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AUTONOMOUS CAR

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Abstract- *Many foreign countries have begun to implement automated car models. India, as a competing country, wants to develop a much simpler and efficient model. The ratio of accidents happening due to human error is quite high as human beings are not well-suited to travel at high speed. According to an online survey, traffic congestion caused by human error is found to be increasing. The main aim is to develop an efficient model that can reduce human effort, reduce the accident rate, provide better traffic flow, navigate to a given destination, avoid environmental obstacles and follow road signs. It increases safety, is more productive, and also reduces the cost of labour and mobility as a service.*

Keywords – Automated Cars, Traffic congestion, Arduino UNO, Increase Safety, Cost of labour, CNN network.

I. INTRODUCTION

An Autonomous vehicle (otherwise called self-driving vehicle or a driverless vehicle) has no human info and can detect encompassing with no human connections. An assortment of sensors are joined and are utilized to recognize the pathway, impediments, people on foot, and so forth from the encompassing. The advantage of having a driverless vehicle is having decreased expenses because of less wastage of fuel, expanded security, expanded versatility, expanded consumer loyalty, and so on the target of a Autonomous vehicle is to make a completely practical mechanized vehicle that can decrease human exertion, lessen the mishap rate, give better traffic stream, explore to a given objective, keep away from ecological deterrents and follow street signs. Right now on interstates drivers for the most part keep between 40 to 50 m (130 to 160 ft) distance away from the vehicle before their pathway. These expansions in expressway limit now and then are one of the principle huge explanations behind sway in gridlock, especially in the metropolitan regions and more influenced in interstate clog in certain spots. For the specialists to deal with the traffic stream generally prompts expanding the gridlock, with the additional information and anticipating the driving conduct of individuals, we can consolidate these two subtleties for decreasing the gridlock the street with less requirement for traffic police on the streets and in any event, for the street signage.

Physically determined vehicles on online reviews are accounted for to be utilized just 4–5% time while being left and unused for the excess 95–96% of the time. Self-sufficient vehicles, then again, be persistently utilized even after it has made a trip from some source to some objective for a given individual. This could prompt decrease the requirement for parking spot.

II. LITERATURE SURVEY

[1] "Review on Autonomous Car using Raspberry Pi". In this system, the camera captures the image which is then sent to the raspberry pi, to which the camera was connected using an USB port. The input image was executed on the Raspbian OS software followed by the execution of the python code. The signals generated after the code is executed, is sent to the car. The car then detects objects and the path to the destination effectively and starts driving towards it. Its components include Raspberry pi, Pi camera, Motor driver, ultrasonic sensor module, Raspbian OS, python, OpenCV. Manually driven vehicles on online surveys are reported to be used only 4–5% time while being parked and unused for the remaining 95–96% of the time. Autonomous vehicles, on the other hand, be continuously used even after it has traveled from some source to some destination for a given person. This could lead to reducing the need for parking space.

Advantages: Raspberry pi and camera is used to detect objects within the given range to ensure safe movement.

Disadvantages: It uses Raspberry pi connected with a single webcam hence the input of the object is limited. It uses a fixed camera which cannot pivot to produce other available options. It does not use sensors to locate the objects more accurately.

[2] "Autonomous Vehicle - Literature Review 305AEE, 2015" The software installed and implemented is the major component to run the vehicle from different aspect. The methodology is split into these 6 tasks:

1. Processing of sensor data
2. Localization
3. Obstacle tracking
4. Path planning
5. A behavioral module that gradually relax constraints in the driving process
6. Control the vehicle itself, its throttle, brake, gear shifter and steering wheel

Advantages:

Uses sensors to detect.

Disadvantages:

Camera is not used only sensors are used.

[3] "Autonomous Driving with a Simulation Trained Convolutional Neural Network". It consisted of a CNN network for image processing, a deep layered network for steering, and additional networks for braking. It used C++ and Keras API to implement the neural network. The camera was used to provide images to the system. It consists of four modules:

1. Steering processing network

2. Short time memory steering network

3. Merging network

4. Anti-collision network

Advantages:

This system successfully drove 98% of the laps on track without navigation issues as well as achieving a 90% success rate in avoiding collisions using only a single camera as input.

Disadvantages:

This proposed system uses a single fixed camera so it cannot rotate and give more accurate information about the road view. This can be solved by using more cameras and variety of sensors to enhance the efficiency. Another disadvantage is that it needs to be trained with huge data sets in order to take a correct decision.

III. EXISTING SYSTEM

The current framework is being fabricated in unfamiliar nations because of which executing these frameworks in our nation becomes troublesome, the issue being

•In some outside nations, driving happens on various paths, while we utilize left-path driving.

•The traffic stream in India is substantially more blocked contrasted with other created nations, subsequently current frameworks may think that it's hard to run on these streets.

Disadvantages of Existing System:

Non-independent vehicles have been around quite a while and in view of an online overview we have tracked down that the proportion of a mishap occurring because of human mistake is very high and the explanation being

•Human creatures are not appropriate to go at high speed. As speed builds, our time and distance discernment corrupt.

•Fuel wastage brought about by human blunder is very high.

•Due to human blunder, gridlock is found to increment.

IV. PROPOSED SYSTEM

The current proposed system uses Raspicam to capture the road pattern, traffic signs or stop sign and IR sensor to detect obstacle. It is then processed using a Raspberry PI and the instructions are sent to Arduino UNO through which the vehicle is instructed to move in specified direction. If the obstacle is detected, the car stops. The vehicle also uses LED indicators to caution the vehicles around that the driving lane will be changed. The vehicle works based on Master-Slave communication where Raspberry Pi 3B+ acts as the Master device and Arduino UNO acts as a slave device.

Advantages:
The Advantages of Autonomous Cars is to create a fully functional self-driving car that can reduce human effort, reduce the accident rate, provide better fuel consumption and better traffic flow. The self-driving car was created for providing benefits to the society we live in, such as providing transportation for those people who are not able to drive because of age or physical impairment.

V. WORKING SYSTEM

The motivation behind the plan stage is to design an answer for the issue determined by the necessity archive. The plan and nature of the framework play an especially significant in the later stages which incorporate testing and upkeep. The yield of this stage is the plan report. Here we have the pi camera that transfers video live and sends it to the raspberry pi as displayed in fig 1. then, at that point we have the raspberry pie that measures the information and sends the information to be prepared in a distant framework set somewhere. The information that is prepared then communicated to the Arduino that further sends the data for the displayed vehicle so it can work dependent on the condition.

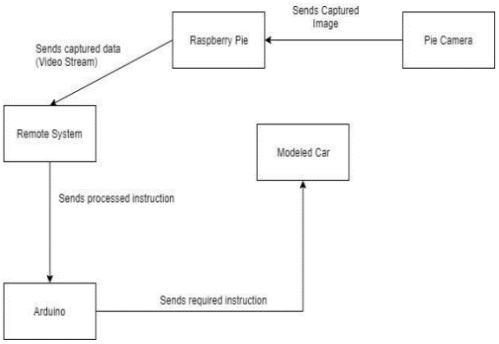

Fig -1: Block Design of working of a modeled car

The vehicle once positioned on the way begins moving except if and until it's anything but a hindrance before it arrives at the finish of the way. The vehicle catches the example present on-street and follows that specific way. In the event that it needs to take a specific way from source to objective and further the current way isn't accessible for reasons unknown then it can allow the client to pick another way to travel. In the event that it interacts with a situation where the current way has two pathways ahead then it allows the client to settle on which way to take.

L298 Dual Channel H-BRIDGE

As per Fig 3, Since the Motor Driver can handle only two motors, we connect two motors in parallel on each side. To power up the Motor Driver, we connect the power pins to Arduino UNO as Arduino is connected to a 12V battery. Enable pins of motor driver are connected to PWM pins of Arduino UNO.

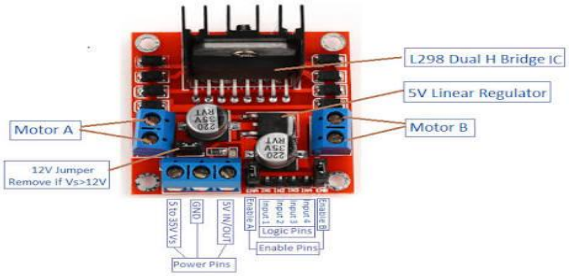

Fig -2: L298 Dual Channel

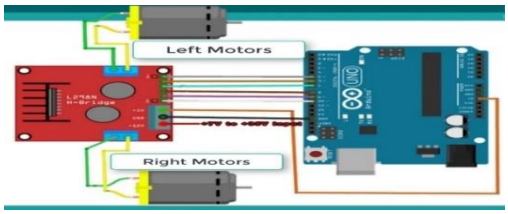

Fig -3: L298 Dual Channel H-BRIDGE (Motor Driver)

The Dual-channel H-bridge is then connected to the Arduino Uno board which in turn receives the instructions from Raspberry Pi Board through wiring Process Information (PI) digital connections. The camera module Raspicam and detection module IR Sensor are connected as inputs to Raspberry Pi based on Fig 4.

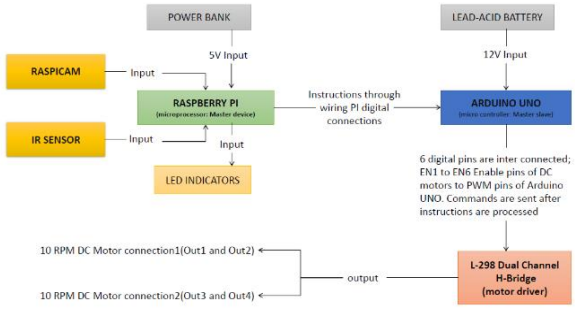

Fig -4: Final System Design

MASTER-SLAVE COMMUNICATION

Arduino Uno is a microcontroller board based on an 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists of other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header, and a reset button. When the ATmega328 chip is used in place of Arduino Uno, or vice versa, the image below (fig.5) shows the pin mapping between the two.

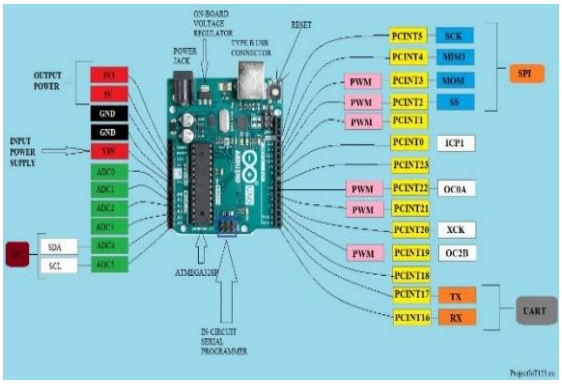

Fig -5: Arduino UNO pin diagram

Raspberry Pi is a little single-board PC. By interfacing peripherals like Keyboard, mouse, show to the Raspberry Pi, it will go about as a scaled down PC. It is famously utilized for ongoing Image/Video Processing, IoT-based applications, and Robotics applications. Raspberry PI pin chart is portrayed in the accompanying outline (fig.6)

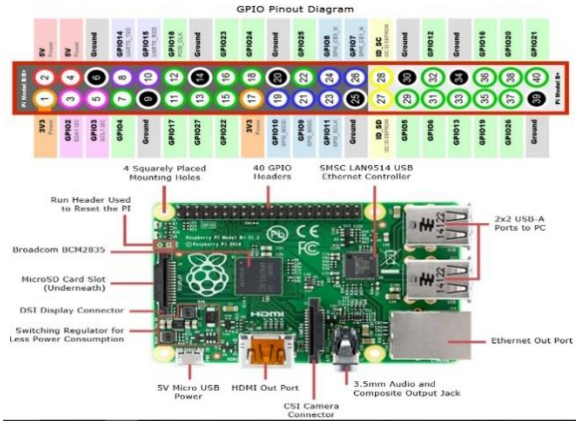

Fig -6: Raspberry PI pin diagram

CSI camera connector port in Raspberry PI is used to connect RasPI camera using CSI cable. Raspberry PI 3B+ is connected to Arduino UNO using WPI 21-24 pins. We have to code using the Wiring PI library to establish the Master-Slave connection. Once the connection is complete, Raspberry PI takes input from the RasPI camera in the form of frames per second and passes instructions to Arduino UNO. Arduino being the microcontroller monitors the movement of the car according to the instructions sent.

VI. MODULES

The Autonomous Car is based on the following models:

1. Live feed is taken from the RasPI camera. This input is fed to the Raspberry Pi.

2. The input video is then converted into several frames and each frame is fed as an input.

3. Each picture then goes through the Haar cascade algorithm and checks for stop signs.

4. If yes, the car stops. Else, the algorithm checks for the traffic signal.

5. If red, the car stops. Else, if green, the car continues to move.

6. If the IR sensor senses an obstacle, the car stops. Else the pictures are fed into the CNN algorithm which tells the car to follow the lane rules.

Lane Detection (Convolutional Neural Network):-

AI executes feed-forward Convolution Neural Network or, all the more especially, multi-facet perceptron (MLP), the most usually utilized sort of neural organization. MLP comprises of the info layer, yield layer, and at least one secret layers. Each layer of MLP incorporates at least one neuron directionally connected with the neurons from the past and the following layer, The CNN has been prepared with the preparation dataset; it can decipher the Lanes. The CNN comprises of three primary layers.

•The first layer is the convolutional layer where the info is given. Here the picture input is consistently in the network structure that is, a channel is applied to a picture and the pixels are recorded into framework structure.

•In the secret layers, the picture goes through numerous channels and turns into a straight pixel exhibit. The yield is as indicated by the straight pixel cluster.

•The last layer is the yield layer.

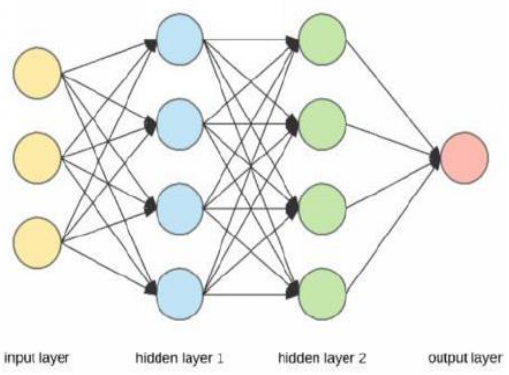

Fig -7: Neural Network

The entire prepared Network functions as follows:

1. Take the component vector as info. The vector size is equivalent to the size of the information layer.
2. Pass esteems as contribution to the primary secret layer.
3. Compute yields of the secret layer utilizing the loads and the enactment capacities.

Traffic Light and Stop Sign Detection (Haar Cascade):-

We use Haar cascade from OpenCV to distinguish signals. It's anything but an AI based methodology where a course work is prepared from a great deal of positive and negative pictures. It is then used to distinguish objects in different pictures. We get the classifiers from OpenCV which are now prepared to identify the stop signs and signals. Each edge goes through this calculation and gets changed over into a pixel exhibit. These clusters are utilized with the classifiers to foresee the signs. Utilizing the yield of the path identification calculation and Haar cascade calculation which offers us the stop hints, the following development of the vehicle is chosen.

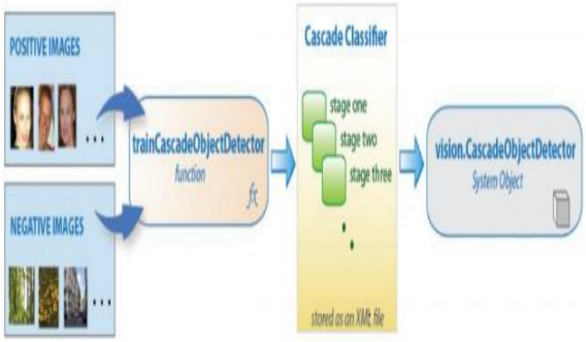

Fig -8: Cascade Classifier

VII ADVANTAGES

1. Reduced Accidents
2. Reduced Traffic Congestion
3. Reduced CO2 Emissions
4. Increased Lane Capacity
5. Lower Fuel Consumption
6. Reduced Travel Time and Transportation Costs
7. More Effective and Affordable Taxis
8. More Efficient Parking
9. Reduction of traffic deaths

VIII CONCLUSION

The model was effectively evolved utilizing Image Processing and Machine Learning. Notwithstanding the innate advantages, independent vehicle innovation should conquer numerous social obstructions. Similar as the issue looked by the principal auto, the impact of metal models can block the headway of innovation. Nonetheless, new enactment is setting out open doors for these vehicles to demonstrate their suitability. As more states legitimize driverless vehicles, the social impediment will give way, considering the biggest upheaval in close to home transportation. We resolved the issue of non-self-ruling vehicles with the proposed framework which decreases the human work of working the vehicle. Moreover, we additionally notice that the given framework execution is far superior to a normal client. Since the exhibition is better and consistently steady, we thusly infer that the proposed framework can tackle the essential human mistake that happens.

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