SMART GATE FOR PUBLIC PLACES

A Course project report submitted

in partial fulfilment of requirement

of

SMART SYSTEM DESIGN

by

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ABSTRACT

Automatic gate is one of the most useful things to use in companies, industries, colleges and schools. Automatic gates are important and very useful because it helps save time, reduces the physical energy applied to the opening and closing of the manual gate which saves energy and also saves gate operators from health hazards caused by exposing themselves to harsh weather conditions in the course of operating the manual gate. The gate was designed, constructed and mounted, the control unit and power supply unit were also designed and implemented. These various units were incorporated and implemented. The automatic gate was tested for speed and efficiency and from the generated results, it can be said that the gate is 90% efficient. The automatic gate senses an object either human within a distance of 1m . The automatic gate has helped reduce the stress of opening and closing the gate where buttons are pressed rather than the usual manpower used in operating the gate. This has made life easier and more comfortable.

CONTENTS

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Gates are commonly used at everywhere . A gate is a point of entry to a space enclosed by walls or fence. Gates may prevent or control entry or exit. The first gate introduced was completely manual such that anyone wanting to gain entrance has to do the manual work. The goal of the smart is to modify the current entrance to ensure the manual work is decreased. The gate here incorporates the use of actuator to control the movement of the gate automatically. The smart gate described here automates the entrances in public areas like parks, hospitals.. etc. The smart gate technology used eliminates gates monitoring and manning by human beings. It provides convenient access and intelligent features that makes it distinct from all the other gates used before.

The gate come with different type of mechanism such as sliding, swing, folding and barrier gate. It is programmed to automatically close the door after its been open for predetermined period of time. It enable fast and smooth control during the departure and arrival without the need of the manual work.

ADVANTAGES

- Decreases man power.
- Easy to enter and exit from a place.
- They are durable, and strong .
- Available in customized sizes.
- It saves our valuable time.
- It is contactless.

DISADVANTAGES

- Equipment and installation cost.
- Human errors.
- In case of power failure, malfunctioning system or anyone trapped inside your property, can cause inconvenience.
- There are no warnings or indications to the user ,if there is any functioning problem in smart gate.

1.2 OVERVIEW OF PROJECT

- As we belong to the modern era, we have to utilize the maximum possible resources which are there around us.
- It allows the user to enter and exit from a place with smart gate, In a effortless way.
- User can operate or even monitor the parameters of the respective devices from anywhere around the world.
- User can build a smart gate which is required near public places .

1.3 OBJECTIVES

Objectives for this project refer to the mission, purpose or standard that can be reasonably

Achieve within the expected timeframe and with the available resources. The objective of this project is to design an automatic gate mechanism for public places . Cost reduction and ease of installation are also considered for this mechanism.

CHAPTER 2

PROJECT DESCRIPTION

2.1 BLOCK DIAGRAM OF THE PROJECT

As shown in the below block diagram it mainly consists of an arduino, three sensors and three actuators. The three sensors are PIR sensor, Ultrasonic sensor and Photodiode and three actuators are Micro servo, Relay and Transistor. The output devices used are Buzzer and Bulb. Now these sensors, actuators and output devices are connected to arduino. The block diagram of the project is shown in fig. 2.1

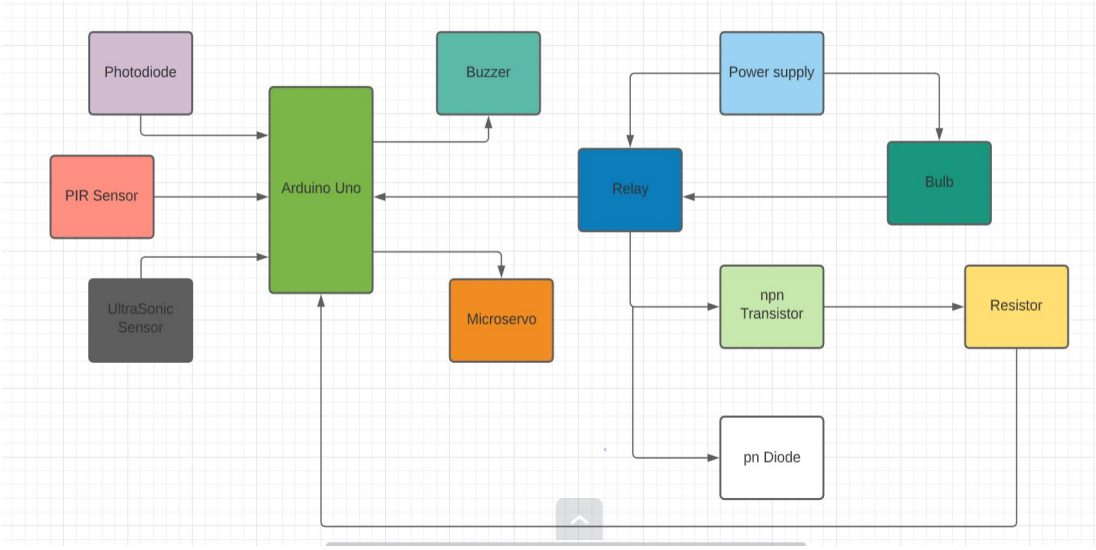


Fig. 2.1 Block Diagram

2.2 HARDWARE DESCRIPTION

2.2.1Arduino UNO

The fig 2.2.1 is an Arduino Uno, which is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode. Revision 3 of the board

has the following new features: 1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the AVR, which operate with 5V and with the Arduino Due that operate with 3.3V. The second one is a not connected pin, that is reserved for future purposes. Stronger RESET circuit. At mega 16U2 replace the 8U2. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)

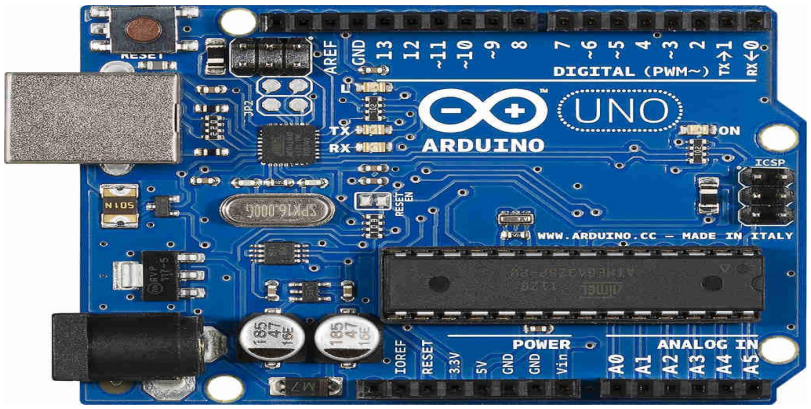


Fig. 2.2 Arduino Uno

Applications:

- Xoscillo, an open-source oscilloscope
- Arduinome, a MIDI controller device that mimics the Monome

- OBDuino, a trip computer that uses the on-board diagnostics interface found in most modern cars
- Gameduino, an Arduino shield to create retro 2D video games
- ArduinoPhone, a do-it-yourself cellphone
- Water quality testing platform
- Automatic titration system based on Arduino and stepper motor
- Low cost data glove for virtual reality applications
- Impedance sensor system to detect bovine milk adulteration
- Homemade CNC using Arduino and DC motors with close loop control by Homofaciens
- DC motor control using Arduino and H-Bridge

2.2.2 PIR Sensor

The below fig 2.2.2 is a Passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. PIR sensors are commonly used in security alarms and automatic lighting applications.

PIR sensors detect general movement, but do not give information on who or what moved. For that purpose, an imaging IR sensor is required.

PIR sensors are commonly called simply "PIR", or sometimes "PID", for "passive infrared detector". The term *passive* refers to the fact that PIR devices do not radiate energy for detection purposes. They work entirely by detecting infrared radiation (radiant heat) emitted by or reflected from objects.

A PIR sensor can detect changes in the amount of infrared radiation impinging upon it, which varies depending on the temperature and surface characteristics of the objects in front of the sensor. When an object, such as a person, passes in front of the background, such as a wall, the temperature at that point in the sensor's field of view will rise from room temperature to body temperature, and then back again. The sensor converts the resulting change in the incoming infrared radiation into a change in the output voltage, and this triggers the detection. Objects of similar temperature but different surface characteristics may also have a different infrared emission pattern, and thus moving them with respect to the background may trigger the detector as well.

PIRs come in many configurations for a wide variety of applications. The most common models have numerous Fresnel lenses or mirror segments, an effective range of about 10 meters (30 feet), and a field of view less than 180. Models with wider fields of view, including 360°, are available, typically designed to mount on a ceiling. Some larger PIRs are made with single segment mirrors and can sense changes in infrared energy over 30 meters (100 feet) from the PIR. There are also PIRs designed with reversible orientation mirrors which allow either broad coverage (110° wide) or very narrow "curtain" coverage, or with individually selectable segments to "shape" the coverage.

Fig. 2.2.2 PIR sensor

Features:

- Wide range on input voltage varying from 4.V to 12V (+5V recommended)
- Output voltage is High/Low (3.3V TTL)
- Can distinguish between object movement and human movement
- Has to operating modes - Repeatable(H) and Non- Repeatable(H)
- Cover distance of about 120° and 7 meters
- Low power consumption of 65mA
- Operating temperature from -20° to +80° Celsius.

2.2.3 Buzzer

The fig 2.2.3 is a buzzer or beeper, which is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Fig.2.2.3 Buzzer

Types of buzzers:

1. **Electromechanical**

Early devices were based on an electromechanical system identical to an electric bell without the metal gong. Similarly, a relay may be connected to interrupt its own actuating current, causing the contacts to buzz. Often these units were anchored to a wall or ceiling to use it as a sounding board. The word "buzzer" comes from the rasping noise that electromechanical buzzers made.

2. **Mechanical**

A joy buzzer is an example of a purely mechanical buzzer. They require drivers.

3. **Piezoelectric**

A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep.

Applications:

While technological advancements have caused buzzers to be impractical and undesirable, there are still instances in which buzzers and similar circuits may be used. Present day applications include:

- Novelty uses
- Judging panels
- Educational purposes
- Annactuator panels
- Electronic metronomes
- Game show lock-out device
- Microwave ovens and other household appliances
- Sporting events such as basketball games

2.2.4 Ultrasonic Sensor

Description:

The above fig 2.2.4 is Ultrasonic Sensor HC-SR04. It is a sensor that can measure distance. It emits an ultrasound at 40 000 Hz (40kHz) which travels through the air and if there is an object or obstacle on its path It will bounce back to the module. Considering the travel time and the speed of the sound you can calculate the distance. The configuration pin of HC-SR04 is VCC (1), TRIG (2), ECHO (3), and GND (4). The supply voltage of VCC is +5V and you can attach TRIG and ECHO pin to any Digital I/O in your Arduino Board.

Fig. 2.2.4 HC-SR04 Ultrasonic Sensor

Features:

- Supply voltage: 5V (DC).
- Supply current: 15mA.
- Modulation frequency: 40Hz.
- Output: 0 – 5V (Output high when obstacle detected in range).
- Beam Angle: Max 15 degrees.
- Distance: 2cm – 400cm.
- **Accuracy**: 0.3cm.
- **Communication**: Positive TTL pulse.

2.2.5 Photodiode

Description:

The below fig 2.2.5 is photodiode, which is a semiconductor device that converts light into an electrical current. The current is generated when photons are absorbed in the photodiode. Photodiodes may contain optical filters, built-in lenses,

and may have large or small surface areas. Photodiodes usually have a slower response time as their surface area increases. The common, traditional solar cell used to generate electric solar power is a large area photodiode.

Photodiodes are similar to regular semiconductor diodes except that they may be either exposed (to detect vacuum UV or X-rays) or packaged with a window or optical fibre connection to allow light to reach the sensitive part of the device. Many diodes designed for use specially as a photodiode use a PIN junction rather than a p–n junction, to increase the speed of response. A photodiode is designed to operate in reverse bias.

Fig. 2.2.5 Photodiode

Features:

- Wavelength Sensitivity (λP): 940nm.
- Open Circuit Voltage: 0.39V.
- Reverse breakdown voltage: 32V.
- Reverse Light current: 40μA.
- Reverse Dark current: 5nA.
- Rise Time/ Fall Time: 45/45nS.
- View Angle: 80 deg.
- Package: 5mm.

2.2.6 Relay

The above fig.2.2.6 is a relay, which is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple

contact forms, such as make contacts, break contacts, or combinations thereof. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations. The traditional form of a relay uses an electromagnet to close or open the contacts, but other operating principles have been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called protective relays.

Fig. 2.2.6 Relay

Types of Relay:

1. **Coaxial relay:** Where radio transmitters and receivers share one antenna, often a coaxial relay is used as a TR (transmit-receive) relay, which switches the antenna from the receiver to the transmitter. This protects the receiver from the high power of the transmitter.
2. **Contactor:** A contactor is a heavy-duty relay with higher current ratings,[14] used for switching electric motors and lighting loads. Continuous current ratings for common contactors range from 10 amps to several hundred amps.
3. **Force-guided contacts relay:**

A force-guided contacts relay has relay contacts that are mechanically linked together, so that when the relay coil is energized or de-energized, all of the linked contacts move together.

4. **Latching relay:**

   A latching relay, also called impulse, bistable, keep, or stay relay, or simply latch, maintains either contact position indefinitely without power applied to the coil.

5. **Machine tool relay:**

   A machine tool relay is a type standardized for industrial control of machine tools, transfer machines, and other sequential control. They are characterized by a large number of contacts (sometimes extendable in the field) which are easily converted from normally open to normally closed status, easily replaceable coils, and a form factor that allows compactly installing many relays in a control panel.

2.2.7 Micro servo

The below fig 2.2.7 is a servo motor, which is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

Servomotors are not a specific class of motor, although the term *servomotor* is often used to refer to a motor suitable for use in a closed-loop control system.

Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing.

A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft.

The motor is paired with some type of position encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller. If the output position differs from that required, an error signal is generated which

then causes the motor to rotate in either direction, as needed to bring the output shaft to the appropriate position. As the positions approach, the error signal reduces to zero and the motor stops.

The very simplest servomotors use position-only a potentiometer and bang bangcontrol of their motor; the motor always rotates at full speed (or is stopped). This type of servomotor is not widely used in industrial motion control, but it forms the basis of the simple and cheap servos used for radio-controlled models.

More sophisticated servomotors use optical rotary encoders to measure the speed of the output shaft and a variable-speed drive to control the motor speed.

Fig. 2.2.7 MicroServo

Applications

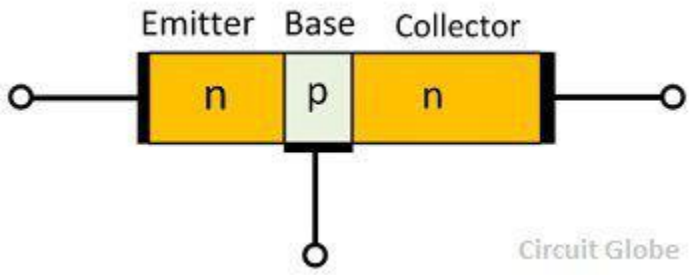
- Robotics: A servo motor at every "joint" of a robot is used to actuate movements, giving the robot arm its precise angle.
- Conveyor Belts: Servo motors move, stop, and start conveyor belts carrying product along to various stages, for example, in product packaging/bottling, and labeling.
- Camera Auto Focus: A highly precise servo motor built into the camera corrects a camera's lens to sharpen out-of-focus images.
- Robotic Vehicle: Commonly used in military applications and bomb detonation, servo motors control the wheels of the robotic vehicle, generating enough torque to move, stop, and start the vehicle smoothly as well as control its speed.

2.2.8 n p n Transistor

The below fig 2.2.8 is a transistor, in which one p-type material is placed between two n-type materials is known as **NPN transistor**. The NPN transistor **amplifies the weak signal** enter into the base and produces strong amplify signals at the collector end. In NPN transistor, the direction of **movement of an electron** is from the **emitter to collector** region due to which the current constitutes in the transistor. Such type of transistor is mostly used in the circuit because their majority charge carriers are electrons which have high mobility as compared to holes.

Fig. 2.2.8 npn Transistor

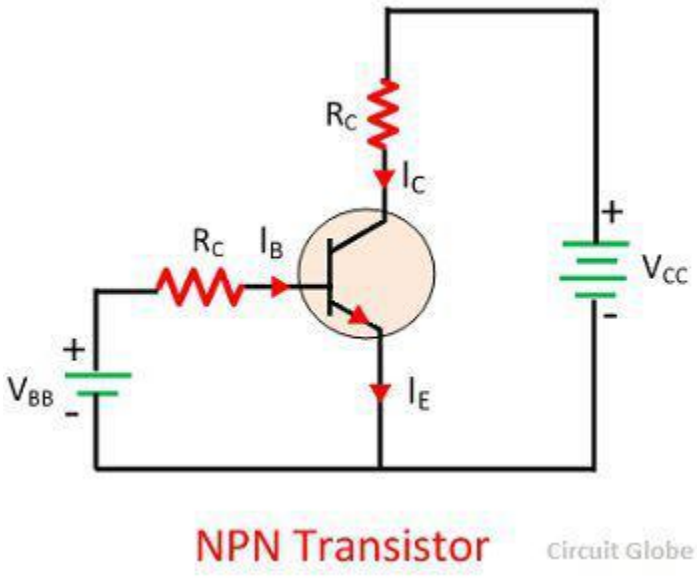
The NPN transistor has two diodes connected back to back. The diode on the left side is called an emitter-base diode, and the diodes on the left side are called collector-base diode. These names are given as per the name of the terminals.



The NPN transistor has three terminals, namely emitter, collector and base. The middle section of the NPN transistor is lightly doped, and it is the most important factor of the working of the transistor. The emitter is moderately doped, and the collector is heavily doped.

Circuit Diagram of NPN Transistor

The circuit diagram of the NPN transistor is shown in the figure below. The collector and the base circuit is connected in reverse biased while the emitter and base circuit is connected in forward biased. The collector is always connected to the positive supply, and the base is in negative supply for controlling the ON/OFF states of the transistor.



Working of NPN Transistor

The circuit diagram of the NPN transistor is shown in the figure below. The forward biased is applied across the emitter-base junction, and the reversed biased is applied across the collector-base junction. The forward biased voltage V_{EB} is small as compared to the reverse bias voltage V_{CB}.The emitter of the NPN transistor is heavily doped. When the forward bias is applied across the emitter, the majority charge carriers move towards the base. This causes the emitter current I_E. The electrons enter into the P-type material and combine with the holes.The base of the NPN transistor is lightly doped. Due to which only a few electrons are combined and remaining constitutes the base current I_B. This base current enters into the collector region. The reversed bias potential of the collector region applies the high attractive force on the electrons reaching collector junction. Thus attract or collect the electrons at the collector. The whole of the emitter current is entered into the base. Thus, we can say that the emitter current is the sum of the collector or the base current.

- Amplifying circuit applications usually have NPN transistors in them.
- They are also used in high frequency applications.
- The NPN Transistor are also present in some classic amplifiers and even in some of the 'push-pull' amplifiers.
- They are also used in the temperature sensing devices

2.3 SOFTWARE DESCRIPTION

The software used here is ARDUINO SOFTWARE:

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

Writing Sketches:

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

NB:

Versions of the Arduino Software (IDE) prior to 1.0 saved sketches with the extension pde. It is possible to open these files with version 1.0, you will be prompted to save the sketch with the ino extension on save.

Verify

Checks your code for errors compiling it.

Upload

Compiles your code and uploads it to the configured board. See uploading below for details.

Note: If you are using an external programmer with your board, you can hold down the "shift" key on your computer when using this icon. The text will change to "Upload using Programmer"

New

Creates a new sketch.

Open

Presents a menu of all the sketches in your sketchbook. Clicking one will open it within the current window overwriting its content.

Note: due to a bug in Java, this menu doesn't scroll; if you need to open a sketch late in the list, use the File | Sketchbook menu instead.

Save

Saves your sketch.

Serial Monitor

Opens the serial monitor.

Additional commands are found within the five menus: File, Edit, Sketch, Tools,and help.

Programming on arduinouno

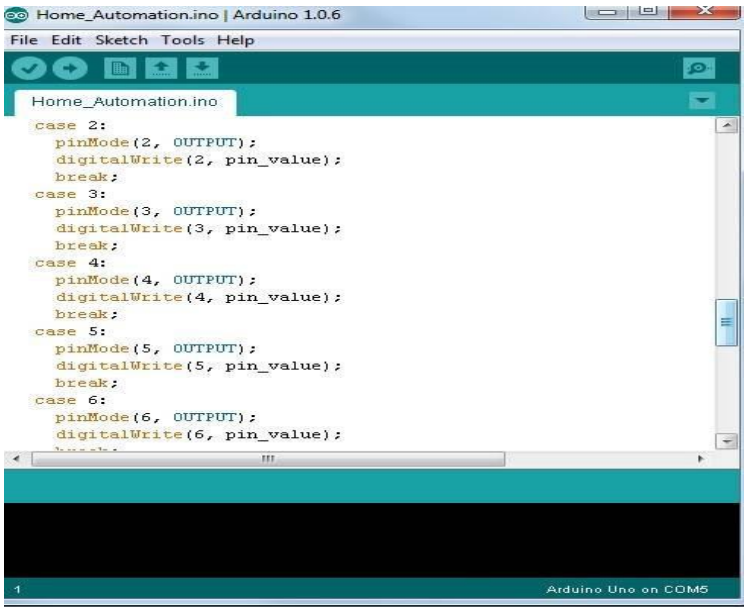


Fig.2.3.2 Software IDE

In order for the Arduino-Uno board to be able to interact with the application used in this project certain program (code) needs to be uploaded to the Arduino-Uno. Arduino Company provides user friendly software which allows writing any code for any function wanted to be performed by the Arduino-Uno and upload it to the board.Refer to appendix A for the full source code of the Arduino-Uno board.

CHAPTER 3

CIRCUIT DIAGRAM AND DESCRIPTION

3.1 Working

As shown in the below schematic diagram it mainly consists of an arduino, three sensors and three actuators. The three sensors are PIR sensor, Ultrasonic sensor and Photodiode and three actuators are Microservo, Relay and Transistor. The output devices used are Buzzer and Bulb. Now these sensors, actuators and output devices are connected to arduino. Whenever the PIR sensor detects the motion of the person, within the range of 1meter from the gate using ultrasonic sensor then immediately it sends an information to arduino, then arduino switches on the buzzer and opens the gate using microservo and the other sensor is photodiode . It detects the change in light intensity in its surroundings, and helps the bulb to turn on or off . The schematic diagram of the project is shown in fig. 3.1

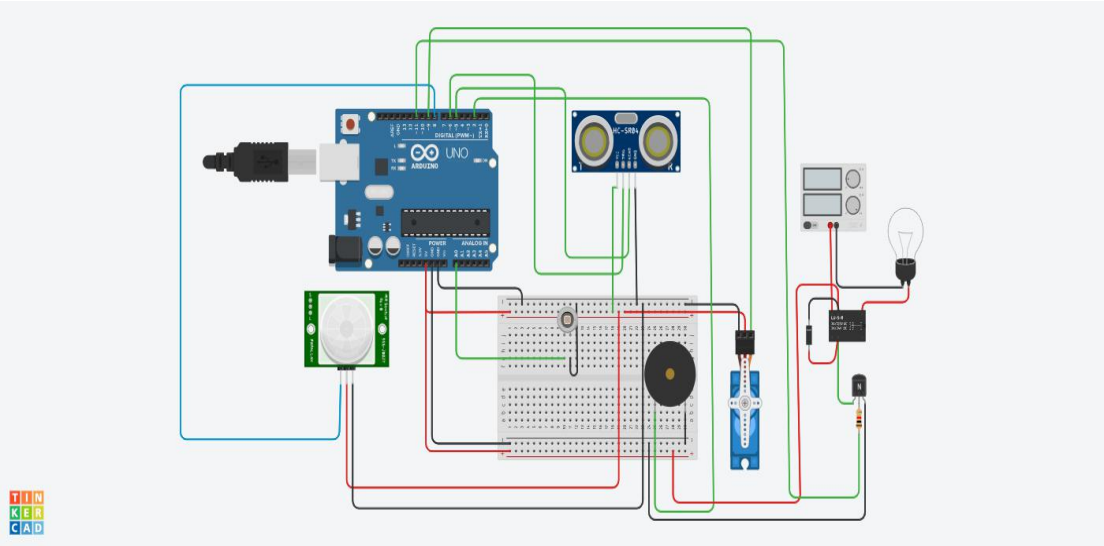


Fig.3.1 Schematic diagram

3.2 RESULTS

The below figure 3.2.1 gives the information that the PIR sensor is in active state i.e it detected the motion of the person.

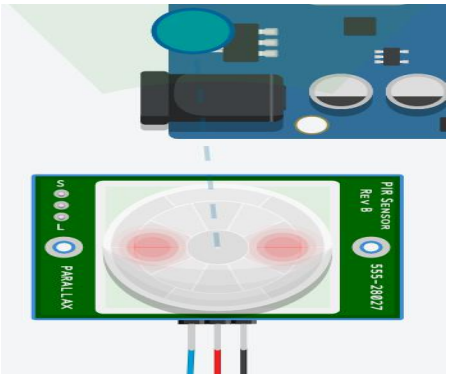


Fig.3.2.1 PIR sensor

The below figure 3.2.2 gives the information that the person is within the range of 1m from the sensor.

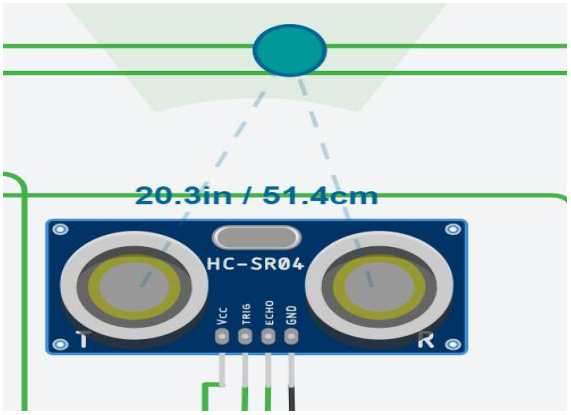


Fig.3.2.2 Ultrasonic sensor

The below figure 3.2.3 shows that, ringing of buzzer and opening of gate when person is detected and within the range of 1m.

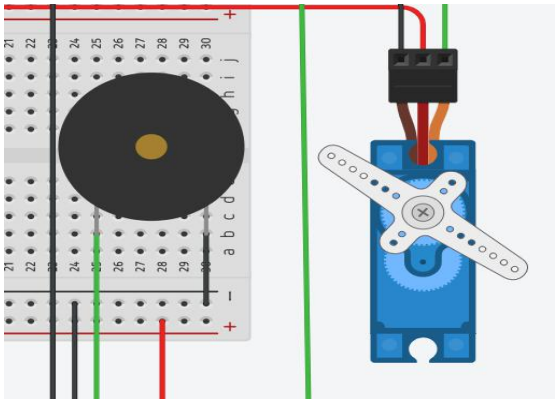


Fig.3.2.3 Buzzer and Microservo

The below figure 3.2.4 gives result that switching on bulb during night time and switching off bulb during day time.

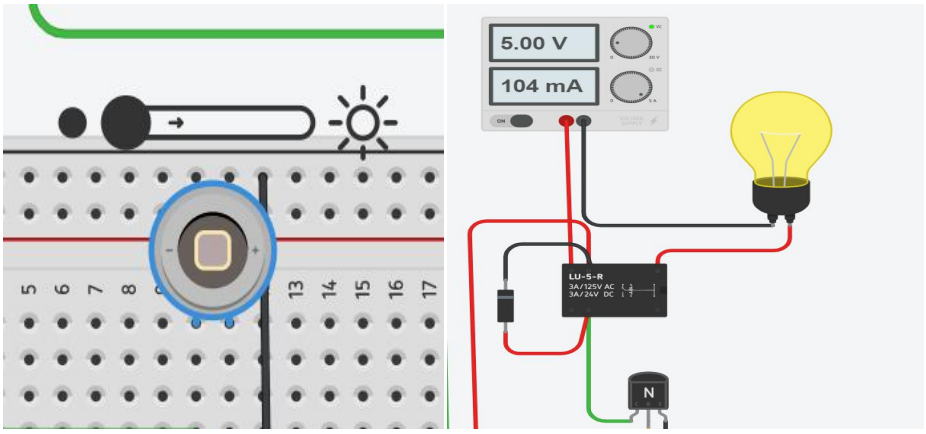
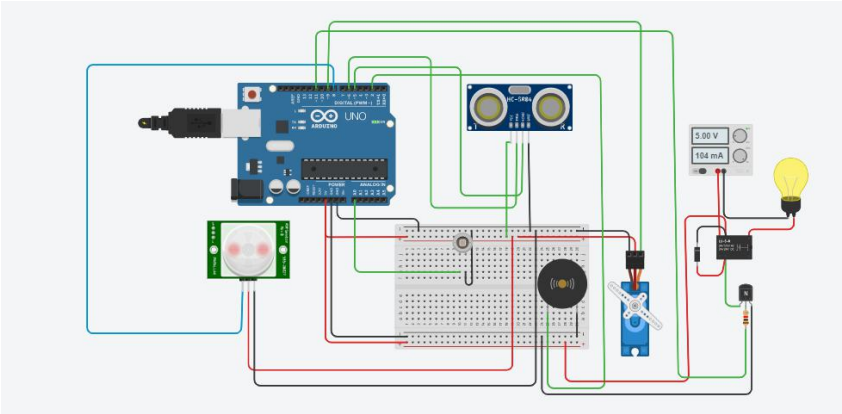


Fig.3.2.4 Photodiode and Bulb

The below figure 3.2.5 is final result of the project



3.2.5 Experimental result

Managed to successfully apply the SMART GATE SYSTEM FOR PUBLIC PLACES USING ARDUINO and it was user friendly and cost effective. User friendly as in anyone can enter and exit from a public place without applying any force to open or close gate. And it is cost effective as in it will cost exactly as the project requires (optimum price).

3.3 ADVANTAGES

- Decreases man power.
- Easy to enter and exit from a place.
- They are durable, and strong .
- Available in customized sizes.
- It saves our valuable time.
- It is contactless.

3.4 DISADVANTAGES

- Equipment and installation cost.

- Human errors.
- In case of power failure, malfunctioning system or anyone trapped inside your property, can cause inconvenience.
- System compatibility.

CHAPTER 4
CONCLUSION

4.1 CONCLUSION

This project is to design and develop auto gate system which is used at public places like parks, hospitals, theatres and shopping malls etc . The primary aim of this project is to learn in details about how the automatic gate system works and to understand the concept involved. The objective of this project had been achieved from designing an auto-gate system that can work smoothly when it operates. The angle of rotation of the auto-gate can also be adjusted so that it is suitable and user-friendly for all. Concluding that the smart gate system is more convenient to people and helps in avoid the usage of manpower in open and closing the gate.

4.2 FUTURE SCOPE

21st century will become more and more self-controlled and automated due to the comfort it provides. And people are getting lazy and habituated to smart devices, as they are reducing their time and physical power. In this pandemic situation everyone is preferring not to get in contact with any object, So our project smart gate gonna have good scope in future .This may have good scope in future and also an extra feature can be added to it with further references. And this have good future scope as it can be used in multiple ways in different areas by adding some extra features to it. Like It can be used as anti theft gate by adding lock system to it. Then this gate can be used at homes, offices etc.

BIBLIOGRAPHY

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[2]. Circuit Design Mighty Wluff-Jaiks| Tinkercad.com

[3]. EEE Project.com

[4]. PotentialLabs.com

[5]. LearnadFruit.com

APPENDIX

```
#include<Servo.h>
Servo servo_9;
Int trigPin=6;
int echoPin=5;
int x=0;
void setup()
{
   servo_9.attach(9);
   Serial.begin(9600);
   pinMode(2,OUTPUT);
   pinMode(echoPin,INPUT);
   pinMode(trigPin,OUTPUT);
   pinMode(8,INPUT);
   pinMode(11,OUTPUT);
}
 void loop()
 {
    if(analogRead(A0)>=-75)
    {
       digitalWrite(11,HIGH);
    }
    else
    {
       digitalWrite(11,LOW);
    }
   digitalWrite(trigPin,LOW);
   delayMicroseconds(2);
   digitalWrite(trigPin,HIGH);
   delayMicroseconds(5);
   digitalWrite(trigPin,LOW);
   long duration=pulseIn(echoPin,HIGH);
   float distance=duration*0.0172l;
```

```
  Serial.print("Distance: ");
  Serial.println(distance);
  x=digitalRead(8);
  if(x==HIGH && distance<100)
  {
    digitalWrite(2,HIGH);
    servo_9.write(100);
  }
    else
   {
     digitalWrite(2,LOW);
     servo_9.write(0);
   }
}
```