



Embedded System

Feb 2025 Presentation

Presentation_Contents to be covered

1. Storyline & Mission Statement/Objectives
2. Task Assignment
3. Abstract Representation (& flows & flow chart) (for Demo session only)
4. Devices
5. Resource (Software), Protocols?
6. Challenges & Goals
7. Specifications
8. Job roles of each member
9. Gantt Chart
10. Budget estimation (Ceiling: NT 1000 per group)
11. 抬頭: 國立臺灣師範大學; 統編: 03735202

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Mission Statement/Objectives

Temperature control in a remote plant has malfunctioned due to a faulty sensor. An IoT-based Service Module (ISM) will be developed to navigate autonomously to the remote plant, by searching for objects of certain shapes for navigation. Upon reaching the plant, the ISM will take over the faulty temperature control, through its on-board temperature sensor and utilizing the plant's heating unit. The ISM's web-cam and temperature sensor, and the plant's heater are all IoT-enabled. Navigation decision and temperature control algorithm are performed on the base station laptop, communicating with the ISM's controller and IoT devices.

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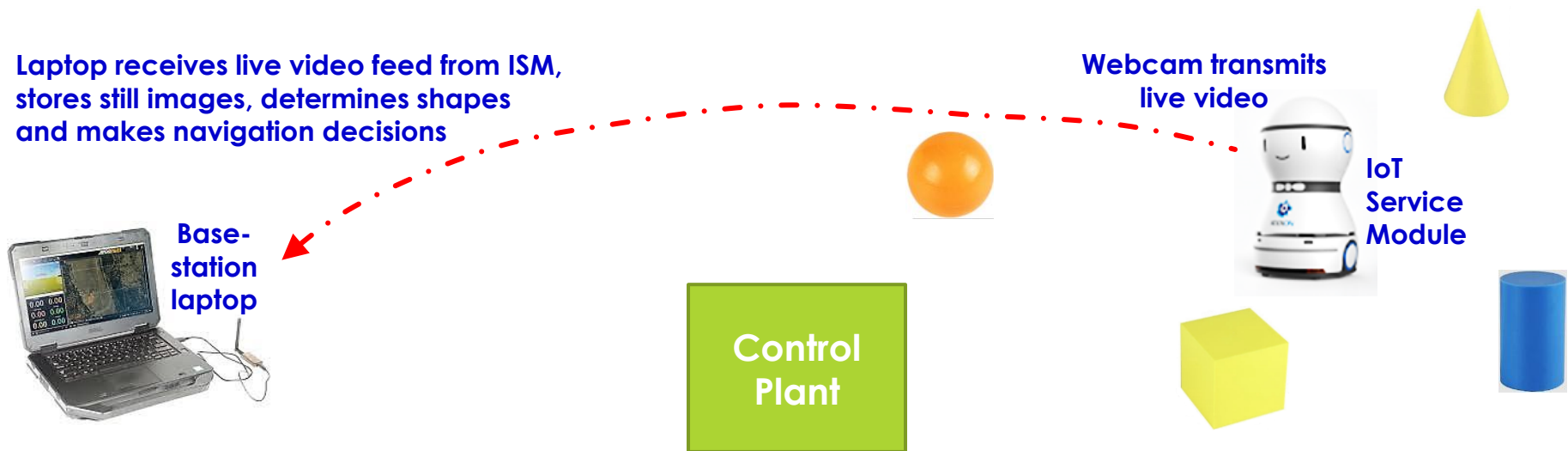
To design, build & operate a service robot (ISM) which:

- 1. Moves autonomously to search for objects of certain shapes for navigation purpose**
- 2. Captures & sends video to base station laptop which performs image processing, makes decisions and sends navigation commands back to the robot**
- 3. Senses temperature and controls a heater in a plant**
- 4. Remotely performs temperature control of the plant**

Task Assignment

1. Image Processing & Transmission (IPT)

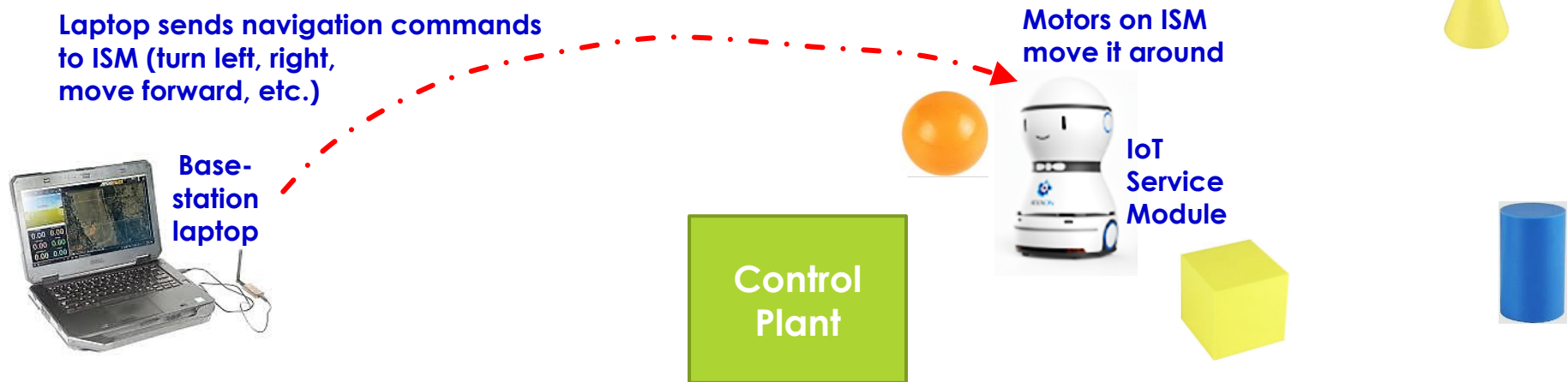
Transmits video from ISM web-cam to base station laptop for navigation objective. Code running on the laptop recognizes the objects' shapes and makes decisions. Still images of the objects are also captured and stored in the base station laptop.



ISM1.0 Task Assignment

2. Autonomous Navigation (AN)

Maneuvers the ISM autonomously to search for objects of certain shapes for navigation purpose, to reach the control plant. Navigation code resides in the base station laptop. Based on shapes of detected objects, the base station laptop sends navigation commands to the ISM controller to move the bot.



ISM1.0 Task Assignment

3. Sensing & Actuation (SA)

Upon reaching control plant, ISM senses and transmits control plant's temperature from its IoT temp sensor to the base station laptop. Supply of power to the plant's heating unit is modulated to maintain the plant's temperature at a certain setpoint.

Laptop receives live temperature data from ISM
& sends heating command signals to ISM

ISM's temp sensor transmits
plant's real-time temp data.
ISM also modulates
power to heater



Base-
station
laptop



IoT
Service
Module



ISM1.0 Task Assignment

4. Plant Temperature Control System (TCS)

Perform remote closed-loop temperature control of the plant, on the base station laptop, for a duration of 2 minutes. The plant's temperature profile and variable command output to the heater are stored in the base station laptop, for final judging objective.

Laptop performs closed-loop temp control of plant for 2 minutes, stores temp profile and heater command data for subsequent retrieval



ISM1.0 Challenges & Goals

Round 1 : Autonomous Navigation Only

- ▶ ISM moves autonomously, detects 3 objects of different shapes for navigation, to reach a final destination.

Round 2 : Autonomous Navigation & Temp Sensing Only

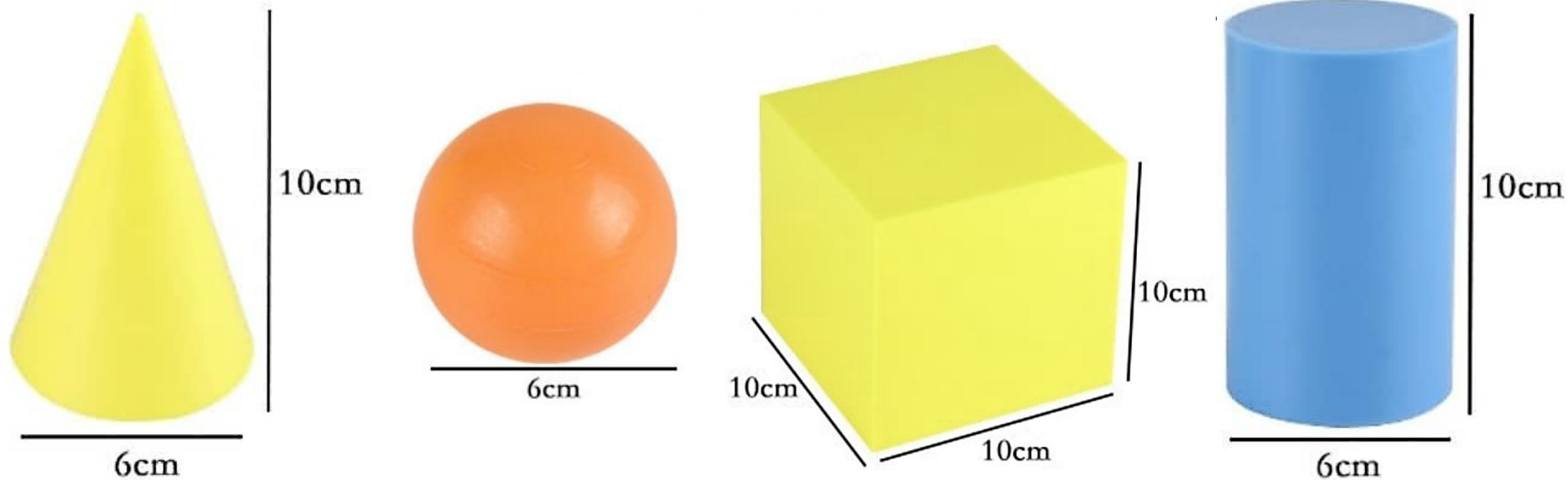
- ▶ ISM navigates autonomously via detection of 2 objects, senses & transmits temperature data to remote laptop for subsequent retrieval.

Round 3 : Remote Plant Temperature Control

- ▶ ISM navigates autonomously via detection of 2 objects to reach control plant & performs remote temperature control for 2 minutes. Temp & heater profile to be retrieved from laptop

Specifications

Shapes for Navigation Guidance



Source of blocks:

(Click for website)

[Vendor 1](#) or [Vendor 2](#)

Project Timeline

[illegible]

