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Research Article

Optical Character Recognition Based Auto Navigation of Robot

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Abstract

Navigation of robot using signboard. The signboard is placed in the environment as landmark to decide the robot's next path. The signboard is designed such that the robot can perform key functions: the signboard detection, identification. Autonomous navigation of mobile robots in wide area as well as cooperative operations requires many signboards with unique identification pattern. Color signboard allows the robot to recognize the sign board when the signboard is visible entirely in the field of view. In OCR (Optical Character Recognition) text detection and recognition system, combined with several other ingredients, allows robot to recognize named locations specified by a user. This paper will give the system for the auto navigation of robot without maps. OCR is equipped with character recognition software (called OCR software) that converts the bitmap images of characters to equivalent ASCII codes. That is scanner first creates the bitmap image of the document and then the OCR software translates the array of grid points into ASCII text that the computer can interpret as letters, numbers, and special characters.

Keywords: *Optical character recognition, text detection, text recognition.*

1. Introduction

Autonomous navigation is an essential prerequisite for successful service robots. In contexts such as homes and offices, sign boards placed sideways of the road, places are often identified by text on signs Posted throughout the environment, by using the concept of the OCR, textual data can be extracted from the image (sign board) and navigate the robot. Landmarks such as signs make labeling particularly easy, as the appropriate label can be read directly from the landmark using Optical Image Recognition (OCR), without the need for human assistance.

The navigation hardware is connected with Android Phone through the Bluetooth for transfer of data for its ordered movement. On the other hand the Android phone is connected to the server through internet (GPRS) by its specific IP address SOCKET connection for transfer of image to the server and later for receiving the interpreted information conveyed by the image after its processing through the OCR module. The received data is spoken by the Text to Speech module of the phone for human interface and the related byte code is sent to the robot based upon which the robot navigates through the path.

Optical Image Recognition (OCR) also referred as Optical Image Reader is a system that provides a full alphanumeric recognition of printed or handwritten images at electronic speed by simply scanning the form. Forms can be scanned through a scanner and then the recognition engine of the OCR system interpret the images and turn images of handwritten or printed images into ASCII data (machine-readable images).

The technology provides a complete form processing and documents capture solution. The basic programming language used in development of this project is JAVA and ANDROID. The JAVA APIs (application program interface) that are used include BLUETOOTH, Android TEXT to SPEECH, SOCKETS.

1.1 Introduction to the Network

Optical image recognition abbreviated as OCR means that converting some text image into computer editable text format. Lots of recognition systems are available, OCR plays a prominent role. Recognition system works well for simple English language. It has 26 image sets. Kohonen neural network is used for training and recognition procedure which means recognition stage. At the beginning gray scale and then BW conversion takes place for producing binary data.

First of all we need a raw data or collected data which will be processed and later trained with the system.

Secondly we have to consider preprocessing stage. Here mainly image processing procedures takes place, like gray image conversion, binary image conversion, and skew correction.

Thirdly the processing steps like thinning; Edge detection, chain code, pixel mapping, and Histogram

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analysis are occurred. This stage basically converts raw data into trainable components.

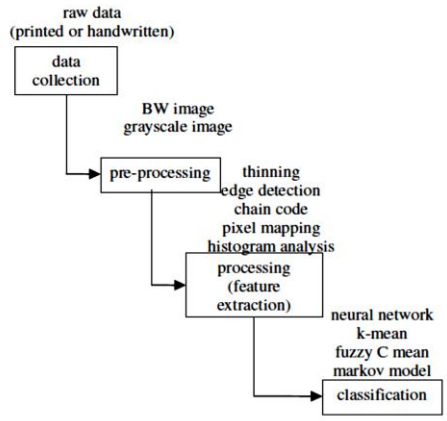


Fig 1: Image Recognition procedure

1.2 Existing System.

Service robots need to have maps that support their tasks. Traditional robot mapping solutions are well-suited to supporting navigation and obstacle avoidance tasks by representing occupancy information. However, it can be difficult to enable higher-level understanding of the world's structure using occupancy-based mapping solutions. One of the most important competencies for a service robot is to be able to accept commands from a human user. Many such commands will include instructions that reference objects, structures, or places, so our mapping system should be designed with this in mind.

2. Literature Survey

Since the 1960s, mobile robot navigation has attracted much attention in the community of robotics(Benjamin Kuipers *et al*,1981; Sebastian). Xinde Li *et al* (2012) proposed a new visual navigation method for a mobile robot. Its originality lies in integrating a sketched map with a semantic map together for the robot's navigation and in using unified tags to help recognize landmarks. Y. Ono et (2004), focus on building an autonomous vehicle as the test bed for the future development of an intelligent wheelchair, by proposing a framework for designing and implementing a mobile robot control program that is easily expandable and portable to other robotic platforms. Nowadays mobile robots find application in many areas of production, public transport, security and defense, exploration of space, etc. Adam Borkowski *et al*(2010) introduced concept of the semantic navigation based upon hyper graphs.

Optical Character Recognition (OCR) has become *et al*,1996 an important and widely used technology. Among its many practical applications are the scanners used at store check-out counters, money changing machines, office scanning machines, and the efforts to automate the postal system. Glennlcash *et al* (1987) carried out an investigation of the use of two-dimensional moments as features for recognition has resulted in the development of a systematic method of character recognition. The method has been applied to six machine-printed fonts. George Nagy *et al* (1999) presented a brief study on OCR technique. Luis von *et al* (2008) presented a new methodology. Weixing Mei *et al* (2012) paper, we propose a semantic-understand based, map less navigation method for robots, which directly using the human navigation system landmarks. Here we make use of kohonen neural network for training and recognition purpose.

3. Proposed System

This system allows a robot to discover path automatically by detecting and reading textual information in signs located (Sign board) by using OCR. In particular, our system allows the robot to identify named locations/Sign boards placed sideways of a road with high reliability, allowing it to satisfy requests from a user that refer to these places by name. Just remember that OCR (optical character recognition) is, as of now, an inexact science and you won't get flawless transcription in all cases.

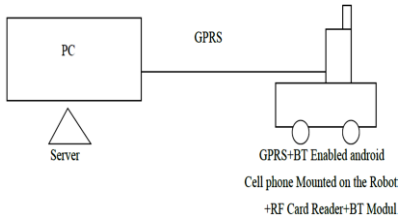
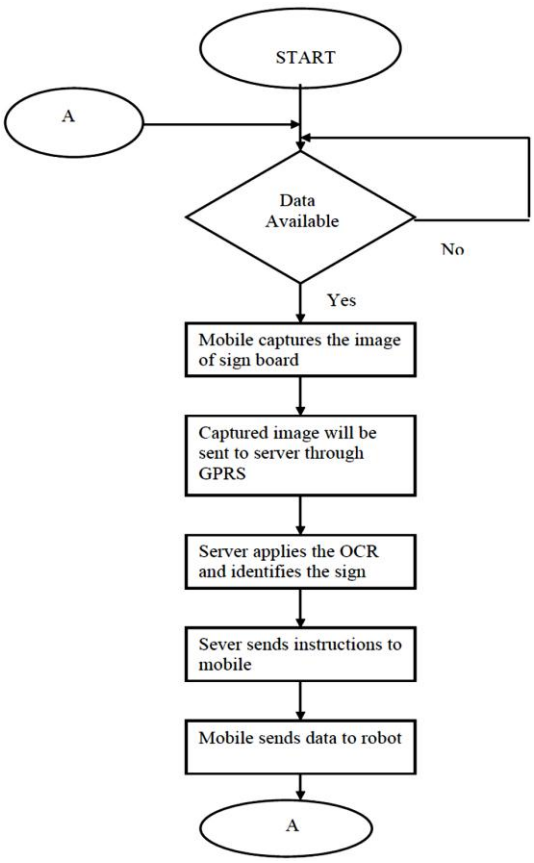


Fig 2: Block diagram of the system

3.1 Flow Chart



The flowchart gives the flow of the working of the auto navigation of the robot. The system will be continuously monitoring for the availability of data. Once the data is available the microcontroller sends a request to the mobile to capture the image of the sign board. The captured image will be sent to server through GPRS. Server applies OCR and identifies the sign. Server sends data to mobile, then mobile sends the instruction to the robot via Bluetooth.

4. Working

Fig 3: An example of an image used to generate a measurement of a door sign landmark. The text read by the OCR program is displayed.

Detection: The output from the mapping module includes a set of images that need to be scanned for text. A Significant body of work focuses on detecting text in natural scenes and video-frames. In this work, we use a logistic regression classifier that uses a variety of text features; our system computes a set of features known to be associated with the presence of text. The features are computed in 10x10 pixel windows (each 3 pixels apart) across the entire image, yielding a vector of features for each 10x10 patch. These feature vectors are then used as input to the classifier. We use several text features from the text detection literature: Local variance, local edge density, and horizontal and vertical edge strength. The features provided to our classifier are the given this set of features and a hand-labeled training set, we train a logistic regression classifier to distinguish between text and non-text image patches. For each 10x10 window, this classifier outputs the probability that the region contains text. Running this classifier across an image and thresholding yields a binary image where the positive-valued pixels represent regions identified as likely to contain text. These pixels are then grouped together into connected components. We reject regions whose areas are less than a predefined threshold

Recognition: The text detection module outputs a set of image regions believed to contain textual information. The next step is to extract text strings from these regions. We binarize the image and then pass its output to an off-the-shelf OCR engine. In our experiments we use the freely available Tesseract engine. Given a candidate image region containing text, it is usually possible to separate the text from the background using a simple constant threshold across the image..This project provides the way to navigate the robot without any human intervention. A robot serves the purpose here. Mount the camera on the robot. The communication between the robot and the PC is thru GPRS. So, distance between the control unit and the robot does not matter and between cell phone and robot through Bluetooth. Java Application running at the server side and Android application in mobile. Initially robot will be moving in a particular direction. If robot comes across RF Card then it stops immediately, takes the snap then sends it to server. Server processes the image and sends the instruction to robot. The signboard is therefore designed such that the forward-looking camera can reliably detect the signboard even though it is partially blocked with unforeseen obstructions.

As soon as RF card reader gets the data, micro controller stops the robot and sends instruction to Cell through Bluetooth to capture the image. cell takes the image and sends to server for processing. Server receives the image from the cell phone through GPRS, applies the OCR to extract the data. Based on the extracted data, server sends the instruction to the robot. Robot moves according to instruction. If the data such as Restaurant, Petrol pump, Men at work etc the server sends instruction to robot to speak up current place where exactly you are, then waits for the next instruction.

4.1 Image Recognition Procedure With Kohonen Network

Steps are described below:

a. Printed given image in taken for raw data.

b. Printed given image is gray scaled and then converted into BW image in preprocessing stage.

c. Pixels are grabbed and mapped into specific area and vector is extracted from the image containing given word or image. This part is considered as processing stage.

d. Lastly Kohonen Neural Network is taken as classification stage.

Image Processing

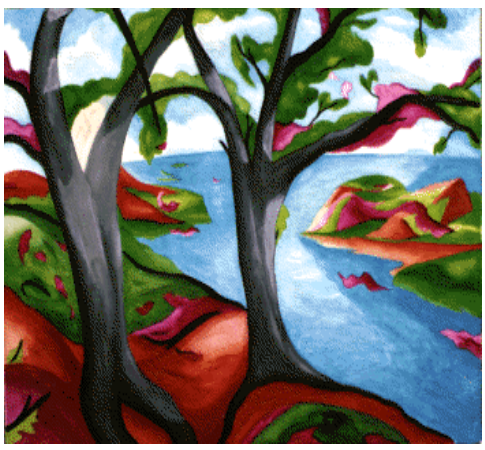


Fig 4: RGB image

In pre-processing the input RGB image is converted into gray scale image. Here the Othu's algorithm is used. The algorithm is given below:

1. Count the number of pixel according to color (256 colors) and save it to matrix count.

2. Calculate probability matrix P of each color, Pi = count i / sum of count,
where i= 1, 2, … … 256.

3. Find matrix omega, omega i = cumulative sum of Pi where i= 1, 2 … 256.

4. Find matrix mu, mu_i = cumulative sum of Pi *i, where i= 1, 2 … … 256
and mu_t = cumulative sum of P256 * 256

5. Calculate matrix sigma_b_squared,
Where sigma_b_squaredi = (mu_t × omega i – mu i) 2 / omega i - (1- omega i)

6. Find the location, idx, of the maximum value of sigma_b_squared. The maximum may extend over several bins, so average together the locations.

7. If maximum is not a number, meaning that sigma_b_squared is all not a number, and then threshold is 0.

8. If maximum is a finite number, threshold = (idx - 1) / (256 - 1);

Fig 5: Image to Grey Scale Conversion

In the pre-processing 2nd stage the gray scale image converted into binary image.

Fig 6: grey scale to binary

Pixel Grabbing: A binary image of fixed size is considered, so can easily get 250 X 250 pixels from a particular image containing Given character or word. One thing is clear that we can grab and separate only character portion from the digital image.

Now sample the entire image into a specified portion to get the vector easily. Specify an area of 25 X 25 pixels. For this we need to convert the 250 X 250 image into the 25 X 25 area.

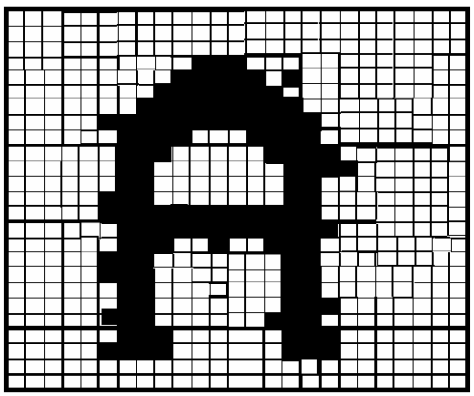
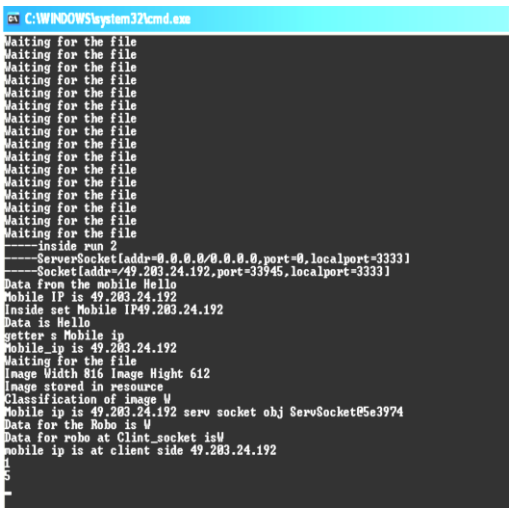


Fig 7: Sampled Image

Now sample the entire image into a specified portion to get the vector easily. Specify an area of 25 X 25 pixels. For this we need to convert the 250 X 250 image into the 25 X 25 area.

4.2 Results

Application will be waiting for the image from the mobile. Once it receives the image it applies the OCR, and identifies the Sign. Once sign has been identified, server sends instructions to mobile for navigation of robot. This application is created using Android, Java, J2EE hence runs in the all platform. Android Cell phone with Android OS 2.1 and above is needed. Mobile should be GPRS enabled. The Product is developed using android, java, j2ee. In Android OS technology, Inbuilt Text to speech facility is available



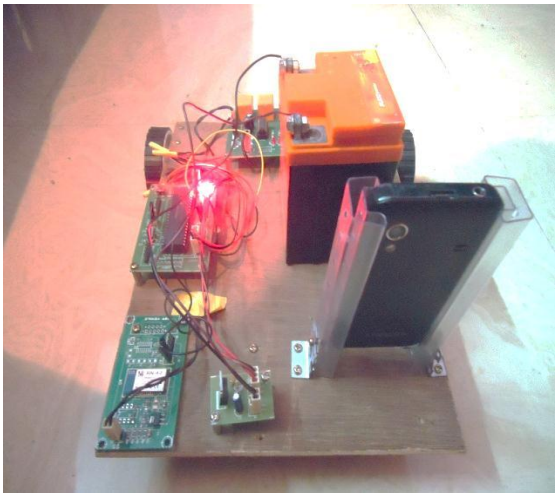


Fig 9: Snapshot of the proposed system

The snapshot of the project shows the robot mounted with PIC microcontroller, relay, and android mobile with Bluetooth activated paired with the Bluetooth module on the robot and battery. Below we have DC motor and RFID reader. This as shown when comes in contact of RFID card stops, which are placed beneath the sign boards. Then it takes the snap of the sign on the signboard with the help of the mobile and sends it to the PC for further processing.

Conclusion and Future Work

In this paper, we propose a method that applies human navigation system landmark to fulfill map less navigation of robots. After locating and tracking of the landmark, we extract the semantic information of texts and arrows contained in those signs, and use the result to guide the robot to the destination. This report tries to emphasize on a way or method of given character recognition in the simplest possible manner. We can conclude by quoting that there is a huge area to research on given Character and its recognition procedure.

In future the whole system with robot and android mobile can be embedded into a single system with the advancement of the android mobiles we could be able to process the OCR algorithm in the mobile itself while avoiding PC. But inaccuracy is palpable in segmentation of given character. So for efficient system still research is needed.

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