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Recent Trends in Automotive Industry

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***Abstract*:** Advancement in technology has made a lot of changes in today's life. New technologies such as automatic breaking system, adaptive and co-operative cruise control, self-driving cars, vehicle running on artificial intelligence etc., have helped in maintaining road safety, obeying traffic rules thus increasing the chances of life expectancy. Both electric and solar chargeable batteries help in saving fossil fuels from getting extinct. All the new technologies mainly help the car drivers to maintain an optimum distance between the vehicles to avoid collisions.

Keywords: Artificial Intelligence, Automatic Breaking System, Adaptive Cruise Control, Co-Operative Cruise Control,Renewable sources,Non-renewable Resources.

I. INTRODUCTION

The proliferating economic growth and energy consumption intensification are leading to ever-growing demand for energy. This problem is worsened by the steady depletion of fossil fuels such as natural gas, oil and coal. Burning these fossil fuels has increased the amount of carbon-dioxide in the atmosphere leading to extreme weather patterns. The 2017 Global Energy and $C0_2$ Status Report revealed that demand for energy worldwide rose by 2.1%. In 2017, over 70% of the growth in global energy demand was met with oil, natural gas and coal, resulting in energy related carbon emissions rising by 1.4%. Thus, there is a need for utilizing the natural resources such as solar and wind energy to meet the requirements of energy.

Due to high population growth, traffic congestion is a common problem in urban areas. Also, road safety is a major concern. The number of deaths due to road accidents is staggeringly high. According to WHO, an estimated 1.25 million deaths occurred due road injuries in the year 2010. Most of these accidents occur due to poor judgment in driving, distraction, and over-speeding or by simply not following the lane discipline. By implementing AI in driving, many accidents can be avoided. It provides assistance to the driver in reaching the destination.

The special features of our vehicle are:

A. It is solar-powered and hence, is eco-friendly, since it does not burn fuel and emit green-house gases.
B. Adaptive Cruise Control: This feature makes the vehicle adjust its speed based on the speed of vehicles in front of it. This helps in avoiding collision between the vehicles.
C. Automatic Forward-Collision Braking: The forward-collision braking system, when it detects an imminent collision alerts the driver and quickly applies the brakes, to avoid accident.

II. LITERATURE SURVEY

"Autonomous Electric Vehicle Using Ultrasonic Sensor Skirt Approach", in this proposed system an ultrasonic sensor skirt approach and a GPS system is used to map travel path and navigate autonomously. It utilizes three microcontrollers that are connected to each other via UART. The vehicle detects the side walls to follow a straight path. It avoids all static and dynamic obstacles in between the travel path .The system runs on a battery that is charged using solar panels using MPTT technology. The system is entirely autonomous. It can be used for automatic shuttle services within a predefined location such as an industrial site or a college campus.[1] "Combining Raspberry pi and Arduino to Form a Low-cost, Real-Time Autonomous Vehicle Platform", this paper presents a low-cost platform for autonomous vehicle research. It uses two micro controllers Arduino Uno and Raspberry pi. They work together to create a real-time feedback control system and are connected using a USB cable for serial communication. The Arduino allows the control law to be executed at hard real-time intervals while the Raspberry Pi provides additional computing power, a web interface, and wireless data-streaming for control tuning and debugging. In the proposed system the USB-to-serial connection limits the digital control frequency to 100-150 Hz.[2]

"Automated Vehicle Control System", This paper utilizes elementary robotics, digital imaging with image processing and artificial intelligence for design of a completely automated vehicle which follows lane driving at a constant speed of 30kmph with an accident prevention due to automatic collision control. This work is ideal for locomotion of physically challenged people or

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transport of goods and personnel within a particular place. The proposed system is available only in gear-less two wheelers and the tracking mechanism involves painting two white strips along the path.[3]

"Solar Powered Vehicle", this paper proposes three wheel electrical vehicle powered using solar energy. The vehicle proposes a DC drive in contrary to the usual AC drive used in solar vehicles thereby reducing losses in the vehicle power up. The vehicle uses a multi-crystalline solar cell to improve the efficiency. The panel used has a rating of 140WP which is kept in south-east direction from 6AM to 11:30 AM and switched to south-west at other times for maximum efficiency. The solar module produces an output of 24-25V at STC. This prototype is ideal for shuttle services and short distances. The proposed system runs completely on solar power but the rate of energy conversion is found to be only 17%, it has a small speed range and the initial cost is high.[4]

"Self Driving Cars: A Peep into the Future", this paper proposes a driverless, green energy powered, collision protected and GSM destination guided vehicle using embedded controller design. They use camera, obstacle sensor and GPS to automate the driving. A rooftop solar PV panel with battery backup is used for power supply. A speaker is used to convey important information along the path. The proposed GPS system requires real time data for outputting NMEA messages. This was achieved by mapping important places manually beforehand.[5]

"Solar powered electric vehicle", this paper aims at using solar powered electric vehicle (SPEV) to reduce the Green-house effect using inbuilt solar panels, thereby encouraging pollution less transportation with minimal cost. The SPEV has an advantage of being implemented for limited area with help of Ultrasonic array for obstacle avoidance. The advantage of the vehicle is that it can be implemented for limited area for obstacle avoidance with help of Ultrasonic array, LoRa, GPS Maps API and intelligence algorithm. The use of polycrystalline solar panel is to build a cost effective and simpler vehicle. MPPT is an electronic converter that determines the best power that solar panel can outsource to charge its corresponding battery. Brushless DC Motor is used for long battery lifetime. The microcontroller is preprogrammed for obstacle avoider. The Android app is used for updating information related to driver mode selection, charging and discharging of battery. The disadvantage of this driver mode automated vehicle is that it is limited to small environment [6].

"Obstacle Avoidance in a Solar Powered Autonomous Vehicle", this paper explains Obstacle avoidance to be most crucial step in an autonomous vehicle. The present prototype of the vehicle is controlled by a microcontroller and two servo motors along with a solar panel. The main advantage of this prototype is that it is suitable for alien environment and can take decisions based on the trained data of its present place. The built robot uses a preprogrammed Arduino ATmega 2560 microcontroller to move forward, backward and to take left or right. Sonar sensor along with servo motors helps to scan the entire area ahead of vehicle thereby, identifying the distance of obstacles. A single channel 12V DC DPDT is used as connector between the batteries for the charging and discharging paths. The sonar cans the area and if an obstacle is detected it measures its distance and stores in an array, but if there is an empty space then a negative value will be stored in the created array .The main disadvantage of this robot was that depending on the distance of object the robot turns instead of taking width also into consideration. [7].

"Semi-Autonomous Adaptive Cruise Control Systems", this paper explains about deploying semi-autonomous adaptive cruise control as a major advantage for fully automated highway systems. The developed SAACC ensures safety to maintain smaller time intervals, smooth tracking and robustness of a vehicle. SAACC has a longitudinal vehicle system having a lower controller to determine brake commands and upper controller to determine the acceleration of the vehicle itself when running on a lane in highway. The string stability in the upper controller is used to check and correct the spacing errors. This SAACC combines the features of autonomous ACC system and platoon system. The radio receivers are used in front end bumpers to receive and transit information of the neighbourhood vehicles. [8]

"The Challenge of Measuring Distance to Obstacles for The Purpose of Generating a 2-D Indoor Map Using an Autonomous Robot Equipped with an Ultrasonic Sensor", this paper experiments a unique method of determining distance and location of obstacles using a single-point scan by making use of Raspberry-pi 3 Model B . The distance is measured using ultrasonic sensors. The main disadvantage with the sensor usage is that less accuracy to create an indoor map of 2-D structure. The results suggest that the distance obtained using a sensor should be between 2cm and 80cm has a high probability of matching the real distance. By constructing three small wooden boxes around robot, the required indoor map can be generated. Cluster analysis is used to remove ghost points [9]

"Cooperative Adaptive Cruise Control of Vehicles with Sensor Failures", this paper proposes switching controller design system to overcome the non-linear vehicular model. The string stability analysis is done using closed loop co-operative ACC system. Establishing effective communication network was a major drawback of this system. [10]

"Adaptive cruise control", this paper provides assistance to the driver in longitudinal vehicle control to avoid collisions. It uses ultrasonic sensors to measure distance from the sensor to the target objects. Output of ultrasonic sensors is fed to microcontroller

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which in turn drives the motor. Accelerometer is used to measure acceleration forces, which in turn helps us to know the longitudinal and latitude values. This system also includes GSM modem & GPS system which will send message to the pre-defined number if vehicle meet with an accident. The send message contains location of an accident. This project is very feasible because less expensive parts are used. As this reduces number of brake and switch operations it can be used for driver safety and comfort.[11]

In this paper they have presented a prototype of an autonomous mobile robot which finds optimal path using google navigation. It also automatically checks the directions and moves in that direction without waiting for any human command. The designed robot consists of GPS receiver, electric compass, WiFi and proximity sensors to measure distance which also helps to detect and avoid obstacle also avoids any obstacles coming on the way. MATLAB is used to
communicate with google maps and google navigation. The drawback in this project is that it takes only road information, so improvement should be made to get information from google maps not only the path but also on buildings and other obstacles.[12]

This paper is designed to develop a new system that can control braking system to avoid accidents. The system consists of two photoelectric distance measurement sensors, kit of electronic control unit (ECU) to give input and output of sensor, hydraulic circuit and single acting hydraulic cylinder. The photoelectric sensors can measure hurdle up to 10m.Hydralic cylinder is used to auto force the break paddle. The braking system is a complex arrangement and simply changing one component may completely upset the whole system. Distraction Driving is a Major Contributor to Accident death, thus by implementing this System we can reduce the Close impact Potential Accident.[13]

“Self-driving car system using AI”, this paper is regarding driverless automatic vehicle. It uses LIDAR, 3D camera and a software openGL to create a 3D image. By using GPS, the vehicle can navigate across the road. The traffic signs is detected based on multi-layer perceptron neural network. Every situation is mapped with the brain samples and supervised the neural network to take decision for the movement of steering and breaking. This system minimizes the road accidents but the problem of traffic congestion still exits. It provides a cost-effective transportation. [14]

“Adaptive Cruise Control Systems for Vehicle Modeling Using Stop and Go Maneuvers”, this deals with the adaptive cruise control (ACC) and stop and go maneuvers which was implemented on a passenger car using PID controller. It provides speed tracking and measures the distance of the vehicle present ahead of our vehicle. The actual distance is being measured and it’s modelled with a signal builder on Simulink. This system can control the velocity at urban areas to avoid accidents.[15]

“Automatic Intelligence Car Robot”, this paper introduces an automatic intelligence robot, which is so-called because it can sense its environment and create a navigation path without human intervention. It has features such as line following and obstacle avoiding. Arduino Uno is used as the microcontroller to actuate the DC motor according to the data obtained from an ultrasonic sensor and light sensor. If the presence of an obstacle is detected by the ultrasonic sensor, the robot changes its path so as to avoid it. The combination of infrared LED and light sensor is used to detect dark line on a light surface or light line on a dark surface, using which the robot can be made to move on a particular line. Using Bluetooth communication, the robot is controlled by an app made by MIT app inventor. The robot has skid-steering property and hence it can turn in its own track with a skid, which makes it suitable for use in compact and narrow areas. It can be used in industries to carry load from one place to another, military, etc., [16]

CACC differs from the conventional Adaptive Cruise Control System (ACC) by introducing vehicle-to-vehicle communication. The V2V communication provides information about surrounding vehicles. The vehicles that have V2V facility can communicate with each other. This improves driving capacity and helps in preventing accidents. CACC system focuses on improving traffic flow control, less fuel consumption and comfort. CACC System also uses Vehicle-to-Infrastructure Communication (V2I). The V2I Communication provides communication between Vehicle and infrastructure through which vehicle gets idea about the current environment.[17]

“Adaptive Cruise Control System Based on Time Headway and Speed and Sensor”, this paper has given implementation of adaptive cruise control on a car. A proper inter-vehicle gap is maintained based on the time headway and speed of the vehicle moving ahead. ARM7 is the microcontroller used, and laser scanner fitted to the bumper of the vehicle measures the distance between the host vehicle and the leading vehicle. To achieve ACC, the throttle valve system and braking pedal are modified. In order to increase the speed of the vehicle, the throttle valve which is connected to a DC motor is controlled by the ARM7 based on Proportional and Derivative (PD) algorithm. To maintain a proper inter-vehicle gap, there are two levels of control – low level and high level. In low level, depending on whether the vehicle needs to accelerate or decelerate, the throttle valve and braking pedal, each connected to a DC motor are controlled respectively. In high level, there are three inputs – speed of the leading vehicle, time headway set by the driver and the distance gap between the two vehicles. These inputs are processed to determine distance error and relative speed, which are then given as inputs to a fuzzy controller, which provides the necessary speeding command. The performance of velocity

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control and distance control were tested and the results suggested that the vehicle could run at desired speed without causing jerk and it could maintain the desired inter-vehicle gap accurately with small relative velocity. [18]

"A Review Paper on Automatic (Intelligent) Braking System with Gas Sensor and Alcohol Detector ", this paper aims to avoid accidents that occur due to loss of control and rash driving. The system consists of a 16PI microcontroller, Hall sensor and ultrasonic sensor. The hall sensor determines the speed of the vehicle, and the ultrasonic sensor measures the distance of the obstacle in the front, and calculates the braking distance. The braking distance and the distance of the obstacle is determined. If the driver doesn't recognize the obstacle and apply brakes at the right time, then the microcontroller actuates the braking motor to apply brakes if the obstacle is present at a close distance. [19]

"Laser-based Adaptive Cruise Control for Intelligent Vehicles", this paper aims at implementing a laser-based adaptive cruise control using fuzzy logic. The system consists of a headway laser scanner, a PC and a fuzzy logic speed controller. The laser scanner (SICK LMS) has a range up to 90m. Various input variables based on error in speed of two vehicles, time headway and acceleration are processed and the throttle valve position is actuated by the controller. [20]

III. CONCLUSION

From the above survey about the autonomous car we come to a conclusion that any system to work on its own need to be first trained itself for the suitable environment under different constraints and time measures. The use of renewable resources like solar, wind helps in overcoming the dependency on exhaustible resources. Although the initial installation of these renewable resources are costly but in a long run they do have more advantage for upcoming automotive industry. The idea of building a semi-autonomous car is to guide a man with right traffic rules and ensure his safety.

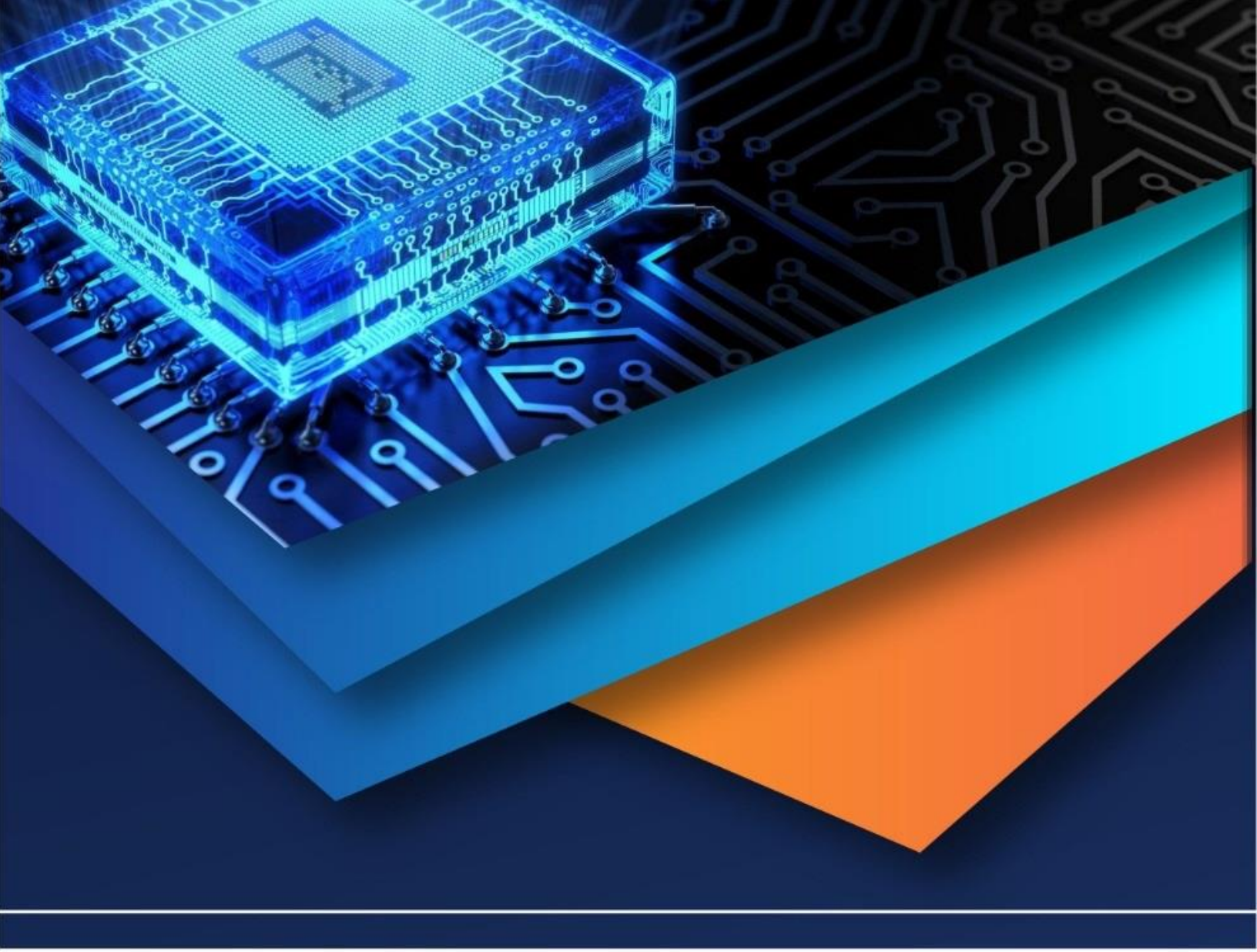
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