

Progress Presentation-I

e-Yantra Summer Internship-2018

A System for Solving Jigsaw Puzzle using Multiple Robots

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Ashis Kumar Maharana

Kiran S Patil

Mentors:

Abhinav Sarkar, Kalind Karia

IIT Bombay

June 7, 2018

Overview of Project

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Mentors:
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Kalind Karia

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■ **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 solution of the system

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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

- Established communication with the robot using XBee

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Task Accomplished

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

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- Found the pose and orientation of the robot using ArUco markers

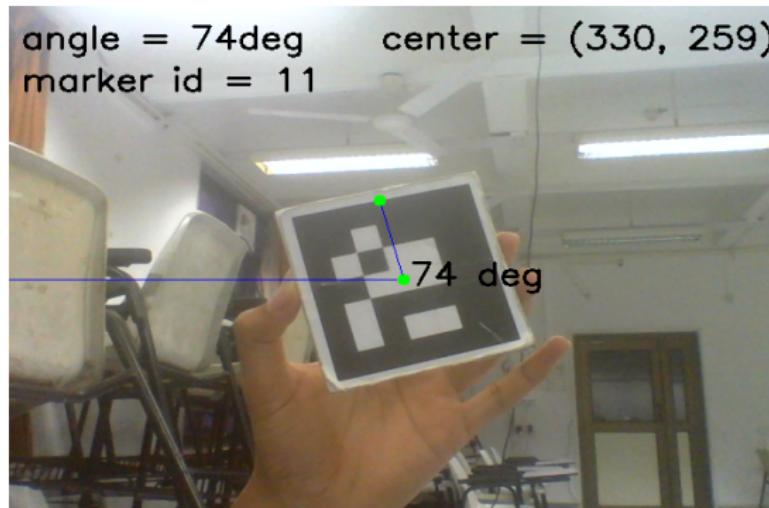


Figure 1: ArUco id, center position, orientation

Task Accomplished

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Future Plans

Thank You

- Formed the data packets to be sent, received and parsed correctly

Task Accomplished

- Formed the data packets to be sent, received and parsed correctly

```
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```

Figure 2: Data Packets

The format of data packets is:

$< T | tar_x | tar_y | P | kp | ki | kd | R | head_x | head_y | tail_x | tail_y | A | deg | >$

Task Accomplished

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- Tuned the PID values to perfection
- Developed a Go-To-Goal controller for multiple robots

Demo

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Thank You



Figure 3: PID tuned



Figure 4: showing error angle being corrected



Figure 5: travelling to the nearest node

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

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

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- Determining the angle of ArUco Marker in the frame with proper resolution
- Finding the right library for serial communication
- Understanding the parameters of Xbee ('DH', 'DL', 'MY', channel='C', API, AT, etc...)

Challenges Faced

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

Future Plans

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■ Path Planning of Robot

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- Path Planning of Robot
- Designing and building Gripper Mechanism to pick and place Jigsaw blocks and implementing the entire solution for Jigsaw puzzle

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

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