ABOUT
Knowledge Incubation for TEQIP, IIT Kanpur in association with Centre of Mechatronics at IIT Kanpur organized Summer Training Program in Robotics. This is the third year KIT has organized this program. Out of 62 applicants 4 under-graduate students were selected for the training in the general area of robotics.

This year the main target of this program was to develop a 7-DOF mobile robot with the arm mounted on it. The
objective of this robot was to find the specified object in the workspace through camera, plan its motion towards it, pick that object through the arm mounted upon the robot and place that object at the specified destination.
TOPICS DISCUSSED

a. Biped locomotion
b. Motion planning
c. Mobile robotics
d. Design
e. Control of robotic systems, vision, etc.

COURSE ORGANIZERS

1. **Dr. Ashish Dutta**
   Professor
   Dept. of Mechanical Engineering
   IIT Kanpur
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2. **Dr. Anjali V. Kulkarni**
   Principal Research Engineer
   Center for Mechatronics
   IIT Kanpur
   [http://home.iitk.ac.in/~anjalik/](http://home.iitk.ac.in/~anjalik/)
<table>
<thead>
<tr>
<th>Name</th>
<th>Institute</th>
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<tbody>
<tr>
<td>Anuj Pahariya</td>
<td>Madhav Institute Of Technology &amp; Science, Gwalior, M.P</td>
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<tr>
<td>Pranav Sharma</td>
<td>Madhav Institute of Technology and Science, Gwalior, M.P</td>
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<td>Swapnanil Das</td>
<td>National Institute of Technology Silchar</td>
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<tr>
<td>Tanvi Agrawal</td>
<td>Madhav Institute of Technology and Science, Gwalior, M.P</td>
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SUMMARY of STUDENT FEEDBACK

Program

1. **Clarity of communication about the event**

   - Excellent: 75%
   - Good: 25%
   - Ordinary: 0%

2. **Organization of the sessions**

   - Excellent: 100%
   - Good: 0%
   - Ordinary: 0%

3. **Quality of Lectures**

   - Excellent: 75%
   - Good: 25%
   - Ordinary: 0%
4. Effectiveness of discussions

5. Effectiveness of learning experience

6. Workshop duration
7. **Would you like to have more such sessions?**

8. **Would you like e-lectures by experts on special topics?**

9. **Suggest specific topic that you would like additional expert lectures on**
   - Image Processing
   - Inverse Kinematics
   - Robotics in Industry

10. **Additional Suggestions**
    - Can conduct more number of teaching sessions
    - Can select more than 4 students so that more students can experience this great learning period of 2 months
Learning

1. **Do you get enough class projects?**

   - Yes: 100%
   - No: 0%

2. **Is the learning adequate?**

   - Yes: 100%
   - No: 0%

3. **Do you have sufficient resources for laboratory?**

   - Yes: 100%
   - No: 0%
4. Is the library/journal support/e-connection adequate?

5. Would you like have common (TEQIP) repository of course material?

6. Would you like to visit IITK to attend specialized courses?

7. Would you like MOOCs/e-resources based courses?
8. How can TEQIP help improve your learning?

- TEQIP can help us improve our learning by organising workshops and conferences in other TEQIP affiliated colleges
- Can provide online courses
- Sharing some online courses on robotics and starting collaborative research work with professors

Research

1. Would you like to visit an IIT for a short visit/internship/post-doctoral stint, if offered (via TEQIP)?

2. Would you like to share/use research infrastructure at IITK, if made available?
3. **Would you like to conduct collaborative research with IITK faculty?**

4. **Would you like lectures by experts (Indian and International) on niche research areas/topics?**

5. **Do you want special-topic conferences?**
6. How can TEQIP help improve your research?

- TEQIP can help us improve our research by conducting workshops and e-resources on how to choose research topics, how to publish research papers etc.
- TEQIP should give more options to conduct the research with the faculty at IIT Kanpur and have discussions with them. This will help a lot.
- Interaction with faculty of the specified research topic
- Funding on proposed project
- Collaborative work with professors at IIT Kanpur
- Tackling on real life problems

**OUTCOME**

This program helped students to learn about various aspects of robotics:

- How biped locomotion works
- How to do motion planning
- How mobile robotics works
- Design of various robotic systems
- How to design control of robotic systems
- How to incorporate vision sensors into a robot
Organizer’s Report

on

TEQIP Summer Training in Robotics
(May 28 – July 15, 2018)

Dr. Ashish Dutta, Professor, ME Department, IIT Kanpur
Dr. Anjali V. Kulkarni, PRE, Centre for Mechatronics, IIT Kanpur

A two months summer training program was carried out with the support of TEQIP IIT Kanpur. From more than 65 applications of third year B. Tech. students, four candidates were selected based on their ranking (till third year) and interest of working in Robotics fields of research topics. Four candidates namely: Mr. Anuj Pahariya, Mr. Pranav Sharma and Ms. Tanvi Agrawal of Madhav Institute of Technology & Science, Gwalior, M.P and Swapnanil Das of National Institute of Technology Silchar joined for the training. The training was rescheduled to May 28 as their exam sessions continued till 25th May.

During the first week, trainees were given the introductory lectures by Prof. Dutta on the robotics subject. Mechanics and control of manipulators, Transformations, inverse kinematics, sensors & actuators and microcontroller programming topics were covered during the series of lectures. They were made aware of the current research topics and few of the research and development work done in the centre. After having this orientation, they chose the topics to work on. Mr. Rajendra Rai helped them in hardware development of robot, sensor and motor interfacing, etc. Mr. Saha was associated with them for the software development.

They were also encouraged to attend a M.Tech. viva of Prof. Dutta’s student to have the idea of study, execution, and presentation aspects of any project.

At the end of the training program, TEQIP IIT Kanpur presented them the certificates.

After grasping the theory part, all the four students worked in a single group paying attention to different aspects of their developmental work involving hardware and software, at the same time focusing on one particular aspect. At the end, they submitted the report on the studies performed. Swapanil submitted his report on the topic he focused on and other three students namely, Mr. Anuj Pahariya, Mr. Pranav Sharma and Ms. Tanvi Agrawal, submitted an integrated report. Their work is summarized below.

Mr. Anuj Pahariya, Mr. Pranav Sharma and Ms. Tanvi Agrawal, carried out the development work in three phases:
1. Detection of object either on the basis of color or template and calibration of pixel to real world coordinates.
2. Solution to the Motion Planning problem of the mobile robot.
3. Controlling robotic arm which is mounted on the top of mobile robot using the theory of kinematics.

Mr. Swapnanil focused on ‘Interfacing of ultrasonic sensors and motors with Arduino using MATLAB.

They all were happy about what they learnt and grasped during this summer training.