

Automatic Speed Control of Vehicles Based on Signboard Recognition

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Abstract: *The system proposed in this paper is an advanced solution for automatic speed control of vehicles based on speed limit signboard recognition. The technology behind this system is image processing technique which is used in many fields such as space exploration, medicine, geology, etc. The main objective of this paper is to demonstrate the ability of image processing algorithms on embedded computing platforms. It describes a road sign recognition system based on an embedded system that reads and recognizes speed signs and also controls the speed of the moving vehicle. The paper also describes how to deal with numbers using image processing techniques based on shape and dimension analysis. Colour analysis plays an important role in road sign detection. Visual Studio, an embedded computing platform, and Arduino Uno are the main components to implement this system, as they have built-in capabilities. This is a computer vision-based system for traffic sign detection, tracking, and recognition in real-time. The signs on the roadside are captured with the help of a camera interface. The captured image is then compared with pre-defined road signs or preset algorithms. Dimension analysis is performed with the help of the K nearest algorithm. Upon obtaining the best match, the corresponding speed limit in the detected image will be sent to the visual studio that runs python code, Arduino will generate a pulse width modulated signal to control the speed of the vehicle (DC Motor) accordingly with the help of motor driver L298N.*

Keywords: Arduino Uno, Python, DC Motors, L298N, Visual Studio, Traffic Sign Detection, etc.

I. INTRODUCTION

Traffic signs play an important role while driving. They act as route guides, warnings, and traffic regulators. Avoiding this leads to the loss of lives. In adverse traffic conditions, the driver may not notice traffic signs, which may cause accidents. In such scenarios, automatic road sign detection comes into effect [1]. There are four types of traffic signs that usually show in the traffic code: a) warning; b) prohibition; c) obligation; and d) informative. Depending on the form and the color, the warning signs are equilateral triangles with one vertex upwards. They have a white background and are surrounded by a red border. Prohibition signs are circles with a white or blue background and a red border. Obligation signs are circles with a blue or white background. Informative signs have the same color. To detect the position of the sign in the image, we must know the two properties i.e., color and shape. [2]

Traffic sign recognition is used to maintain traffic signs, warn distracted drivers, and prevent his/her actions that can lead to an accident. A real-time automatic speed sign detection and recognition can help the driver, significantly increasing his/her safety. Traffic sign recognition also gets an interest lately by large-scale companies driven by the market needs for intelligent applications such as autonomous driving, driver assistance systems (ADAS), mobile mapping, etc. we have focused on a low-cost, off-the-shelf solution. In order to provide fast processed results, this system aimed to demonstrate the use of simple shape recognition algorithms and open-source optical character recognition (Tesseract OCR) in a visual studio.

Tesseract OCR is one of the top character recognition engines in terms of accuracy. Tesseract can detect letters in various forms of images, and it uses the open-source Leptonica library. we will pass images to Tesseract OCR and read them. To improve accuracy, we have to do pre-processing on images before passing them to the

Tesseract OCR engine.

II. SOFTWARE

VISUAL STUDIO

Visual Studio is an Integrated Development Environment (IDE) developed by Microsoft to develop GUI (Graphical user interface) consoles, Web applications, web apps, mobile apps, cloud, and web services, etc. With the help of this IDE, you can create managed code as well as native code. It uses the various platforms of Microsoft software development software like Windows store, Microsoft Silverlight, Windows API, etc. It is not a language-specific IDE as you can use this to write code in C#, C++, VB (Visual Basic), Python, JavaScript, and many more languages. Visual Studio supports 36 different programming languages and allows the code editor and debugger to support any programming language.[3]

OPEN CV

It stands for Open-Source Computer Vision. It has a library of programming functions mainly for real-time computer vision. The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, and track moving objects.[4]

III. HARDWARE

ARDUINO UNO

The Arduino Uno is an open-source microcontroller based on the Microchip ATmega328P Microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output(I/O) pins that may be interfaced to various expansion boards (shield) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE, via a type B USB cable. It can be powered by a USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a creative common attribution share- Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available. [5]



Figure 1: Schematic representation of Arduino Uno

MOTOR DRIVER L298N

This L298N Motor Driver Module is a high-power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control.

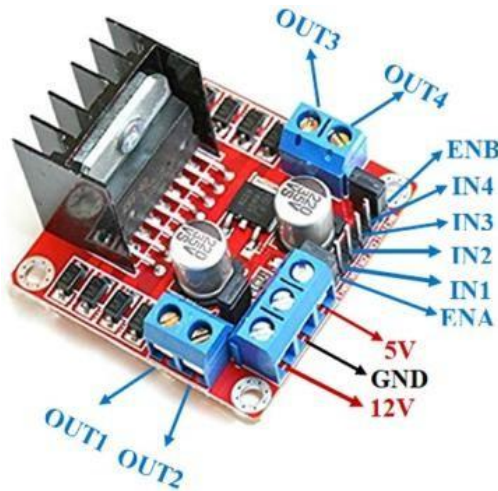


Figure 2: Schematic representation of Motor driver L298N

Following are the Features and Specifications of L298N motor driver.

1. Driver Model: L298N 2A
2. Driver Chip: Double H Bridge L298N
3. Motor Supply Voltage (Maximum): 46V
4. Motor Supply Current (Maximum): 2A
5. Logic Voltage: 5V
6. Driver Voltage: 5-35V
7. Driver Current: 2A
8. Logical Current: 0-36Ma
9. Maximum Power (W): 25W [6]

DC MOTOR

A 300RPM -12Volts geared motor is generally a simple motor with a gearbox attached to it. This can be used in all-terrain robots and a variety of robotic applications This motor has a 3 mm threaded drill hole in the middle of the shaft thus making it simple to connect it to the wheels or any other mechanical assembly. 300RPM 12V DC geared motors are widely used for robotics applications. Very easy to use and available in standard size. Also, you don't have to spend a lot of money to control motors with an Arduino or compatible board.

The most popular L298N H-bridge module with an onboard voltage regulator motor driver can be used with this motor that has a voltage of between 5 and 35V DC or you can choose the most precise motor diver module from the wide range available in the market as per specific requirements. Nut and threads on the shaft provide easy interlocking with wheels. DC Geared motors with robust metal gearbox for heavy-duty applications are available in wide RPM ranges.

DC motor we have used has following specifications:

1. Range- 300RPM
2. Rated voltage- 4V to 12V
3. Brush type- Carbon
4. Weight- 280gms
5. Shaft length-17.5mm6.
6. Shaft diameter-8mm
7. Torque- 2Nm [7]

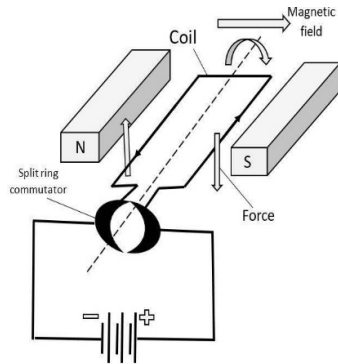
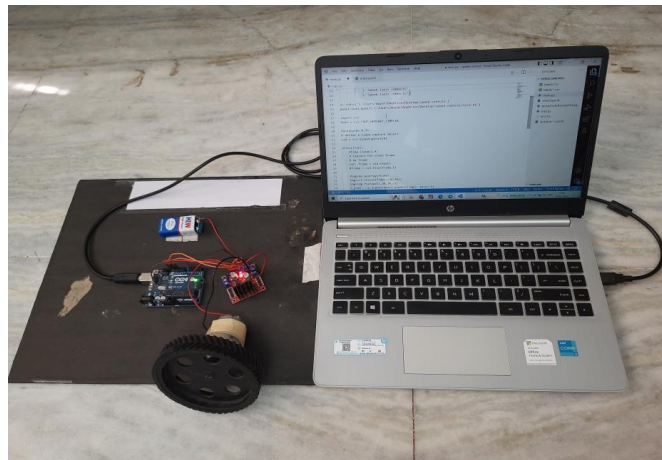


Figure 3: Schematic representation of DC motor

IV. ACTUAL MODULE SETUP



V. DIAGRAMS

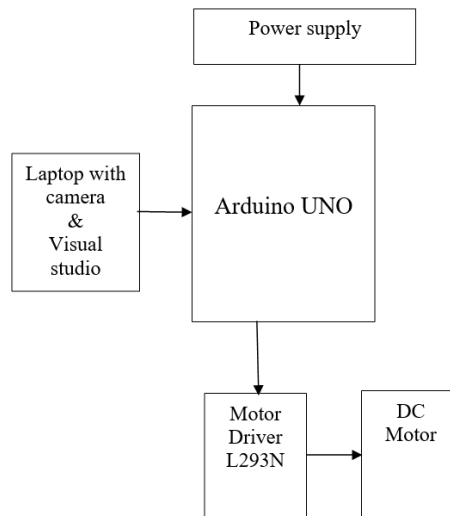


Figure 4: Block diagram of system

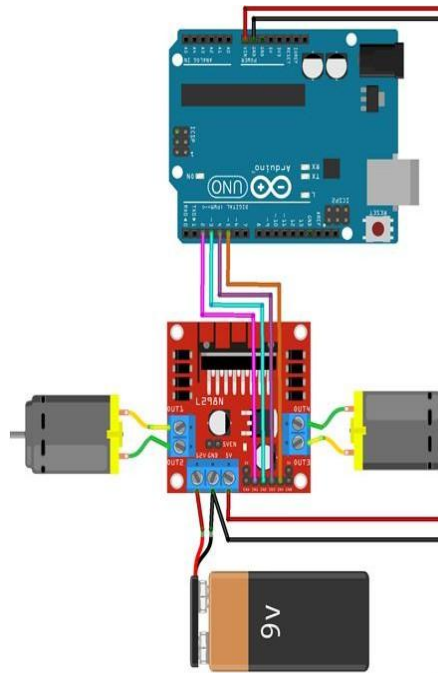






Fig.5. Interfacing diagram of system

VI. WORKING OF SYSTEM

As two wheels of chassis are connected with two motors, Motor driver L298N is capable to run more than two motor at a time. The rated speed limit (digit) is shown to the camera, camera captures the digit, verifies it with preset algorithms and processes with Arduino Uno. Arduino generates a pulse with modulation to motor driver and motor driver controls the motor at the rated speed. The input for motor driver IC is given by the Arduino Uno and the output pins of the motor IC are connected to the motor of the chassis

VII. ROAD SIGN AND CORRESPONDING ACTIONS

Table 1: The table below illustrates the different road signs and the corresponding action to be performed by the system

	As speed limit indication. Performs the motor operation at 30km/h.
	As speed limit indication. Performs the motor operation at 60km/h.
	As speed limit indication. Performs the motor operation at 80km/h.
	As a stop indication. Performs stop operation and halts the system.

VIII. CONCLUSION

The system proposed in this system is to replace the manual operations of automotive. Automotive process, proved beneficial as it decreases the human error, increases the efficiency, accuracy, processing speed and

reliability. The very motive behind this development is to bind the driver in traffic regulations, that driver usually do not follow. The basic idea is to recognize and classify the traffic signs from an input image and runs the vehicle on the prescribed rated speed limit. The performance of the system solely depends on the quality of the input image, size, contrast, and the way sign appear as an input.

For future enhancement, more advanced resolution and advanced processor can be used in order to detect signs quickly and precisely. Using different machine learning algorithms, various objects or signs can be detected. The current performance is good but to make it more efficient, it needs to run on advanced processors.

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AKNOWLEDGMENT

We extend our sincere thanks to prof. Sharad S. Patil for guiding us throughout the project implementation.