

AI-enabled implementation of Autonomous Vehicle 4.0 for Smart Environment

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Abstract

In the Era of the Digital world, autonomous vehicles inform many developments. Now, we have a tendency to Reached up to level five with high integrated functions. However we have a tendency to cannot integrate the close object, therefore we have a tendency to enhance A level four autonomous vehicles in order that it are often configured as high automation as capable full automation within which containing a personality's ride continues to be AN possibility. Within the field of vehicles, varied aspects are thought of which create a vehicle machine-driven. Tesla, Google that performing on the sphere of autonomous and still developing new changes to offer a full new level to the machine-driven vehicle with some robust algorithmic rule and clearly with a high expansive model. This algorithmic rule varies from ancient management to machine learning. During this paper, we are going to use some actuators and algorithmic rule of computing that helps to take care of vehicle detection and chase and road sign recognition with all practicality that having a standard vehicle level1. Advanced management systems interpret sensory data to identify applicable navigation methods additionally as obstacles and relevant collection.

Keywords level4 automation, Artificial intelligence algorithm, Actuators, Microcontroller, Raspberry pi

1.INTRODUCTION

We enhance A level four an autonomous vehicle in order that it are often designed as high automation as capable a full automation within which containing a personality's ride continues to be An option. This paper introduces analysis and an academic project towards autonomous level4 vehicles. This focuses on building a model of high automation level4 autonomous vehicles. This idea isn't new in late 90s Norman Bell guided by guided electromagnetic fields generated with attractable metal spikes embedded within

the roadway, later several discoveries were occurring, and as a result that we have a tendency to square measure booming in making up level5 autonomous vehicle, however rather than level5 we have a tendency to use level4 with high automation And human ride still a possibility. In order that in AN emergency or for security purposes we have a tendency to run the vehicle manually or stop the vehicle. if we have a tendency to see a history of traffic related problems, nearly 1.3 million individuals die in road accidents every year and talking about the Indian landmass. it's a significant concern that in 2019 alone, the country reported over 151 thousand fatalities due to road accidents. Every year regarding three to

five percent of the country's gross domestic product was invested with in road accidents and in keeping with the survey. At a Rate of 73.4 deaths per 10000 people. Meanwhile, the Autonomous vehicle is one in all the foremost mentioned technologies of this state of affairs. Autonomous vehicle technology could be a reality and within the next decade, they're expected to succeed in the very best level of automation. The brain of the system is that the Raspberry Pi that capable of exchanging knowledge with the sensors and quick enough to calculate some knowledge per second. Since our vehicle can use computing it'll want significant parallel computing power for that reason the Raspberry Pi can use here. The Autonomous vehicle is controlled by a motor controller that is controlled by Arduino UNO, capable of reading its move speed. The camera is wont to realize, sight objects and road sign detection that square measure then processed by the most controller (Raspberry Pi) inside the vehicle. Autonomous vehicles square measure technological development inside the sphere of automobiles. Several corporations throughout the globe square measure creating a significant and continuous effort to form vehicles a secure and nonhazardous method.

1.LITERATURE SURVEY

In this proposed system we tend to style a high automation vehicle that is of level5 within which we add an individual's interfere so for any security reason we will handle the vehicle or stop the vehicle.

1. The paper given by Dong, D., Li,

X., & Sun, "A Vision-based methodology for improving the security of Self-driving" provides careful read concerning however they developed a machine that is in a position to find traffic signs, lanes and road segmentation.

2. The paper "Traffic and connected Self-Driven Many-Particle Systems" by dagger Helbing address that papers have already self-addressed just like the basic diagram between traffic flow and vehicle density or the instability of traffic flow.

3. The paper "Self-Driving and Driver reposeful Vehicle", given by Qudsia Memon, Muzamil Ahmed, Shahzeb Ali, Azam Rafique Memon, Wajiha crowned head throughout this paper they need designed 2 applications of AN autonomous vehicle, which might facilitate the driver to relax for the restricted length of your time. It additionally presents an inspiration that focuses on changed thought of Google automotive, the Google automotive needs to reach the static destination automatically; during this image, they created the dynamic destination. Here self-driving car can follow a vehicle that's moving on an explicit route. This image can follow that vehicle.

4. The paper "IoT based mostly Self Driving Car" given by Rahul P. Kharapkar, Abhishek S. Khandare, Zeeshaan W. Siddiqui, Vaibhav U. Bodhe, Prof. M. Nasiruddin address that resolution pi camera can offer the mandatory data and therefore the Raspberry Pi can analyze the info and it'll get trained in Raspberry Pi with neural network and machine learning formula which could finish in police

work road lanes, traffic lights and thus the automotive can alternate consequently. Additionally to those options, the automotive can overtake with correct crystal rectifier indications if it comes across AN obstacle)

5. The paper “Working model of Self-driving automotive victimization Convolutional Neural Network, Raspberry Pi and Arduino” by Hindu deity Kumar religion. The projected model takes a picture with the assistance of a camera module hooked up with Raspberry Pi on the vehicle. The Raspberry Pi and therefore the portable computer area unit connected to constant network, the Raspberry Pi sends the captured image to the Convolutional Neural Network. The image is gray-scaled before passing it to the Neural Network. Upon prediction, the Model provides one in all the four outputs i.e. left, right, forward, or stop. Once the result is expected corresponding Arduino signal is triggered that in turn helps the automotive to maneuver throughout a particular direction.

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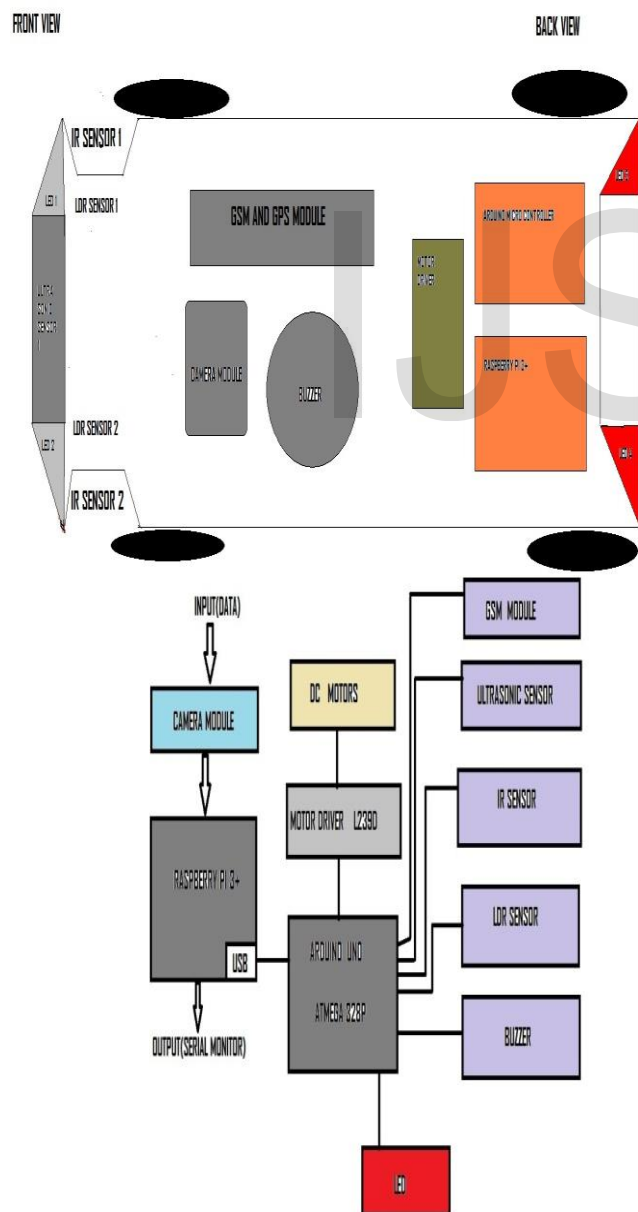
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3. METHODOLOGY

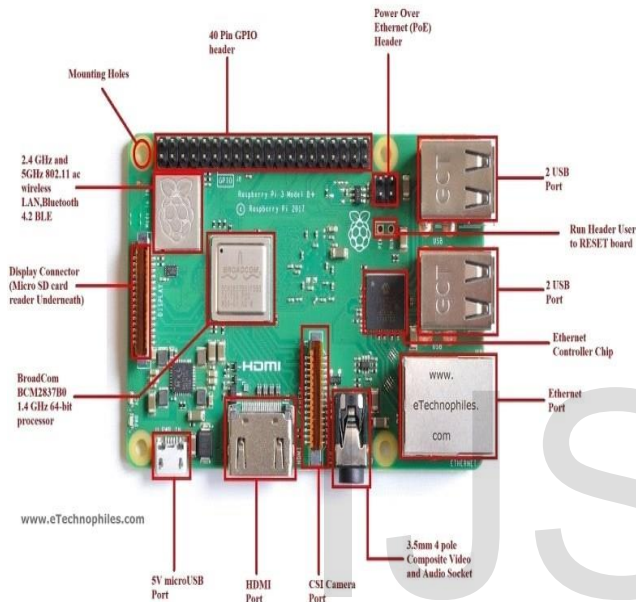
all the four outputs i.e. left, right, forward, or stop. Once the result is expected corresponding Arduino signal is triggered that in turn helps the automotive to maneuver throughout a particular direction.

Figure 1: Model Structure



3.1 Camera Module

The Pi camera module could also be a transportable light-weight camera that supports Raspberry Pi. It communicates with Raspberry pi exploitation the MIPI camera serial interface protocol. It's usually used in image process, machine learning, or surveillance comes. Here we tend to exploitation is V2 version that comes with specifications like Associate in Nursing eight or a lot of megapixel camera and supports 1080p30 resolutions in conjunction with an IMX219 detector Associate in Nursing F2.9 aperture.



Raspberry Pi could be a series of tiny single-board computers. Raspberry Pi is Foundation in association with Broadcom. The raspberry pi is that the main processor here. Known as cheap single board pc. we tend to ar exploitation raspberry pi 3+ version for Vehicle detection and Road sign Recognition With the assistance of Open CV package, an Artificial Intelligence formula is enforced and also the outputs ar trained in numerous lighting conditions exploitation neural network technology. Further, the alternatives taken by the raspberry pi are sent as commands to Arduino.

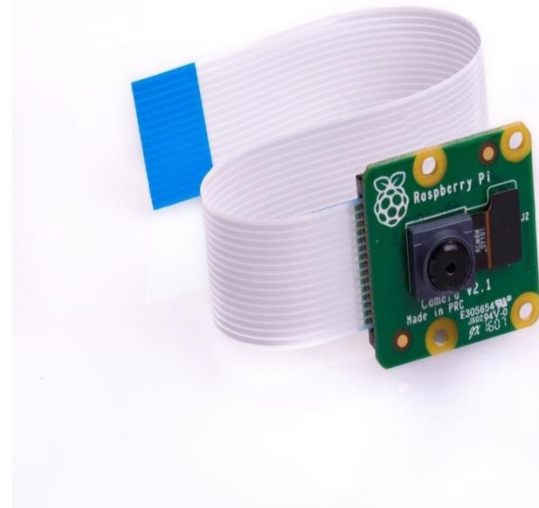


Figure 2: Camera module

3.2Raspberry pi

Figure 3: Raspberry pi 3+

3.3Arduino UNO

Arduino Uno could also be a microcontroller board supported the ATmega328P. It has 14 digital input/output pins (of that vi are usually used as PWM outputs). Arduino is Associate in

3.4 L293D Motor Driver

The L293D could be a fashionable 16-Pin Motor Driver IC. Because the name suggests it's chiefly accustomed drive motors. One L293D IC is capable of running 2 DC motors at constant time, conjointly the direction of these 2 motors ar usually controlled severally. It is a basic motor driver module. Associate in nursing h bridge is employed in conjunction with L293D IC to drive motors. H Bridge could be a circuit that may drive current in polarity and can be controlled by pulse dimension modulation (PWM).



Figure 5: L293D Motor Driver

3.5 Ultrasonic Sensor

Contact with the receiver.

The distance is usually calculated with the next formula:

$$\text{Distance } L = 1/2 \times T \times C$$

Where L is that the space, T is that the time between the emission and reception, and C is that the sonic speed. (The price is increased by 1/2 as a result of T is that the time for the go and-return Distance.



Figure 6: Ultrasonic Sensor

A supersonic detector is Associate in Nursing device that measures the house of a target object by emitting ultrasonic sound waves Associate in Nursing converts the mirrored sound into an electrical signal. Ultrasonic sensors have 2 main components: the transmitter and also the receiver.

To calculate the house between the detector and so the item, the sensor measures the time it takes between the emission of the sound by the transmitter to its

(HC-SR04)

3.6 IR Sensor

IR detector is Associate in nursing device that emits lightweight to sense some object of the surroundings. Associate in Nursing IR detector will live the heat of Associate in nursing object conjointly as detects the motion. Usually, at intervals the spectrum all the objects radiate some type of thermal radiation. These types of radiations are invisible to our eyes however the infrared detector can sight these radiations. The electrode is simply associate in Nursing IR junction rectifier (Light Emitting Diode) and therefore the detector is simply associate in Nursing IR photodiode. Here we

tend to used Associate in Nursing IR detector for lane detection and giving the output to the motive force module so it will able to stop or move the vehicle consequently.



Figure 7: IR Sensor

3.7 LDR Sensor

Photo resistors, conjointly cited as light-dependent resistors (LDR), are lightweight sensitive devices most often accustomed indicate the presence or absence of sunshine or to measure the sunshine intensity have a Sensitivity that varies with the wavelength of the sunshine applied and is nonlinear devices. The regulation of Associate in Nursing LDR is photoconductivity, that is nothing however Associate in Nursing natural Phenomenon. Once

the sunshine is absorbed by the material then the physical phenomenon of the material enhances. Once the sunshine falls on the LDR, then the electrons at intervals the valence band of the material are eager to the conductivity band. Here we tend to used Associate in Nursing LDR detector for the most lightweight of the Autonomous vehicle so it mechanically turns the sunshine on once it's required there's no interference of human state of affairs.

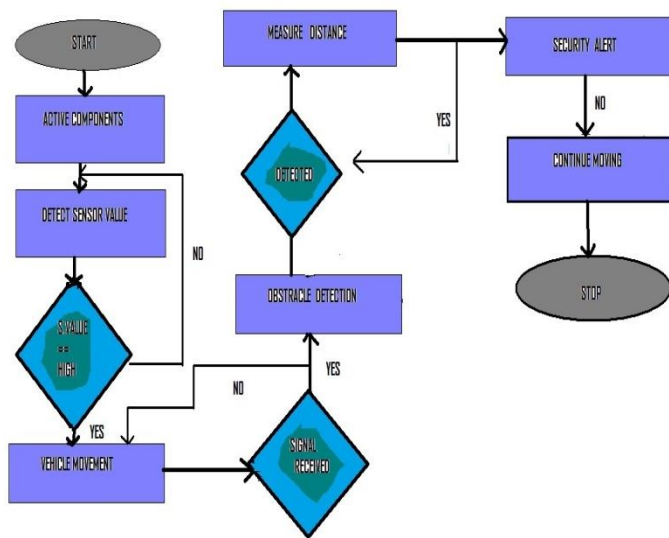


Figure 8: LDR Sensor

4 DESCRIPTION OF THE SYSTEM

An autonomous vehicle will drive itself from a begin line to a preset destination in “autopilot” mode exploitation numerous in-vehicle technologies and sensors, including adaptive Management, active steering (steer by wire), anti-lock braking systems (brake by wire), GPS navigation technology, lasers, and radar. most focus was on Following Vehicle, that detects and avoids obstacles, coordinates with live video streaming, follow the route. For an additional application, it checks vehicles around and mechanically moves slowly behind the traffic till it gets out of holdup state of affairs

4.1 FLOW CHART



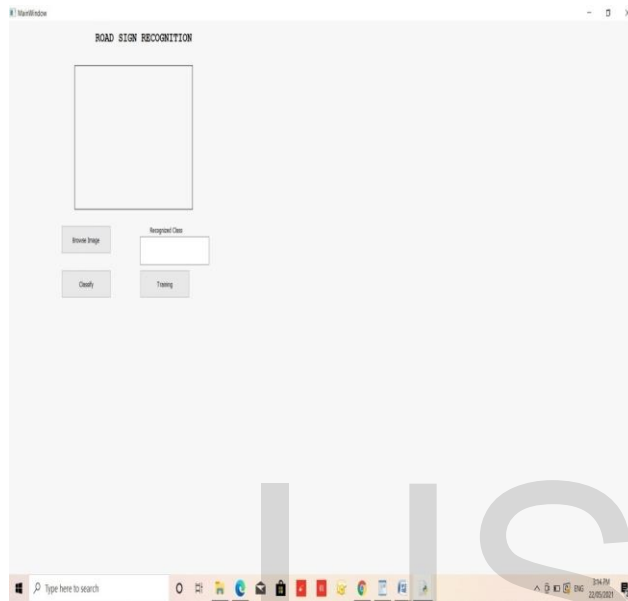
then it will send the signal to the Arduino board to stop the vehicle. if any obstacle is detected then the sensors used with Arduino microcontrollers give the command to the motor driver to stop or slow the vehicle until there is any obstacle. if any obstacle is not moving until some given time then Arduino commands the buzzer to notify the obstacle, then the vehicle overtakes the obstacle by giving proper turning indication which is given by a LED.

Figure 9: Flow chart

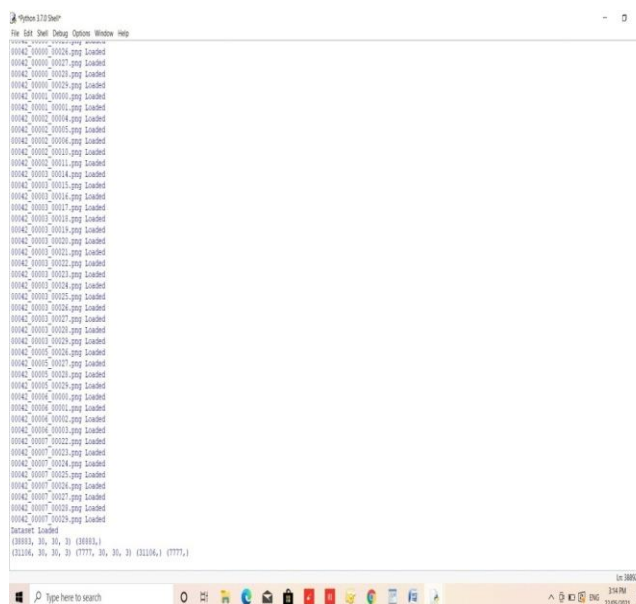
As the Autonomous vehicle start, all the sensors are ready to gets signals and hardware components get activated, the camera module is capturing images of road sign recognition and obstacle detection. Raspberry pi3+starts working and the vehicle will start moving. While the processor starts processing the images and send them to the Arduino microcontroller for the output of the vehicles. after the processing of Road sign recognition and obstacle detection like a stop sign, minimum speed, etc. if anyone of road sign recognition image detected then raspberry pi3+ send the appropriate signal to Arduino to work ahead. For example: if raspberry pi detects the signal STOP

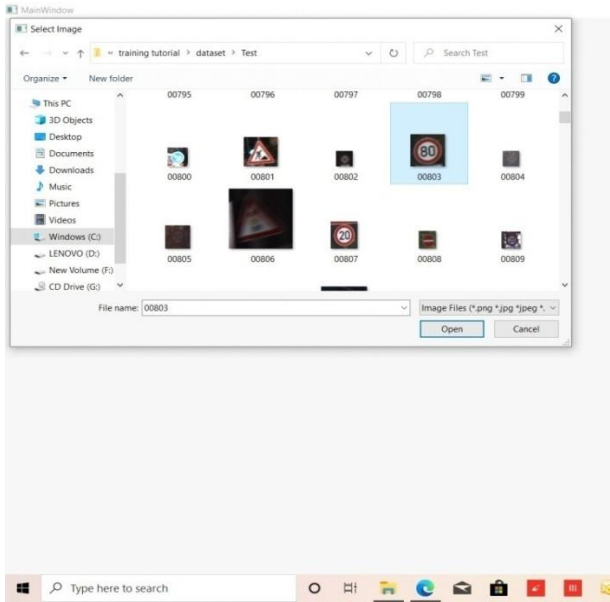
5 RESULTS

Processing GUI

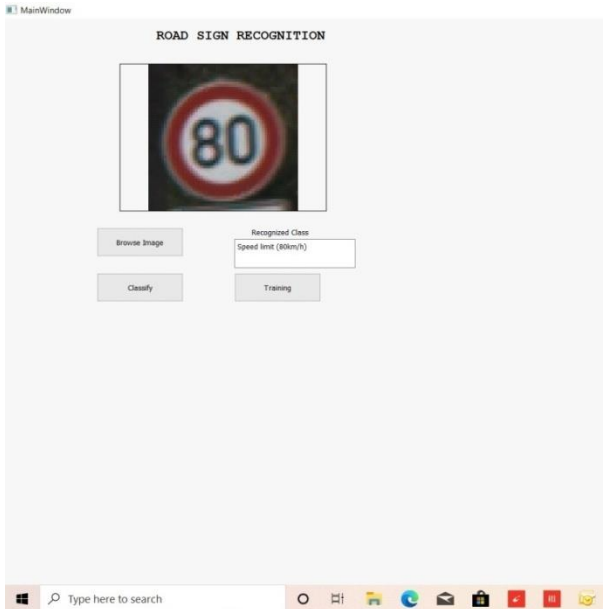


Loaded images

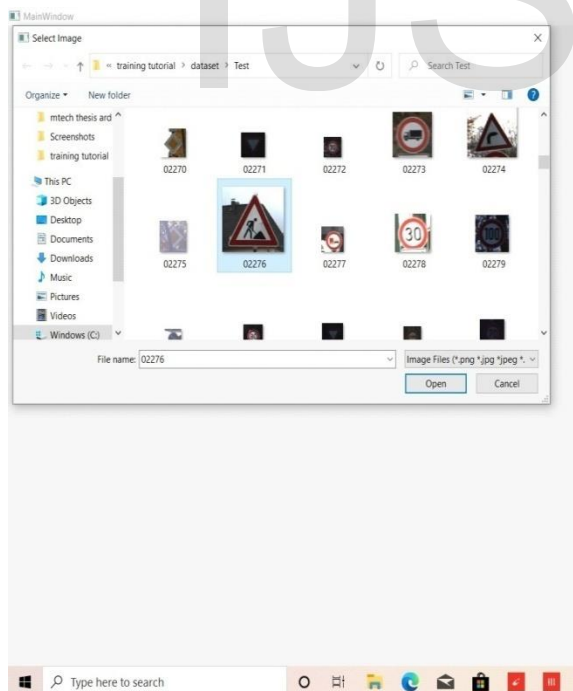




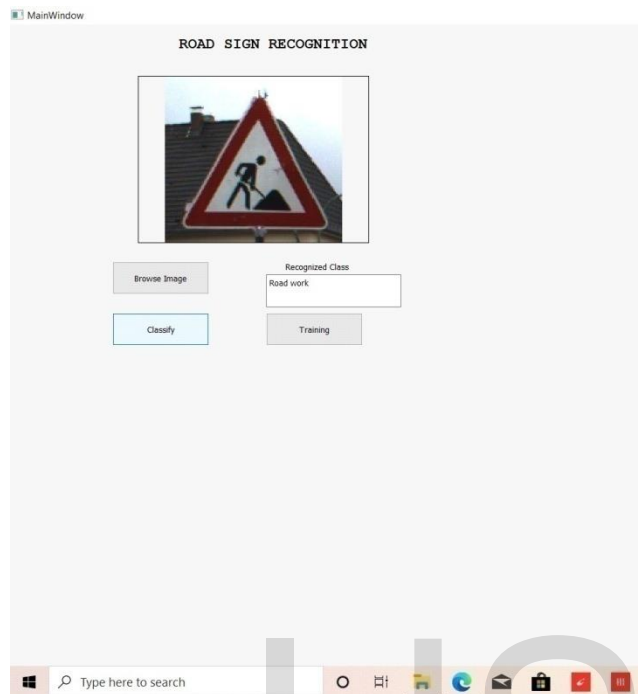
Output (speed limit 80)



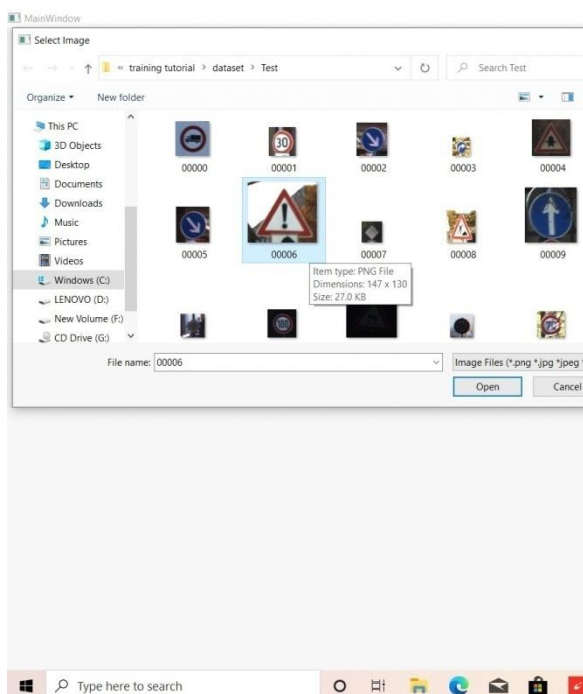
2 Loaded images



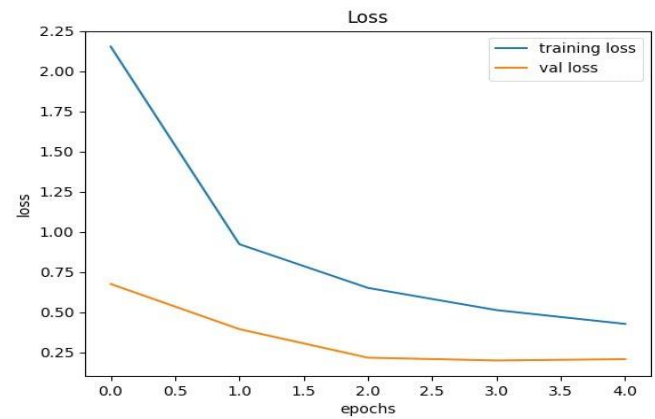
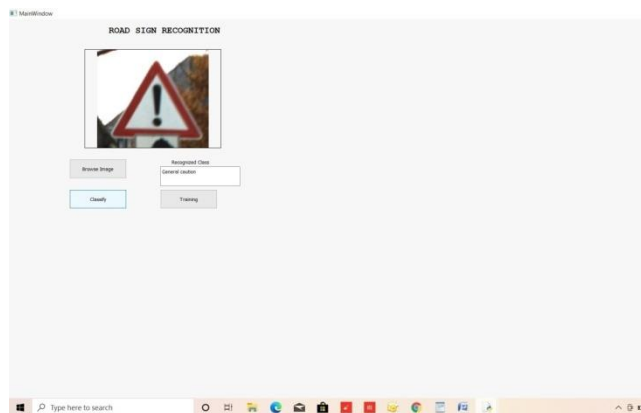
Output (road work)



3 loaded image

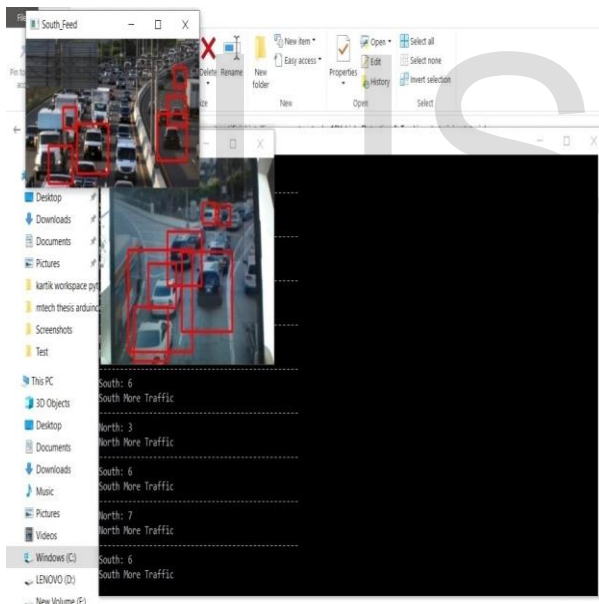


Output (general caution)

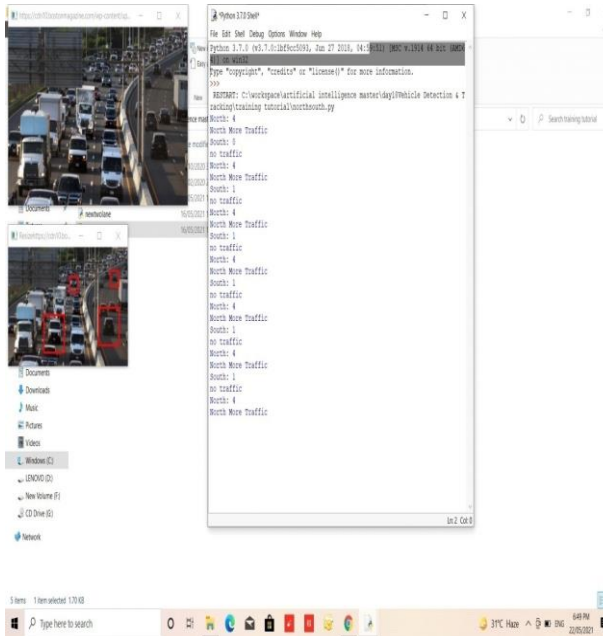


Vehicle detection

Training accuracy



Training loss



6 CONCLUSION

As many technologies exist to detect obstacles and classify objects for a driverless vehicle. But in this proposed autonomous vehicle level4 is successfully created, implemented, and tested. This vehicle is tested with the both camera module and the webcam with different 500 images and tested in real-time also. it based on the high automation with the interfere of human when needed it, the decision taken by the vehicle to overcome this minor issue the training should be done precisely with perfect frames rates. The main reason for this autonomous vehicle is, compared to human eye sensor data is more accurate. This review paper clearly describes the working methodology of our autonomous

vehicle

7 FUTURE SCOPE

There is a huge scope of an autonomous vehicle in future as we know that there are huge traffic jams, accidents occurred in our country to reduce these fatalities we have a better option i.e Autonomous vehicle. Many Automobile companies are improving their autonomous vehicle rapidly making them more accurate and secure. By using multiple cameras and actuators, the accuracy can be improved. Human interaction in an Autonomous vehicle is compulsory because if the vehicle gets accident or hacked by someone, in that case, the SMS is popup then either the driver handle the vehicle manually or stop the vehicle but if the vehicle is in traffic then the best case is that the driver handles the vehicle manually.

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