

Progress Presentation-I

e-Yantra Summer Internship-2017

Automatic Evaluation of Black Line Following Robot

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June 5, 2017

Overview of Project

Progress
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Overview of
Project

Overview of Task

Task
Accomplished

Challenges Faced

Future Plans

Thank You

- Project Name: Automatic Evaluation Of Black Line Following Robot
- Objectives: To build a platform which automatically evaluates videos submitted by students in eYRC and to perform marker based robot localization
- Deliverables:
 - 1 MATLAB code for automatic evaluation of black/white line following robot from video
 - 2 openCV code for camera calibration, pose estimation and tracking of robot from video

Overview of Task

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Future Plans

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Task no	Tasks
1	Installation of required softwares (MATLAB and openCV)
2	Understanding of theory of camera calibration and camera coordinates to world coordinates
3	Development of code for extraction of intrinsic and extrinsic parameters of camera

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Challenges Faced

Future Plans

Thank You

Task no	Tasks
4	Obtaining dataset for implementation
5	Track the bot and extract trace file
6	Development of code for evaluating black line following robot

Task 1

Installation of software

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Challenges Faced

Future Plans

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- MATLAB - Installation of MATLAB and learning of the various toolboxes
- openCV - Installation of openCV and numpy libraries

Task 2

Theory of camera calibration

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Future Plans

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$$\begin{bmatrix} x_{im} \\ y_{im} \\ 1 \end{bmatrix} = M_{int}M_{ext} \begin{bmatrix} X_w \\ Y_w \\ Z_w \\ 1 \end{bmatrix}$$

Task 2

Intrinsic parameters

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Future Plans

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- Focal length in x
- Focal length in y
- Center pixel coordinates

$$\text{camera matrix} = \begin{bmatrix} f_x & 0 & c_x \\ 0 & f_y & c_y \\ 0 & 0 & 1 \end{bmatrix}$$

Task 2

Distortion Coefficients

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Future Plans

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- Radial distortion
- Tangential distortion

$$\text{Distortion coefficients} = (k_1 \ k_2 \ p_1 \ p_2 \ k_3)$$

Task 2

Extrinsic parameters

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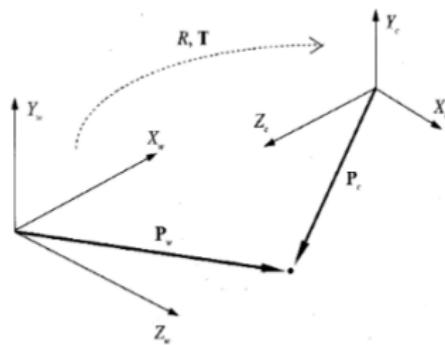
Task
Accomplished

Challenges Faced

Future Plans

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- Rotation vector
- Translation vector



Task 2

Image coordinates to world coordinates

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Future Plans

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$$x_{im} - o_x = f_x \frac{r_{11}X_w + r_{12}Y_w + r_{13}Z_w + T_x}{r_{31}X_w + r_{32}Y_w + r_{33}Z_w + T_z}$$
$$y_{im} - o_y = f_y \frac{r_{21}X_w + r_{22}Y_w + r_{23}Z_w + T_y}{r_{31}X_w + r_{32}Y_w + r_{33}Z_w + T_z}$$

Task 3

Step 1 - Generate corners

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Overview of
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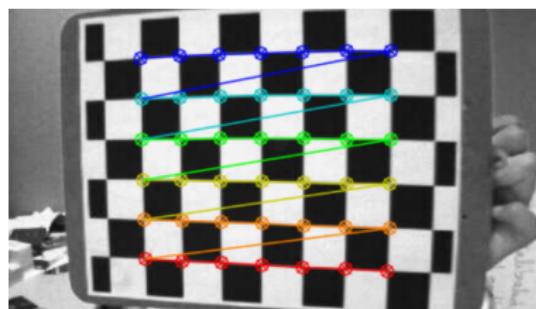
Task
Accomplished

Challenges Faced

Future Plans

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- `findchessboardcorners()`
- `cornerSubPix()`
- `drawchessboardcorners()`



Task 3

Step 2 - Get intrinsic parameters and Distortion coefficients

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Future Plans

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- cameracalibrate()
- undistort()



Task 3

Step 3- Get extrinsic parameters

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- solvePnP()
- Rodrigues()

Task 4

Obtain the data set

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Overview of

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Task

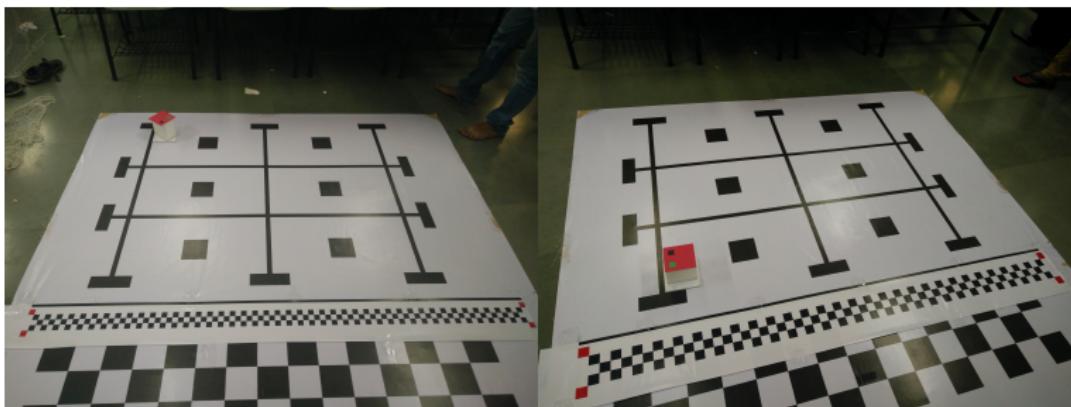
Accomplished

Challenges Faced

Future Plans

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- 36 angle
- 4 marker sizes
- 5 positions
- 3 cameras



Task 4

Experimental results

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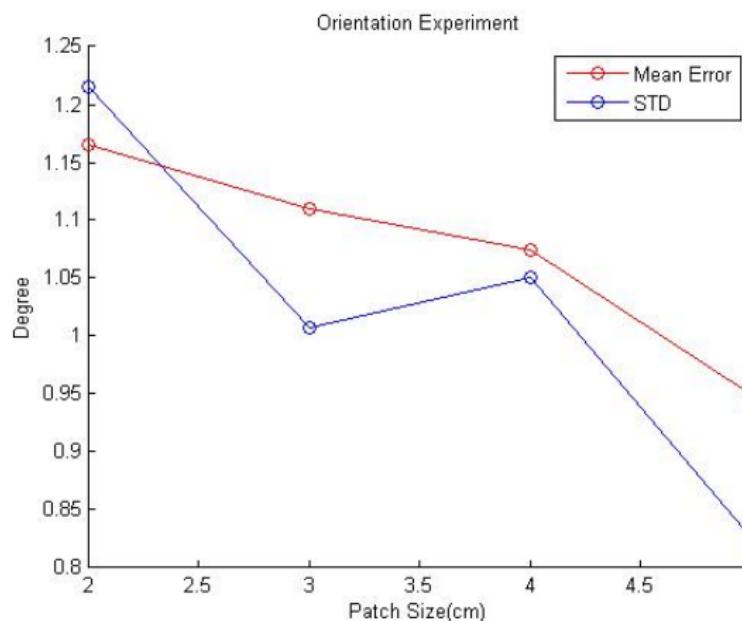
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Task 6

Evaluation of black line following robot

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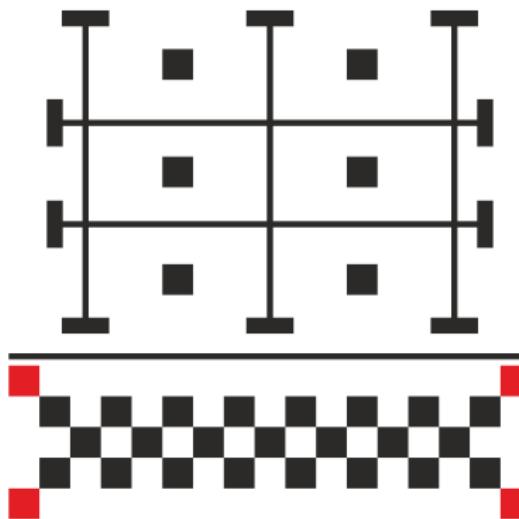
Task
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Challenges Faced

Future Plans

Thank You

- 1 Event detection
- 2 Initial position detection
- 3 comparison algorithm using windows



Challenges Faced

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Challenges Faced

Future Plans

Thank You

- Unsorted trace file
- Window size
- Window shape
- Circular shaped window
- Optimization of camera matrix
- Using video feed to calibrate camera

Future Plans

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Future Plans

Thank You

By the next progress presentation we aim to have finished:

- Track bot using video and generate trace file
- Calibrate camera from live video stream
- Curved path evaluation
- Distance of error position from ideal position

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THANK YOU !!!