

AUTOMATIC DOOR OPENING SYSTEM

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Abstract - The automatic door locally available in market and it's very expensive. This high price is reduced by some remove of the sensors and unwanted chip or object. The aim of our project is to design, develop and test automatic door opening system. The raw material which is locally available in local market at low cost of price this is recommended that research paper which I read low speed high torque DC motor and the sensor that satisfy our project automatic door opening system requirements.

Keywords - IR sensor, L293d motor driver IC, Automatic, DC motor, arduino uno

1. INTRODUCTION

This project mainly aims automatic door opening system for industrial and domestic application also Automatic door control system is highly demanded & applicable project which can be used in offices, restaurant, malls, home vehicle garage, etc. Nowadays technology are advancing day by day with the help of electronic devices is making our work easier the development of world expansion types of industrial product. In the previous year pandemic situation due to covid-19 human required to take precaution do not touch anything, keep distancing, hand sanitizing. Humans constantly upgrade and improve performance working on automatic door opening systems that support the process to be more productive and efficiently. There are many technology invented by human some goes to the mall door opening system, industrial door opening system and garage door opening system. It will help to easy human works.[1]

Our project is based on IR sensor for long range, arduino uno and L293d motor driver IC in which door automatically open and closed. In our research we see the automatic door opening system most of the door is using arduino microcontroller and it is cheap price available in market. The additional advantage of this kind of automatic door opening system is that it will reduce pollution in the work area and the doors are opened and closed only when a person approaches the door, there is significantly less loss of air conditioning It will so because normal or manual doors may be kept open when opened once. But this automatic door opening system will get opened when required and then closed automatically through the sensor mechanism. The

door automatically turned open and after about 5 to 10 seconds the door closes by turning in the reverse direction. There is some additional modification to operate manually by unicycle with the help of simple mechanism and also we include to charging the battery with the help of solar panel.

Aim:- the main objective of this project is to save electricity and the reduce need of manual labour.

2. METHODOLOGY

In this chapter a method is presented for development of automatic door opening system which is based on sensor and also include for material selection based on various engineering parameters which is suitable for application.

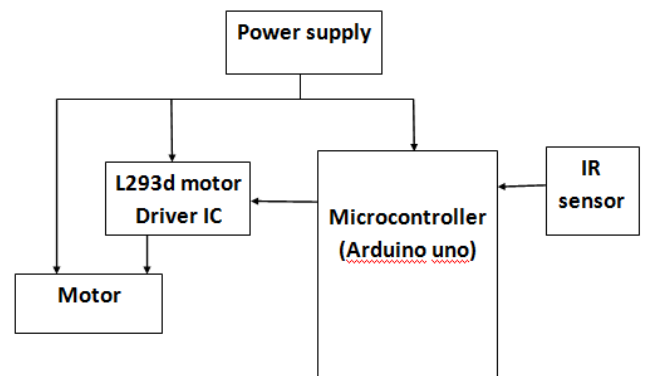


Fig:- Block diagram

3. Material selection:

Component Name	Material	Reason for use
Pulley	aluminium	it is light in weight
Door frame	steel sheet	strength/flexibility
Prime mover	dc motor	size consideration, control efficiency
Sensor	Infra red	long range
Control	L293d Motor driver IC	space consideration
Prime mover	electric	Easy to control
Bearing	bearing no 300	standard
Microcontroller	arduino uno	space consideration
Battery	24v, 15A	power supply

All the above parts can be purchased easily across any market whereas suitable supporting clamps can be easily designed and manufactured in a workshop that is fully capable of manufacturing parts as per the user requirements.

IR Sensor

The IR transmitter consists of the LED that emits the IR (Infra Red) radiation. This is received by the photo diode, which acts as IR receiver at the receiving end. Since the IR radiation is invisible to human eye it is perfect for using in wireless communication. An electronic device mainly consists of this IR transmitter and receiver.



Fig:- IR sensor

L293d motor driver IC

The L293d motor driver IC is used to control the rotation direction and speed of two DC motors. The L293d is a dual-channel H-Bridge motor driver IC. This module uses two techniques for the control speed and rotation direction of the DC motors. These are PWM – For controlling the speed and H-Bridge – For controlling rotation direction. These modules can control two DC motor or one stepper motor at the same time.



Fig:- L293d motor driver IC

How L293D Motor Driver IC Works:

This IC uses two techniques for the control speed and rotation direction of the DC motors. These are H-Bridge – For controlling rotation direction and PWM – For controlling the speed.

Arduino UNO

In this project, Arduino UNO acts as the main controlling part. It reads the data from the IR Sensor and activates the Motor Driver based on the data from the IR Sensor.



Fig:- Arduino UNO

12V DC Motor –

A direct current (DC) motor is an electric motor that converts electrical energy into mechanical energy to produce torque, which causes it to turn.



Fig:- 12V DC Motor

Power supply

Power supply is use for giving electric power to the motor, driver module and Arduino UNO board. The motor required 12 V and 5 Amp. current as an input power, so that we are going to use 12V, 5A Power Supply. This power supply requires 90 to 240 Volts as an input power.

Solar panel

This solar panel is the best option for this project we use Microtek 75 Watt 12V Multi-crystalline Solar Panel which will provide to charge the battery.

4.Design and calculation

4.1. Rotational speed of motor

$$\omega = \frac{v}{r}$$

$\omega = \text{speed in radians per second}$

$v=0.5 \text{ m/s}$ (instantaneous speed)

$r= 0.030 \text{ m}$ (radius of driver pulley)

$$\omega = \frac{0.5}{0.030}$$

$=16.66 \text{ rad/sec}$

$$N = \frac{50}{2\pi} * \omega$$

$N= \text{rotation speed in rev/sec}$

$$N = \frac{50}{2\pi} * 16.66$$

$=132.57 \text{ rev/min}$

4.2 Power required for acceleration P_a

$$V = u^2 + 2aS$$

$$F_a = ma$$

$$= m \left(\frac{v^2}{2s} \right) \text{ acceleration force}$$

$a= \text{acceleration of the door}$

$v= \text{maximum velocity by the door}$

$s= \text{total distance covered by the door}$

But,

$$S = \frac{2.15}{5 * 5} \text{ (travel of door)}$$

$=0.086$

Now,

$$F_a = 20 * \left(\frac{0.5}{2 * 0.086} \right)$$

$=58.13\text{N}$

$$P_a = F_a * v$$

$=58.13 * 0.5$

$=29.06 \text{ Watts}$

4.3 Power transmitted by belt drive (P_b)

$$F_c = T_1 \left(1 - \frac{1}{e^{\mu\pi}} \right)$$

$T_1 = \text{Tension on tight side of belt}$

$\mu = \text{Coefficient of friction between belt \& pulley}$

Power required to overcome belt friction

But $T_1 = F_a = 58.13\text{N}$

$$\mu = 0.42$$

$$F_c = 58.13 \left(1 - \frac{1}{e^{0.42 * \pi}} \right)$$

$=42.59 \text{ N}$

$$P_b = F_c * v$$

$=42.59 * 0.5$

$=21.29 \text{ W}$

4.4 Power required driving the sliding door (P)

$$P = P_a + P_b$$

$$= 29.06 + 21.29$$

$$= 50.35 \text{ W}$$

$$\cong 50 \text{ W}$$

4.5 Length of belt required (L)

$$L = \pi(r_1 + r_2) + \frac{(r_1 - r_2)^2}{d} + 2d$$

When two pulley are equal

i.e. $r_1 = r_2 = r$ (radius of a pulley)

$$L = 2(r\pi + d)$$

$$= 2(0.030 * \pi + 1.7)$$

$$= 3.58$$

$$\cong 4 \text{ m}$$

5. Conclusion

The project entitled "Automatic Door opening system" is a simple design that serves Arduino Uno as a microcontroller. Secondly, the growing technology using motor driver IC. The output from IR sensor is feed as input to the microcontroller. The microcontroller will continuously monitor the output from IR sensor.

In this study, a door system has been developed that opens and closes automatically. There are three way to operate the door first when person detect IR sensor, secondly in case of any malfunctioned in system they can operate the door manually by unicycle and Thirdly, every person can do this easily the door rotate 360 degree when person comes out and come in they push or pull the door by less effort. Thus the project has been successfully designed and tested

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