Robotics Lab - 221 LIA 001

Assignment 2
Due:November 1, 2023, 2.00 pm IST
Submission via Github classroom

- **Question 1:** Realize the ROS nodes and messages as shown in the figure 1 below

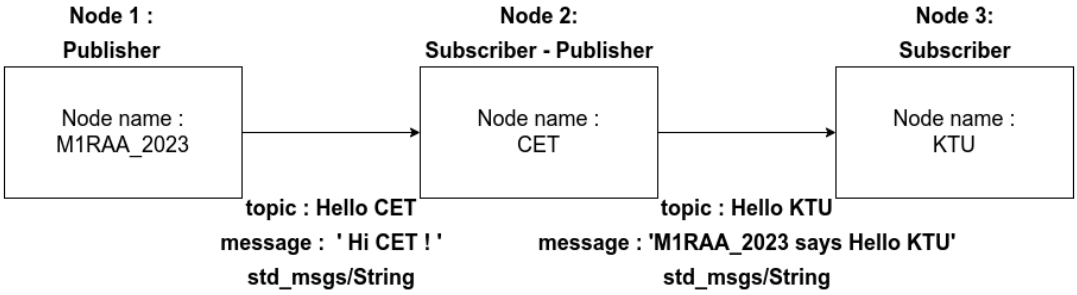


Figure 1: Illustration of nodes and messages for assignment 2 question 1

Run the code for the nodes and answer the questions below. Type down the questions and answers in the a text file "<your name>assign2_answers and commit to assignment git. All Python script files (suitably named), ros graphs saved in *png* format are also to be committed to the git.

1. List the currently running nodes
2. List the currently running topics
3. What is the role of the node *rosout*
4. Change the name of the first node to 'M1RAA 2023' and rerun the code. Write down any error message displayed.
5. Run the rqt_graph tool and save the node graph as 'assign2_rosgraph'

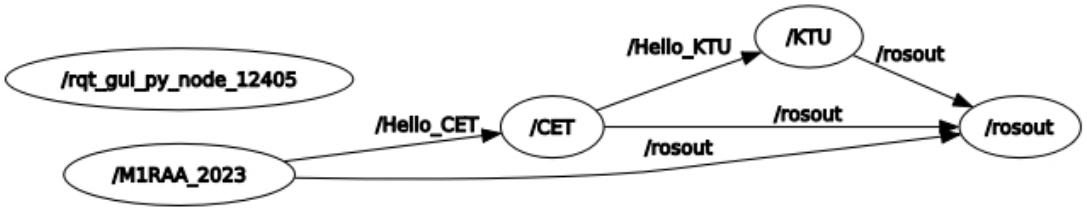


Figure 2: Expected ros graph

- **Question 2:**
On August 27 2023, the Indian Space Research Organisation (ISRO) released a graph of the temperature variation between the moon's surface and a point around 8 cm below as measured by an instrument named ChaSTE on board the lander module of the Chandrayaan-3 mission [1][2]. ChaSTE is a temperature probe that can be driven into the moon's surface using a motor to a depth of up to 10 cm. The temperature probe has 10 sensors.

The question 2 of assignment is inspired from the ChaSTE probe on-board the Vikram lander. Assuming that the above system is ROS 1 based, we simulate the temperature acquisition using ROS publisher-subscriber model involving two nodes 'temperature_sensor'

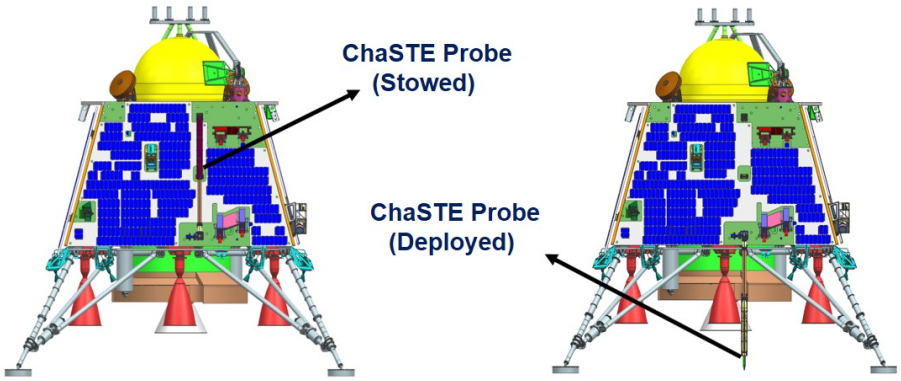


Figure 3: Chandra's Surface Thermophysical Experiment (ChaSTE) probe [1]

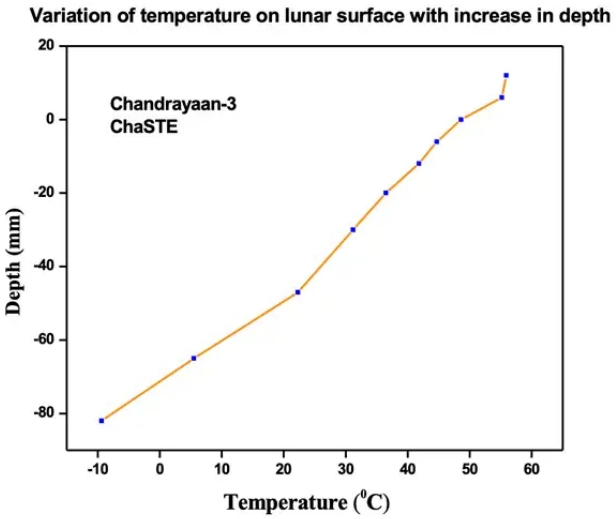


Figure 4: Variation of temperature on lunar surface with increase in depth [2]

and 'control_unit_01'. The 'temperature_sensor' node publishes temperature updates acquired by 'probe_01' on topic 'temperature_update' at rate of 1.0 Hz. The 'control_unit_01' node subscribes to the 'temperature_update' topic.

Hints :

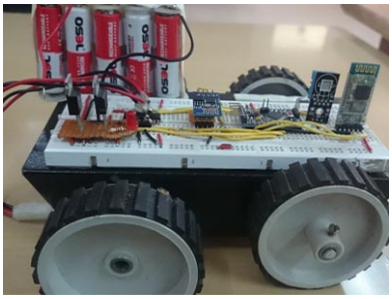
1. Use suitable ROS message types from *sensor_msg* package to simulate the system
2. The random temperature values can be generated using methods from *random* Python module like *random.randrange()* or *random.random()*

- **Code execution videos**:

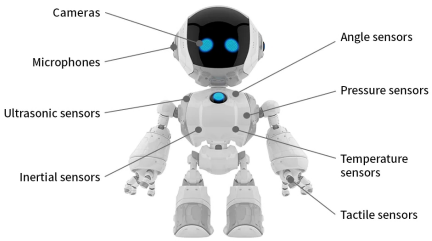
(a) Question 1

(b) Question 2

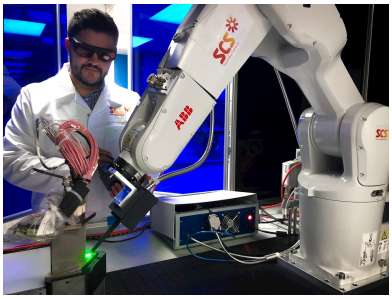
- More examples involving robots in sensing applications



(a) A simple application involving temperature sensor(s) mounted on an mobile chassis. This does not seem to be a ROS based system



(b) Latest service robots are equipped with dozens of sensors for purposes like spatial awareness and motion detection [3]



(c) ABB IRB 1200 robot in non-invasive extreme temperature sensing application [4]

References

[1] @online Chandra's Surface Thermophysical Experiment (ChaSTE), `https://www.prl.res.in/~pids/ChaSTE.html#` Online; accessed 24-October-2023

[2] @online The first observations from the ChaSTE payload onboard Vikram Lander, `https://www.isro.gov.in/Ch3_first_observation_ChaSTE_Vikram_Lander.html#:~:text=ChaSTE%20(Chandra's%20Surface%20Thermophysical%20Experiment,10%20cm%20beneath%20the%20surface.` Online; accessed 24-October-2023

[3] @online What Role Do High-Precision Sensors Play in Creating Natural Movement in Robots?, `https://www.tdk.com/en/featured_stories/entry_037.html` Online; accessed 24-October-2023

[4] @online It is rocket science: ABB robot helps test extreme high temperature systems, `https://new.abb.com/news/detail/61133/it-is-rocket-science` Online; accessed 24-October-2023