Design of a smart controller for a Lizard Inspired Tube Inspection Robot

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RESEARCH QUESTION

Can we build a smart controller for lizard inspired robot to inspect tubes?

ABSTRACT

In this work, a smart force feedback controller is designed for a Lizard Inspired Tube Inspection (LTI) robot that has force-sensitive sensors embedded in its fingers. The primary function of this controller is to translate the robot application program and convert the commands from its source code to its respective motion. With the help of this controller, the operator would be able to send command to actuate the robot thus moving it along the robot. With this sophisticated gripper design, we need to include a force sensitive sensor at the point of contact the gripper makes with the tube to ensure effective gripping.

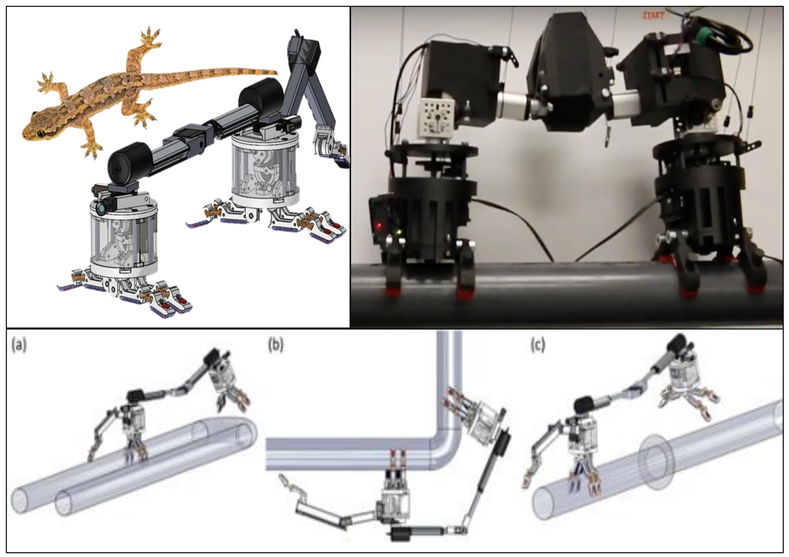

Fig. 1: Lizard Inspired Tube Inspection Robot (a) switching over parallel tubes (b) navigating around bends (c) elongating along a tube

METHODOLOGY

These sensors would send the appropriate force values exerted by the gripper. We have embedded distance sensors to provide us appropriate feedback on the linear elongation of robot. In order to make this user-friendly for the operator, we created a simple graphical user-interface to control the robot. Thus, allowing the operator to easily control the robot and perform maneuvers along the bends of the tube.

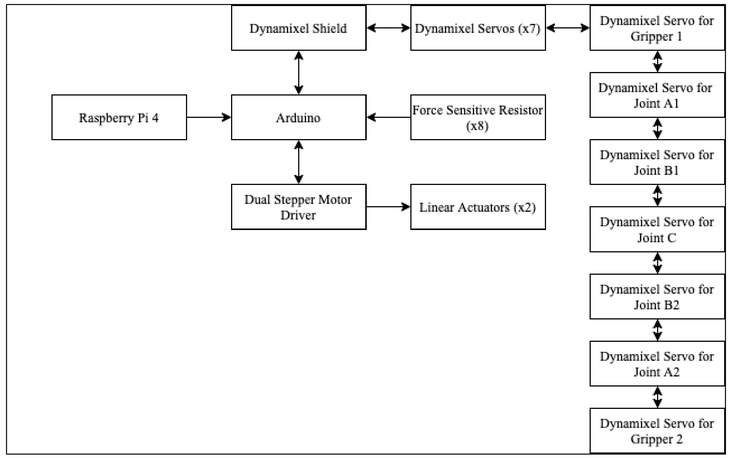

Fig. 2: Block Diagram of the proposed controller implemented to control the LTI Robot

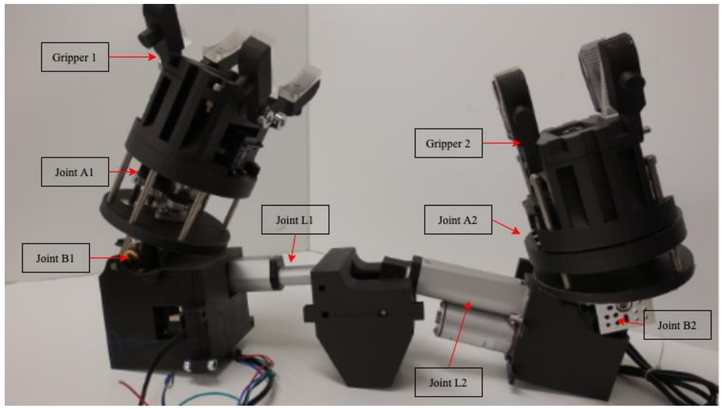

Fig. 3: Fully assembled LTI Robot indicating all joints that need to be actuated

EXPERIMENTS

To test out the controller, we set up the robot to grab onto a pipe and recorded the normal force applied by each finger. This test was repeated for a total force of 70N , 150N and 200N from each finger to ensure that the gripper has effectively latched onto the pipe. From these experiments, we conclude that a total of 200N of normal force is required from each gripper to effectively latch onto the pipe.

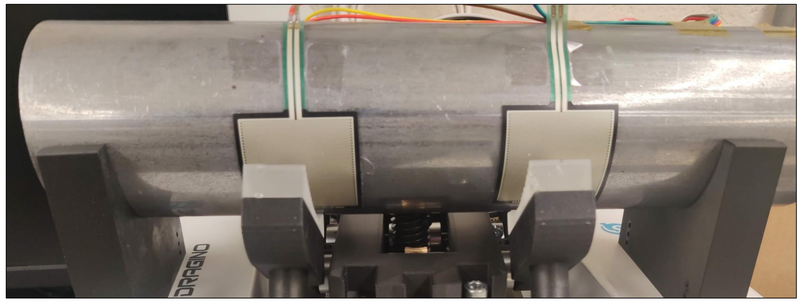

Fig. 4: Normal load testing to estimate the appropriate force needed for the gripper to effectively latch on the tube

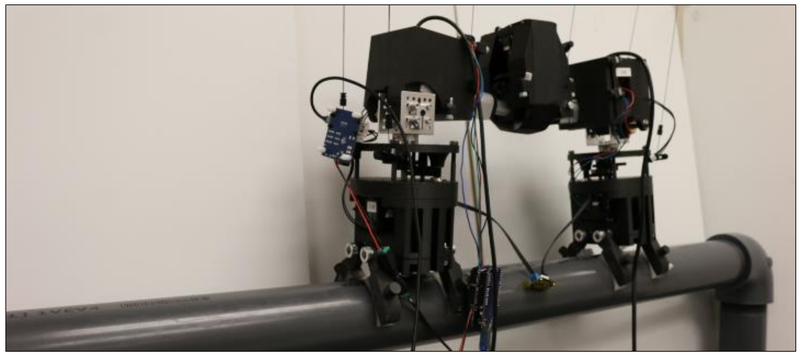

Fig. 5: Testing out the overall mobility of the LTI Robot on a horizontal tube setup

ACKNOLEDGEMENTS

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