A

PROJECT REPORT

On

"MOTION DETECTION USING CAYENNE"

Submitted to:

Rashtrasant Tukadoji Maharaj Nagpur University,

For the Partial Fulfillment of the Degree of

Bachelor of Engineering in Computer Science & Engineering

Submitted By

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COMPUTER SCIENCE AND ENGINEERING

NAAC Accredited with A+ Grade | **ISO 9001:2015 Certified**

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur-441108

(An Autonomous Institute affiliated to RTMNU, Nagpur)

Session 2022-23

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur-441108

(An Autonomous Institute affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur)

CERTIFICATE

This is to certify that project work described in this report entitled, **“Motion Detection Using Cayenne”** was carried out by **Saurav Tiwari, Mukesh Pimpalkar, Punam Rajput, Kashifa Sheikh, Sakshi Rahangdale** in Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur under my supervision and guidance in partial fulfillment of the requirement for the degree of Bachelor of Engineering in **Computer Science & Engineering**, of Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.

This work is the own work of the candidate, completed in all respect and is of sufficiently high standard to warrant its submission to the said degree. The assistance and resources used for this work are duly acknowledged.

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ACKNOWLEDGEMENT

With profound feeling of immense gratitude and affection, we would like to thank our guide **Prof. Suraj Mahajan**, Department of COMPUTER SCIENCE & ENGINEERING, for his continuous support, motivation, enthusiasm and guidance. His encouragement, supervision with constructive criticism and confidence enabled us to complete this project.

We also wish to extend our reverences to the **Prof. Abhimanyu Dutonde,** Head of COMPUTER SCIENCE & ENGINEERING for providing necessary facilities to complete our project.

We, are also thankful to all the faculty members and all non-teaching staff of the department & college for their cooperation throughout the project work.

We, also put forth our deepest sense of gratitude towards the Principal, TGPCET for constant motivation and providing necessary infrastructure.

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PUBLICATION BASED ON THIS WORK

[1] Prof. Suraj Mahajan, Mr. Saurav Tiwari, Mr. Mukesh Pimpalkar, Ms. Punam Rajput, Ms. Kashifa Sheikh, Ms. Sakshi Rahangdale **“Motion Detection Using Cayenne”**, **International Journal of Scientific Research in Engineering and Management (IJSREM)**, Volume: 07 Issue: 06, June - 2023.

[2] Prof. Suraj Mahajan, Mr. Saurav Tiwari, Mr. Mukesh Pimpalkar, Ms. Punam Rajput, Ms. Kashifa Sheikh, Ms. Sakshi Rahangdale **“Motion Detection Using Cayenne”**, **International Conference on Disruptive Technology for achieving Sustainable Development Goals (IC-DTSDG)**, Volume 07, Issue 09, December 2022.

ISSN: 2582-3930

ACCEPTANCE CERTIFICATE

Impact Factor: 8.176
DOI Prefix: 10.55041

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OVERVIEW OF PRESENT WORK

CHAPTER – I

Overview of Present Work

1.1 Introduction

Internet of Things (IOT) is a concept where each device is assigned to an IP address and through that IP address anyone makes that device identifiable on the internet. The mechanical and digital machines are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. Basically, it started as the "Internet of Computers." Research studies have forecast an explosive growth in the number of "things" or devices that will be connected to the Internet. The resulting network is called the "Internet of Things" (IoT). The recent developments in technology which permit the use of wireless controlling environments like, Bluetooth and Wi- Fi that have enabled different devices to have capabilities of connecting with each other.

Using a WIFI shield to act as a Micro web server for the Arduino which eliminates the need for wired connections between the Arduino board and computer which reduces cost and enables it to work as a standalone device. The Wi-Fi shield needs connection to the internet from a wireless router or wireless hotspot and this would act as the gateway for the Arduino to communicate with the internet. With this in mind, an internet-based home automation system for remote control and observing the status of home appliances is designed. Due to the advancement of wireless technology, there are several different types of connections introduced such as PIR, LDR, and ultrasonic, etc. Each of the connections has their own unique specifications and applications. Among the four popular wireless connections that are often implemented.

ESP8266 is chosen for its suitable capability. The capabilities of WIFI are more than enough to be implemented in the design. Also, most of the current laptop/notebook or Smartphone come with built-in WIFI adapter. It will indirectly reduce the cost of this system.

1.2 Background of Present Work

There are many different motion detection technologies, but we selected ultrasound because it works in low-light conditions or even in the dark and, unlike radio waves, ultrasound waves do not travel through drywall, so there's less risk of detecting motion in other rooms. With ultrasound-based presence detection (USPD), an ultrasonic signal (>=32 kHz) is transmitted via onboard loudspeakers, and changes in the signal received at the microphones are monitored to detect motion.

Ultrasound sensors can be broadly categorized as using Doppler sensing or time-of- flight sensing. In Doppler sensing, once the signal is transmitted, the system detects motion by looking for frequency shifts in the recorded spectrum of the signal, which are caused by its reflection from moving objects. This frequency shift is similar to the shift in sound frequencies you hear in a police car siren approaching you or moving away from you.

In time-of-flight sensing, variations in the arrival time of the reflected signal are monitored to detect changes in the environment. We use Doppler sensing due to the robustness of its motion detection signal and because it generalizes well across the cases when Alexa is or is not playing audio simultaneously.

The magnitude of the Doppler-shifted signal depends on factors such as distance from target to source, the size and absorption coefficient of the target, the absorption coefficient

of the room, and even the humidity and temperature in the room. In addition, when a person moves through a closed space, not only do we observe multiple Doppler components due to various parts of the body moving in different directions with different speeds, but we also observe repetitions of those components due to reflections.

Because of all these complexities, the signal received at the source is not at all as clean as a single tone with a frequency shift. In practice, what we observe looks more like this:

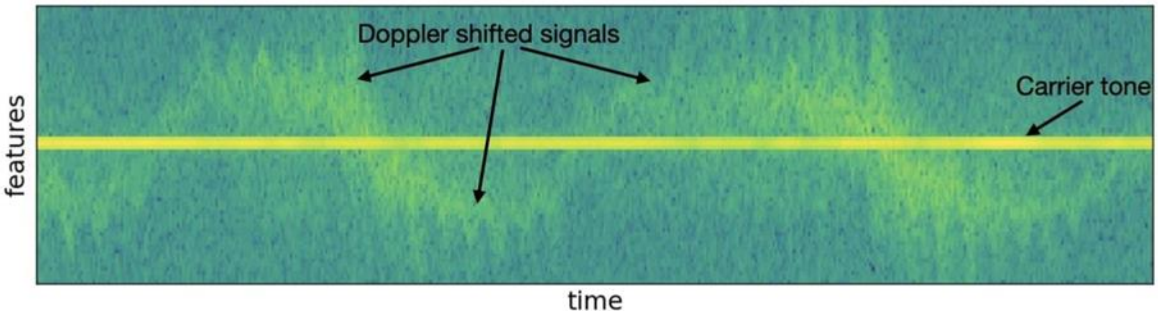


Fig. 1.1 Features-Time Diagram

With the advancement of sensor and actuator technologies, our indoor environment, such as buildings, has been instrumented with various sensors, including temperature, humidity, illumination, CO_2 and occupancy sensor, and, thus, can be aware of changes in the user's state and surrounding, finally controlling building utilities to adapt their services and resources to the user's context, e.g., automatic lighting control, heating, ventilation and air- conditioning (HVAC) system adjustment, electrical outlet turn-off, unusual behavior detection and home invasion prevention. Such context-aware systems have deployed occupant location as the principal form of the user's context. Accordingly, indoor tracking and localization is one of the key technologies for providing activity-aware services in a smart environment.

1.3 Scope of the Project

The scope of motion detection project can vary depending on its specific objectives and requirements.

- **Motion Detection Algorithm:** Developing or implementing an algorithm that can detect and track motion in a given scene or video feed. This may involve techniques such as background subtraction, optical flow, or machine learning-based approaches.
- **Hardware Setup:** Determining the appropriate hardware components required for motion detection, such as cameras or sensors. Selecting the right equipment depends on factors like the environment, lighting conditions, and desired accuracy.
- **Data Acquisition:** Capturing video streams or sensor data from the selected hardware setup. This involves configuring cameras or sensors to provide input for motion detection algorithm.
- **Preprocessing:** Preparing the acquired data for analysis by applying preprocessing techniques such as noise reduction, image enhancement, or calibration, depending on the specific requirements of the project.
- **Motion Analysis:** Analyzing the preprocessed data to detect and track motion events. This can involve comparing consecutive frames, identifying moving objects, or extracting relevant features from the data.
- **Event Triggering and Notifications:** Developing a mechanism to trigger events or notifications when motion is detected. This may include sending alerts via email, SMS, or integrating with other systems such as security alarms or home automation systems.
- **User Interface and Visualization:** Creating a user interface or visualization component that displays the motion detection results in real-time or provides access to recorded data for further analysis. This can involve developing a web-based dashboard, a mobile app, or integrating with existing software.
- **Integration and Deployment:** Integrating the motion detection system into the desired environment or platform. This may include configuring network settings, integrating with other software or hardware components, and deploying the system to the target location.
- **Performance Optimization:** Fine-tuning the motion detection system to improve its efficiency, accuracy, and robustness. This may involve optimization algorithms, adjusting parameters, or exploring hardware acceleration techniques.
- **Testing and Validation:** Conducting thorough testing to ensure the reliability and effectiveness of the motion detection system. This can involve simulated scenarios, real-world testing, and performance evaluation against defined metrics.

CHAPTER - II

LITERATURE REVIEW

CHAPTER – II

Literature Review

Wireless sensor network is a very useful system for monitoring and interacting with the environment because it consists of small sensor nodes with wireless communication capability which enables easy integration with the environment. Moreover, they can be automated so no human intervention is required. There are a lot of monitoring applications based on wireless sensor network technology and they are interested in monitoring specific events or objects. Not only do they need to figure out the occurrence or existence of such events or objects but also, they need to find out where the events have occurred or the objects are present. Examples of that kind of application include fire monitoring systems, surveillance systems, livestock monitoring and protection systems, and so on. The target application aimed by this paper is surveillance systems for home, office, or factory. In surveillance systems, it is very important to detect undesired intrusion by foreign people while nobody is present in the office, home, or factory. Wireless sensor network is ideal for such application because it is a fully automated system which does not require any human intervention and easily connected to external networks such as the Internet or the cellular network so it can notify the user about the undesired situation. To find out not only the existence of intruders but also the location of them, we propose a region-based human tracking algorithm using passive infrared motion sensors (PIR sensors). There are several reasons why we use PIR sensors as base sensing tools for tracking humans in surveillance systems.

First, PIR motion sensors do not require any device or signal from detecting objects unlike sound, ultrasound, or RSSI based localization schemes. This fact is very important in surveillance applications because intruders usually do not have such characteristics.

Second, PIR motion sensors can work in the dark whereas vision- based systems cannot. They detect a change in temperature so the human body's movement can be detected because body temperature makes a change in temperature in the PIR sensor's view. Third, PIR sensors are cheap and easy to use. Processing data from a PIR sensor is much easier than those from a microphone, ultrasound, or vision device.

Therefore, scaling security systems based on PIR sensors to large systems does not cost much and does not require huge computational power. Given that PIR sensors have several advantages over other sensors in surveillance applications, we propose region-based human tracking algorithms. First, we discuss the performance and the characteristics of the passive infrared motion sensor used in this paper. In addition, issues related to the deployment of sensors are discussed because the performance of the algorithm is highly dependent on how the sensors are deployed in monitored space. Then, we provide mathematical abstraction of the detection region of the PIR sensor which is a building block for the region-based tracking algorithm.

K. C. Sahoo et al [1], Nowadays the need to build an affordable and effective intrusion detection system is a necessity with the events of intrusion or burglary on the rise and as we are approaching towards making our house a smart house in this digital era. The demand for such a system is going to increase rapidly if it comes with a feasible price to every household. In most of the prevailing intrusion detection systems, motion sensors are used to detect the presence of an intruder. In this paper, the passive infrared sensor (PIR) is used to detect motion. This paper discusses the application of PIR sensors in such systems and use of ZigBee to create a wireless sensor network and ESP8266 module to send data to a remote server. PIR sensor, being passive in nature is undetectable and works well in the dark environment also. The Global System for Mobile communication (GSM) module is also used to send text alerts to the concerned user when an intrusion is detected. Sensor nodes which are implanted in every room send data to the center node when motion is detected. Different sensor nodes which use ZigBee for wireless transmission are all connected to a center node.

B. Song et al [2], Wireless Sensor Networks for surveillance systems in home, office, or factory environments require correct tracking of intruders. For such systems, passive infrared motion sensors (PIR sensors) are ideal because they do not require any signal or devices on the object to be tracked and they can work in dark environments as well. This paper first analyses the performance and the applicability of the PIR sensors for security systems. Then, we propose a region-based human tracking algorithm with actual implementation and experiment in a real environment. From the experiments, we show that the human tracking algorithm based on the PIR sensors performs very well with proper sensor deployment.

P. N. Saranu et al [3], In this paper, we are providing home security for the theft by implementing a smart surveillance system using RP and PIR sensors. Now-a-days, the IoT plays a major role in many fields by automating the application. The sensor used in this paper is PIR and temperature sensor. PIR is an electronic sensor that detects the motion of objects, by measuring the level of IR radiation. This principle is used to detect the stranger entering the house. Temperature sensor and a camera are used to monitor and control the fire incident that takes place in a house. A sub motor setup with a solenoid valve is used to spray chloroform. This action is done, which moves the stranger into unconscious state. The camera and PIR sensor are integrated in such a way that any movement in the room switches ON the camera automatically. The house owner can view the live stream of motion that takes place inside the house by the stranger. A mail and phone call services are included in the paper to alert the owner about the stranger's action. The proposed work provides a smart home automation.

B. Song et al [4], Wireless Sensor Networks for surveillance systems in home, office, or factory environments require correct tracking of intruders. For such systems, passive infrared motion sensors (PIR sensors) are ideal because they do not require any signal or devices on the object to be tracked and they can work in dark environments as well. This paper first analyses the performance and the applicability of the PIR sensors for security systems. Then, we propose a region-based human tracking algorithm with actual implementation and experiment in a real environment. From the experiments, we show that the human tracking algorithm based on the PIR sensors performs very well with proper sensor deployment.

J. Andrews et al [5], This novel approach provides the advantages of utilizing a single PIR sensor for human presence detection, while eliminating the major known drawback to this type of sensor. Scanning the room using a PIR sensor also allows for an expanded field of view (FoV) and a simpler deployment, in comparison to other approaches using a PIR sensor. Finally, MI-PIR expands the functionalities of PIR sensors by using an ANN to detect various other occupancy parameters. The experimental results show that the system can detect room classification with 99% accuracy, 91% accuracy in occupancy count estimation, 93% accuracy in relative location prediction, and 93% accuracy in human target differentiation. These results show promise for an application of tracking and monitoring an at-risk patient in an indoor setting.

I. V. Paputungan et al [6], Smart home security becomes necessary due to an increasing level of house thievery or home security breach. Previous supporting security systems such as CCTV are not enough to support home security. Such a system can only focus on monitoring a limited area where it is installed and it is high cost for personal use. This paper presents an Internet of Things (IoT) system to support home security via remote and timely manner monitoring based on motion and movement detection. The IoT system uses a wireless point to multipoint technique within a node sensor (motion detector) that connects to a microcontroller. Passive Infrared (PIR) and Accelerometer GY-61 are used as the sensor to perform the detection. A web-based dashboard is then deployed to display the monitoring result in a timely manner. It receives data from two (2) node sensors that are transmitted via Adafruit server. A Do-It- Yourself (DIY) sensor is then developed. Simulation shows that the sensor system works very well as it is able to detect any object within a certain range and any movement of the door and window. The system is one of the practical smart home security solutions that is able to perform timely manner home monitoring based on motion and movement detection.

R. Porins et al [7], The article deals with short-range PIR motion sensors' application into the intelligent street and walkways lighting illumination control for energy saving and better human experience needs. Future research of illumination level ramping profiles to achieve maximum energy efficiency and not downgrading human comfort feeling must have an experimental setup, including discussing several possible and implemented simple control systems.

S. Akbas et al [8], In recent years, wireless sensor networks offer cost effective solutions to various surveillance and tracking applications with the developments in sensor techniques. In many of these applications, sensor nodes are equipped with directional sensors and they operate autonomously in unattended environments. The deployment strategy of directional sensor nodes is critical to improve target detection and tracking accuracy. In this paper, deployment of passive infrared motion (PIR) sensors is analyzed in terms of coverage issues. A PIR Sensor Deployment (PSD) problem is addressed using deployment schemes that are based on computational geometry. Finally, the performance of deployment schemes is evaluated in a Java based simulation environment.

Yogesh Pawar, Abhay Chopde, Mandar Nandre et al [9], Pyroelectric Infrared Sensor (PIR) are the sensors which are most widely used for cheap surveillance. Due to their high-end sensitivity and area of detection PIR sensors are popular in security. PIR sensors are excellent in human and animal detection. They are mostly used in triggering an intruder alarm and activating household appliances upon the presence of a human. However, the output from the sensor is proportional to several temporal relationships between an object in the field of view of the sensor, the sensitivity of the sensor, PIR lens features, and the environmental heat conditions.

W. A. Indha et al [10], This paper developed security system prototype using motion sensor powered by Radio Frequency Energy Harvesting, one form of energy harvesting that regardless its lowest output power among other energy harvesting forms, it's all the time availability, battery less and readiness everywhere make its own advantages no other type of energy harvesting has. Motion sensor acts as a shield to detect movement and to detect crime. In this project, there are two security systems using motion sensors. First stage of the security system, which is outdoors, operated as the sensor detects motion, the bulb will light up. Second stage security system which in indoor, operated as the sensor detects motion, it will trigger the dial speed key of the GSM and send an alarm call to the user. The RF to DC energy will be stored in the LiPO battery to power up the operation of the motion sensor. Together with data and analysis measured, the RF energy harvesting is able to generate voltage and current which can operate the low power consumption of the PIR sensor.

CHAPTER - III

FORMULATION OF PRESENT WORK

CHAPTER – III

Formulation of Present Work

3.1 Need for Proposed Work:

Motion sensors have a lot of impact in security situations, since they can detect the presence of intruders or sudden changes in the environment. Let's see its definition, some applications of motion sensors in IoT, and the different types of sensors in the market. Motion sensors are small, connected devices that are used to detect and measure movement within a specific area. These sensors are very popular and an essential component of the IoT ecosystem (and belong to a wider IoT sensors set). Because they allow the different devices to interact with their surroundings and trigger alerts or perform an action according to changes in motion. Motion sensors are important because they provide protection and safety for people and belongings from family neighborhoods to restricted military areas with the following primary benefits: Keep homes and families safe from intrusions. Prevent burglary and theft on commercial properties.

3.2 Proposed Work:

Cayenne is an open-source computer vision library that can be used for motion detection. Here's a general formulation of motion detection using Cayenne:

- Import the necessary libraries: Begin by importing the required libraries, including Cayenne and any other dependencies.
- Initialize the Cayenne framework: Set up the Cayenne framework by initializing the necessary components, such as the video source, motion detector, and event handler.
- Configure the video source: Specify the video source from which the motion will be detected. This can be a webcam, video file, or IP camera.
- Configure the motion detector: Set the parameters for motion detection, such as the sensitivity, threshold, or region of interest (if applicable). These settings depend on the specific requirements of your project.
- Set up event handling: Define the actions to be taken when motion is detected. This can include triggering an alert, saving the video clip, or performing any other desired tasks.
- Start the motion detection process: Begin the motion detection process by starting the video feed and continuously analyzing the frames for motion.
- Process each frame: For every frame received from the video source, pass it to the motion detector for analysis.
- Detect motion: The Cayenne framework will process each frame and compare it with the previous

frame(s) to determine if any motion is present. The motion detection algorithm implemented in Cayenne will generate a motion mask or bounding box indicating the regions with detected motion.

- Handle motion events: If motion is detected, the event handler will be triggered, and the specified actions will be executed accordingly. This can involve sending notifications, recording video clips, or any other desired responses.
- Repeat steps 7-9: Continuously repeat the process of analyzing frames, detecting motion, and handling motion events until the motion detection process is stopped.
- Clean-up and termination: Once the motion detection process is complete or terminated, perform any necessary clean-up tasks, such as releasing resources or closing connections.

3.3 Working Module:

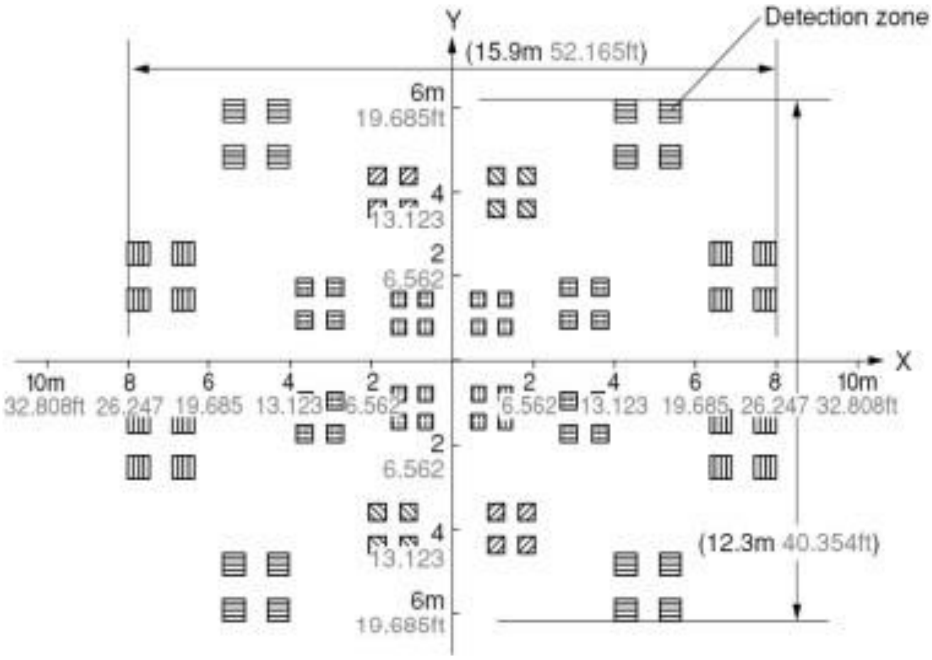


Fig. 3.1 X-Y cross-sectional view of detection zones of PIR sensor according the datasheet

How the PIR sensors are deployed is very important for localizing an object when region-based tracking algorithm is used because the performance of tracking is highly dependent on the deployment of the sensors. When we use only one PIR sensor, the only information we can obtain is existence of an object (technically, the motion of an object) within the detection region of that one sensor as shown in Figure 3 (i). However, if we deploy 2 PIR sensors, we can divide a space into 3 different regions as shown in Figure 3 (ii).

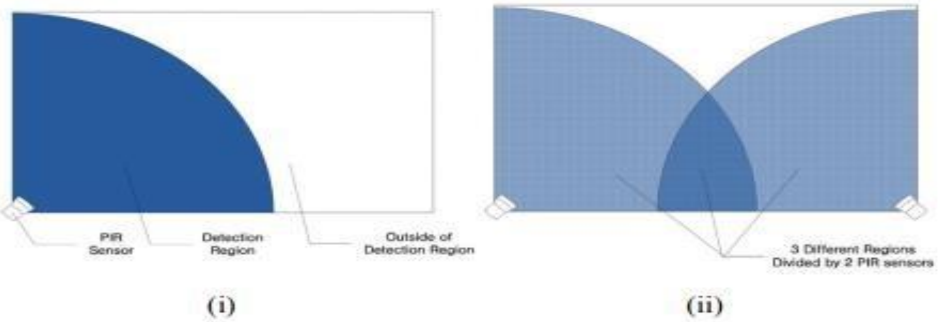


Fig. 3.2 Sensor deployment with only one PIR sensor (i) and two PIR sensors (ii)

Here we propose a simple example of sensor deployment in a small room with 10 sensors. Suppose the width of the small room is 14.25m and the height is 9.0m. Figure 3.4 shows a possible deployment of 10 sensors which divide the small room into approximately 39 different regions. Maximum error is 4.5m and minimum error is 0.27m.

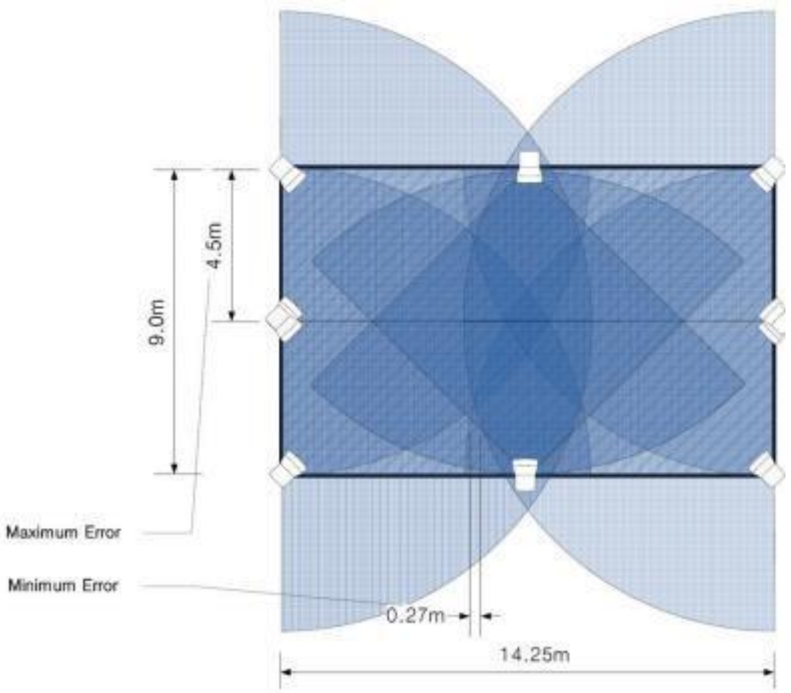


Fig. 3.3 A possible deployment example for a small room with PIR sensors.

The purpose of the region-based tracking algorithm proposed in this paper is finding out which region an object is located by using the output signal of several sensors. For example, there are 39 different regions in the example of Figure 4. If the output signals of all PIR sensors are high, which means they are detecting an object in their own detection region, the object is in the center region of the small room because it is an intersection of the detection regions of each sensor. Therefore, in general, region-based tracking algorithms can be summarized as the following equation.

You might find many electronic circuits related to motion sensing but most of them incorporate shadow detection through a single LDR, which does not work very effectively. Because a shadow might not always be very sharp enough and at times the circuit may just fail to interpret it. The present motion detector/sensor circuit is also based on similar principles but it detects a motion by differentiating the light level using two LDRs, this makes the system more sensitive and works irrespective of the shadow intensity.

- As we know that in this proposed system, we are using PIR sensors in the place of LASER or INFRARED transmitters and receivers. The sensor is basically a pyroelectric device. When the device is in contact with infrared radiation, it generates an electric charge like that.
- The more in change in the amount of infrared exposed to the device, the more the voltage generated, which is measured by an on- board amplifier. The infrared is nothing but light radiating from all objects in their respective surroundings. We don’t need a transmitter or receiver because the device is not able to emit, it only accepts the energy released from things or objects in radiation forms.
- Thus, the temperature will be different from a moving human and a wall present there which is constant. Thus, the word passive in Passive Infrared Sensor explains clearly that it does not emit a radiation rather than it accepts the incoming infrared radiation.
- The connections are made according to the circuit diagram shown and switch on the power supply.
- The PIR sensor gets power and it detects the IR rays emitted from any intruder who is passing over there.
- Usually, PIR sensors can vary up to work in a limit of 5 meters. We can adjust the sensor by varying the distance.
- If any human or intruder is detected, the PIR sensor outputs a logic of HIGH value i.e., voltage of nearly 3.5 V to 5 V in the Arduino UNO’s PIN 3.
- As soon as the Arduino detects logic HIGH on Pin 3, it makes a PIN 4 too HIGH state for a duration of nearly 10 seconds. During this time, the SIREN IC UM3561 also gets activated as its Pin 5 provided with +5V.
- The Siren generator consists of an oscillator internally, to produce the sound in a certain frequency and using 220K ohm resistor externally.
- Then it is passed to the control circuit, which depends on tone selection pins.
- These tone selection pins decide one tone from different tones produced by the IC.
- Thus, oscillation along with selected tones are sent to the address counter. The address counter then sends the data to the ROM, then sends the tone on the output pin 3.
- The output is given to the NPN transistor to amplify the siren.
- The base of the transistor gets voltage from the output pin of the siren generator.

- Transistor starts conducting when it gets the cut off voltage at the base and the speaker is negative pin and is connected to ground.
- Thus, sound produced can be heard from the speaker when a human is detected.
- The sound can be of various types like ambulance, police, alarm etc.

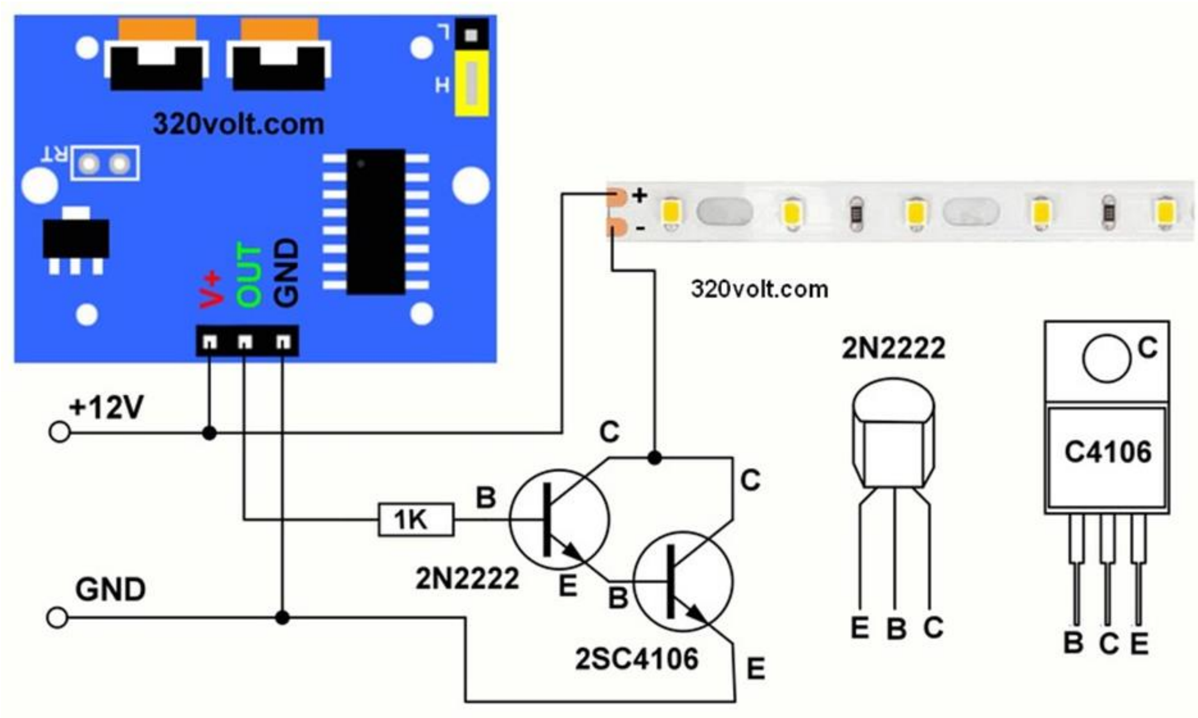


Fig. 3.4 Circuit Diagram

- Connect the Vcc (power) pin of the PIR sensor to the +5V pin of the Arduino or microcontroller.
- Connect the GND (ground) pin of the PIR sensor to the GND pin of the Arduino or microcontroller.
- Connect the signal output pin of the PIR sensor to any digital input pin of the Arduino or microcontroller.
- Connect one end of the LDR sensor to the +5V pin of the Arduino or microcontroller.
- Connect the other end of the LDR sensor to an analog input pin of the Arduino or microcontroller.
- Connect a resistor (e.g., 10k ohms) from the analog input pin to the GND pin of the Arduino or microcontroller.

CHAPTER - IV

DESIGN OF EXPERIMENTAL SET-UP

CHAPTER – IV

Design of Experimental Set-up

4.1 Components

4.1.1 Node MCU:

Node MCU is an open-source firmware and development kit that helps you to prototype or build IoT products. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The firmware uses the Lua scripting language.

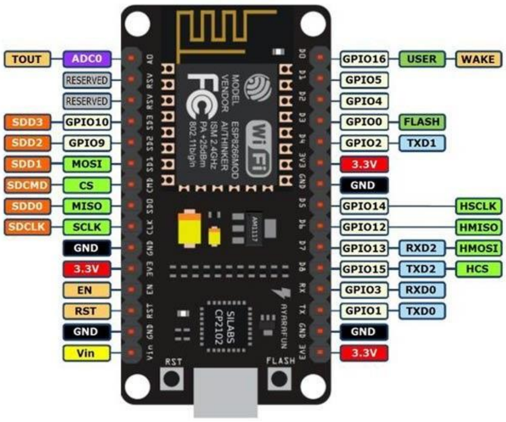


Fig. 4.1.1 Node MCU

4.1.2 IR Sensor:

An electrical device known as an infrared sensor uses infrared radiation to detect and/or emit specific features of its environment. Additionally, infrared sensors have the ability to measure heat emissions from objects and recognize motion. An explanation of what the electromagnetic spectrum is and how it relates. From the supposed red edge of the visible spectrum at 700 nanometers (nm) to one- millimeter, infrared energy is present. These wavelengths are equivalent to a frequency range of roughly 430 THz to 300 GHz.

Fig. 4.1.2 IR Sensor

4.1.3 DHT11:

The widely used DHT11 temperature and humidity sensor has an exclusive NTC for temperature measurement and an 8-bit microprocessor to output the temperature and humidity measurements as serial data.

Fig. 4.1.3 DHT11 sensor

4.1.4 PIR Sensor (Passive Infrared Sensor):

It is an electronic sensor which measures infrared (IR) radiation in its field of view from objects. They are most widely used in motion-detectors based on PIR. These sensors are widely used in safety alarms and automatic lighting. PIR sensors sense general movement, but don't have information on who moved or what. An active IR sensor is necessary for this purpose. PIR sensors are generally referred as "PIR" or sometimes as "PID" for "passive infrared detectors." The term passive refers to the fact that PIR devices for detection purposes don't radiate energy, instead they work entirely by detecting infrared radiation (radiant heat) emitted by objects or reflected from them.

Fig. 4.1.4 PIR motion sensor

4.1.5 Arduino Uno ATMEGA 328P:

Arduino UNO is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button.

Fig. 4.1.5 Arduino Uno ATMEGA 328P

4.1.6 LED:

A light emitting diode (LED) is a semiconductor device that emits visible light when an electric current passes through it.

Fig. 4.1.6 LED

4.1.7 HC-SR04 ultrasonic sensor:

The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 2 cm to 400 cm or 1” to 13 feet.

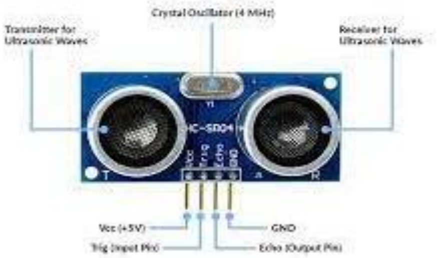


Fig. 4.1.7 HC-SR04 ultrasonic sensor

4.1.8 Nine-volt (9v) battery:

The nine-volt battery, or 9-volt battery, is an electric battery that supplies a nominal voltage of 9 volts. Actual voltage measures 7.2 to 9.6 volts, depending on battery chemistry. Batteries of various sizes and capacities are available.

Fig. 4.1.8 Nine-volt (9v) battery

4.1.9 Connecting cables:

Cable for Arduino UNO/MEGA is the most common A to B Male/Male type peripheral USB cable for Arduino. Micro USB cable allows to connect your NodeMCU to your computer for programming and power supply.

Fig. 4.1.9 Connecting/Power cables

4.2 Software's / Tools

4.2.1 Arduino IDE:

- The Arduino software IDE is an open-source software, which is used to program the Arduino boards, and is an integrated development environment, developed by arduino.cc. Allow to write and upload code to Arduino boards. And it consists of many libraries and a set of examples of mini projects.
- Arduino software (IDE) is compatible with different operating systems (Windows, Linux, Mac OS), and supports the programming languages (C/C++).
- The Arduino software is easy to use for beginners, or advanced users. It uses to get started with electronics programming and robotics, and build interactive prototypes.

Fig. 4.2.1 Arduino IDE

4.2.2 XAMPP Server:

- XAMPP is a free and open-source cross-platform web server solution stack package developed by Apache Friends, consisting mainly of the Apache HTTP Server, MySQL database, and interpreters for scripts written in the PHP and Perl programming languages.
- XAMPP is the title used for a compilation of free software. The name is an acronym, with each letter representing one of the five key components. The software packet contains the web server Apache, the relational database management system MySQL & the scripting languages Perl and PHP. It is mainly used for web application testing on a local host webserver.

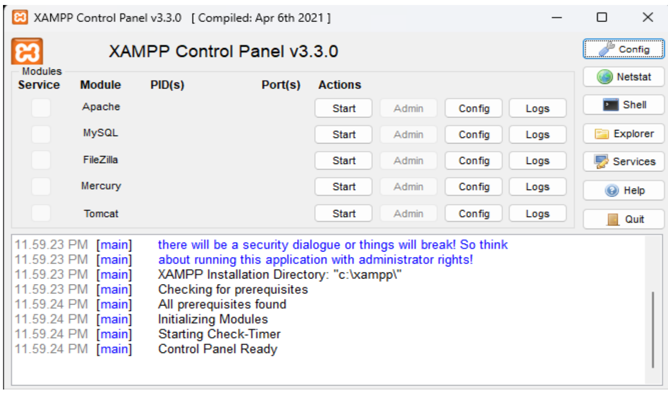


Fig. 4.2.2 XAMPP Server

4.3 Languages/Technologies

4.3.1 Embedded C:

- Embedded C is most popular programming language in software field for developing electronic gadgets. Each processor in electronic system is associated with embedded software.
- Embedded C programming plays key role in performing specific function by processor.
- In general, the languages offer low-level access to the device hardware. A good example for an Embedded System, which many households have, is a Washing Machine.

4.3.2 HTML:

- Hypertext Markup Language (HTML) is the standard markup language for creating web pages and web applications. With Cascading Style Sheets (CSS) and JavaScript, it forms a triad of cornerstone technologies for the World Wide Web.
- Web browsers receive HTML documents from a web server or from local storage and render the documents into multimedia web pages. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document.

4.3.3 CSS:

- Cascading Style Sheets (CSS) is a style sheet language used for describing the presentation of a document written in a markup language like HTML. CSS is a cornerstone technology of the World Wide Web, alongside HTML and JavaScript.
- CSS is designed to enable the separation of presentation and content, including layout, colors, and fonts. This separation can improve content accessibility, provide more flexibility and control in the specification of presentation characteristics, enable multiple web pages to share formatting by specifying the relevant CSS in a separate .CSS file, and reduce complexity and repetition in the structural content.

4.3.4 JavaScript:

- JavaScript (JS) is a lightweight, interpreted, or just-in-time compiled programming language with first-class functions. While it is most well-known as the scripting language for Web pages, many non-browser environments also use it, such as Node.js, React.js, Vue.js, etc.

4.3.5 Cayenne:

- The Cayenne Library is a collection of code, known as sketch files, that makes it easy for you to connect and send data to and from sensors, actuators and devices connected to Arduino boards. Cayenne sketch files can be combined with other sketch files for your IoT projects.
- The Cayenne dashboard is the main screen where you can setup, customize, monitor, manage and control your connected devices.

CHAPTER - V

IMPLEMENTATION

CHAPTER – V

Implementation

5.1 System Design

To implement motion detection using a Passive Infrared (PIR) sensor, an ultrasonic sensor, and an LDR (Light Dependent Resistor), you will need to connect and program each sensor accordingly. Here's a general guide on how to do it:

- Gather the required components:
  - PIR sensor
  - Ultrasonic sensor (HC-SR04 or similar)
  - LDR sensor
  - Arduino and ESP8266
  - Breadboard or jumper wires
  - LEDs or buzzer for indicating motion detection (optional)
- Connect the sensors to the microcontroller:

PIR Sensor:

- Connect the VCC pin of the PIR sensor to the 5V pin of the microcontroller.
- Connect the GND pin of the PIR sensor to the GND pin of the microcontroller.
- Connect the OUT pin of the PIR sensor to any digital pin of the microcontroller.

Ultrasonic Sensor:

- Connect the VCC pin of the ultrasonic sensor to the 5V pin of the microcontroller.
- Connect the GND pin of the ultrasonic sensor to the GND pin of the microcontroller.
- Connect the Trig pin of the ultrasonic sensor to any digital pin of the microcontroller.
- Connect the Echo pin of the ultrasonic sensor to any digital pin of the microcontroller.

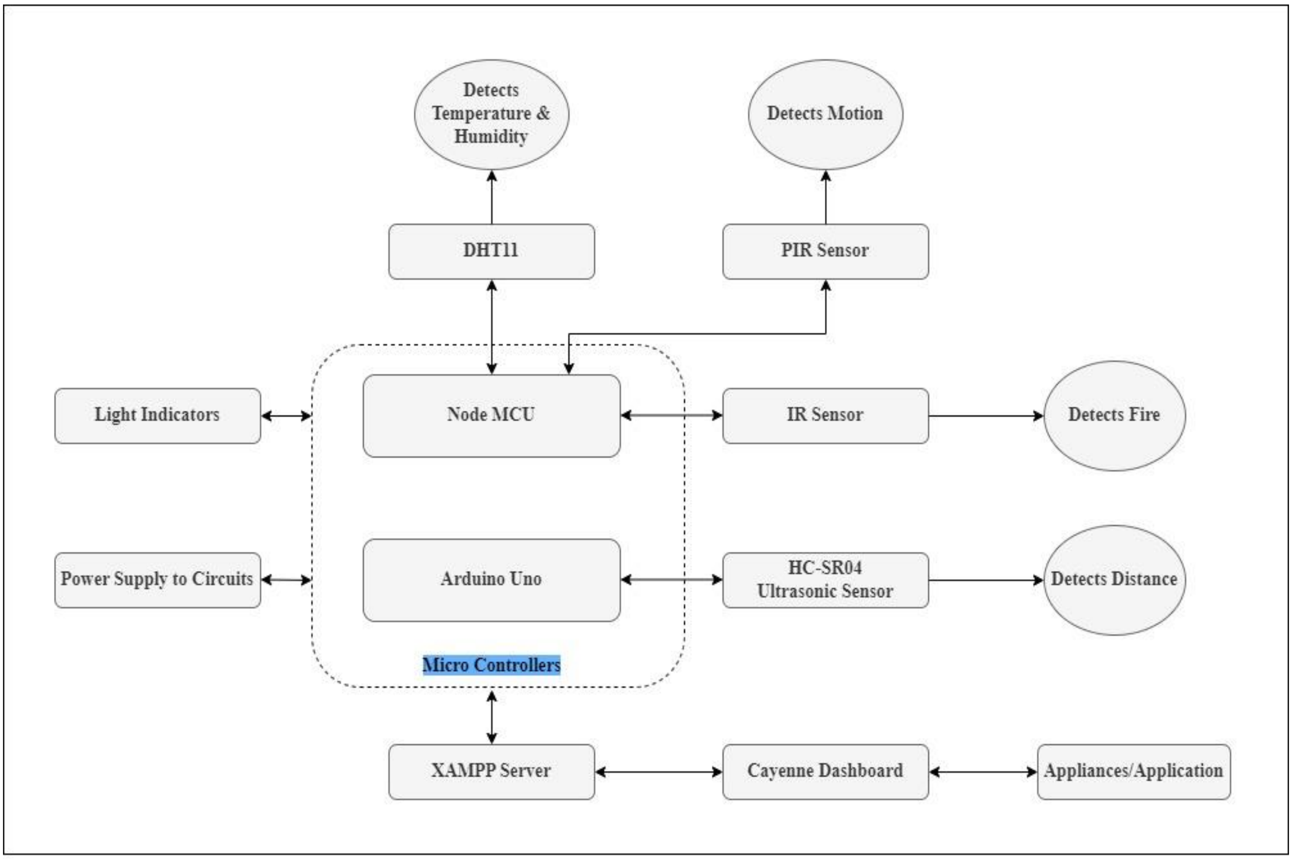
LDR Sensor:

- Connect one leg of the LDR to the 5V pin of the microcontroller.
- Connect the other leg of the LDR to the A0 (analog input) pin of the microcontroller.
- Connect a resistor (10kΩ is common) from the same leg of the LDR to the GND pin of the microcontroller.

5.2 Flow Chart:

Flow chart of code implementation:

- Initialize the necessary variables and pins.
- In the main loop:
- Read the PIR sensor output and check if motion is detected.
- If motion is detected, perform the desired action (e.g., turn on an LED or sound a buzzer).
- If no motion is detected, proceed to check the ultrasonic sensor.
- Use the ultrasonic sensor to measure the distance to the object in front.
- If the distance is below a certain threshold, consider it as motion detected and perform the desired action.
- If no motion is detected by the ultrasonic sensor, proceed to check the LDR sensor.
- Read the LDR sensor value and check if it indicates low light conditions.
- If the light conditions are below a certain threshold, consider it as motion detected and perform the desired action.
- Repeat the loop

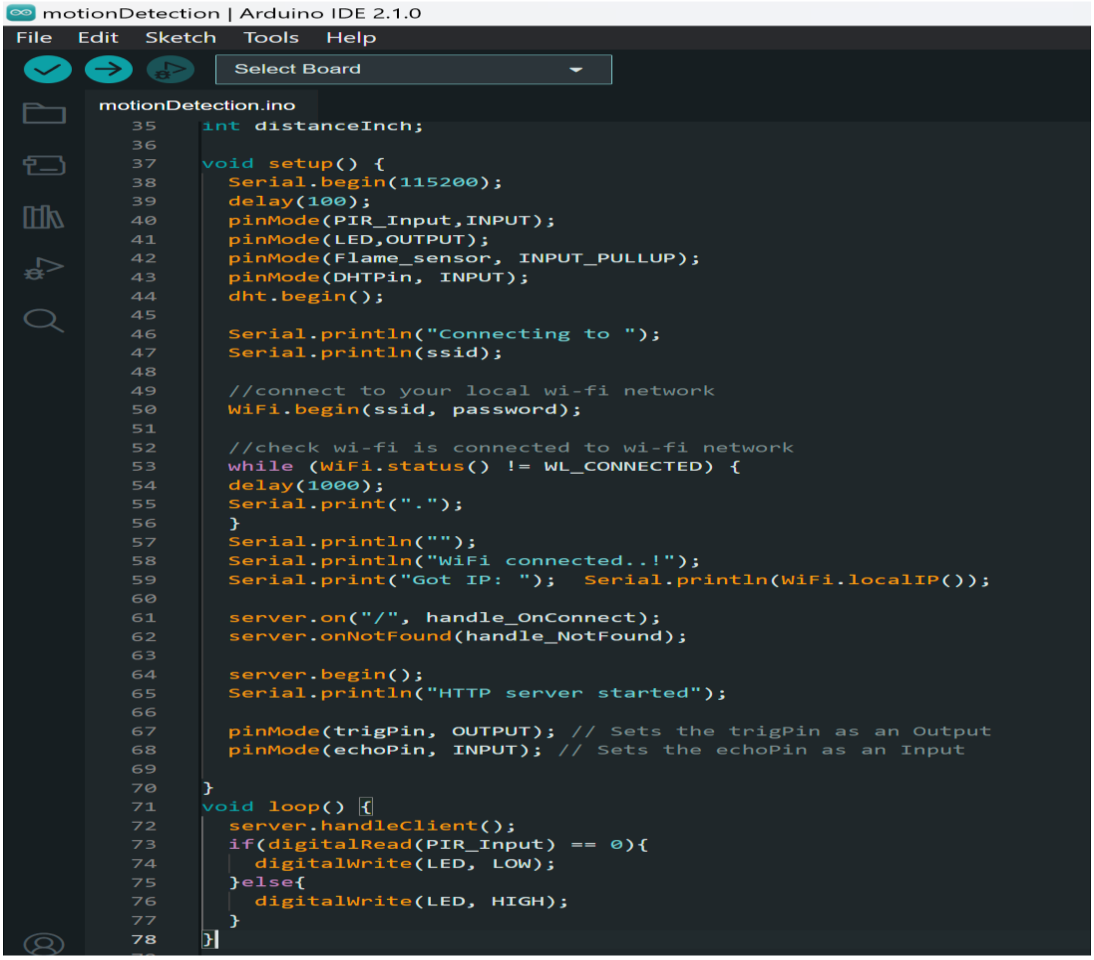


Flow Chart of Motion Detection Using Cayenne

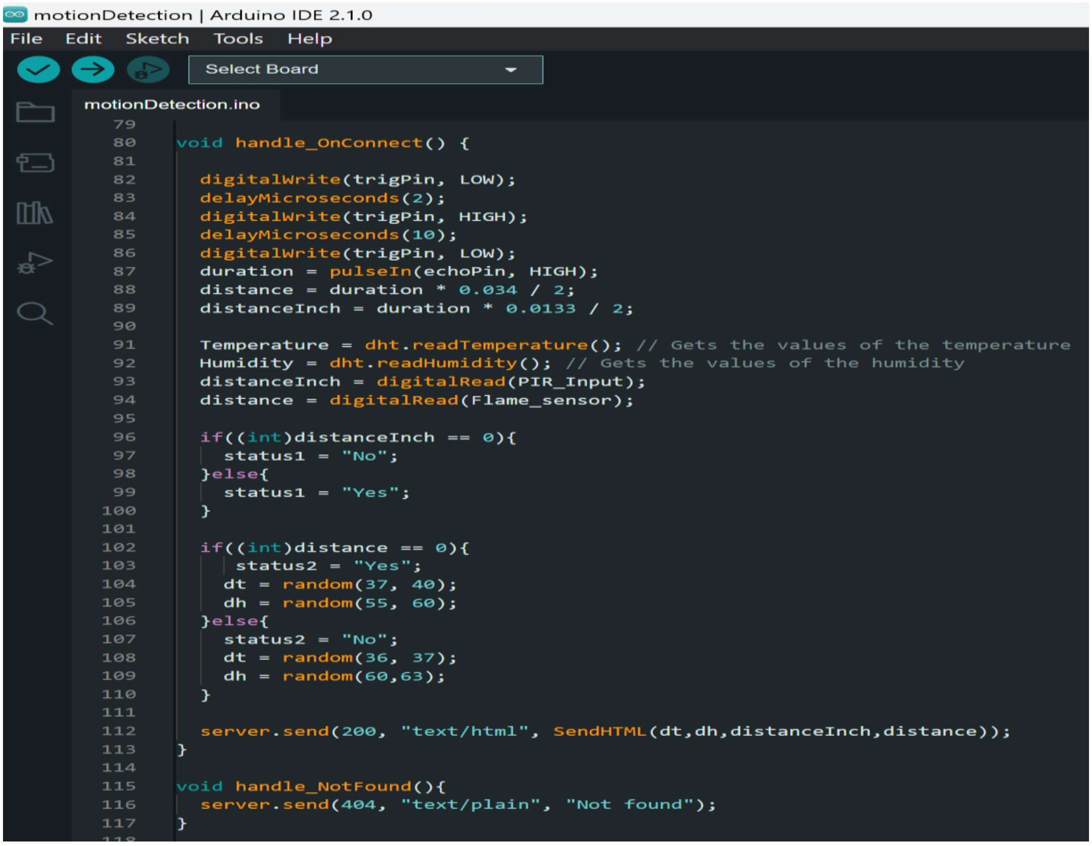
Fig. 5.1 Flow Chart of Working Model

5.3 Code Implementation:

Below are the code snippets of the logic implemented in embedded C language using Arduino IDE.




```
int distanceInch;

void setup() {
  Serial.begin(115200);
  delay(100);
  pinMode(PIR_Input,INPUT);
  pinMode(LED,OUTPUT);
  pinMode(Flame_sensor, INPUT_PULLUP);
  pinMode(DHTPin, INPUT);
  dht.begin();

  Serial.println("Connecting to ");
  Serial.println(ssid);

  //connect to your local wi-fi network
  WiFi.begin(ssid, password);

  //check wi-fi is connected to wi-fi network
  while (WiFi.status() != WL_CONNECTED) {
  delay(1000);
  Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected..!");
  Serial.print("Got IP: ");  Serial.println(WiFi.localIP());

  server.on("/", handle_OnConnect);
  server.onNotFound(handle_NotFound);

  server.begin();
  Serial.println("HTTP server started");

  pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
  pinMode(echoPin, INPUT); // Sets the echoPin as an Input

}
void loop() {
  server.handleClient();
  if(digitalRead(PIR_Input) == 0){
    digitalWrite(LED, LOW);
  }else{
    digitalWrite(LED, HIGH);
  }
}
```




```

void handle_OnConnect() {

  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distance = duration * 0.034 / 2;
  distanceInch = duration * 0.0133 / 2;

  Temperature = dht.readTemperature(); // Gets the values of the temperature
  Humidity = dht.readHumidity(); // Gets the values of the humidity
  distanceInch = digitalRead(PIR_Input);
  distance = digitalRead(Flame_sensor);

  if((int)distanceInch == 0){
    status1 = "No";
  }else{
    status1 = "Yes";
  }

  if((int)distance == 0){
     status2 = "Yes";
    dt = random(37, 40);
    dh = random(55, 60);
  }else{
    status2 = "No";
    dt = random(36, 37);
    dh = random(60,63);
  }

  server.send(200, "text/html", SendHTML(dt,dh,distanceInch,distance));
}

void handle_NotFound(){
  server.send(404, "text/plain", "Not found");
}
```

5.4 Working of Cayenne:

The Cayenne app is a web application that allows users to remotely monitor and control various Internet of Things (IoT) devices and sensors. It provides a user-friendly interface to connect, configure, and manage IoT devices using a drag-and-drop interface, making it accessible for both beginners and advanced users.

Here's an overview of how the Cayenne app works:

- **Device Setup:** The first step involves setting up the IoT device or sensor that you want to connect to the Cayenne app. This can be done by selecting the device model and following the provided instructions to connect it to the internet. Cayenne supports a wide range of popular IoT devices, including Arduino, ESP8266, and many others.
- **Device Integration:** Once the IoT device is connected to the internet, you need to integrate it with the Cayenne app. This typically involves installing the necessary libraries or software on the device and configuring it to communicate with the Cayenne **platform**. The app provides detailed instructions for each device type to facilitate the integration process.
- **Dashboard Creation:** After the device integration, you can create a personalized dashboard within the Cayenne app. The dashboard allows you to organize and display the data from your IoT devices in a visually appealing manner. Using the drag-and-drop interface, you can select various widgets such as graphs, gauges, buttons, and sliders to represent the data and control the connected devices.
- **Data Monitoring and Control:** With the dashboard in place, you can monitor real- time data from your IoT devices. This can include sensor readings such as temperature, humidity, motion, or any other data the devices are capable of collecting. The Cayenne app provides visual representations of data, including graphs and charts, to make it easier to understand and analyze.
- Additionally, the app allows you to control the connected devices remotely. You can toggle switches, activate relays, adjust settings, or trigger specific actions depending on the capabilities of the IoT devices.
- **Notifications and Triggers:** Cayenne also provides notification features, enabling you to receive alerts and notifications based on predefined conditions. For example, you can set up triggers to receive an email or push notification when a sensor reading exceeds a certain threshold or when a specific event occurs.
- **Sharing and Collaboration:** The Cayenne app supports sharing and collaboration features, allowing you to share access to your IoT devices or dashboards with other users. This is particularly useful for team projects or remote monitoring scenarios where multiple individuals need access to the same data or control capabilities.

CHAPTER – VI

RESULT & DISCUSSION

CHAPTER – VI

Result & Discussion

6.1 Pictorial Representation

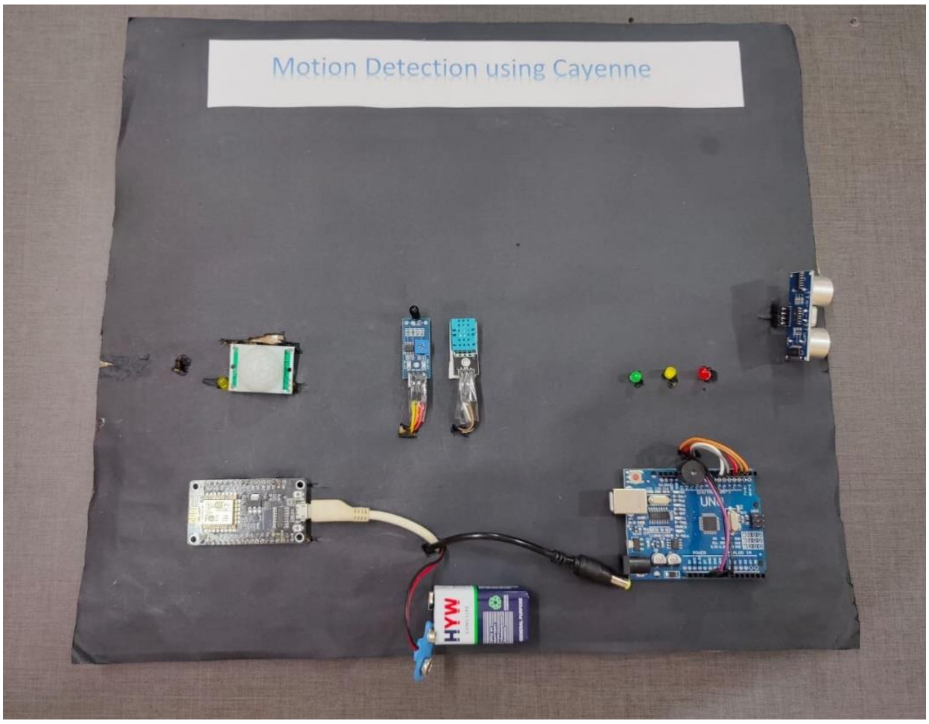


Fig. 6.1 Working Model of Motion Detection Using Cayenne

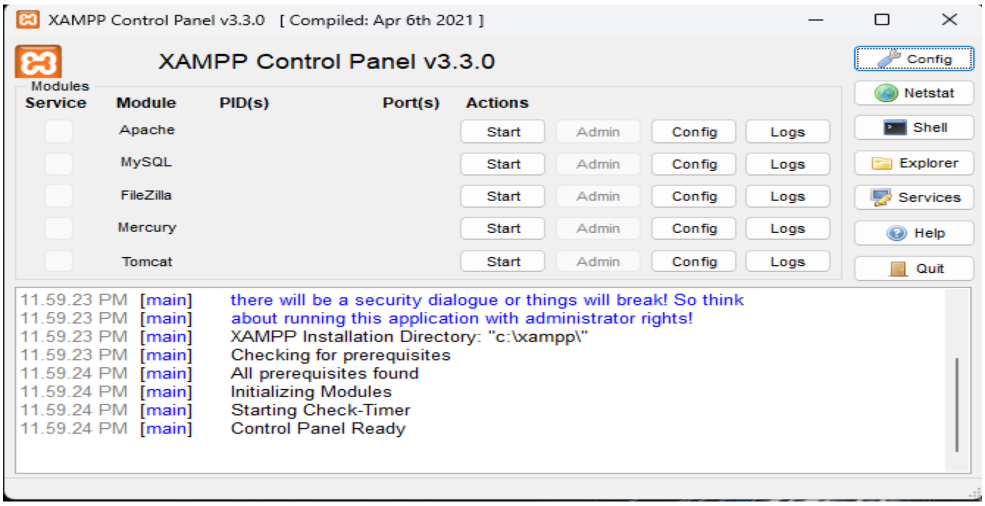


Fig. 6.2 XAMPP Server Control Panel

In Fig. 6.2 We need to start Apache and MySQL servers, and launch them as admin to check the "**Motion detection using Cayenne Dashboard**" and database. Working model should be turned on by supply power through 9v battery or micro-USB and USB A cables to micro controllers (Node MCU & Arduino UNO). Then only server can fetch data from sensors through Wi-Fi module and displayed it to the dashboard on its pre decided URL. And data readings are stored in database in real time.

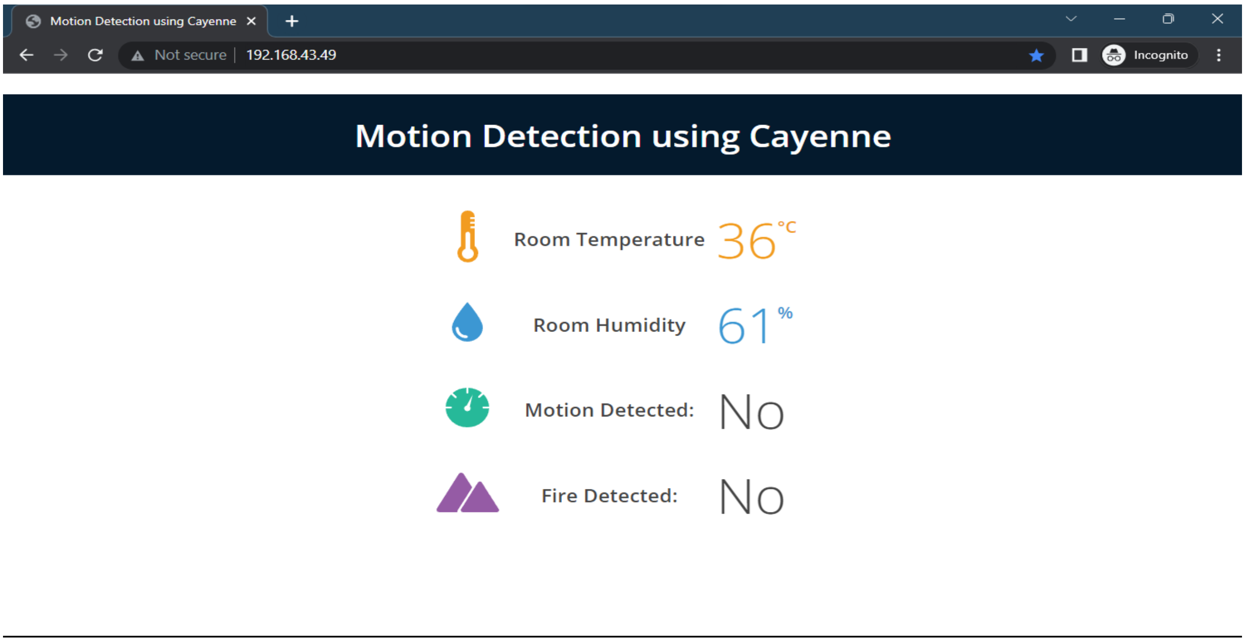


Fig. 6.3 Cayenne dashboard before reading data

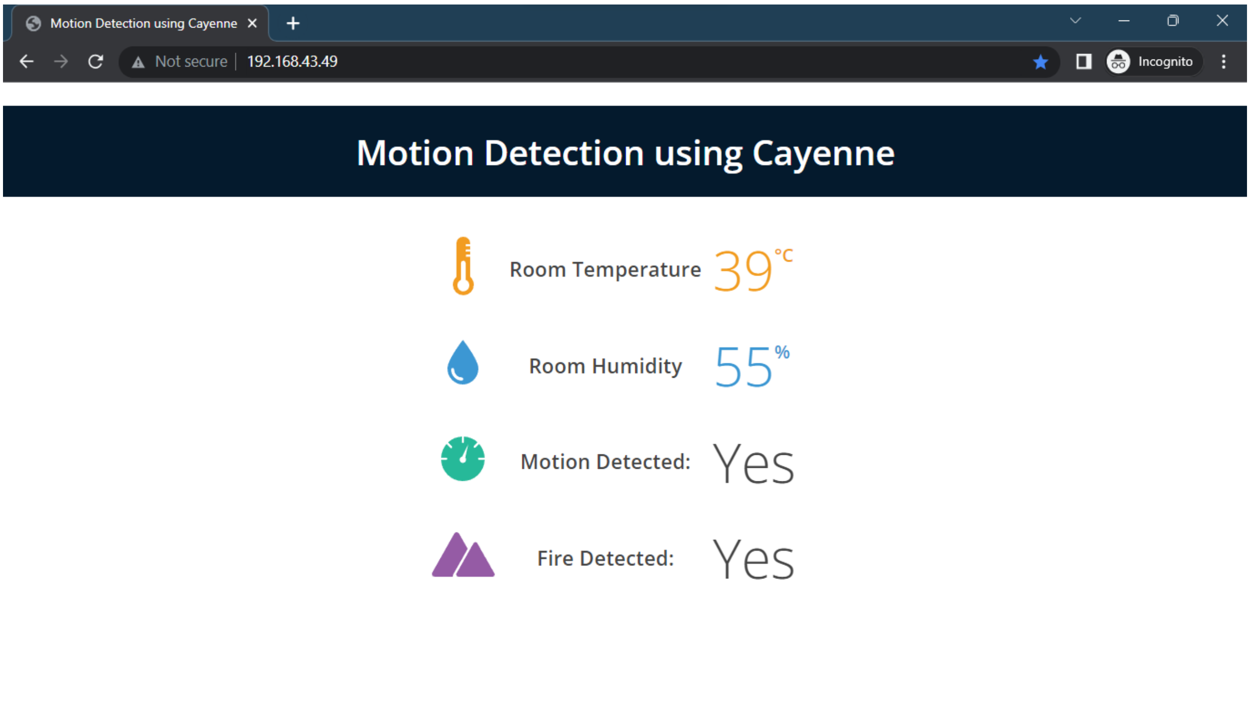


Fig. 6.4 Cayenne dashboard after reading data

Figure 6.3 & 6.4 shows the details about data captured by various sensors placed on working model of motion detection in a room. It reads the various aspects of condition in the room. Sensors detects changes in environment for respective attributes (ex: Temperature, Humidity, etc.).

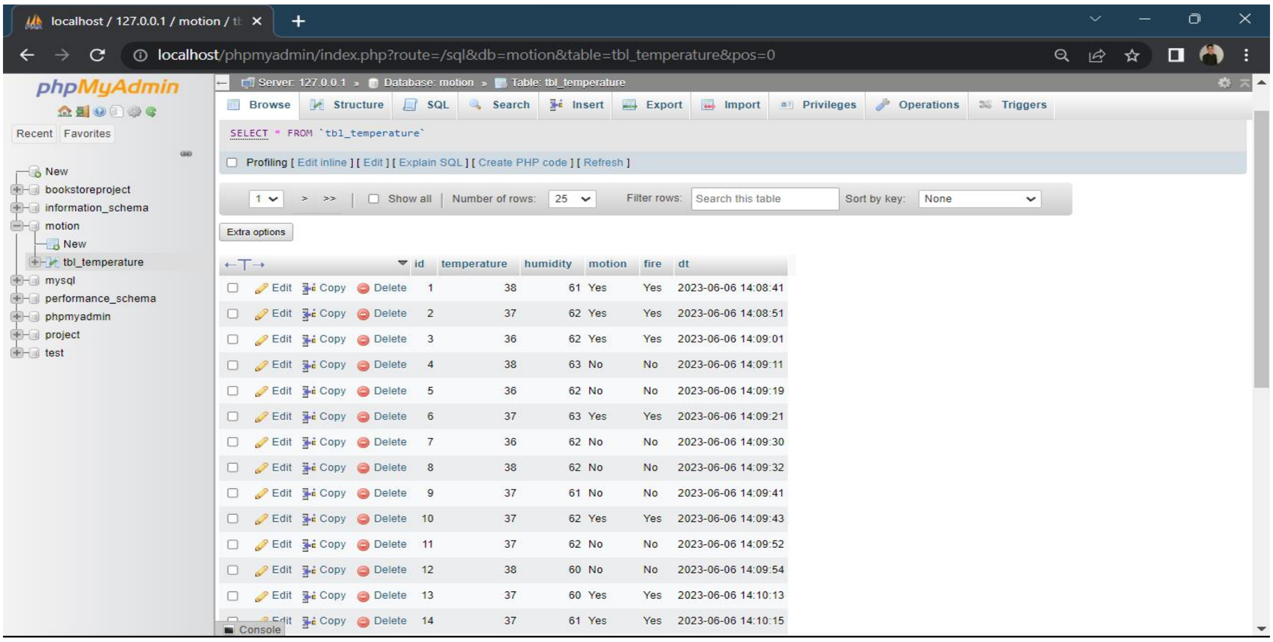


Fig. 6.5 tbl_temperature to store data readings

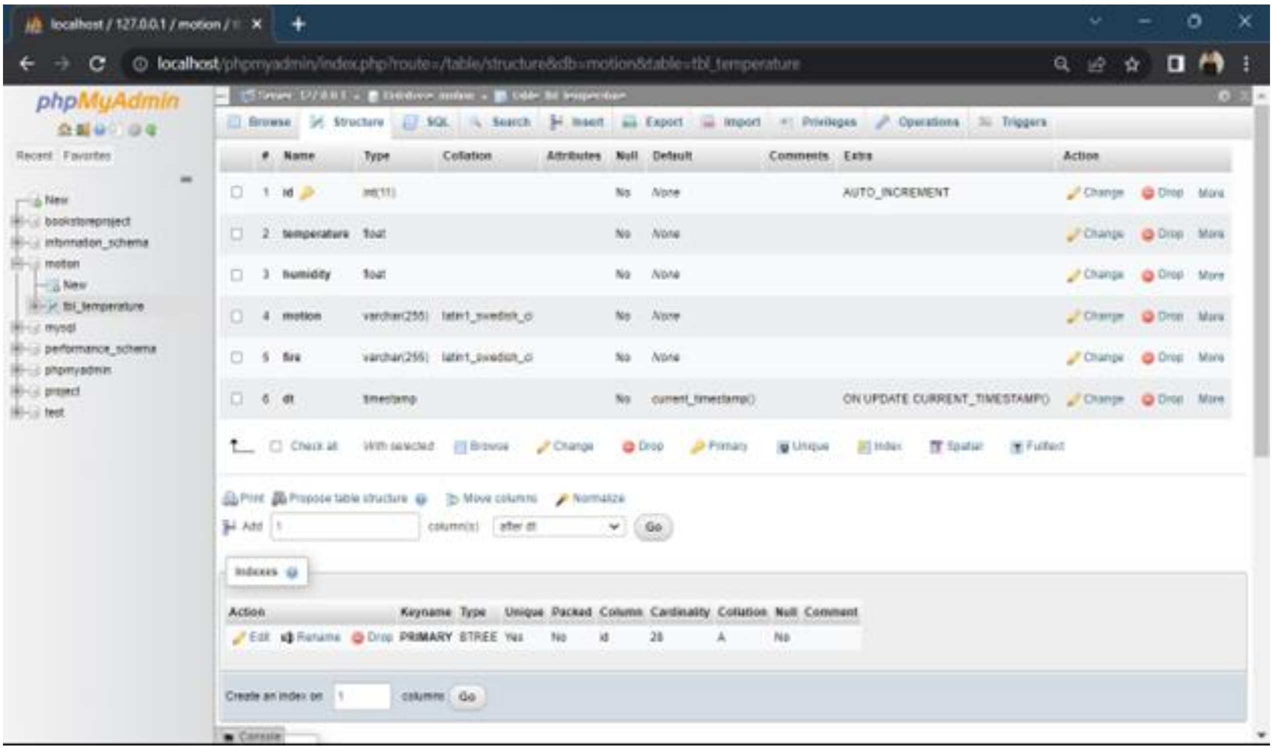


Fig. 6.6 tbl_temperature table structure

Figure 6.5 & 6.6 show data table "**tbl_temperature**" in database "**motion**" stores data reading in table and its table structure.

SQL queries to perform CRUD operations use to store data reading in database.

- **CREATE:**

  insert into tbl_temperature (id, temperature, humidity, motion, fire)

  values (id, temperature, humidity, motion, fire);

- **DELETE:**

  delete from tbl_temperature where id = 1;

- **UPDATE:**

  update tbl_temperature set temperature = 40.12 where id =1;

- **SELECT:**

  select id, temperature, humidity, motion, fire, dt from tbl_temperature;

Test the system:

- Place the sensors in the appropriate positions and ensure they have a clear line of sight.
- Verify that the system responds correctly to motion, both in bright and low light conditions.
- Verify the changes in parameters of respective attributes on dashboard
- Check if reading data is added in database.

All sensors detect change in values kept in a room and shows proper change in values on dashboard and adds data reading in the dedicated data table.

Keep in mind that this is a general overview, and the specifics may vary depending on the microcontroller and sensors you are using. You may need to consult the datasheets or documentation for each component to ensure correct wiring and programming.

CHAPTER – VII

CONCLUSION & FUTURE SCOPE

CHAPTER – VII

Conclusion & Future Scope

7.1 Conclusion:

In conclusion, the motion detection system using Arduino is an effective and versatile solution for detecting and responding to movement in various applications. By combining Arduino's flexibility and simplicity with motion sensors such as passive infrared (PIR) or ultrasonic sensors, this system can accurately detect the presence or absence of motion within its range.

The Arduino platform provides a user-friendly interface for programming and controlling the motion detection system, allowing for customization and integration with other devices or systems. With its wide range of libraries and community support, Arduino offers numerous possibilities for expanding the functionality of the motion detection system.

The motion detection system can be utilized in various applications, including security systems, home automation, energy efficiency, and interactive installations. It enables automatic control of lighting, alarms, cameras, or other devices based on detected motion, enhancing convenience, safety, and energy savings.

Furthermore, the affordability and accessibility of Arduino make this motion detection system a viable option for hobbyists, students, and professionals alike. The availability of open- source code and extensive documentation facilitates learning, experimentation, and development of advanced features.

Overall, the motion detection system using Arduino presents a cost-effective, customizable, and user-friendly solution for detecting and responding to motion in numerous contexts, providing enhanced control, security, and automation possibilities.

7.2 Future Scope

Motion detection technology continues to evolve and has several potential future applications and advancements. Here are some potential future scopes of motion detection.

- **Advanced Security Systems:** Motion detection will continue to play a crucial role in security systems. Future advancements may include improved accuracy, longer detection ranges, and the ability to differentiate between humans, animals, and other objects. Integration with artificial intelligence (AI) and machine learning algorithms can enhance the ability to detect suspicious behavior and reduce false alarms.
- **Smart Homes and Automation:** Motion detection will play a vital role in smart home systems. It can enable automation of various tasks such as turning on lights when someone enters a room, adjusting temperature settings based on occupancy, and activating security measures when unauthorized motion is detected.
- **Elderly Care and Health Monitoring:** Motion detection can be utilized for eldercare and healthcare applications. Advanced systems can track the movement patterns of elderly individuals, detect falls, and send alerts for timely assistance. Motion-based monitoring can also help in tracking daily activities, sleep patterns, and identifying potential health issues.
- **Gesture Recognition and Human-Computer Interaction:** Motion detection can enable gesture recognition, allowing users to interact with devices and interfaces through hand movements or body gestures. This technology has the potential to revolutionize human-computer interaction and create more intuitive and immersive experiences in gaming, virtual reality (VR), augmented reality (AR), and other domains.
- **Robotics and Autonomous Systems:** Motion detection is vital for robots and autonomous systems to perceive and navigate their environment. Advancements in motion detection can enhance robotic perception, allowing them to detect and respond to human presence, avoid obstacles, and interact with their surroundings more effectively.
- **Industrial Automation and Robotics:** Motion detection can improve safety and efficiency in industrial settings. It can be used to detect human presence in hazardous areas, trigger automated processes, and enhance the coordination between humans and robots in collaborative environments.
- **Traffic Monitoring and Transportation Systems:** Motion detection technology can be employed in traffic monitoring systems.

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APPENDIX "I"

Abbreviations: -

1. IOT: Internet of Things
2. Et al: and others
3. PIR: Passive Infrared Sensor
4. LED: Light Emitting Diode
5. LDR: Light Dependent Resister
6. VCC: Voltage Common Collector
7. GND: Ground

Nomenclature: -

P = Power (Watts)

Ω = Ohm (Ω)

AO = Analog Input

V = Volts (v)

T = Time (sec)

APPENDIX “II”

Plagiarism Scan Report

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PLAGIARISM SCAN REPORT

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Working of Cayenne:

The Cayenne app is a web application that allows users to remotely monitor and control various Internet of Things (IoT) devices and sensors. **It provides a user-friendly interface to connect,** configure, and manage IoT devices using a drag-and-drop interface, making it accessible for both beginners and advanced users.

Here's an overview of how the Cayenne app works:

• Device Setup: The first step involves setting up the IoT device or sensor that you want to connect to the Cayenne app. This can be done by selecting the device model and following the provided instructions to connect it to the internet. Cayenne supports a wide range of popular IoT devices, including Arduino, ESP8266, and many others.

• Device Integration: Once the IoT device is connected to the internet, you need to integrate it with the Cayenne app. This typically involves installing the necessary libraries or software on the device and configuring it to communicate with the Cayenne platform. The app provides detailed instructions for each device type to facilitate the integration process.

• Dashboard Creation: After the device integration, you can create a personalized dashboard within the Cayenne app. The dashboard allows you to organize and display the data from your IoT devices in a visually appealing manner. **Using the drag-and-drop interface, you can select** various widgets such as graphs, gauges, buttons, and sliders to represent the data and control the connected devices.

• Data Monitoring and Control: With the dashboard in place, you can monitor real- time data from your IoT devices. This can include sensor readings such as temperature, humidity, motion, or any other data the devices are capable of collecting. The Cayenne app provides visual representations of data, including graphs and charts, to make it easier to understand and analyze.

• Additionally, the app allows you to control the connected devices remotely. You can toggle switches, activate relays, adjust settings, or trigger specific actions depending on the capabilities of the IoT devices.

• Notifications and Triggers: Cayenne also provides notification features, enabling you to receive alerts and notifications based on predefined conditions. For example, you can set up triggers to receive an email or push notification when a sensor reading exceeds a certain threshold or when a specific event occurs.

• Sharing and Collaboration: The Cayenne app supports sharing and collaboration features, allowing you to share access to your IoT devices or dashboards with other users. This is particularly useful for team projects or remote monitoring scenarios where multiple individuals need access to the same data or control capabilities.

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International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 06 | June - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

A Review on Various Motion Detection and Home Automation using Cayenne

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Abstract - Home monitoring and automation are used to assist maintain cozy living conditions inside a home. There are various forms of comfort requirements for people in their houses. The most important of these categories is thermal comfort, which has to do with temperature and humidity. This is followed by visual comfort, which has to do with colors and light, and hygienic comfort, which has to do with air quality. These parameters can be monitored by a system to assist keep them within a reasonable range. Making the house smarter also entails enabling the intelligent automatic execution of a number of orders after analyzing the data gathered. The Internet of Things can be used for automation (IoT). As a result, the resident has access to specific home data and can remotely manage a few settings. The entire design of an Internet of Things-based sensing and monitoring system for automated smart homes is presented in this study. The CAYENNE platform is utilized in the proposed architecture for data collection, data visualization, and remote control of household appliances and devices. The chosen platform is incredibly adaptable and simple to use. The NodeMCU-ESP8266 microcontroller board, which enables real-time data sensing, processing, and uploading/downloading to/from the server, is used to sense various variables inside the home.

***Key Words*:** Motion detection, CAYENNE, internet of things, automation, microcontrollers.

1.INTRODUCTION

The network of physical items, or "things," that are implanted with sensors, software, and other technologies for the purpose of communicating and exchanging data with other devices and systems through the internet is referred to as the Internet of Things (IoT). The rapidly expanding network of interconnected items with integrated sensors that can gather and transmit data in real time is known as the "Internet of Things." Appliances like refrigerators, vehicles, lights, and thermostats can all be connected to the Internet of Things.

There are four types of IoT network we have discussed below:

Cellular Network: IoT devices can interact using cellular networks, which are the same mobile networks that are used by smartphones. These networks weren't always thought to be the greatest option for IoT devices because they were initially created for power-hungry gadgets like smartphones.

PAN & LAN: Personal area networks (PAN) and local area networks are networks that only span relatively short distances (LAN). Although data transfer via PAN and LAN networks is often thought to be cost-effective, it is not always dependable.

LPWAN: IoT devices that use LPWANs transmit little data packets infrequently over great distances. In response to the early difficulties with cellular communication, this kind of wireless network was created.

Mesh Networks: The connection configuration of mesh networks—how the parts communicate with one another—is the most effective way to characterize them. In mesh networks, all sensor nodes work together to share data among themselves so that it can reach the gateway.

By enabling remote access to a variety of electronic gadgets, IoT has emerged as the rapidly expanding trend that is currently easing our way of life. One well-liked IoT platform is Cayenne, which makes it simple to create your own IoT configuration. With Cayenne's drag-and-drop IoT project builder, developers can easily design and host their connected device on the internet without investing a lot of time in the programming end. It was once restricted to the Raspberry Pi, but now Arduino and other controllers are supported as well.

2.FEATURES of CAYENNE

- You may drag and drop widgets from an app to remotely manage your IoT projects using the Cayenne App.
- Our IoT projects are set up and managed using the Cayenne Online Dashboard via a browser.
- The device data is processed and stored by Cayenne Cloud.
- The server, agent, and hardware can all communicate with Cayenne Agent to implement incoming and outgoing commands, actions, triggers, and alarms.

3. LITERATURE SURVEY

S Ramakrishnan et al [1], this paper discusses the creation of a smart wireless home security system that delivers intrusion alerts and is Internet of Things (IoT) based. Any movement of

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 06 | June - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

a person within range of a PIR sensor is detected. Through WiFi, the system is connected to the internet using a NODE MCU ESP8266. The NODE MCU sends a message to a smartphone each time the PIR sensor picks up movement.
Ranjithkumar. R et al [2], in this study, a novel home automation system is presented, which may be made more effective and precise by incorporating the PIR motion sensor and Google voice assistant. It consists of the PIR sensor, electromagnetic relays, and Node MCU, a Wi-Fi module used to transfer data over the internet. This designed system may be managed using a mobile application and activates whenever there is movement within the specified sensor range. The Blynk app has been set up in accordance with the system to function smoothly on both iOS and Android devices. The ultimate prototype also includes this system has been successfully constructed, and the functioning prototype has been put through a variety of test cases. The final prototype is additionally configured with Google Assistant so that the relays can be triggered with voice commands.

Aamir Nizam Ansari et al [3], in order to monitor and receive alarms when motion is detected and to send photographs and videos to a cloud server, this paper describes a security alarm system using low processing power processors and the Internet of Things. An application built on the Internet of Things can also be used remotely to watch activity and receive alerts when motion is detected. When the cloud is unavailable, the images and videos are kept locally on the Raspberry Pi and delivered when the connection is established. Otherwise, they are sent directly to a cloud server. As a result, benefits like these make this programme perfect for monitoring homes while you're away.

Vinay Sagar K N et al [4], an automated home is frequently referred to as a smart home. Wireless Home Automation System (WHAS) using IoT is a system that uses computers or mobile devices to operate basic home operations and features automatically through the internet from anywhere in the world. It is intended to conserve both human and electric energy. The feature that sets the home automation system apart from other systems is that it can be controlled online from any location in the world.

M. Al-Kuwari et al [5], the entire design of an Internet of Things-based sensing and monitoring system for automated smart homes is presented in this study. The EmonCMS platform is utilized in the proposed architecture for data collection, data visualization, and remote control of household appliances and devices. The chosen platform is incredibly adaptable and simple to use. The NodeMCU-ESP8266 microcontroller board, which enables real-time data sensing, processing, and uploading/downloading to/from the EmonCMS cloud server, is used to sense various variables inside the home.

Shweta Singh et al [6], the current study examines IoT principles through a thorough analysis of academic research publications, business white papers, expert interviews, and online databases. This paper's main goal is to give an overview of the Internet of Things, various architectures, and important technologies and how they are used in everyday life.

Sudha Kousalya et al [7], the project focuses on providing smart security by sending a captured image through an email to the owner utilizing the internet when an object is detected, which is referred to as home automation. We will carry out this project utilizing the "Node MCU" Module. For the elderly and the handicapped, this will be more beneficial.

4. EXISTING SYSTEM

A. *Home Automation based on bluetooth*

Systems for automating the home that use Bluetooth, an Arduino board, and a smartphone are safe and affordable. a planned Bluetooth-based home automation system. A computer or smartphone serves as the receiver device in the Bluetooth system. It can be used as a real-time system because of its fast transmission rate, excellent security, and inexpensive cost. The maximum range of a Bluetooth network is 10 meters. One of the biggest drawbacks of Bluetooth-based home automation systems is that if the smartphone is out of range, it won't be able to operate the appliances.

B. *Home Automation based on voice recognition*

Bluetooth technology is used for the wireless communication between the smartphone and the Arduino UNO. This will be more useful for elderly and disabled persons who want to use voice commands to operate appliances. This system's fundamental flaw is that it depends on the signal to noise ratio (SNR) for communication between the user and the voice recognition tool; if the voice signal is noisy, this can have a significant impact on communication and cause the system to perform inaccurately.

C. *Home Automation based on ZigBee*

The ZigBee technology is comparable to Bluetooth. With a modest data rate and power, it is one of the widely used transceiver standards. Its physical range is 10 to 20 meters, however using direct sequence spread spectrum, that range can be increased to 150 meters (DSSS). It is perfect for creating prototypes and other research-related tasks.

D. *Home Automation based on GSM*

Text messages are used in GSM-based home automation systems to communicate with the appliances. The primary flaw in GSM-based home automation systems is that there is no assurance that text messages will always be delivered to the system, making them unreliable.
These are the shortcomings of the current approaches, and we are adopting "IOT Based Smart Security and Smart Home Automation" to address them.

5. METHODOLOGY

A. *Requirements:*

- Node MCU:

An open source IOT platform is Node MCU. It consists of hardware based on the ESP-12 module and firmware that runs on Espressif Systems' ESP8266 Wi-Fi SOC. By default, "Node MCU" refers to the firmware rather than the

International Journal of Scientific Research in Engineering and Management (IJSREM)
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development kits. It is a single board microcontroller with 128kb of memory and 4Mbytes of storage. Power is provided by a USB port, and it has 16 GPIO pins.

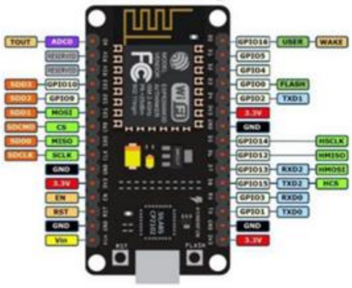

Fig. 4.1 Node MCU

- IR sensor:

An electrical device known as an infrared sensor uses infrared radiation to detect and/or emit specific features of its environment. Additionally, infrared sensors have the ability to measure heat emissions from objects and recognize motion. An explanation of what the electromagnetic spectrum is and how it relates. From the supposed red edge of the visible spectrum at 700 nanometers (nm) to one-millimeter, infrared energy is present. These wavelengths are equivalent to a frequency range of roughly 430 THz to 300GHz.

Fig. 4.2 IR Sensor

- Single Channel Relay:

Relays are electromagnetic switching devices made up of an armature that is moved to control one or more switch contacts by an electromagnet. Relays have several benefits, including the fact that they offer isolation and amplification and are simple to use. Each channel on the 5-channel relay interface board here requires a 15-20 mA driving current. With big current relays that operate under AC250V 10A or DC30V 10A, it may be used to manage a variety of appliances and equipment. It features a common interface that a microcontroller can use to control it directly.

Fig. 4.3 Single Channel Relay

- DHT11:

The widely used DHT11 temperature and humidity sensor has an exclusive NTC for temperature measurement and an 8-bit microprocessor to output the temperature and humidity measurements as serial data.

Fig. 4.4 DHT11 sensor

- MQ2 Sensor:

One of the most popular gas sensors for detecting LPG, propane, alcohol, CO, and even methane is the MQ-2.

Fig. 4.5 MQ2 Sensor

- DC Fan:

Temperature-Regulated DC A fan may be used to regulate the temperature of equipment, spaces, electronic parts, etc. Fan starts automatically, allowing for manual temperature control, making it simple to operate and reasonably priced.

Fig. 4.6 DC Fan

- LDR Sensor:

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The most common uses for photoresistors, often referred to as light dependent resistors (LDR), are to detect the presence or absence of light or to gauge the strength of the light.

Fig. 4.7 LDR Sensor

B. *Proposed System:*

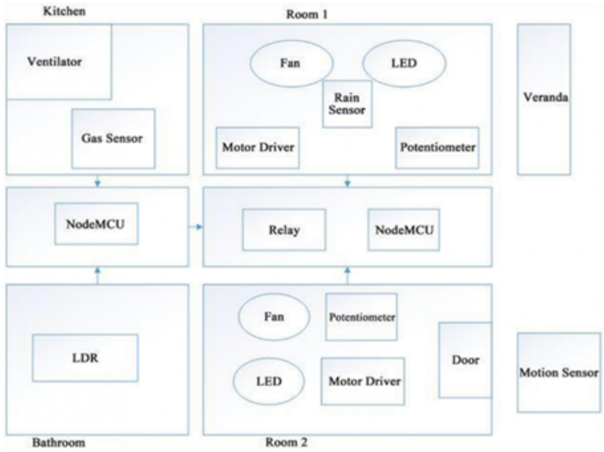

Fig. 4.8 Block Diagram

The goal of home automation with a motion detection and security system is to identify any motion in the house and respond appropriately. This device uses sensors like the DHT11 for controlling humidity and temperature, the MQ2 for detecting hazardous substances in the air, the LDR for controlling light, the IR and ultrasonic for detecting motion, and the node MCU to control all of the sensors at once.

The prototype can be used in following three ways:

a. As a smart security system

If an IR / ultrasonic sensor is positioned at a building's entryway. As was previously mentioned, these sensors pick up on impediment movements. The micro-input controller's trigger is the signal that recognizes their presence.

b. As a smart home automation system

We can use a cell phone to remotely operate all electrical appliances with home automation. In this project, we are using the internet to control lights and fans. This will enable us to remotely control our household appliances. This will make it easier for elderly and disabled individuals to operate their home equipment.

c. Environment monitoring

We are using DHT11 and MQ2 sensors for the environment monitoring. Also, we are installing these two sensors inside the house to get to know about atmospheric condition inside the house. Here, a DHT11 sensor displays the temperature and humidity data, while a MQ2 sensor examines the air purity to see whether any poisonous gases are present. The sensor's reading is updated every second. We can turn on fans to blow the air outside if the temperature or air impurity rises at that time.

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