WORKSHOP 4: DESIGNING NOVEL ROBOTIC SYSTEMS

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Topics

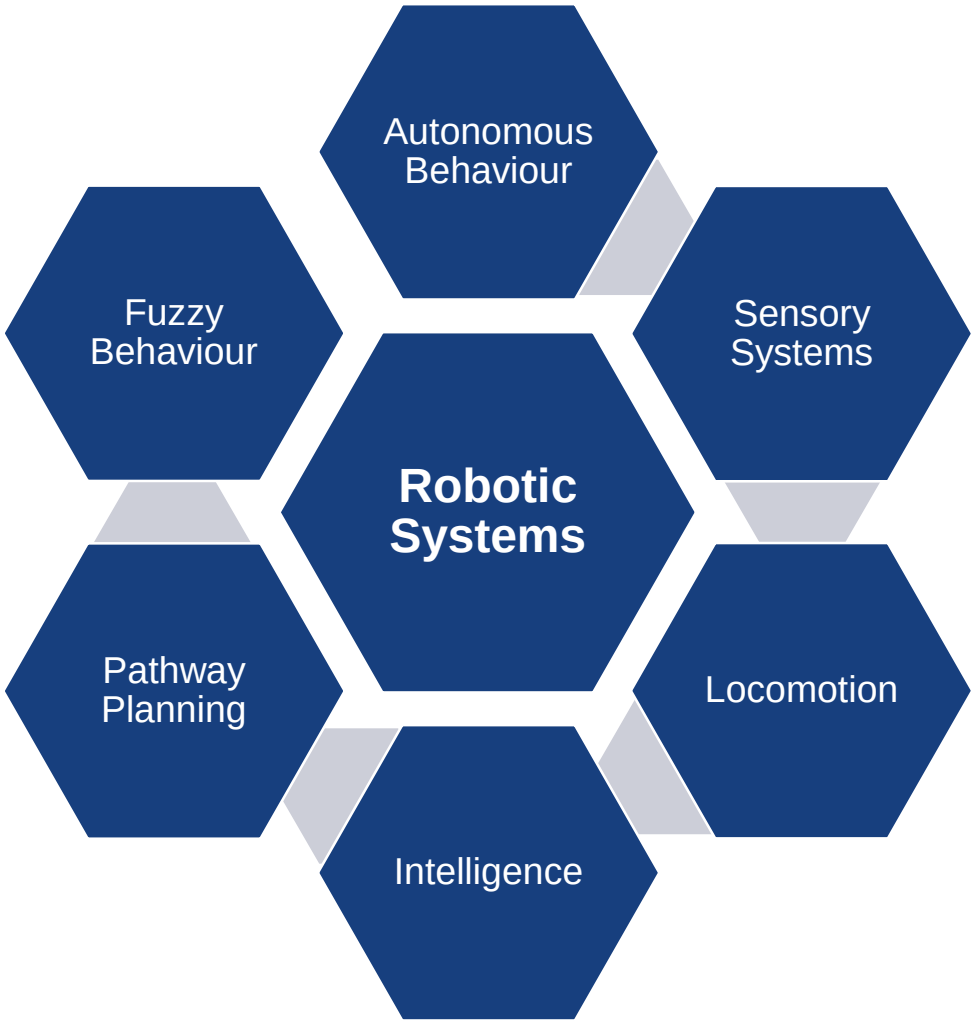
- Introduction
- Summary of topics covered
- Novel methodologies

Introduction

- This workshop is to train and teach participants to implement and design robotic systems for real world applications

- RBS professionals need to identify proper pain points to tackle to ensure success

Summary of Topics Covered



Novel methodologies

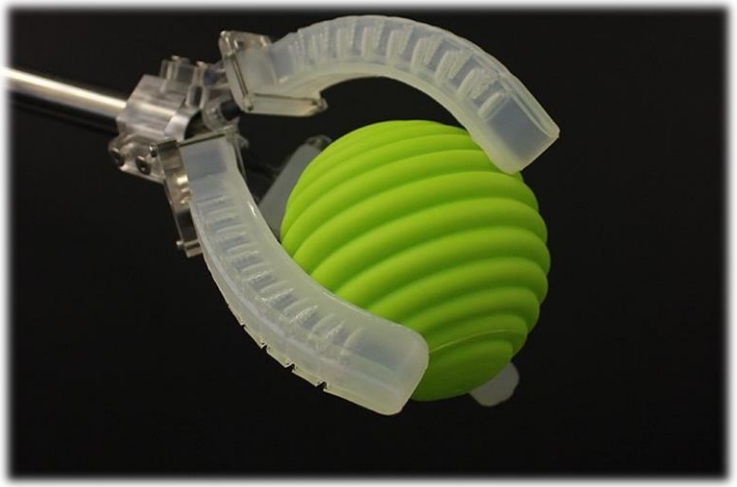
Soft Robotics

- To achieve **high compliance and nature-like movement**
- Use of **pneumatics, electric field, thermal, inflatables, elastic materials**
- Applications: Medical, Massage, Assistive device, Space exploration

Video Link:

https://www.youtube.com/watch?v=X0XGure7mak

https://www.youtube.com/watch?v=N28bttqLoZE



https://www.therobotreport.com/97810-2/

Novel methodologies

Soft Robotics Example 1:

https://www.youtube.com/watch?v=X0XGure7mak

Novel methodologies

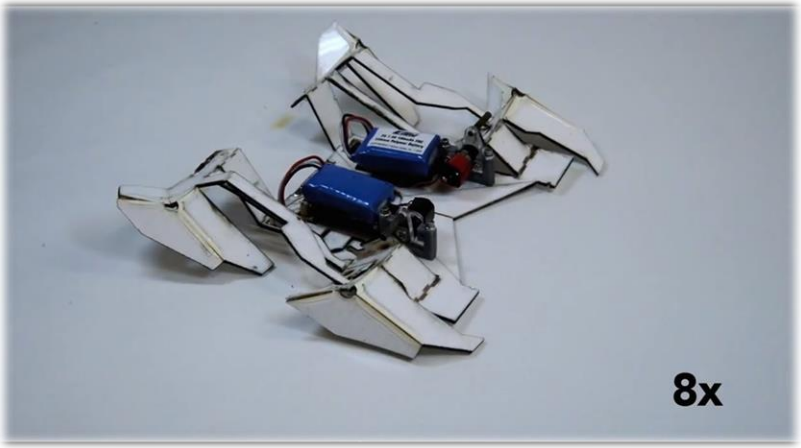
Soft Robotics Example 2:

https://www.youtube.com/watch?v=N28bttqLoZE

Novel methodologies

Shape Shifting/Self Assembly Robots

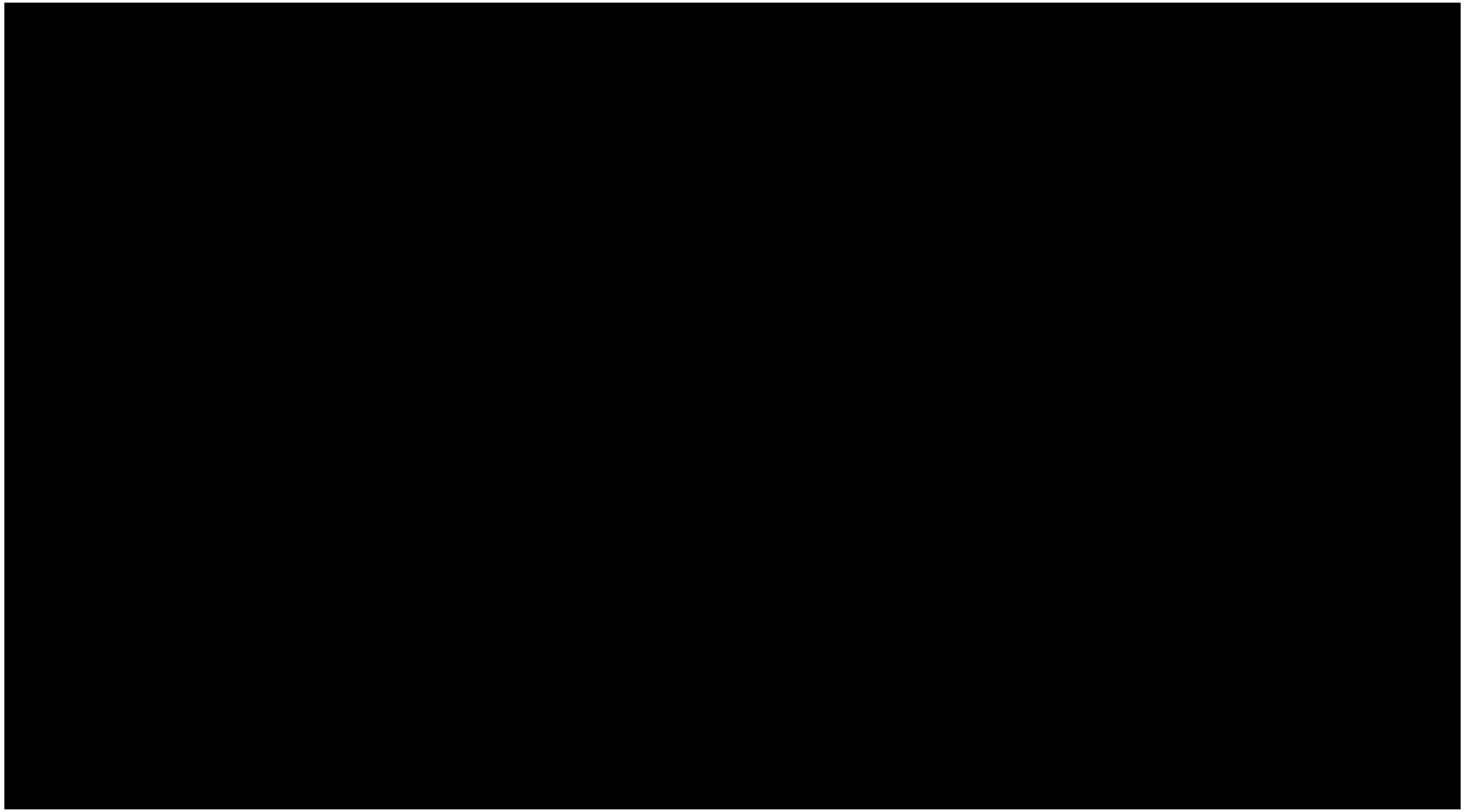
- **Assemble and morph by itself**
- Can change from **2D to 3D**
- Based on principles of origami and other mechanisms
- Applications: Space, Military



https://www.youtube.com/watch?v=9M1zNIVGrjM

Novel methodologies

Self Assembly Robots



https://www.youtube.com/watch?v=9M1zNIVGrjM

Novel methodologies

Shape Shifting Robots

https://www.youtube.com/watch?v=Pfo233eN3HE

Novel methodologies

Telerobot

- Based on a **Master and Slave** approach
- Algorithms may assist pilots to better control the robotic limbs
- Applications: Surgery, Manufacturing, Space, Military… etc.

https://www.youtube.com/watch?v=3rZYn62OId8

Novel methodologies

Telerobot (Shadow Hand) Example:

https://www.youtube.com/watch?v=3rZYn62OId8

Identifying Use-cases

Look for:

- **Daily pain issues** (no pain, no interest)
- **Revenue generating or manpower saving or cost saving** opportunities

After identifying, ask yourself these questions:

- Can the problem be solved with other cheaper alternatives than using robots?
- Will robotics result in cost or manpower savings in the long run?
- Will it infringe any patents or company IT policy or ethical policies?
- Will it cause inconvenience in any way?
- Is it cheap to try out ?

Robotics Blueprint and Implementation Plan

ISO 29990:2010

NUS National University of Singapore

ISS

Design

- What is its purpose? And design/constraint factors to consider?
- What is the technical requirement?
- Info about required hardware and software components?
- Components integration plan and tools?
- Robotic flow process (see next slide)

Production

- Assembly requirement and process?
- Diagnosing of issues during prototyping or production

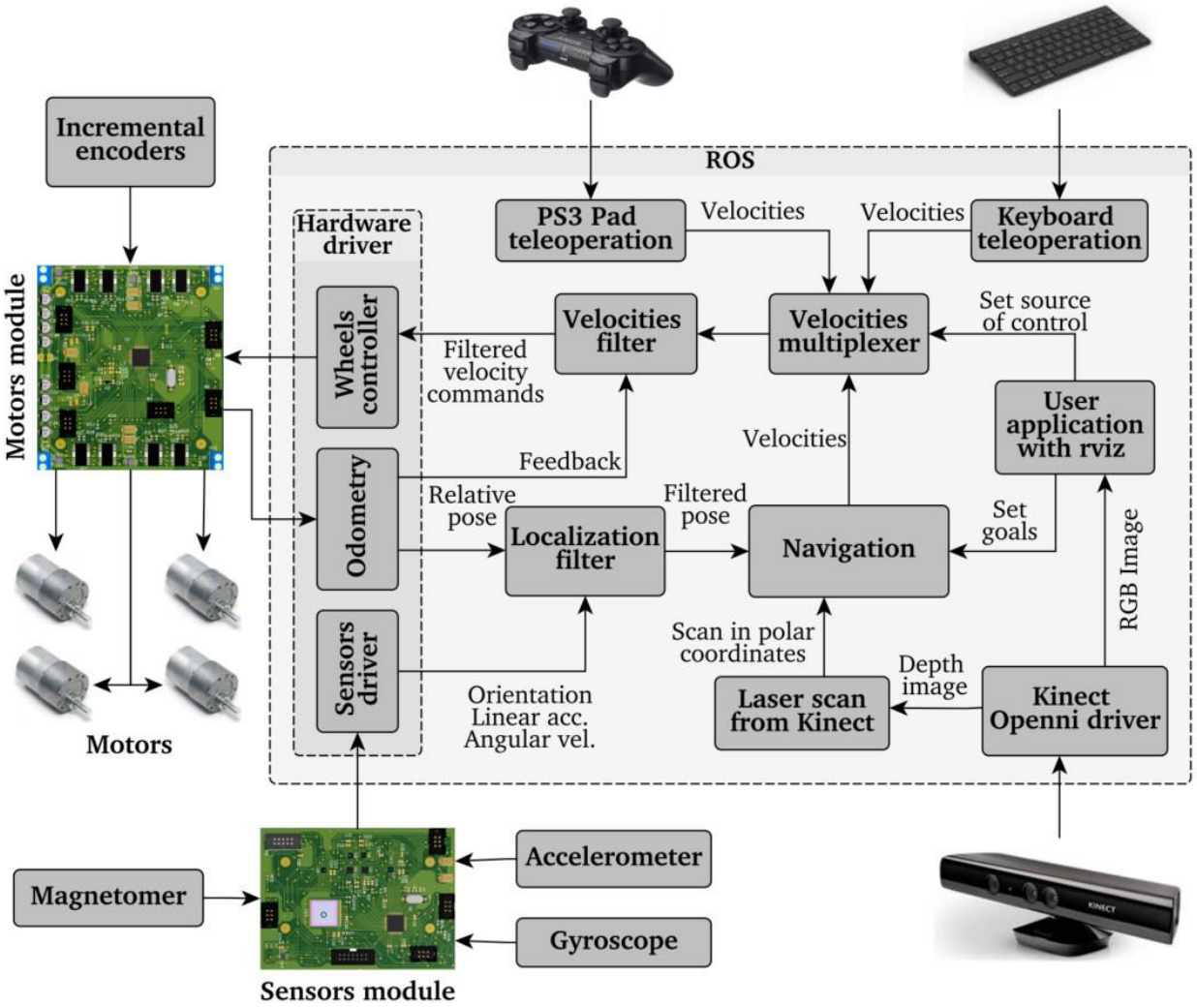
Service

- Maintenance requirement and monitoring?
- Reliability issues and Mitigation Plan?
- Safety and Security Risk and Mitigation Plan?

Focus

**** Use the pointers as a guide only. Need not follow everything.**

Example of Robotic flow process



Various critical components:

1. Sensors
2. Variable derived
3. Processing
4. Sub-Components
5. Decisions
6. Actuation/Action

Homework

- **Prepare a real robotics implementation plan** specific to your work place or identified use-case
- Include all the points discussed in the previous few slides
- **To be presented and submitted on the 5th day**
- **5~10 minutes presentation** (10 slides or less) and 5 minutes Q&A per person
- Have more graphics/charts/figures than wordy
- PowerPoint-based
  - Use template provided

End of Workshop 4