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

Cyber-attacks on the Implanted Medical Devices Using Compatible Novel Bio-Mechatronics Technique

Supervisor (s): (**Assist. Prof. Dr. Eng.** Amir Roushdy)
(**Assoc. Prof. Dr. Eng.** Amr ElMougy) from Media Engineering and Technology

In this project a new concept of charging implanted devices through the means of acoustic energy harvesting. The harvester used in this study is a resonator tube that would amplify the bending stresses on the lead zirconate titanate piezo electric material (PZT) cantilever inside of it at the resonant frequency. A sweep of different frequencies from 5Hz-70Hz were tested and results were recorded to measure the best output. This output energy can then be stored and used to charge implanted medical devices. Measures were also taken in efforts to secure the system from physical layer attacks that would disrupt the charging process. Different attack configurations were analyzed to understand how they can be executed in real-life scenarios. The maximum voltage recorded was at 45Hz at 0.74V. Attacks on the system were also successfully simulated, and the result is that they were observable and not discrete. **The project will be in collaboration with the MET department and there is other students in the MET Department will be working with you to create the cyber security on the system. Also, There is a senior student from ARAtronics lab and the Lab Engineer from ARAtronics, guiding and directing the student**

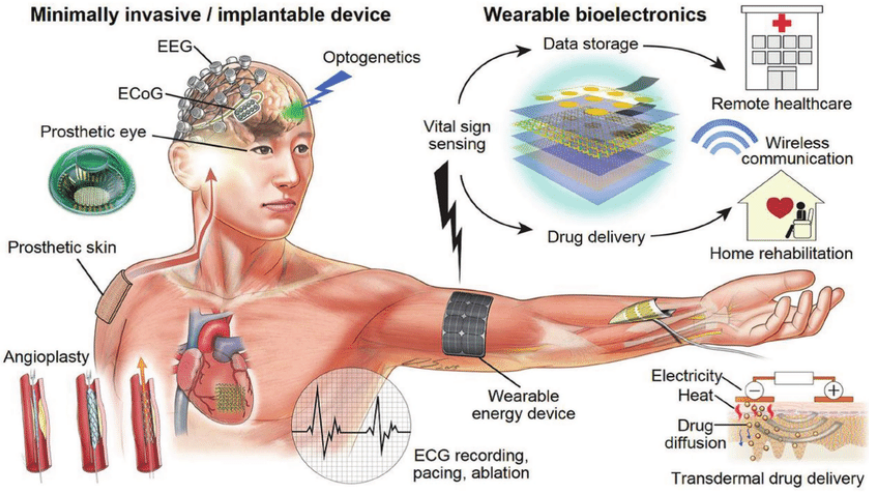

Fig.: Cyber-attacks on the Implanted Medical Devices

Project description and objective:

In this project, a resonator was fabricated from acrylic sheets, and a piezoelectric cantilever was attached at the open end of the tube. A frequency sweep was performed and the resulting voltage changes were

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recorded and analyzed. Moreover, a jamming attack was employed on the system and the resulting data concluded and showed that there would be a significant drop in the energy harvested.

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, Sensing Design, 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 robot/system using 3D printer/CNC machine (small parts).
- Assembly all parts of the proposed system.
- Changing the working variables and see the effect on the system.

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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