### Progress Presentation-I

e-Yantra Summer Internship-2015 Marker based localisation

> Niharika Jayanthi Dheeraj Kamath Mentor: Sanam Shakya

> > IIT Bombay

June 16, 2015

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Future Plans

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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
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- Deliverables:
  - 1 Develop modules for:
    - 1. Morphological operation
    - 2. Image filtering operation
    - 3. Lines and contour detection
    - 4. Shape detection

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

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Cotone Diagram

- Marker based localisation
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  - 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
  - 4 Then robot should give the (x, y) coordinate in the room.
  - Sobot 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 rasp- berry 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	3 Days
	shape detection with documentation	
6	Design a marker and develop the marker	3 Days
	detection and recognition algorithm	Ť
7	Camera calibration and pose estimation and recognition algorithm	2 days
8	Mapping the robot position from the data	5 Days
	obtained from the marker	
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

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■ Setup of the Raspberry Pi

## 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

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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.



Figure: Raspberry Pi

### 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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 Raspberry Pi Software Configuration Tool (raspi-config) Expand Filesystem Ensures that all of the SD card s Change password for the default u 2 Change User Password 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 Configure advanced settings 8 Advanced Options 9 About raspi-config Information about this configurat <Finish> <Select>

# Task 2 Thresholding

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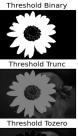
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- Simplest method of image segmentation
- Can be used to create binary images from grayscale images
- Pixels compared with threshold value







## Task 2 Morphological Operations

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## • 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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Opening





Closing



## Task 2 Distance Transform

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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.





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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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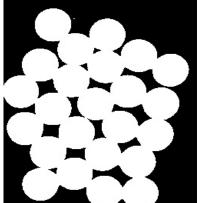
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Step 1:



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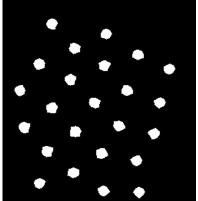
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Step 2:



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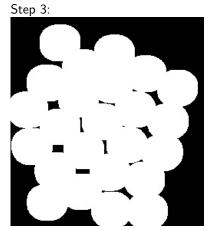
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#### Step 4:



## Task 3 Gradients

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#### Three commonly used methods to find gradients:

- Scharr
- Sobel
- Laplacian

## Task 3 Gradients

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# Task 3

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#### Types of blurring techniques:

Original



Blur



Gaussian



Median Blur



# Task 3 Line Detection

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#### ■ 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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## Task 3

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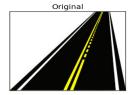
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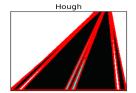
#### **Hough Line Transform**

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

#### How is the line detected?

Intersections between curves





# Task 4 Shape Detection

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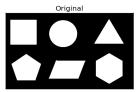
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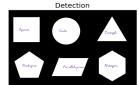
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#### Detection and identification of various shapes by:

- 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 opency 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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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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Any questions?