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Self-Driving Autonomous Car

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Abstract: The field of autonomous car is of great interest to researchers, and much has been accomplished in this area, of which this paper presents a detailed chronology and developing a self driving car prototype. This paper can help one to understand the trends in autonomous vehicle technology and we also build a prototype of a self driving car .The car is built using all the essential blocks including the navigation, compass, sensor, odometer and classifier blocks and we also see how these blocks communicate with each other to make the car autonomous. In this project we explore many technical fields including Artificial Intelligence, Deep Learning and neural networks, Database Management, Android app development and use of microcontrollers to build our self-driving car. The implementation of this idea into the real world would result in a vast number of advantages. Prevention of accidents, a huge revolution in cost of transportation, a god solution to death of 1.3 million people world-wide death due to car accidents, are few advantages of this idea.

I. INTRODUCTION

Traditionally, the vehicle has been extension of human's ambulatory system, docile to the driver's commands. Recent advances in communications, control and embedded systems have changed the model, paving the way to the intelligence vehicle grid. The motor transportation has changed the living style of people enormously.

Now autonomous vehicles are going to acquire the position. There was a greater evolution of our transportation i.e., from horses and carriages, to bicycles, to motor vehicles, to car, to driver-less vehicles in future, it has driven by both technical innovation and economical factors.

The car is now a formidable sensor platform, absorbing information from the environment and feeding it to drivers and infrastructure to assist in safe navigation, pollution control and traffic management.

Over the course of last decade there has been a major impact in the autonomous driving, which has been seen both in academia and industry. This self driving autonomous car has begun to migrate from laboratory development and testing conditions to driving in public roads.

II. BACKGROUND

Autonomous Driving has been said to be the next big disruptive innovation in the years to come. Considered as being predominantly technology driven, it is supposed to have massive social impact in all kinds of fields. Sixty five years of automotive car development stages [1]: In 1948 Modern cruise control was invented.

Followed by Electronic cruise control and Electronic stability control invented by BMW, Bosch, and Mercedes Mechanical anti-lock braking installed in a standard production car in 19ci. During the late 80's Electronic stability control was invented by BMW, early and in 1995 Mitsubishi Diamante introduced laser based adaptive cruise control, 2001 Nissan Cima Introduced lane departure warning system, and in 2003 Toyota Harrier comes with pre-crash mitigation.

Then in 2010 Google Car Debuts which took a blind man for tacos. 2012 had Nevada offer a license for autonomous cars, in 2013 Mercedes "Bertha" takes itself for a drive Mercedes S-Class gets highway autonomy (but requires an attentive driver as a backup). 2014, NHTSA issues draft of proposed rulemaking for autonomous driving. Finally in 2018-2019 Expected launch of first vehicles with vehicle to vehicle and vehicle-to infrastructure communication.

There are other self-driving vehicles like Google's [2] driverless car that would be available without pedals and wheels to make it available to the general public by 2020, but according to the current trends its fulfilment is still unlikely.

nuTonomy's [2] A Small group of graduates of the Massachusetts Institute of Technology (MIT) created the nuTonomy software and algorithm especially for self-propelled cars with integrated sensors and GPS technology and many more projects similar to these are in development stages.

III. BLOCK DIAGRAM

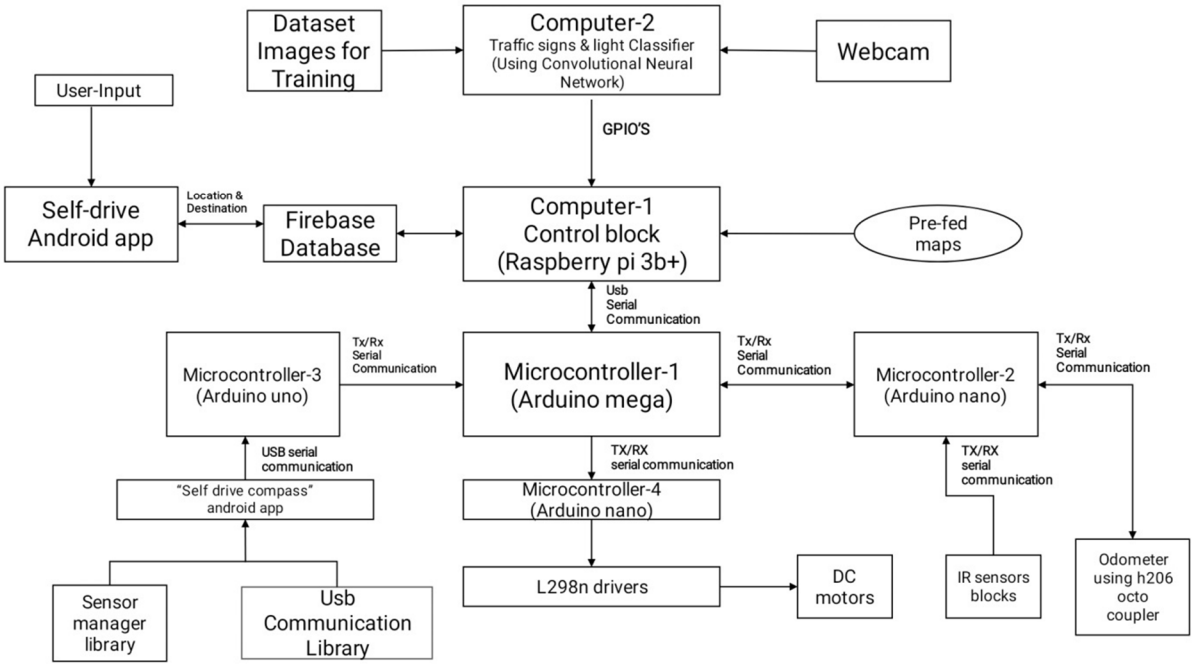

Figure 1. Block Diagram of Proposed Model

IV. METHODOLOGY

This project is all about how different blocks contribute to make a car autonomous. Firstly we have self-designed map designed to test the car for various test conditions including curves, bends and straight roads. The map consists of 14 locations. The android app "The self-drive" sends the source and destination to the car through firebase database. The car on receiving the data of source and destination starts its journey by calculating the shortest path using Dijkstra;s Algorithm. The route the car must take from one node to another which includes the direction in which it has to head and the distance it has to travel is pre-fed to the car and thus it can get its instructions and travel easily from one node to another to reach its destination. The car gets the live direction in which the car is heading using the "Self drive Compass Android" app which gives the magnetic direction in which the car is heading from an android phone which is an integral part of the car. The distance it has to travel is supervised by the odometer block constructed using H206 module. Thus in this way, car having known the distance it has to travel and direction it has to head to reach a particular point, it accomplishes the task with the aid of odometer and compass blocks. In real world case this task is accomplished by using GPS and tools such as Google Maps. The car is also provided with 6 IR sensors (3 in the front and 3 at the back) for protection against any obstacle. In real world scenario where accuracy and speed of detection is an important factor RADARS and LIDARS are used in the car. The car has a vision too and it's capable of classifying 9 traffic signs and 3 traffic lights (red, orange and green) and behaves accordingly. This is achieved by building a classifier using Convolutional Neural Network with a dataset of images which is used to train the model. Each and every blocks communicates either using UART Serial Communication or through GPIO's(General Purpose Input Output) of a controller. Thus in this way the car is able to judge, decide and travel from one location to another without the aid of a human being.

The car is built using Raspberry pi mini-computers (3B and 3B+), Arduino Microcontrollers (Mega, Uno and Nano), IR sensors, H206 module, L298n motor drivers, DC motors and webcam to capture the images.

V. RESULTS AND DISCUSSION

Thus the car is capable of producing good results and thus the prototype can be extended and implemented into real world. Many new features too can be added. With fields like automation and artificial intelligence getting closer to humans day by day no doubt self driving cars will result in making human life simpler and more comfortable. Self-driving cars have been an active area of research for some decades but particularly in the past five years. The recent joint efforts by universities and manufacturers have brought self-driving cars to near readiness.

These are believed to considerably lower transportation costs. In one estimate, social these have impacts in terms of crash savings, travel time reduction, fuel efficiency, and parking benefits. These are still in the infancy stage. There is a considerable road to travel before maturity, implementation, and mass-market release are achieved. We can see the output of our prototype car, Figure 1 shows the prototype map in which the car is tested, Figure 2 shows the graph of the map to calculate shortest distance using Dijkstra's algorithm, Figure 3 shows the prototype car, Figure 4 shows the "The Self Drive" android app, Figure 5 shows the "Self drive Compass" android app and Figure 6 shows the car classifying a traffic sign board.

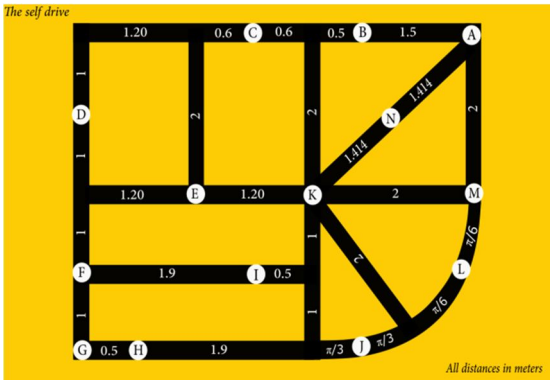

Figure 1. The Prototype Map

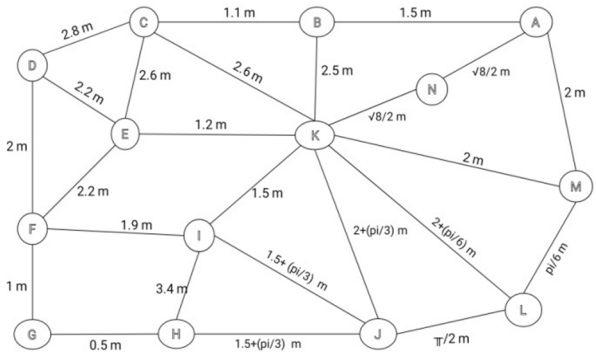

Figure 2. Graph of the Map

Figure 3. The Prototype Car

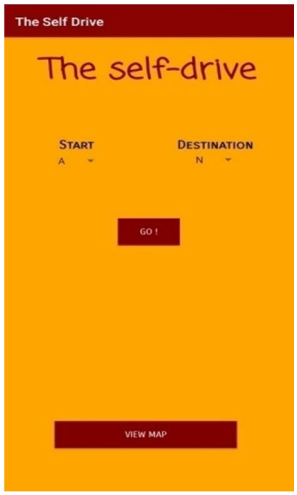

Figure 4. Screenshot of "The Self-drive" android app

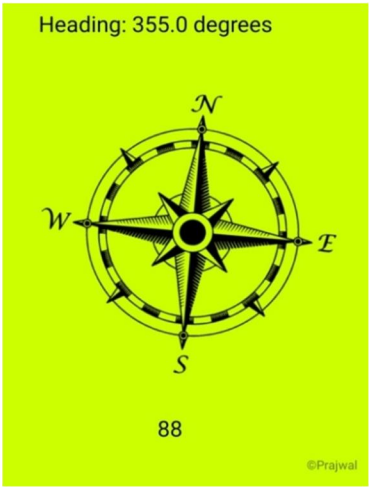

Figure 5. Screenshot of "Self-drive Compass" app

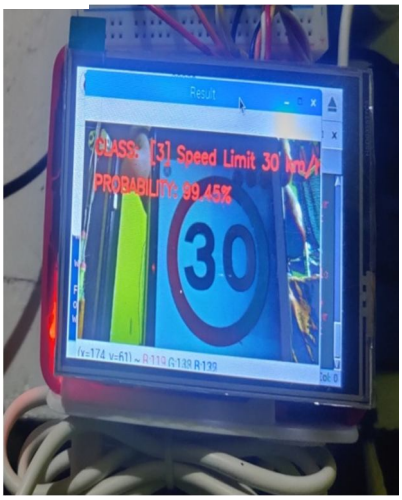

Figure 6. Traffic Sign board predicted

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VI. CONCLUSION

Considering the benefits that Self-driving cars have to offer in terms of both safety, and the reduction in traffic, it is evident that they stand to change the future in a significant way. Most people, young and old, are affected by cars, because it is the most common form of transportation. That being said, if technology offers a way to make traveling more effective, it should certainly be embraced. Furthermore, utilizing these vehicles, because of their capabilities, will improve both driver confidence and the assurance of pedestrians. As a consequence, this could change the very way that people live. In fact, not only could it change how a person lives, it has the power to save their very life. Thus, this paper demonstrates a prototype working model of a self driving car which can be further developed to add-on new features and along with the developments in terms of electrical and mechanical sections of the project, this can be implemented into the real world.

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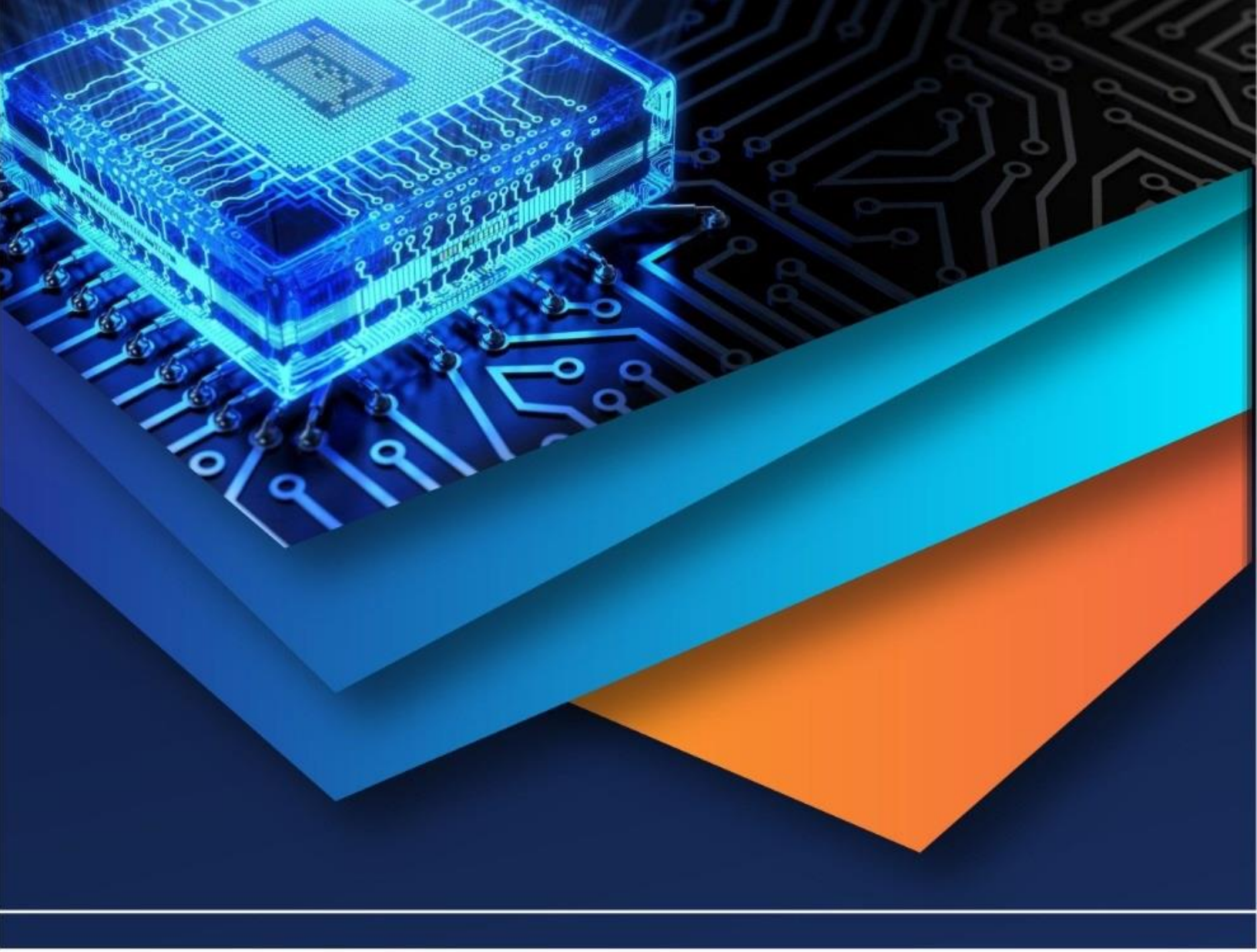

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