AUTOMATIC DOOR OPENING SYSTEM

A PROJECT REPORT

SUBMITTED IN COMPLETE FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE

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BACHELOR OF TECHNOLOGY

IN

INFORMATION TECHNOLOGY

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INTRODUCTION:

In this modern-day, everything around us becoming automated which makes our life more easy and more advanced. One of the most common systems is the automatic sliding door opening and closing system. We all must have seen this type of automatic sliding door in hotels, shopping malls, theatres, and other commercial buildings. These are the highly visited places where a person is always required to open and close the door for visitors. To reduce human effort most commercial buildings are used automatic sliding doors. This system is used to open the door when a person comes in front of the entrance of the door and closes it automatically after entering into the door.

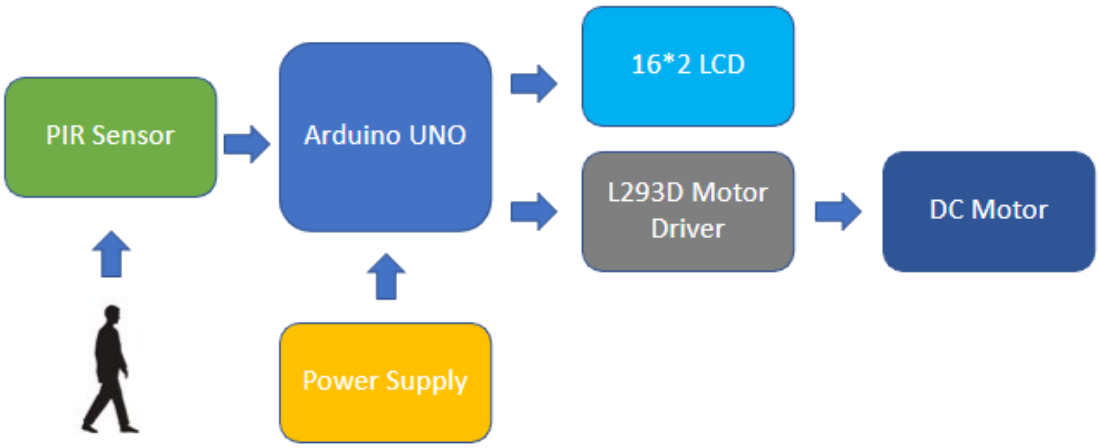
PROJECT CONCEPT:

This project concept is very simple and easy to construct. The main parts of this project are Arduino, PIR Sensor, motor driver IC, and an old PC DVD writer. Where the Arduino is the main microcontroller that will be used to control the whole system. The PIR sensor is able to sense the infrared energy produced by the human body. For this reason, in this project is used to detect human movement. The motor driver IC is used to control the DC motor of the door.

This system works like that when someone comes in front of the door (PIR Sensor), then the PIR sensor detects a motion and produces high output. Arduino read that output and send commands to the L293D motor driver IC to open the door by controlling the DC motor of the DVD writer.

When nobody is present in front of the door, the PIR sensor doesn't detect any motion and produces high output. Again, the Arduino reads this that output and sends commands to the L293D motor driver IC to close the door by controlling the DC motor.

BLOCK DIAGRAM

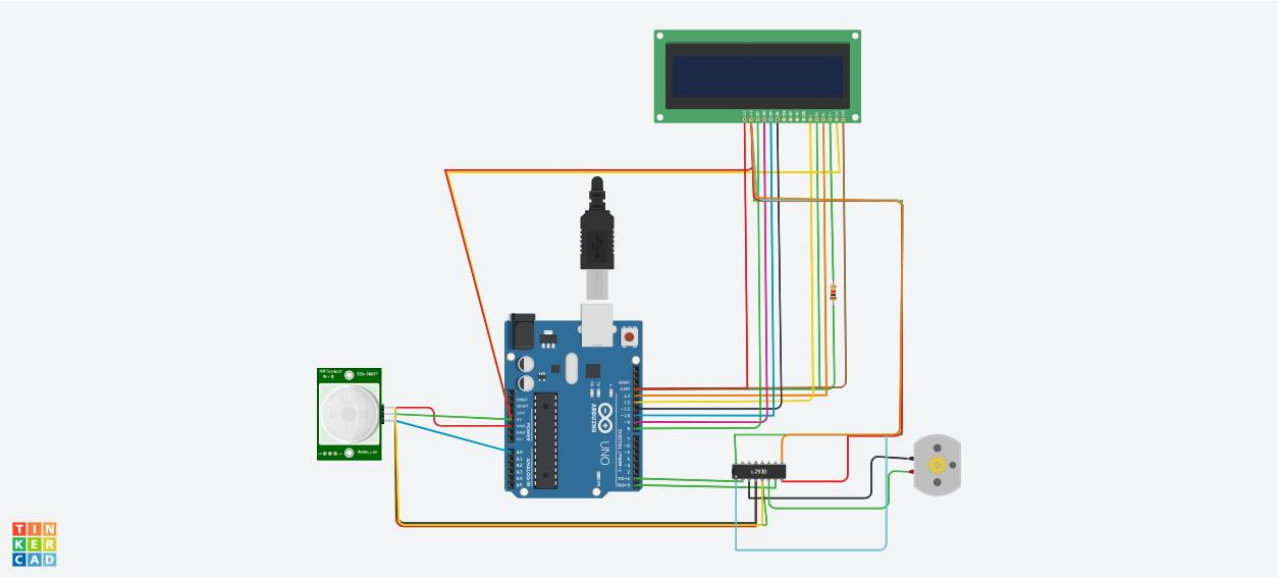


HARDWARE REQUIREMENTS:

1. Arduino UNO
2. 16x2 LCD
3. PIR Sensor
4. Connecting wires
5. 1 k resistor
6. Power supply
7. Motor driver (L293D)
8. DC Motor

This circuit was implemented on Autodesk Tinkercad.

CIRCUIT DESIGN:



In this project, we have used Arduino Uno as the microcontroller to control the system.

At first, connect the Signal pin of the PIR Sensor to the Analog IN A0 pin of Arduino. The power and GND pins of the PIR Sensor are connected to +5V and GND of Arduino respectively.

Now coming to the Motor Driver, here we have used the first channel of the L293D Motor Driver Module to control the motor. Hence, the IN1 and IN2 of the Motor Driver are connected to Digital Pins 1 and 0 of Arduino respectively. Now, using the Output 1 and Output 2 pins we can control the DC Motor used to open and close the gate.

In the project, we have used the DC motor that is a 5V Motor. So, we have connected the enable 1,2,3,4 and power 1 and power 2 pins of the L293D to the LED anode pin of the 16*2 LCD which is in turn connected to the 5V pin of the Arduino UNO. So constant 5V is supplied to the motor driver. The Ground pins of the motor driver are connected to the GND pin of the Arduino.

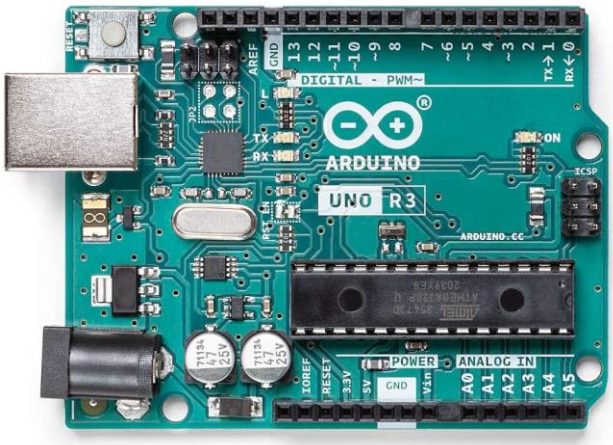
Now, coming to the connections of the 16*2 LCD. The LED cathode pin is connected to the GND pin of Arduino. The DB4, DB5, DB6, DB7 pins are connected to digital pins 11, 10, 9, 8.

The enable(E) pin is connected to digital pin 12. The register select (RS) pin is connected to digital pin 13. The GND, V0 and read/write (RW) pin are connected to the GND pin of the Arduino. The Vcc pin is connected to the +5V pin of the Arduino which powers the LCD.

DESCRIPTION OF COMPONENTS:

ARDUINO UNO:

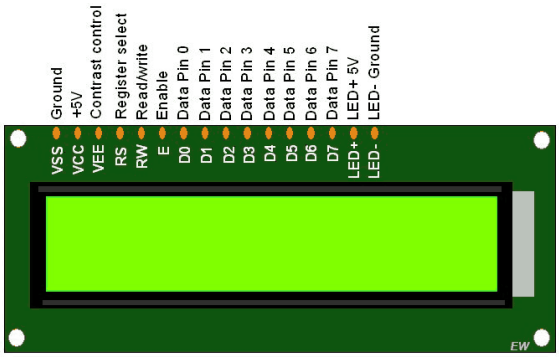
Arduino/Genuino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.



L.C.D:

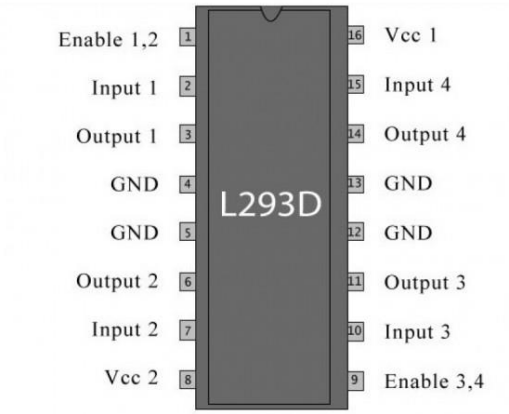
Here we are using a 16x2 L.C.D which is a dot matrix Liquid Crystal Display. Its function is to display the alphanumeric symbols to indicate the status message of the circuit. This L.C.D can display the two lines and each line contains 16 characters. This

L.C.D contains an internal oscillator circuit to work in synchronization with the controller. Data pins of LCD(DB0-DB7) describes the current status of system and three control pins RS, RW and E controls the state of the LCD. The RS pin determines whether a command is sent(RS=0) or direct data is sent(RS=1). The RW pin decides if the data is written on the LCD(RW=0) or read from it(RW=1). In this circuit RW is grounded, which means the LCD is always on write mode. The V0 pin is used to contol the display contrast of the LCD. It is connected to the ground pin and a resistor of 1K ohm resistance is applied in between.



D.C Motor Drive:

It is a machine used to convert the electrical energy into mechanical energy. This D.C motor uses a 5V battery as an input through a Switching Relay and rotate to open the door or to lock the door. To interface this D.C motor drive with the Micro Controller we use an L293D I.C.



PIR Sensor:

PIR sensor detects any change in heat, and whenever it detects any change, its output PIN becomes HIGH. They are also referred as Pyroelectric or IR motion sensors.

Here we should note that every object emits some amount of infrared when heated. Human also emits infrared because of body heat. PIR sensors can detect small amount of variation in infrared. Whenever an object passes through the sensor range, it produces infrared because of the friction between air and object, and get caught by PIR.

The main component of PIR sensor is Pyroelectric sensor shown in figure (rectangular crystal behind the plastic cap). Along with BISS0001 ("Micro Power PIR Motion Detector IC"), some resistors, capacitors and other components used to build PIR sensor. BISS0001 IC take the input from sensor and does processing to make the output pin HIGH or LOW accordingly.

Pyroelectric sensor divides in two halves, when there is no motion, both halves remain in same state, means both senses the same level of infrared. As soon as somebody enters in first half, the infrared level of one half becomes greater than other, and this causes PIRs to react and makes the output pin high.

Pyroelectric sensor is covered by a plastic cap, which has array of many Fresnel Lens inside. These lenses are curved in such a manner so that sensor can cover a wide range.

WORKING PRINCIPLE

Generally, the human body emits infrared energy. When a human body comes in the detection range of the PIR sensor then it detects the infrared energy of the human body and gives High output (+5v) from the output pin. When it doesn't detect the infrared energy of the human body, then it gives Low output (0) from the output pin. In this way, the PIR sensor detects motion and produces output.

WORKING

In this automatic sliding door opening and closing system, the PIR sensor is placed at the top of the entrance. When a person comes in the range of PIR Sensor, then the PIR sensor detects the motion of that person and its Signal Pin will become HIGH (+5). Then the Analog IN pin A0 of Arduino read this HIGH output and it understands that there is a person approaching the door. Then the digital pin 1 and pin 0 of Arduino become High (+5) and Low (0) respectively that immediately activates the L293D Motor Driver module to start rotating the DC motor at one direction and the door opens.

After some time, if movement is not detected, the digital pin 1 and pin 0 of Arduino become Low (0) and High (+5) respectively, which will once again activate the L293D Motor Driver module to start rotating the DC motor in another direction. Now the door will close automatically.

ALGORITHM:

- Start.
- Initialize LCD.
- Print "Automatic door opener" on the LCD.
- Clear LCD.
- Print "CIRCUIT READY".
- If movement is seen in the PIR sensor, open the door in the first iteration and print "Movement Seen Door Opened".
- For further iterations of PIR signal being high, keep the door opened.
- If the PIR signal is low, for the first iteration close the door and print "Gate Closing" and "Gate Closed."
- For further iterations, keep the door closed and print "No Movement Gate Closed."

CODE:

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(13, 12, 11, 10, 9, 8);
#define PIR_sensor 14
#define motor1 0
#define motor2 1
void setup()
{
  lcd.begin(16, 2);
```

```
  pinMode(motor1, OUTPUT);
  pinMode(motor2, OUTPUT);
  pinMode(PIR_sensor, INPUT);
  lcd.print("    Automatic    ");
  lcd.setCursor(0,1);
  lcd.print("   Door Opener   ");
  delay(1000);
  lcd.clear();
  lcd.print("CIRCUIT READY ");
  delay(1000);
}
int f=0;
void loop()
{
  if(digitalRead(PIR_sensor)&&f==0)
  {
    lcd.setCursor(0,0);
    lcd.print("  Movement Seen");
    lcd.setCursor(0, 1);
    lcd.print("   Gate Opened    ");
    digitalWrite(motor1, HIGH);        // gate opening
    digitalWrite(motor2, LOW);
    delay(1000);
    f=1;
  }
  else if(digitalRead(PIR_sensor)&&f==1)
```

```
{
  digitalWrite(motor1, LOW);          // gate stop for a while
  digitalWrite(motor2, LOW);
  delay(1000);
}
else if(!digitalRead(PIR_sensor)&&f==1)
{
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print(" Gate Closing ");
  digitalWrite(motor1, LOW);          // gate closing
  digitalWrite(motor2, HIGH);
  delay(1000);
  lcd.clear();
  digitalWrite(motor1, LOW);          // gate closed
  digitalWrite(motor2, LOW);
  lcd.setCursor(0,0);
  lcd.print(" Gate Closed ");
  delay(2000);
  lcd.clear();
  f=0;
}
else
{
  lcd.setCursor(0,0);
  lcd.print("   No Movement   ");
```

```
    lcd.setCursor(0,1);
    lcd.print("   Gate Closed   ");
    digitalWrite(motor1, LOW);
    digitalWrite(motor2, LOW);
  }
}
```

CODE EXPLANATION:

For the implementation of the automatic door opener, we have used the LiquidCrystal library. This library provides inbuilt functionalities to avoid giving inputs to the LCD in more complex machine language. We have defined pin 14(A0) of the arduino as PIR_sensor as it takes input from the PIR, and pins 1 and 0 as motor1 and motor2 respectively as these pins give the input to the motor driver to open and close the door. If pin 1 is high and pin 0 is low, then the door gets opened. If both the pins are low, the door stays in its current stage and if pin 1 is low and pin 0 is high, the door gets closed. Now, we define pins 13 and 12 as RS and RW respectively and pins 11,10,9,8 as the data pins(d4,d5,d6,d7). Motor1 and Motor2 are defined as outputs and PIR_sensor is defined as the input to the arduino. Delays are used to keep displaying whatever is displayed on the screen for a longer time. If PIR_sensor is HIGH, then motor1 is set to HIGH and motor2 is set to LOW to open the door and then both the outputs are set to LOW to keep the door opened until a LOW signal from PIR_sensor is encountered. When a LOW signal comes, motor1 is set to LOW and motor2 is set to HIGH to close the door and then both the outputs are set to LOW to keep the door closed until movement is detected by the PIR sensor.

ADVANTAGES OF AUTOMATIC DOORS

Style options

One of the best things about automatic doors is that it comes in an array of different styles, shapes, colours, finishes and designs. This not only lends your residential or commercial premises an eloquent and sophisticated look but also helps enhance its reputation as well. Available in three basic configurations, -swinging, sliding and folding doors, when you choose automatic doors, one thing is for sure, you don't have to sacrifice form for function. Additionally, they are available in tough, sturdy and durable materials such as aluminium, steel, fibreglass, and timber that enhances or compliments any home or business's unique style.

Convenience

Automatic doors don't necessitate any human effort or force to perform their operation. It helps do away from the struggle and aggravations when it comes to opening a relatively heavier manual door. Moreover, as their operation doesn't require the use of hands, they provide unparalleled access for the elderly, handicapped and those with children in tow. Furthermore, they are helpful for people carrying heavy packages, luggage's or children. Automatic doors grant you the option to open and close the door manually as well.

Energy-Savings

Automatic doors effectively contribute to energy saving and reduce annual heating and cooling costs. Doors open only when activated and automatically close so to eliminate the doors being left open. They also prevent air-conditioning from escaping and outside air and dust from entering.

Hygiene Control

The hands-free operation of automatic doors offer a optimal solution to hospitals and food factories where sanitation is essential. Automatic door with air-tight function can

also prevent the entry of dust and dirt by increasing the air pressure of the room, which is suitable for operating rooms and other controlled environments.

DISADVANTAGES OF AUTOMATIC DOORS

Installation and Maintenance

The installation process of automatic doors mandates the need of a professional technician in order for it to be accurate and efficient. They also require regular maintenance and check-ups to guarantee proper functioning which also can be expensive. This means that the expenses do not end upon installation. If repairs are required, replacement parts can be costly. Sometimes owing to power failures, electrical gates cease to work causing inconvenience which might require you to physically set the gate to open and close or call in a technician to look at it.

Pricing

Automatic doors are definitely more pricey as compared to their manual counterparts. Due to the presence of many automatic features, automatic doors can be expensive to procure and mandates a high budget. Moreover, in the case of repairs, they are comparatively more expensive as compared to traditional doors.

Cleaning

Automatic doors are more difficult to clean as you need to polish and oil internal parts like springs and bolts to avoid it from rusting. They also require constant services and inspections that all need to be paid for. In the case of metal gates, they might need periodic repainting and maintenance to prevent it rusting. Automatic doors with wooden frames can look washed out and unsightly over time, making them very difficult to take care of.

CONCLUSION AND FUTURE SCOPE:

The implementation of automatic door opening system using Arduino UNO and PIR sensor is straightforward and simple. These types of systems are extensively used in shopping malls and hotels and in places where doors are needed to be opened repeatedly. These systems reduce human effort and increase the hygiene of a place. This system can also be implemented in a number of other ways. For example, instead of a PIR sensor, we can use a numpad to make a password protected door lock system. These systems are easily implementable, convenient, useful and has a lot of scope for future improvement. In the future, these systems can be implemented with a technology to store information regarding the entry and exit of customers. Different kinds of sensors can be used for different purposes. For places with greater security like locks and houses, password protected doors and doors with biometric scan security are used and for places which require easy access like malls and hotels, PIR sensors are used. The uses of automatic door opening systems are extensive and their application is only going to increase in the future.