RMI

ROBOTICS AND MACHINE INTELLIGENCE

INDUCTIONS '19

Greetings from RMI!

Welcome to the RMI Inductions '19! Over the next few weeks, you will be given a progression of tasks designed to help you learn and explore the field of robotics.

The inductions will be conducted in two stages:
  I.   The Practical Implementation Stage. Here, you will be given a set of tasks to work on that will facilitate your learning and understanding.
  II. The Personal Interviews (PIs) Stage. This stage will be conducted at the start of the next semester.

The Practical Implementation Stage is split into two section: **Basic** and **Advanced**. This document outlines all the Basic tasks to be completed. **All Basic Tasks are compulsory.**

The problems are designed in such a way that even a beginner can learn by implementing these tasks. You might face issues or difficulties in completing the tasks, but do not give up. It is quite normal to hit roadblocks while progressing. In any case, feel free to contact your mentors or any member of the club

Rules:

1. All the basic tasks are compulsory.
2. It is good to work in teams, but the tasks are not meant to test your teamwork. The problems must be solved individually. Learning how everything works is key. Make sure you understand everything well.
3. Maintain documentation of all tasks you complete and take videos of them. You may be asked to explain the working of your task using these videos.

General Instructions:

1. The components can be reused for other tasks. (It isn't necessary that you preserve the setup, but bring the required components because you may be asked to rebuild it in college)
2. Go through the problem statement and understand the task well before you start working on it. A task misunderstood and completed will not be considered.
3. We expect you to understand the concepts and write your own code. It is acceptable to refer to code snippets online but copying the code is not an option. You will be extensively questioned based on the code and will be asked to make modifications during PI's
4. The estimated time mentioned may vary from person to person and approach.
5. You may use the Microcontrollers and Programming Languages of your choice for all tasks.
6. Divide a complex task into modules and work on the individual modules. Completing the modules will be appreciated even if you are unable to complete the entire task.
7. In case you have doubts, search for solutions online. If you are unable to get answers you may post your queries on the RMI Fresher's Forum.

Task 1:

Objective: A four bar is a mechanism that is commonly used in legged robots and manipulators due to its mechanical advantage. Fabricate such a four bar quick return mechanism.

Details: Build a working model of a four bar quick return mechanism(Crank Rocker) with any material of your choosing. Make sure that it is robust and sturdy enough to transport.

Estimated time: 4 days

Task 2:

Objective: Servos are position controlled rotary actuators that find widespread use in many Robotics applications. Your task is to mirror a potentiometer twist angle with a Servos head angle.

Details: You must interface a potentiometer to a microcontroller using ADC and control the angle of a Servo using PWM, making sure that the Servo angle mirrors the potentiometer angle.

Estimated Time: 2 days

Things to Learn: ADC, Timers, PWM, Servos

Task 3:

Objective: DC Motors are generally used to facilitate locomotion in mobile robots. Use an ultrasonic sensor to control a DC motors speed.

Details: Your task is to interface an Ultrasonic Sensor and a DC motor to a microcontroller. Your program should speed the motor up when an object is close to the sensor and vice versa.

Estimated Time: 2 days

Things to Learn: Motor Driver Interfacing(L293D/L298N), Ultrasonic Sensor Interfacing.

Task 4:

Objective: TSOP is a common protocol used in swarm robotics to communicate between multiple units. You are tasked with implementing a very basic TSOP communication setup. Toggle an LED on/off whenever a button is pressed on a remote Microcontroller.

Details: Your setup must include a TSOP IR Sensor connected to an LED, and a button, IR Led connected to a Microcontroller. When the button is pressed, the IR LED connected to the Microcontroller must send a signal, which is received by the TSOP module to make the other LED glow.

Estimated Time: 2 days

Things to Learn: IR TSOP communication, Button debouncing

Task 5:

Objective: Serial communication is a common communication protocol for data transmission. Your goal is to light up an LED matrix based on keyboard input.

Details: Your setup must be a 4 by 4 grid of LED's (16 total). Choose any five letters and hardcode the LED matrix to glow in the shape of one of these letters when the corresponding key is pressed on the keyboard. When the word 'blink' is entered on the keyboard, the entire LED matrix must blink twice.

Estimated time: 4 days

Things to Learn: Serial communication

Task 6:

Objective: Most robotic systems depend on the ability to draw inferences based on sensory data input. Your task is to identify the pattern of letters present in a given array.

Details: You will be a given an array of characters of max length 16. Write code in a language of your choice to recognise the repeating pattern that can be of maximum length 8.
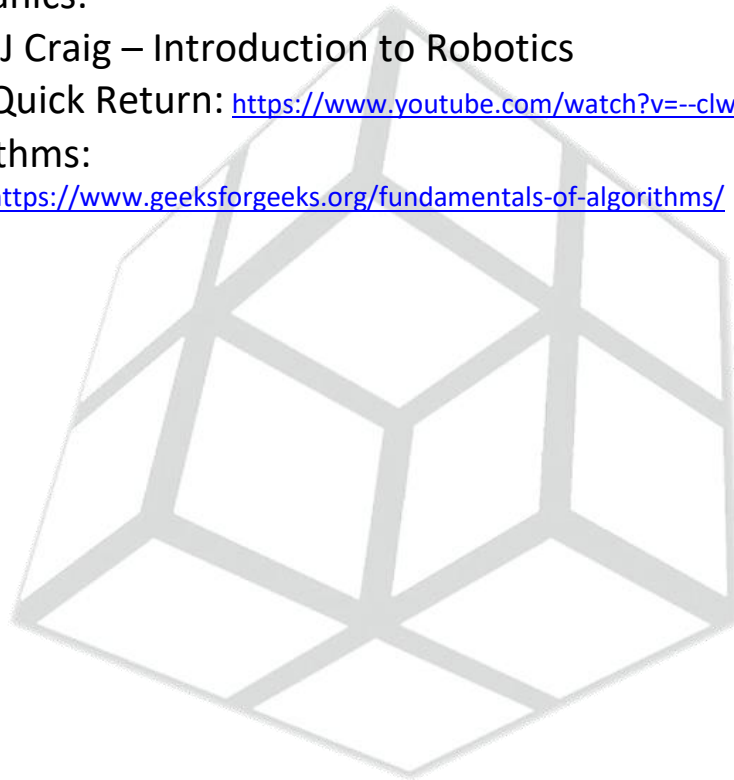
An example array: "abxyabxyabxyabxy". Your program must detect the repeating pattern abxy and print it to the console.

Estimated time: 2 days

Things to Learn: Basic console I/O, String Matching

Resources:

- Genesis Presentations :
  https://drive.google.com/drive/u/0/folders/1hmMgcCb3uzrQFf2C0V5VNAsskymVd1kE
- Arduino:
  https://www.youtube.com/watch?v=d8_xXNcGYgo&list=PLGs0VKk2DiYx6CMdOQR_hmJ2Nb B4mZQn-
- Mechanics:
  - JJ Craig – Introduction to Robotics
  - Quick Return: https://www.youtube.com/watch?v=--clwnCG6rg
- Algorithms:
  - https://www.geeksforgeeks.org/fundamentals-of-algorithms/