Automatic Gate Opening Mechanism

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Abstract- *Automatic gate is one of one of the useful thing to use in companies, industries, colonies, collages and schools. Most of the times this gate open and closed by the human effort. There is some type mechanism available in market to operate a gate such as a sliding on screw, piston operated. Most of the products we used in our country imported from foreign country and cost of these mechanism is high. The objectives of this Paper are to study, analyze, and develop a new mechanism that is cheap, safe easily available and installation is simple as well. In this research work we fabricated the gate which opens on chain and sprocket assembly which is runs without human effort. The cost of installation and maintenance is also lower as compared to other types of gate opening mechanism.*

Keywords- Automatic gate, Human effort, Mechanism, Chain and sprocket

I. INTRODUCTION

Gates are commonly used nowadays at residential area, offices, educational institutions, industries. A gate is a point of entry to a space enclosed by walls, or an opening in a fence. Gates may prevent or control entry or exit, or they may be merely decorative.

Figure No.1 Manual Gate opening

Today many gate doors are opened by an automated gate operator. Those gates come with many special features. The need for automatic gates has been on the increase in recent times. The gates have to perform gyrations by open, auto reverse, stop, fully close and fully stop. Those gates come with different type of mechanism such as sliding, swing, folding, and barrier gate. Those mechanisms have their own working principle and feature but, automatic gate design seem limited at the local market. Most of the product is imported fromoutsider supplier. The price of the product also seems expensive. Cost study and new mechanism design, can be marketable toward wider customer at lower cost and new innovation of auto gate mechanism can enhance local design capability. The aim of this project is to learn in detail about how the automatic gate system and arcwelding works, tounderstand the concepts involved and to fabricate a simple model to show the system works.

II. LITERATURE REVIEW

The automatic gate opener mechanism is the system that combined mechanical system and electrical system. The function of mechanical part is to move the gate according the directions that have been set. While, electrical system is to give source energy to move the mechanical part. The function of automatic gate opener mechanism is to help user open or close the gate without using human energy to pull or push the gate. It functions automatically to move the gate by switch on the switch. There are various types of automatic gate opener. For example, the swing operator and slide operator. Many of users at home usually use the swing type operation. While, at big industry they using the slide type operation.

In some researchers uses the rack and pinion mechanism to convert the rotary motion of pinion into linear motion of the rack for the motion of the gate. Infrared or wireless technology also come in to market provides an alternate, more portable, more independent means of accessing, opening and closing of a gate and other electronic information. This research work examines how users can open and close the gate with password using IR control. The device connected to this gate is working through the process from microcontroller that has been programmed with assembled language and logic circuit.

III. OBJECTIVES OF RESEARCH

- To minimize cost and develop a simple mechanism that can be reasonably achieved within the expected time and with the resources which are available.

- To design an automatic gate mechanism for collage with weight of 300kg of the gate. Cost reduction and ease of installation are also considered for this mechanism.

IV. WORKING PRINCIPLE

In Automatic gate mechanism electrical power is given to motor in order to have mechanical motion of the gate. Initially Power is given to the 3 Phase AC motor having capacity 0.75 H. P.The sprocket is connected to the motor shaft so it will run at the speed of motor.The chain is mesh with the sprocket so the rotary motion of the sprocket is converted into linear motion of the chain.

The chain mechanism is connected to the gate so it will open or close the gate.

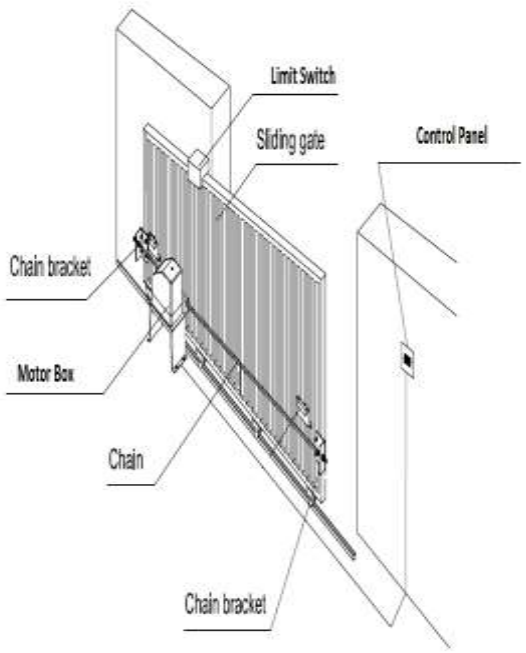

Figure No. 2 Automatic gate opening mechanism

To stop the motor after opening or closing of the gate, rotary limit switch is connected to each end of the gate.When Chain comes in contact with limit switch, it will cut the power supply of the gate this results stopping of motor.

V. DESIGN CALCULATIONS

Total mass of gate mechanism is 270 kg but from safety design point of view it was considered as 300 kg.

When roller moves over the track, friction is takes place between roller and track of sliding of gate mechanism

Assume coefficient of friction between rollers and track $\mu=0.20$

Acceleration due to gravity, $g = 9.81\ m/s^2$

According to Newton's second law of motion,

$$\text{Force } F = \mu \times m \times g \text{ -- -------(1)}$$

$F = 0.20 \times 300 \times 9.81$
$= 588.6\ N$

Twisting moment required to move the gate is given by,

$$\text{Torque, } T = F \times x \text{-- --------- (2)}$$

Where, x is distance between chain and centre of sprocket

So, $x = D/2 = 0.05$ (Diameter of sprocket = 100 mm)

Now, $T = 981 \times 0.05$, $T = 29.43\ N.m$

Velocity or speed at which the gate is open or close is given by,

$$\text{Velocity, } V = \text{Distance (D)/ Time (T) ---------- (3)}$$

Where D = Distance between two points of the gate

T = Time required to open or close the gate.

T =30 sec Distance, D = 9.7 m

$V = 9.7/30 = 0.3233\ m/s$

Speed at which the motor is runs is given by,

$V = \Pi dn/60\ 0.17$

$0.3233 = (\pi \times 5.3 \times 10\text{-}3 \times N)/60$, $N = 123.55$ rpm

Speed of revaluation, N = 123.55 rpm

Power required to drive the motor is given by,

$$P = 2\pi NT/60 \text{---------- (4)}$$

$= (2 \times \pi \times 61.25 \times 39.24) / 60$, $P = 380.58W$

We know that, 1HP = 746 W

So, P = 380.58/746, P = 0.51 HP So, we select the standard motor of power P = 0.75 HP.

VI. MATERIALS

The following material is required for the fabrication of Automatic gate opening mechanism

Table No. 1 list of components

Sr. No.	Component	Quantity
1	3 phase A. C. motor	1
2	Roller type limit switch	2
3	Sprocket	1
4	Chain	9m
5	Contactor	3
6	Pulleys	3

Knowledge of Welding, turning, grinding, Sheet metal working, Basic electrical was used to assemble the various components

VII. CONCLUSION

This automatically gate is most useful and simple to operate at any condition in commercial sector, industrial sector, schools and colleges.

Because of atomization no manual force requires. It also has less cost and energy required for it is very less. The design and construction minimizes the risk of operation.

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