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

Spine Inspired Biotensegrity Model for Humanoid Robots

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

Most traditional robotic mechanisms feature inelastic joints that are unable to robustly handle large deformations and off-axis moments. As a result, the applied loads are transferred rigidly throughout the entire structure. The disadvantage of this approach is that the exerted leverage is magnified at each subsequent joint possibly damaging the mechanism. In this project, we will work on two lightweight, elastic, bio-inspired tensegrity robotic mechanism adapted from prior static models which mitigate this danger while improving their mechanism's functionality. **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.**

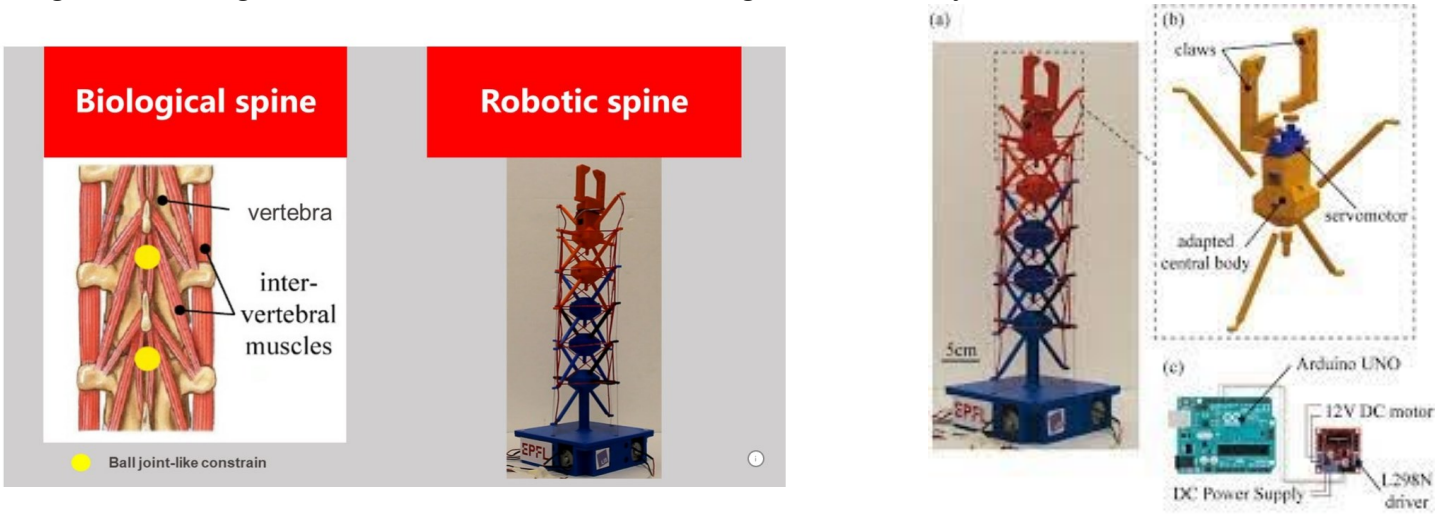

Fig.: A novel robotic spine can transition from compliant to stiff mode and back. The artificial spine consists of a variable-stiffness tensegrity design inspired by the vertebrate spine and could be used as the backbone of safe robotic manipulators, or agile and strong robots.

Project description and objective:

The project will be interested in presenting the development of the multi-segment lumbar structure based on the human spine. The structural advantages will demonstrate the joints will illustrate a solution to the fundamental issue of elegantly handling off-axis compliance. Additionally, this initial experiments will illustrates that moving tensegrity arms must be designed with large reachable and dexterous workspaces in mind, a change from prior tensegrity arms which were only static.

Research focus of this project:

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

- 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

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