Automatic Door Opening And Closing System Using Arduino

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Abstract - This paper illustrates the implementation of a system which is capable of opening and closing a door automatically by detecting a matter or a substance in close proximity. In this project we are trying to make an Automatic Door Open and Close Control System using some electronic components, mainly a board called Arduino. Along with the arduino board we also use an led , an IR sensor or a PIR sensor , a Cardboard door, a 5 V Dc Supply using a Laptop, a servo motor of 5 grams , a simple dc motor , a motor driver and some connecting wires for perfect working of the circuit.

Introduction

An Automatic Door Opener System is a simple project based on a PIR Sensor or an IR Sensor and Arduino that detects a person or object in close proximity and automatically opens and closes the door.

We all have encountered Automatic Door Opener Systems in shopping malls, movies, and hospitals, where the door automatically slides open as soon as a person approaches (at about 2 or 3 feet). After a short period of time (approximately 5 to 10 seconds), the door closes by sliding backwards. And before 10 seconds if there is again some movement or if there is someone near the door the door remains open.

Such Automatic Entrance Opener Systems are extremely convenient because they eliminate the need for a person to remain by the door and open it whenever a visitor arrives. It completely eliminates the job of a doorman. Furthermore, because the doors are only opened and closed when a person approaches them, there is substantially less noise.

These kinds of Arduino projects have many applications in real life. The Arduino-based Automated Door Opener System is a great project since it teaches you about the concept of automatic door openers and how they work.
These systems are already in use in a variety of locations, including malls, theaters, and hospitals. This Arduino-based project can be used in garage door openers, toilet cover openers, office door openers, and other applications.

Working Of The Circuit

Actually the Working of the Circuit is pretty simple. So there are two ways in which we can perform or carry out the project . Both ways have only one difference which is using different sensors for the purpose of object detection.

So we can either use a PIR sensor or an IR Sensor. The difference between two of them is that IR sensor detection is based on if the IR Wave that was transmitted by transmitter is received properly

and the PIR sensor uses energy level difference for object detection. In hardware we have used an IR sensor for simplification but there won't be any major change in the circuit, we would just need to replace the IR sensor with PIR.

Now the IR Sensor has Three pins, one gets connected to the Ground , other one to the 5v Vcc and the other one to the signal, digital pin 6 or 7.
The servo motor also has three terminals. One to the Ground ,other one to the Vcc and the Third one gives the signal at digital pin 9.

We can also attach some optional elements such as an LED or an LCD module which would glow up or show that the object has been detected. IR sensor generally is in High Mode , when an Object is in close proximity it's output becomes low. So, in the arduino code we have written that when the output of the IR sensor is high the servo will be at 180 degrees. And when it detects an object the outwill become low and the servo motor will be at 90 degrees.

Which would result in movement of the cardboard attached to the servo motor to move 90 degrees just like an actual door. Now after every loop in the arduino code we have given a small delay to detect any kind of further change. If the door is open again and an object is detected before the specified delay the gate will remain open and close after another delay.

ALL THE COMPONENTS REQUIRED

1. Arduino UNO
2. Servo Motor
3. Infrared Proximity Sensor
4. Cardboard Door
5. Power Supply
6. Led
7. USB A to B Cable
8. Breadboard

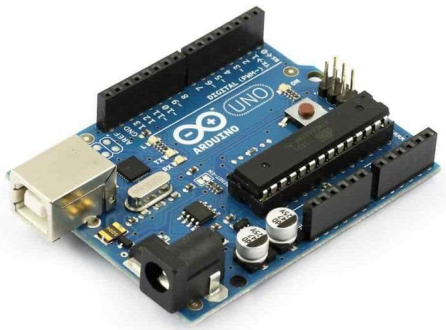
Component Description

Arduino

Arduino is an open-source electronics platform that uses simple hardware and software to make it easy to use. Arduino boards can take inputs - such as light from a sensor, a finger on a button, or a Twitter message - and convert them to outputs - such as turning on an LED, triggering a motor, or publishing anything online. By providing a set of instructions to the board's microcontroller, you may tell it what to do. The Arduino programming language (based on Wiring) and the Arduino Software (IDE) (based on Processing) are used to accomplish this.

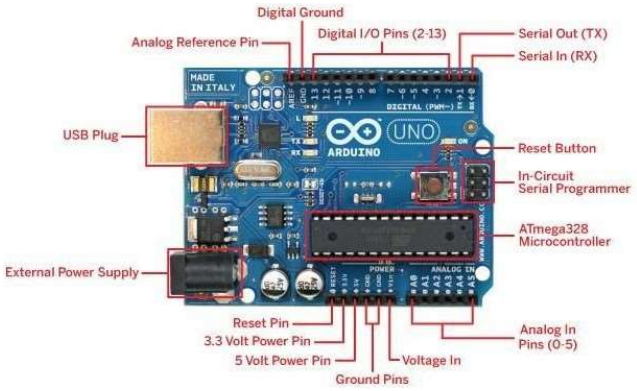
Thousands of projects have used Arduino throughout the years, ranging from simple household items to complicated scientific apparatus. This open-source platform has united a global community of makers, including students, hobbyists, artists, programmers, and professionals.

The Arduino/Genuino Uno microcontroller board is based on the ATmega328P microcontroller (datasheet). There are 14 digital input/output pins (six of which can be used as PWM outputs), six analogue inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button on the board. It comes with everything you'll need to get started with the microcontroller; simply plug it into a computer with a USB cable or power it with an AC-to-DC adapter or battery. You can tamper with your UNO without fear of making a mistake; if something goes wrong, you can replace the chip for a few dollars and start over.



Arduino Architecture

The Harvard architecture is used by Arduino's CPU, which means that the program code and program data have distinct memory. It is made up of two types of memories: programme memory and data memory. The data is saved in the data memory, while the code is kept in the flash programme memory. The Atmega328 is a 16MHz microcontroller having 32 KB of flash memory for storing code (0.5 KB of which is used for the bootloader), 2 KB of SRAM, and 1 KB of EEPROM.



Power Jack: Arduino can be powered either from the pc through a USB or through external source like adaptor or a battery. It can operate on an external supply of 7 to 12V. Power can be applied externally through the pin Vin or by giving voltage reference through the IORef pin.

Digital Inputs: It consists of 14 digital inputs/output pins, each of which provide or take up 40mA current. Some of them have special functions like pins 0 and 1, which act as Rx and Tx respectively , for serial communication, pins 2 and 3-which are external interrupts, pins 3,5,6,9,11 which provides pwm output and pin 13 where LED is connected.

Analog inputs: It has 6 analog input/output pins, each providing a resolution of 10 bits.

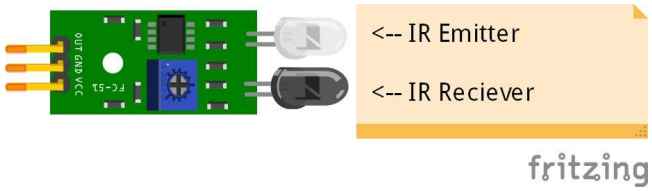
ARef: It provides reference to the analog inputs

Reset: It resets the microcontroller when low.

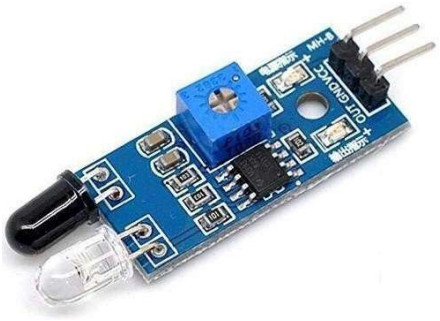
Ir proximity sensor

The IR Proximity sensor is a basic infrared sensor that detects obstacles. This sensor can be utilized in a variety of robotic applications, including obstacle avoidance robots, line follower robots, and other obstacle detection projects. This is an Active Infrared sensor, meaning it both emits and detects IR photons. A passive infrared sensor detects just the IR Rays generated by objects. The PIR Sensor is an example of a passive IR sensor.

Working Principle



Infrared lights are longer-wavelength electromagnetic radiations that are invisible to human vision. We have IR emitting and receiving LEDs in IR Sensors. When the angle of light and sensor collide across a long distance, the output is HIGH (+5v). When an impediment is present, the angle is reduced, and the receiving LED is unable to detect the IR wave. As a result, it will produce a LOW signal (0v). There are three connectors on the IR Sensor: two for power and one for output. A potentiometer is also included to calibrate the sensor.



Servo motor

A servomotor is a linear or rotary actuator that provides for exact control of position, acceleration, and velocity in linear or angular directions. It is made of a motor and a position feedback sensor. It also necessitates a complex controller, which is frequently a separate module created exclusively for servomotors.

A special form of electric motor application is one in which the motor's rotation is required for only a specific angle. For these applications, we need some unique motors with unique arrangements that cause the motor to revolve at a specific angle for a given electrical input (signal). The use of a servo motor is necessary for this. A servo motor is typically a simple DC motor with added servomechanism to regulate specified angular rotation (a typical closed-loop feedback control system). Servo systems are frequently employed in industrial applications nowadays.

Servo motors are also extensively employed to regulate the direction of motion in remote-controlled toy automobiles, and they are also widely utilized as the motor that moves the tray of a CD or DVD player. Aside from this, we witness hundreds of servo motor applications in our everyday lives.

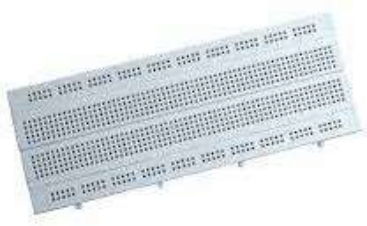
Using Servo With Arduino

The Servo Library is a great library for controlling servo motors. Servo motors have three wires: power, ground, and signal. The power wire is typically red, and should be connected to the 5V pin on the Arduino board. The ground wire is typically black or brown and should be connected to a ground pin on the board. The signal pin is typically yellow or orange and should be connected to the PWM pin on the board. In these examples, it is pin number 9. There are 2 modes of it working. They are given below:

- **Knob example** : Connect the potentiometer's two outer pins to power (+5V) and ground, and the potentiometer's middle pin to A0 on the board. Connect the servo motor to +5V, GND, and pin 9 after that.

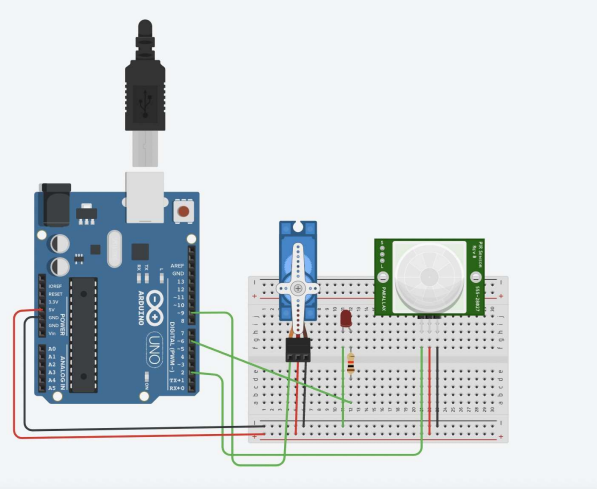
- **Sweep example**: Connect the servo motor to +5V, GND and pin 9.

Breadboard



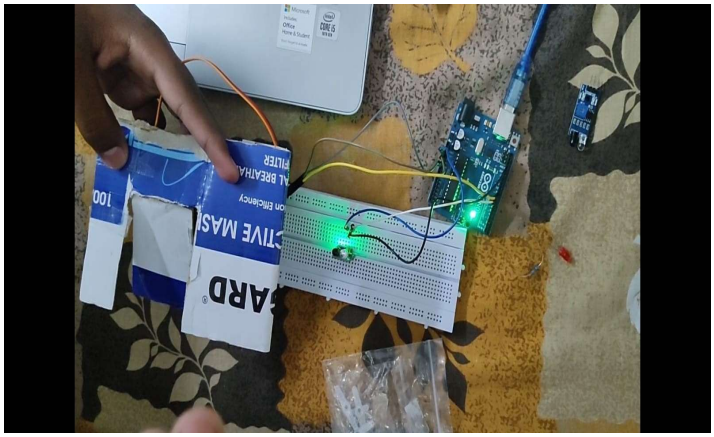
USB A to B Cable

Online Simulation Using Tinkercad



Note: *Using PIR Sensor here in Tinkercad Simulation*

Hardware Simulation



Note: *Using IR Sensor here in Hardware Simulation*

Code:-

```
#include <Servo.h>
Servo myservo;
int  led=6;
int pir=2;
void setup()
{
  pinMode(pir,INPUT);
  pinMode(led,OUTPUT);
  myservo.attach(9);
  Serial.begin(9600);
}
void loop()
{
  int val = digitalRead(pir);
  Serial.println(val);
  if(val==HIGH){
  digitalWrite(led,LOW);
  myservo.write(90);
  }
  else{
  digitalwrite(led,high);
  myservo.write(180);
  }
  delay(10);
  }
```

Applications:- There are several applications of automatic door open and close using Arduino, including:

1. Residential homes: An automatic door opener and closer can be used in homes to provide convenience, especially for people with disabilities or mobility issues.
2. Hospitals and healthcare facilities: Automatic doors can help healthcare professionals move equipment and patients between rooms more easily.
3. Commercial buildings: Automatic doors can be used in shopping malls, airports, and other public buildings to improve accessibility and reduce the spread of germs.
4. Educational institutions: Schools, universities, and other educational institutions can benefit from automatic doors, especially in areas with high traffic.
5. Manufacturing facilities: Automatic doors can be used in manufacturing facilities to improve safety and reduce the risk of accidents.
6. Government buildings: Automatic doors can be used in government buildings to improve accessibility for people with disabilities.
7. Hotels: Automatic doors can be used in hotels to provide convenience and improve security.

8. Parking garages: Automatic doors can be used in parking garages to control access and reduce the risk of theft.

Overall, automatic door openers and closers using Arduino can be used in a variety of applications to provide convenience, improve accessibility, and enhance security.

Conclusion

The Above mentioned Circuit can be used in the following ways. It can be very helpful for the disabled and the old people . If there is no object detected it will remain closed and it will save a lot of energy in the form of air conditioning. As it an also be implemented using face detection it can help with security applications and in this Period of Corona Terror it is better if everything can be acheived with minimal or no contact.

References

For Completion of this Project. we have taken a lot of help from books, videos and websites and which all of them are mentioned below:

[1]Arduino For Dummie By John Nussey

[2]https://www.electronicshub.org/automatic-door-opener-using-arduino/

[3https://www.arduino.cc/en/Guide

[4https://www.arduino.cc/reference/en/libraries/servo/

[5]https://www.elprocus.com/automatic-door-opening-system-project-circuit/

[6]https://create.arduino.cc/projecthub/Raushancpr/arduino-with-ir-sensor-1579b6

Note:- we don't have any bill of materials because we bought it from a local store near our hostel.