AUTOMATED FALL DETECTION DEVICE FOR ELDERLY

A report submitted in partial fulfilment of the Academic requirements for the award of the degree of

Bachelor of Technology

Submitted by

T. PRANAY [19H510A4L7]

UNDER THE COURSE SOCIAL INNOVATION IN PRACTICE

CENTRE FOR ENGINEERING EDUCATION RESEARCH

CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)
(NAAC Accredited with 'A' Grade & NBA Accredited)
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KANDLAKOYA, MEDCHAL ROAD, HYDERABAD-501401
2020-21

CENTRE FOR ENGINEERING EDUCATION RESEARCH

CERTIFICATE

This is to certify that the course project report entitled **"AUTOMATED FALL DETECTION DEVICE FOR ELDERLY"** is a bonafide work done by **T.Pranay(19H51A04L7)** of I B.Tech II Sem, in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology, submitted to Centre for Engineering Education Research, CMR College of Engineering & Technology, Hyderabad during the Academic Year 2020-21.

1. R. VENKATESWARA REDDY (Assistant professor) Mrs.D.SOWJANYA

(Name of the project coordinator) **(HEAD CEER)**

EXTERNAL EXAMINER

DECLARATION

We, the students of I year B. Tech of Centre for Engineering Education Research , CMR COLLEGE OF ENGINEERING AND TECHNOLOGY ,Kandlakoya , Hyderabad, hereby declare, that under the supervision of our course coordinators, we have independently carried out the project titled "**AUTOMATED FALL DETECTION DEVICE FOR ELDERLY**" and submitted the report in partial fulfillment of the requirement for the award of Bachelor of Technology in by the Jawaharlal Nehru Technological University, Hyderabad (JNTUH) during the academic year 2020-21.

STUDENT NAME	ROLL NUMBER	SIGNATUR E
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ACKNOWLEDGEMENT

We are obliged and grateful to thank **Mrs.D. Sowjanya**, Head (CEER) and R**. venkateswara Reddy** (Assistant professor) CMRCET, for their cooperation in all respects during the course.

We would like to thank the Principal of CMRCET, Dr.V.A.Narayana , for his support in the course of this project work.

Finally, we thank all our faculty members and Lab Assistants for their valid support.

We own all our success to our beloved parents, whose vision, love and inspiration has made us reach out for these glories.

ABSTRACT

The concept behind this project of "AUTOMATED FALL DETECTION DEVICE FOR ELDERLY" is many elder people, live alone either in an apartment or a smaller house after their children have grown up and left home. It is not uncommon after a fall that an elderly person is unable to get up by themselves or summon help. There is therefore a need for an automatic fall detection system in which a patient can summon help even if they are unconscious or unable to get up after the fall.

To solve this problem, we went through a solution of fall detection system using both accelerometers and gyroscopes in the MPU6050 Sensor thereby our algorithm reduces both false positives and false negatives, while improving fall detection accuracy. The device notifies to a concern person with SMS/Email when fall occurred. It has also a panic button and an emergency notification can be sent by pressing it.

This project aims to design, simulate, and construct a simple and concise fall detector.

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1. INTRODUCTION:

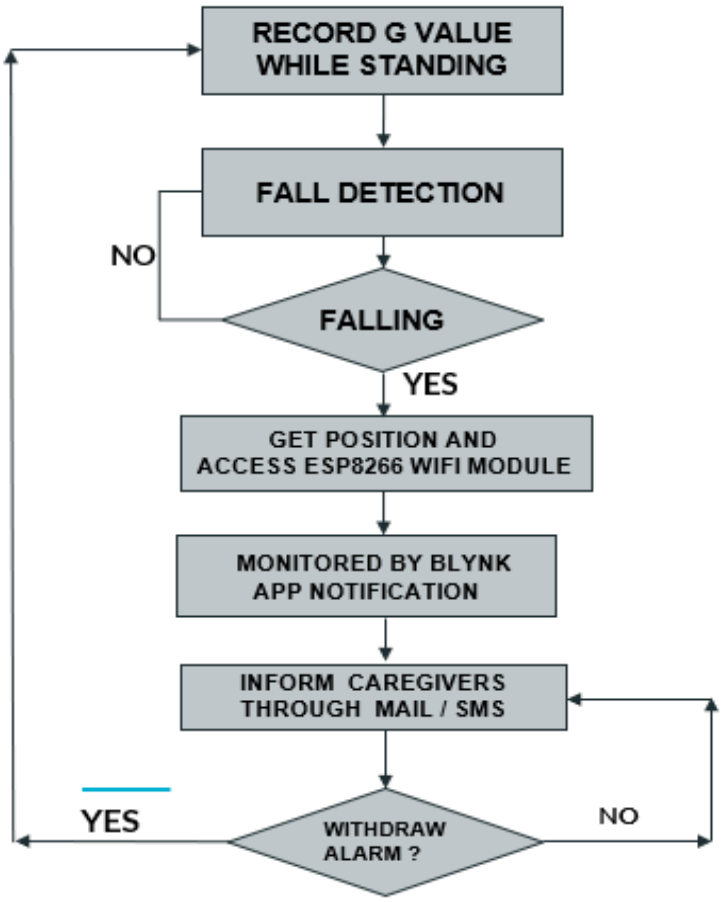
Every year, one-third to one-half of the population aged 65 and over experience falls. Falls are the leading cause of injury in older adults and the leading cause of accidental death in those 75 years of age and older. For a human, experiencing a fall unobserved can be doubly dangerous. The obvious possibility of initial injury may be further aggravated by the possible consequences if treatment is not obtained within a short time. Statistics show that the majority of serious consequences are not the direct result of falling, but rather are due to a delay in assistance and treatment. Post-fall consequences can be greatly reduced if relief personnel can be alerted in time.

Many algorithms have been developed but till now it is difficult to distinguish real falls from certain fall-like activities such as sitting down quickly and jumping, resulting in many false positives. Most of the algorithms use accelerometer to detect fall with body orientation, but it is not very useful when the ending position is not horizontal, e.g., falls happen on stairs.

Our project is different from other fall detectors in various factors like the power consumption is low, portable, low of cost.

2. WORKING PRINCIPLES:

The working principle of this automatic fall detection is, the NodeMCU with ESP8266 interacts with the MPU6050 and checks for the fall detection event. If any fall detects the concerned care taker gets email notification and nearby helpers can help them by alert sound of buzzer. A panic button is kept in the device for emergency and it gives similar notification as above. The blue led will be on showing the working status of device and the red led is on when fall is detected or panic button is pressed. Otherwise, the leds will be in OFF position. This is the working principle.



3.LITERATURE REVIEW:

3.1. Existing Solutions:

1) Floor sensors for Elderly:

- A smart floor that detects falls and immediately sends an alarm signal when a fall occurs. It was specifically conceived for care facilities. This sensitive floor warns the caregivers in case one of the residents falls.

- The premise like similar products is to alert someone when the patient needs help or has gotten out of bed. It doesn't ring in the room but instead through a pager that is worn by a nurse.

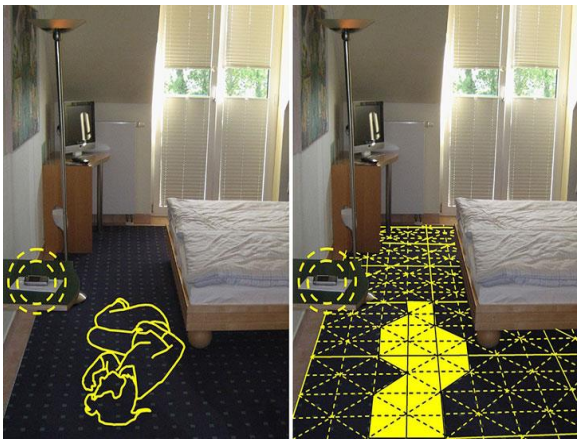
- The mat is a decent size. It will hold up to regular use too. The system is self-contained and will work with other Secure products. The pager can monitor up to four devices. Our primary concern is that the alarm continues buzzing as long as someone—or a pet—is standing on the mat, even with the reset button. The issue of being triggered accidentally is one you likely encounter with any
  Product

  - **Pros**

- The caregiver has three different options for setting the alarm.
- It works within a 500-foot radius.
- The sound won't disturb others in the room or startle the patient.
- The mat is reversible and latex-free.
- It is also anti-microbial.

- **Cons**

- It is expensive.
- No volume control on alarm.
- The radius applies only to unobstructed space within the same room.



2) Ambient Device:

- Ambient devices measure the environment of a subject under protection. The most common technology used in this group is infra-red sensing, but additional technologies based on sound and vibration sensing are the subject of promising developments. One of the drawbacks of these systems is that they have to be installed in several rooms to cover the whole area of actuation.

3) Wearable Sensors:

- The most common technologies found in these types of sensors are accelerometers and gyroscopes. These are devices that are easy to wear, but have some drawbacks as the power consumption (limiting its usability) and the sensitivity to body movement (which may cause false alarms). In addition, a considerable amount of these devices relies on a user's ability to manually activate an alarm after a fall event. Furthermore, even if they incorporate automatic fall detection technology.

  - **Pros**

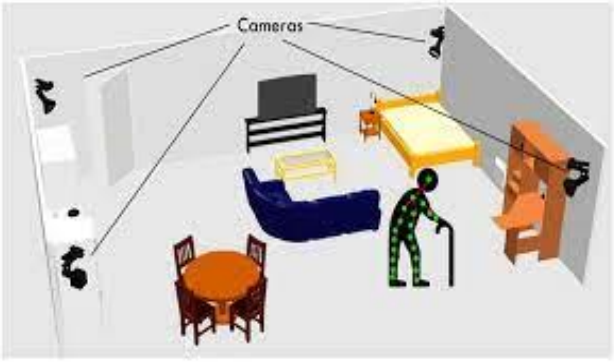
- Monitors our fitness levels.
- Keeps track of our location with GPS.
- Hands free and portable, eliminating the need to take our devices out of our pockets.
- Helps you with setting goals and tracking your progress toward them.

- **Cons**

- Short battery life.
- Can’t last for several days.
- Data inaccuracy.
- Some wearables have been reported to measure on occasion. This can be especially dangerous when measuring data like heart rates.

4) Vision Based Device:

- Most commercial fall-detection systems in the market are based on portable devices. Nowadays, it is not easy to find commercial devices using computer vision, but their associated technical advancements and related literature remain promising. In our case, the systems send only images when the fall has been detected. It recognises by 2D surveillance of the camera.



- **Pros:**

- Could detect multiple events simultaneously.
- Low obtrusive.
- Obtain postures relatively easily.
- High accuracy.

- **Cons:**

- The privacy issue sometimes.
- Medium cost.
- Medium complication on installation and setup.
- Accuracy depends in scenarios.

4. GAPS IN EXISTING SOLUTIONS:

Wearable sensor technology is the most commonly utilized type of commercial device, typically taking the form of a pendant, belt, or watch. Technologies found in these types of sensors are accelerometers and gyroscopes. These are devices that are easy to wear, but have some drawbacks as the power consumption (limiting its usability) and the sensitivity to body movement (which may cause false alarms).

- Costly.
- Infra-red sensing with additional technologies based on sound and vibration sensing one of the drawbacks of these systems is that they have to be installed in several rooms to cover the whole area of actuation.
- The systems sends only images when the fall has been detected (Vision based devices).
- Not Portable.
- Less image sensing techniques.
- Automated remote fall detection using impact features from video and audio may not be effective.
- Floor vibration to Detect Human Falls may not work all the time especially when some construction works goes nearby or greater sound is detected nearby.

5. PROPOSED SOLUTIONS:

By developing a small prototype using, MPU6050 and NODEMCU with ESP8266 to which code is written and uploaded, also we have a breadboard which is the base for connecting different elements, MPU6050 the sensor we used for detecting fall, led an indication for device working, panic button for emergency, buzzer for alerting nearby and finally a battery through which power is supplied. Hence the power consumed for fall detection can be minimized.

6. PROBLEM DEFINITION:

6.1. Problem Statement:

Many elderly people live alone either in an apartment or a smaller house after their children have grown up and left home. It is not uncommon after a fall that an elderly person is unable to get up by themselves or summon help. So, design a wearable Automatic Fall Detection Device in which a patient can summon help even if they are unconscious or unable to get up after the fall. Where it should notify the concerned person with no SMS and Email when fall occurred. It has also a panic button and an emergency notification can be sent by pressing it. And the cost ranges from 2500 – 3000 Rs /-which should be efficient and every one access it.

6.2 REQUIREMENT ANALYSIS

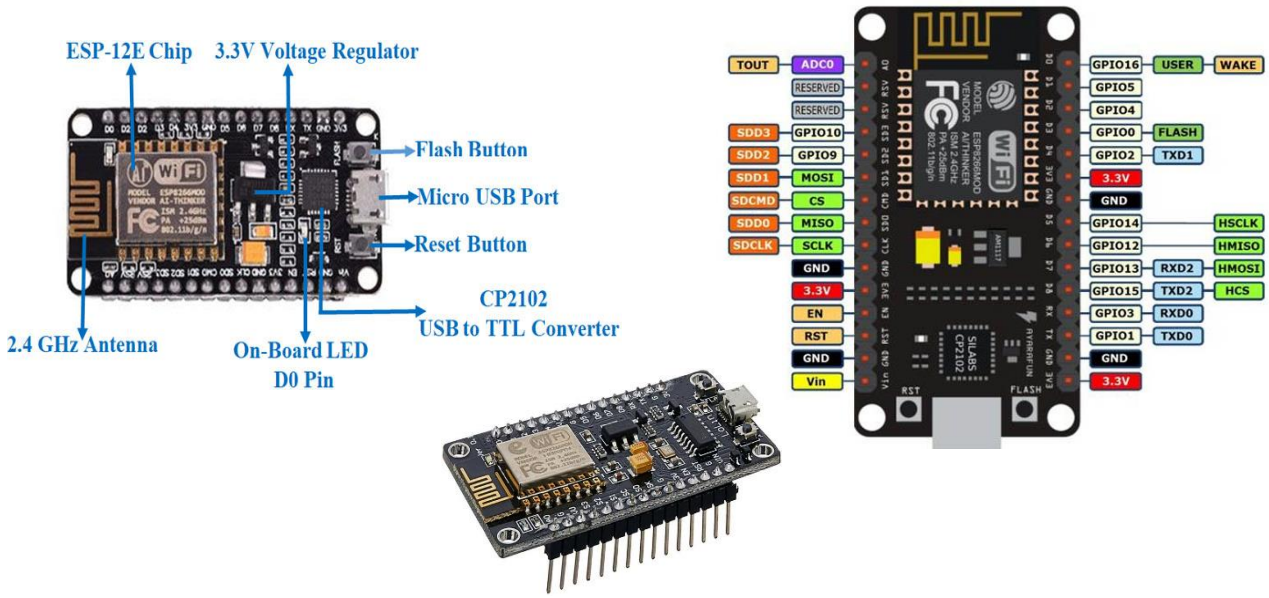
HARDWARE REQUIREMENTS:

1) NODEMCU WITH ESP8266

The **NodeMCU ESP8266 development board** comes with the ESP-12E module containing ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor supports RTOS and operates at 80MHz to 160 MHz adjustable clock frequency. NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects. NodeMCU can be powered using Micro USB jack and VIN pin (External Supply Pin). It supports UART, SPI, and I2C interface.

Applications of NodeMCU:

- Network projects.
- Prototyping of IoT devices.
- Projects requiring multiple I/O interfaces with Wi-Fi and Bluetooth functionalities
- Low power battery operated applications.



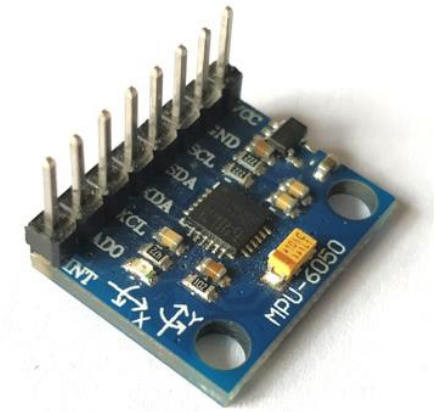
2) MPU6050 6-AXIS GYROSCOPE

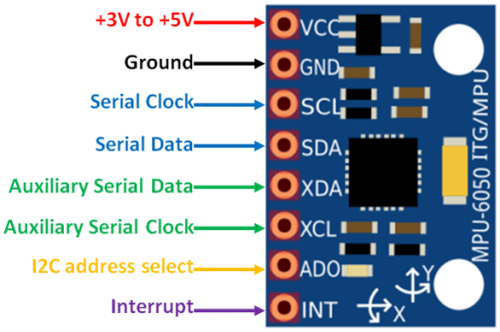
The MPU6050 is a Micro Electro-Mechanical Systems (**MEMS**) which consists of a 3-axis Accelerometer and 3-axis Gyroscope inside it. This helps us to measure acceleration, velocity, orientation, displacement and many other motions related parameter of a system or object. This module also has a (DMP) Digital Motion Processor inside it which is powerful enough to perform complex calculation and thus free up the work for Microcontroller.

The module also has two auxiliary pins which can be used to interface external IIC modules like a magnetometer, however it is optional. Since the IIC address of the module is configurable more than one MPU6050 sensor can be interfaced to a Microcontroller using the AD0 pin.

FEATURES:

- MEMS 3-aixs accelerometer and 3-axis gyroscope values combined
- Power Supply: 3-5V
- Communication: I2C protocol
- Built-in 16-bit ADC provides high accuracy
- Built-in DMP provides high computational power
- Can be used to interface with other IIC devices like magnetometer
- Configurable IIC Address
- In-built Temperature sensor



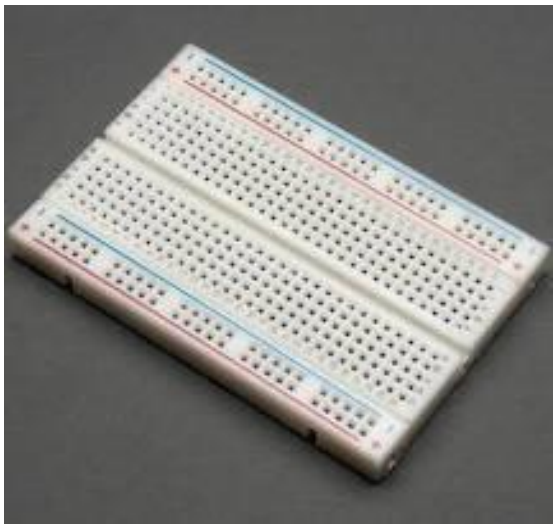


3) BREADBOARD

Breadboard is a plastic board with a bunch of tiny holes and is used for building and testing circuits. It has holes on them which are connected internally in a particular pattern as shown in the below picture. The holes which are connected through green line represents they are connected internally. The Red line indicates Power, which is normally connected to the power rail. The Blue line indicates Ground, which is normally connected to the ground of the circuit. ICs like Decade Counter can be placed in the middle breadboard to share the 1st eight pins to the yellow line and the 2nd eight pins to the green lines.

FEATURES AND SPECIFICATIONS:

- 400 tie-point plug-in Solderless Bread-Board.
- Four independent common bus lines.
- Hole Pitch/Style: 0.1" (2.54 mm), Square Wire Holes.
- Insertion Wire Size: 21 to 29 AWG wire, or 0.025” Square post headers 0.016 to 0.028 inches diameter (0.4 to 0.7mm diameter)
- Contact Life: 50,000 insertions.

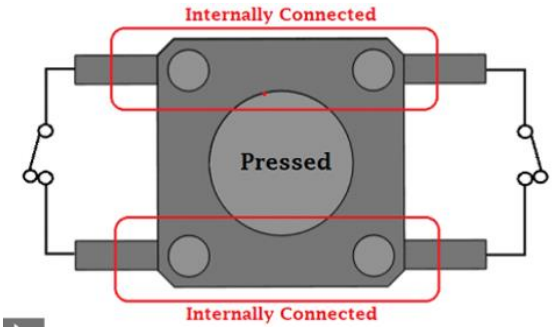


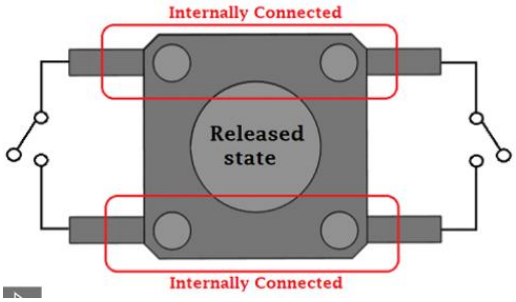
4) PUSH BUTTON

Push-Buttons are normally-open tactile switches. Push buttons allow us to power the circuit or make any particular connection only when we press the button. Simply, it makes the circuit connected when pressed and breaks when released. A push button is also used for triggering of the SCR by gate terminal. These are the most common buttons which we see in our daily life electronic equipment's. Some of the applications of the Push button are mentioned at the end of the article.

APPLICATIONS

- Calculators
- Push-button telephones
- Kitchen appliances
- Magnetic locks
- Various other mechanical and electronic devices, home and commercials.





5) BUZZER

A **buzzer** is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications.

There are two types are buzzers that are commonly available. The one shown here is a simple buzzer which when powered will make a Continuous Beeeeeeppp.... sound, the other type is called a readymade buzzer which will look bulkier than this and will produce a Beep. Beep. Beep. Sound due to the internal oscillating circuit present inside it. But the one shown here is most widely used because it can be customised with help of other circuits to fit easily in our application.

This buzzer can be used by simply powering it using a DC power supply ranging from 4V to 9V. A simple 9V battery can also be used, but it is recommended to use a regulated +5V or +6V DC supply. The buzzer is normally associated with a switching circuit to turn ON or turn OFF the buzzer at required time and require interval.

FEATURES

- Rated Voltage: 6V DC
- Operating Voltage: 4-8V DC
- Rated current: <30mA
- Sound Type: Continuous Beep
- Resonant Frequency: ~2300 Hz
- Small and neat sealed package
- Breadboard and Perf board friendly

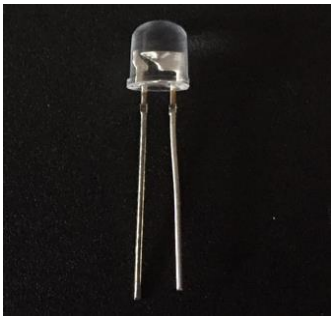
6) LED [LIGHT EMITTING DIODE]

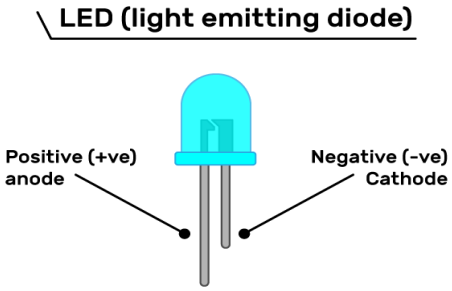
LED stands for "Light Emitting Diode", they allow to emit light with the wavelength of up to 940nm. The wavelength range varies from 760nm to 1mm. These are mostly use in the remote control of TV's, cameras and different types of electronic instruments. The semiconductor material used to make these LEDs are gallium arsenide or aluminium arsenide. Mostly used in IR sensor as it is the combination of IR receiver and IR transmitter. An LED is used in various daily used electronic appliances. As in the remote of the television, infrared cameras, transmission systems. We can make various projects, sensor using this LED like obstacle detector, visitor-counter and line-followers.

FEATURES

- Temperature for storage and operation varies from -40 to 100 ℃
- Forward current (IF) is 100mA (normal condition) and 300mA (max.)
- 1.5A of surge forward current
- 1.24v to 1.4v of forward voltage
- High Reliability
- Excessive radiant intensity
- Forward voltage is low

- Having lead spacing of 2.54mm
- Maximum wavelength is 940nm
- Easy to use with breadboard.





7) JUMPER WIRES

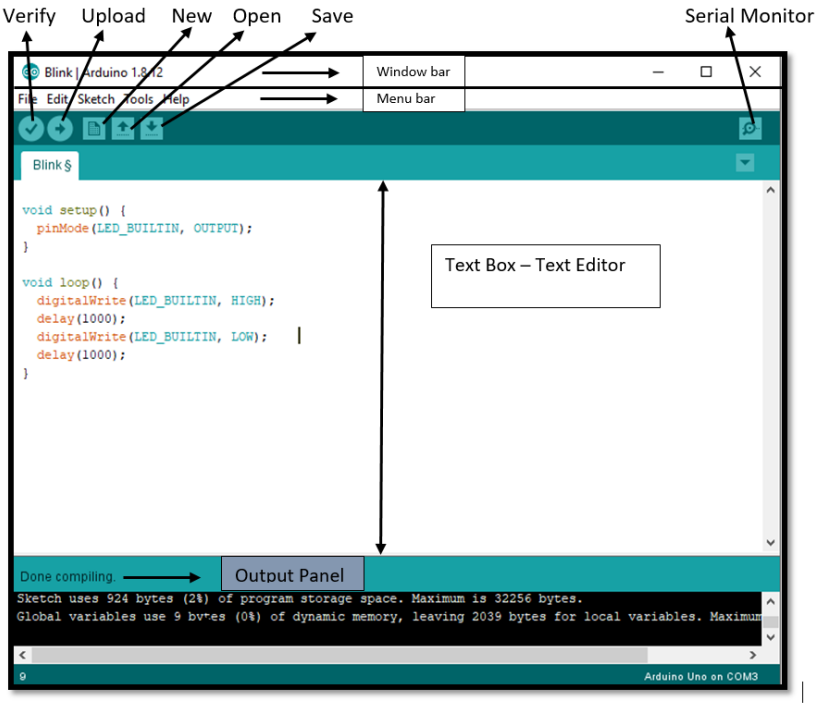
A **jump wire** (also known as jumper, jumper wire, jumper cable, DuPont wire or cable) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

SOFTWARE AND IDE USED:

1) ARDUINO IDE:

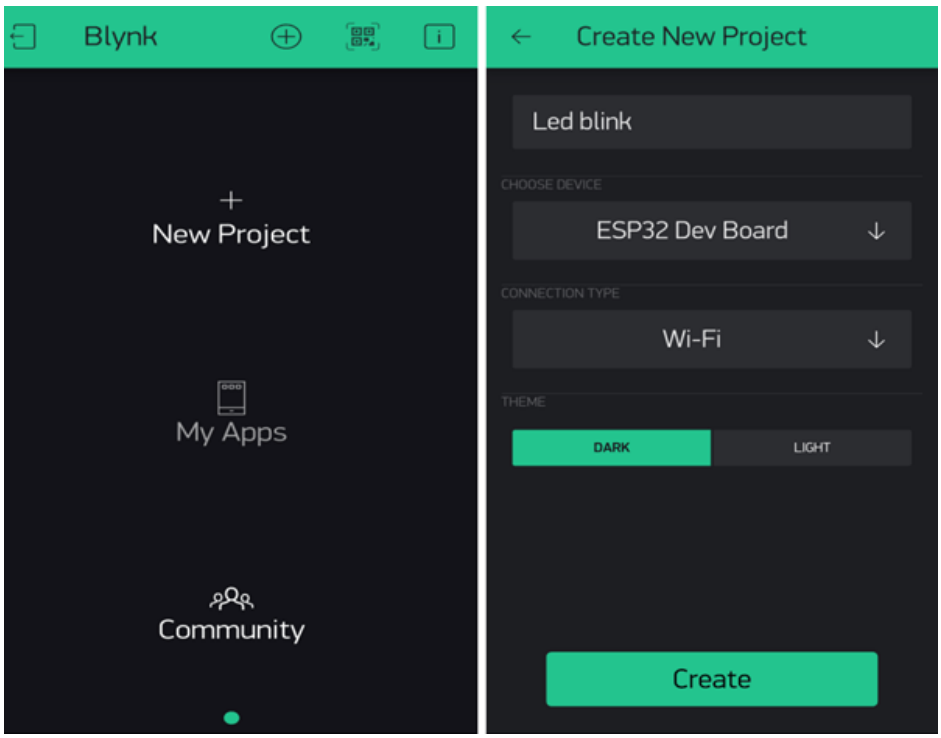
Arduino IDE (Integrated Development Environment) is the software for Arduino. It is a text editor like a notepad with different features. It is used for writing code, compiling the code to check if any errors are there and uploading the code to the Arduino. It supports C/C++ language. Word file in Arduino is called a **Sketch** where the user writes code. The format of Arduino is saved as **.ino.** When a user writes code and compiles, the IDE will generate a Hex file for the code**. (Hex file are Hexa Decimal files which are understood by Arduino)** and then sent to the board using a USB cable. Every Arduino board is integrated with a microcontroller, the microcontroller will receive the hex file and runs as per the code written.



2) BLYNK:

Blynk is a Platform with IOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets.

The **Blynk app** is actually an **app** editor. It allows you to create one or more projects. Each project can contain graphical widgets, like virtual LEDs, buttons, value displays and even a text terminal, and can interact with one or more devices.



7) CONCEPTUAL DESIGN:

I. DESIGNING METHODOLOGY

Hardware Setup:

1. Gather all the components and check if NODEMCU, ESP8266 and MPU6050 Sensors are working fine or not.

2. Connect the SCA, SCL pins to the D1, D2 pins of NODEMCU and the voltage, ground pins of sensor to the voltage, ground pins of NODEMCU respectively.

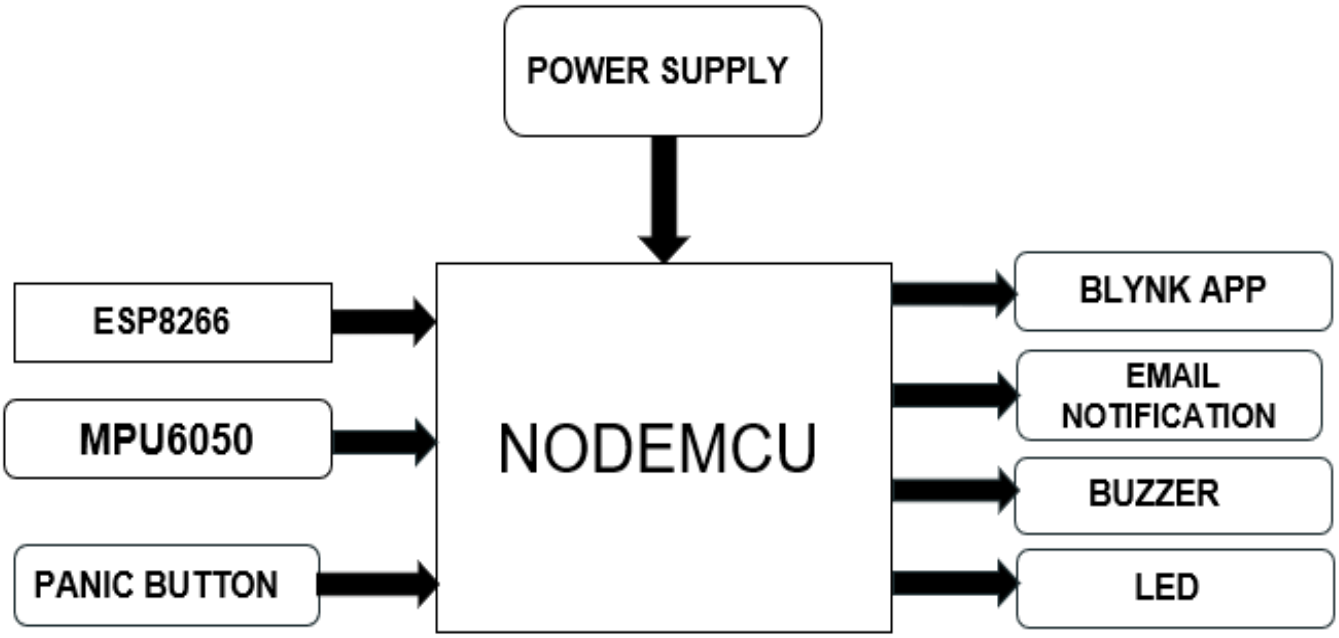
3. Connect the PUSH BUTTON one pin with the digital pin and other two pins with voltage and ground pins of NODEMCU.

4. Connect two led with resistors on the breadboard so that one end of resistor is connected to digital pins and other two are given to ground.

5. Finally connect positive of buzzer with the digital pin and negative to ground.

6. Code is written such a way that when fall detects buzzer and one led is on and in other case buzzer is off and another led will on. Same works with panic button.

8. BLOCK DIAGRAM:



9. IMPLEMENTATION:

9.1 RESULTS AND DISSCUSSION:

Fall detection system is very useful for older people. This is because it can notify the individual or family member when it detects a fall and **reduces the risk of delay in medical attention**. In our prototype we have a NODEMCU with ESP8266 Module which is similar to Arduino IDE to which code is written and uploaded, also we have a breadboard which is the base for connecting different elements, MPU6050 the sensor we used for detecting fall, led an indication for device working, panic button for emergency, buzzer for alerting nearby and finally a battery through which power is supplied.

In our proposed design firstly, we place a breadboard and connect NODEMCU, MPU6050 to it (Pins to be soldered). Now through jumper wires we connect voltage, ground and the digital pins of NODEMCU with SCA, SCL (accelerometer and orientation pins) of MPU6050.Now with coding the MPU6050 can be interfaced with NODEMCU. The MPU6050 uses the algorithm to see if the acceleration magnitude (AM) breaks a set TRIGGER 1. If this TRIGGER 1 is broken (ACTIVATED), the algorithm then checks to see if AM breaks a set TRIGGER 2 within 0.5s. If this TRIGGER 2 is broken (ACTIVATED), the algorithm then checks to see if the person's orientation (TRIGGER 3) has changed in a set range within 0.5s, which would indicate a person has fallen or not. If the person's orientation has changed, the algorithm then examines to see if that orientation remains after 10s, which would indicate the person is fallen and couldn't react in their fallen position on the ground. If this holds true, the algorithm recognizes this as a fall. So, if fall occurs the buzzer is on and the ESP8266 which is used to connect Wi-Fi module and the cloud app (BLYNK which is used in this project) through which app is connected and notification is sent through email. A failure of any of the intermediate decision conditions would reset the triggers and can withdraw the alarm. This prototype has LED to check the condition of device and a panic button: when pressed in the similar manner buzzer is on and the notification of uneasiness is expressed through mail to concerned caretakers. Finally in this way the device works and this model can be kept to the hands of end users.

CODE:

```
#include <Blynk.h>
#include <Wire.h>
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#define switch D3
#define LED1 D5
#define LED2 D6
int buzzerPin = D4;
const int MPU_addr = 0x68; // I2C address of the MPU-6050
int16_t AcX, AcY, AcZ, Tmp, GyX, GyY, GyZ;
float ax = 0, ay = 0, az = 0, gx = 0, gy = 0, gz = 0;
boolean fall = false; //stores if a fall has occurred
boolean trigger1 = false; //stores if first trigger (lower threshold) has occurred
boolean trigger2 = false; //stores if second trigger (upper threshold) has occurred
boolean trigger3 = false; //stores if third trigger (orientation change) has occurred
byte trigger1count = 0; //stores the counts past since trigger 1 was set true
byte trigger2count = 0; //stores the counts past since trigger 2 was set true
byte trigger3count = 0; //stores the counts past since trigger 3 was set true
int angleChange = 0;
// WiFi network info.
char auth[] = "hoCSC2qZmu8N1ymJRSegMG-bTMlFDRVL"; //Auth code sent via Email
const char *ssid = "Mi A2"; // Enter your Wi-Fi Name
const char *pass = ""; // Enter your Wi-Fi Password
```

```
void setup() {
  Serial.begin(115200);
  Blynk.begin(auth, ssid, pass);
  Wire.begin();
  Wire.beginTransmission(MPU_addr);
  Wire.write(0x6B);  // PWR_MGMT_1 register
  Wire.write(0);     // set to zero (wakes up the MPU-6050)
  Wire.endTransmission(true);
  Serial.println("Wrote to IMU");
  Serial.println("Connecting to ");
  Serial.println(ssid);
  WiFi.begin(ssid, pass);
  while (WiFi.status() != WL_CONNECTED)
  {
    delay(500);
    Serial.print(".");            // print … till not connected
  }
  Serial.println("");
  Serial.println("WiFi connected");
  pinMode(switch, INPUT_PULLUP);
  pinMode(buzzerPin,OUTPUT);
  pinMode(LED1,OUTPUT);
  pinMode(LED2,OUTPUT);
}
```

```
void loop() {
  panicButton();
  Blynk.run();
  mpu_read();
  ax = (AcX - 2050) / 16384.00;
  ay = (AcY - 77) / 16384.00;
  az = (AcZ - 1947) / 16384.00;
  gx = (GyX + 270) / 131.07;
  gy = (GyY - 351) / 131.07;
  gz = (GyZ + 136) / 131.07;
  // calculating Amplitute vactor for 3 axis
  float Raw_Amp = pow(pow(ax, 2) + pow(ay, 2) + pow(az, 2), 0.5);
  int Amp = Raw_Amp * 10;  // Mulitiplied by 10 bcz values are between 0 to 1
  Serial.println(Amp);
  if (Amp <= 2 && trigger2 == false) { //if AM breaks lower threshold (0.4g)
    trigger1 = true;
    Serial.println("TRIGGER 1 ACTIVATED");
  }
  if (trigger1 == true) {
    trigger1count++;
    if (Amp >= 12) { //if AM breaks upper threshold (3g)
      trigger2 = true;
      Serial.println("TRIGGER 2 ACTIVATED");
      trigger1 = false; trigger1count = 0;
    }
  }
```

```
if (trigger2 == true) {
    trigger2count++;
    angleChange = pow(pow(gx, 2) + pow(gy, 2) + pow(gz, 2), 0.5); Serial.println(angleChange);
    if (angleChange >= 30 && angleChange <= 400) { //if orientation changes by between 80-100 degrees
      trigger3 = true; trigger2 = false; trigger2count = 0;
      Serial.println(angleChange);
      Serial.println("TRIGGER 3 ACTIVATED");
    }
  }
  if (trigger3 == true) {
    trigger3count++;
    if (trigger3count >= 10) {
      angleChange = pow(pow(gx, 2) + pow(gy, 2) + pow(gz, 2), 0.5);
      //delay(10);
      Serial.println(angleChange);
      if ((angleChange >= 0) && (angleChange <= 10)) { //if orientation changes remains between 0-10 degrees
        fall = true; trigger3 = false; trigger3count = 0;
        Serial.println(angleChange);
      }
      else { //user regained normal orientation
        trigger3 = false; trigger3count = 0;
        Serial.println("TRIGGER 3 DEACTIVATED");
      }
    }
  }
```

```
if (fall == true) { //in event of a fall detection
    Serial.println("FALL DETECTED");
    Blynk.notify("Alert : Fall Detected…! take action immediately.");
    Blynk.email("chsivasai11@gmail.com", "Alert : Fall Detected…!", "Alert : Fall Detected…!
take action immediately.");
    digitalWrite(buzzerPin,HIGH);
    digitalWrite(LED1,LOW);
    digitalWrite(LED2,HIGH);
    delay(5000);
    fall = false;
  }
  if (trigger2count >= 6) { //allow 0.5s for orientation change
    trigger2 = false; trigger2count = 0;
    Serial.println("TRIGGER 2 DECACTIVATED");
  }
  if (trigger1count >= 6) { //allow 0.5s for AM to break upper threshold
    trigger1 = false; trigger1count = 0;
    Serial.println("TRIGGER 1 DECACTIVATED");
  }
  delay(100);
}
void mpu_read() {
  Wire.beginTransmission(MPU_addr);
  Wire.write(0x3B);  // starting with register 0x3B (ACCEL_XOUT_H)
  Wire.endTransmission(false);
  Wire.requestFrom(MPU_addr, 14, true); // request a total of 14 registers
```

```
AcX = Wire.read() << 8 | Wire.read(); // 0x3B (ACCEL_XOUT_H) & 0x3C (ACCEL_XOUT_L)
  AcY = Wire.read() << 8 | Wire.read(); // 0x3D (ACCEL_YOUT_H) & 0x3E
(ACCEL_YOUT_L)
  AcZ = Wire.read() << 8 | Wire.read(); // 0x3F (ACCEL_ZOUT_H) & 0x40 (ACCEL_ZOUT_L)
  Tmp = Wire.read() << 8 | Wire.read(); // 0x41 (TEMP_OUT_H) & 0x42 (TEMP_OUT_L)
  GyX = Wire.read() << 8 | Wire.read(); // 0x43 (GYRO_XOUT_H) & 0x44 (GYRO_XOUT_L)
  GyY = Wire.read() << 8 | Wire.read(); // 0x45 (GYRO_YOUT_H) & 0x46 (GYRO_YOUT_L)
  GyZ = Wire.read() << 8 | Wire.read(); // 0x47 (GYRO_ZOUT_H) & 0x48 (GYRO_ZOUT_L)
}
void panicButton(){
    while(digitalRead(switch)==LOW){
        Serial.println("PANIC BUTTON: CARE REQUIRED!!!");
        Blynk.notify("Alert : BUTTON PRESSED…! take action immediately.");
        Blynk.email("chsivasai11@gmail.com", "PANIC BUTTON : Care Required…!", " :
BUTTON PRESSED…! take action immediately.");
        digitalWrite(buzzerPin,HIGH);
        digitalWrite(LED1,LOW);
        digitalWrite(LED2,HIGH);
        delay(5000);
        break;
    }
    digitalWrite(buzzerPin,LOW);
    digitalWrite(LED1,HIGH);
    digitalWrite(LED2,LOW);
}
```

9.2 CONCLUSION:

The complete Software and Hardware which are used in this project is explained in the above headings. The NODEMCU with ESP8266 and MPU6050 makes way easier in automatic fall detection for elderly. This prototype doesn't delay in fall detection & notification and also ensures to give a proper medical assistance in case if any severe injuries occur through fall and it works with a consumable power supply. The cost of practical application is very less and designing a model for this Unit is easy. The simulation model is constructed.

,

10. APPENDIX:

- https://components101.com/development-boards/nodemcu-esp8266-pinout-features-and-datasheet
- https://www.arduino.cc/en/Tutorial/BuiltInExamples/InputPullupSerial
- https://www.javatpoint.com/arduino-blinking-two-led
- https://www.electronicwings.com/sensors-modules/esp8266-wifi-module
- https://www.electronicwings.com/sensors-modules/mpu6050-gyroscope-accelerometer-temperature-sensor-module
- https://www.lively.com/health-and-aging/what-is-fall-detection/#:~:text=Fall%20detection%20devices%20automatically%20employ,the%20user%20suffers%20a%20fall.
- https://lastminuteengineers.com/mpu6050-accel-gyro-arduino-tutorial/
- https://docs.blynk.cc/