ADDRESS RECOGNITION FOR DELIVERY MANAGEMENT SYSTEM USING OCR

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Abstract— Self-Driving vehicles can significantly accelerate delivery and can reduce the human efforts associated with the delivery. The delivery management using GPS is not precise, as the exact location can't be identified by it. For precise location, we have integrated OCR with the present system, which is one of the challenging tasks. This technology can help us solve the self-delivery problem of identifying the correct address effectively. The system will recognize address-using OCR, which is a technique for character recognition from the given image. The delivery is done by using the technology of self-driving vehicle.

Keywords **- Address recognition, Optical Character Recognition (OCR), self-driving car, automatic delivery system, image processing.**

I. INTRODUCTION

Autonomous technologies have been used productively in a number of different applications for many years. As with many technological advancement delivery sectors was also an adopter of self-driving vehicles, in which operation occurs without direct driver input to control the steering, acceleration, and braking. To achieve a vehicle capable of driving itself, four interdependent functions are required. These are navigation, situational analysis, and motion planning and trajectory control. Self-driving vehicles offer several advantages such as improved safety, higher efficiency, lower environmental impact and greater comfort.

We have used optical character recognition for address recognition, which is used as a core for efficient delivery management system using self-driving vehicles. The delivery system using self-driving vehicle consists of the following stages. The first step is the route planning using GPS. The second step is the detection and capturing of the house image using the camera, and the third step is the detection and extraction of an address plate in an image. The fourth step uses the image segmentation technique for individual character and optical character recognition (OCR) to recognize the individual character with the help of a database stored for each alphanumeric character.

The system is computationally inexpensive compared to the other automatic number plate recognition systems. Besides the robustness, the earlier methods used either feature based approached using edge detection which is computationally expensive or uses an artificial neural network which requires large training data.

Optical Character Recognition can be used in many areas such as automatic number plate recognition, which can be further used as a security system for the tollbooth. It can also, be used in parking management system to solve the vehicle-parking problem as its core function lies in the character recognition of the license plate of vehicles.

II. LITERATURE REVIEW

Arduino helps people to create sophisticated design prototypes and interactive hardware. It can control dc motors, which can be used to build small cars. Since Arduino can communicate over Bluetooth connection, we can use this to control the movement of our car using Bluetooth. This method is used in our project to assist the movement of our self-driving vehicle. The signal is sent from program to Arduino through Bluetooth. [1]

According to, "B-LIGHT: A Reading aid for the Blind People using OCR and OpenCV", Optical character recognition (OCR) is the identification of printed characters using a camera and computer software [2]. To implement OCR technology to recognize the address, we can use OpenCV (Open source Computer Library) to do image capture of text and recognize their characters. It is a four-step process which includes scanning, pre-processing, feature extraction and classification, recognition.

As per, "Automatic License Plate Recognition", the license plate of a vehicle can be located from an image and its number can be recognized [3]. This can be also be used to locate the address plate of a building and recognize its address from a live video. An LPR process consists of two main stages: 1) locating license plates and 2) identifying license numbers.

According to," A Survey on moving object tracking using image processing" Moving object classification has a strong cue of periodic property shown by a non-rigid articulated motion of the object[4]. Rigidity analysis and periodicity of moving entities is done by the residual flow. The non-rigid dynamic objects such as human being can have greater average residual flow and display a periodic component, while the rigid objects are expected to have little residual flow.

III. TECHNOLOGY USED

3.1 Optical Character Recognition

Optical Character Recognition (OCR) is the recognition of printed or written text characters by the computer. This involves photo scanning of the text character-by-character, analysis of the scanned image, and the translation of the character image into character codes such as ASCII, commonly used in data processing. In OCR processing, the scanned image is analyzed for light and dark areas in order to identify each alphabetic letter or numeric digit. When a character is recognized, it is converted into an ASCII code. OCR can be used for data entry in business documents, e.g. check, passport, invoice, bank statement and receipt. In airports, for passport recognition and information extraction.

In our proposed system of address recognition with OCR, it has six algorithm process to detect the plate data properly. The first algorithm is the plate localization, which is the process of responsibly finding the plate on the image captured on the screen. The second is the plate orientation and size. It is a process that will compensate for the skew and get the desired image size by

setting the dimensions. Also, in automatic number plate recognition with OCR, is the normalization, character segmentation and geometrical analysis algorithms. The last algorithm and system is optical character recognition. The address recognition with OCR works by using the technology to capture the images and retrieving the address numbers on the plate. It works by highlighting the numbers on the image and separating them from the other objects on the screen, and the number recognized by the computer is compared with the database.

3.2 EMGU, VB.Net and Database

The software is the spirit of this system. We have used EmguCV and Visual Basic.NET to perform all the desired functions. EmguCV allows OpenCV functions to be called from .NET language Visual Basic. OpenCV is a programming function library that adds computer vision capabilities to a program. It is written in C++ language. For wider adoption, its wrapper has been developed in other languages. EmguCV provides a .NET wrapper to the OpenCV library in Visual Basic. This helped us to access webcam, capture video and perform OCR. We used Visual Basic.NET to create the program as it is a cross-platform and has standard framework libraries.

A database is made to store all the details of the address where the delivery is to be done. As soon as the order is received the details are stored in the database. Later, the output of the OCR is compared with the stored details so as to track the precise address. Login functionality is also added to protect the database from being leaked.

Once, the self-driving vehicle reaches nearby location using GPS. Address of every building is scanned and run through OCR. If the scanned address is stored, the LED glows indicating that precise location is found. If the scanned address is not stored in our database, the program assists the vehicle to move to the next building. In practical use, once the correct address is identified, the self-driving vehicle can perform any action starting from calling the owner about its arrival to informing the company to do so.

3.3 Self-Driving Vehicle

The essence of the system lies in the fact that there must not be any human who controls the vehicle else, we will not require such a system because human will find the address himself or herself. We used a simple self-controllable car, as shown in figure 1, which decides the movement based on the output from the program. The car has the ability to move in only one direction with a predefined speed.

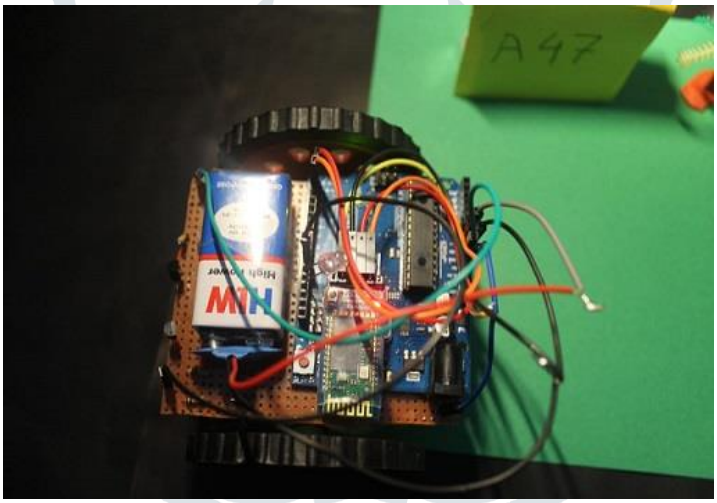

Figure 1 Self-controlled car

Devices used to make car are DC motors, Bluetooth module and Arduino-UNO. DC motors run the wheel of the car and hence move them. They are fitted with speed control devices like transistor and resistor. Other devices:

3.3.1 Arduino UNO

It is a microcontroller based open source reprogrammable device. It is the brain of the vehicle. It decides and controls the action of the vehicle. Whenever it receives a true signal from the program, it glows the LED and whenever it receives a false signal, it turns on the motors. The speed of the motor is also controlled using Arduino. It has 6analog pins which can increase or decrease the amount of current given to a device. Since the vehicle is a wireless system it is powered by a 9V battery which is sufficient according to our present requirements and system size, however, for field trials, it won't be enough as Arduino battery consumption is high which means it drains the battery in 30 hours or two days.

3.3.2 Bluetooth Module

It connects two devices wirelessly. It enables wireless communication between the software program and the vehicle. It carries signal from program to Arduino. The Arduino has the ability to communicate via the Bluetooth module. This act as an input channel for our vehicle.

IV. PRESENT TECHNOLOGY

Autonomous delivery vehicles have become increasingly popular over recent years, as many companies worldwide such as Tesla, Uber, Toyota, and Google etc. are testing it. Amazon's core business necessitates a high demand for shipping, so it is natural that they would look for innovation in this sector, seeking ways to integrate self-driving trucks into their delivery network.Autonomous vehicles can run 24 hours a day. Being permanently operational makes delivery faster and replacing

humans, saves money on wages which often represents half of a company's expenditure. Driverless vehicles bring increased efficiency and potentially reduced delivery times.

To achieve a vehicle capable of driving itself for the delivery function such as navigation is required. Navigation is basically route planning which creates and recalculates a digital map that includes information on locations. The present automated delivery system memorizes a route based on the Global Position System(GPS) to estimate the location. Otherthan locating a position, it also helps in tracing other factors like speed, bearing tracks, trip distance etc. However, GPS doesn't provide the exact location as it uses man-made satellites as a reference to calculate position which is accurate to a matter of meters only. Therefore, the proposed system aim at improving the delivery services using OCR to bring the automated shipping vision into a reality.

V. PROPOSED TECHNOLOGY

We have integrated OCR technology with self-driving vehicles for developing a self-controlled and efficient delivery system that can work without human interference.

The vehicle will be preloaded with GPS technology. It will guide the system to reach to the nearest point of the address but precise location cannot be achieved by GPS, as it is not accurately marked in a GPS. To counter this issue, the address of each building will be scanned and run through OCR. OCR will recognize the address and will match it with the address stored in the database. Depending on the output of the computing, the movement of the vehicle will be decided. Once the correct address is reached, the vehicle can inform the owner. Flow diagram of the above technology is shown in figure 2 below.

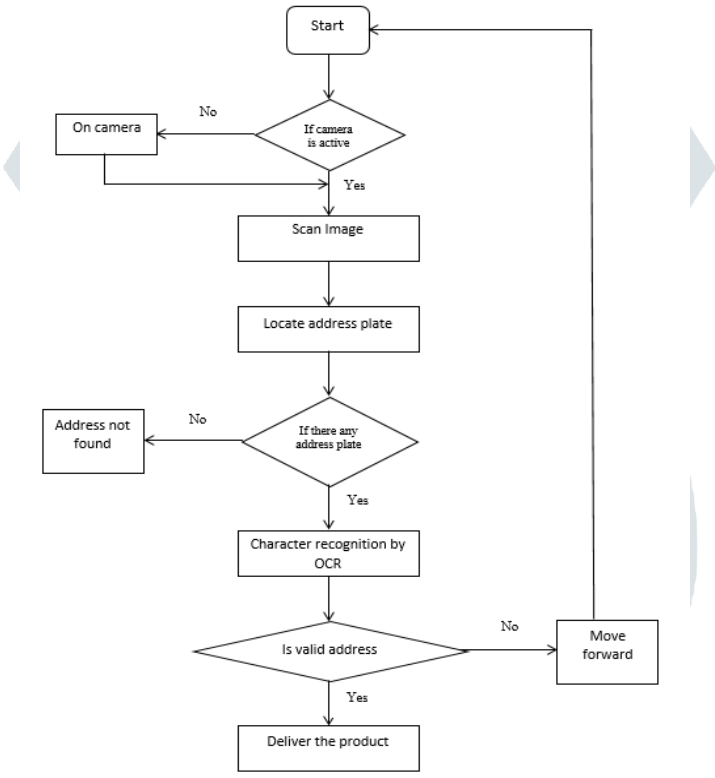

Figure 2 Flow diagram of the technology

This technology can also be used in drone delivery systems where correct identification is extremely important. It is cost-effective, as it does not require additional devices or software. Using machine learning and artificial intelligence, it can be made to handle real-time problems.

VI. WORKING

The program starts with a login page, as shown in figure 3; it is added to protect the user data. Upon successful login, home page opens as shown in figure 4 and the webcam starts capturing the video. For additional security, the program stops asking for username and password after three incorrect inputs.

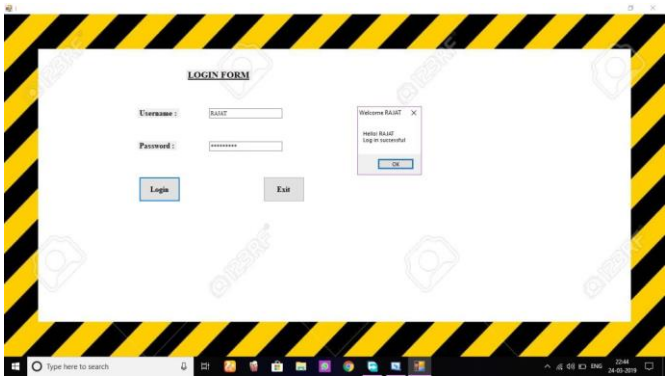

Figure 3 Login Page

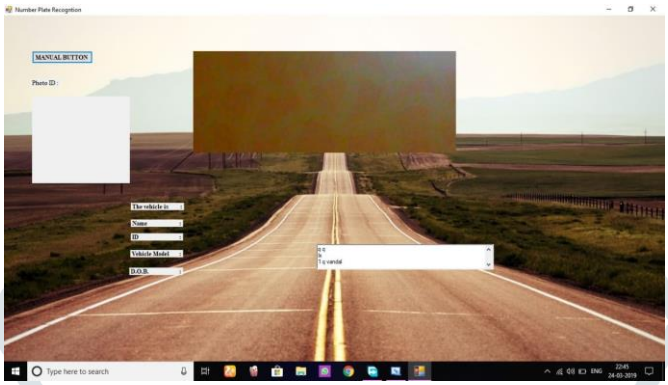

Figure 4 Home Page

The vehicle is activated by just connecting a battery to it. Bluetooth connection is established between the program (computer) and the vehicle. There are two methods to moving the vehicle initially so that it can reach the first building and they are 'the start button' and 'the start image'. The 'start button' is present on the home page, which can be pressed to run the vehicle. The other option is to display an image with start written over it in front of the webcam. The webcam will recognize this image and will order the vehicle to move.

Delivery address is stored in the database. The webcam captures the video and recognizes its character using OCR. These characters are compared with the address stored in the database. If the address matches, the program sends a true signal to the vehicle via Bluetooth and it indicates by glowing a LED. If it doesn't match, the program sends a false signal to the vehicle which orders it to move ahead to next house.

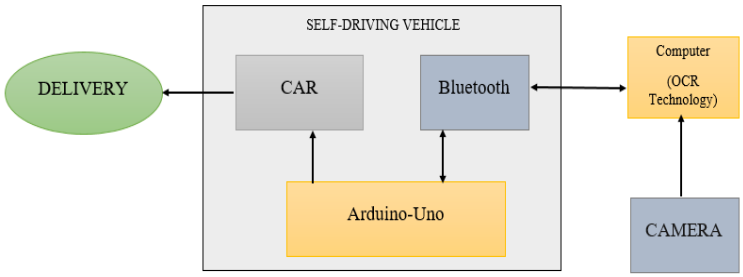

Figure 5 Block diagram of deliver system

Self-driving vehicle keeps scanning and moving forward unless it does not get a True signal from the program. In this way, the vehicle reaches a precise location.

VII. RESULTS

To evaluate the working of the system, we tested it with different images. These images resembled an address plate which contained the address of the house. There were both the images of the desired address and other address. These addresses were: ABC1, RWA2 and LHR786. We stored LHR786 in our database which was our desired address. After starting the system, we displayed ABC1 on our webcam. Since it was not the desired address, the program recognized it as an unsaved address. And as per the expectation, the vehicle moved forward to the next Address.

For the second address, we displayed RWA2 in front of the webcam. This was also an unsaved address and as a result of this, the vehicle further moved to the next address.

Then we kept LHR786 in front of the webcam. The OCR recognized its number as shown in figure 6, identified it as the desired address, as shown in figure 7 and the green LED glows as in figure 8 indicating that it is the right house where the vehicle was to reach.

Figure 6 Recognition of address

Figure 7 OCR finds the correct address

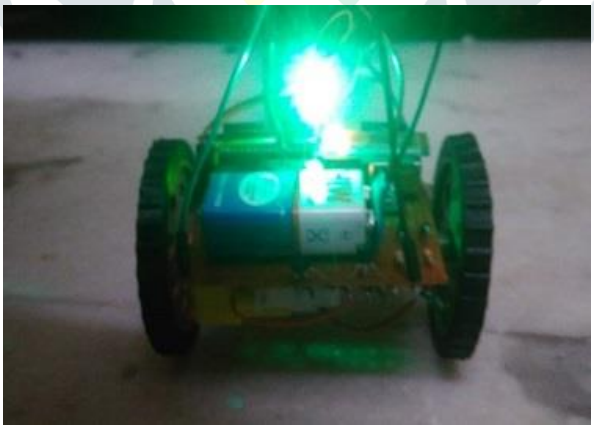

Figure 8 LED glows

The system worked properly. It recognized all the addresses correctly and guided the vehicle to act accordingly. However, In this system, we have used some predefined addresses format which is easily recognized by the basic OCR algorithm but there can be cases where different address format needs to be recognized which require advanced OCR with more elaborated algorithms and advanced machine learning methods to provide high accuracy. Many advanced OCR engines are available like Google Cloud Vision, Ocrad, Readiris, which can be integrated with the system requirements. Moreover, by improving the quality of the image which means images with sharp character borders, well-aligned characters and high contrasts, it is possible to achieve good OCR result.

VIII. Conclusion and Future Scope

In this paper, we proposed a delivery management system, checked and evaluated the accuracy of the OCR technique. Address recognition is processed using the three main stages i.e., address plate extraction, character segmentation and optical character recognition. We have designed the complete system on a self-driving car which consists of Bluetooth for establishing a

connection with Arduino. With the help of command received Arduino indicates whether the number plate is recognized or not and it controls the movement of the vehicle.

The implementation works quite well however, there is scope for improvement. The OCR method used in this project for the recognition is sensitive to misalignment and to different sizes; the affine transformation can be used to improve the OCR recognition from different size and angles. In the future, the work can be done on these factors and efficiency may be increased further for better results.

We aim to implement this system in the future for automatic number plate recognition, which can be further used as a security system for the tollbooth. The automatic number plate recognition which will be used on tollbooth, capture images and the number recognized using OCR will be compared with the database. If the number is blacklisted then the computer will send a command to microcontroller and barrier remains locked otherwise the barrier gets open. OCR can be used to capture number plate and the number recognized using OCR will be compared with the database. If the number is not registered then the computer will send a command to the microcontroller and will inform the nearby police. This will prove very useful to stop theft related crimes.

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