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A REVIEW OF DRIVERLESS VEHICLE

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ABSTRACT
In recent times, accidents are happening rapidly and the reasons behind the accidents are lack of driving knowledge, driving and drinking and so many other distractions from entertainment systems in the vehicles. Driver error is the most common cause of Road Traffic Accidents (RTAs). Cell phones in-car, entertainment systems, more traffic and more complicated road systems makes it more frequent. Driverless vehicles are vehicles that can drive itself from one point to another without assistance from a driver using an autopilot system. These vehicles utilize a number of well-placed sensors that detect different things such as other vehicles, people and traffic light. Blue chip companies like Google, Tesla, and Volvo are some of the companies that have made giant stride in this automobile technology. By this improved technology, our vehicles' safety is ensured and minimizes the occurrences of Road Traffic Accidents (RTAs).

KEYWORDS: Driverless, Vehicle, Accident, Autopilot, Traffic, Automobile

INTRODUCTION
In the early 19th century, most great city was full of stables and horses were the prime movers of the transportation industry. Horses pulled chariots of various sizes constituted mankind's traditional means of road transportation. Plagued with problems like horse dung pollution and slow speed, the need for faster and more efficient means of road transportation arose. This need lead to the invention of cars.

For more than 125 years the automotive industry has been a force for innovation and economic growth and cars have gradually gained popularity over other forms of terrestrial transportation. For most persons, the purpose behind their preference for cars now transcends rational economic choices and entails aesthetic, emotional and sensory responses to driving (Sheller, 2004).Consequently, car manufacturers make references these

consumer preferences during the design of cars and their functionality.

In the early long periods of the 21st century, the pace of headway is quickening and the business is on the dubious edge of another creative bombshell: Autonomous vehicles. An independent vehicle, otherwise called a driverless vehicle, robot vehicle, self-driving vehicle or self-governing vehicle is a vehicle that can control itself without human intervention.

This new innovation could give answers for a portion of our most immovable social issues, the mind-boggling expense of car accidents and transportation framework. A huge number of hours squandered in roads turned parking lots, and the squandered urban space offered over to parking areas, just to give some examples. With research into autonomous cars progressing remarkably since the first demonstrations in the 1980s, this kind of vehicle is fast becoming a concrete reality and expected to pave the way for future systems where computers take over the art of driving (Hudda *et al.*, 2013). However if self-driving vehicles become a reality, the implications would also be profoundly disruptive for almost every stakeholder in the automotive ecosystem (Wallace and Silberg, 2016).

REVIEW OF RELATED LITERATURE

According to Dant and Martin (1999), the proliferation of automobiles as a mass medium of transportation has been one of the most momentous developments of the twentieth century. The car is a highly distinctive mode of transportation in bringing a previously unimagined degree of personal mobility to the populations of industrialized societies.

Macnaughton and Urry (1998) said that driving cars are clearly more than transporting the human body from here to there. The pleasure derived from driving cars or even in being driven in them, also has to do with the user interaction and functionality of the car. Speed can be enjoyed as a mystical experience, as competition and as overcoming natural and mechanical forces. It is a pleasure that can even be enhanced by interaction with other cars in traffic, as well as the status and attention enjoyed by those who possessed cars.

Over the last hundred years, cars have evolved from being an unreliable and extremely expensive hobby for the rich to being a necessary object consumed through routine and often daily use. The significant roles played by these machines are perhaps the reason why everyone considers them to be so handy. Dant and Martin (1999), conducted a survey during the Pew Research Centre's and Demographic Trends Project on the most needed items by Americans in 2006 revealed that cars were rated as more "necessary" than other relevant consumer goods like phones, computers, high speed internet and clothing. These cars are no longer the owners interest or a sign of status. Like televisions, telephones, central heating and inside toilets, cars are just part of the conveniences of modern living that is more noticeable when absent than when present.

Amidst these convenient perceptions attributed to automobiles, these machines also bring about a

plethora of challenges ranging from environmental challenges to safety challenges. These conveniences and challenges collectively shape the manner in which automobile industries design cars today.

CARS AND SAFETY

Dant and Martin (1999), argued that in addition to aesthetic appearance, pleasure and status, 'functional features' of cars like the safety of occupants in the event of a crash have become more important. Porter (2014) attributes safe driving and low accident rates to drivers' decision making skills. According to Oyeyemi (2003), human factors constitute about 80% of the cause of road traffic accidents recorded in developing countries. Afolabi, (2017) highlighted driver training and licensure as a key strategy for minimizing road accidents in Nigeria. According to him, the driver of a vehicle is the most important single factor in road traffic crash. The generation of superb drivers is subsequently non-debatable. The two basic requirements in producing high quality motor vehicle drivers are proper training and licensing programmes.

Afolabi, (2017) suggested that many countries have established organizations to assess the driving skills of drivers, teach them road laws and issue licenses to those deemed fit as qualified drivers, with the expectation that such a move would ensure the admission of flawless drivers in roads as well as the curtailment of human factor challenges. However, this move has not yielded much success as human factor induced traffic accidents rates are still on a record high. As such, automobile manufacturers are still exploring alternative means of solving these human factor challenges.

AUTONOMOUS VEHICLE

Nowakowski *et al.* (2015) explained that a vehicle is autonomous if it can perform some functions of a human driver. Autonomous vehicles properly should be called automated vehicles; more precisely, vehicles with some level of automated driving capacity. Fully autonomous vehicles can operate without any human control or even monitoring – they can drive themselves and have been called driverless or self-driving. This report refers to vehicles with any level of automation as autonomous vehicles (AVs), a term frequently used in state laws.

LEVELS OF AUTOMATED VEHICLES

The Society of Automotive Engineers (SAE, 2016) and the National Highway Traffic Safety Administration (NHTSA) define five levels of AVs (SAE, 2016; NHTSA, 2016).

- **Level 0**
  No automation: In level 0, the driver is in complete control of the vehicle at all times.
- **Level 1**
- Driver help: The vehicle can help the driver or assume responsibility for either the vehicle's speed, through journey control, or its path position, through path direction. The driver must screen the vehicle and street consistently and must be prepared to take control at any minute, with hands on the guiding haggle on or close to the pedals.
- **Level 2**
- Intermittent self-driving: the vehicle can assume responsibility for both

the vehicle's speed and path position in certain circumstances, for instance on constrained access interstates. The driver may separate, with hands off the directing haggle away from the pedals, however it should screen the vehicle and street consistently and be prepared to take control at any minute.

- **Level 3**
  Constrained self-driving: the vehicle is in full control in certain circumstances, screens the street and traffic, and will illuminate the driver when the person must take control. At the point when the vehicle is in charge the driver need not screen the vehicle, street, or traffic however should be prepared to take control when required.
- **Level 4**
  Full self-driving under specific conditions: the vehicle is in full control for the whole trip in these conditions, for example, city ride-sharing. The vehicle can operate without a driver in these conditions; the driver's only role is to provide the destination.
- **Level 5**
  Full self-driving under all conditions: the vehicle can operate without a human driver or occupants.

AUTONOMOUS CARS AS A POSSIBLE SOLUTION TO HUMAN FACTOR FLAWS OF DRIVEN CARS

Albright *et al*. (2015) as report by KPMG, over 90% of accidents each year are caused by driver error, and accident frequency could drop as much as 80% with commercially viable Level fully automated vehicles. Self-ruling (additionally called self-driving, driverless, or mechanical) vehicles have for some time been anticipated in sci-fi and examined in well-known media. As of late, significant partnerships have declared designs to start selling such vehicles in a couple of years, and a few purviews have passed enactment to enable such vehicles to work legitimately on open streets.

Jiang (2015) explained that as at the end of 2014, most of the biggest car manufacturers have been building their own versions of self-driving cars. Google has moved its concentration from thruway arranged self-governing heading to driving on nearby avenues. Organizations, for example, Baidu, a Chinese web administrations partnership, have declared their goal to enter oneself driving vehicle showcase. Everyone seems to have realized that self-driving cars are the future of automotive industry. This new prospect, however, is elucidating the major split that is occurring in the self-driving industry.

This separation originates in the approach that companies are taking to achieve the goal of fully autonomous driving. On one side, auto manufacturers are adopting the incremental approach; cars are becoming more and more autonomous over the years. On the opposite side, Google is intending to discharge a completely self-governing vehicle directly to the market.

Litman (2017) this split is best articulated in the words of Carlos Ghosn, CEO of Nissan Motor Co., Ltd.: Autonomous drive is about relieving motorists of everyday tasks, particularly in congested or long-distance situations.

The driver stays in charge in the driver's seat, of a vehicle that can do more things consequently. Although Self-driving cars still remain a long-way from commercial reality, their ability to function without any form of human intervention connotes an end to human factor induced safety challenges. The advancement of self-ruling vehicle innovation can possibly give a huge improvement in wellbeing, help lessen blockage, improve vehicle eco-friendliness and give expanded versatility choices.

ADVANTAGES OF DRIVERLESS VEHICLES

Mirejovsky, (2018) highlighted some advantages of driverless vehicles as follows:

i. The adoptive cruise control (ACC) technology used in the cars from automobile makers keeps advancing to new levels of safety. In microwave radar unit there is a laser handset, fixed on the facade of the vehicle to decide the separation and relative speed of any vehicle in its way, which is careful good ways from different vehicles on the bustling streets. The driver can set the speed of his vehicle and the separation among his and different autos. When traffic slows down vehicle speed is altered using moderate braking to maintain a constant distance between his and other cars.
ii. In the case of advanced systems, the driver over speeds or suddenly falls over, the car is guided to safety without being halt. What's more, on the off chance that you have modified it right, the GPS in the vehicle would take you to your goal .along these lines, directly from brakes to programmed footing control to air sacks and fuel-air blend control, the insight dominates.
iii. A few advanced car prototypes with embedded systems, have been tried and tested where even if a smart thief has managed to break in through the car, the vehicle doesn't fire up regardless of whether it does the PC of the vehicle would bolt the guiding haggle the fuel infusion supply, meanwhile a sign is set to the closest police headquarters and the proprietor illuminating them about the hoodlum.

Some designs now include so-called "pre-safe" systems, which sense possible collisions in advance based on emergency braking, skidding, and sudden evasive man overs. The thought is to "support" the vehicle's inhabitants for most extreme well-being.

DISADVANTAGES OF DRIVERLESS VEHICLES

Mirejovsky, (2018) reported that with many automotive companies testing the latest technology, it is not uncommon to find yourself sharing the road with a driverless vehicle. There are various opinions on the self-driving system. Some think it can possibly build well-being for drivers and travelers, while others accept the detriments of driverless vehicles exceed the advantages.

Mirejovsky, (2018) suggested top 5 concerns about self-driving vehicles:

a. Trusting a computer to perform adequately

This is the main concern people have. Numerous people are doubtful about giving over all the ability to a PC, which could glitch and put the driver in danger

and every other person out and about in danger. **Autonomous vehicles travel according to GPS, is not always successful.**

- **Software stores personal information, which could draw attention from hackers.**

b. Autonomous vehicles will be expensive to run smoothly, driverless car needs:

i. Sensors

ii. Software

iii. Modified vehicle parts (i.e. computer system)

The cost of having an autonomous vehicle adds up to over $100,000(about #38,000,000).

c. Sensors fail during conditions out of the norm

Autonomous vehicles rely heavily on their sensors, making them vulnerable to sensor failures during certain situations.

i. **Drastic weather conditions**

ii. Human traffic signals

iii. Roadblocks and local traffic laws

d. Increase in unemployment rate

Driverless cars could eliminate many transportation industry jobs, causing a negative impact on the unemployment rate and the economy.

e. Learning new technology

i. Once drivers fully adjust to the new technology, they may forget how to drive a car

ii. Driving a traditional vehicle may become more difficult when you get used to a driverless car

AUTONOMOUS VEHICLE TECHNOLOGY

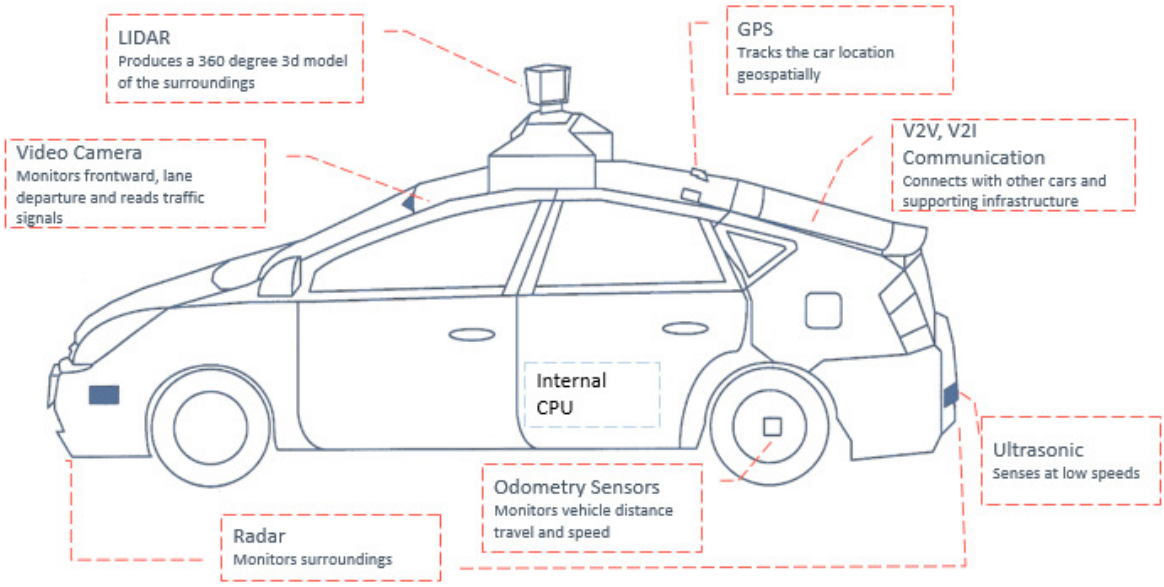

Fig. 1: Components of a Fully Automated Vehicle
Source: Retrieved from http://driverless.guru/104/driverless-car-101-avs-work-part-2-3/

- **LIDAR**

The LIDAR is situated at the top of the vehicle. While the vehicle is in operation, it constantly spins and uses laser beams to generate a 360 degree or 3d model of the cars surroundings.

- **Video Camera**

The video camera uses parallax from multiple videos to compute distance from nearby objects. They likewise identify traffic lights and signs and help perceive moving items like people on foot and bicyclists.

- **GPS**

The GPS tracks the car location geospatially using readings from tachometers, altimeters and gyroscopes

- **Odometry Sensors**

The odometry sensor monitors vehicles distance travel and speed.

- **Vehicle Communication Sensors**

The work of a vehicle communication sensor is to connect with other cars and supporting infrastructure via the internet of things.

- **Ultrasonic Sensors**

The ultrasonic sensor senses at low speeds and measures the position of objects very close to the vehicle.

- **Radar**

The radar monitors the vehicle's surroundings and measures the position of objects that are very close.

- **Central Processor**

The central processor is an internal computer that analyses all sensor input, applies the rules of the road, and operates the steering, accelerator and brakes. It also compares its stored maps to access current conditions.

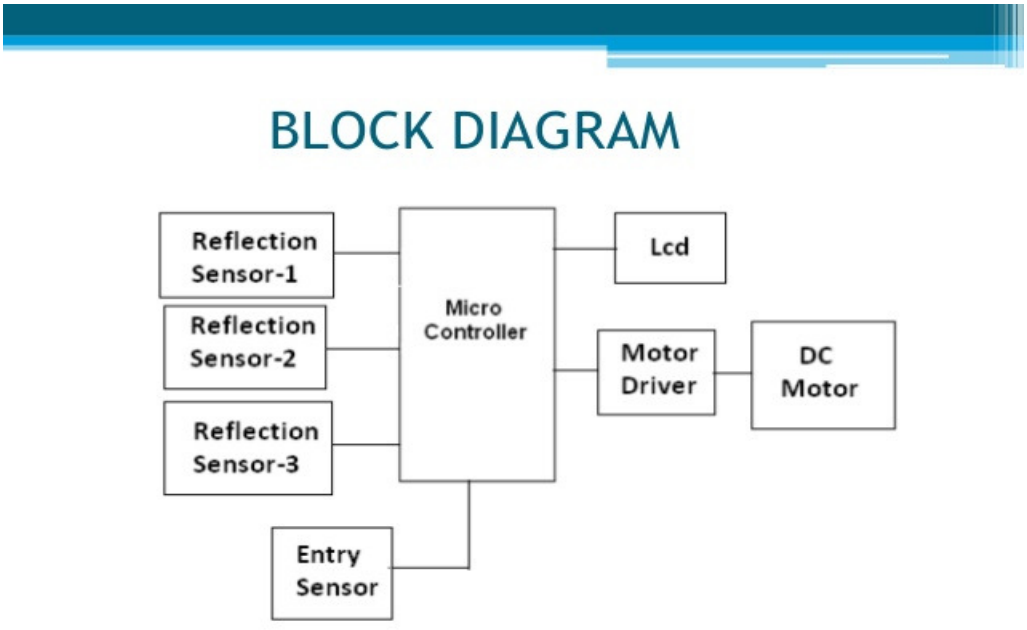

Fig. 2: Block diagram of a Central processor of an autonomous vehicle
Source: https://www.google.com/search

FUNCTIONAL SYSTEMS EMBEDDED IN AUTONOMOUS VEHICLES

At the heart of every automated vehicle are computers that perform the functions necessary to understand the world around the vehicle and make the driving decisions that safely transport passengers and these computers use a combination of systems that work safely together, including

- **Safety Systems**

The safety system is built into the decision-making for the computers' technologies and systems.

- **Behavioural Control Systems**

This system uses information from Safety, Planning and Controls to provide safe and comfortable rides to customers with driving behavior that is predictable to other human road users.

- **Machine Learning**

The machine learning system rapidly advances the computers' capabilities, such as identification of certain objects and road infrastructure by Perception.

- **Simulation**

These are computerized system that facilitates rapid development to continuously improve vehicle performance.

- **Perception**

The perception system "Sees" surrounding environment in three dimensions of space and over time, using information from vehicle's sensors and Mapping.

- **Localization**

The localization system knows the vehicle's location at all times.

- **Mapping**

Uses high-definition maps of the roads upon which it will travel.

- **Planning**

The planning system knows how to navigate safely through its environment using information from Dispatch and Routing, Perception, Safety and Mapping.

- **Remote Assistance**

The remote assistance connects passengers with remote operators upon request, and in emergencies.

- **Controls**

Turns the routes and decisions from Planning into commands sent through Networking to the vehicle actuators.

- **Dispatch and Routing**

Connects to the operations centre to obtain pick-up and drop-off locations, and uses mapping and planning data to determine routes.

- **Networking**

Moves large amounts of data to the computers within the vehicle and to and from the operations centre.

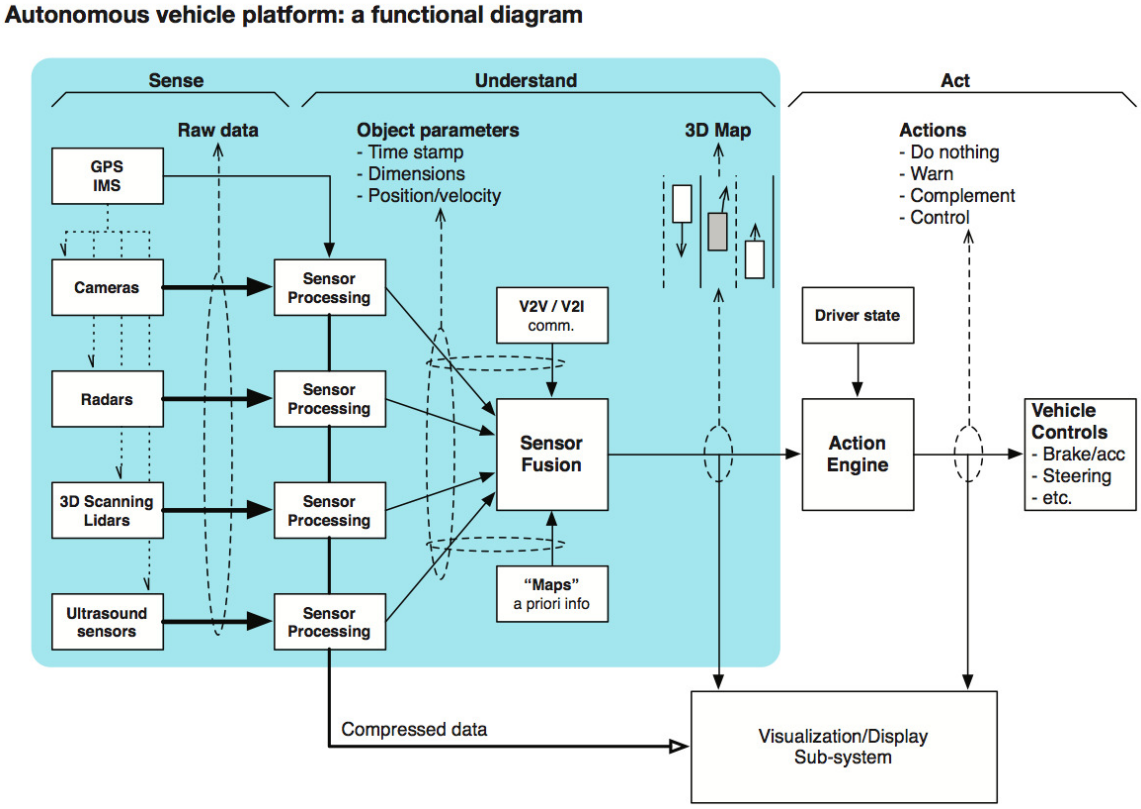

Fig. 3: A functional diagram of an autonomous vehicle
Source: http://www.google.com/search

THE FINE ART OF AUTOMATION

The heap code of the goal is on the dashboard, the PC and turns the vehicle on, while the situated stay joyful on the back of the seats. A completely mechanized vehicle equipped for doing nearly everything a vehicle darling would need. Almost all automobiles will interact with computer on dashboards. From ordering pizza to booking tickets at the nearest theatre, things would be as easy as giving orders to your servant. As a matter of fact, vehicles all over the world are now fitted with intelligent devices that make the vehicles to respond to various factors –be it climate control, sudden accelerations or braking or even self-repair of modules. The unique mark advancements have been acquainted with enter and start your vehicle with the bit of a finger. The fingerprint, which is acting as a key, would trigger a check of the mirrors, steering wheel, radio and temperature to ensure that they are the way you like them. The convenience of fingerprint recognition technology comes with heightened security. Dissimilar to individual distinguishing proof numbers, passwords and keys, every individual's novel fingerprints can't be copied, lost or overlooked.

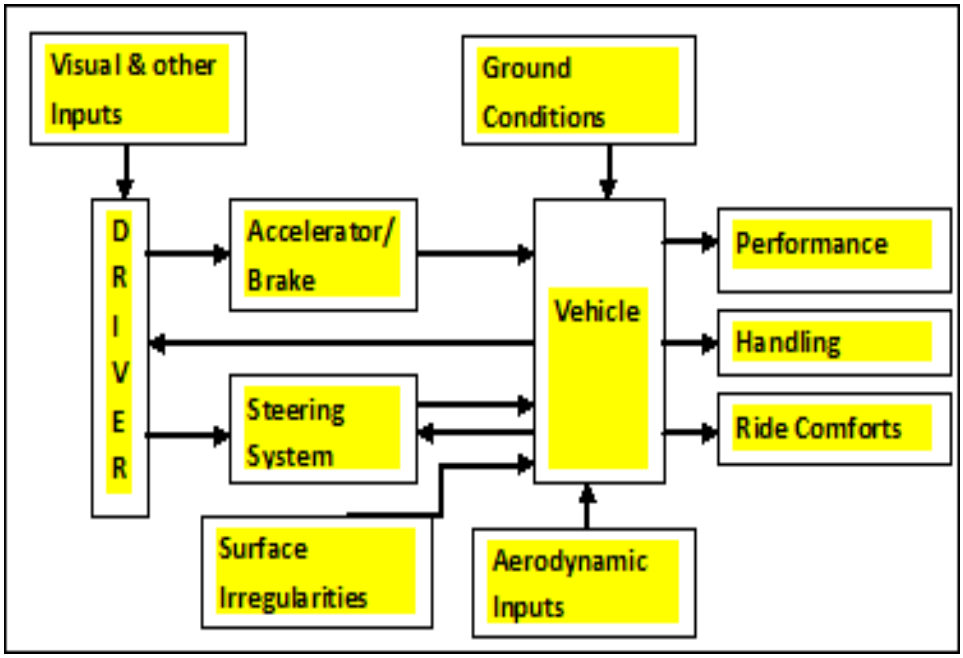

Fig. 4: Flow diagram of an embedded system of an autonomous vehicle
Source: http://www.google.com/search

TECHNOLOGY OF THE AUTONOMOUS VEHICLE

Self-sufficient vehicles will be vehicles that can keep running independent from anyone else without the intercession of individuals and this move makes place by the installed knowledge in it. For this purpose Global Positioning System (GPS) using satellites can provide positioning information and proves to be a versatile all-time. For still higher precision wide territory differential GPS is utilized, which offers a strong framework that promptly manages particular accessibility mistakes and satellite clock blunders.

The models for GPS likewise incorporate helping sensors, for instance: dead retribution, radar and camera. A PC is just required to bolster goal into a dashboard PC. Highly sensitive actuators simulate a human driver completely and direct the vehicle on the road. The vehicle transmitter broadcasts its position and velocity to other immediate participants for collision-avoidance and lane changing man overs. Forward and reverse motions and u-turns are precisely achieved as per route guidance requirements. Furthermore, an accurate steering control is obtained using Pulse Code Modulation technique and acceleration/braking control is successfully implemented using learning adaptive system.

The reliability, efficiency and cost effectiveness of an autonomous vehicle depend mainly on how judiciously its navigation sensors, perception unit and computer control is incorporated.

The driver's activity is influenced by several factors that depend on driver

itself and is environment such as traffic density, traffic status, time of travel and weather. Thus the driving activity deals with a combined driver vehicle-environment system shown in figure 5. The vehicle is required to mix its ecological observation capacities with its canny controls so as to influence ideal way arranging procedures that maintain a strategic distance from snags as well as limit criteria, for example, time of movement, fuel utilization, presentation to contamination/threat, etc. however basic driving functions consists of lane-keeping, safe distance maintenance, timely lane changing and overtaking. The key to all these driving tasks is collision avoidance.

The desired destination and starting position of the vehicle together with the time of travel, manifest an optimal route on the road network. Once the vehicle commences the journey the sensors continuously keep track of the direction and displacement of the vehicle initial calibration is a little
crucial for dead reckoning performance; however a feedback calibration indicated in fig suggested obtaining distance accuracy better than 99.9 percent.

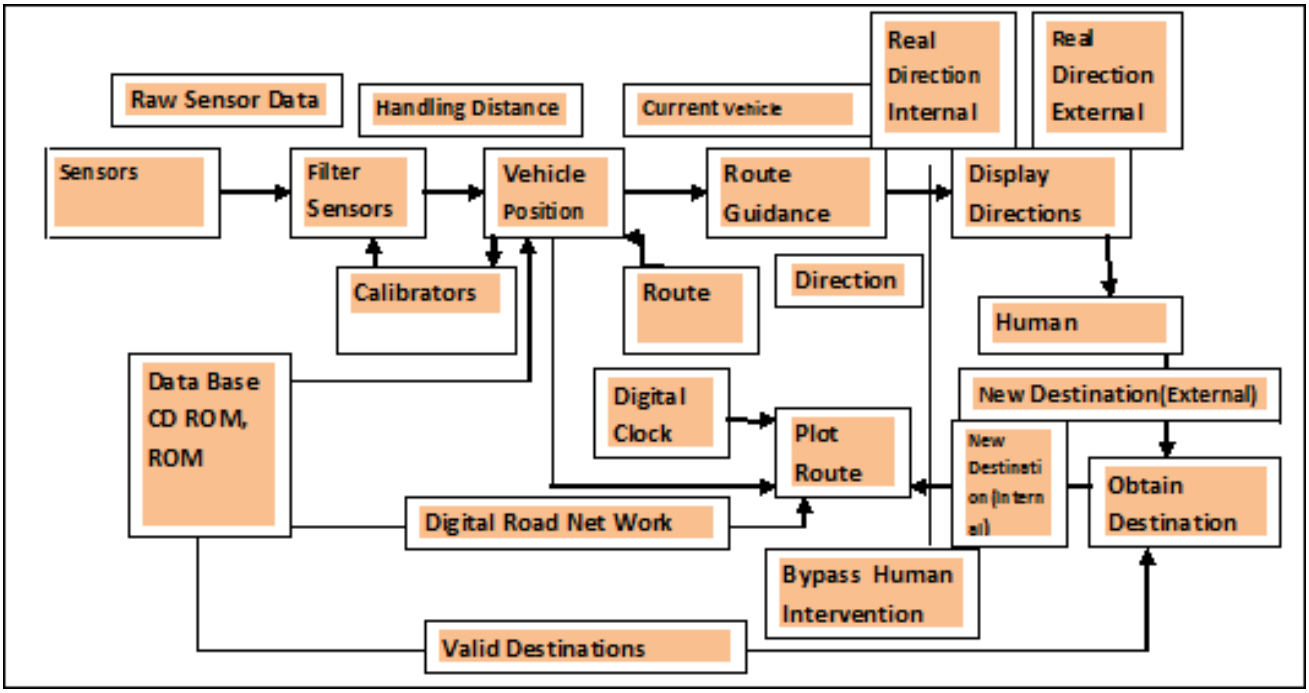

Fig. 6: Block diagram of an autonomous vehicle system.
Source: International Journal of Advances in Science Engineering and Technology, ISSN: 2321-9009.

CONCLUSION

A driverless vehicle gives a wide scope of urgent advantages including improved street wellbeing, more noteworthy eco-friendliness, and decreased ecological effect. We are just barely starting to comprehend the size of this effect. Sooner rather than later,

we are probably going to see improvements to existing driver help capacities, with an especially solid spotlight on wellbeing. A few upgrades can be envisioned, incorporating more noteworthy accuracy in computerized mapping, better calculations to anticipate the conduct of other street clients, and extra framework adaptability for simpler joining and sending. Nearby innovation improvement, we may see a progressive decrease in current legitimate and risk system holes, alongside increasingly across the board open acknowledgment of self-governing driving. Regardless of the ebb and flow specialized, administrative, and cultural obstacles to the take-up of driverless vehicles, some convincing use cases have just risen in various enterprises, obviously showing an expansive readiness to create and convey independent innovation. Furthermore, if any associations in any businesses set out to receive a progressive methodology, the pace of advancement could increment drastically.

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