ARAtronics Research Center for
Opto-Mechatronics Engineering

ARAtronics Research Center,
Mechatronics Engineering Department,
Faculty of Engineering and Material Sciences (EMS),
The German University in Cairo (GUC)

Bachelor's Thesis, Term Project

Quadruped Robot with A Tensegrity Spine Model Robot

Supervisor (s): (**Assist. Prof. Dr. Eng.** Amir Roushdy)

This project will do care about the current prototype of robot which will has stiff legs attached to the spine, and it will be used as a test setup for evaluation of the spine itself. This project will shows the advantages of Robot's spine by demonstrating the spine lifting each of the robot's four feet, both as a form of balancing and as a precursor for a walking gait. These foot motions, using specific combinations of bending and rotation movements of the spine, are measured in both simulation and hardware experiments. Hardware data are used to calibrate the simulations, such that the simulations can be used for control of balancing or gait cycles. Also, we can work with attach actuated legs to robot's spine, and examine balancing and gait cycles when combined with leg movements. **There is a Master's student from Mechatronics engineering Department and the Lab Engineer from ARAtronics, guiding and directing the student with Assist. Prof. Dr. Eng. Amir Roushdy.**

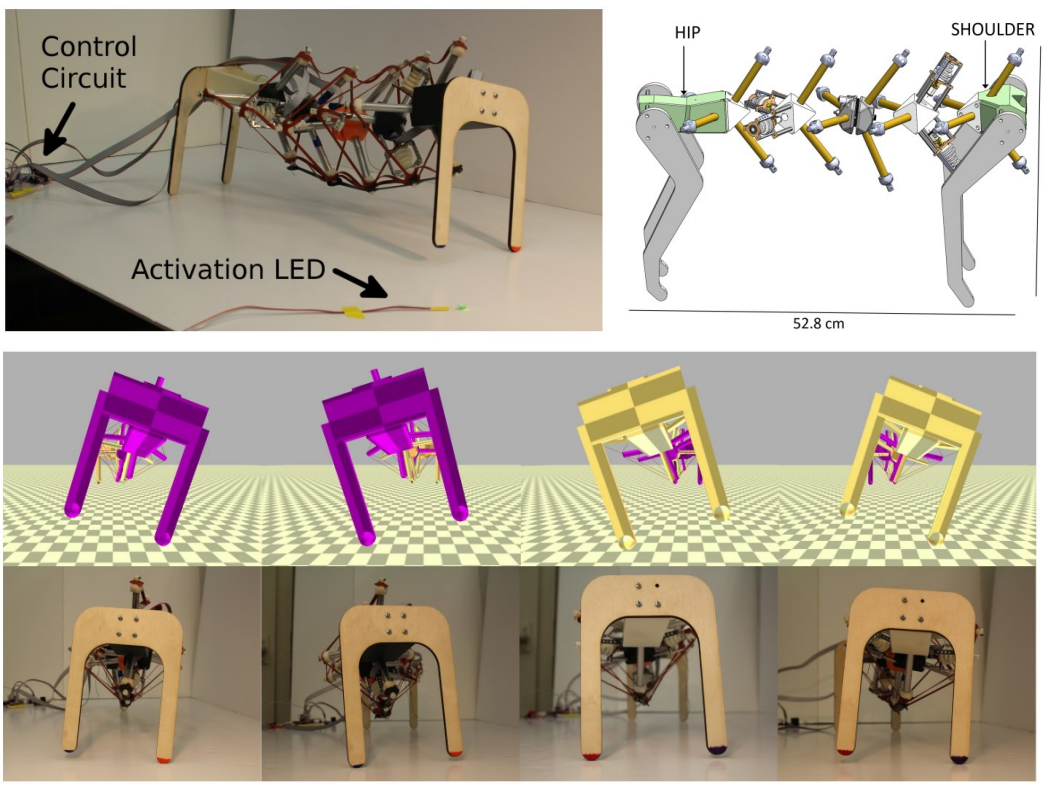

Fig.: Prototype of the quadruped robot with the flexible, actuated tensegrity spine. Motion of the spine allows a robot to balance on obstacles such as rocks (top). In comparison, without actuating the spine, the robot cannot balance and falls to its side (bottom.)

Project description and objective:

For more details please contact:
Assist. Prof. Dr. Eng. Amir Roushdy, Room: C7.108, E-mail: amir.ali@guc.edu.eg, Web site: www.aratronics.com

We will work on the quadruped robot's spine itself, the Underactuated Lightweight Tensegrity Robotic Assistive Spine, as well as the supporting hardware for robot's legs. The spine bends by adjusting the lengths of the cables that separate its vertebrae, and twists using an actuated rotating vertebra at its center

Research focus of this project:

- Literature review on the project should be studied properly.
- Not only, creating a software control system for the project but also the hardware.
- Experiments using the gadget and control system should be built properly.
- The outcomes must be documented.

Requirements:

- Passionate to learn more about 3D Printing design, Robotics and control.
- Prior mechatronic design expertise is desired like "SolidWork and Arduino".
- Enthusiasm for completing actual practical work with 3D printing staff (design fabrication and construction).
- A method of working that is both structured and self-contained.

General tasks of the project:

- The complete methodology is already available in the ARAtronics Lab, so we will discuss it from the first day to start the automation process for it
- Fabricate the machine/system using 3D printer/CNC machine (small parts).
- Assembly all parts of the Robot.
- Changing the working variables and see the effect on the locomotion of the robot.

Other notes:

- A weekly meeting with the advisors will be required for this project, as well as weekly progress updates (***The meeting could be more than once during the week based on your progress and based on your achievements***).
- You should to be in the Lab two days per week (***It could be more than two days based on your progress and based on your achievements***).
- All reports must be prepared in the style of a research paper.
- The outcome of this research will be published in one of the coming international Conferences and , or Journal

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