OS PROJECT REPORT

167181 – BICS 2.2 A

Abstract

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Title

Smart Washrooms using a motion detector

Abstract

This project involves the development of a smart motion detection system using an Arduino platform, integrating a PIR sensor, LED, LCD display, and Bluetooth module. The system is designed to detect motion and reflect the received input through an LED and an LCD display. When motion is detected, the LED lights up, and the LCD displays "LIGHTS ON!" and when no motion is detected, the LED turns off, and the LCD shows "LIGHTS OFF." Additionally, the system can be controlled via Bluetooth, allowing users to manually override the automatic behavior by sending commands through a serial monitor. For the serial monitor, when the user keys in 1 in the serial monitor the LED lights up as well as the LCD displaying “LIGHTS ON” and when the user keys in 0, the LED switches off and LCD displays “lights off”. Any other command keyed in by the user in the serial monitor would result to an LCD display of “invalid input.”

Introduction

The project aims to create an interactive motion detection system that not only automates lighting based on motion specifically for convenient places like washrooms but also allows user control through Bluetooth. This dual functionality enhances user experience and adaptability in various environments.

Problem Statement

The primary problem addressed by this project is the need for an efficient and user-friendly method to control lighting based on motion detection and inherently saving on power as well. Traditional systems often lack flexibility, requiring manual operation, which can be inconvenient and since it is the in the human nature to forget sometimes, it leads too poor consumption of power.

Relevance of the Study

This project is relevant as it combines automation with user control, making it suitable for smart home applications. The ability to control the system remotely via Bluetooth adds a layer of convenience, addressing modern needs for smart technology integration.

Objectives

- **Design**: Create a schematic view for the motion detection system incorporating all components.
- **Analyze**: Evaluate the performance of the PIR sensor in detecting motion accurately.
- **Develop**: Write the Arduino code to manage the sensor input, LED output, and LCD display.
- **Implement**: Integrate the Bluetooth module for remote control functionality.
- **Test**: Conduct tests to ensure the system responds correctly to motion and Bluetooth commands.

Literature Review

Previous studies have explored various applications of PIR sensors in security systems and automation. Many projects have successfully integrated Bluetooth technology for remote control, enhancing user interaction. However, few have combined these elements into a cohesive system that provides both automatic and manual control.

Methodology

1. **Component Selection**: Choose appropriate components including a PIR sensor, LED, LCD display, and Bluetooth module.
2. **Circuit Design**: Create a circuit diagram connecting the components to the Arduino.
3. **Programming**: Develop the Arduino code to handle input from the PIR sensor, control the LED and LCD, and manage Bluetooth commands.
4. **Testing**: Test the system for responsiveness to motion and Bluetooth commands, ensuring it displays "invalid command try again" for unrecognized inputs.

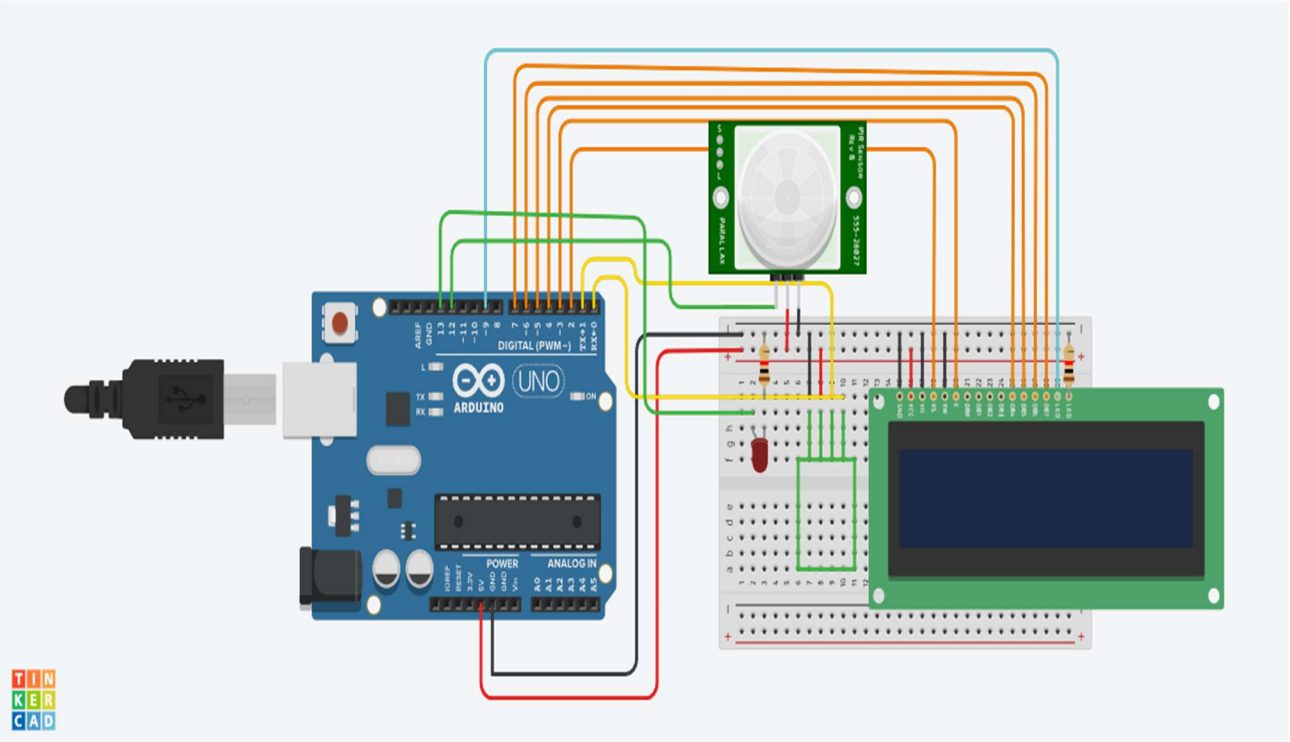
SAMPLE CODE

```
// C++ code

 #include<LiquidCrystal.h>
LiquidCrystal lcd(2,3,4,5,6,7);
const int lcdBrightness = 9;
void setup()
{
  lcd.begin(16,2);
  pinMode(lcdBrightness,OUTPUT);
  pinMode(13, OUTPUT);
  pinMode(12, INPUT);
  Serial.begin(9600);

}

void loop()
{

  if (Serial.available()) {
    char command = Serial.read();

    if (command == '1') {
      lcd.clear();
      lcd.setCursor(0, 0);
      lcd.print(" LIGHTS ON ");
      digitalWrite(13, HIGH);
      analogWrite(lcdBrightness, 255);
      Serial.println("Motion detected");
      delay(2000);
```

```
  } else if (command == '0') {
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("  LIGHTS OFF");
    digitalWrite(13, LOW);
    analogWrite(lcdBrightness, 64); // Dim LCD
    Serial.println("No motion detected");
    delay(2000);
  } else {
    lcd.clear();
    Serial.println("Unknown Command");
    lcd.setCursor(0, 1);
    lcd.print("  Invalid command");
    lcd.scrollDisplayLeft();
    delay(2000);
  }
}


 int sensor = digitalRead(12);
if(sensor == HIGH){
   lcd.clear();
  lcd.setCursor(0,0);
  analogWrite(lcdBrightness, 255);
lcd.print("  LIGHTS ONN");
  lcd.scrollDisplayLeft();
  Serial.println("Motion detected");
        digitalWrite(13,HIGH);
  delay(100);
}else{
```

```
    lcd.clear();
   lcd.setCursor(0,0);
   analogWrite(lcdBrightness, 50);
 lcd.print("  LIGHTS OFF");
   lcd.scrollDisplayLeft();
 digitalWrite(13,LOW);
   Serial.println("No motion detected");
 }
 delay(200);
}
```

Circuit implementation



Results and Discussions

The system successfully detects motion and controls the LED and LCD display accordingly. The Bluetooth functionality allows for manual control, and the system effectively handles invalid commands by displaying an appropriate message on the LCD.

Recommendations

Future research could explore the integration of additional sensors for enhanced functionality, such as temperature or light sensors. Additionally, expanding the Bluetooth control to include a mobile application could improve user interaction.

Conclusion

The project successfully achieved its objectives, demonstrating a functional motion detection system with Bluetooth control. The expected results were met, providing a practical solution for automated lighting systems useful in various environments such as washrooms.

References

- E-books and papers from e-journals related to Arduino projects, PIR sensors, and Bluetooth technology.

Learn more:

1. SOLVEDSOLVEDSOLVEDPIR motion sensor problem - Sensors - Arduino Forum
2. Bluetooth LED not turning on - Programming Questions - Arduino Forum
3. PIR sensor with LCD Display and LED - Programming Questions - Arduino Forum