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PROJECT REPORT

on

SMART WHEELCHAIR WITH FALL DETECTION PROVISION

Submitted in partial fulfilment of the

Requirement for the award of the

Degree of

BACHELOR OF TECHONOLOGY

in

ELECTRONICS AND COMMUNICATION ENGINEERING

by

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SCHOOL OF ELECTRICAL, ELECTRONICS AND COMMUNICATION ENGINEERING

(Accredited by NBA)

May, 2020

DECLARATION

We declare that the work presented in this report titled "**Smart Wheelchair With Fall Detection Provision**", submitted to the Department of Electronics & Communication Engineering, Galgotias University, Greater Noida, for the Bachelor of Technology in Electronics and Communication Engineering, is our original work. We have not plagiarized unless cited or the same report has not submitted anywhere for the award of any other degree. We understand that any violation of the above will be cause for disciplinary action by the university against us as per the University rule.

Place: Galgotias University

Date: 22/05/2020

Signature of the Student

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Richa Rai (16SECE109014)

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Shubham Pratap Singh (16SCSE112036)

SCHOOL OF ELECTRICAL, ELECTRONICS AND COMMUNICATION ENGINEERING

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BONAFIDE CERTIFICATE

This is to certify that the project titled "**Smart Wheelchair With Fall Detection Provision**" is a bonafide work carried out by **Richa Rai and Shubham Pratap Singh** , during the academic year 2019-20. We approve this project for submission in partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in Electronics and Communication Engineering with specialization in Internet of Things, Galgotias University.

Dr. B. Mohapatra
Project Guide

The Project is Satisfactory / Unsatisfactory.

Internal Examiner (s) External Examiner

Approved by

Dean

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ABSTRACT :-

This *smart wheelchair with fall detection provision* is, the most important systems and have become technology wise reliant over the past few years. Living rate, is decreasing day by day, due to different illness, that is due to the deficiency of medical facilities, to the patients. *The main aim of our project is to develop a brilliant medical management system and a wheelchair which will provide an alarm signal, at the time when an old aged or a paralyzed individual will fall from that moving chair*, and all these things would be implemented with the help of INTERNET OF THINGS, in which doctors can supervise their patient in terms of medical aspects, irrespective of the place, either the person is at hospital or at their home using our work in this project. In this project various sensors or smart devices are used and all the parameters like human body temp., human pulse rate etc. will be uploaded to a website, and a database of the same will be stored for future reference, in addition to all these things the same real time data will also be represented in a graphical form, from where these parameters can be monitored across the globe. The doctors as well as patient's family can check these different parameters and take care of the patient accordingly.

This system is a corollary to ***telemedicine***, where a patient is being instructed, the doctor use to tell the procedure and the medicines to be taken ,

the patient will have to note down all the things and through video conferencing it is being dome, in the same way we are providing this system to the people so that a single doctor could monitor multiple people at a time.

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CHAPTER 1 :

INTRODUCTION

1. INTRODUCTION :-

In this era there is an increase, in the rate of development of devices in the field of medical management. It have created huge bang into the world. Caring for a health specialist are taking advantage of benefits of these technologies and hence developing an important advancement in medical management

By using this, many common users is offered to dominance of the IOT enabled medical management system to enhance, boost, support and aid the medical wealth.

1.1 IMPORTANCE OF HEALTH :-

We have tried to build a ground-breaking or an advance system that will acquire patient's health parameter and along with this we have a smart wheelchair which detects whether an individual falls from, and inform about the medical condition of the patient, In which we use sensors to track health parameters of patient, sensors to detect collision and wheelchair fall and uses internet to update the doctors or dear ones about the medical condition, so that they can help in case of any issue.

Wheelchair fall detection provision is a technology, that will enable a system for an old aged or paralyzed person's condition in an emergency at the time of collision (or a sudden impact of the wheelchair) and monitoring patient's health without using pre-existing kits or methods (in our home or in a clinic) which eventually increases care of a patient and decrease cost of the traditional method . Through this, quality of treatment will increase, difficulty in travelling reduces and cost of treatment will also reduce. This will definitely help out people to live long because of the system. It allows a patient, to be independent, restrict complexity, and reduce overall expenditure on the treatment. This system is very useful by providing medical care, right at the door step. In addition with this, patients and family members, both feel

comfortable that the patient is being monitored properly and will be assisted if some problem arise in future.

1.2. ENHANCEMENT USING IOT :-The Internet of things is basically the junction of a device, an application, a sensor or a network connection that improves this property of gathering and exchanging the data. The main feature of IOT in this project work, is the regular management of a patient's health for checking those elementary measurement and derive a better output, against the history of these management system. There might be some cases, where the medical instructor could not be informed in time, about some incidence when there is an emergency, even if 24x7 a week of monitoring is there. And, this may raise some difficulty in transmitting and receiving the informative data with the medical instructor and also with related family member and friends. The technology, which improves the details has been presented previously but these was no authentication access, feasible (economically lesser) rate and the common personal in the developing nation as in India, could afford such expensive items or system.

Therefore the output to this type of difficulty can be resolved by summing-up uncomplicated expansion of this device, in which they do not has such type of expertness. Now, the project tells about the Smart wheelchair with fall detection, and patients health care system controlled by Arduino. In the project, a system is built to regularly assist patient's current state and medical parameters such as human pulse-rate and human body temp. The data is being published on the web server, from there the data could be fetched and thrown back onto a website in a graphical form or on a datasheet, by an authorized ID-password only. And whenever a person sitting on a wheelchair falls due to some reason or have a sudden collision

with some obstacle, an alarm will rang and the nearby people can be informed about such incident, and in case, if a person is all good despite of such collision than he can just switch the alarm off.

This work or the idea behind this might not be very new, here the difference is we are going to publish an acute system and within a feasible rate also using an Arduino-UNO board. The primary aim of the project is to continuously monitor patient's state of rest and continuously send, body's parameter on the website and the people related to the patient can fetch the data accurately. The project or the work presented here has more opportunities in the further years of development because no one can be there physically with the patient all the time and the informative-data arranged by this system is having so much value, this work can also be modified by adding more medical parameter with it and help whether a patient is having any disease. And again it can also be presented in any kind of the research and medical field

1.3. MAJOR AIMS OF THE PROJECT :-

· To acquire a real-time health or medical data of a patient with the help of a website

· Processing and differentiating the data obtained about a patient.

· To understand and anticipate any disease/disorder in the initial point of time.

· To detect whether an old aged or a paralyzed person have been fallen for a wheelchair, if so then an alarm will be rang out.

To build a system so as to monitor a patient's medical condition throughout the globe and physical state of a person whether he is comfortably sited on a wheelchair or not, without being physically present with them.

CHAPTER 2 :

LITERATURE SURVEY

2.1. LITERATURE SURVEY :- In this part we are going to interact with the studies, done by different people, on their respective work while performing the project

In [1] , The author studied the Flexible and scalable patient's smart wheelchair with fall detection in 6LoWPAN .

Advantage – The parameters while combining the technology and communication part. The outputs of IoT are co-operative activities collected by different parts of knowledge like tele-communication, informatics and electronics.

Disadvantage - Difficulty in sending and fetching data on cloud.

In [2] ,The authors proposed a cell phone based smart wheelchair with fall detection with the self-analysing processor with the help of technology - wireless sensor network

Advantage – Telemedicine is helpful in isolated places where there is no access to medical services or it is very costly. In present time many programming languages are supported by modern mobile phones it helps to develop telemedicine apps very easily.

Disadvantage - It is not useful to people who can't afford smartphone.

In [3], The author designed the system of machine-to-machine technology gears up for growth.

Advantage - M2M provide the advantage of connectivity to enable different machines - including data centres, equipment of manufacturing and telecommunications sector, storage tanks, products of property-security , industry-specific assets such as public-utility systems, and vending machines - to communicate directly with one another.

Disadvantage - Require technical knowledge about the related field of M2M .

In [4], The authors proposed the system of Global wireless machine -to-machine standardization

Advantage - When a machine is networked with other machines it is more valuable because more intelligent and soverign applications can be developed. By using decision-making and autonomous control, M2M systems can be upgraded to cyber-physical systems (CPS).

Disadvantage - When various machines are connected on single network there will be more traffic in network and cause delay in sending and receiving data.

In [5], The authors designed a system which is Real time wireless health monitoring application using mobile devices.

Advantage - The system is designed in a way that it measures and monitor the physiological data of patient to check his health status and if his health is not good it will send message about the same to his family.

Disadvantage – It is useful fr privileged people who have smarthphones and gadgets.

In [6], The authors designed a project on Secured Smart Healthcare Monitoring System Based on Internet of Things.

Advantage - When we develop products using IOT IT include embedded technology and it facilitates the user by exchanging information, with each other or with the Internet . The whole IOT system is based on sensors, gateway and wireless network which enable users to communicate and access the application or information.

Disadvantage - Always require strong internet connection for the system and sensors to work properly.

In [7], The authors developed a system which is Wireless Fatal Heartbeat Monitoring System Using ZigBee & IEEE 802.15.4 Standard.

Advantage - This system help to reduce the fatal mortality rate. It is also helpful for pregnant ladies since they have to visit hospitals frequently for regular check-ups which is very time consuming by using this system they can do their check-up at home by themselves.

Disadvantage - Not a very economical system.

In [8], The authors proposed the system, Design and Implementation of Wireless Body Area Sensor Network Based Health monitoring system.

Advantage - To monitor the health parameter of patient having medical issues this system is very beneficial. This system use miniature sensor for detecting the health parameters. Then this data is send to physician's server. The physician then send back the advice regarding the patient's current health condition.

Disadvantage - It requires sending and fetching data online so strong internet connection with domain and website required.

In [9], The authors designed the system on A Smart Device Integrated with an Android for Alerting a Person's Health Condition: Internet of Things.

Advantage - This project is a smart device, which is developed for helping the old aged people during the time of medical emergency situations or any critical situations using Internet of Things (IoT).

Disadvantage - It is not cost efficient from the perspective of project implementation.

In [10], The authors proposed the system Healthcare Monitoring System Using Wireless Sensor Network.

Advantage - This is a smart gateway which is used for interconnection and services management platform mainly with WSN healthcare systems at home environment. This system fills the gap between WSN and public communication network. It is compatible with on-board decision making system and a incompetent database, this system empower to make patients' health state decisions in low-power and low-cost embedded system and get faster response time on the emergencies.

Disadvantage - The user must have knowledge about the wireless sensor network and public communication network.

In[11], The authors proposed the system- PerFallD: A Pervasive Fall Detection system using mobile phones

Advantage - They have Used an Android-G1 cell phone platform for detecting device falling, and the system is automated and iterative to call and to text the contacts in the case of an emergency on detecting the falling this is also available in both the format either it is indoor or outdoor.

Disadvantage – Cell-phones have battery limitations and may be affordable for all or not, alarms system, integration of the system by adding few additional protective items, e.g., airbags for safety purpose.

In[12], The authors proposed the system - Wearable fall detection monitoring system for the elderly

Advantage – Differentiates, between a fallen and a non-fallen event, produces optical, audio, and a tactual fall alert.

Disadvantage – Few portions haven't been differentiated properly, for a fall/non-fall event, as a wearable item, old-aged people mostly tends to forgot wearing these items, produces a false/wrong alarm.

In[13], The authors proposed the system - Accurate, Fast Fall Detection Using Gyroscopes and Accelerometer- Derived Posture Information .

Advantage - They have applied both, a gyroscope and a tri-axial accelerometer, which enhance the fall detection property accurately, it also reduces both the alarms either it is positive or negative.

Disadvantage – Faced a lot of difficulty in differentiating different actions which needs contextual information.

In[14], The authors proposed the system - The WAMAS Wearable Accelerometric Motion Analysis System: Combining Technology Development and Research in Human Mobility

Advantage - Measure head movement via 3-axis sensor which have been attached on both the corners of the frame and two more sensors around someone's waist.

Disadvantage - Old-aged people mostly tends to forgot wearing devices, they need the device lesser in weight

In[15], The authors proposed the system - SPEEDY: a Fall Detector in a Wristwatch

Advantage – It was Easy to wear that device, also smaller in size when compared to [14], legs movements were also analysed.

Disadvantage - The complications in the algorithm of the fall detection, not all of the falling time have been perceived with same accuracy , Old-aged people mostly tends to forgot wearing devices

In[16], The authors proposed the system - Wearable Sensors for Reliable Fall Detection.

Advantage – Small-size and lesser in weight devices for the waist, it also finds the location via RADIO FREQUENCY SINGNAL

Disadvantage – Nothing was as impressive as the items were already developed in smaller size and lesser weight.

In[17], The authors proposed the system - Pervasive, secure access to a hierarchical sensor-based healthcare monitoring architecture in wireless heterogeneous networks

Advantage – Wearable (indulge into the strap) sensors, environment based sensor for outside the home for old-aged people / patient's monitoring.

Disadvantage – Issue with the strap, blue-tooth was not performing efficiently and encryption was based on polynomials.

In[18], The authors proposed the system - Adaptive Body Posture Analysis for Elderly-Falling Detection with Multisensors

Advantage – Sensors were working together for detecting behaviour of the body and accidental fall, an adjusting model for detecting elder's body posture.

Disadvantage – Sensors cannot determine the position/situation of the body after an impact, a lot of sensors were there for determining some simple parameters.

In[19], The authors proposed the system - HMM Based Falling Person Detection Using Both Audio and Video

Advantage – Human movements and voice tracking in the video using Human Motion Models, avoiding unwanted/false alarm with the help of collision sound of person's fall.

Disadvantage – It was difficult to predict the trajectory, the items were already developed in smaller size and lesser weight.

In[20], The authors proposed the system - A Customized Human Fall Detection System Using Omni-Camera Images and Personal Information

Advantage - Analyses AR (aspect ratio) of the moving object, using omni-directional cameras for avoiding null/blind spots.

Disadvantage – Neglected different types of falls.

In[21], The authors proposed the system - Activity Summarisation and Fall Detection in a Supportive Home Environment

Advantage – They were using 'unusual inactivity' the term for telling a fall detection, uses a rough-cut model and particles filters to handle multiple sources of illumination

Disadvantage - No audio information considered

In[22], The authors proposed the system - Intelligent Video Surveillance for Monitoring Fall Detection of Elderly in Home Environments

Advantage – It was a solution to [20] disadvantage (front side, backside or else side), it was using a horizontal trajectory.

Disadvantage – Timing and calculation costs and its complications in real environment were not proved.

In[23], The authors proposed the system - Intelligent Video Surveillance for Monitoring Elderly in Home Environments

Advantage – It was using horizontal and vertical trajectory in a normalized way, it was also using an algorithm K-N-N and gathering the evidences to derive the postures of the humans for detecting the falls, it was using very importantly, the speed for the real life falling event

Disadvantage – There was a delay in detecting the miss-happening because of the gathering of the evidences

In[24], The authors proposed the system - An Advanced Mobile System for Indoor Patients Monitoring

Advantage – In this project work a regular ECG data and an accelerometer's data was there, detecting abnormal movements of the patient, lesser false alarms

Disadvantage - Special purposes systems which were based on Alive wirelessly monitoring sensor for health.

In[25], The authors proposed the system - Distributed Smart Cameras for Aging in Place.

Advantage – Induced some extra cameras and their applications for finding the objects, also they applied MLT (machine learning technique), alarms as an information were also produced for homes and for the 3rd person.

Disadvantage - Integrating RADIO FREQUENCY IDENTIFICATION - based object finding in the system.

In[26], The authors proposed the system – iFall :- An Application for Fall Detection and Monitoring

Advantage – It was using HTC-G1 a cell-phone with an integrated-tri-axial-accelerometer , it was using a flexible peak-value based on some parameter, an automated notifications were provided on fall event, providing an alert to the people of the family via different means efficiently.

Disadvantage – Cell-phones were having lesser battery and very expensive.

In[27], The authors proposed the system - Wireless sensor networks based on home-safety for elder people.

Advantage – In this, they were regularly monitoring real-life on daily basis, False-alarm were lesser and irregular behaviour were also predicted.

Disadvantage – Sensors were classified into different category, it was already developed in smaller size and lesser weight.

This is a bit surprising, that the falling(dropping down) have been considered as a natural part of the life in the ageing people. Actually, this is the collision/impact instead of it is natural in elder people, also this is an important topic to worry about. Old-age people are not stable when we talk about balance for not getting dropped, their reacting time is very late, when compared to younger people, and they need some extra care when they are going to be even older. In today's market there are plenty of products, which are going to assure that will predict and resist the people to fall down, still we are facing such issue, that is why we need a better solution so as to resist this and additionally, taking care of those people with some parameters, which is the second part of this project. To assist a patient without being actually present there, by acquiring some data about the patient's health and storing the data as a database, so as to keep a track record and assist in case of an emergency.

CHAPTER 3 :

PROBLEM DESCRIPTION

3.1. PROBLEM DESCRIPTION :- After 15th of August (Independence day), there has been a tremendous enhancement in the quality of healthcare . But still the situation is not that much better, and according to WHO, Indians are lagging with some of the of neighbouring countries

In neighbouring countries many countries have a better rank than India and they are Bangladesh, Bhutan and Sri lanka. When we come towards South Asia, here Bangladesh have made the most improvement when compared to other countries mentioned in the above table. It have improvement of almost 30 points, amending or enhancing itself from 1990 to 2016. Contrasting to this, the rankings of Afghanistan and Pakistan are the worse in this period.

HAQ Rankings In South Asia			
Country	HAQ Index Score, 2016	HAQ Index Rank, 2016	Improvement In Score, 1990-2016
India	41.2	145	16.5
Pakistan	37.6	154	10.8
Bangladesh	47.6	132	29.8
Afghanistan	25.9	191	10.1
Sri Lanka	70.6	71	23.2
Nepal	40	149	19.1
Bhutan	47.3	134	27.2

Table- 3.1

India's rank is also at its worse than that of many other countries, much poorer than India such as Botswana (122), Equatorial Guinea (129), Sudan (136) and Namibia (137). Even Yemen (140) performs better than India.

The major obstacle of India's growth in healthcare system is the negligence of mostly rural areas. The services are mostly provided in urban hospitals. It is not like rural are not being facilitated, but the thing is that, the

advanced facility is not being provided at such places. According to a health organization approximately 32% of hospitals and 15% hospital beds, are situated in rural areas, where most of the population of India resides, and it is 3/4th of the total population. Also, most of the doctors are not willing to be a part of rural areas. It may be salary issue or society but the doctors are lesser in rural areas.

In India less number of medical personals like a doctor, a nurse or anyone related to this profession , is the basic and the major problem in the healthcare field. In 1999-2000, in India there were only 6 doctors / 10,000 population in India, and when we talk about different countries , then 25 in the USA and 20 in China per 10,000 people.. And here is only one allopathic government doctor for every 10,926 people in India against the WHO's recommended doctor-population ratio of 1:1000, stated a government report.

In India, healthcare services, like homeopathic, ayurvedic, Unani and allopathic, among them allopathic is somewhat expensive. It is not easy to afford, for common people. Pricing of different important medicines have gone high

And we are also putting some extra feature so as to make it more reliable with the term ***telemedicine***, where a patient is being instructed, the doctor use to tell the procedure and the medicines to be taken , the patient will have to note down all the things and through video conferencing it is being dome, in the same way we are providing this system to the people so that a single doctor could monitor multiple people at a time.

Falling (or dropping down) form the chair, is the main reason of the injuries in the ageing people also of accidental death, if the impact was strong mostly in those who are above 70 years old. And, more than 80% of the bone fractures are driven by these impact.

Therefore, all these problems could be encountered by using a system which will provide a better and efficient method to the people. The system which will provide an accurate, less costly, time saving for the betterment of people and to improve the health quality of the people.

CHAPTER 4 :

WORKING OF THE SYSTEM

4.1 SYSTEM ARCHITECTURE :-

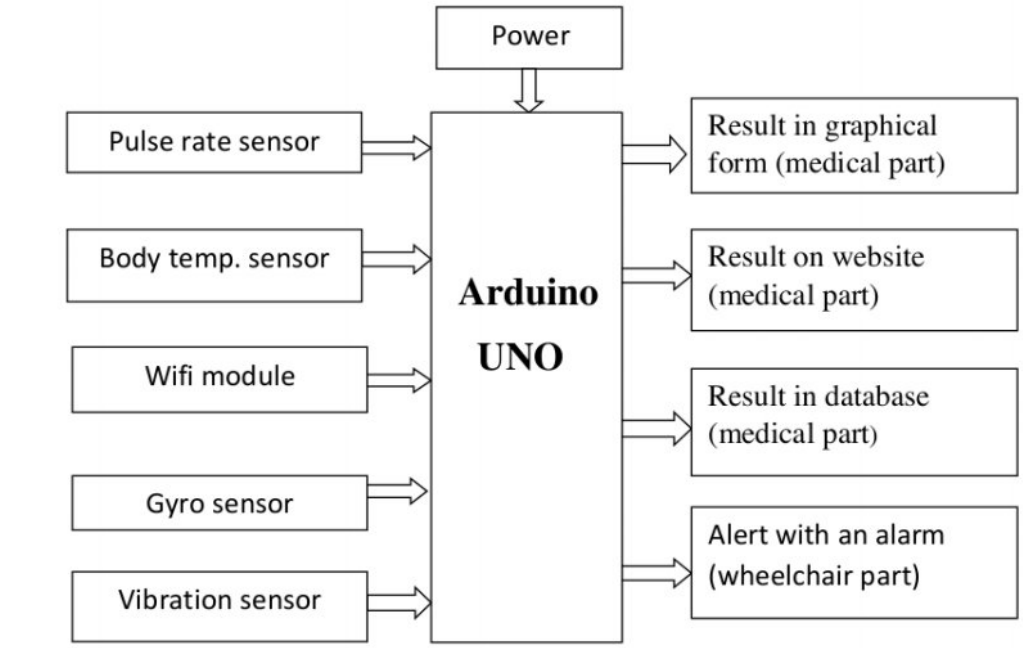


Fig 4.1.System Architecture

4.2 WORKING OF THE SYSTEM :-

In our project, we are working on two 2 aspects which will be combined on a single automated system for monitoring medical parameter such as the human body-temperature , the human pulse-rate of patient's body, and along with this we have implemented a smart wheel chair fall detection. Here *smart* stands for the capability of doing multiple task, and further we are going to expand or elaborate our as mentioned system.

Firstly, we are going to explain our smart healthcare part, wherein there are two parameters which will be acquired by two different sensors

and they are human body-temperature sensor, and human pulse-rate sensor. Now, with the help of 8266 wifi module, we are uploading both the parameters acquired by the two sensors to a website in the form of graphical representation, and the same will be stored in a database by which we can make a track record of a patient's health. We have used here a baud rate of 115200, which will help in communication between wifi module and Arduino board.

Fig 4.2.(a). Project placed on a Moving Chair or on a Bed

Here, in figures Fig.4.2.(a). and Fig.4.2.(b)., we are showing the two options by which we can place our project on a moving chair or on a bed, so that whenever a sudden collision will happen in case of a moving chair then these two positions would acquire those impact and provide the result or rang the alarm, so that someone would help them out.

Fig 4.2.(b). Second Option to Place that Work on a Moving Chair

And, now we are explaining the second part of this project efficiently i.e., smart wheelchair fall detection, wherein we are using a gyro sensor and a vibration sensor so as to keep in contact with the person sitting on a wheelchair. The time when an old aged or a paralyzed person will fall from the wheelchair, the gyro sensor make an alarm so as to inform near one that the wheelchair have been fallen and in a case when a collision is there and the wheelchair have not been tilted or fallen but the person sitting on that have been fallen down, than again the vibration sensor comes to play it's role and make an alarm to inform the near one, so as to help that needy person as soon as possible, and if everything is alright then the person may switch off the alarm.

The working of the system will tell us, the flow of information and how our project or how our system is working and producing a meaningful output. Starting from the data source and flowing through data processing phase and coming up with an output. This project will be further expanded that how some of the symptoms are pointing to a chronic disease or any other abnormality. Now, in the first level , unprocessed raw data from different sensors would be obtained, then compared with some aspects an d then at last stored on the web server.

The data acquired by these sensors are patient's real time data. The information provided by them would be used as a supplement in further levels for exploring if a person is going through some abnormality in the health or disorder. It would be helping in making the project more efficient and reliable. Therefore, it will categorize the condition or the symptoms with the help of stored database that the result are Normal or not, if not which type of disease it could be .

4.3 PROJECT METHODOLOGY :-

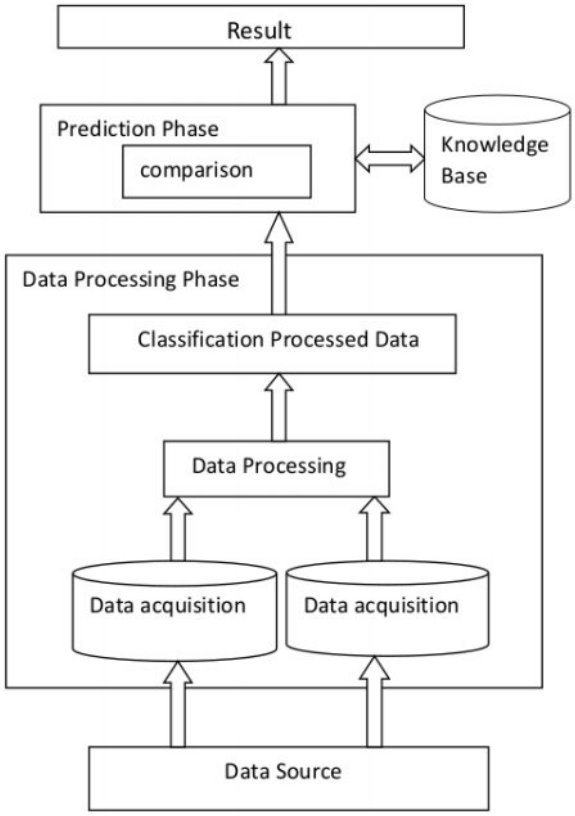


Fig 2.3. Project Architecture

In the first level , unprocessed raw parameters from different IoT equipment would acquire and put them on the web-server. Those devices would be of different sensors like the temp. Sensor and the pulse sensor

In the level two, the consistent information and data was acquired as an output from the parameters that was stored on the web server and making a database of the same. These data is the real-time data of the patient and the symptoms. The information would use supplementary in the next level for predicting if a person is suffering from any kind of disease or disorder. This would helps in making the system more smart and efficient.

In level three the analysis or predication phase, we could use the data mining techniques in predicting the type more smarter.

Hence it can infer the disease or disorder by using the existing database and categorize the result in various categories such as normal, ideal and With Symptoms etc.

4.4 SYSTEM MODULES :-

4.4.1 Health Monitoring Module :- This section consist of the hardware part (equipment) of the project that makes it *Internet of Things* enabled and is taken to record the health determining parts of the patient with the help of different sensors. And Arduino UNO perform its central part to which all the sensors are connected with the General Purpose Input Output pins and may use ADC if the output is in analog-form as this Arduino UNO board works on both digital and analog signals. It reads the real-time data and update it to databases and then it is displayed on the web server..

4.4.2 . Emergency Alert Module :- This section is used particularly on the steps to be followed after an emergency is being happened in the patient's health and informing their family member as well as the doctor. We have taken some values in our coding part (programming) when a threshold is crossed an alert in the form of graph and an alarm will rang to inform family or doctor.

4.4.3 . Health Status Prediction Module :- This is the most helping and important section of our project. In this module, we will use the data as on database by our system along with any parameter, the patient could be feeling by, asking some questions and then comparing it with the pre-defined knowledge so as to predict if some disorder or any kind of disease, the patient could have so, developing an efficient project to help patient.

4.5 IMPLEMENTATION :-

In our project, we have designed a system which will monitor the body temperature, heart rate, body movements and blood pressure reading of the patient. The readings which are obtained with help of different sensors which are placed on the body of patient and then send the corresponding signal obtained to the ARDUINO UNO. The Arduino UNO is a single-board computer of credit card-sized. Here, the different sensors which are used for measuring the patient's, heart rate, Blood Pressure ,body temperature and their respective results will be sent to the database via Arduino UNO and it will be monitored from anywhere in the world with the help of the internet facilitated through GSM module.

4.5.1 Programming Language :- The programming language employed in Arduino UNO is done python language and the

patients' health data will be send to the server connected through Internet.

We can access the details of patient's health report very easily and can monitored according to that but only in case of authentic user who have ID and password and unauthentic users will not be able to access it. So it ensures the security of the system too.

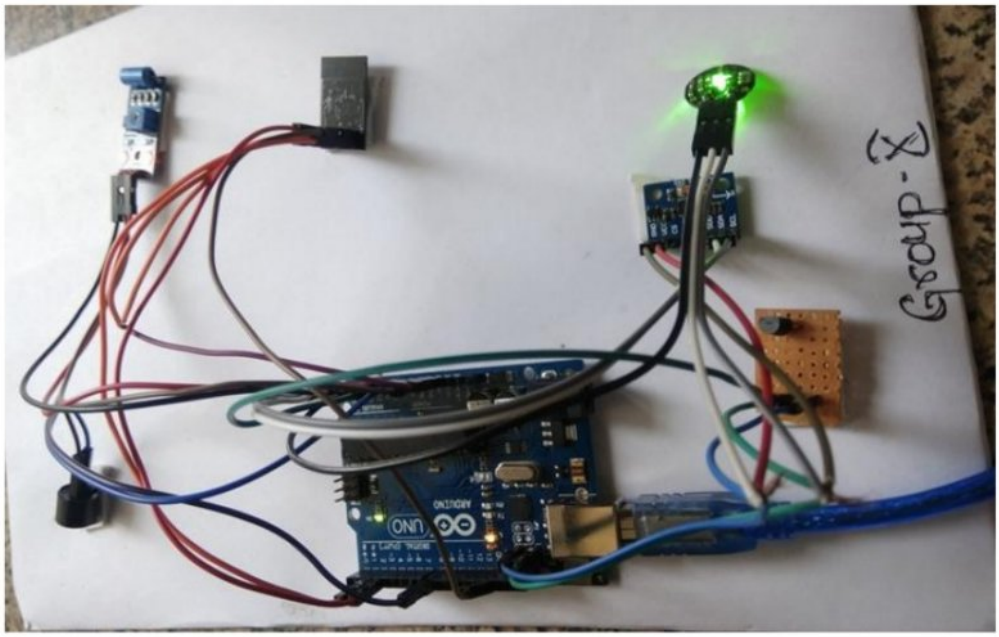


Fig 4.5.(a). Working setup

4.5.2 Components Used :- The different components used in this project are following

- Arduino Uno :-The Arduino Uno is developed by Arduino.cc. This microcontroller board is open source based on the Microchip ATmega328P microcontroller . The board is fitted out with sets of analog input/output pins and digital input/output pins .These pins can be easily interfaced to different expansion

boards (shields) and any other circuits according to our need. The board consist of 14 digital input-output pins (out of which 6 are capable of PWM output), 6 analog input-output pins, and it has ability to be programmable with the Arduino IDE (Integrated Development Environment), with the help of USB cable which is a type B . It can be powered with the help of USB cable or by an external battery of 9-volt However it work with voltages between 7 and 20 volts. It is similar to other Arduino board like the Arduino Nano and Leonardo.

Fig 4.5.(b). Arduino UNO

- Body Temperature Sensor :- LM35 series is a temperature devices with precision integrated-circuit with an output voltage which is linearly-proportional with the Centigrade temperature. This LM35 device have a superior quality than the linear temperature sensors marked in Kelvin, in this the user does not required to subtract the greater magnitude constant voltage from the output to receive suitable Centigrade scaling. The LM35 device does not require any external marking or trimming to provide distinctive accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range.

Fig 4.5.(c). Body temperature sensor

- Heartbeat Sensor / Pulse rate sensor :- If we are deciding our daily routine of exercise , studying or have an anxiety levels or just we want our shirt to reflects with our heart beat then Heart rate data can be really very useful. The problem regarding this is measuring heart rate can be a difficult task . Fortunately, the Pulse Sensor which is also known as Heart Rate Sensor cando this task! The Pulse Sensor are plug-and-play heart-rate sensor for an Arduino UNO board. It can be utilized by student of college and school or anywhere, artists, athletes, makers, and developers of game & mobile who want to include the live data of heart-rate into their projects.

Fig 4.5.(d). Heartbeat Sensor

- Wifi Module :- ESP8266 WiFi Module is the independent,liberated SOC with integrated TCP/IP protocol stack that can provide any microcontroller access to your WiFi network. The ESP8266 is capable in hosting an application and also capable of offloading all Wi-Fi networking functions from the any other application processor. Every ESP8266 module comes with a pre-programmed AT command set firmware, which means, you could absolutely hook this up to your Arduino device and you will get about as much WiFi-capability just as a WiFi Shield provides. This ESP8266 module is highly cost effective board with a large, huge and ever increasing community.

  This module has a powerful on-board processing and a storage capability which permits it to be integrated with a sensors and any other application related particular devices with help of its GPIOs with a minimum development up-front and a minimum loading during the runtime. Its allows for a minimal external circuitry, including the front-end module, because of high degree of the on-chip integration is designed to occupy minimal area of PCB. This ESP8266 supports the APSD for the VoIP applications and also the Bluetooth co-existence interfaces, it will contains a self-calibrated RF which permits it to work under all the operating conditions, and don't requires any external RF parts.

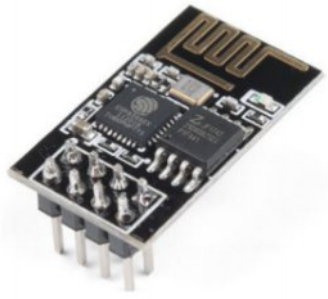


Fig 4.5.(e). Wifi Module

- Vibration sensor :- The vibration sensor is also known as a piezoelectric sensor. This sensors are very flexible devices which found use in measuring the various processes. While measuring the changes regarding the acceleration, the pressure, temperature, force it uses the piezoelectric effects otherwise it will be strain by changing to an electrical charge. This sensor decides the fragrances in the surrounding air by frequently measuring capacitance as well as quality of air.

  The sensitivity of these types of sensors usually have range from the 10 mV/g to 100 mV/g, and there are also lower and higher sensitivities associated which are also accessible. The sensitivity regarding this sensor could be selected on basis of the application. So it will be essential to know about the levels of the vibration amplitude range to which the sensor will be open or exposed throughout the measurements.

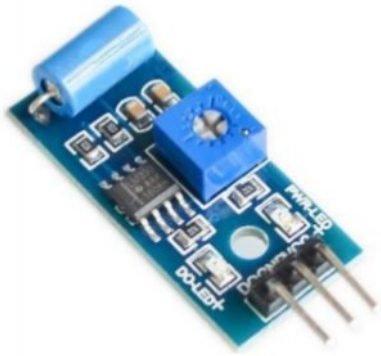


Fig 4.5.(f). Vibration Sensor

- Gyro sensor :- The Gyroscope sensor is a device which is able to measure and maintain the orientation and the angular velocity of an object. This device is more advanced than the accelerometers. These

are able to measure the tilt and also capable to measure the lateral orientation of the object whereas the accelerometer can only measure the linear motion of an object. These Gyroscope sensors are also called as the Angular Rate Sensor or the Angular Velocity Sensors.

Whenever it seems difficult to measure the orientation of the object to sense by humans we use these sensors which are installed in the applications. It is measured in degrees per second, and the angular velocity is the change in the rotational angle of the object per unit of time.

Fig 4.5.(g). Gyro Sensor

- Buzzer :- A **buzzer** is a modest yet very productive component. It is used to add sound features in our project. It is a very small and a concise 2-pin structure hence it could be easily used on breadboard, the Perf Board and even on the PCBs which will makes this a highly used constituent in most of the electronic applications. This buzzer can be used with the help of simply powering. It uses a DC power supply of range from 4V to 9V. A simple 9V battery could also be used here , but it is suggested to use a regulated +5V or +6V DC supply. The buzzer is normally syndicated with a switching circuit to

turn it ON or turn it OFF the buzzer at a required time and a require interval.

The picture shown in the next page is a simple buzzer, which is operated when power is turned on and it will make a Continuous Beeeeppppp..... sound . Simple buzzer, the mostly used buzzer because of its specifications as it could be customised with the help of different circuits to be compatible easily in our application.

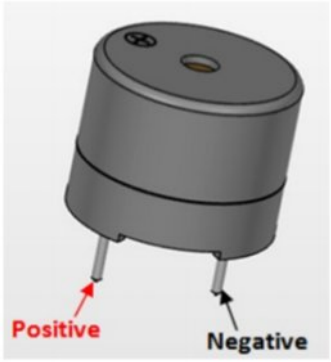
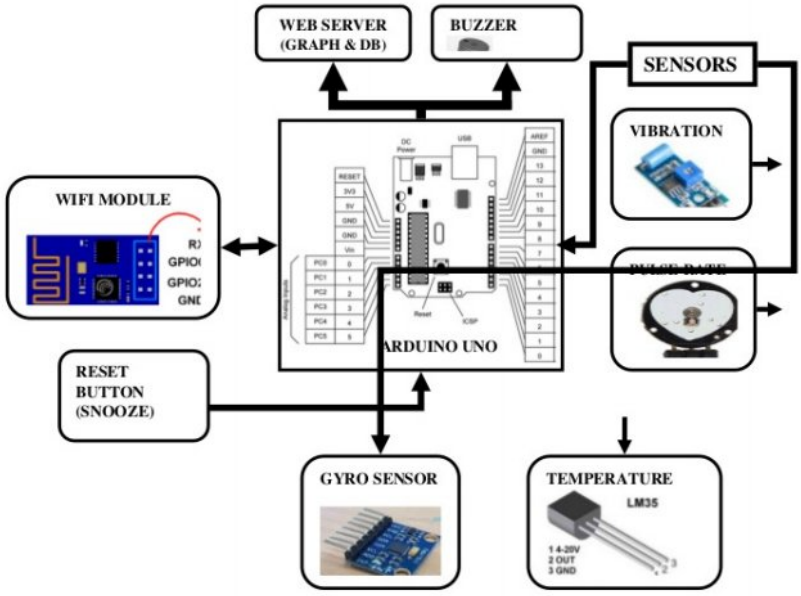


Fig 4.5.(h). Buzzer

4.6. BLOCK DIAGRAM :-



CHAPTER 5 :

CONCLUSION, RESULT AND FUTURE DIRECTIONS

5.1. FUTURE DIRECTIONS :-

Our healthcare facilities have grown highly since independence but the solution for major issue regarding falls in elderly and the pain through which they suffer is main reason of the increased awareness to develop such a system so that we can prevent such mishappening . A lot of efforts are required to prevent or diminish such kind of events and to provide the older people with better life quality and also to render them with a helpful,accessible and immediate fall detection and prevention techniques which will be convenient for them to use . Inspite of the substantial and great achievements which have been carried out in the field of providing multiple solutions for the monitoring of elderly fall, its detection, and its prevention in the recent years, there are still some more challenges to overcome in this field.

Usually , the drawbacks which are stated previously while the surveying of different types of research and various commercial fall detection and prevention solutions available, are considered to be as open issues that have to be deliberate for further research in future. Also, regarding the detection of falls with the help of camera-based surveillance or the image processing techniques there still some major difficulties which are needed to be overcome.

From few these complexity are stated here- first of all the most important point is the existent fall detection is innately sensitive to a lofty levels of the treasonable fall detection, as if what seems to be a fall of elderly person may not be an actual fall rather its his or her conscious move towards a particular place. Means, many of the present day systems which are used in this time are not able to differentiate between the real fall incident and an incident when the person is lying or sitting down hastily. Also, the existing fall detection techniques manage to deal with the restricted movement patterns and fall incidents to be detected with respect to this , whereas in the real indoor environments various normal and also some abnormal motions occur.

Other systems which are used the audio information or which uses the 3D trajectory and the speed of head to derive incident . These techniques become more complex and also need more additional costs. Furthermore , using the accelerometer sensor technology which is integrated in our smart phones for the fall detection have a lot of advantages in the cost and also the capability of the system . However, it may be difficult to persuade the users to mount the phone to different body parts in order to improve the fall detection rate and decreasing it . Likewise steps like , elevating the phone upto the user's ear to make a call and lowering down the phone from the user's ear to cut the call may terribly affect the phone's ability to measure correct fall detection. So, the software applications which are used must dynamically adjust to different locations and also different methods of carrying the phone by the user . This necessitate the software to classify the acceleration parameters of general use to identify the correct parameters with respect to the fall detection logic.

Moreover , the area regarding the behaviour determination, which is used for the building of a behavioural profile of the aging patients and the monitoring deviations occurrence from the model, is still extensively open for the further research work. Behaviour determination is highly based on the activity identification and the location tracking that detects a specific behaviour, which may be caused due to decreased health status, progressing disease, or the emergency situation . Another challenge is that despite of understanding to a large degree the causes of most of the falls, there are still not much methods to precisely and accurately predict that a fall incident is likely to occur. Broadly speaking , all of the monitoring algorithms and the approaches regarding the fall detection and prevention depends on only one data provider i.e (the movement-sensor, camera and the accelerometer, etc.)

have their own limitations and boundary and they do not ensure 100% reliability .

In fact, the prevention of falls and the injuries due to that fall is difficult because they are complex and composite events caused by the combination of underlying impairments and the disabilities with or without incidental to environmental conditions. Algorithms for fall detection for some environments and the patient's physical conditions were rather difficult to deal with , nevertheless , a combination of the movement sensors and the signal-processing technologies can provided supply more exact, accurate and precise indications of fall detection and the prevention approaches too. Data fusion which is based on the multi-sensing of technology offers many challenges for supplying more accurate approaches for the fall detection and prevention techniques.

Multi-sensor data fusion is the field which focusing on creation of multi-modal systems, which is able to receive data from different providers and functions the correlation or fusion upon it for increasing the accuracy and reliability of the systems. Moreover, with the combination of modern day data fusion technology which involve multi-sensing and it is collection of information with the predicting technologies such as the Machine Learning and the Artificial Intelligence would help in development of an automatic system for preventing the fall. Eventually, old aged persons in enduring care centres or elderly people with realistic emotional and mental disablement, who hasn't been greatly studied in this provided survey, are also endangered of falling and a more extensive and comprehensive technology required to be designed particularly for them also.

- Fall Detection and Prevention Solutions :- Presently a vast number of technology regarding the fall detection prevention have been developed greatly .Indian society have a considerable number of elderly people who are always at risk of misshapen if not properly taken care of, that's why we family member need to have a proper check on them to avoid such kind of incidents by monitoring with various technology present today.

In our nearby market a large number of high-tech devices are available which we can use for monitoring and to keep an eye on our greatest assets –our elderly people. Every device has its own merits and demerits associated with that its our responsibility to distinguish between them and choose the one which suits our requirement best .The devices or sensors could be fixed in elder people's clothes, watch or handheld devices like phone or even in the room in which they reside for uninterrupted movability support and modest fall detection. In past few years, there have been a large number of solutions present in the market whose main aim is to detect fall .It can be automatic or non-automatic detection such as fall detectors those are wearable with a combination of accelerometer and tilt sensors. Also, there are many products, help to solve the problem of fall detection and aid elderly people requesting for help or assistance if they fall.

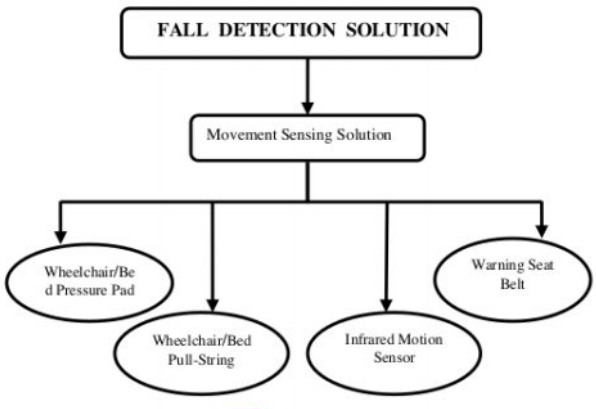


Fig.3.1. Fall Detection Solution

When the data of our census it is approximated that in a group of five people more than one will be aged 65 or over that. As we all know that this age group is more vulnerable to miss-happening like falling is one of the most grave and dangerous deadly events that can occur, according to a report one-third to one-half of our population aged 65 and over that (mostly the residents of old age home) go through falls on a yearly basis and half of them do fall repeatedly. So, the automatic fall detection system would help to reduce the arrival time of medical personnel, and as a result the mortality rate will reduce which are caused by fall.

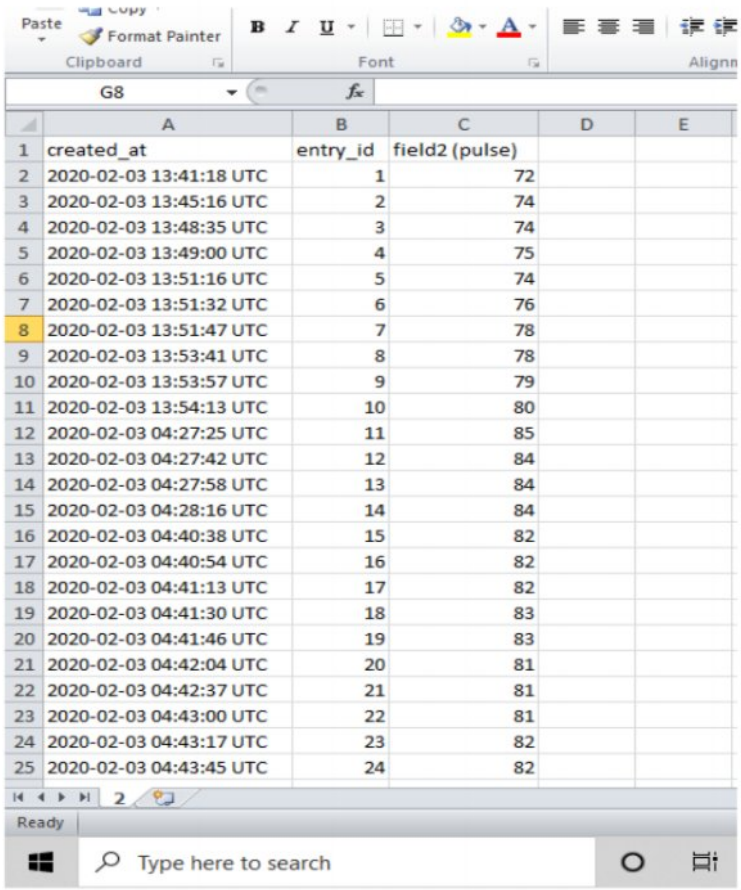
5.2. RESULTS :- As we had discussed earlier that how less number of medical practitioners are there in our nation, so to overcome the need of such people we have develop this system, so that a single doctor can monitor multiple patients at a time and the time to travel will be reduced much. And there will be fewer requirements of hospitals and hospital beds, and through this we would also promote ***telemedicine.*** The result will consist the output what we will get on our serial monitor and the result or the output what we will be shown on our website, here on different section we have shown the database of pulse rate, database of human body temperature and further the graphical representation of the output. That was all about smart patient's healthcare.

Now, in case of smart wheelchair fall detection, the alarm had been blown at the time when the wheelchair collide with some obstacle and at the time when the wheel chair had been tilted with an angular velocity of plus(+) 5degre/sec and minus(-) 5 degree/sec, it will blow the same alarm and it will indicate that some miss-happening is being done.

All these problems could be encountered by using a system which will provide a better and efficient method to the people. The system which will

provide an accurate, less costly, time saving for the betterment of people and to improve the health quality of the people.

5.2.1. Record of pulse rate of a human body under different situation. :-



	A	B	C	D	E
1	created_at	entry_id	field2 (pulse)		
2	2020-02-03 13:41:18 UTC	1	72		
3	2020-02-03 13:45:16 UTC	2	74		
4	2020-02-03 13:48:35 UTC	3	74		
5	2020-02-03 13:49:00 UTC	4	75		
6	2020-02-03 13:51:16 UTC	5	74		
7	2020-02-03 13:51:32 UTC	6	76		
8	2020-02-03 13:51:47 UTC	7	78		
9	2020-02-03 13:53:41 UTC	8	78		
10	2020-02-03 13:53:57 UTC	9	79		
11	2020-02-03 13:54:13 UTC	10	80		
12	2020-02-03 04:27:25 UTC	11	85		
13	2020-02-03 04:27:42 UTC	12	84		
14	2020-02-03 04:27:58 UTC	13	84		
15	2020-02-03 04:28:16 UTC	14	84		
16	2020-02-03 04:40:38 UTC	15	82		
17	2020-02-03 04:40:54 UTC	16	82		
18	2020-02-03 04:41:13 UTC	17	82		
19	2020-02-03 04:41:30 UTC	18	83		
20	2020-02-03 04:41:46 UTC	19	83		
21	2020-02-03 04:42:04 UTC	20	81		
22	2020-02-03 04:42:37 UTC	21	81		
23	2020-02-03 04:43:00 UTC	22	81		
24	2020-02-03 04:43:17 UTC	23	82		
25	2020-02-03 04:43:45 UTC	24	82		

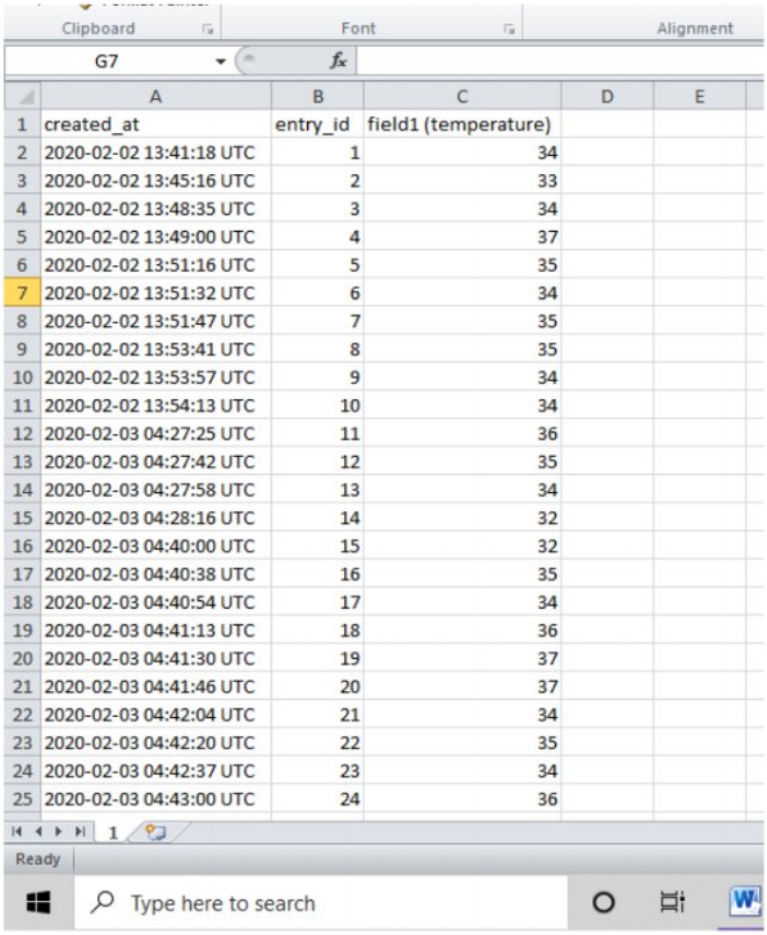
Table- 5.2.(a)

In the table mentioned above, we are able to see that there are three columns 1, 2 and 3 representing date and time when the parameter is being created, entry ID and pulse rate of a human body at the respective date and time. So these are the parameters which will be auto generated

and a database will be formed and a track record could also be maintained that how the patient is recovering, having a stable state or the condition is going worst, so with this it will be much helpful, and need not to maintain a record of a patient with our own.

The same thing can also be observed in case of human body temperature.(refer table 3.2.2)

5.2.2.Record of human body temperature under different weather. :-



	A	B	C	D	E
1	created_at	entry_id	field1 (temperature)		
2	2020-02-02 13:41:18 UTC	1	34		
3	2020-02-02 13:45:16 UTC	2	33		
4	2020-02-02 13:48:35 UTC	3	34		
5	2020-02-02 13:49:00 UTC	4	37		
6	2020-02-02 13:51:16 UTC	5	35		
7	2020-02-02 13:51:32 UTC	6	34		
8	2020-02-02 13:51:47 UTC	7	35		
9	2020-02-02 13:53:41 UTC	8	35		
10	2020-02-02 13:53:57 UTC	9	34		
11	2020-02-02 13:54:13 UTC	10	34		
12	2020-02-03 04:27:25 UTC	11	36		
13	2020-02-03 04:27:42 UTC	12	35		
14	2020-02-03 04:27:58 UTC	13	34		
15	2020-02-03 04:28:16 UTC	14	32		
16	2020-02-03 04:40:00 UTC	15	32		
17	2020-02-03 04:40:38 UTC	16	35		
18	2020-02-03 04:40:54 UTC	17	34		
19	2020-02-03 04:41:13 UTC	18	36		
20	2020-02-03 04:41:30 UTC	19	37		
21	2020-02-03 04:41:46 UTC	20	37		
22	2020-02-03 04:42:04 UTC	21	34		
23	2020-02-03 04:42:20 UTC	22	35		
24	2020-02-03 04:42:37 UTC	23	34		
25	2020-02-03 04:43:00 UTC	24	36		

Table- 5.2.(b)

5.2.3.Result on serial monitor where field 1 denotes body temperature and field 2 denotes body pulse rate:-

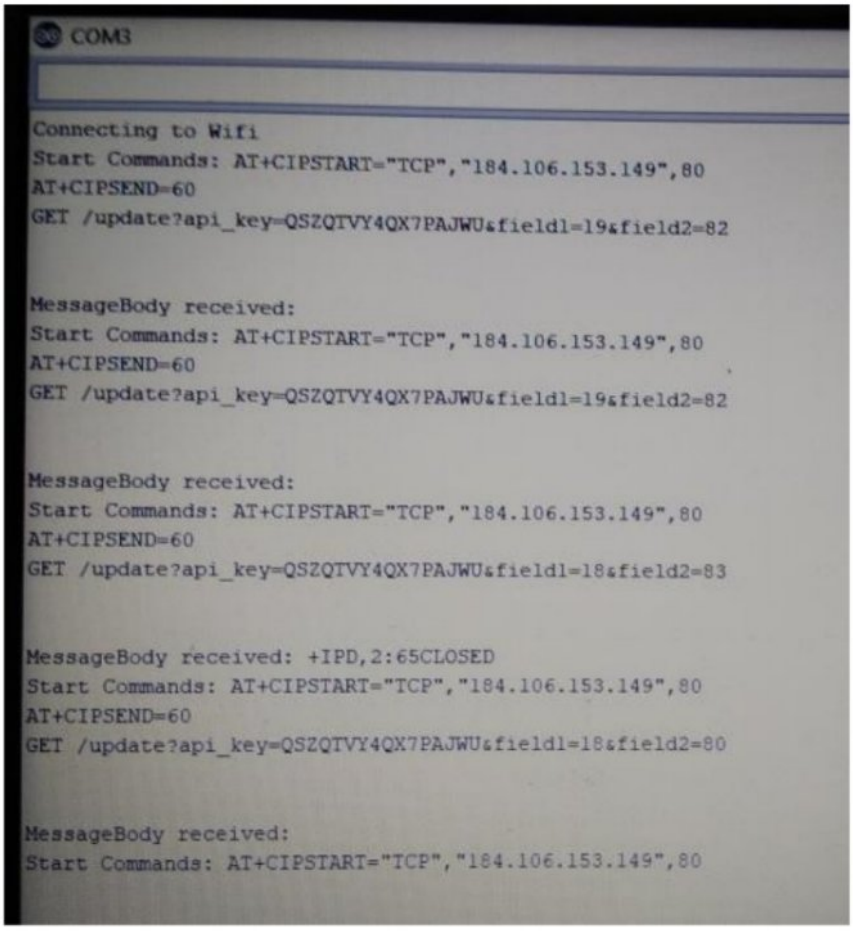


Fig.5.2.(a) Result on serial monitor

In the above mentioned figure we are able to see the result on a serial monitor, here field1 represents human body temperature and field 2 represents here the human body pulse rate. Since we are using a LM35 temperature sensor, so it will take some random temperature when the sensor is not being pressed or hold within our hand.

5.2.4.Result in the form of graph, on the website where field 1 denotes body temperature and field 2 denotes body pulse rate.:-

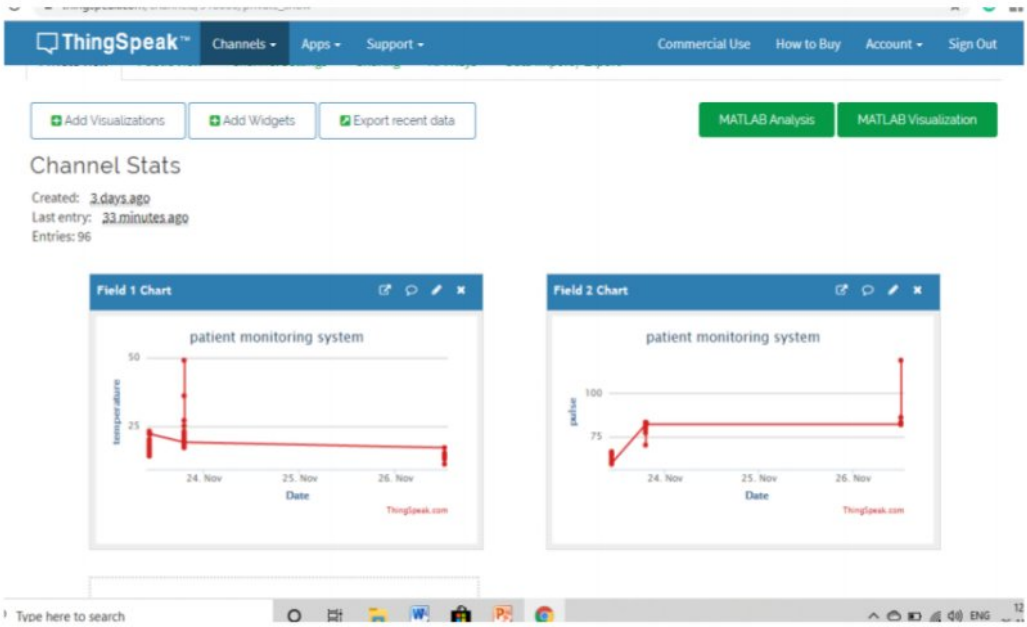


Fig.5.2.(b) Graphical representation of the parameters

In the above mentioned figure we are able to see the result in a graphical form, here field1 represents human body temperature and field 2 represents here the human body pulse rate. Since we are using a LM35 temperature sensor, so it will take some random temperature when the sensor is not being pressed or hold within our hand.

5.3. DISCUSSION :-

According to the data of our census it is approximated that in a group of five people more than one will be aged 65 or over that. As we all know that this age group is more vulnerable to miss-happening like falling is one of

the most grave and dangerous deadly events that can occur, according to a report one-third to one-half of our population aged 65 and over that (mostly the residents of old age home) go through falls on a yearly basis and half of them do fall repeatedly. So, the automatic fall detection system would help to reduce the arrival time of medical personnel, and as a result the mortality rate will reduce which are caused by fall.

The system is easy to make and it only need a lot of study, so that one can effectively make a system which can produce an appropriate output or a result and can be made in a economically lesser price.

The major issue of this system is internet connectivity, because there are some area where there could be some issue in internet and is not easily available.

The baud rate should be precisely selected so that our wifi module could connect effectively with the Arduino UNO.

Here, in this system we have used an analog vibration sensor and by coding it to a digital form we are using it in this project or in this system.

5.4. CONCLUSION:-

The project is regarding Smart wheelchair with fall detection, and patient's health care system controlled by Arduino UNO. The main aim of our project was to continuously monitor patient's current state and medical parameters such as human pulse-rate and human body-temperature and also to check whether the patient's wheelchair is in normal condition or not. The data is being published on a web server and the data could be fetched and thrown back onto a website in a graphical form and on a datasheet, by an authorized ID-password only, which will be accessible only to the people who have this ID and password.

If a patient sitting on a wheelchair falls due to some reason or have a sudden collision with some obstacle, an alarm will start to blow and the nearby people can be informed about the incident, and in case, if a person is all good despite of collision than he or she can just switch the alarm off. May be this work is not very new but, here the difference is we are going to publish an acute system and it will be in a feasible rate also, using an Arduino-UNO board.

The basic feature of the project is to continuously monitor patient's wheelchair condition and continuously send body's parameter on the website and the people related to the patient can fetch the data accurately. The project or the work presented here has more opportunities in the further years of development because no one can be present there physically with the patient all the time and the informative-data arranged by this system is having so much value, this work can also be modified by adding more medical parameter like EEG,ECG etc with it and help whether a patient is having any disease.

Our goal was to develop a project with brilliant medical management system and a wheelchair which will provide an alarm signal, at the time when an old aged or a paralyzed individual will fall from that moving chair, and all these things would be implemented with the help of INTERNET OF THINGS, in which doctors can supervise their patient in terms of medical aspects, irrespective of the place, whether the person is at the hospital or at their homes using our work in this project.

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APPENDICES :-

A. Code for Connection Between Sensors and Wifi Module :-

```
#include <Wire.h>
#include <Adafruit_Sensor.h>
#include <Adafruit_ADXL345_U.h>
Adafruit_ADXL345_Unified accel = Adafruit_ADXL345_Unified();

// Thingspeak
String myAPIkey = "VUPUEOPSS33SPY7R";

#include <SoftwareSerial.h>
SoftwareSerial ESP8266(2, 3); // Rx,  Tx

int buzzer=8;
int temp=A0;
int pulse= A1;
int vibration=A2;
int val_temp , val_pulse;
int val2=0;

long writingTimer = 10;
long startTime = 0;
long waitTime = 0;
//
//boolean relay1_st = false;
//boolean relay2_st = false;
unsigned char check_connection=0;
unsigned char times_check=0;
boolean error;
void setup()
{
 pinMode(buzzer,OUTPUT);
 pinMode(vibration,INPUT);
 Serial.begin(115200);
 ESP8266.begin(115200);
```

```
if(!accel.begin())
  {
    Serial.println("No valid sensor found");
    while(1);
  }
//   dht.begin();
  startTime = millis();
  ESP8266.println("AT+RST");
  delay(2000);
  Serial.println("Connecting to Wifi");
//   while(check_connection==0)
// {
//    Serial.print(".");
  ESP8266.print("AT+CWJAP=\"shivam\",\"12345678\"\r\n");
  ESP8266.setTimeout(5000);
// if(ESP8266.find("WIFI CONNECTED\r\n")==1)
// {
// Serial.println("WIFI CONNECTED");
// break;
// }
// times_check++;
// if(times_check>3)
// {
//  times_check=0;
//   Serial.println("Trying to Reconnect..");
// }
// }
}
void loop()
{
 sensors_event_t event;
  accel.getEvent(&event);
 Serial.print("X: "); Serial.print(event.acceleration.x); Serial.println("  ");
 if(event.acceleration.x >5 || event.acceleration.x < -5)
 {
   digitalWrite(buzzer,HIGH);
```

```
   delay(1000);
  }
 val2=digitalRead(vibration);
  if(val2 == HIGH)
  {
   Serial.println(" VIB ON ");
  digitalWrite(buzzer,HIGH);
  delay(5000);
  }
waitTime = millis()-startTime;
 if (waitTime > (writingTimer*1000))
 {
   readSensors();
   writeThingSpeak();
   startTime = millis();
 }
 else
 {
   digitalWrite(buzzer,LOW);
   }
}
void readSensors(void)
{
 int val=analogRead(temp);
  val_temp=map(val,0,1023,0,350);

 int val1=analogRead(pulse);
  val_pulse=map(val1,0,1023,0,150);
}
void writeThingSpeak(void)
{
 startThingSpeakCmd();
 // preparacao da string GET
 String getStr = "GET /update?api_key=";
 getStr += myAPIkey;
 getStr +="&field1=";
 getStr += String(val_temp);
```

```
  getStr +="&field2=";
  getStr += String(val_pulse);
  getStr += "\r\n\r\n";
  GetThingspeakcmd(getStr);
}
void startThingSpeakCmd(void)
{
  ESP8266.flush();
  String cmd = "AT+CIPSTART=\"TCP\",\"";
  cmd += "184.106.153.149"; // api.thingspeak.com IP address
  cmd += "\",80";
  ESP8266.println(cmd);
  Serial.print("Start Commands: ");
  Serial.println(cmd);

  if(ESP8266.find("Error"))
  {
    Serial.println("AT+CIPSTART error");
    return;
  }
}
String GetThingspeakcmd(String getStr)
{
  String cmd = "AT+CIPSEND=";
  cmd += String(getStr.length());
  ESP8266.println(cmd);
  Serial.println(cmd);

  if(ESP8266.find(">"))
  {
    ESP8266.print(getStr);
    Serial.println(getStr);
    delay(500);
    String messageBody = "";
    while (ESP8266.available())
    {
      String line = ESP8266.readStringUntil('\n');
```

```
    if (line.length() == 1)
    {
      messageBody = ESP8266.readStringUntil('\n');
    }
  }
  Serial.print("MessageBody received: ");
  Serial.println(messageBody);
  return messageBody;
}

else
{

  ESP8266.println("AT+CIPCLOSE");
  Serial.println("AT+CIPCLOSE");
 }

}
```

B. Arduino (ATMEGA328) Architecture :-