

# Progress Presentation-I

## e-Yantra Summer Internship-2018

### A System for Solving Jigsaw Puzzle using Multiple Robots

Aniket Anantraj Navlur

Ashis Kumar Maharana

Kiran S Patil

Mentors:

Abhinav Sarkar, Kalind Karia

IIT Bombay

June 6, 2018

# Overview of Project

Progress  
Presentation-I

Aniket Anantraj  
Navlur  
Ashis kumar  
Maharana  
Kiran S Patil

Mentors:  
Abhinav Sarkar,  
Kalind Karia

Overview of  
Project

Overview of Task

Task  
Accomplished

Videos

Challenges Faced

Future Plans

Thank You

- Project Name: A System for Solving Jigsaw Puzzle using Multiple Robots
- Objective:
  - To develop an autonomous system that can solve any Jigsaw Puzzle given its image using multiple robots.
- Deliverables:
  - 1 Go-to-Goal controller for robot in a given frame
  - 2 Autonomous solving of any Jigsaw Puzzle given just its image
  - 3 Proper documentation and report on the system.

# Overview of Task

Progress  
Presentation-I

Aniket Anantraj  
Navlur  
Ashis kumar  
Maharana  
Kiran S Patil

Mentors:  
Abhinav Sarkar,  
Kalind Karia

Overview of  
Project

Overview of Task

Task  
Accomplished

Videos

Challenges Faced

Future Plans

Thank You

Task No.	Task	Deadline (in Days)
1	Python, OpenCV, Firebird V Intro, Xbee Communication	3
2	Pose and orientation calculation of 2 Firebird robots using color/Aruco markers	4
3	Programming the Go-To-Goal Controller for single Firebird V robot. Tuning the PID values to perfection	4
4	Implementing path planning with Firebird V where obstacles have been placed in arena	3
5	Detection of jigsaw puzzle blocks using Template Matching	2
6	Pick and place of blocks - gripper mechanism building	4
7	Implementing the entire solution for a given jigsaw puzzle	5
8	Documentation and reporting results	4

# Task Accomplished

Progress  
Presentation-I

Aniket Anantraj  
Navlur  
Ashis kumar  
Maharana  
Kiran S Patil

Mentors:  
Abhinav Sarkar,  
Kalind Karia

Overview of  
Project

Overview of Task

Task  
Accomplished

Videos

Challenges Faced

Future Plans

Thank You

- Established communication with the robot using XBee.

# Task Accomplished

Progress  
Presentation-I

Aniket Anantraj  
Navlur  
Ashis kumar  
Maharana  
Kiran S Patil

Mentors:  
Abhinav Sarkar,  
Kalind Karia

Overview of  
Project

Overview of Task

Task  
Accomplished

Videos

Challenges Faced

Future Plans

Thank You

- Established communication with the robot using XBee.
- Found the pose and orientation of the robot using ArUco markers.

# Task Accomplished

Progress  
Presentation-I

Aniket Anantraj  
Navlur  
Ashis kumar  
Maharana  
Kiran S Patil

Mentors:  
Abhinav Sarkar,  
Kalind Karia

Overview of  
Project

Overview of Task

Task  
Accomplished

Videos

Challenges Faced

Future Plans

Thank You

- Established communication with the robot using XBee.
- Found the pose and orientation of the robot using ArUco markers.
- Created the data packets to be sent, received and parsed correctly

# Task Accomplished

Progress  
Presentation-I

Aniket Anantraj  
Navlur  
Ashis kumar  
Maharana  
Kiran S Patil

Mentors:  
Abhinav Sarkar,  
Kalind Karia

Overview of  
Project

Overview of Task

Task  
Accomplished

Videos

Challenges Faced

Future Plans

Thank You

- Established communication with the robot using XBee.
- Found the pose and orientation of the robot using ArUco markers.
- Created the data packets to be sent, received and parsed correctly
- Tuned the PID values to perfection.

# Task Accomplished

Progress  
Presentation-I

Aniket Anantraj  
Navlur  
Ashis kumar  
Maharana  
Kiran S Patil

Mentors:  
Abhinav Sarkar,  
Kalind Karia

Overview of  
Project

Overview of Task

Task  
Accomplished

Videos

Challenges Faced

Future Plans

Thank You

- Established communication with the robot using XBee.
- Found the pose and orientation of the robot using ArUco markers.
- Created the data packets to be sent, received and parsed correctly
- Tuned the PID values to perfection.
- Developed a Go-To-Goal controller for multiple robots.

# Task Accomplished

Progress  
Presentation-I

Aniket Anantraj  
Navlur  
Ashis kumar  
Maharana  
Kiran S Patil

Mentors:  
Abhinav Sarkar,  
Kalind Karia

Overview of  
Project

Overview of Task

Task  
Accomplished

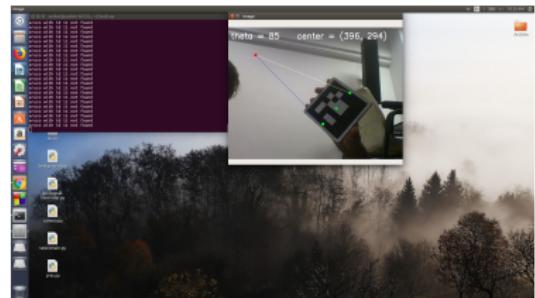
Videos

Challenges Faced

Future Plans

Thank You

- Established communication with the robot using XBee.
- Found the pose and orientation of the robot using ArUco markers.
- Created the data packets to be sent, received and parsed correctly
- Tuned the PID values to perfection.
- Developed a Go-To-Goal controller for multiple robots.



# Task Accomplished

Progress  
Presentation-I

## Overview of Project

## Overview of Task

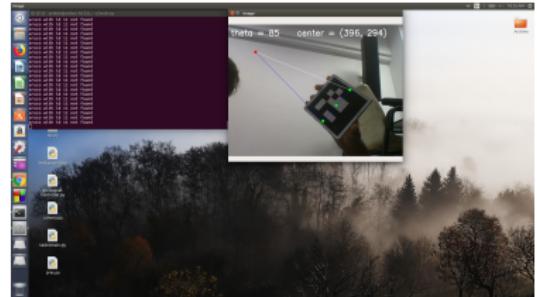
## Task Accomplished

## Video E

#### **Challenger Faced**

## Future Plans

- Established communication with the robot using XBee.
- Found the pose and orientation of the robot using ArUco markers.
- Created the data packets to be sent, received and parsed correctly
- Tuned the PID values to perfection.
- Developed a Go-To-Goal controller for multiple robots.



The data packet is formed by the following values  
 $< T \ tar_x | tar_y | P \ kp | ki | kd | R \ head_x | head_y | tail_x | tail_y | A \ deg | >$

# Demo

Progress

Presentation-I

Aniket Anantraj

Navlur

Ashis kumar

Maharana

Kiran S Patil

Mentors:

Abhinav Sarkar,

Kalind Karia

Overview of  
Project

Overview of Task

Task

Accomplished

Videos

Challenges Faced

Future Plans

Thank You

# Challenges Faced

Progress  
Presentation-I

Aniket Anantraj  
Navlur  
Ashis kumar  
Maharana  
Kiran S Patil

Mentors:  
Abhinav Sarkar,  
Kalind Karia

Overview of  
Project

Overview of Task

Task  
Accomplished

Videos

Challenges Faced

Future Plans

Thank You

- Determining the angle of ArUco Marker in the frame with proper resolution.

# Challenges Faced

Progress  
Presentation-I

Aniket Anantraj  
Navlur  
Ashis kumar  
Maharana  
Kiran S Patil

Mentors:  
Abhinav Sarkar,  
Kalind Karia

Overview of  
Project

Overview of Task

Task  
Accomplished

Videos

Challenges Faced

Future Plans

Thank You

- Determining the angle of ArUco Marker in the frame with proper resolution.
- Finding the right library for serial communication

# Challenges Faced

Progress  
Presentation-I

Aniket Anantraj  
Navlur  
Ashis kumar  
Maharana  
Kiran S Patil

Mentors:  
Abhinav Sarkar,  
Kalind Karia

Overview of  
Project

Overview of Task

Task  
Accomplished

Videos

Challenges Faced

Future Plans

Thank You

- Determining the angle of ArUco Marker in the frame with proper resolution.
- Finding the right library for serial communication
- Understanding the parameters of Xbee('MY')

# Challenges Faced

Progress  
Presentation-I

Aniket Anantraj  
Navlur  
Ashis kumar  
Maharana  
Kiran S Patil

Mentors:  
Abhinav Sarkar,  
Kalind Karia

Overview of  
Project

Overview of Task

Task  
Accomplished

Videos

Challenges Faced

Future Plans

Thank You

- Determining the angle of ArUco Marker in the frame with proper resolution.
- Finding the right library for serial communication
- Understanding the parameters of Xbee('MY')
- Displaying the received data on LCD of firebird

# Challenges Faced

Progress  
Presentation-I

Aniket Anantraj  
Navlur  
Ashis kumar  
Maharana  
Kiran S Patil

Mentors:  
Abhinav Sarkar,  
Kalind Karia

Overview of  
Project

Overview of Task

Task  
Accomplished

Videos

Challenges Faced

Future Plans

Thank You

- Determining the angle of ArUco Marker in the frame with proper resolution.
- Finding the right library for serial communication
- Understanding the parameters of Xbee('MY')
- Displaying the received data on LCD of firebird
- Creating data packets to hold the information about robot(its orientation, position, etc...) and parsing it once received by the robot.

# Future Plans

Progress

Presentation-I

Aniket Anantraj

Navlur

Ashis kumar

Maharana

Kiran S Patil

Mentors:

Abhinav Sarkar,

Kalind Karia

Overview of  
Project

Overview of Task

Task  
Accomplished

Videos

Challenges Faced

Future Plans

Thank You

## ■ Path Planning of Robot.

# Future Plans

Progress

Presentation-I

Aniket Anantraj

Navlur

Ashis kumar

Maharana

Kiran S Patil

Mentors:

Abhinav Sarkar,

Kalind Karia

Overview of Project

Overview of Task

Task Accomplished

Videos

Challenges Faced

Future Plans

Thank You

- Path Planning of Robot.
- Designing and building Gripper Mechanism to pick and place puzzle pieces and implementing the entire solution.

# Future Plans

Progress  
Presentation-I

Aniket Anantraj  
Navlur  
Ashis kumar  
Maharana  
Kiran S Patil

Mentors:  
Abhinav Sarkar,  
Kalind Karia

Overview of  
Project

Overview of Task

Task  
Accomplished

Videos

Challenges Faced

Future Plans

Thank You

- Path Planning of Robot.
- Designing and building Gripper Mechanism to pick and place puzzle pieces and implementing the entire solution.
- Solve a Multi-Robot Cooperative Box-pushing problem.

# Thank You

Progress

Presentation-I

Aniket Anantraj

Navlur

Ashis kumar

Maharana

Kiran S Patil

Mentors:

Abhinav Sarkar,

Kalind Karia

Overview of  
Project

Overview of Task

Task  
Accomplished

Videos

Challenges Faced

Future Plans

Thank You

THANK YOU !!!