

Gate opening and closing by using linear actuator

1st Phuge S.S., 2nd Harale Y.C., 3rd Sawant C.D., 4th Lamkane S.T., 5th Shaikh S.J.

¹ Professor, ² Student, ³ Student, ⁴ Student, ⁵ Student.

¹ Mechanical,

¹ Karmayogi Institute of Technology (Polytechnic), Shelve, Pandharpur, India

ABSTRACT This project aims to automate gate actuation using a lever-operated toggle switch. The gate opens within 10 to 20 seconds, and its movement is controlled by switches. The actuator, powered by both AC and DC, is constructed using a cost-effective electric DC motor. The goal is to provide an efficient, space-saving, and budget-friendly solution for gate automation, minimizing manual effort and ensuring quick and controlled gate operation.

INDEX TERMS – Gate, linear actuator, automation, electric DC motor, cost-effective, space-saving, quick operation.

I. INTRODUCTION

We're making a special gadget called a "linear actuator." It helps things move without people doing it by hand. This gadget changes the turning motion of a tool called a "servo" into back-and-forth motion. It's like magic because it uses electricity to move things faster and stronger. We can use it in tricky places where it's not safe for people to go.

Now, let's talk about our project with gates. You know those long bars or poles that go up and down at the entrance of parking lots or buildings? We want to make a smart version of those. It's like a gate that thinks a little! We're using special sensors and buttons to make it open and close in different ways, like when you press a button, use a remote, or even with a phone app. This gate is like a superhero guard for schools, hotels, and offices!

There are different types of gates we see around:

1) Vertical Lift Gate:

This gate goes up in the air when it opens, like a lift for cars.

2) Swing Gates:

Works like doors that swing open, either inside or outside. It can be controlled by machines.

3) Slide Gates:

a. Slides to the left or right, like a sliding door.

b. Some gates have special rollers to help them move, but they can get stuck with things like dust or ice.

4) Vertical Pivot Lift Gate:

Opens by going up in the air like a turning superhero, and then goes back to its normal position.

5) Bi-Folding Gates:

This gate has two parts that open up like a book and then come back together in the middle.

II. PROBLEM STATEMENT

Our college gate is not secure. It's monitored by a security guard, and the boom gates are from foreign countries, causing delays in orders and expensive maintenance. The current system wastes time and human resources. Smart boom gates are costly, but necessary for better security

III. LITERATURE SURVEY

We are working on a special kind of gate called a "smart boom gate." It's like a gate that can think and do things on its own. This gate uses special sensors to know when to open and close. The information from the sensors goes to a smart computer called Arduino UNO. This computer helps the gate decide what to do based on what it has learned before.

Now, let's talk about some other projects people have done with gates:

1. Automatic Vehicle Gate Opener:

- This project uses electricity and sensors to make a gate open and close.
- It has a remote control that sends a signal to the gate to tell it what to do.
- But, it's not fully automatic, and people worry a bit about its security.

2. Smart Gate Security:

- This project uses a special card called RFID to open the gate.
- There's also a camera that sends pictures wirelessly to a computer.
- But, it costs a lot, and you can only open the gate with the card.

3. Auto Gate System for House:

- This project is about making a gate that opens and closes when you press a button.
- It's not so good with security, and it needs a lot of space because it slides.

4. Automated Parking Gate Controller using Raspberry Pi:

- This project uses a tiny computer called Raspberry Pi to control the gate.
- It also uses sensors to know when a car is there.
- It even uses Wi-Fi to talk to other things. It's like a smart gate for parking.

5. Automatic Railway Gate Control System Using Microcontroller:

- This project is about keeping people safe near train tracks.
- It uses a special computer to control when the gate opens and closes.
- There are sensors that tell the computer when a train is coming.

Now, let's talk about another project. Some people made a special part called a "mechanical actuator" to control something called a "measurement probe." This part helps the probe move in a certain way, and it's good because it's not too expensive.

Lastly, someone talked about using something called a "linear actuator" for gates near canals. This helps the gates open and close without using too much electricity. They found a way to keep it safe from the weather, too.

IV. BLOCK DIAGRAM AND SOME COMPONENT DETAIL

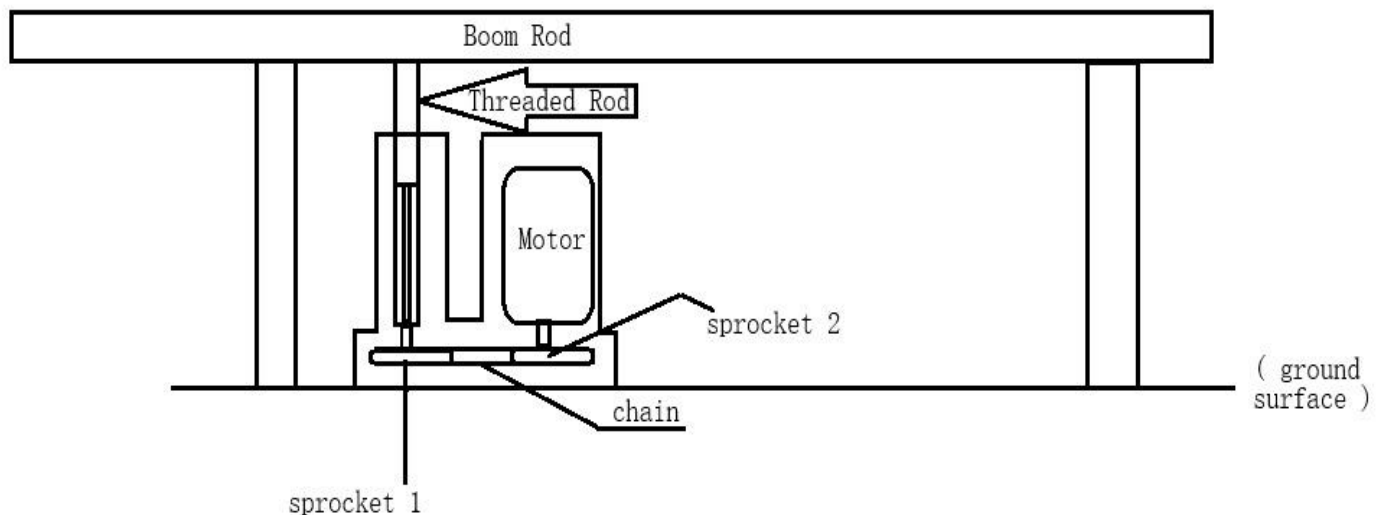


Fig.1 Boom gate opening and closing by using linear actuator system block diagram.

1) Bolt and Nut



Fig.2 Screw rod

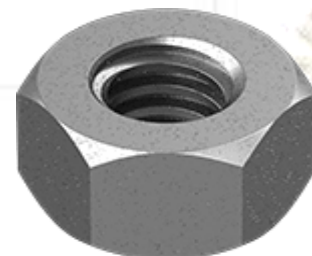


Fig.3 Nut

Imagine bolts like the special friends that hold things together. When we want to join or connect two things, like pieces of wood or metal, we use bolts. Bolts are like superheroes that do two important jobs!

First, they have a round part called the "shank" that doesn't have any twists like the rest of the bolt. This part is like a strong stick that keeps everything in place. It's like when you use a stick to pin your drawing against the wall. This shank makes sure things stay in the right position.

Second, bolts have a special friend called a "nut." The nut is like a helper that hugs the bolt and keeps it tight. It's like when you twist the cap on your water bottle to keep the water inside.

So, bolts and nuts work together to hold things tight and not let them wiggle or move. Bolts are like strong sticks that also get a nice hug from nuts, and together they make sure everything stays in place!

2) D.C Motor



Fig.4 DC Motor

Alright, let's talk about DC motors! Imagine a DC motor like a tiny helper that loves to spin and move things. It can work with special electricity called direct current (DC) or sometimes with alternating current (AC) using a special trick.

This little motor is strong when it starts moving, and it doesn't like to be lazy – it prefers to keep going. Inside the motor, there are some cool magnets that don't move, and there's a part called the "armature" that loves to spin around. The armature has special wires wrapped around a strong center, kind of like a candy with a sweet filling.

When we give our motor some electricity, it creates a magical field that makes the armature spin. It's like when you turn on a switch, and the motor starts doing its dance. The motor is not perfect; it's like a playful friend that sometimes uses its energy really well (around 60-75% of the time).

So, in simple words, a DC motor is like a little buddy that loves to spin and move when we give it a special kind of electricity!

V. WORKING

There are two sprockets, D.C motor(12V-1A), battery(12V-7.5A), screw and nut, chain, bearings and hollow square rods are used in this system. one sprocket is connected to D.C. motor (12V-1A) and other sprocket is connected to screw. one sprocket is connected to other sprocket with the help of chain. And nut is installed into screw. nut is covered by square rod and actuate the gate.

When D.C battery is connected to D.C motor in clockwise direction then the gate will opened and when we change the direction of D.C motor (anticlockwise Direction) then gate will closed this process is done in 5 to 20 sec. and actuation is completed.

For charging of D.C battery we are used Adapter (12V-2A).

VI. ADVANTAGES

1. Automation.
2. Safety.
3. Compact Design.
4. Low Maintenance.
5. Durability.
6. Minimizes efforts

VII. APPLICATIONS: -

1. Robotics: -
Linear actuators are used within robotics to control repetitive movements: they can control the acceleration rate and the force applied.
2. Toll Plaza: -
By using linear actuator boom gate can open and close with the help of A.C. motor.
3. Cannel valves: -
By using actuator gate valves can open and close with the help of A.C. motor.
4. Schools, Colleges: -
It is used for opening and closing of gate in schools, colleges, parking system.

VIII. CONCLUSIONS

In simple terms, we created a cool gadget called a "linear actuator" to make gates open and close automatically. It's like a superhero for gates! We used a special motor that loves to spin and move things, and with the help of some bolts, nuts, and a chain, our gate can now open and close smoothly.

Why did we do this? Because sometimes gates need to be smart and open on their own, especially in places like schools and colleges. We don't want people to struggle with heavy gates or waste time waiting for someone to open them. Our gadget makes gates open within 10 to 20 seconds, and you can control it with buttons, switches.

This is not just about being cool; it's also about safety. Our gadget ensures that gates open and close securely, making places like schools and toll plazas safer. Plus, it's compact, low-maintenance, and durable, making it a budget-friendly solution.

IX. REFERENCES

- 1) The stands4 network. What does gate mean? [Online]. (2001). Available: <https://www.definitions.net/definition/gate>.
- 2) <https://community.home-assistant.io/t/diy-linear-actuator-for-opening-and-closing-150kgswing-gate/472839>.
- 3) Hellenic News of America. 10 things we wouldn't have without ancient Greece. [Online]. (2016). Available: <https://hellenicnews.com/20717-2/>
- 4) Sighila, P., Valsan, V. and Preethibha, C. (2016). IOT Based RFID Gate Automation System. International Journal of Engineering Trends and Technology, 36(9), 471-473.
- 5) Toliyat, H. A. and Campbell, S. G. (2003). DSP-Based Electromechanical Motion Control. CRC press. 6) Akio Katsuki, H. Onikura, T. Sajima, H. Murakami, T. Sato, H. Nishi, V. Pietri, and MD Hazrat Ali, Development of a Laser-guided Measurement System with Lower Production Cost, 25th Annual Meeting of the American Society for Precision Engineering Atlanta, USA, 2010.

