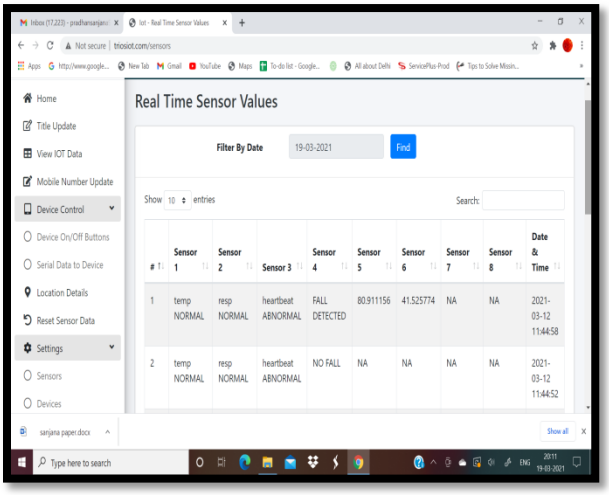

FIGURE 12: Webpage Output

The patient's history is updated in the Website is shown in the above figure 12. The estimated values of the sensor uploaded in the web page.To provide the information about the current location of the patient, latitude and longitude values are also included in the website.

Sensor 1	Sensor 2	Sensor 3	Sensor 4
Temp Normal	Resp Normal	Heart beatAbnormal	FALL DETECTED
Temp Normal	Resp normal	Heart beat Normal	NO FALL

FIGURE 13: Results obtained in hardware setup

If there is any abnormal movement of the patient is detected by the accelerometer MEMS sensor, the detection of fall is updated as "FALL DETECTED". Else, it is updated as "NO FALL".

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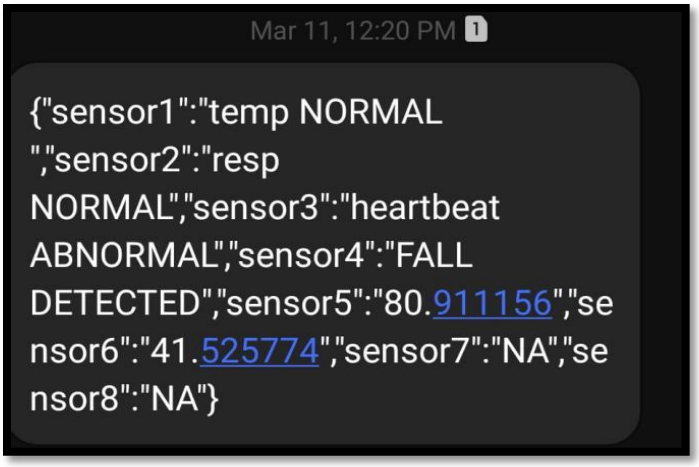

FIGURE 14: Alert Message

The fig 14 showsthe alert message that is sent to the care taker's mobile phone through IOT.

VIII.CONCLUSION

As fall detection is considered to be the major challenge in domains like health care, especially in the cases of elder people,fall detection system has been developed based on IOT using MEMS sensor. The system is capable of continuous monitoring of the human body movement and these kinds of detection method uses some threshold value which is set with controller to detect a fall. The prototype can be tested for real time use and can be developed into a product that can be used for elder people and patients. Once the acceleration crosses the threshold value, the fall is detected and an alarm is generated. The system consumes less power and has more efficient. It also keep track of some of the biological parameters such as heart beat, temperature etc. This system issuitable for indoor as well as outdoor fall detection since both software as well as hardware are suitable for this purpose.

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