TITLE: Autonomous Vehicle Control through Traffic Signs Detection

GROUP – 1

1. ABSTRACT

Autonomous vehicles are the vehicles of the future. And this fact is not hidden that, many developed countries have started replacing human-driven vehicles with autonomous vehicles on roads. Features like self-driving nature, environmentally friendly, automatic obstacle detection, less fuel consumption, time-efficient, robustness; etc are making them a hot topic of discussion at present time. But autonomous vehicles are still a distant dream for India. The Indian Motor Vehicles Act, 1988 and the rules, that regulate the operation of vehicles here, do not currently allow fully automated systems. This is because these vehicles will find most Indian roads too chaotic to function. This chaos can be due to the poor road condition, accumulation of vehicles at a single place beyond its capacity, or maybe due to some environmental cause. Negligence of drivers towards traffic signs, traffic signals and not to mention traffic rules sometimes causes critical accidents and therefore must be given serious attention. Moreover, in current traffic management systems, there is a high probability that the driver may miss some of the traffic signs on the road because of overcrowding due to neighboring vehicles. And not to miss, with the continuous growth of vehicle numbers in urban agglomerations around the world, this problem is only expected to grow worse. One of the ways to limit this problem is by using Traffic Sign Detection And Recognition (TSDR) System. A TSDR system is developed and implemented as a part of the Intelligent Transportation System (ITS), which aims to minimize the number of accidents due to drivers' negligence and wrong decisions. This system detects and recognizes traffic signs from and within images captures by cameras or imaging sensors displaying to the user what traffic rules are applicable at that stretch of roads. Even though the technology warns the user about the detected traffic sign, there are chances that the user might violate them, and violating the traffic sign rules might lead to accidents where the life of the people would be at stake.

Hence, to avoid encountering such conditions we would like to implement a – " TSDR system" on an IOT based hardware which will culminate as a proto-model of the real-life autonomous vehicle system that can support drivers and increase driving safety.

2. THE OBJECTIVE OF THE STUDY

The two phases of the objectives are:

- To develop an automated model for the detection of Traffic Signs on the roadsides by using concepts like Deep Learning, Learning, Data Analysis & Image Processing
- To implement a prototype of Traffic Sign Detection & Recognition (TSDR) System with violation control on a miniature vehicle by using concepts of Communication and IoT.

3. SCOPE AND LIMITATIONS

The detection algorithm must be fast as the main aim is to implement it in real life due to

- Continuous changes in the environment and lighting conditions.
- Partial obscuring of traffic sign
- Multiple traffic signs appearing at the same time

- Blurring and fading of old traffic signs.

It may not be suitable for all countries, where peak traffic is much less than the regular traffic

4. RESEARCH METHODOLOGY

This project comprises both Hardware + Software.

The build of the system is majorly concentrated on a cost-effective, out-of-the-box solution using a mini embedded computer Raspberry Pi. To provide fast processed results deep learning techniques have to be used with the help of the TensorFlow and Keras platform.

SOFTWARE PART:

We will build a customized deep neural network model that will be trained on the traffic signs dataset. Later, during the implementation stage, the model will be used to detect real-time traffic signals.

The proposed dataset scheme can be divided into 5 stages:

- Video and frame capturing
- Preprocessing
- Traffic sign detection
- Character/icon extraction
- Recognition

HARDWARE PART:

We will be using a pi camera connected to the Camera Serial Interface (CSI) connector of the Raspberry pi to capture the images. The images are captured in a continuous manner and every frame is processed by the already trained model to detect the traffic sign if present. And based on the result the message will be sent to the RC car.

Here Arduino coding is been used for basic locomotion of the RC car, violation control of the car if so traffic sign is detected, and as well as for the NodeMCU to retrieve data in continuous from IoT data log.

Fig.1 represents the block diagram of the proto-model.

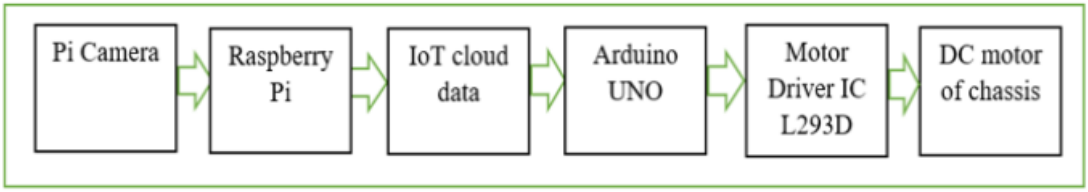

Fig. 1. Block diagram of the proposed prototype

5. BUDGETING

The tentative budget is shown in table 1

Table 1 : Tentative Budget (proposed)

APPARATUS	COST
RASPBERRY PIE	8000
PI CAMERA	2000
ARDUINO UNO	600
BLUETOOTH MODULE	700
NodeMCU	250
DUAL H BRIDGE/ DC Motor	2000
HARDWARE EQUIPMENT	1500
Ultrasonic distance sensor	2000
TOTAL	17100 (Approx)

REFERENCES

A. Lorsakul, and J. Suthakorn, "Trafdic Sign Recognition for Intelligent Vehicle/Driver Assistance System Using Neural Network on OpenCV", The 4th International Conference on Ubiquitous Robots and Ambient Intelligence, 2007

R. Vicen-Bueno, R. Gil-Pita, M.P. Jarabo-Amores and F. L´opez-Ferreras, "Complexity Reduction in Neural Networks Applied to Traffic Sign Recognition", *Proceedings of the 13th European Signal Processing Conference*, Antalya, Turkey, September 4-8, 2005