

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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Thank You

- 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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- Objective: To develop modules for Image Processing and robot localisation using markers
- Deliverables:
 - 1 Develop modules for:
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 - 2 Robot which is capable of recognizing the markers and localize in the indoor environment. For testing, robot will be placed in the predefined environment with markers. Then robot should give the (x, y) coordinate in the room.

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- Objective: To develop modules for Image Processing and robot localisation using markers
- Deliverables:
 - 1 Develop modules for:
 1. Morphological operation
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 - 2 Robot which is capable of recognizing the markers and localize in the indoor environment. For testing, robot will be placed in the predefined environment with markers. Then robot should give the (x, y) coordinate in the room.
 - 3 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

Overview of Task

cont...

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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

Steps Involved

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Future Plans

Thank You

- 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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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

Original image



Threshold Binary Inv



Threshold Tozero



Threshold Binary



Threshold Trunc



Threshold Tozero



Task 2

Morphological Operations

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Future Plans

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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Thank You

Erosion



Dilaion



Opening



Closing



Task 2

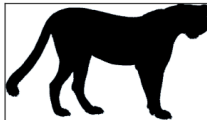
Distance Transform

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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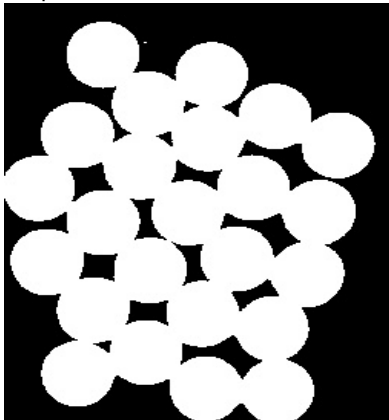
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Step 1:



Task 2

Watershed Segementation

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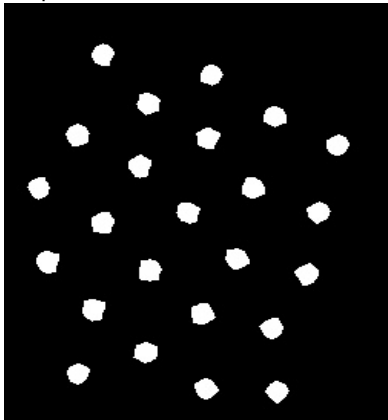
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Step 2:



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Watershed Segmentation

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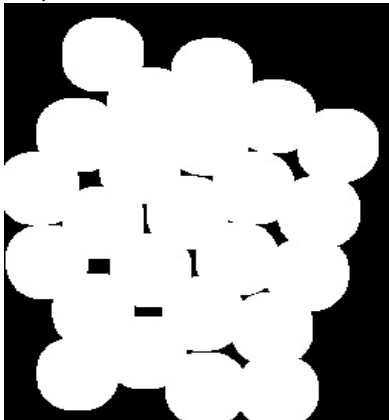
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Step 3:



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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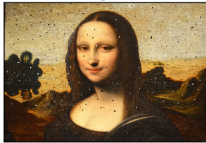
Challenges Faced

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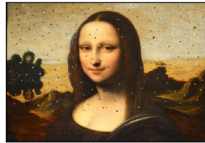
Thank You

Types of blurring techniques:

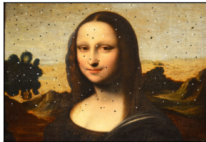
Original



Gaussian



Blur



Median Blur

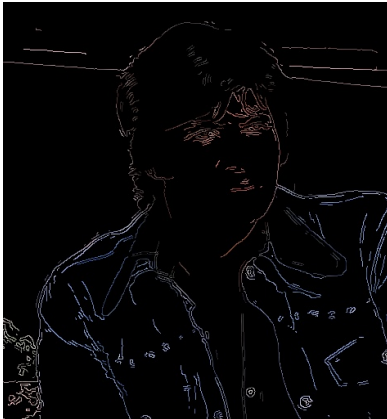


Task 3

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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Thank You

And the answer is ...



Task 3

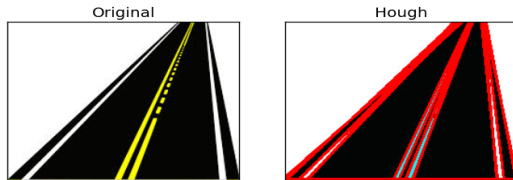
Line Transform

Hough Line Transform

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

How is the line detected?

- Intersections between curves

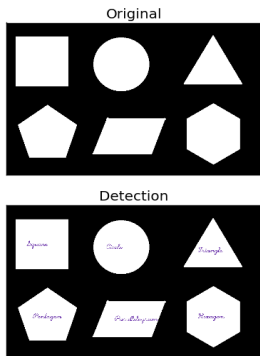


Task 4

Shape Detection

Detection and identification of various shapes by:

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



Challenges Faced

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Future Plans

Thank You

- 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

Future Plans

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Future Plans

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?