

# Position Sensing and Imitation

## Intermediate Presentation

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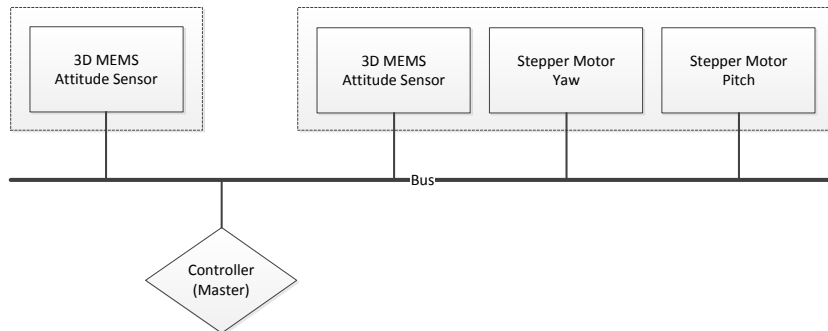
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# Reminder: Goal Statement

- **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

# 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

# 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

# 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

Thanks for your attention!

Questions? Ideas? Suggestions?