Robotics Club Winter Camp 2019

"Robotics Club Winter Camp: Unlock The Roboticist Within" was a series of intensive workshops that were designed to carve a roboticist out of absolute beginners. "Robo101: A Zero Credit Course" was conducted, which consisted of workshops on 5 topics. Each of the 5 workshops focused on developing a skill that is crucial for a robotics team to have.
This comprised:

1. Basic programming
2. Designing
3. Microcontrollers
4. Computer Vision Algorithms
5. ROS (Robot Operating System)

- There were thoroughly planned lectures for exploring the theory and assignments for practical implementation so that they get a feel of how things are done.
- Around 27 people were selected for participating in Winter Camp through the recruitment process, but almost 50 students actually attended the workshops (Members of team Humanoid and team Aerial Robotics who got their stay permissions for their team-related work also attended the winter camp.)
- Each participant was assigned a personal mentor(Y18) to guide them through the winter camp.
- There was one lecture to showcase the origin and growth of Machine Learning and it's potential in the near future. Then there was a brief lecture on introductory machine learning.
- There were 2 guest lectures as well:
    1. **Opportunities and Experiences in Robotics:** Speakers - Nitik Jain, Faizan Siddiqui, Neil Shirude
    2. **The Art of PCB Designing:** Speaker - Inshu Namdev
- Piazza was used as a forum for the participants to reach out to the tutors and for the instructors to post resources and assignments.

- The programming assignments for basic and advanced programming were posted as a contest on Hackerank.

PROGRAMMING

- A 4-day lecture series was organised to familiarize the participants with the basics and a few concepts of advanced programming.
- Basic programming included I/O statements, conditional statements, loops, arrays, data structures like stacks & queues using arrays.
- Advanced programming included topics such as advanced data structures, graph theory and modelling and maze solving.
- Participants were required to solve the programming assignments for basic and advanced programming that were posted as a contest on Hackerank.

DESIGNING

- A 3-day workshop and lecture series was organised to introduce the participants to engineering designs and their implementation in a 3D CAD software (Autodesk Inventor)
- The lecture focussed on the importance of design, ways of approaching a design problem with some examples and some mechanisms commonly used in robotics. The assignments focussed on creative implementation of these mechanisms to make a robot design.
- The next part introduced the participants to Autodesk Inventor, a 3D CAD software where they learned to model their designs and then make motion animations using them.
- Assignments were designed to improve their familiarity with the software.

MICROCONTROLLERS

- A 3-day workshop and lecture series was organised to give the participants a basic idea on how a microcontroller works and how to interface them with different sensors.
- The sessions were focused on Arduino and the participants were taught to program it using arduino ide.

- For introducing the participants with sensors, ultrasonic sensor (HC-SR04), QTR A (IR) were used. They were asked to learn how each of them worked, application on where it can be used and how to wirelessly transfer data to other devices using a bluetooth module.
- Other than this, some assignments were given to test and make them more comfortable with using microcontrollers and sensors.

COMPUTER VISION

- 3-day workshop to introduce participants to applications of computer vision and some of the basic algorithms that are generally used.
- This part of the winter camp was theory extensive so the assignments were designed to make the participant implement the algorithms that have been taught in the workshop from scratch.
- On the final day of the workshop, they were introduced to OpenCV - An open-source image processing library.
- By this point, they had implemented some of the well-known image processing algorithms. Now they were shown the difference in the efficiency of their codes and the codes written by professional open-source developers - A motivation to improve their coding skills.
- Vectorised implementation (using NumPy) was encouraged and given more credits towards the final evaluation.
- Assignments were based on Jupyter Notebooks.

ROS

- 3 6-hour sessions conducted to give participants basic knowledge and hands-on experience of ROS.
- Linux and ROS were pre-installed on the participants' personal laptops, before the commencement of the Winter Camp so no time was wasted on this.
- The sessions explained ROS architecture and data transmission structures in detail.
- Participants were walked through the implementation of a simple talker-listener module in the sessions, building on more complexity as the camp progressed.
- The learning imparted in the sessions was reinforced via a series of 10 assignments, each focusing on a simple aspect. The end goal of the assignments was to autonomously control a ground bot in simulation

- The assignments walked participants through setting up the simulation, inspecting and analysing pre-existing ROS networks and then finally building their own ROS system to achieve the desired goal.
- Participants were required to answer a set of questions and provide video and photo evidence of the completion of the assignment via Google Forms.

GUEST LECTURES

1. **Opportunities and Experiences in Robotics:** Robotics is undoubtedly a remarkable field to work in, but the awareness about the opportunities that exist in this area are not very well known to people. This lecture aimed at informing the participants about opportunities they can avail to gain experience in the field of robotics and the organisations that hire roboticists.
2. **The Art Of PCB design:** The participants were given a brief introduction to PCB designing and KICAD.