Position Sensing and Imitation
Intermediate Presentation

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Reminder: Goal Statement

- **Goal:** Mimic position and motion of a plate

- **Sensing:** 3D MEMS attitude sensor embedded in a plate
- **Communicating:** Implement industrial bus
- **Actuating:** Rotate a plate using motors
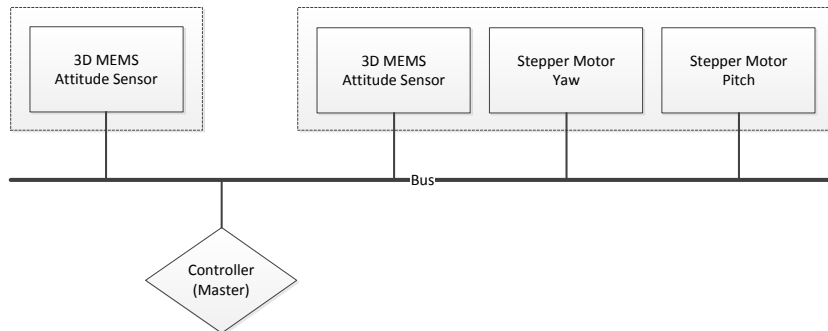
Reminder: Functional Overview

Figure: Diagram of the Functional Specification

Reminder: Major Milestones

- **Sensing:** Read and process MEMS data
- **Actuation:** Control stepper motors
- **Mechanics:** Construct movable plate
- **Communication:** Implement industrial bus
- **Controller:** Bus master, main computational unit

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Milestone: Sensing
Read and process MEMS data

Status:

- Reading data via I2C works
- Computing plate position from data works
- Additional filtering might be required

Milestone: Actuation
Control stepper motors

Status:

- Communication with stepper drivers via SPI works
- Control of stepper motors works
- Additional work on control daemon necessary

Milestone: Mechanics

Construct movable plate

Status:

- First version of plate construction printed
- Works for now
- Design on second, refined version in progress

Milestone: Communication

Implement industrial bus

Status:

- A lot of research was done
- EtherCAT selected as most interesting
- CAN selected as fallback
- Work in progress

Milestone: Controller
Bus master, main computational unit

Status:

- Modular design to fit CAN and EtherCAT
- High-level controller class receives periodic sensor input events
- ... and computes angle corrections for all drives
- CAN or EtherCAT wrapped into classes to provide the events and send corrections
- Built on a BeagleBone Black

Timing

Timing goal: Move plate to desired position within 1 second

Fixed timings:

- Sensors
  - Sample every 10 ms
  - Report mean value every 100 ms
- Actuation takes up to 500 ms

Delay constraint: 500 ms to compute & communicate

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Node Description

Node Name	ID / Priority	Master / Slave
Controller	1	Master
Source Sensor	2	Slave
Target Sensor	3	Slave
Stepper Driver	4	Slave

Table: Nodes in the network

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Message Description

Description	Data Request	Length
Sensor Position	Allowed	6 Bytes
Rotation Command	Not Allowed	3 Bytes

Table: Possible messages in the network

Future work

- Implement bus communication
- Finish master controller
- Tune motor timings
- Refine plate construction

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Thanks for your attention!

Questions? Ideas? Suggestions?

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