Autonomous Car: The Future of Secured Transportation

Ms.Jashwanthi A.

4th year,B.E.Computer Science and Engineering
Velammal Engineering College,
Chennai,India
jashwanthi03@gmail.com,

Abstract- **An autonomous car is a driverless car or a robotic car, which uses techniques such as radar, lidar, GPS, odometry and computer vision to sense its environment and to navigate without human input. It uses Vehicle to Vehicle communication (V2V) protocol to communicate and share data with its surrounding vehicles but data hiding cannot be done. In this paper, we implement V2V protocol using ZigBee for privacy in data sharing. ZigBee provides secured communication, transportation of cryptographic key and helps in controlling the devices. It is developed using the basic security framework defined in IEEE 802.15.4.**
Index Terms-**Autonomous,V2V, Zigbee, VANET,AES.**

I. INTRODUCTION

An autonomous car or a robotic car is a cutting edge idea which is under development. The Electri Utility Company in the year 1956,evolved with an idea that "electricity maybe the future driver", which in turn lead to the prediction of autonomous car[3]. The first ever autonomous car was emerged in the year 1980's with Carnegie Mellon University's Navlab. Since then, several working prototype of autonomous cars has been developed. The main advantage of self-driving car is its good performance under uncertain situation in the environment. The reason behind the idea of autonomous car is that it reduces the traffic congestion, has a higher speed limit and thus giving us a smoother ride. During the car theft, the sensors provide us the details in tracking the cars and thus reducing the number of cases of car theft. In case of car sharing, implementation of autonomous cars leads to a reduction in the total number cars on road, space and thereby leading to a less polluted environment. New business such as mobility as a service is also enabled by these cars.

II. FEATURES:

- **RADAR:** Autonomous car uses radar technique to detect the nearby vehicles by determining the range, angle or velocity of the vehicles with the help of radio waves. Radar technique is also used in detecting the weather formations.
- **LiDAR** (Light Detection And Ranging):It is a popular technology which helps in providing high-resolution maps and also determines the distance between two vehicles by illuminating a target with a laser light.
- **Global Positioning System (GPS):** It is a sensor chip that provides the location information at all weather conditions everywhere on or nearby earth.
- **Odometry**: It uses odometry which provides the estimate change in position over time with the help of motion sensors.
- **Computer Vision:** Fully autonomous vehicles typically use computer vision for navigation, i.e. for knowing where it is, or for producing a map of its environment and for detecting obstacles. It can also be used for detecting certain task specific events.

III. CLASSIFICATION:

Level 0: The vehicles are controlled by the drivers at all time.

Level 1: The vehicular control such as electronic stability control or automatic braking is automated.

Level 2: At best two controls are to be concorded as a one such as adaptive cruise control in lane keeping.

Level 3: The vehicular safety control functions are fully conceded by the drivers to the cars in certain conditions.

Level 4: As all the safety -critical functions are performed by the vehicles from the beginning to end it could include unoccupied cars.
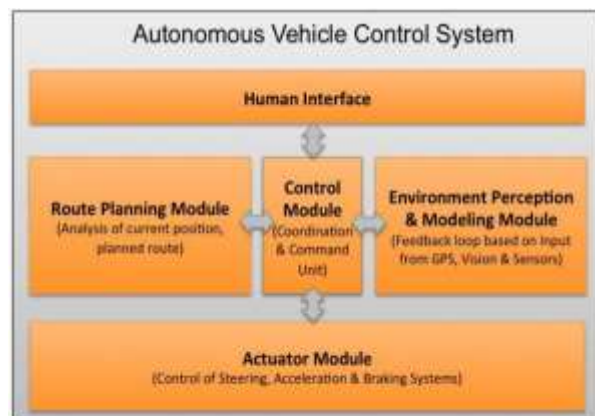

Fig.1.shows the control system in autonomous car

IV. POTENTIAL ADVANTAGES:

- The traffic collisions that are caused due to the human driver errors can be reduced.
- Traffic congestion is reduced due to the better managing capability of the traffic flow with the help of sensors that detect the distance between two nearby vehicles.
- Once the map is set to the correct destination there won't be any problem with the navigation chores.
- A higher speed limit is also possible for autonomous cars.
- There are no more constraints to be imposed on the occupants who are under age, over age, physically challenged, unlicensed, blind, etc..,..
- Less space is required for parking and the vehicle can easily drive where space is not scarce.
- It leads to a less polluted environment as the number of cars on road will be minimised.
- Reduction in car theft, due to the vehicle's increased awareness.

V. POTENTIAL OBSTACLES:

- The communication system between cars can be potentially compromised by GPS jammers and disrupting the camera sensors.
- There is no privacy as the information are shared through V2V and V2I protocols.
- These cars can be misused as a suicidal bomber as it can be loaded with bombs and explosives.
- Loss of driver related jobs.
- The roads must be laid properly in order to function the car optimally.

VI. V2V PROTOCOL:

Vehicle-to-vehicle (V2V) communication is a wireless network which works as a transceiver in order to share the information among the autonomous cars. Information such as location, speed, direction of travel, braking and loss of stability can be exchanged. It uses Dedicated Short-Range Communication (DSRC) which was introduced by FCC and ISO. The topology used here is mesh topology, in which data can be sent, captured and retransmitted. The frequency ranges from 300 metres to 1000 feet. It is a type of MANET (Mobile AdHoc Networks).

The information shared using this protocol are not governed by a centralized base station. A management entity or a Certificate Authority(CA) uses a public key infrastructure and digital certificates to establish a secured communication by generating a unique certificate to each drivers. These unique certificate does not provide any privacy as the drivers identity can be revealed to other drivers.

The main disadvantage is that V2V protocol shares all the information among the autonomous cars, thereby not providing any authorization for certain information such as the movements and location of the car that the driver visits.

Proposed System Using Zigbee:

The disadvantages in V2V communication is solved by using ZigBee. It is based upon mesh network and it is a low power wireless local network .It covers large area.

AES algorithm (Advanced Encryption Standard) is used to provide secure communication in ZigBee by using 128 bit symmetric key. Security is provided in network and application layers. Payloads generated by the network layer should be ciphered. A trust center is elected by every device which controls secure communication .In the network layer, network key which is generated during pre-installation or key transport is shared among the network. It is changed periodically. In application layer, link key provides unicast secured communication (i.e.,)point to point communication .The security provided by the ZigBee is robust and strong.

VII. PROPOSED SYSTEM FOR DETECTING EXPLOSIVES:

This is a solution to overcome one of the disadvantages of the autonomous car. As an autonomous car can be used as a suicidal bomber by loading it with explosives , we need to place a sensor that detects and identifies the bombs. Traditional methods such as Ion Mobility Spectrometry(IMS) and chemiluminescence helps in detecting the explosives , but are less effective . Overcoming these disadvantages, the proposed system uses paper sensors for detecting the IED(Improvised Explosive Detectors).

These paper sensors are coated with chemicals that are commonly used in other IEDs. These chemical compound dissolve in the environment and detect the type of IED without using any expert systems.
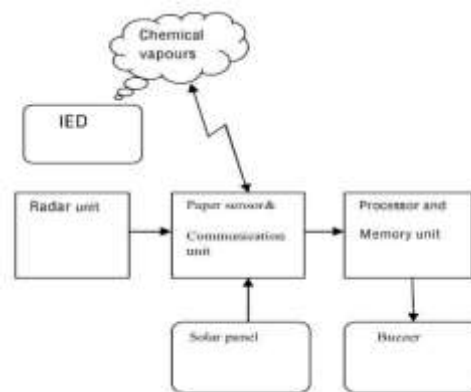

Fig.2.architecture of paper sensor IEDs

VIII.   POSSIBLE DEVELOPMENTS:

YEAR	COMPANY	DEVELOPMENT
2016	Mercedes	Hands free highway driving
2016	Mobileye	Capabilities for country roads
2017	Mobileye	Capabilities for city traffic
2018	Nissan	Allow the vehicles manoeuver its way On multi-lane highways
2020	Volvo	Vehicles will Effectively be "crash free".

IX.   CONCLUSION:

The advancement in technologies has brought many changes in the field of computing and communication. Recent announcements states that many manufacturers are aspire to soon sell such vehicles in the market. Autonomous cars will soon be widely available giving a solution for the transportation problems.

Thus, the proposed system will add many benefits to the predicted features as it overcomes two main biggest disadvantages: privacy(security) and safety. By using Zigbee with V2V protocol we can ensure that there is privacy between the vehicles and data hiding can be achieved. Implementation of paper sensors as an IED can solve the problem of using an autonomous car as an explosive. We believe that the evolution of the advancement in the technology will cause a greater change in the automotive value chain.

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