

AlertU-We Drive Safe! Do You?

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Abstract: Rules are necessary restrictions that we intend to enforce on ourselves to regulate unwanted or harmful behavior. Simple abidance to road safety rules such as strict compliance to traffic sign boards prove to be highly effective on easing the traffic commotion. Driver assistance systems become one of the most important features of the modern vehicles to ensure driver safety and decrease accidents on roads. In this paper, we propose an idea that enforces the commuters to follow sign boards, else would result in long term penalization. Firstly, on sign board violation the camera attached to it captures the number plate of the car. This information along with sign board identification bit is relayed to the database from where it can be extracted. Secondly, the system also keeps a track of the number of violations per user that can help the driver to take appropriate corrective actions in order to mitigate or completely avoid the event in future. Further, on frequent violation of the rule an alert is sent to the nearest police station.

Keywords: IoT, sign boards, NODEMCU, IR sensor, Arduino UNO, Driver monitoring

1. Introduction

Over the last few years there have been a lot of innovations in the automobile industry which have made our vehicles more efficient and easier to drive. Majority of the accidents are caused due to the violation of sign boards by the driver. With increasing road traffic in today's world there is a necessity to follow the traffic rules correctly. Notwithstanding, we observe that majority of the drivers are free-spirited about this fact. Due to this ignorant behaviour of the driver the number of accidents are increasing. Therefore there is a need to design a system that can recognize traffic signs. Automatic traffic sign detection plays a crucial role in building an autonomous system for e.g. driverless Cars.

The solution to this problem can be looked at in two ways:

- 1) Using high-definition cameras, capturing the image of the sign board and then processing this image.
- 2) Making the sign board smart.

In this project we are taking the second approach thus developing an IoT based system AlertU, which would alert the driver on violation of the sign board. The Internet of Things (IoT) can be defined in many different ways. However IoT can most commonly be defined as the [4] inter-networking of physical devices within the existing Internet infrastructure. It encompasses many aspects of life from connected homes and cities to connected cars and roads, roads to devices that track an individual's behaviour [5]. IoT offers advanced connectivity of devices that goes beyond machine-to-machine communications (M2M) and covers a variety of protocols [4]. Wireless sensors can be used to detect the obstacles and update this information over the internet. The major reason behind choosing the second method is that, cameras encounter various problems due to weather conditions while capturing the image. With IoT, communication between Cross platform devices is made easier. Enormous data accumulated from divergent assemblage of sensors used in IoT systems empowers yearning data analysts to exploit the available data to its fullest.

The salient features of this system are:

- 1) Monitor the road for any sign board violations.
- 2) On violation update the information about his violation on the database.
- 3) Also the system identifies repetitive offenders and sends a notification to the concerned authority for them to undertake suitable actions.

In Section II, we review the previous work and highlight the advancement in our approach. Then in Section III, we outline the technique of monitoring, processing and storage of information. In Section IV, implementation details are specified. Section V comprises of future scope, conclusions are drawn in Section VI followed by references.

2. Related Works

There have been many works in the literature that deals with road sign recognition problem concerning docility of traffic rules. Aakash Darekar et al.[1] proposed deference to traffic signals and signs by method of capturing images using a camera placed on the vehicle, processing it through color segmentation and informing the driver of its meaning as well as regulating the speed of the vehicle according to the sign.

In Detection and recognition of Indian traffic signs by Pritika Priya et al. [2], a similar approach was adopted in three steps: detection, classification, recognition. However in [1, 2] accuracy and inability to get the sign boards captured largely depends on the position of the vehicle and board placement.

In Real time detection and recognition of road traffic signs by Jack Greenhalgh et al. [3] recognition is based on cascade of support vector machine classifiers that were trained using HOG features. It may lead to mismatch against similar signs missing from database.

Our approach focused on associating with each sign board a unique identifier that could be matched with its meaning stored in the database thus preventing unnecessary processing time. Also the vehicle number is captured and processed only on malefaction thus making the course more potent and brisk.

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3. Proposed System

The proposed system can be broadly categorized into three sub-modules. The Process diagram [Fig. 1] depicts the functionality and flow of data between various module setups.

3.1 Monitoring and Data Collection

Every sign board is equipped with a module constituting an arduino board, sensor, NODEMCU: Wi-Fi module and a high definition camera. The sensor operates invariably to monitor the road for any cars violating the sign board. On violation a signal is sent to arduino and the camera captures an image of the cars' number plate. This image is now fed as input to the image processing algorithm in MATLAB.

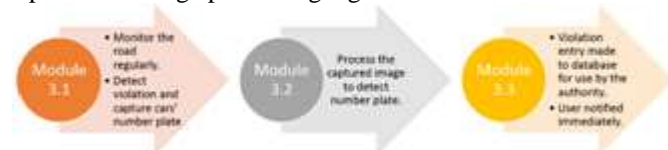


Figure 1: Process diagram

3.2 Data Processing and Information Acquiring

A multistep image processing algorithm now runs on the captured number plate image. The algorithm is based on technique of template matching. An alphanumeric template is maintained against which the patterns of segments are matched with and decided upon the alpha numeric character it corresponds to (Optical Character Recognition-OCR). Various operations are performed on the image once captured. First the image is loaded and converted to grey scale, passed through filters to remove noise and dilated. On this image morphological operations are performed followed by horizontal and vertical segmentation based on pixel values. The segmented values now undergo OCR matching with template after which the actual text entries of car number plate are obtained.

3.3 Information Storage and Usage

The car plate number and the sign board name are now stored in a database. The arduino uses the network connectivity of Wi-Fi module to transfer and store this information on a remote database server. An application is made available to the user and authority that retrieves the database violation entries against the input car number. Once the violation entries against a car number increase above a predetermined value say 5, a notification would be sent to the concerned authorities that enable them to undertake strict action or penalization.

4. Implementation

In this paper we provide the implementation details for a no-way sign board violation. Every no-way sign board is equipped with a module constituting an arduino board, IR sensor, NODEMCU: Wi-Fi module and a high definition camera. The IR sensor operates like an obstacle sensor that invariably monitors the no-way road for any cars violating the sign board. Whenever the sign board detects an obstacle in the no-way road a signal is sent to the arduino that

captures number plate of the car. This image is input to the image processing algorithm in MATLAB where it is processed to obtain the number of car.

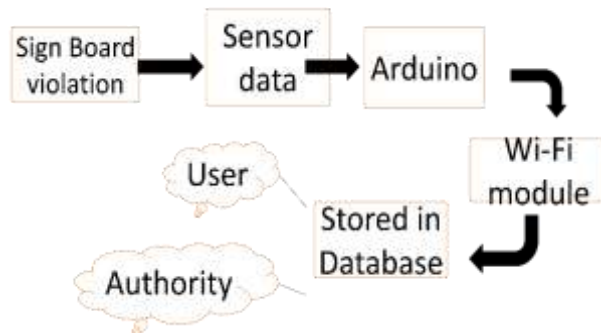


Figure 2: Block diagram

The processed car number is stored along with the no-way sign board violation in the database. The database is designed to trigger a notification to the concerned authority once the number of violation entries exceed 3 per day. An application is maintained that is developed for use by the authorities, as well as drivers that provides violation data about a specified car based on its number plate.



Figure 3: Processing of captured image to detect numbers of number plate

The entire process can be briefed out into a five step algorithm as specified below

Algorithm:

Step 1: Set up the module at No-way sign board such that it monitors the no-way road for any car movement in that direction.

Step 2: If a car violates this sign board then the IR sensor detects the vehicle movement and captures the image of cars' number plate.

Step 3: The image captured by the camera is pushed into MATLAB that identifies the car plate numbers.

Step 4: This information is then forwarded to arduino that stores this information in a database. The connectivity to the network is enabled by a Wi-Fi module (NODEMCU).

Step 5: If the same driver commits repetitive offences the database triggers a notification to the authority.

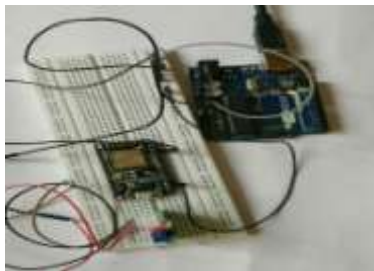


Figure 4: Circuit Setup

5. Future Scope

In the paper the proposed system intends to capture the traffic sign board violators' information that may be used for penalization. However this data can be utilized as a potential reference by authorities while re-issuing driving licenses. This provides the actual drivers' abidance to traffic laws, rather than just on the license test day and also could be extended to obtain a driving finger print of a person. Further, this system could be improvised to provide a forewarning to the driver about any upcoming sign boards that would most likely pave way for an added feature in autonomous car that are in forefront research today.

6. Conclusion

This paper presents a novel approach towards monitoring of drivers' observation and abidance to traffic sign boards. The system surveils the geography around the sign board for any violations. Once it detects that a commuter has violated a sign board the system captures the cars' number plate and processes it to obtain the car number. This violation data is then maintained for driver that is later utilized to enforce corrective action. Thus the system enforces traffic law on commuters to an extent that it might change their perspective of negligence towards traffic sign boards.

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