Motion Detection Using IR Sensor

Project Report Submitted

to

MANIPAL ACADEMY OF HIGHER EDUCATION

For Partial Fulfillment of the Requirement for the

Award of the Degree

Of

Bachelor of Technology

in

Information Technology

By

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Reg.no: 210911252

Date: - **20/11/2023**

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MANIPAL INSTITUTE OF TECHNOLOGY
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A Constituent Unit of MAHE, Manipal

November 2023

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1. Abstract

This project focuses on the integration of the LPC1768 microcontroller and an IR sensor to detect motion and implement it in a Home automation System. The LPC1768, armed with an ARM Cortex-M3 processor, forms the core of the system, providing robust processing capabilities. The motion sensor we have used for this work is the IR sensor. Proximity Infrared Sensor(IR) is known for its affordability, energy efficiency, and reliability. This system incorporates the sensor, a lighting component, and a recording setup (comprising a webcam and the necessary software for video storage) to address various security issues. IR sensors are designed to detect changes in infrared radiation within their field of view. When a warm object (like a human or an animal) moves across the sensor's detection range, it triggers a response. This PIR sensor is designed to work with all Parallax microcontrollers that operate at either 3.3V or 5V. It's very energy-efficient, drawing less than 100 microamperes of current. So, it's compatible with a wide range of microcontrollers, and it won't consume much power. [2]

2. Introduction

Objective:

The goal of this project is to use infrared sensors (IR) to detect motion in order to improve security measures in a variety of settings, such as homes, offices, industries, and banks. The goal is to provide a dependable and reasonably priced system that makes use of technology improvements to detect mobility based on changes in the speed or vectors of objects inside the field of vision, given the rising number of crimes. The suggested system uses a PIR sensor coupled with a microcontroller to sense body temperature, setting off alerts and warning owners when someone is not supposed to be in a restricted area. The study also investigates the flexibility of infrared sensors beyond security uses, such as their incorporation into energy-saving devices and home automation systems. The aim is to develop a resilient system that proficiently recognizes movement, offering a pragmatic and effective resolution to security issues. Initial testing shows that the system can achieve expected performance levels.[1]

Scope:

This project involves designing and implementing an intelligent lift control system using LPC1768, Keil uVision, and Flash Magic. The project's goal is to create a motion detection system that uses infrared (IR) sensors to improve security in buildings such as banks, industries, offices, and residences. [2]The emphasis is on using advances in technology to measure changes in object speed or vectors inside the field of view in order to identify motion. The device, which has a microprocessor and a PIR sensor integrated, detects heated items and sounds an alert when someone tries to enter restricted regions without authorization. It also looks at energy-saving techniques and home automation applications. The project's objective is to provide a cost-effective, dependable, and energy-efficient solution that has undergone preliminary testing. Its scope include design, development, and real-world deployment.

Project Description:

Our project involves interfacing an IR sensor with the LPC1768 microcontroller. The objective is to activate a buzzer upon detecting motion. Additionally, we're utilizing the Analog-to-Digital Converter (ADC) output to enhance motion detection capabilities. The ADC output serves as a means to detect changes in the environment, contributing to a more robust motion detection system. This integration with the LPC1768 microcontroller allows for a versatile and programmable solution, expanding the scope beyond basic motion sensing. The project's implementation involves the coordination of the IR sensor, ADC, and buzzer, providing a comprehensive motion detection system with the LPC1768 as the central control unit.[1]

Hardware Requirements:

LPC1768 Development board
Ultrasonic Sensor (HC-SR04)
LED (for light simulation),
Buzzer (for alarm)
Wires
Power Supply

Software Requirements:

Language: Embedded C
Software: Keil uVision, Flash Magic

3. Working Principle:

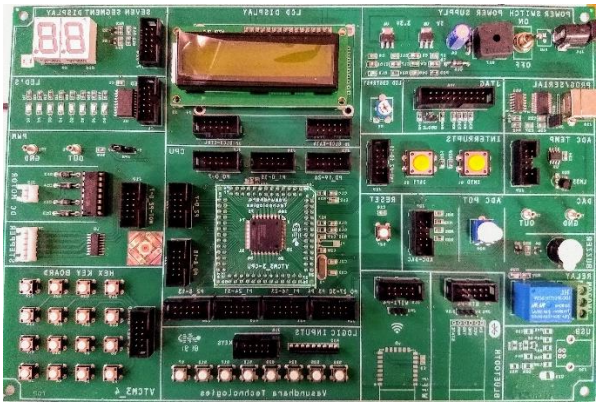

Fig 1. Lpc1768 kit and IR Sensor

Lpc1768 Microcontroller:

The LPC1768 is a microcontroller based on the ARM Cortex-M3 architecture, and it is manufactured by NXP Semiconductors. It is part of the LPC1700 series of microcontrollers, which are designed for embedded applications.

Processor Core:
Utilizes an ARM Cortex-M3 processor core for high performance and low power consumption, handling the execution of instructions.

Peripherals:
Integrates on-chip peripherals (e.g., UART, SPI, I2C, GPIO, timers) for communication with external devices and general-purpose input/output operations.

Memory:
Utilizes Flash memory for program storage and SRAM for data storage during program execution.

Clock System:
Features a sophisticated clock system for precise control of the processor clock frequency, crucial for meeting performance requirements and minimizing power consumption.

Communication Interfaces and Development Tools:
Supports various communication interfaces (e.g., UART, SPI, I2C) for serial communication and is programmed and debugged using development tools like Keil uVision and Flash Magic.

IR Sensor(Infrared Sensor):

An Infrared (IR) sensor is a device that detects infrared radiation in its surroundings. Here are some applications of the same:

Infrared Radiation Detection:

IR sensors are designed to detect the presence of infrared radiation, which is emitted by objects based on their temperature. This makes them particularly useful for sensing the heat emitted by living organisms or other warm objects.

Motion Detection:

- One of the primary applications of IR sensors is in motion detection. These sensors can detect changes in the infrared radiation pattern within their field of view, making them effective for triggering alarms or activating devices when motion is detected.[1]

Proximity Sensing:

- IR sensors are often used for proximity sensing. By measuring the reflection of emitted infrared light, these sensors can determine the distance between the sensor and an object, enabling applications such as touchless switches or automatic faucets.[1]

Object Detection:

- IR sensors can be employed for detecting the presence or absence of objects in their detection range. This is useful in applications like industrial automation and robotics for object recognition and handling.[2]

Energy Efficiency:

- IR sensors contribute to energy efficiency by enabling systems like automatic lighting controls. Lights can be turned on or off based on the detection of motion, reducing energy consumption in spaces when lighting is not needed.

Burglar Alarms and Security Systems:

- IR sensors play a crucial role in security systems for detecting intruders. When integrated into burglar alarm systems, they trigger alarms or activate surveillance cameras upon detecting unauthorized motion.[2]

Integration with Microcontrollers:

- IR sensors can be interfaced with microcontrollers to process and interpret the detected signals. This allows for more advanced control and automation in various applications.

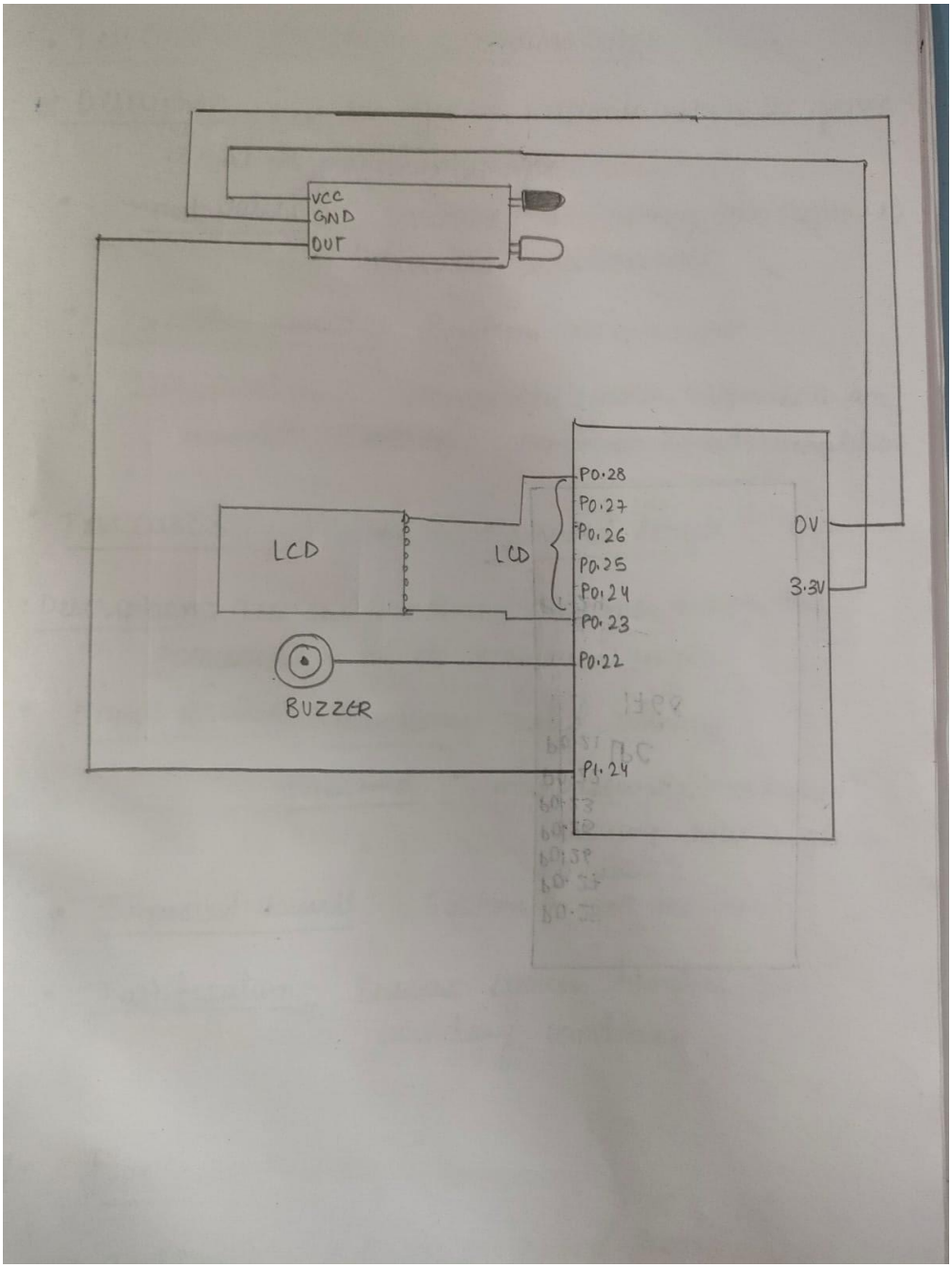

Fig 2. Circuit Diagram used for the project

4. Embedded C Working Code:

```
#include <lpc17xx.h>
#include <stdio.h>

int temp1, temp2, flag1, i, x;

void delayMS(unsigned int k) {
    for (i = 0; i < k * 100; i++);
```

```
}

void port_write(void);
void lcd_write(void);
void buzz_init(void);

int main() {
    int command[] = {3, 3, 3, 2, 2, 0x01, 0x06, 0x0C, 0x80};
    char message1[] = "Obstacle Present!";
    char message2[] = "No Obstacle.";

    SystemInit();
    SystemCoreClockUpdate();

    LPC_PINCON->PINSEL0 = 0;

    LPC_PINCON->PINSEL3 = 0; // for sensor
    LPC_GPIO1->FIODIR = 0;
    LPC_PINCON->PINSEL1 |= 0;
    LPC_GPIO0->FIODIR |= 0X3F << 23;
    flag1 = 0;
    for (i = 0; i < 9; i++) {
        temp1 = command[i];
        lcd_write();
    }
    flag1 = 1;
    i = 0;

    while (1) {
        if ((LPC_GPIO1->FIOPIN & (1 << 24)) == 0) {
            i = 0;
            buzz_init();
            while (message1[i] != '\0') {
                temp1 = message1[i];
                lcd_write();
                i++;
            }
        } else {
            i = 0;
            LPC_GPIO0->FIOCLR = 1 << 22;
            while (message2[i] != '\0') {
                temp1 = message2[i];
                lcd_write();
                i++;
            }
        }
        flag1 = 0;
```

```
        temp1 = 0x01;
        lcd_write();
        flag1 = 1;

        delayMS(950);
    }
}

void port_write() {
    int j;
    LPC_GPIO0->FIOPIN = temp2 << 23;
    if (flag1 == 0) {
        LPC_GPIO0->FIOCLR = 1 << 27;
    } else {
        LPC_GPIO0->FIOSET = 1 << 27;
    }
    LPC_GPIO0->FIOSET = 1 << 28;
    for (j = 0; j < 25; j++);
    LPC_GPIO0->FIOCLR = 1 << 28;
    for (j = 0; j < 30000; j++);
}

void lcd_write() {
    temp2 = (temp1 >> 4) & 0xF;
    port_write();
    temp2 = temp1 & 0xF;
    port_write();
}

void buzz_init() {
    LPC_PINCON->PINSEL1 |= 0;
    LPC_GPIO0->FIODIR |= 1 << 22;

    LPC_GPIO0->FIOSET = 1 << 22;
    for (x = 0; x < 100000; x++);
    LPC_GPIO0->FIOCLR = 1 << 22;
}

```

97. Conclusion:

In order to achieve motion detection functionality, the project successfully implemented an Infrared (IR) sensor interfaced with the LPC1768 microcontroller. When motion is detected, the system not only sounds a buzzer but also uses the Analog-to-Digital Converter (ADC) output to increase sensitivity. The project's scope is increased beyond simple motion detection thanks to this integration, which enables a flexible and programmable solution. The project demonstrates the practical application of these technologies in security and automation contexts by demonstrating a comprehensive and effective motion detection system through the utilization of IR sensors and

theLPC1768microcontroller.

98. Future Scope:

The project on IR sensor interfaced with the LPC1768 microcontroller for motion detection presents several avenues for future enhancements and expansions:

Wireless Connectivity:
Integrate wireless communication modules (such as Wi-Fi or Bluetooth) to enable remote monitoring and control. This could enhance the system's flexibility and accessibility.

Cloud Integration:
Implement cloud connectivity to store and analyze motion detection data. This would enable users to access historical data and receive real-time alerts through cloud-based platforms.

Machine Learning Algorithms:
- Explore the incorporation of machine learning algorithms for advanced motion pattern recognition. This could improve the system's accuracy in distinguishing between different types of movements or objects.

Multi-Sensor Fusion:
- Combine the IR sensor with other types of sensors (e.g., ultrasonic or microwave sensors) to create a multi-sensor fusion system. This could enhance the overall reliability and accuracy of motion detection.

Smart Home Integration:
- Integrate the system with smart home platforms, allowing users to incorporate motion detection into broader home automation scenarios. For example, triggering lights, thermostats, or security cameras based on detected motion.

User Interface Enhancements:
- Develop a user-friendly graphical interface for configuring and monitoring the system. This could include a web-based dashboard or a dedicated software application for ease of use.

By exploring these future enhancements, the project can evolve into a more advanced and feature-rich motion detection system, catering to diverse applications and addressing emerging technological trends.

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[1] Rokhsana Titlee and Muhibul Haque Bhuyan, “Design, Implementation and Testing of Ultrasonic High Precision Contactless Distance Measurement System Using Microcontroller”, SEU Journal of Science and Engineering, vol. 10, no. 2, 2016

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Sharanya Ghosh	210911252	49	V (IT)	C

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by Hari Narayanan M

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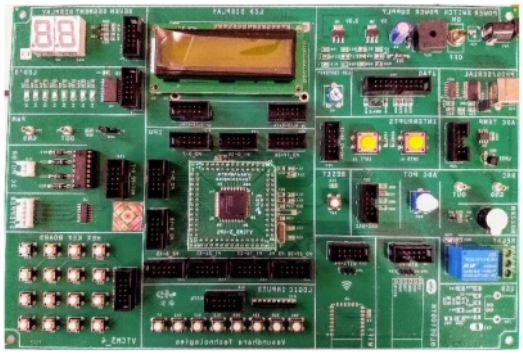

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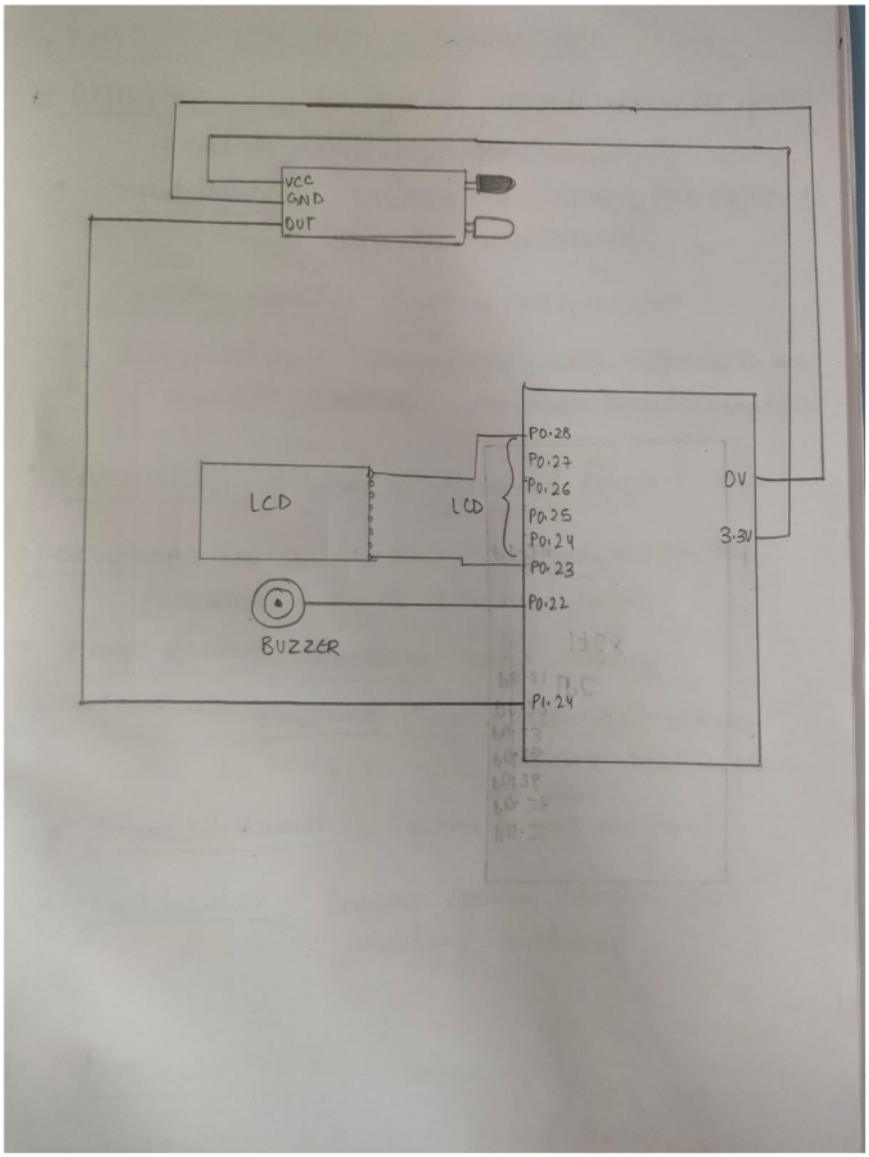

Fig 2. Circuit Diagram used for the project

4. Embedded C Working Code:

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#include <stdio.h>

int temp1, temp2, flag1, i, x;

void delayMS(unsigned int k) {
    for (i = 0; i < k * 100; i++);
```

```
}

void port_write(void);
void lcd_write(void);
void buzz_init(void);

int main() {
    int command[] = {3, 3, 3, 2, 2, 0x01, 0x06, 0x0C, 0x80};
    char message1[] = "Obstacle Present!";
    char message2[] = "No Obstacle.";

    SystemInit();
    SystemCoreClockUpdate();

    LPC_PINCON->PINSEL0 = 0;

    LPC_PINCON->PINSEL3 = 0; // for sensor
    LPC_GPIO1->FIODIR = 0;
    LPC_PINCON->PINSEL1 |= 0;
    LPC_GPIO0->FIODIR |= 0X3F << 23;
    flag1 = 0;
    for (i = 0; i < 9; i++) {
        temp1 = command[i];
        lcd_write();
    }
    flag1 = 1;
    i = 0;

    while (1) {
        if ((LPC_GPIO1->FIOPIN & (1 << 24)) == 0) {
            i = 0;
            buzz_init();
            while (message1[i] != '\0') {
                temp1 = message1[i];
                lcd_write();
                i++;
            }
        } else {
            i = 0;
            LPC_GPIO0->FIOCLR = 1 << 22;
            while (message2[i] != '\0') {
                temp1 = message2[i];
                lcd_write();
                i++;
            }
        }
        flag1 = 0;
```

```
        temp1 = 0x01;
        lcd_write();
        flag1 = 1;

        delayMS(950);
    }
}

void port_write() {
    int j;
    LPC_GPIO0->FIOPIN = temp2 << 23;
    if (flag1 == 0) {
        LPC_GPIO0->FIOCLR = 1 << 27;
    } else {
        LPC_GPIO0->FIOSET = 1 << 27;
    }
    LPC_GPIO0->FIOSET = 1 << 28;
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void lcd_write() {
    temp2 = (temp1 >> 4) & 0xF;
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```

Demonstration Of the lift automaton System using Lpc1768:

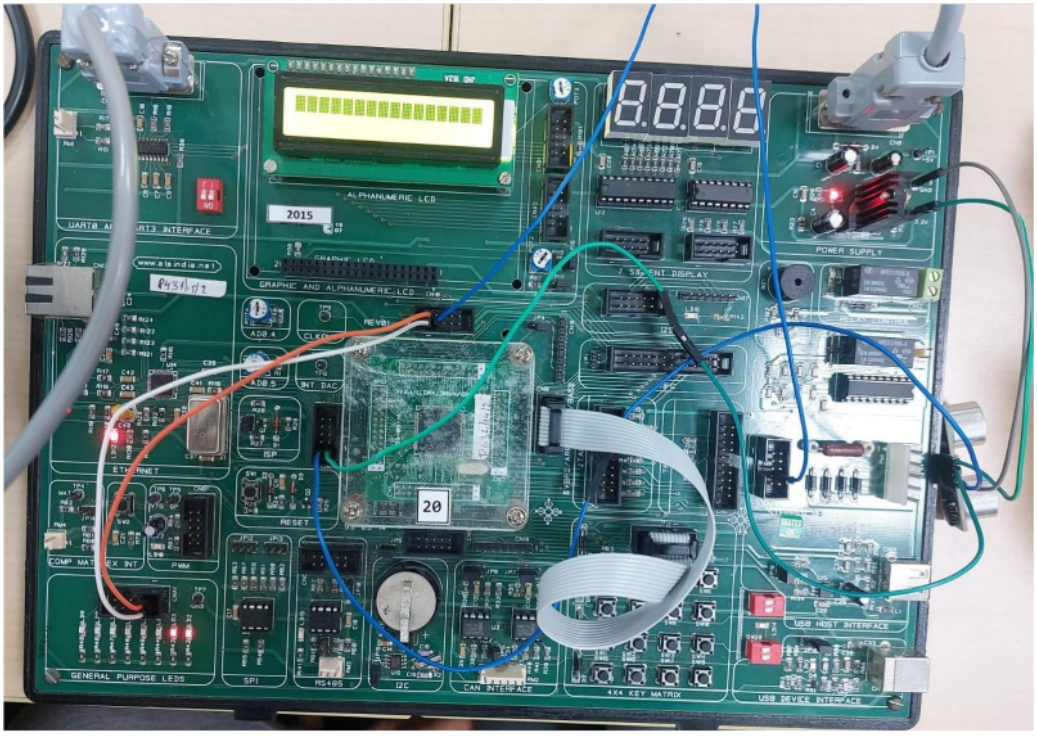

Fig 3. Working Project

98. Conclusion:

In order to achieve motion detection functionality, the project successfully implemented an Infrared (IR) sensor interfaced with the LPC1768 microcontroller. When motion is detected, the system not only sounds a buzzer but also uses the Analog-to-Digital Converter (ADC) output to increase sensitivity. The project's scope is increased beyond simple motion detection thanks to this integration, which enables a flexible and programmable solution. The project demonstrates the practical application of these technologies in security and automation contexts by demonstrating a comprehensive and effective motion detection system through the utilization of IR sensors and theLPC1768microcontroller.

99. Future Scope:

The project on IR sensor interfaced with the LPC1768 microcontroller for motion detection presents several avenues for future enhancements and expansions:

Wireless Connectivity:
Integrate wireless communication modules (such as Wi-Fi or Bluetooth) to enable remote monitoring and control. This could enhance the system's flexibility and accessibility.

Cloud Integration:
Implement cloud connectivity to store and analyze motion detection data. This would enable users to access historical data and receive real-time alerts through cloud-based platforms.

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- Integrate the system with smart home platforms, allowing users to incorporate motion detection into broader home automation scenarios. For example, triggering lights, thermostats, or security cameras based on detected motion.

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