IOT AND MACHINE LEARNING-BASED SOLAR AUTOMATED AMBULANCE

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Abstract—This paper helps to develop a vehicle that can be self-driven using the latest technologies such as IoT and Machine Learning. The ambulance can be run using battery technology as well as solar energy, this helps in addressing the over usage of fossil fuels. The vehicle is capable of sensing the environment, navigating and fulfilling the human transportation capabilities, the automated vehicle technology here is being used for emergency vehicles in order to reduce delay occurrence in reaching the victim, the same technology can also be used to design and develop cars to help specially-abled people to transport independently.

1. INTRODUCTION

Emergency situations in case of road accidents or health-related issues such as heart- attacks which often require immediate hospitalization is carried out by means of ambulances. An ambulance is capable of providing on-board emergency services such as oxygen supply, medical attender doctor, or in some cases defibrillation. They pick up the patient from the location and transport them immediately to the nearest hospital. In most of the cases, the victim calls up the nearest hospital for medical support. The complaint is registered and the response time of the ambulance to reach the victim becomes unpredictable due to various reasons like delay, traffic, time in searching the victim, etc. In most of the cases, the victim calls up the nearest hospital for medical support. This results in loss of crucial time which either results in the complication in the victim's health or might even lead to death. The Average daily response time of Ambulance over a span of one year. In 2014-15 the number of emergency cases varied and the response of ambulances fluctuated. This was due to various factors such as response time, traffic conditions, etc. An increase in traffic led to a decrease in daily responses covered by the ambulance and hence some of the victims were not covered. This paper's the main objective is to delay this delay of response by emergency Two main technologies used in this paper are IoT and Machine Learning, IoT is simply "A network of internet-connected objects able to collect and exchange data", IoT helps the vehicle to make on-spot decisions, it also helps in controlling vehicles in order to reduce the load on the driver and avoid accidents. IoT also helps the vehicle to detect and understand traffic flow. Machine Learning is an application of AI (Artificial Intelligence) that provides systems the ability to automatically learn and improve from experience. Machine Learning along with technologies such as IoT makes autonomous cars capable of sensing its surroundings and making appropriate decisions.

2. LITERATURE SURVEY & PROBLEM STATEMENT

LITERATURE SURVEY

1. Self-Driving and Driver Relaxing Vehicle[Qudisa Memon, Muzamil Ahmed, Shazeb Ali, Azam Rafique Memon, Wajiha Shah, department of electronics, Mehran University of Engineering and Technology,2018]. [1]

This paper is based on applications of an automated car. The one major issue is during heavy traffic. A driver has to continuously push brakes, accelerator, and clutch to move to the destination slowly. We have proposed a solution to relax the driver in that situation by making the vehicle smart enough to make decisions automatically and move by maintaining a specified distance from vehicles and obstacles around. In the pre-computer days of the 1980's the driverless cars were only the science of fiction. But the development of the digital computer made it possible to dream of self-driven vehicles outside the fiction. After many successful road testing of google cars has made to believe in some years roads will be safely occupied with self-driven cars. The vehicle whenever receives a message through the GPRS message is sent to Arduino. The Decodes the message and fetches the coordinates of the vehicle. Through GPRS, Arduino then connects to Google Maps and compares the existing location coordinates of the vehicle received through the message with existing location coordinates of the vehicle. Another possible scenario might come in which there are three obstacles, in front, at the right side and at the left side of the vehicle, the ultrasonic sensors again detect the obstacles and the vehicle will then moves backward even if there is an obstacle behind, it will stop for a moment and thus again looks for the obstacles from the beginning thus deciding the route on the basis of circumstances. The potential applications of the robotic vehicle are to use these types of autonomous vehicles on a highway or heavy traffic roads.

2. Navigating Self-Driving Vehicle using Convolutional Neural Network
[Minh - Thien Duong, Truong-Dong Do, and My - Ha Le*. 2018 4th International Conference on Green Technology and Sustainable Development (GTSD)][2]

In this paper, a method for navigation of self-driving vehicles is proposed. Although the research for this problem has been performed for several years, we noticed elevated accuracy in results has not been achieved yet. Therefore, the method we are using for training and simulation of unmanned vehicle models on the UDACITY platform by using convolutional neural networks(CNN). In this model, we will be using three cameras mounted in front of the vehicle to follow three directions where the left, right, and center position to collect data. The data are the images that are captured from the cameras. The label with two parameters is the steering angle and the speed from each image would also be created. After collecting the data, these parameters will be achieved by training CNN to navigate the vehicle. When the vehicle deviates to the left, the error of the steering angle value between the middle and left position. Afterward, the steering angle value will be adjusted to control the vehicle that could run in the center of the lane. Similarly, in the case where vehicles deviate to the right use simulated and obtained the result with an accuracy of 98.23%.

3. Future Trends in Electric Vehicles Enabled by Internet Connectivity, Solar, and battery technology, [Ben Rutten and Roy Cobbenhagen][3]

This paper brings how electric vehicles are enabled by internet connectivity, solar battery technology in the future. Nowadays, the evolution of the automotive ecosystem undergoes big changes due to ICT(information and communication technology) capabilities entering the transport sector. Accessing information about a car from a distance by connecting the car to the internet shows to be an enabling or possible technology. The development in the generation and distribution of renewable energy results in the increase in solar energy performance and how it affects the charging of Battery Electric Vehicles (BEV).
The change in the automotive ecosystem results in the electric vehicles strongly influenced by sustainable energy production by solar and wind farms and the invention of the self-driving vehicles.

PROBLEM STATEMENT

There are three problems that are considered in the paper. First, the delay occurs in reaching the victim in emergency situations. Second, over usage of fossil fuels and lastly transportation of specially-abled people independently. In emergency conditions each and every second is important in saving a human's life. The theme of this paper is to use each second efficiently to save a life. When the patient is in an ambulance in an emergency condition, the ambulance should reach the hospital's utmost speed. The hospital staff needs to make prior arrangements for the treatment of the patient while the ambulance is on its way to the hospital.

3. DESIGN OF AUTOMATED AMBULANCE

The two main components to make this work are the Arduino Uno board and Raspberry Pi along with the camera module. a power bank and solar panel are used to power up the vehicle in order to make it energy conventional. L298 motor driver can be used to give instructions to dc motors which are given by the Arduino board. The software that is used to program the motions of the car is Arduino Uno, Raspbian OS, geany editor, and open CV. The vehicle can make decisions using neural network training given to it using Machine Learning and IoT.

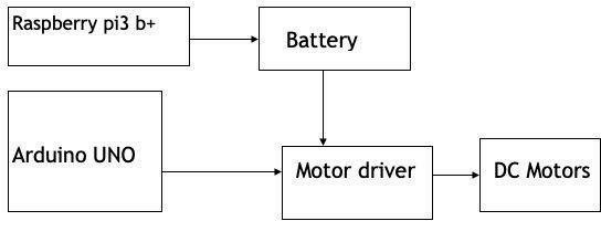

Fig 1: Block Diagram of vehicle

Figure 1 shows a block diagram of vehicle. The system consists of one dc motor per wheel these motors are controlled by a motor driver. the L298 motor driver gets instructions from the Arduino UNO board. the raspberry pi camera model analyses the vehicle's environment and gives the information to the raspberry pi which in-turn sends instructions to Arduino to execute appropriate code snippets to make the car move in particular directions.

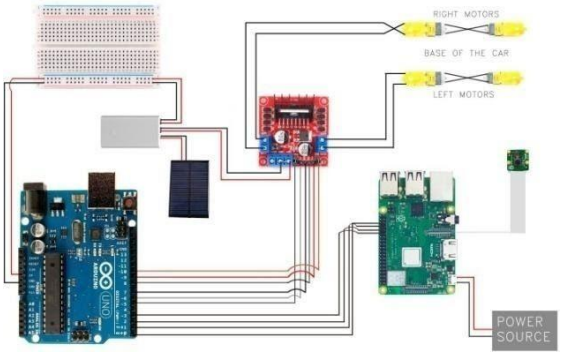

Fig 2: The detailed connection of all the components.

Figure 2 shows detailed connections of all the component power banks and solar panels are used to power up the whole circuit and rest of the circuit is explained in the description of figure 1.

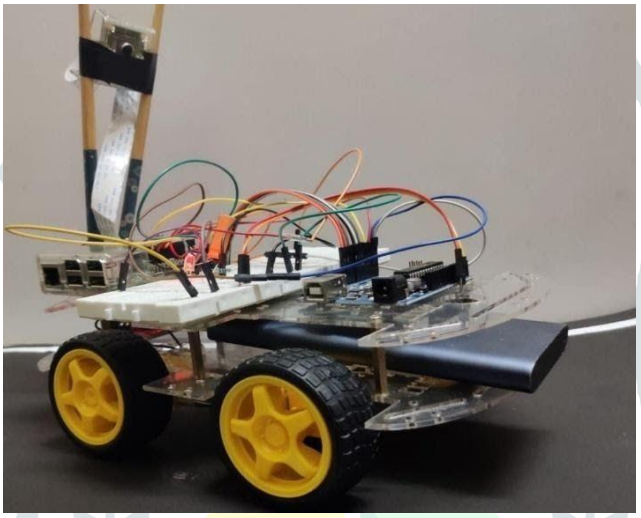

Fig 3: Prototype of the Vehicle

Fig 3 shows the prototype of the vehicle. this prototype executes all the features like object detection, stop sign detection, lane end detection etcetera. becomes easier for the hospital authorities to operate the victim.

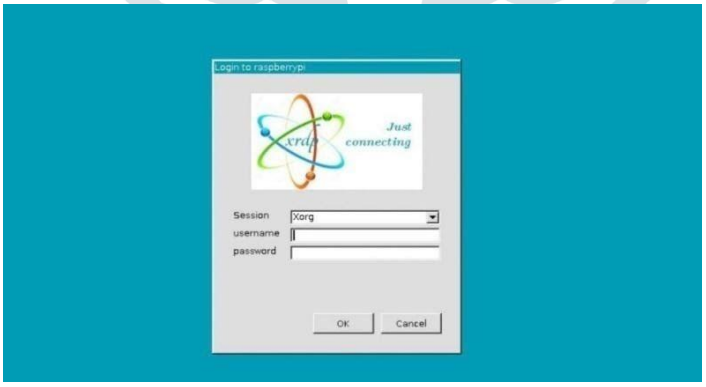

Fig 4: Raspberry Pi login window

Figure 4 shows the Raspberry Pi login window where the user can provide the user name and password in order to access the rasbian OS.

4. WORKING & RESULTS

WORKING

When a complaint is made by the patient, the nearest hospital notes down the location of the patient and initiates the Ambulance. The ambulance leaves to attend to the patient and the propulsion of the vehicle is regulated by the Arduino. The input location and the destination are routed to the ambulance via GPS. The GPS directions regarding the turns are fed to Arduino. The motor driver then controls the steering, throttle, braking, and safety systems of the vehicle. Once the vehicle reaches the destination, the rescue services are carried out. After this, the vehicle again traces back the path to the hospital. Crucial time is saved by continuously rerouting the direction and updating the route in case of heavy traffic. To make the car move in a particular direction by powering on the Raspberry pi and launching the graphical user interface and compiling and executing the file on Geany. Executing the file will result in activating the camera module which will detect signals from various sources in different situations. It provides an input to govern a particular system. When the Arduino receives these signals from the camera module, based on the algorithms present in the Arduino, it takes the appropriate decision and the motor driver performs the specific task that involves moving in a particular direction.

The following data is sent to the hospital

1. Vehicle Location
2. Estimated time
3. Medical Condition of Patient
4. Heart rate, breathing rate, etc.
5. Route of the Vehicle

These important data about the ambulance is sent to the hospital which records it and keeps it for reference. The data gives the complete details about the vehicle and the patient and it.

Fig 5: Raspbian OS window

Figure 5 shows the Raspbian OS window where machine learning code can be written and images from the camera can be analyzed in order to help the vehicle take smart decisions.

RESULTS

The camera mounted on the device is able to capture images and sense its surroundings by using c++ programs that are compiled and executed in Geany IDE with OpenCV and instructions in the programs are given to the Arduino which is controlling the motion of the device. The camera senses and instructs the Arduino to move accordingly with the reference area, which is in red color which will help in moving in the right path. The reference area is also responsible for detecting the lane ends and obstacles in front of the car. It will be also responsible for halting the car when it recognizes the stop sign or the traffic lights when they are red.

Fig 6: Camera view with Reference.

Figure 6 shows the camera view with reference, this reference is used by the vehicle to make decisions about its movement.

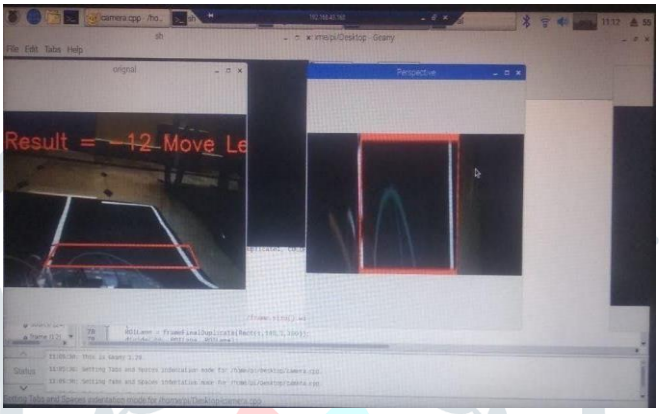

Fig 7: Camera view with lane position.

Figure 7 shows the camera view with lane position on the road. It shows the exact position of the vehicle on the track, this helps the vehicle to stay in appropriate lane positions.

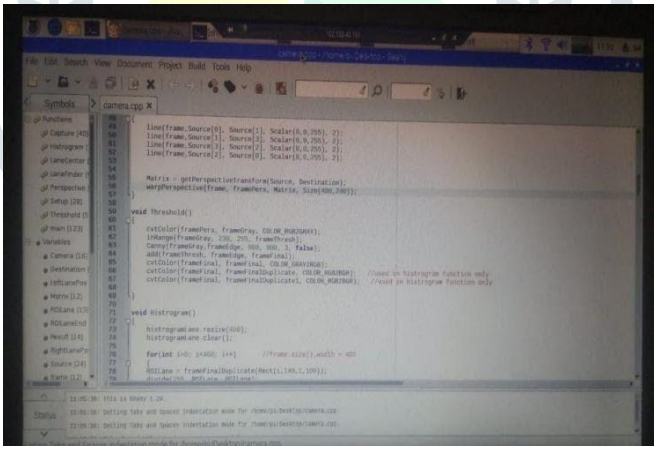

Fig 8: Geany Editor

Figure 8 shows a glimpse of Geany Editor which is used to write programs that help to capture images and videos of the track i.e image processing.

5. APPLICATION, ADVANTAGES & DISADVANTAGES

APPLICATIONS

- The major application of this paper is an autonomous ambulance.
- Autonomous cabs can be bought into utilization in order to increase female safety.

The autonomous vehicles can be used in a wide range which includes another major application i.e military operation.
Many incidents are occurring due to human errors. To prevent this we can use autonomous vehicles for school transportation. Self-driving cars can be used as tourist buses too as they are enabled with GPS technology they can take us to the exact most popular destinations with no confusions.

ADVANTAGES

- Disabilities which will no longer be a factor.
- Efficient time usage in emergency conditions.
- Eliminate the risk of human error.
- Safer than a conventional vehicle.
- Reduces the number of casualties.
- It helps in the control and usage of fossil fuels.

DISADVANTAGES

- Expensive.
- Impact on employment.
- Malfunction may occur in the electronic vehicle system.
- Cars are not suitable for all road conditions.

6. CONCLUSION

This technology will have a great revolution in the emergency field. Using the technologies mentioned in the paper the needs in the present day emergencies can be fulfilled with ease. In conclusion, driverless cars are actually good at this era where technology has really evolved, however, we must take great control of these vehicles. Companies manufacturing them should take great care and control mechanisms for these vehicles. Once cars are driverless, intersections will be equipped with sensors, cameras, and radar that controls traffic flow. That will not only end collisions but promote the fuel-efficient flow of traffic. There are some bold predictions coming from members of the Institute of Electrical and Electronics Engineers, which predicts that 3 of 4 cars on the road will be driverless by 2040.

7. REFERENCES:

[1] Qudisa Memon, Muzamil Ahmed, Shazeb Ali, Azam Rafique Memon, Wajiha Shah, “Self-Driving and Driver Relaxing Vehicle” 2017 IEEE Conference paper.
[2] Minh - Thien Duong, Truong-Dong Do, and My - Ha Le, “Navigating Self-Driving Vehicle using Convolutional Neural Network” 2018 4th International Conference on Green Technology and Sustainable Development (GTSD).
[3] Ben Rutten and Roy Cobbenhagen,Future Trends in Electric Vehicles Enabled by Internet Connectivity, Solar, and battery technology.