Interfacing APL Snake End Effector to LARS

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Outline

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Statement of Our Project

The main and static aim of our project is to interface the APL Snake end effector to the LARS and achieve end-point control.

Image from: Tutkun Şen: *Elastography with LARSnake Robot*
Background & Significance

• The APL Snake was initially developed with an intention of use in hip osteolysis removal surgery.

• Various potential applications have been thought of since development, such as use in heart surgeries etc.

• Constantly being upgraded to be a self sustained surgical tool.

• Intuitive control interface for the manipulator, has since, been designed and integrated with the snake using PHANTOM® Premium haptic controller.

• LARS is an ideal system to aid autonomous operation of the APL Snake due to its mobility, dexterity, and versatility of use with various end-effectors.

Image courtesy: Tutkun Sen
Original Plan: Project Stages

Minimum:
- Fix the LARS ————→ (Mar 15th)
- End-point control ————→ (Apr 15th)

Expected:
- 3D Registration and alignment with insertion axis— —→ (Apr 22nd)

Maximum:
- Configure the Snake in any desirable alignment— —→ (May 6th)
- Demonstration of the same on cadaver ——— —→ (*)

*after the end of EN.600.446 timeline Prof. Armand expects us to demonstrate application on a cadaver and record video of the same.
Major Change

- The repairing of original LARS given to us is taking more time than expected. Hence we had requested Dr Taylor for another LARS which is working. We have received the same on 9th April 2013.

Problems Faced

- Open ends and loose wires. (resolved)
  The connections where problems were detected were re-soldered.

- Gear slip in motor. (unresolved)
  Notified to mentors. It was decided to be dealt with at the end when other motors were working.

- Broken encoders. (partially resolved)
  New encoders have been received recently.

(images by Piyush, Ashish)
In –Progress

Registration Algorithm.
The registration algorithm is a pre-operative as well as intra operative procedure. Our algorithm can be depicted as follows:
In Progress
Forward Kinematics

Image from Seth Billings and Ehsan Basafa
In Progress
MATLAB Simulation OF Forward Kinematics
**Project Plan Timeline**

<table>
<thead>
<tr>
<th>Task</th>
<th>Timeline</th>
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<tbody>
<tr>
<td>Finalisation of 'Aims to achieved' and project proposal presentation</td>
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<tr>
<td>Understanding 'Galil Suite' and DMX Controller of the LARS</td>
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<td>Going through CISST libraries and understanding installation</td>
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<td>Reporting about issues of LARS to Dr Taylor</td>
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<td>Getting the LARS Ready</td>
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<td>Algorithm for registration process</td>
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<td>Calculation for Inverse Kinematics of LARS</td>
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<td>Integration of controllers for LARS and APL Snake</td>
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<td>End Point control of LARS and APL Snake</td>
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<td>Achieving alignment with insertion axis</td>
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<td>Configuration of APL Snake in desired alignment</td>
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<td>Preparation of report and poster</td>
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<td>Final Presentation</td>
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**Key for timeline**

- **Done**
- **In Process**
- **Delayed indefinitely**
- **Not Started**
Dependencies

• Requirement of parts/tools for replacement in the LARS.
After discussion with Prof Taylor and our mentors Prof Armand & Ryan Murphy it was found best to replace the LARS. *We have received the new LARS today i.e. 9th April 2013.*

• Working platform/software with the snake.
We hope to have a working platform/software which can control the snake’s precision by 22\textsuperscript{nd} April 2013. This will allow us to implement accurate control of snake after mounting it on the LARS. Ryan Murphy is working on the same.
Reading List


QUESTIONS?

THANK YOU!