Development of Toll Gate System Based On AI Automatic License Plate Recognization

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Abstract: ***The conventional toll collection systems often cause traffic congestion and long waiting times at toll gates. This project presents an automatic toll gate system using a combination of Optical Character Recognition (OCR) for number plate recognition and RFID technology to create a seamless and efficient toll payment experience. The system automates the toll collection process and enhances road traffic management, reducing human intervention. The Arduino microcontroller serves as the central processing unit for this system, integrating various components such as image processing for number plate detection, RFID readers for vehicle identification, and servo motors for gate control. When a vehicle approaches the toll gate, the system uses a camera to capture the vehicle's number plate. The captured image is processed using OCR technology to extract the vehicle's registration number. Simultaneously, if the vehicle is equipped with an RFID tag, the RFID reader scans the tag to retrieve the pre-registered vehicle information. The system cross-checks the information obtained from both the RFID tag and the OCR-based number plate detection for enhanced accuracy. Once the vehicle is identified and verified, the Arduino triggers the servo motor to automatically open the toll gate if the vehicle has sufficient balance in its pre-registered account or is authorized to pass through. The entire transaction data can be logged for auditing purposes and displayed on an LCD screen for the driver's reference. If the vehicle lacks authorization or balance, the gate remains closed, and the driver can be notified via alerts. The IoT-enabled system can also transmit real-time toll transaction data to a central server, making it easier for authorities to monitor and manage the toll collection process. By using image processing, RFID, and automation with Arduino and servo motors, this system improves the overall efficiency of toll management, reduces delays, and enhances the user experience on highways.***

Keywords: Automatic Toll Gate, Number Plate Recognition, OCR, RFID Technology, Arduino, Image Processing, Servo Motor, Automation, Traffic Management

I. INTRODUCTION

Number Plate recognition plays an important role in various applications such as traffic monitoring on road, automatic toll payment, parking lots access control, detection of stolen vehicles. To identify a car number plate is effective because of its uniqueness of the car. Real time number plate recognition plays an important role in automatic monitoring of traffic rules. The recognition of car number plate can be used for automatic car parking because each car has its own identification number. The camera is used to capture the image automatically and can be used for many application such as automatic toll plaza and car parking.

The information from these image documents would give higher efficiency and ease of access if it is converted to text form. The process by which Image Text converted into plain text that computer can recognize its ASCII character is Text Extraction. The information from image documents should be converted into text in order to get efficient use and access of it like archiving or reporting that are used in different image-based applications such as office works.

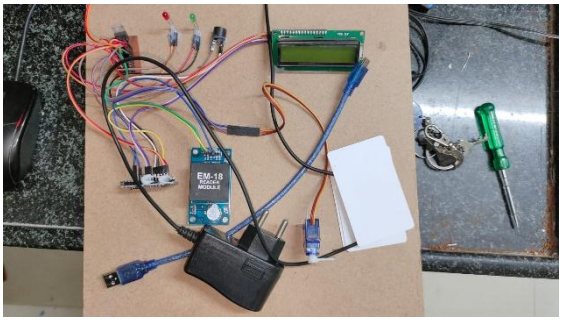


Fig: Kit of automatic toll gate system

II . LITERATURE SURVEY

1.A New Approach for Vehicle Number Plate Detection

Authors: Sarthak Babbar; Saommya Kesarwani ; Navroz Dewan ; Kartik Shangle ; Sanjeev Patel, 2018

Identification of cars and their owners is a tedious and error prone job. The advent of automatic number

plate detection can help tackle problems of parking and traffic control. The system is designed using image processing and machine learning. A new system is proposed to improve detection in low light and over exposure conditions. The image of vehicle is captured, which is preprocessed using techniques like grayscale, binarization. The resultant image is passed on for plate localization, for extracting the number plate using CCA (Connected Component Analysis) and ratio analysis. The characters of the number plate are segmented by CCA and ratio analysis as well. Finally, the recognized characters are compared using techniques such as SVC KNN, Extra Tree Classifier. The proposed techniques help the system to detect well under dim light, over-exposed images and those in which the vehicle is angled.

2.A hierarchical license plate recognition system using supervised K-means and Support Vector Machine Authors: Wei-Chen Liu ; Cheng-Hung Lin, 2017

License plate recognition technology has been widely used in parking lot management systems which has fixed shooting angle and lighting environments. The license plate recognition used in traffic monitor will encounter difficulties in character recognition due to factors such as shooting angle, vehicle speed and environment light and shadow. The supervised K-means is used to classify characters into subgroups. The advantage of the proposed approach is to reduce the classes of characters in each subgroup to further reduce the number of SVMs and their complexity, and thus improve the accuracy of character recognition. Experimental results show that our proposed hierarchical architecture achieves an accuracy of 98.89% in character recognition. Compared with the license plate recognition technology using SVM alone, we get a 3.6% improvement in recognition rate.

Ⅲ. METHODOLOGY

In previous we used that project in matlab with hardware connection but now we use no hardware only software we use only python code & some libraries. The drowsiness detection system is built using MATLAB and Viola Jones Algorithm.

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential. Three key considerations involved in the feasibility analysis are

1. Economic feasibility
2. Technical feasibility
3. Social feasibility

This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

SYSTEM DESIGN AND COMPONENTS

Hardware requirement are the principles used for the implementation of the system which shows what the system does and not how it should be implemented. Software requirements deal with defining software resource requirement and prerequisites that need to be installed on a computer to provide optimal functioning of an application. Such as,

System	:	Pentium IV 2.4 GHz
Hard Disk	:	1TB
Floppy Drive	:	1.44 Mb
Monitor	:	15 VGA Colour
Mouse	:	Logitech
Ram	:	8Gb

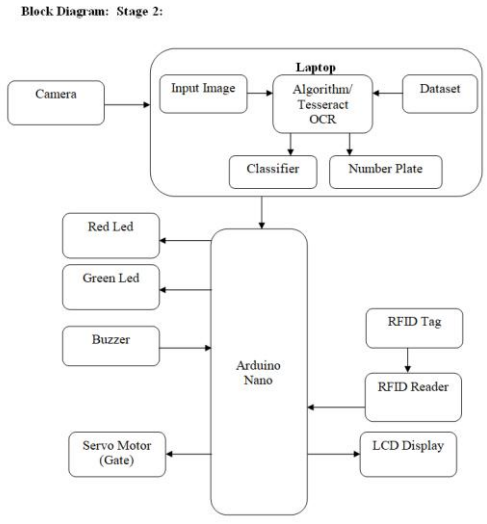


Fig: Block Diagram

The Arduino reference design can use an Atmega8, 168, or 328, Current models use an ATmega328, but an Atmega8 is shown in the schematic for reference. The pin configuration is identical on all three processors.

Specifications

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

Power

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

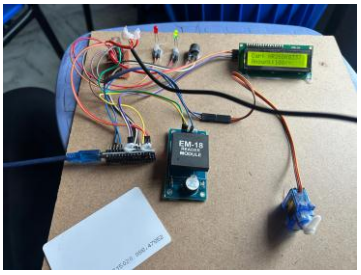
External (non-USB) power can come either from an AC-to-DC adapter (wall- wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supplyless than five volts and the board may be unstable. If using more than 12V, thevoltage regulator may overheat and damage the board. The recommended range is 7to 12 volts.

The power pins are as follows VIN.

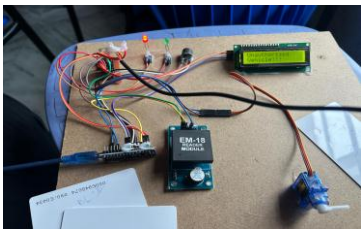
GND. Ground pins.

IOREF. This pin on the Arduino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs for working with the 5V or 3.3V.

IV. RESULTS



RESULT: CAR23



RESULT: CAR1

ADVANTAGES:

Improved Efficiency:
Faster processing times compared to manual toll collection
Enhanced Accuracy:
High-precision license plate recognition reduces human errors
Cost Reduction:
Lower labor costs by reducing manual toll operators
Improved Traffic Management:
Real-time traffic monitoring capabilities

APPLICATIONS

Highway Toll Collection:
Automated tolling on expressways and bridge
Smart City Integration:
Part of intelligent transportation systems (ITS)
Parking Management:
Automated entry/exit systems for parking facilities
Law Enforcement:
Identification of vehicles with expired registration

V. FUTURE SCOPE

The prototype gives a basic functioning of how the Toll systems in India can be automated. There is a lot of scope for development of this paper. Better detection systems can be implemented. Higher resolution cameras with autofocus on license number plates can be installed for quick and better response of detection using DIP. Active RFID sensors can be implemented in place of passive ones for increasing

the distance of RFID detection which will result in smoother process of Toll collection. Back-up LAN can be installed for uninterrupted services in case of network failure. Better schematics can be implemented for Hub, Switch and Router configuration. Future work lies in producing more accurate results with lesser response time according to the prescribed specifications of vehicle number plates and automated system software is to be developed in future work.

VI. CONCLUSION

The paper demonstrates complete working of a prototype of an Automated Toll-Booth. Implementation of the optical character recognition on actual number plates of vehicles has been successful. The scanning of RF ID takes place within a range of 1 - 4.3cm. The database of 150 vehicles is available in the system. The paper implies for working of a better alternative for current scenario of Toll systems in India. Several state governments are planning and working on such automated systems for Toll systems along with NHAI. Government of Maharashtra is seeking the automation of toll booths based on the request from Member of Parliament Mr. Sachin Ramesh Tendulkar. In this work, we have presented technique to recognize number plate of vehicles. For this, we introduced Image capture, preprocessing, edge detection, segmentation, character resizing, feature extraction and finally recognized character of number plate using machine learning algorithms. Dataset creation consisted number of images which are collected real times, parking and etc.

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