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Design and Analysis of Automated Shop Shutter

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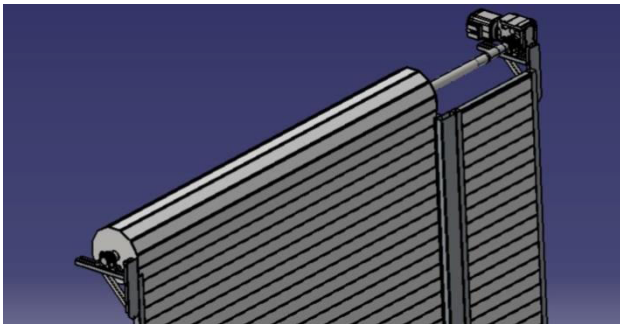
ABSTRACT: In today's world, security, wellbeing and accommodation has gotten exceptionally imperative than before. Since innovation depends on growth, individuals need the ability to consider trivial tasks and focus on other relevant issues. This type of interest needs to be met by a well-equipped framework to quickly, accurately and reliably translate client needs and independently implement appropriate moves.

A remote controlled garage door utilizes current innovations to provide such a framework. The general idea driving is to actualize a framework where the client isn't basically responsible for deciding the activity, yet the order module veils the movement, the garage door must perform, and the fitting changes.

In an age where no one has much time for things like getting out of the car and opening the garage door, the remote-controlled garage door comes to solve their problem.

The research project for a garage door that can be opened with a mere touch of a remote-control button is studied, reviewed and its prototype has been developed. For development purposes the problems encountered by the users are identified, the detailed specifications of the product part have been completed and a working prototype has been created.

I. INTRODUCTION



Background The uses of garage doors can go back to 450 BC when chariots were kept in it, its uses increased extensively around 20th century when expensive motorized vehicles came into existence and its safety became a concern for its users. Clue suggests that the upward-lifting garage door was invented in 1906, and since then there have been advancements in these doors, such as ease of use and ease of operation.

They also got motorized in later years. After the huge progress made in the field of electronics that touched everything of our basic necessities, garage doors were not

an exception. Garage Challenge There is many doors available with remote control that open reach and use them for various security measures. Therefore, the advantages and disadvantages of different types of garage doors are considered and one is selected for additional development.

The various types of existing garage doors are:

- Sectional Doors
- Flex-A-Door
- Rolling Doors

Sectional Door They are created out of various inflexible segments/boards that are pivoted together and move vertically in the opening, then evenly along the roof, guided by tracks and balanced springs. The Sectional garage door offers the best level of stylish flexibility. It includes various vast segments or boards. Advantages of Sectional Garage Door:

- They open upwards and run parallel to the roof.
- Unlike the customary "tilt" doors, they don't swing outwards to open.
- Vehicles could be stopped straight up to the front of the garage door without blocking its opening.
- In instance of any harm, areas or boards could be supplanted independently.

• Require little headroom. Image shows the view of a Sectional Door from inside of the Garage.Flex-A-Door They are made from a durable Roll-A-door curtain which is fitted on a curving track – that slides from a vertical position up into a horizontal position, close to the ceiling. It is especially suited to applications where there is not the headroom for a rolling door, or where a smoother, easier to use solution is required to replace an existing tilt door. Advantages of Flex-A-Door:

- Suitable for low headroom.
- Great for accommodating vehicles that require extra height.
- They open upwards and parallel to the ceiling.
- Vehicles can be parked right in front of the garage door.
- Robust & striking Roll-A-Door curtain.

II. METHODOLOGY

Sectional doors are named in light of the fact that they are made up of sections.

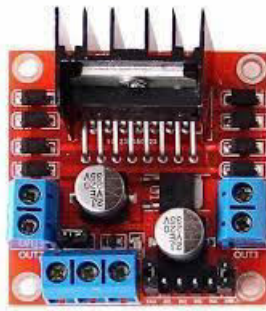
Private doors regularly have four or five segments. These garage door segments are stacked vertically. they are kept together With pivots along the length of the sectors.

pivot grips at each endsegments together, as well as they serve a extra motivation behind catching roller s establish. Rollers are required to permit the door to be opened and shut-in tracks. These tracks are connected with track sections to the sides of the opening called the pillar. These sections are likewise called frame sections. The end pivots also a third reason - allowing the door to close the wedge. The last pivots are taken in sequence - 1, 2, 3, 4, 5, 6, and, with each higher roll moving the roller further away from the pivot.A vertical track aids in wedge activity by using graduated track sections, with easy-numbered support sections held close to the frame at the bottom of the track, while higher-numbered sections place the highest point of the vertical track long from the pole. The net effect is a garage door that seals tightly against opening.

This fitting was initially protected by Overhead Door Corporation, and for a few decades a considerable measure of creativity went into getting garage doors to seal against the openings. Pivots allow the segments to rotate when the garage door is opened, however no pivots are required at the lowest point of the base segment or at the highest point of the top segment.Thus, other fittings are utilized. At each one end of the top area is a top apparatus or top section that holds the roller in position in the track. At each one end of the bottom area is a comparative section that holds the lowest part rollers set up. This part, or the lowest part installed, similarly forms the bottom link used in door counterbalancing. Sectional doors require opening and joining only at the top through the framework of the garage frames and group clear brick at the top.

The door rises vertically up and then back into the ceiling space. No door frame is required which means the maximum garage opening width can be exploited for drive-through.

motor drive

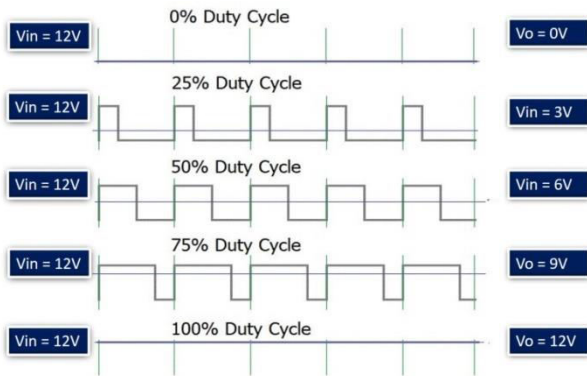


Inside the L298N chip, you'll find two standard H-bridges capable of driving a pair of DC motors. Hence it makes sense to build a to wheeled robotic platform using it as it can drive up to two motors individually. The L298N motor



driver have a good supply of range 5V to 35V this can give 2A continuous current so that's why it works very well with DC motor.

PWM – to control speed



The input voltage controls the speed of dc motor by changing its input voltage. PWM technique is used to this (Pulse Width Modulation).

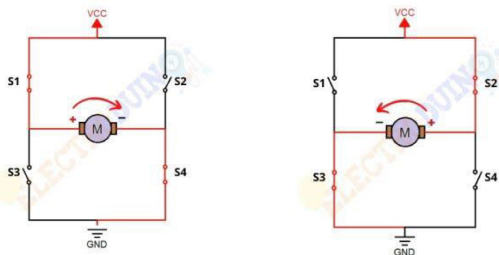
The average value of the input voltage can be adjusted by sending a series of ON-OFF pulses.

The width of the pulses is proportional to average voltage is known as duty cycle.

The duty cycle is higher when higher voltage applied to DC motor and shorter the duty cycle when average voltage apply is lower to DC motor.

The image below shows PWM technology with different duty cycles and average voltages.

H-Bridge Techniques

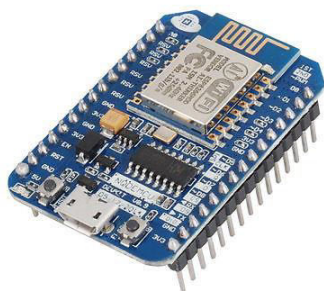


L298n motor driver module uses the H-Bridge technique to control the direction of rotation of a DC motor. In this technique, H-Bridge controlled DC motor rotating direction by changing the polarity of its input voltage.

An H-Bridge circuit contains four switching elements, like transistors (BJT or MOSFET), with the motor at the center forming an H-like configuration. Input **IN1, IN2, IN3, and IN4** pins actually control the **switches** of the H-Bridge circuit inside L298N IC.

We can change the direction of the current flow by activating two particular switches at the same time, this way we can change the rotation direction of the motor.

node-MCU



Node-MCU is a IOT based electronic device which works on basis of wifi ESP8266. We are using this device to control the upward and downward motion of shutter.

We can control the operation of the node-MCU with different programming codes.

It consist of ESP8266 wifi chip. It is a low-cost Wi-Fi chip to explore the information regarding ESP8266, we can refer to the ESP8266 Module.

Varies package styles of node-MCU are available in market. One of is common based on ESP8266.It consist of 30 pins layout.Amica bases on standard narrow pin spacing is a most common type of model. LoLin stands with wider pin spacing and larger board



DC Motor



DC motor is a electric device that work with direct current power. Electric motor works on the principle of electromagnetic induction. We are using the geared motor for this project to reduce the speed. The main purpose of gear motor is to minimize the speed. Current carrying wires creates the electromagnetic field when this place with external magnetic field then it exerts some force proportional to current due to which electric energy get convert into magnetic energy.

why node-mcu instead of aruidno UNO

- In nodeMCU all the digital pins that is 16 pins can be used as PWM pins programmatically. The arduino UNO contains only 6 pins for PWM.
- Node-MCU comes with 4MB flash memory and arduino comes with only 32 KB flash memory.
- Node-MCU comes with wifi connectivity which is most commonly used in IOT applications but arduino do not comes with wifi connectivity feature.
- Node-MCU are more cheaper than arduino UNO.

Sample calculations

Assuming that the height, width and weight of the shutter is given

Let,

Height=3.3m

Width=4.5m

Thickness=0.2m

Shutter weight=4.5 kg/m²

Radius of shaft=0.25m

Therefore,

$$1) \text{Totalweight of shutter}(W) = \text{width} * (\text{height} + 20\text{cm}) * (\text{shutter weight}/\text{m}) = 4.5 * (3.3 + 0.2) * (4.5) = 70.375 = 70 \text{ N}$$

2) Total torque required

T=W*R=total weight of shutter*Radius of shaft

Therefore,

$$T = 70 * 0.25 = 17.5 \text{ Nm}$$

3) Selection of motor for the required torque:

Hence the torque required for the motor will be greater than the above torque

That is torque of the required motor should be greater than 17.5 Nm

- Selected motor for the given parameter is

Worm drive motor

12v-DC

1.3 Ampere =Load current

3000 rpm = speed

4) Selection of gear ration(spur gear)

Gear ratio=N1/N2

Here,

N2=speed of motor shaft in rpm

N1=speed we required

N2=3000 rpm

Assume N1=100rpm

Therefore,

Gear ratio=100/3000

Gear ratio=1:3



III. CONCLUSION

We would like to conclude that our project “Design and analysis of automated shop shutter” which can be totally operate with smart phones . We are using node-MCU as controller for Wi-Fi connection and other material according to the required application.

The command to move the door via this automatic switch can be carried out according to the command using the wifi controller application on the smartphone, this design can occur when the smartphone and node-MCU are connected.

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