

Progress Presentation-I

e-Yantra Summer Internship-2015
Marker based localisation

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Dheeraj Kamath

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IIT Bombay

June 16, 2015

Overview of Project

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■ Marker based localisation

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- Marker based localisation
- Objective: To develop modules for Image Processing and robot localisation using markers

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- Marker based localisation
- Objective: To develop modules for Image Processing and robot localisation using markers
- Deliverables:
 - 1 Develop modules for:
 1. Morphological operation
 2. Image filtering operation
 3. Lines and contour detection
 4. Shape detection

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 - 2 Robot which is capable of recognizing the markers and localize in the indoor environment.

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 - 3 For testing, robot will be placed in the predefined environment with markers.

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 - 4 Then robot should give the (x, y) coordinate in the room.

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 - 3 For testing, robot will be placed in the predefined environment with markers.
 - 4 Then robot should give the (x, y) coordinate in the room.
 - 5 Robot which is capable of moving between two random way points in the room with markers.

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Task no	Tasks	Deadlines
1	Installation of required softwares on raspberry pi and documentation	2 days
2	Develop modules for morphological operation with documentation	3 Days
3	Develop modules for image filtering operation with documentation	2 Days
4	Develop modules for extracting lines and contours with documentation	3 Days

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Task no	Tasks	Deadlines
5	Creation of various shape detectors for shape detection with documentation	3 Days
6	Design a marker and develop the marker detection and recognition algorithm	3 Days
7	Camera calibration and pose estimation and recognition algorithm	2 days
8	Mapping the robot position from the data obtained from the marker	5 Days
9	Create path from source to destination waypoints with the help of visual markers	6 Days

Task 1

Setting up of Raspberry Pi

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Task 1

Setting up of Raspberry Pi

■ Setup of the Raspberry Pi

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Task 1

Setting up of Raspberry Pi

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■ Setup of the Raspberry Pi

Raspberry Pi is a small, low-cost, powerful credit card sized computer that was developed to promote education among adults and children alike.

Task 1

Setting up of Raspberry Pi

■ Setup of the Raspberry Pi

Raspberry Pi is a small, low-cost, powerful credit card sized computer that was developed to promote education among adults and children alike.



Figure: Raspberry Pi

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Steps Involved

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- Download Raspbian and win32DiskManager softwares.
- Insert your sd card.Run win32DiskImager and choose the Raspbian image and select the drive corresponding to your sd card.
- Insert it into the sd card slot of the Raspberry Pi.
- Use HDMI cable to connect the board to the monitor/tv. Power on the board and the monitor. You will notice a set of code running on the monitor.
- It opens a software configuration tool.

Steps Involved

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Thank You

Raspberry Pi Software Configuration Tool (raspi-config)

1 Expand Filesystem	Ensures that all of the SD card s
2 Change User Password	Change password for the default u
3 Enable Boot to Desktop/Scratch	Choose whether to boot into a des
4 Internationalisation Options	Set up language and regional sett
5 Enable Camera	Enable this Pi to work with the R
6 Add to Rastrack	Add this Pi to the online Raspber
7 Overclock	Configure overclocking for your P
8 Advanced Options	Configure advanced settings
9 About raspi-config	Information about this configurat

<Select>

<Finish>

Task 2

Thresholding

- Simplest method of image segmentation
- Can be used to create binary images from grayscale images
- Pixels compared with threshold value



Task 2

Morphological Operations

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Thank You

- **Erosion**
Erodes the boundaries of an object image
- **Dilation**
Increases the size of boundary of image
- **Opening**
Erosion followed by dilation
- **Closing**
Dilation followed by erosion

Task 2

Morphological Operations

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Erosion



Dilaion



Opening



Closing



Task 2

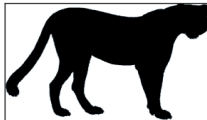
Distance Transform

Distance transform is used to modify a image to display its skeleton.

How is the image modified?

The closer a pixel is to the boundary of the object image, the darker it is (i.e. it has a lower value).

In this way, the center (or the skeleton) of the image is highlighted.



Task 2

Watershed Segmentation

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Watershed is an algorithm in image processing used for isolating objects in the image from the background.



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Watershed Segmentation

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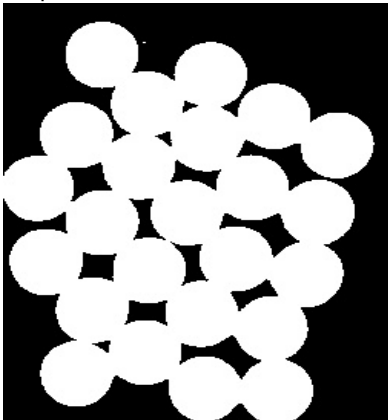
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Step 1:



Task 2

Watershed Segementation

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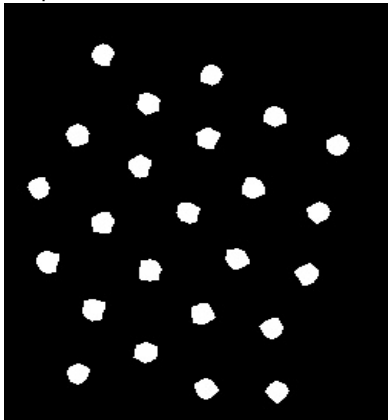
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Step 2:



Task 2

Watershed Segmentation

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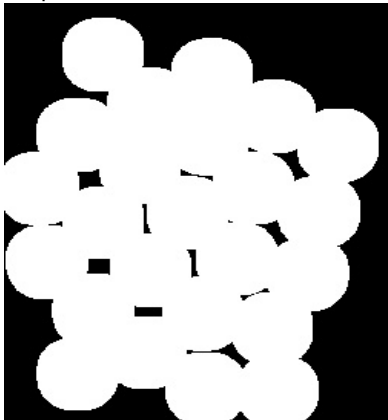
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Step 3:



Task 2

Watershed Segmentation

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Step 4:



Task 3

Gradients

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Thank You

Three commonly used methods to find gradients:

- Scharr
- Sobel
- Laplacian

Task 3

Gradients

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Original



Sobel



Laplacian



Scharr



Task 3

Blur

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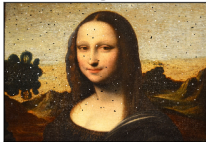
Challenges Faced

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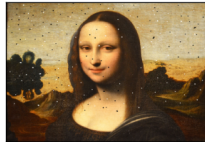
Thank You

Types of blurring techniques:

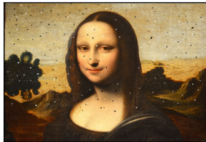
Original



Gaussian



Blur



Median Blur

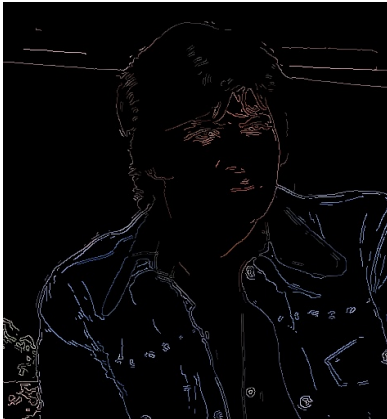


Task 3

Line Detection

■ Canny Edge Detection

As the name suggests, this algorithm is used to detect the edges in an object image.



Task 3

Line Detection

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And the answer is ...



Task 3

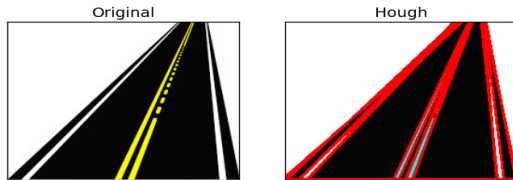
Line Transform

Hough Line Transform

- Feature extraction technique
- Purpose: Find imperfect instances of objects

How is the line detected?

- Intersections between curves

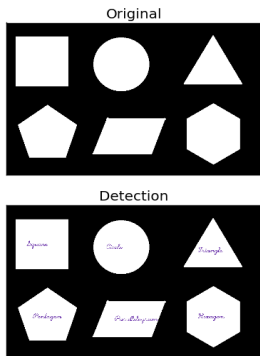


Task 4

Shape Detection

Detection and identification of various shapes by:

- Uses Hu moments to compare two objects
- Identifying the shape based on number of vertices



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- Configuring wifi settings in Raspberry Pi
- Installation of opencv in MAC OSX
- Difference in bitness of Python and module to be installed(modules like matplotlib and numpy)
- Counting of overlapping object using watershed segmentation
- Lane detection with extraneous objects on the road

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Thank You

By the next project presentation, we aim to accomplish the following:

- Develop marker detection and recognition algorithm
- Develop pose estimation algorithm by calibrating the camera
- Map the robot's position by the data obtained from the marker

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THANK YOU !!!
Any questions?