Robotics Club, IIT(BHU)

ORGANIZES

Summer Camp-2020

Overall Structure:

The camp will effectively span for a period of 25 days. We aim to give you a wholesome journey through the field of robotics in a more structured way starting from the very basics to state of the art work in the field. Robotics is a very versatile field with varied skills, a foundational course of this sort is quite crucial in any technical field that one might decide to pursue.

The main motive of this camp is three-fold:

1. Learn Robotics the right way.
2. Give you a basic foundation in the various aspects of Robotics to prepare you for your future endeavors, projects, and competitions.

3. A way for you to acquire the necessary skillset and prove your passion towards the field and the effective participation in club related activities.

About the camp:

1. The camp will be divided into 4 parts (5 days per part - discussed in curriculum structure below) and each part will have 3 subparts i.e. every 5 days we will send 3 pdfs/course material in equal intervals, containing a balanced diet of theory, tutorial and simple individual tasks (mostly based on implementing the idea discussed).

2. For the ones who are more theory liking a quiz as well will be conducted somewhere in the middle of the camp.

3. Finally, a team project that encapsulates almost all ideas discussed has to be submitted by the end of the camp. Teams will get around 3 weeks to work on it (we will release the problem statement somewhere around the 2nd week of the camp)

4. There will be a continuous assessment strategy and an active leader board will be maintained based on the performance, participation, and enthusiasm of the students in the camp's activities.

5. All official announcements, task/content/event related queries will be directly addressed by the organizing team in the WhatsApp group created.

6. The detailed description of the scoring and evaluation and submissions will be enclosed upon the start of the camp.

Curriculum Structure:

Part 1:

- Introduction to simulations, need for simulation.
- Intro to Pybullet, why PyBullet over other simulators?.
- Intro to urdf files, robot geometry, links, base, joints.
- Installation of PyBullet.
- Demonstrating some examples of PyBullet simulations.
- Basic functions in PyBullet: connect, gravity, loading urdf, saving, creating shapes, simulation, positions, and orientations in PyBullet.

Part 2:

- What are quaternions, rigid body orientation, DOF of robots, and dynamics.
- PyBullet functions for control of motors, apply force, adding/removing constraints, getDynamics
- User Input management, getKeyboard, getMouse functions.

Part 3:

- Getting an image feed from the simulation.
- Collision models, joint characteristics and real-world parameters.

- Inverse kinematics, Forward kinematics.
- Types of Controllers (open-loop, forward, feed-forward).

Part 4:

- ML-based controllers for robots, why better than pre-existing traditional controllers.
- Robot learning/Computer Vision based approach towards robotics.
- Scalability and deployability of such methods
- Some state of the art work and projects in the world of robotics.

Robotics Club Summer Camp 2020 -Organizing Team:

- **Event advisors and organizing:**
  - **Daksh Garg**
  - **E Dinesh Reddy**
  - **Ankur Agarwal**

- **Task Evaluation and logistics:**
  - **Mayank Chakravorty**
  - **Anagh Sharma**
  - **Arvind Murali**

- **Technical coursework and Problem Setting:**
  - **S.Niranth Sai**
  - **R.Lokesh Krishna**