Daffodil Institute Of IT
Department of Computer Science and Engineering (CSE)
6th semester
Project Report

Project Title : Home Security Alarm
Course Title : Embedded System Programming Lab
Course code : 530224

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1. Introduction

In today's world, home security has become a critical concern. With the advent of affordable and advanced technology, it is now possible to design and implement efficient home security systems that are easy to install and operate. This project aims to develop a Home Security Alarm system using an ESP32 microcontroller (similar as Arduino UNO). The system will detect motion using a PIR sensor and trigger an alarm, displaying the status on an I2C LCD display. Additionally, this system can help save energy by turning off home appliances when no one is present and can be adapted for use in street lighting to enhance safety.

2. Objectives

- To create a home security alarm system that detects motion and alerts the user through visual and auditory signals.
- To display real-time status and alerts on an I2C LCD display.
- To implement energy-saving features by turning off home appliances when no motion is detected.
- To enhance safety by turning on lights when motion is detected at night.
- To design a system that is easy to set up and use, ensuring user-friendliness.

3. System Specification

3.1 Hardware Requirement

ESP32 Node MCU module

- High-performance, low-power microcontroller with integrated Wi-Fi and Bluetooth capabilities.

I2C LCD Display with Driver

- 16x2 character LCD display with I2C interface for easy communication with the ESP32.

PIR Motion Sensor

- Passive Infrared (PIR) sensor to detect motion within its range.

LED

- To provide a visual indication of motion detection.

Buzzer

- To provide an auditory alert when motion is detected.

Jumper Wires

- For connecting the components.

3.2 Software Requirement

Arduino IDE

- For writing and uploading code to the ESP32.

Micro Python

- As an alternative programming environment for the ESP32.

4. Circuit Diagram

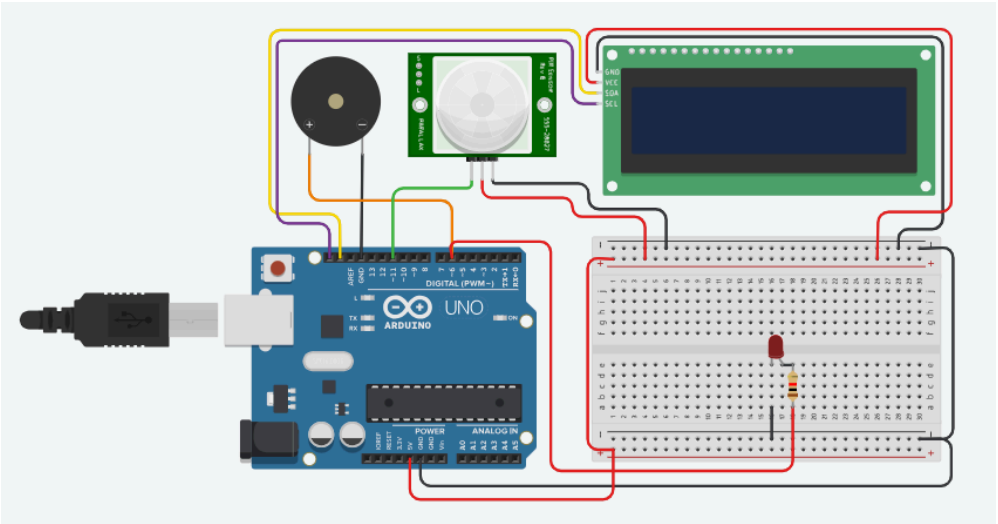

Fig: 1.1 Circuit Diagram

5. Working Process

The home security alarm system works by detecting motion using the PIR sensor. When motion is detected, the ESP32 processes the signal and triggers the buzzer and LED to provide auditory and visual alerts, respectively. The status of the system is displayed on the I2C LCD display. This system can also be extended to save energy by turning off home appliances when no one is present and to enhance road safety by turning on street lights when motion is detected at night.

6. Implementation

6.1 Connecting the Components

1. I2C LCD Display
   - Connect GND to GND, VCC to 3V3, SDA to GPIO 8(SDA pin), and SCL to GPIO 9(SCL pin) on the ESP32 board.
2. PIR Motion Sensor
   - Connect the VCC pin to 3V3, GND pin to GND, and the OUT pin to GPIO 11 input pin on the ESP32.
3. LED
   - Connect the anode to GPIO 6 output pin on the ESP32 through a current-limiting resistor and the cathode to GND.
4. Buzzer
   - Connect positive terminal to GPIO 6 output pin on the ESP32 and the GND terminal to GND.

6.2 Source Code

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27, 16, 2);

const int sensor = 11;
const int buzzer = 6;

void setup() {
  Wire.begin(8, 9);
  lcd.init();
  lcd.backlight();

  pinMode(sensor, INPUT);
  pinMode(buzzer, OUTPUT);
  digitalWrite(buzzer, LOW);
  delay(2000);
 }

 void loop() {
   int movement = digitalRead(sensor);
    delay(50);
    int movementConfirm = digitalRead(sensor);

    if (movement == HIGH && movementConfirm == HIGH) {
      digitalWrite(buzzer, HIGH);
      lcd.setCursor(0, 0);
      lcd.print("Warning!");
      lcd.setCursor(0, 1);
      lcd.print("Movement Detected.");
      delay(3000);
      lcd.clear();
     }
    else {
      digitalWrite(buzzer, LOW);
      lcd.setCursor(0, 0);
      lcd.print("Peace..");
      lcd.setCursor(0, 1);
      lcd.print("No movement here.");
      delay(500);
      lcd.clear();
    }
   delay(100);
}
```

6.3 Testing the System

- Verify all connections are secure and correct.
- Upload the source code to the ESP32 using the Arduino IDE or MicroPython environment.
- Power up the system and observe the functionality:
  - The LCD display should show the system status.
  - The LED and buzzer should activate when motion is detected by the PIR sensor.
  - Test the system under different conditions to ensure reliable operation.

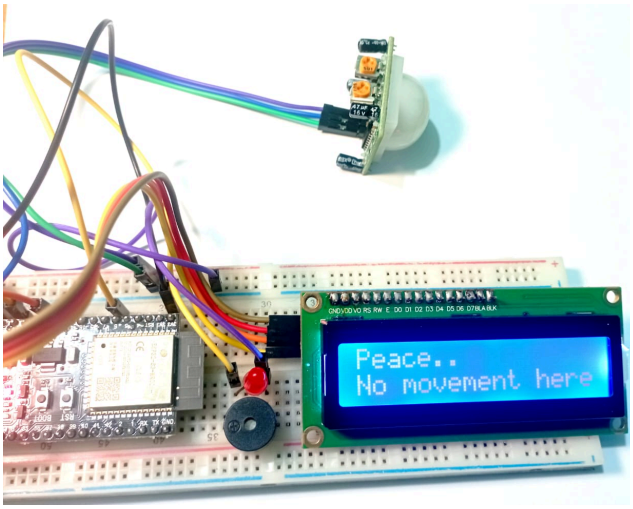

Fig : 1.2 No Movement here

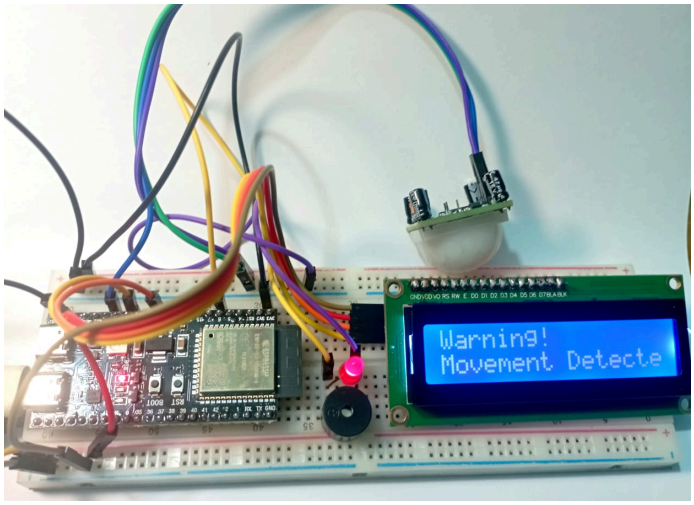

Fig : 1.3 Movement Detected

7. Results

The PIR sensor detector successfully detects living object movements. The the sensor detects any movement of living object, it sends signals to the ESP32. The the ESP32 shows “Movement Detected” notification on the I2C LCD display along with the Buzzer sound and a Blue LED shines bright. When there is no movement, the system shows “NO Movement” on the I2C LCD display and the Buzzer and LED turns off.

8. Conclusion

This Home Security Alarm project demonstrates the integration of various components to create an effective home security system. The use of an ESP32 microcontroller, along with a PIR sensor, LED, buzzer, and I2C LCD display, allows for a versatile and user-friendly system. The project provides a cost-effective solution for enhancing home security, ensuring peace of mind for homeowners. Furthermore, its applications in energy saving and road safety highlight its versatility and potential for broader use.