Automated Gate for Vehicular Entry Using Image Processing

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Abstract - *This paper presents the study and research on a construction of a fully autonomous entry gate for vehicular access to a protected / guarded premise. Here we have used Raspberry Pi 3B+ module for overall control of hardware. First, we have installed OS Raspbian, and all the other required packages like OpenCV, NumPy and Virtual environment. The system is based on a Raspberry Pi module which is interfaced to it via I2C bus. Here, in this pairing, the Raspberry Pi module acts as the master. A python program running on Raspberry Pi will be handling the entire logic for the system. In this project we will be implementing OCR (Optical Character Recognition) to extract the number plate details which is linked with the unique Radio Frequency Identification (RFID) of vehicle owner. Using OpenCV library for processing the image through Python program from the video feed of the web cam connected on a USB port of the Raspberry Pi module. The OCR function will be implemented using the OpenCV library for Digital Image Processing through Python program*

Key Words: Number plate details, RFID, OpenCV, Tesseract OCR Engine

1. INTRODUCTION

Automated Gate for vehicular Entry Using Image Processing is needed for fast, secure, efficient and cost-effective application like fully autonomous entry gate for vehicular access to a protected / guarded premise. Paper presents the technique as any visitor to the premises approaches the gate using the vehicle, the proximity sensor on the gate boom will detect it and in response activate RFID scanner and webcam. If the details are generated from the database because RFID tag scan found to be matching with authorised vehicle's number plate-numbers extracted from the live feed from webcam, the gate boom will be raised by system or else alarm will be raised, This process will carried out by Raspberry Pi with the help of OpenCV and Tesseract OCR Engine. The guards in the control room will a complete remote access to the system. The concept of Digital Image Processing (DIP) is used throughout the project. The number plate of the vehicles is stored in the database.
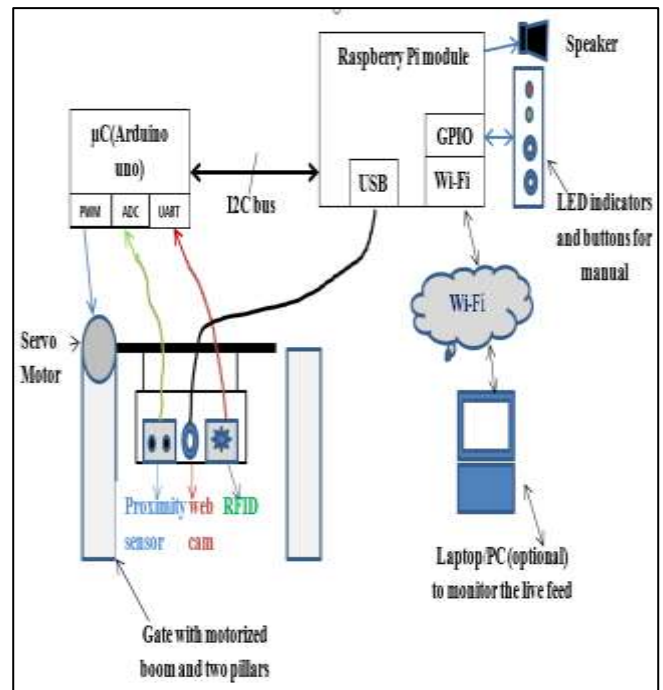

Fig -1. System Block Diagram

1.1 *LITERATURE REVIEW*

Various methods, techniques and processes are available and proposed by following authors:

Eltoum et al [1] proposed a system based on Vehicle License Plate Recognition. Here, system used PIC16f877 microcontroller for primary function. Image processing is done via MATLAB software to extract numbers from vehicle's number plate.

Meghana et al [2] presented the Image Recognition for Automatic Number Plate Surveillance system. For number plate recognition normal image processing methods are used like Noise filtering, Image binarization, Edge Detection, Template Matching, Histogram Approach, OCR using Template Matching.

Agbemenu et al [3] proposed a technique for detecting the four-wheeler vehicle number plate using OpenCV and Tesseract. Image is captured and extraction is done for standard Ghanaian number plate. Image processing is done via Tesseract OCR Engine.

Santosh et al [4] proposed a framework about how to detect the number plate of different vehicles and storing them in the database. This technique used-OpenCV, python Library for program, TensorFlow-KNN and CNN algorithms, MongoDB database for storing the vehicles information.

Shah1 et al [5] presented fast responsive technique to detect car's number plate known as Car Licences Plate Detection (CLPD). This based on character division, OCR and format co-ordinating, MATLAB Simulink

Chauhan et al [6] proposed a system to identify the vehicle number plate known as Automatic Number Plate Recognition (ANPR). This system includes capturing of number plate, extraction of numbers from plate by utilizing the division procedure, MATLAB Software.

2. METHODOLOGY

The system is based on a Raspberry Pi module which is interfaced to it via Inter-Integrated Circuit (I2C) bus. Here, in this pairing, the Raspberry Pi module acts as the master. A python program running on Raspberry Pi will be handling the entire logic for the system. The USP of this project/system is the implementation of OCR to extract the number plate details from the video feed of the web cam connected on a USB port of the Raspberry Pi module. The OCR function will be implemented using the OpenCV library for Digital Image Processing through Python program. Tesseract is used for Text Extraction from the processed image. General purpose I/O pins on Raspberry Pi board are accessed using GPIO_zero library.

(a) When any visitor to the premise approaches the gate with the tag on his/her vehicle, the proximity sensor on the gate boom will detect it and in response activate the RFID scanner and web cam.

(b) The Microcontroller connected to the Raspberry pi module tries to scan the RFID tag. If the tag found is valid then microcontroller sends tag number to Raspberry Pi (Rpi).

(c)RPI checks the tag present in the database. If the tag details found then RPI performs OCR operation on the Web Cam to find the number plate details.

(d) If the details generated from the database because of the RFID tag scan are found to be matching with those deduced from the live video feed from the web-cam, the gate-boom will be raised by the servo motor connected to the microcontroller or else an alarm will be raised.

(e) Also, the guards in the control room will have complete remote access to the system, wirelessly, so as to manually override the decisions made by the system to grant access to strangers whose details are not in database.
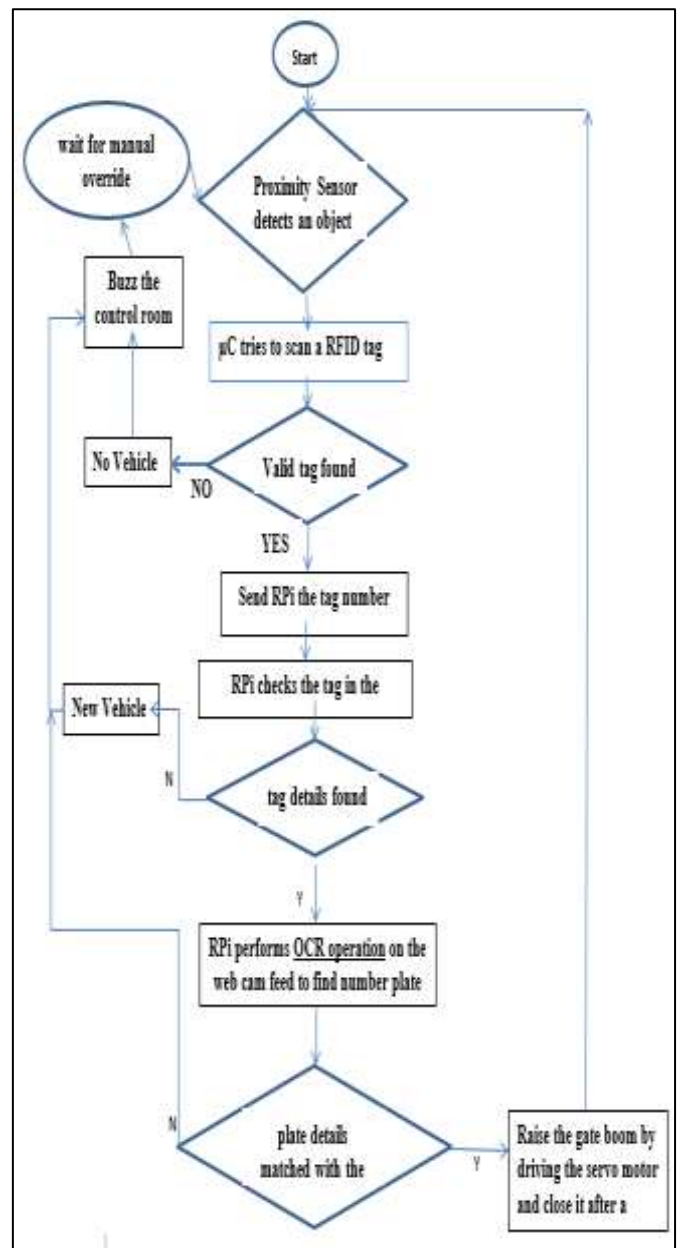

Fig -2. Operational Flowchart

3. RESULTS

As per the methodology this project gives the following outputs:

(a) Vehicle as an object is sensed by proximity sensor having 30cm range. It is a placed at the entry point of gate.

(b) Driver of vehicle scan the unique RFID card that a linked with the vehicle number.

(c) Whenever the unique RFID data allotted to the authorized person match with the linked vehicle number then and then only the boom open. Refer the below Fig-3 and Fig-4.
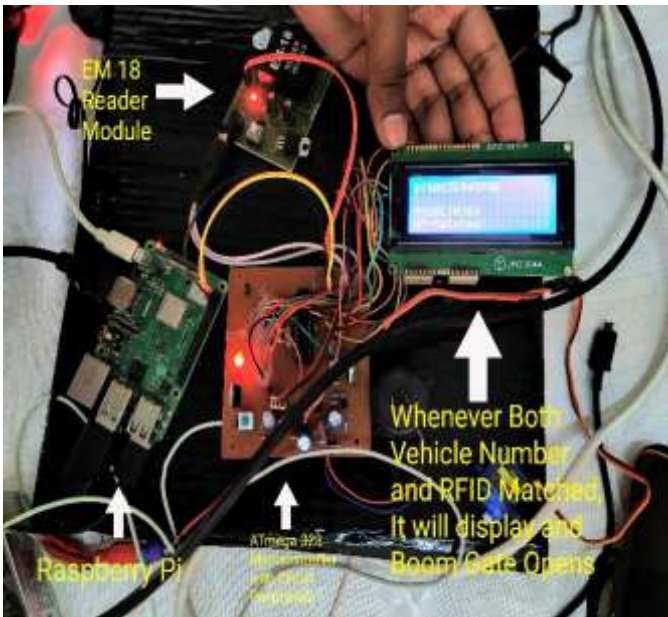
Fig -3. An Authorised Entry

Fig -4. Displaying RFID and Vehicle Number with Matched Status

(d) Otherwise boom does not open and vehicle will not enter the premises. Refer the below images Fig.5 and Fig.6
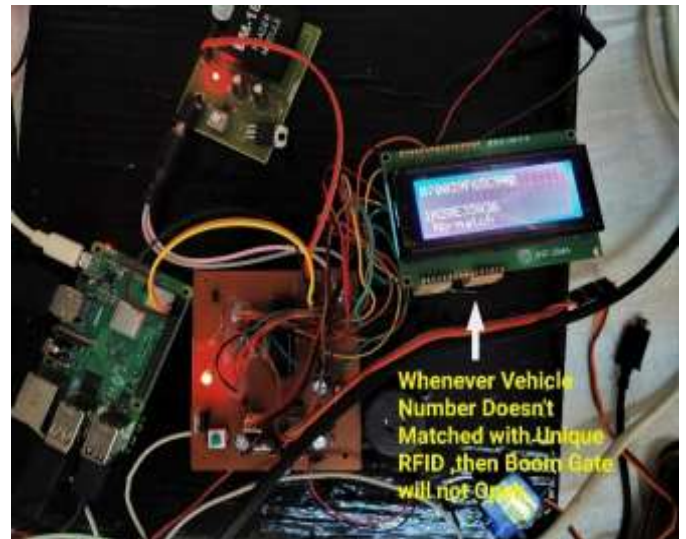

Fig -5. An Unauthorised Entry

Fig -6. Displaying RFID and Vehicle Number with Mismatched Status

4. CONCLUSION

The proposed paper presented a system which solving the problem of Security automatically. This has been achieved by implementing optical character recognition technology (OCR) extracting number plate details from live video feed of web cam using Tesseract on Raspberry Pi module with open CV library and a python program. The RFID technology used in this model providing solution to allow only the authorized vehicles to enter into the premises. It is also increasing asset visibility. Here, Raspberry pi act as master and microcontroller as slave. All the process is handled by Raspberry pi. OpenCV with python libraries helps for efficient and simple programming logics. Tesseract OCR Engine is used for image processing using OpenCV platform. Hence System is able to perform task on

vehicle number plate with high accuracy about 90%. This system is cost effective, efficient, requires less maintenance, easy to use, secure, independent.

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