



CSE360

Computer Interfacing

Project Title: Intrusion Detection System

Section: 01

Group: 02

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Introduction

An Intrusion Detection System (IDS) is a security measure that watches and analyses network or system activity to find and report any malicious or strange behaviour. Arduino is an open-source microcontroller platform that can be used to build a wide range of electronic gadgets and systems. It has become a popular choice for building IDSs for small-scale applications because of its small size, little power consumption, and cheap. IDSs that use sensors like motion detectors, temperature sensors, and proximity sensors to identify intrusions can be designed and built with Arduino. The IDS can then set off a warning or send a message to warn the security staff about a possible security breach. An IDS that is built on Arduino has many benefits, such as being easy to change, cheap, and easy to use. It can also work with other security tools, like firewalls, antivirus software, and systems that stop hackers from getting in. Overall, an Arduino-based IDS is an effective and cost-efficient way to detect and stop small-scale intrusions in homes, small businesses, and industrial control systems, among other places.

Application Area

Intrusion Detection Systems (IDS) are often used in a wide range of situations to find and warn security staff or system managers about possible security breaches or attempts to get in without permission. This is used in banks and other places where people put or store important things.

Technology & Tools

1. Arduino Uno R3 SMD

Arduino Uno is the microcontroller that will be used to interpret the data collected from the sensors that are connected to it and will give output based on how it has been programmed.

2. Ultrasonic HC-SR04 Sensor

With the help of sonar, this sensor detects objects within a range of distances, i.e 0.02 metres to 4 metres. It operates at low power and is immensely easy to interface.

3. PIR Sensor

The PIR sensor can detect when a human or animal enters or leaves the sensor's field of view. When we want to respond to motion, this sensor is what we use in modern security systems, automatic light switches, garage door openers, and similar devices.

4. OLED Display

OLED stands for Organic Light Emitting Diode. An OLED display is a type of display technology that uses organic compounds to create light. OLED displays are made up of organic materials that emit light when an electric current is passed through them. OLED displays are known for their deep black levels, high contrast, and wide viewing angles. They also have fast response times and consume less power than traditional LCD displays, making them ideal for use in mobile devices, like smartphones and tablets.

5. Buzzer

An Arduino Buzzer is basically a beeper. The Arduino buzzer is a device that produces sound when an electric current is passed through it. The buzzer can be directly connected to the Arduino and produce different tones by giving different frequency electric pulses to the buzzer.

6. MB102 Breadboard

The breadboard is used to build circuits in which the parts can be added or taken away easily. Here, no soldering is required to connect the components.

7. SG90 Servo Motor

Servo motors contain a small DC motor that controls physical movement.

8. Softwares

Arduino IDE will be used for programming and the programming language that will be used is C. To design the circuit and its connections with the components, Tinkercad is used. Packages like "NewPing by Tim Eckel" are used for HC-SR04 Ultrasonic Sensor, Servo for servo motors, "LiquidCrystal I2C by Marco Schwartz" for 16x2 LCD display and Servo library to control the operation of servo motor.

Working Mechanism of Sensors

1. HC-SR04 Ultrasonic Sensor



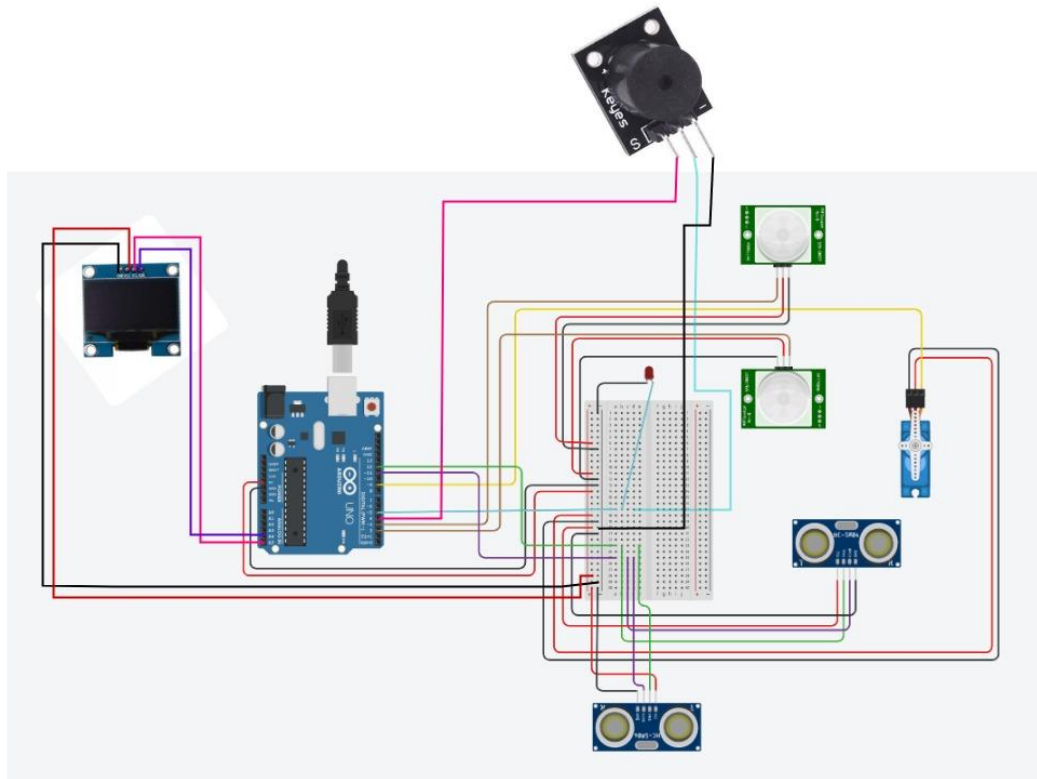
The HC-SR04 ultrasonic sensor includes a transmitter and a receiver. The transmitter converts the electrical signal into 40 KHz ultrasonic sound pulses. The receiver then receives these pulses, and it produces an output pulse whose width is proportional to the distance of the object in front. So, it can be used to detect an obstacle from 2 cm to 400 cm with an accuracy of 0.3 cm.

2. PIR Sensor

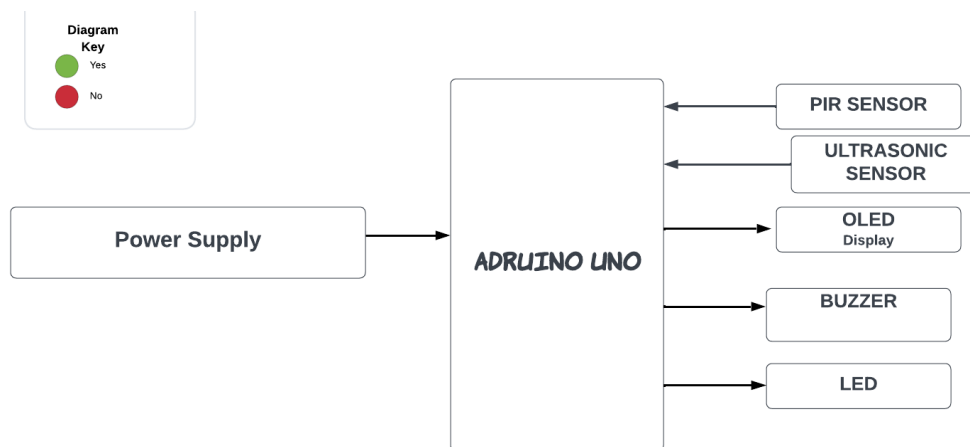


A passive infrared (PIR) sensor works by detecting changes in the amount of infrared radiation given off by objects present in its field of view. The sensor is made of pyroelectric material, which generates a voltage when exposed to changes in infrared light. The energy is then boosted and put through a computer to find movement. PIR sensors are often used to sense motion in security systems, automatic lighting, and other places. The PIR sensor works best to find moving things that are warmer or cooler than their surroundings, like people, animals, and cars. The sensor is made to be inactive, which means it does not give off any radiation and can work in the dark.

Connection with ICs



Data Flow



HC-SR04 Ultrasonic Sensor

The Trig (trigger) pin is used to trigger ultrasonic sound pulses, and it is connected with digital pin 12 of Arduino Uno. By setting this pin to HIGH for 10 μ s, the sensor initiates an ultrasonic burst. The echo pin goes high when the ultrasonic burst is transmitted and remains high until the sensor receives an echo, after which it goes low. Echo pin is connected with the analog pin 11 of Arduino Uno. By measuring the time the echo pin stays high, the distance can be calculated. If the distance between the intruder and ultrasonic sensor is close enough, it will detect and show a signal that an intruder is here.

PIR Sensor

The PIR sensor has 3 pins. They are - VCC, GND and OUTPUT pins. The signal from the PIR sensor is sent out through the OUT pin. This pin will go high when the sensor recognizes motion, which indicates that motion has been detected. The OUT pin can be linked to any digital pin on the Arduino. In our project, the Out pin is connected to Digital Pin 3 and Digital Pin 2. The VCC pin is connected with the 5V pin of Arduino UNO, which takes in power input to operate. The ground (GND) pin of the PIR sensor is connected with the GND of Arduino UNO to complete the circuit.

OLED Display

There are four pins in an OLED panel - +VCC, SDA, SCL, and GND. The sensor gets power from the 5V pin on the Arduino Uno, which is linked to the Vcc pin. Ground Pin is linked to GND. The A4 and A5 pins are linked to the SDA and SCL pins. When both PIR sensors sense movement, the OLED display will start to show a count for each person's entrance. When someone leaves the room, the OLED will decrease the count on the OLED display.

Buzzer

The buzzer has three pins. They are VCC, GND and Control Pin. The buzzer's control pin is linked to the Arduino board's digital 4 output pin in our project. Vcc is connected to the 5V pin on the Arduino Uno. The GND pin of the buzzer is connected to the Arduino board's ground (GND) pin. When an intruder is detected the buzzer gets on and will make a beep sound.

Servo Motor

Three cables are required to connect a servo motor to an Arduino board: power, ground, and control data. To power the motor, the power and ground wires are connected to the Vcc and

GND pin on the board. The control signal is connected to digital output pin 9 in order to control the motor's position. According to the project, the red wire is connected to Vcc, while the brown ground wire is connected to the Gnd pin on the Arduino board. After 20 seconds, if an intrusion is detected, the motor will commence to close the door permanently.

LED

LED (Light Emitting Diode) can be attached to any digital pin on Arduino. Pin 13 is the most frequently used digital pin for connecting an LED, as it is typically connected to the LED on the Arduino board. To attach an LED to an Arduino, we must connect the anode (long leg) of the LED to a digital pin on the Arduino and the cathode (short leg) of the LED to a ground pin on the Arduino board. Positive terminal is connected to Digital Pin 2 in our . When an intruder is present and the buzzer sounds, the led illuminates simultaneously.

Estimated Cost Analysis

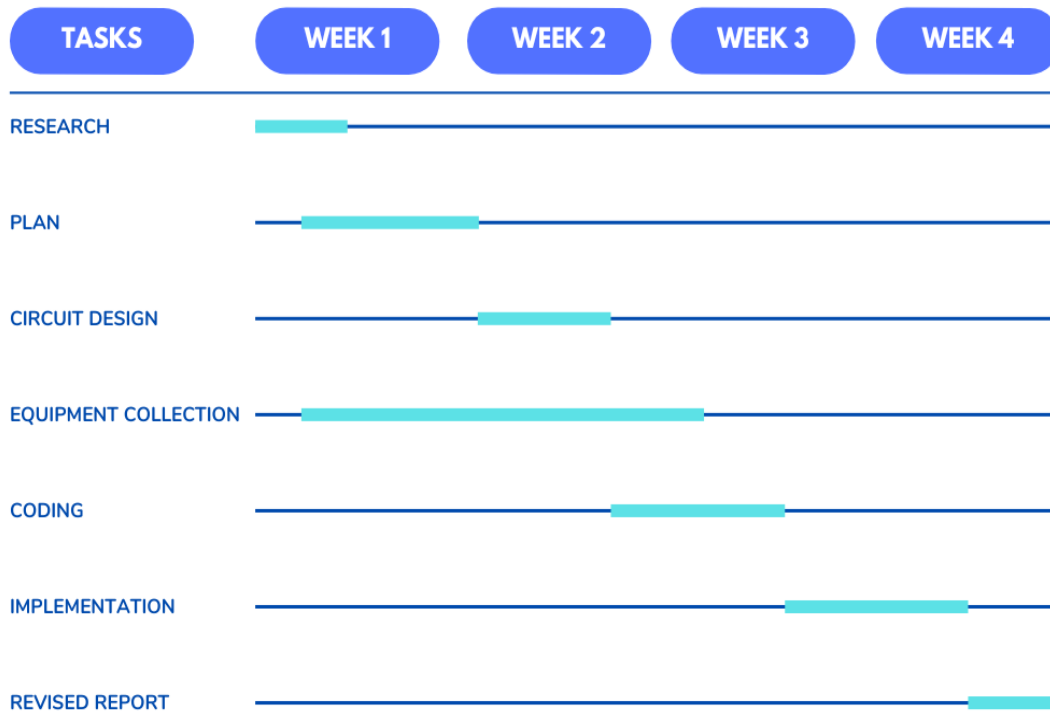
Component	Quantity	Price (BDT)
Arduino Uno R3 SMD	1	860
HC-SR04 Ultrasonic Sensor	2	180
PIR Motion Sensor	2	160
OLED Display	1	345
5 mm Red Led	5	5
MB102 Breadboard	1	145
Mini Servo SG90	1	138
On/Off Switch Mini	1	6
Buzzer	1	59
Jumper wire: Male to Female	100	100
Jumper wire: Male to Male	100	100

Grand Total =	2098
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Responsibilities of Each Member

Name	Responsibility
Moin Uddin	<ul style="list-style-type: none"> Report writing and circuit connections
Mahir Aseef	<ul style="list-style-type: none"> Coding and circuit connections
Valentina Mithylin	<ul style="list-style-type: none"> Report writing and circuit connections
Shahadat Ahmed	<ul style="list-style-type: none"> Coding and circuit connections
Muhammad Farhan Rahman	<ul style="list-style-type: none"> Report writing and circuit connections

Gantt Chart



References

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5. <https://www.arduino.cc/reference/en/libraries/servo/>
6. <https://www.arduino.cc/reference/en/libraries/newping/>