

SOLAR POWERED REMOTE CONTROLLED SMART SECURITY GATE

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ABSTRACT

With the advent of technology, people are moving continuously towards smart system. India also has laid so many frameworks for development of smart cities. This project deals with the development of smart automatic gate opening systems. The proposed system can be implemented in domestic as well as commercial gates where the gates need to pushed or pulled manually. The project involves development of solar powered remote controlled smart gates which can be controlled using Remote from a distance to be opened and closed. Further the entire system is solar powered thus eco-friendly as well as cost free to operate. The gate can also be controlled by android cell phones if the remote is not available at particular instant of time.

Keywords: Gates, Manually, Smart, Remote, Solar Powered, Eco-friendly, Android etc.

I.INTRODUCTION

Automation is the need of present century. As days pass by people are moving towards smart homes and smart cities. One such application is the concept of the automatic gates. The security challenges being encountered in many places require electronic means of controlling access to communities, recreational centres, offices, and homes. Main gate security system has very wide market as everyone is looking for secure life. The Main purpose of the gate is to keep away the trespassers as well as unauthorized personal away from our property. This is also implemented in commercial buildings, offices as well as residential buildings, thus the concept of automation of the above said system has very wide scope.

Gates are commonly used nowadays at residential area. 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. 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 system described here incorporates the use of actuator to control the movement of the gate automatically. The gates have to perform gyrations by open, auto reverse, stop, fully close and fully stop. It provides convenient access and intelligent features that makes it distinct from all other gates which bring it so close to a security device. 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 from outsider 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 arc welding works, to understand the concepts involved and to fabricate a simple model to show the system works.

The theory of the automatic gate is very simple, when we press the open button, a signal is sent to the main circuitry board. The developed project is operated wirelessly where the operator of the gate can have a small keychain type remote for opening and closing the gate. When the user presses open button, the wireless signal is sent to the developed gate which then commands the motor to run and the drive train to open the gate. The similar action can be done for closing the gate. The project also involves setting the open and closing limits wherein the opening and close limits can be set using the end stop sensors. Further the proposed project is solar powered thus making it clean and cost free to afford.

II.METHODOLOGY

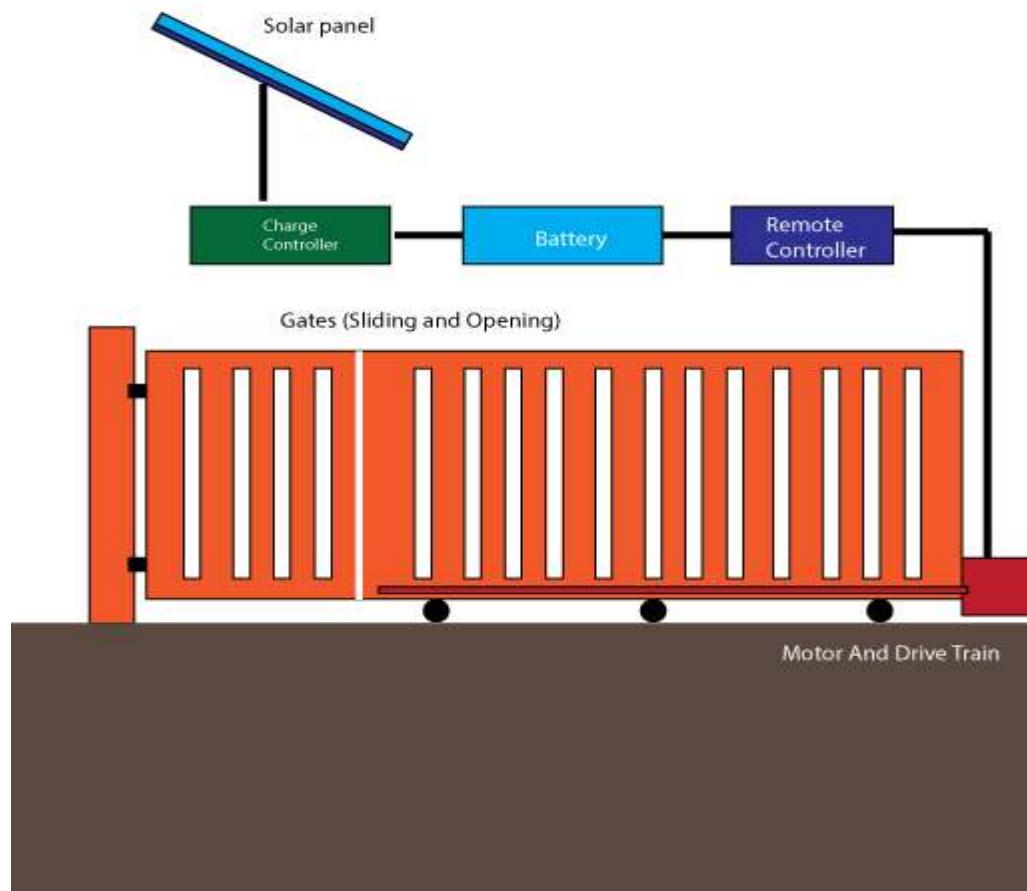
Before starting the actual project it is very necessary to devise the plan or agenda with the project will proceed. This will not only help to carry out the entire project work systematically but also help to minimize the errors which may occur thought the conduct of the project work. The entire project is divided into following phases which will be carried out in steps.

1. The literature review: This is the initial phase of the project and most important one. Before beginning with the project a number of research papers are studied to study a detailed literature of the currently existing systems. The study was further analyzed to find the advantages and disadvantages of the currently existing systems.
2. The Market survey: After the literature study the market survey will be done to find the most suitable materials for the project. The chosen materials should properly fit the application to be designed as well as economical so that it can be easily implemented by everyone.
3. Initial Design and 3D Modelling: The rough sketch of the proposed system will be developed in this phase. The initial design will be done and the 3D model of the proposed system will be developed.
4. Fabrication of security Gate: Once the sketch is ready, the gate will be fabricated. The gate will be fabricated in ERW steel pipes as they not only fit the cause but also are economical.
5. Development of Drive train: Once the gate is ready, the next step is development of drive train. The drive train developed will be responsible for opening and closing the gate using the motor incorporated in the next phase.
6. Motor Incorporation: The motor clamping systems are fabricated in this phase and the motor is incorporated to the drive train using the required Gear drive.
7. Design of remote control system : In this phase the remote control system is designed which can drive the motor as well as the gates to which it is incorporated. The Remote control system devised should have a fair range and should operate with least interference.
8. The solar Power system: Finally the solar power system is chosen and incorporated in this step. The solar power system consists of solar panel, the charge controller and the battery system. The solar panel provides the required power to open and close the gate as well as to drive the remote controlled system.

9. Assembly: In this phase the components fabricated as well as electronics control system is assembled to develop a Solar powered Remote controlled Security gate.
10. Testing and optimization: This is the final step where all the things are tested and optimizations or modifications required if any are done..

III.INITIAL CONCEPT AND WORKING PRINCIPLE

The figure below shows the initial concept of the project. As shown in the figure the project consists of development of solar powered remote controlled security gate. The gate consists of a mechanical drive train which is connected to the DC motor. The DC motor is responsible for driving the drive train, and the drive train by proper gearing ratio achieve the required torque for moving the gate. The end stop limit switches are also incorporated in the project which control or constrain the movement of gates in between set limits of opening and closing. As shown in the figure, the solar energy is used to drive the entire prime mover and the prime mover is controlled wirelessly using the remote controlled designed as a part of the project. Thus the proposed project plans to solve the problems used in manual control of security gate which is a tedious and hectic task.



IV.DESIGN AND CALCULATIONS

The entire design part of the project consists of various design parts. The design of following components is required as a part of the project. The various components which require design in the project of Automatic Solar Gates are

- Rack and Pinion
- Theoretical Power developed.
- Gear Design
- Power Calculations

RACK AND PINION:

Its primary function is to convert translatory motion into rotary motion. It must have higher strength, rigidity and resistance to shock load and less wear and tear.

RACK AND PINION CALCULATIONS

Module = Pitch Circle Diameter/ Number of teeth = $57.5/23 = 2.5 \text{ mm}$

Pitch Circle Radius(r) = $57.5/2 = 28.75 \text{ mm}$

Addendum(a) = module = 2.5 mm

Addendum Circle Radius (ra) = $r + \text{addendum} = 28.75 + 2 = 31.25 \text{ mm}$

Pressure angle of pinion (Φ) = 14.5° involute

Minimum Length of rack = $2\pi ra = 125.66 \text{ mm}$

POWER CALCULATIONS:

Battery used: 90 Watt

Total power or both motors = $17 \times 2 = 34 \text{ Watt}$

Solar panel used: 20 Watt

Therefore time required to charge entire battery:

$T=90/20$

$T=4.5 \text{ Hours}$

The battery backup

$=90/34$

2.64 Hours.

Therefore the gate will operate for 2.64 hours when fully charged.

V.CONCLUSION

The objective of designing solar powered remote controller smart security Gate to reducing the man power and important thinks is that to save electricity by using solar power. The design is first conceptualized on personal experience and intuition. We use engineering principles and some

Mechanical system to operate the gate automatically. After initial testing it will be seen that our concept should improve the design, durability and lower cost of automatic gate system.

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