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Overview of Differences between Servo and Stepper Motor Technology

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***Abstract*—** *Each technology has its niche, and since the selection of either of these technologies for a given application affects its chance of success, it is important for the machine designer to select the best motor-drive system for the application, while considering the technical advantages and disadvantages of both. I make an auto-bridge system based on Arduino with servo and stepper motor. This paper presents an overview of different baseline capabilities for selection criteria between stepper and servo technology. A thorough understanding of these technologies will help generate the best and most efficient mechatronic designs to bring forth the full capability of a machine.*

***Keywords*—** *Motor-drive, servo motor, stepper motor.*

I. INTRODUCTION

It is all about utilizing these technologies with balance to achieve the desired process performance for a given machine design while balancing cost versus the capability of the required mechanism. Machine designers shouldn't limit utilization of steppers or servos by a predetermined mindset or comfort level, but learn where each technology works best for controlling a specific mechanism and process to be performed. Today's digital stepper motor drives provide enhanced drive features, option flexibility, and communication protocols using advanced integrated circuits and simplified programming techniques. The same is true of servo motor systems, while higher torque density, improved electronics, algorithms, and higher feedback resolution have resulted in higher system Bandwidth (BW) capabilities, and lower initial and overall operating costs for many applications.[1]

A. Stepper Motor System Overview

Stepper motors have several major advantages over servo systems. They are typically lower cost, have common NEMA mountings, offer lower torque options, require less costly cabling, and their open loop motion control component makes machine integration simplistic and provides ease-of-use to end users.

II. TORQUE AND SPEED CONSADERATIONS

The issue of whether to use a stepper or servo is dictated by the application in most cases. Steppers are typically sized for twice their continuous requirements for additional acceleration and/or deceleration torque capability or for a required peak torque. In contrast, servo motors are generally sized for the specific application velocities and torques for maximum intermittent acceleration/deceleration, holding torque (if applicable), and continuous RMS requirements over the complete motion profile.

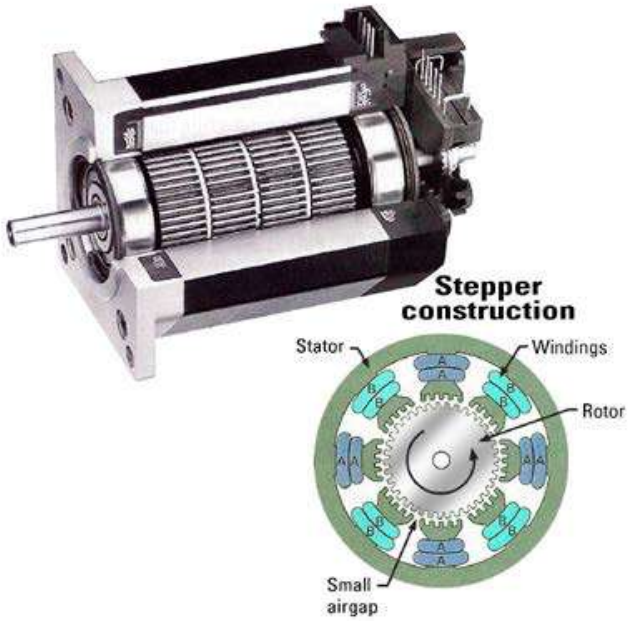

Fig. 1. Stepper Construction

A. Servo Motor

Servo motors have several distinct advantages over steppers. They can generate high torque over a wide speed range on demand, and are available in wider torque ranges and higher voltages (up to 480 Vac). They respond to disturbances with a torque much greater than their continuous capability and use only the power required to accomplish the commanded motion and are compact. Two servo motors are used to lift up and down the tollgate's hand in this project.[2]

B. Modern Stepper developments

Modern steppers are available in larger power ratings than earlier generation steppers. Newer design techniques have led to smaller airgaps, stronger magnets, physically larger magnets and rotor oversizing. Increasing the rotor's diameter generates more torque per unit volume. For this technique, the physical frame size and winding of the step motor stays the same while the rotor's diameter and inertia are increased. Of course, the larger rotor inertia can affect acceleration and deceleration times for a given application; but this method opens up more applications to a given stepper frame size by

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the effective decreased ratio of the load (J_load) to motor rotor (Jm) inertia. Generally, step motor systems are sized with a J_load : Jm of less than 30:1, but with slower accelerations and decelerations and advanced microstepping operation, inertia ratios of 200:1 are achievable.

III. DISCUSSION

My native is Rakhine state in Myanmar. It is coastal region and it has plenty of rivers. Many bridge systems have been presented but only one transport, high way. This system is provided bi-functional transport, high way and water way .There is can be used by various vehicles above the bridge and ships and boats can be passed under the bridge. The use of automated bridges system in many metropolitan cities would be an efficient step towards the overcrowding of the city highways in heavy congestion of traffic. It provided with two toll gates at each end of the bridge. Toll gate is made with Servo motor to lift up and down of toll gate's hand. While vehicles pass the bridge toll gate's hand is lifted, water way is closed. When toll gate's hand is down, it doesn't allow passing the vehicle. Bridge is provided joining by two bridge plates in the middle. One end of bridge is provided with two stepper motors to lift up and down the bridge plates. When both toll gates are closed, the signal LED is on and the water way is opened by lifting the bridge plates from two ends of the bridges. Opening the water way, the vehicles aren't allowed to pass above the bridge by closing the toll gate and ships can pass through the bridge plates. This project is made by using cardboards and system only. The system has been evaluated with the previous works and it was demonstrated to obtain some feedback on the prototype. The testing of the prototype demonstrated that the system was an integrated practical and easy to use and any new device could easily be installed into the system. The aim of this research project has been achieved successfully.[3]

In the first, each of Bridge plates is connected with servo motor to lift the bridge plates. Lifting is quickly and no systematically in the first. Later is become systematically. So, I prepared this project by replacing with two Stepper motors. Stepper motors have several major advantages over servo systems. They are typically lower cost, have common NEMA mountings, offer lower torque options, require less costly cabling, and their open loop motion control component makes machine integration simplistic and provides ease-of-use to end users. It is all about utilizing these technologies with balance to achieve the desired process performance for a given machine design while balancing cost versus the capability of the required mechanism. Machine designers shouldn't limit utilization of steppers or servos by a predetermined mindset or comfort level, but learn where each technology works best for controlling a specific mechanism and process to be performed. Servo motors are extremely repeatable because they run closed loop. But steppers can be just as repeatable in many applications, especially when running in one direction.

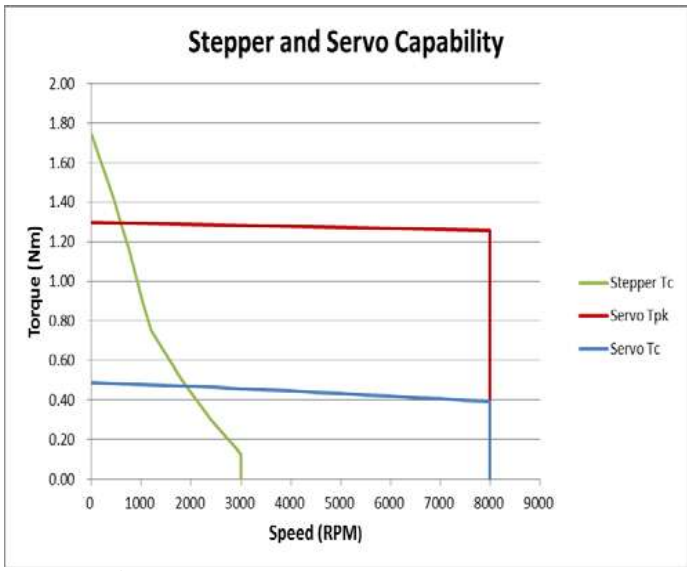

Fig. 2. Performance Curve Comparison with approximately same volume

Fig. 3. Arduino Uno board

Fig. 4. Servo Motor

Fig. 5. Circuit connection of Arduino, Stepper motor and Servo motor

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Fig. 6. Toll gate with Servo motor

Fig. 7. Auto bridge system

IV. CONCLUSION

This paper presents an overview of different baseline capabilities for selection criteria between stepper and servo technology. A thorough understanding of these technologies will help generate the best and most efficient mechatronic designs to bring forth the full capability of a machine.

APPENDIX

Assuming the desired process can be accomplished with either a stepper or servo motor solution, with the repeatability, accuracy and flexibility requirements, for present and future needs, the remaining considerations would likely be environment, life expectancy, operating noise, and/or energy utilization.

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REFERENCES

[1] Balancing Technology & Capacity for the best Performance
[2] Arduino board Uno, 2015. [Online] Available http://arduino. Cc/en/Main/Arduino Board Uno [Accessed 8 July 015].
[3] International Journal of Scientific and Research Publications, Volume 9, , April 2019 145 ISSN 2250-3153

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