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INDUSTRIAL INSTRUMENTATION

EEE-4033

PROJECT REPORT FILE

Under the Guidance of

Prof. Dr.K.V.L.Narayana.

Smart Home Automation using IoT

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CERTIFICATE

We hereby declare that the report entitled **"SMART HOME AUTOMATION"** submitted by us, for the **EEE4033 - (INDUSTRIAL INSTRUMENTATION)** to VIT is a record of bonafide work carried out by us under the supervision of Prof. Dr.K.V.L.Narayana.. We further declare that the work reported in this report has not been submitted and will not be submitted, either in part or in full, for any other courses in this institute or any other institute or university.

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Roles and Responsibility

Team Members	Roles
ARYAN SHEKHAR	▪ Coordinated the project. ▪ Worked on the presentation. ▪ Worked on the project research.
DHRUV GUPTA	• Worked on the presentation.
HARSH KUMAR	• Made the software part. • Worked on the hardware circuit. • Prepared the final project report. • Did research work.
KRITARTH SINGH	• Literature Survey

SMART HOME AUTOMATION

Abstract:

Home automation involves introducing a degree of computerized or automatic control to certain electrical and electronic systems in a home. It uses a combination of hardware and software technologies that enable control and management over appliances and devices within a home. These include lighting, temperature control, entertainment systems, appliances, ventilation, etc. This project demonstrates a simple home automation system that contains a remote mobile host controller and several client modules (home appliances). The client modules communicate with the host controller (here, an android smartphone) through wireless networks, like Wi-Fi or Bluetooth, via the third-party web application Adafruit or a voice assistant. The devices in your homes can be controlled from anywhere in the world from a smartphone. However, it is not necessary to manually control the devices as the devices are triggered automatically with the help of sensors such as like LDR, Ultrasonic sensor, and PIR motion sensor. The purpose of this Home Automation is for homeowners to have centralized control over the electrical and electronic devices in the home and thus provide comfort, convenience, security, and a better quality of life. It also helps save energy and resources which in turn saves money and has a positive effect on the environment. It is especially useful for the elderly and disabled as their dependency on others reduces and patients can live in the comfort of their homes rather than moving to a healthcare facility. Home Automation has countless other applications, such as air and water quality control, pet and baby care, gardening management, smart locks, and security robots.

Literature Survey:

Bluetooth based Smart Home

Bluetooth is a short-ranged wireless technology which is generally used to establish communication between several different devices for transferring of media or instructions. It uses radio waves having short wavelengths that cannot cover up large distances(maximum 100m) It can be used to connect devices .The research shows the implementing smart home using Bluetooth using a host controller, which is implemented on a PC and connected to a microcontroller-based sensor and device controllers. It is proposed to make the communication between devices possible. The system allows multiple device controllers to be connected to the host controller. In some ideal conditions bluetooth has the highest upto some 100m range. Comparatively bluetooth communication usually consumes higher power, so the batteries of devices need to be frequently recharged or replaced. Bluetooth technology should only be used when there is quick short-lived communication with a very small concern of security.

Mobile-based Smart Home

Mobile-based smart homes are striking to companies because of the fame of mobile phones and GSM. The research proposes a smart home system using SMS.

This system detects illegitimate invasions at home and allows only legitimate users to alter the passkey for the gate and control lights in the house. The illegitimate invasions into the home are identified by monitoring the state of the home door which is done using sensors. The work of U. Saeed et al. [4] also proposes an SMS-based home automation system. In this system an android application made to run on the user's mobile phone. Legitimate users can log in to the application using their username and password and remotely control along with some of the functions from the list of available user actions. The application will send the required notification to the user.

Introduction:

Home automation is also known as demotics, and a home with an automation system is known as a smart home.

Home automation is the automatic control of electronic devices in your home. These devices are connected to the Internet, which allows them to be controlled remotely from a mobile device anywhere in the world. When connected with the Internet, home devices are an important constituent of the Internet of Things ("IoT"). With home automation, devices can trigger one another so you don't have to control them manually via an app or voice assistant. The user interface for control of the system uses either wall-mounted terminals, tablet or desktop computers, a mobile phone application, or a Web interface that may also be accessible off-site through the Internet.

A home automation system typically connects controlled devices to a central smart home hub (sometimes called a "gateway"). A home automation system will monitor and/or control home attributes such as lighting, climate, entertainment systems, and appliances. It also controls programming devices like thermostats and sprinkler systems, operating your garage doors schedules so that they turn off when you normally go to sleep, or you can have your thermostat turn the A/C up about an hour before you return to work so you don't have to return to a stuffy house.

Home automation makes life more convenient and could lead to energy-saving measures and thus, save you money on heating, cooling, and electricity bills and a positive environmental impact in the future. Home automation can also lead to greater safety with the Internet of Things devices like security cameras, alarm systems, and all of the doors, windows, locks, smoke detectors, surveillance cameras, and any other sensors that are linked to it. It has a high potential for sharing data between family members or trusted individuals for personal security.

Devices within the home automation system connect and communicate with each other over a local wired or wireless network (like Wi-Fi, Bluetooth). The entire home automation system usually requires system management software, installation of device/appliance controllers, motion and temperature sensors, and other components.

Methodology:

The IoT-based home automation consists of several smart devices for different applications of lighting, security, home entertainment, etc. All these devices are integrated over a common network established by the gateway and connected in a mesh network. The communication amongst devices takes place in a mesh topology where there is no fixed path for the signals transmitted from the controller to the sensors and vice versa. Depending on the availability of the shortest path the signal from the controller will travel to the target sensors either directly or through signal hops. If any intermediate sensor in the pathway is busy or occupied the signal will trace another path within the mesh network to reach the final destination.

The working principle of an LDR (Light Dependent Resistor) is photoconductivity i.e., when the light is absorbed by the material then the conductivity of the material enhances. The light incident on LDR must have ample energy i.e., the photons in the incident light must have energy superior to the bandgap of the material to make the electrons jump from one band to another band (valence to conduction). As more electrons are excited to the conduction band the number of charge carriers is also large and due to this the current flowing increases and thus the conductance of the device increases.

PIR (Passive Infrared) Motion Sensor is made of a pyroelectric sensor, which can detect different levels of infrared radiation. Any object with temperature is constantly radiating infrared rays to the outside world. Once there is infrared radiation from the human body particle with temperature, focusing on the optical system causes the pyroelectric device to generate a sudden electrical signal. So, when a human or animal passes by, then it intercepts the first slot of the PIR sensor which causes a positive differential change between the two bisects. Whereas when the human or animal leaves the sensing area, the sensor generates a negative differential change between the two bisects.

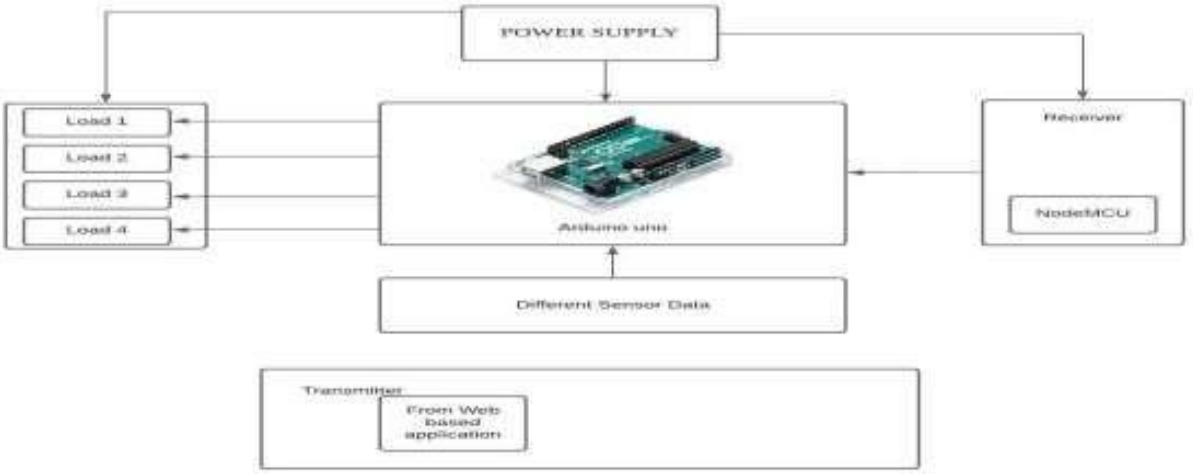
Servo Motor consists of a DC Motor, a Gear system, a position sensor, and a control circuit. The DC motors get powered from a battery and run at high speed and low torque. The Gear and shaft assembly connected to the DC motors lower this speed into sufficient speed and

feeds the information to the control circuit. The control circuit accordingly decodes the signals from the position sensor and compares the actual position of the motors with the desired position and accordingly controls the direction of rotation of the DC motor to get the requiredposition.

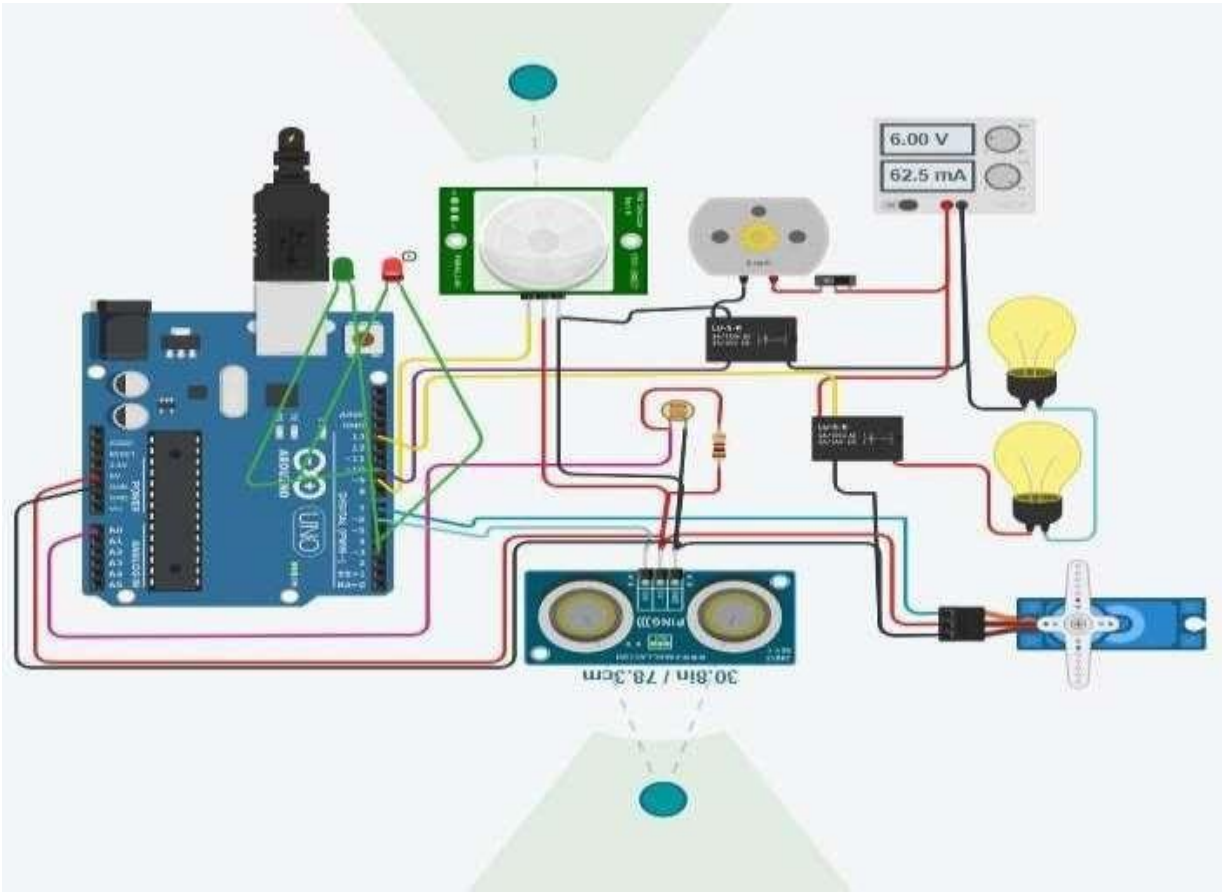
An LED (light-emitting diode) is a two-lead semiconductor light source. It is a p–n junction diode that emits light when activated. When a suitable voltage is applied to the leads, electrons can recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy bandgap of the semiconductor.

Circuit Diagram:

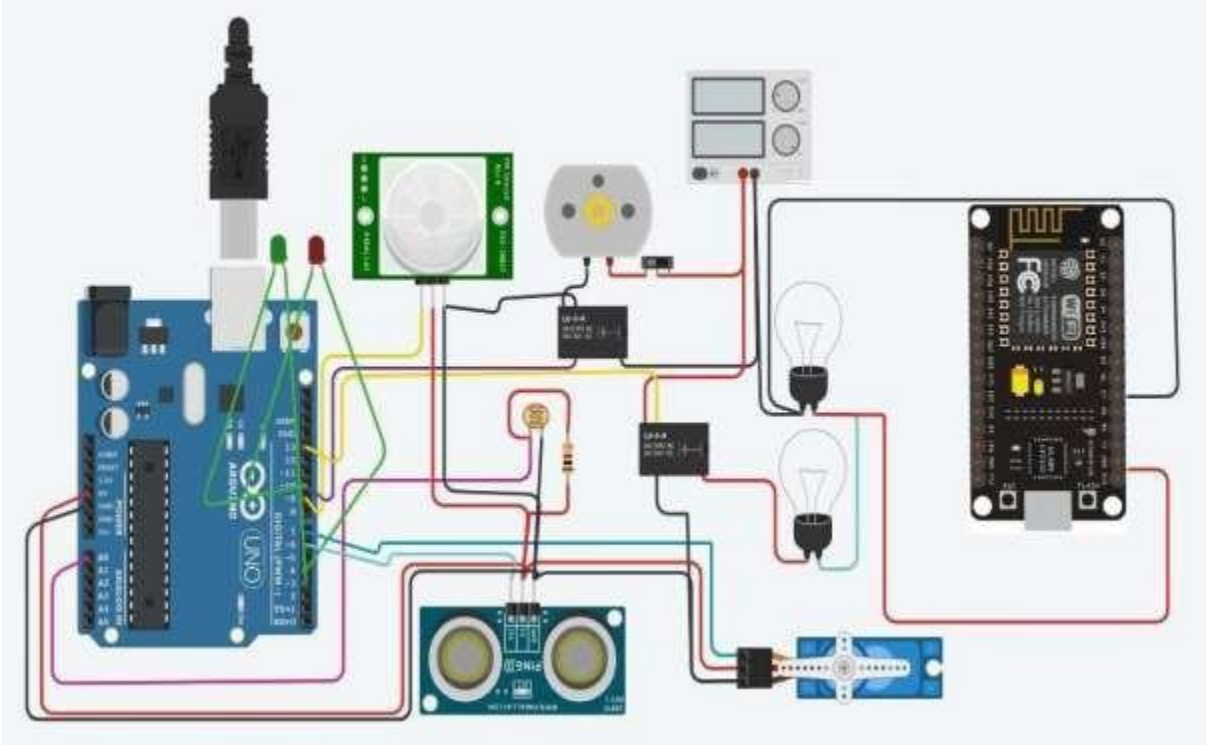
Block Diagram:



Simulation circuit:



Hardware model circuit:



Materials Required:

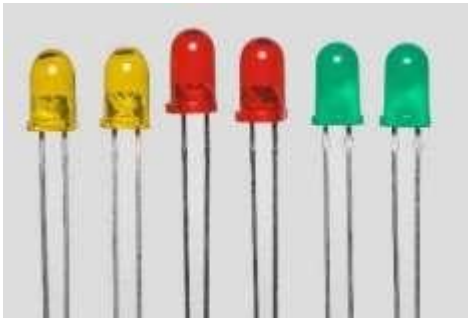
S. No.	Name of the apparatus	Quantity
1.	LDR	1
2.	PIR Motion Sensor (HC-SR501)	1
3.	LED	4
4.	Jumper wires	As per need
5.	Arduino UNO R3	1
6.	Node MCU (Microcontroller-unit)	1
7.	Servo Motor (SG90)	1
8.	Bread Board	1
9.	Ultrasonic Sensor (HC-SR04)	1
10.	Android Phone (pe	1

Components and Supplies:

- **LDR (LIGHT DEPENDENT RESISTOR):**

- **PIR (PASSIVE INFRARED SENSOR) Motion Sensor:**

- **LED:**



- **Jumper wires:**

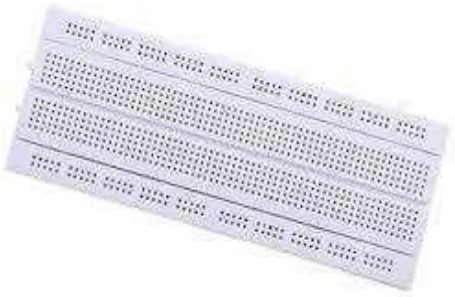
- **Arduino UNO:**

- **Node MCU (Microcontroller-unit):**

- **Servo Motors**

- **Ultrasonic Sensor**

- **Breadboard**



Apps and Online services

- **Arduino IDE**
  - It is a cross-platform application that is written in functions from C and C++.
  - The Arduino code written in the IDE, is uploaded to the microcontroller which executes the code by interacting with inputs and outputs.

- **Microsoft Windows 10**
  - Windows 10 is a major release of the Windows NT operating system developed by Microsoft.
  - Windows 10 is a Microsoft operating system for personal computers, tablets, embedded devices, and internet of things devices.

Code:

- **Arduino:**

```
#include <Servo.h>
Servo servo1;
int trigPin = 8;
int echoPin = 10;

int sen2Value = 0;
long distance;
long duration;
const int pResistor = A0; // Photoresistor at Arduino analog pin A0
const int ledPin=9;       // Led pin at Arduino pin 9
int value;// Store value from photoresistor (0-1023)

void setup()
{
  Serial.begin(9600);
servo1.attach(7);
pinMode(trigPin, OUTPUT);
 pinMode(echoPin, INPUT);// put your setup code here, to run once:
 pinMode(ledPin, OUTPUT); // Set lepPin - 9 pin as an output
 pinMode(pResistor, INPUT);// Set pResistor - A0 pin as an input (optional)
 pinMode(4, OUTPUT); //Red LED
  pinMode(3, OUTPUT); //Green LED
  pinMode(5, INPUT);//PIR
  pinMode(11, OUTPUT);    //signal to npn as switch
}

void loop() {
  sen2Value = digitalRead(5);
```

```
if (sen2Value == 0)
  {
    digitalWrite(11, LOW); //npn as switch OFF
    digitalWrite(4, HIGH); // Red LED ON,indicating no motion
    digitalWrite(3, LOW); //Green LED OFF, since no Motion detected
    Serial.print("     || NO Motion Detected    " );
  }

if (sen2Value == 1)
  {
    digitalWrite(11, HIGH);//npn as switch ON
    delay(100);
    digitalWrite(4, LOW); // RED LED OFF
    digitalWrite(3, HIGH);//GREEN LED ON , indicating motion detected
    Serial.print("      || Motion Detected!      " );
  }
ultra();
servo1.write(0);//servo pin 7
if(distance <= 10){
servo1.write(90);
}
value = analogRead(pResistor);

//You can change value "25"
if (value > 25){
  digitalWrite(ledPin, LOW); //Turn led off
  Serial.print("Bulb OFF = ");
  Serial.print(value);
}
else{
```

```
    digitalWrite(ledPin, HIGH);
    Serial.print("Bulb ON = ");
    Serial.print(value);//Turn led on
  }
}

void ultra(){
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  Serial.println(distance);
  delay(100);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distance = duration*0.034/2;
  }
```

- **NodeMCU:**

```
#include  <ESP8266WiFi.h>
#include "Adafruit_MQTT.h"
#include "Adafruit_MQTT_Client.h"

#define WIFI_SSID "SHARP_VISION_DUAL"
#define WIFI_PASS "12355555"

#define MQTT_SERV "io.adafruit.com"
#define MQTT_PORT 1883
#define MQTT_NAME ""//Enter your adafruit username
#define MQTT_PASS ""//Enter your adafruit Key
```

```
int led = D7;


WiFiClient client;
Adafruit_MQTT_Client mqtt(&client, MQTT_SERV, MQTT_PORT, MQTT_NAME, MQTT_PASS);


Adafruit_MQTT_Subscribe onoff = Adafruit_MQTT_Subscribe(&mqtt, MQTT_NAME "/f/ONOF");
Adafruit_MQTT_Publish LightsStatus = Adafruit_MQTT_Publish(&mqtt, MQTT_NAME "/f/LightsStatus");


void setup()
{
  Serial.begin(9600);
  pinMode(LED_BUILTIN, OUTPUT);

  //Connect to WiFi
  Serial.print("\n\nConnecting Wifi>");
  WiFi.begin(WIFI_SSID, WIFI_PASS);
  digitalWrite(LED_BUILTIN, LOW);

  while (WiFi.status() != WL_CONNECTED)
  {
    Serial.print(">");
    delay(50);
  }

  Serial.println("OK!");

  //Subscribe to the onoff topic
  mqtt.subscribe(&onoff);
```

```
pinMode(led, OUTPUT);
  digitalWrite(LED_BUILTIN, HIGH);
  digitalWrite(led, LOW);
}

void loop()
{
  //Connect/Reconnect to MQTT
  MQTT_connect();

  //Read from our subscription queue until we run out, or
  //wait up to 5 seconds for subscription to update
  Adafruit_MQTT_Subscribe * subscription;
  while ((subscription = mqtt.readSubscription(5000)))
  {
    //If we're in here, a subscription updated...
    if (subscription == &onoff)
    {
      //Print the new value to the serial monitor
      Serial.print("onoff: ");
      Serial.println((char*) onoff.lastread);

      //If the new value is "ON", turn the light on.
      //Otherwise, turn it off.
      if (!strcmp((char*) onoff.lastread, "ON"))
      {
        //active low logic
        digitalWrite(led, HIGH);
        LightsStatus.publish("ON");
      }
```

```
      else if (!strcmp((char*) onoff.lastread, "OFF"))
      {
        digitalWrite(led, LOW);
        LightsStatus.publish("OFF");

      }
      else
      {
        LightsStatus.publish("ERROR");
      }
    }
    else
    {
      //LightsStatus.publish("ERROR");
    }
  }
  //  if (!mqtt.ping())
  // {
  //    mqtt.disconnect();
  // }
}

void MQTT_connect()
{
  //  // Stop if already connected
  if (mqtt.connected() && mqtt.ping())
  {
    //    mqtt.disconnect();
    return;
  }
```

```
  int8_t ret;

  mqtt.disconnect();

  Serial.print("Connecting to MQTT... ");
  uint8_t retries = 3;
  while ((ret = mqtt.connect()) != 0) // connect will return 0 for connected
  {
    Serial.println(mqtt.connectErrorString(ret));
    Serial.println("Retrying MQTT connection in 5 seconds...");
    mqtt.disconnect();
    delay(5000); // wait 5 seconds
    retries--;
    if (retries == 0)
    {
      ESP.reset();
    }
  }
  Serial.println("MQTT Connected!");
}
```

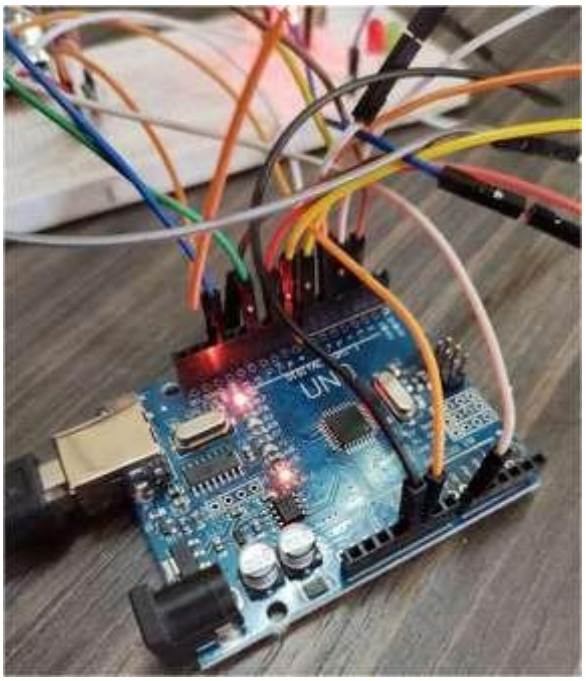
Working:

1. An Arduino UNO will control devices and read the sensor data. The room has multiple controllable devices and sensors like an LDR to detect light intensity to control the lights, PIR to detect human presence in the room to control the lights and fan, and an ultrasonic sensor to get the distance of a person to control the door mechanism.
2. Light Intensity Control: This is managed by the LDR which works on the principle of photoconductivity. The LDR gives out an analog voltage when connected to VCC (5V), which varies in magnitude in direct proportion to the input light intensity on it. That is, the greater the intensity of light, the greater the corresponding voltage from the LDR will be. Since the LDR gives out an analog voltage, it is connected to the analog input pin on the Arduino. The Arduino, with its built-in ADC (analog-to-digital converter), then converts the analog voltage (from 0-5V) into a digital value in the range of (0-1023). When there is sufficient light in its environment or on its surface, the converted digital values read from the LDR through the Arduino will be in the range of 800-1023. If the amount of light falling on the LDR is high, it is activated and the bulbs are turned off. If the amount of light falling on it is low then it deactivates and the bulb is turned off.
3. Light and Fan Control: A passive infrared sensor or PIR sensor is used to control the fans. It can detect the movement of objects that radiate IR light (like human bodies). PIR sensor consists of three pins, ground, signal, and power at the side or bottom. Generally, the PIR sensor power is up to 5V. PIR is fundamentally made of a pyroelectric sensor, which can detect levels of infrared radiation. PIR is used because it is flat control and minimal effort, has a wide lens range and is simple to interface with. If the PIR sensor detects any motion it starts rotating the fan. There are also two LEDs for motion indication. Red color LED indicates no motion and a green color LED indicates motion.
4. Servo Motor: Servo motors are geared DC motors with the closed-loop circuitry incorporated within them. The basic configuration of a servo motor is composed of a DC motor, gearbox, potentiometer, and control circuit. It takes in input from the ultrasonic sensor for distance measurement. It is used to control the door mechanism, as it allows for precise control of angular or linear position, velocity, and acceleration when coupled with the ultrasonic sensor for distance feedback. If the person is less than 100 cm away it will open the door by changing its angle from 180 degrees to 90 degrees. A servo motor was chosen instead of a DC motor as the angle of a servo motor can be controlled, unlike a DC motor.
5. Ultrasonic Sensor: It is used for distance calculation. It offers excellent non-contact range detection with high accuracy and stable readings It has two pins: a trigger pin and an echo pin. The way it functions is a trigger pin starts emitting sound waves that bounce off an object and trigger the echo pin. Using the distance formula, the distance of the object from the ultrasonic sensor can easily be calculated. To measure the distance the sound has traveled we use the formula: Distance = (Time x SpeedOfSound) / 2. The "2" is in the formula because the sound has to travel back and forth. First, the sound travels away from the sensor, and then it bounces off of a surface and returns.
6. We have made use of Arduino Uno which is a microcontroller board; these boards can read input like a light on the sensor, a finger on a button, and then turn it into an output like activating a motor, turning on LEDs, etc. Then we have NodeMCU which is an open-source platform that can connect objects and let data transfer using WiFi protocol. The predominant part of this system is the Node MCU (ESP8266). Node MCU is an

open-source IoT platform. It is simple & smart, interactive, programmable & Wi-Fi enabled. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espress if Systems, and hardware that is based on the ESP-12 module. The sole reason for using Node MCU over Raspberry Pi is that the Node MCU has inbuilt Wi-Fi. This reduces the cost and hence Node MCU is cheaper than other devices available in the market. Inbuilt Wi-Fi helps in remote access. The system is accessible from any remote location around the globe provided an internet connection. Once given an input, the device will continue to operate even if there is no internet access. The device can be physically handled as well. We have included servo motor as servos have an advantage over the DC motor as their angle can be controlled.

7. For the ultrasonic sensor, the trigger pin is used to trigger the ultrasonic sound pulses and the echo pin produces a pulse when the reflected signal is received. (The length of the pulse is proportional to the time it took for the transmitted signal to be detected) , Here we have set the trigger pin to a high state for 10 milliseconds.
8. We have used a PIR sensor for detecting motion; when there is no motion near the sensor the red LED will be automatically on and when we move our hand i.e any motion within the range of the PIR sensor then the green LED will automatically turn on and red LED will be off indicating the presence of some motion.
9. For Light intensity control, we have set values for photoresistors such that if its value is greater than 25 it means it is daylight, and hence the bulb will be off and vice versa. For the implementation of the ultrasonic sensor, we have made use of a servo motor; when the object is in the range of 10cm, the door will be automatically open at a 90°angle and when it's more than 10cm the door will be automatically closed.
10. We have also included voice automation for LEDs which can be used by Google assistant and a third-party web application called Adafruit. It can be used for mobile data from anywhere around the world.

This is the **Arduino UNO R3**, Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board and a piece of software, or IDE that runs on our computer, used to write and upload computer code to the physical board.

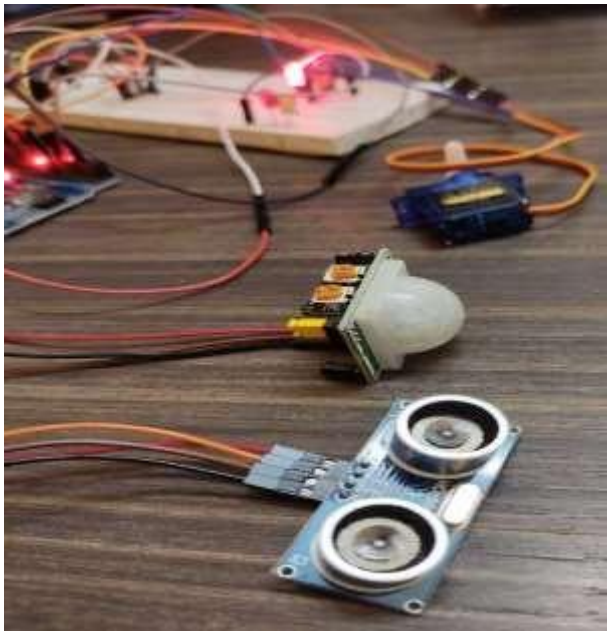


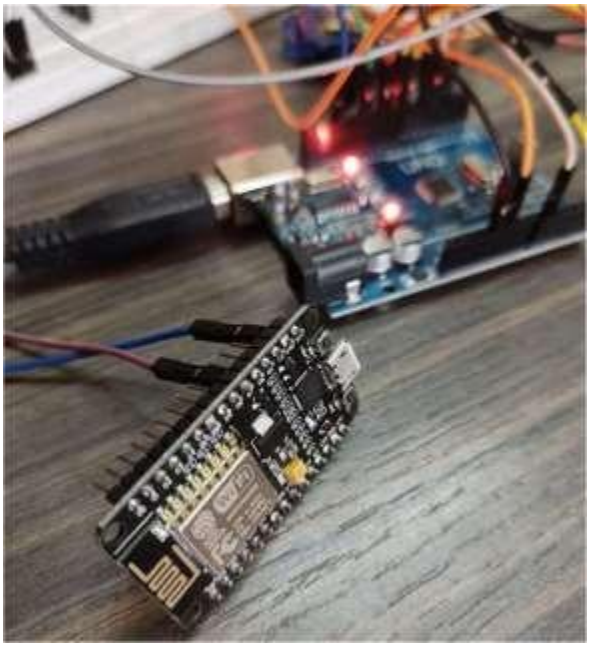
1. From the right first is the **Ultrasonic sensor**, It is used to calculate the distance of an object by using sound waves. Trigger pin emits sound waves and echo pin collects sound waves, by distance formula the distance of the object can be calculated.

2. The next sensor is the **PIR motion sensor** it detects the motion of the object it gives 0 as output if no motion is detected and 1 as output if some motion is detected, We are using it to control fans.

3.Servo motor takes input from the ultrasonic sensor for distance. We are using it to control the door mechanism, If the distance of the person is less than 100cm it will open the door by changing its angle from 180 degrees to 90 degrees. The reason why we chose the servo motor was that we can control the angle of the servo motor, unlike the DC motor which we can't control.

4.This is the **Node MCU** that connects the Arduino to the web, allowing us to control the components via the web and mobile apps.





Statement of Innovation:

We have used Node MCU boards in our project that is used to build a web server through which all the GPIOs of the board can be controlled over Wi-Fi. The advantage here is that the system is controlled using a Web Page that is based on an IoT platform. The intended device can be powered ON or OFF using the above application. Also, it provides the facility to set the intensities of different appliances.

The system becomes platform-independent due to the use of a web application. It can be operated from any location by just opening the IoT platform web application. The web application also serves as a platform for managing the devices and the data. We have also added voice control on our application through which we can easily access the system. All we need is to say which appliances are to be turned ON/OFF.

Novelty:

Our projects includes a variety of sensors like Gas sensors, Ultrasonic Sensors and PIR motion sensor. The gas sensor in our project is able to detect gases of lower density than the existing models available in the market for the current smart home systems, which will significantly increase the safety measures . We are aiming at combining ultrasonic sensor with Voice and Face detection for safe and easier access to doors. Other sensors like LDR and PIR motion sensors greatly help in reducing the energy costs for the user in the longer run.

Our system becomes platform independent due to the use of web application, It can be operated from any location by just opening the IoT platform web application. The web application also serves as a platform for managing the devices and the data. We have also added voice control on our application through which we can easily access the system.

Applications:

Rebuilding consumer expectations, home automation has been projected to target a wide array of applications for the new digital consumer in a variety of different realms, including:

- **Heating, ventilation, and air conditioning (HVAC):**
  - Home automation systems provide homeowners with remote control of all home energy monitors over the internet incorporating a simple and friendly user interface remote.
  - Thus, resulting in streamlined operation of home systems as well as savings on energy costs, increases in efficiency, and more.

- **Lighting control system:**
  - It is a "smart" network that incorporates communication between various lighting system inputs and outputs, using one or more central computing devices. It encompasses everything from a one-room scene-control system to a whole house system controlling interior and exterior lighting.
  - Automated lighting control systems may be hard-wired or wireless.

- **Occupancy-aware control system:**
  - It is possible to sense the occupancy of the home using smart meters and environmental sensors like CO_2 sensors, which can be integrated into the building automation system to trigger automatic responses for energy efficiency and building comfort applications.

- **AI-driven digital experiences**
  - Digital journeys that customers embark upon are being firmly established as the most important focal point, and even a single misstep can result in a broken experience. Many enterprises turn to AI and automation to shape a customer experience ecosphere.
  - It ensures efficiency and cost-reduction of operational processes, turns deep-dive behavioral analytics from AI engines into valuable business and marketing insights, and helps design consistent and memorable experiences across your suite of products, services, and/or solutions.

- **Smart Locks**
  - Smart locks leverage IoT-enabled sensors to operate keyless entry devices that allow users to access doors remotely, through a smartphone or other internet-connected device.
  - Smart locks provide users the ability to unlock their door without a key, from anywhere, as well as distribute virtual keys to visitors.
  - Their functions can include automating processes, like turning on your lights and adjusting your thermostat when the door is unlocked, or triggering the security system to record and send video if the door is unlocked outside of expected hours.

The list is still not exhaustive and will evolve to accommodate new applications.

Result/Inference:

From testing the entire system above, the smart home works according to what is the purpose of this research. Comparison of this research with previous studies, namely this study and control buttons, thus increasing the diversity of the smart home system itself. It has been observed that smooth output has been seen, when sensors play their role, it's been observed on screen easily. Also, we have used a microcontroller that is different from previous studies that are the Node MCU ESP8266 module which has advantages compared to other microcontrollers.

The smart home has been successfully built with hardware arranged in such a way that it can achieve results that are as expected. In this case, the hardware that plays a very important role as the main device is the Node MCU ESP8266 module. The advantages of using the Node MCU ESP8266 are more practical than buying various components and then assembling them by yourself. The Light Control Test is done by pressing the ON / OFF button widget on the Adafruit application on the respective Android smartphone for lights and fans.

Using components and materials mentioned above shows the project that's used as a system controlled by the Adafruit application is running. Loads used in this project can be changed with other devices with AC plugs to connect home-use devices or equipment. The home appliances could be remotely switched over a Wi-Fi network. Both the switch mode and the voice mode control methodologies were successfully achieved. The Adafruit application was also successful in displaying the status of every application.

Conclusion:

Home automation installed in houses allows centralized control of heating, ventilation, air-conditioning, and lighting. It provides homeowners security, comfort, convenience, overall cost reduction, and energy efficiency by allowing them to control smart devices. By incorporating sensors in our project, the devices don't need to be controlled manually using the app or voice assistant. However, for the convenience of the elderly who might be less familiar with the technology, we have that option available too.

Finally, a conclusion can be drawn that there is immense scope for home automation in the near future. It also leads to the development of smart appliances, for example, some smart refrigerators, allow you to scan grocery store receipts and keep an inventory of your items, and alert you if an item is over or about to expire. They suggest recipes based on your refrigerator's contents and smart ovens synch with your smartphone and automatically preheat to the correct temperature based on a recipe selected. Thus, home automation will eventually lead to the development of a technology-friendly environment.

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