**Latency Measurement of Multiple Servo Network**

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**Abstract – Many industries implement robotics to maintain a competitive advantage in terms of cost and labor. As these industries continue to grow, the need for more sophisticated robots grows proportionally. A key component to robotics is servo motors, which are actuation devices capable of precise control of angular position, velocity and acceleration. This study analyzes the Dynamixel AX12 series servos, and the effect of multiple servos on the overall delay between a command from a microcontroller to the servo’s response.**

# INTRODUCTION

The motivation of this study is a result of the development of a bipedal humanoid robot, which uses up to twenty AX12 servos simultaneously in order to perform functions such as legged locomotion. AX12 servos are high performance servos capable of precise position control, and are also capable of continuous rotation, making them very useful in developing particularly sophisticated robots.

# BACKGROUND

# METHODOLOGY

To determine the delay between the microcontroller command signal and the servo response an oscilloscope probe is placed at the command signal wire between the microcontroller and the servo, while another probe is similarly placed at the voltage wire. The oscilloscope is set to single trigger, on the falling edge of the voltage signal. The microcontroller is connected to a PC, and an instruction to move the servo is sent via a terminal program.

As the command is executed, the microcontroller sends out a signal to the servo, and the servo will draw current from the microcontroller in order to move. This results in a small, but measurable drop in voltage that will be detected by the oscilloscope. The oscilloscope will trigger, and capture both the voltage change and the signal command. The delay is measured between the rising edge of the servo command and the falling edge of the voltage drop.

This procedure is done on a single servo setup, a three servo setup, a six servo setup and a nine servo setup.

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Figure 1 - Measurement of the delay between the command and the servo response on oscilloscope.

# RESULTS

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# ANALYSIS

# CONCLUSION