

Next Generation Cars

with Smart Devices

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ABSTRACT:

With this paper we want to highlight some of the latest advancement in technology which can be used and integrated with the next generation cars (Smart Cars). The paper not only deals with integration of advancement in current technologies in other fields such as GPS, Tablet, Smart phones with the car but also introduces some of the new technologies that can enhance driving experience.

INTRODUCTION:

There are many new technologies what could be utilized in the automobiles with very little cost. These technologies could be made available with dedicated apps and of course a collaboration between the technology firms and auto industry. Imagine a tablet or smartphone app (application) that completely revamps the device to make it compatible with the automobile. The app transforms the smart device to an equivalent of tech package that comes with the automobile. This way we could utilize the maps, console and other features already present in the smart device at no extra cost. This paper also deals with technologies which can enhance the safety and communication capacity of the cars. We seek to achieve safety and productivity through intelligent transportation which integrates communication between automobiles.

RECENT ADVANCEMENT IN TECHNOLOGIES:-

We all wish that our cars come with the technology package but few of us are willing to shell out extra money for it. The average tablet costs \$200 to \$600. As compared to technology package which comes in the car this is a really small amount. Usually the tech package adds \$2000-\$5000 to the cost of the car. Let's start this discussion with a very simple example of integrating tablets with the automobiles. There are so many variations in tablets. Also there are so many interfaces and apps, it gets tricky to have a consistent interface dedicated to automobiles. We recommend an app dedicated to utilizing all the vital features of tablet or smart device for the automobile. As soon as we plug in the device to the car, it should activate the app with all the features relevant to the automobile (as depicted in Fig.1). Ease of use is always the key for the success of the any product. Some of the most utilized features from tablets and smartphones relevant inside the cars are

- a. *Location Search and Directions*
- b. *Communication (Emails, Phone Call or Texting)*

- c. *Voice searches (Siri for Iphone or Google Search)*
- d. *Alerts (Bad Weather, Traffic Alerts)*
- e. *Search (Food, Hotel, Gas station)*
- f. *Organizer (Meetings, Schedules, Appointments and Task Setup and Reminders)*
- g. *Entertainment (Music, Shows, Games and Video)*
- h. *Informations (Books, Magazine, News, Podcasts)*
- i. *Ecommerce (Mobile order to restaurant, EZpass, Paying for Parking)*
- j. *Identity Management (Unique ID of Mobile as independent Identification for Ecommerce and other purpose)*



Smart Device with standard display

Most of the features mentioned above have a common bottleneck, i.e. when we board our cars, we have to have our eyes on the road and not on the smart device same time our both hands should be on wheel not on keyboard of tablet or smartphone. There is a very powerful solution which we propose and is applicable to most of points listed above. Imagine looking for directions to a store, the first thing we would do is to look for an opportunity while driving to look for the information on our smartphone. What if car is voice activated? We can combine smart device with car and command "Genie, look for the nearest coffee shop". The smart device gets activated by voice command and not by physical touch to the device. This would erase the risk of getting

distracted while driving. When we activate the driving app, the smart device can be set in a drive mode. In this mode the device will continuously look for certain voice activators from the user. In the example which we discussed above the device gets activated by the configurable keyword "Genie". Some of other useful commands that can be used are listed below

- a. *Genie, Play Pandora*
- b. *Genie, Check the Rite Aid Pharmacy hours at Reston*
- c. *Genie, Text to Alex that I am driving and I will be there in 30 minutes.*
- d. *Genie, Check the traffic on 66 east.*

The smart device should have capacity to turn on/off air conditioning and other maintenance activities needed in the car. Smart device would become the key to the car. The car would auto adjust temperature based on the outside temperature. Some of these features are already available on higher end cars. But if we manage to integrate smart device in the automobile then this technology could be made available to a wider audience. We could place fingerprint scanner at the door handle and integrate it with the smart device of the car, this would eliminate the need for a key.

CAR ECOMMERCE:

Smart Device Integrated within car can be used for in car food ordering. You want to order a burger at Burger King, instead opening window in drive in during rainy day and try to communicate , their receptors will be able to pick up your car and communicate with take your order without opening your car window by using integrated smart phone with the car. This could help in making the experience better and smoother. Another place where we could use this is at parking garage. Suppose you are parked in a garage and the machine installed at the entrance picks your car license plate. Once you exit out the payment is made electronically from your mobile device. This way we could avoid looking for the payment booth and looking for change etc. Similar application is toll payment. Instead of EZ Pass and paying so called convenience fee owning this devices, we could integrate mobile device within the car for the toll payment.

SMART NAVIGATION (USING GPS FROM SMART DEVICE).

The other aspect we want to introduce is making the apps more customizable. For example, Not many people would like changing 3 highways to save .2 mile. Someone might not like taking left turns and only prefer right turns. So we could add features like most right turns, less ramps, less lane change etc. as an option on the Global Positioning System. The GPS system on the smart device (Fig 2) should have well defined selections for the above mentioned conditions.



Smart Device incorporated in the automobile

SMART MECHANICS (CAR ROUTINE MAINTENANCE OR SELF DIAGNOSTICS ALERTS):

A car with integrated smart devices can send periodic reports to the dealership regarding for routine maintenance. It can alert not only owner but also to dealership when a routine maintenance is due. It can also act as a self diagnostic tool and create a diagnostic report and transmit to the dealership for any emergency checkup required to prevent any costly failures. For this, car and the App software have to be linked. All the alerts could be easily managed through the app on the smart device shown below in Fig 3. All the statistical and historical



Car monitoring through smart device

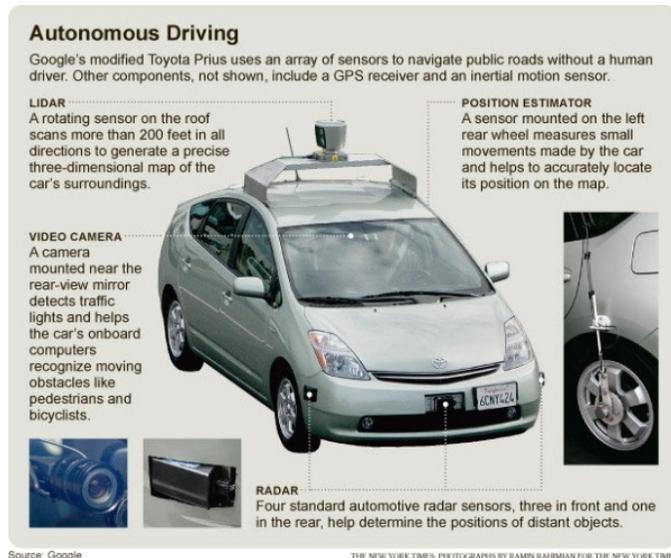
MONITORING DEVICES (CAMERA AND MOTION SENSOR LINKED TO SMART DEVICES):

The cameras and sensors of the car could be used not only for security of car itself but also for external monitoring. You can car park car near playing area and monitor your children while shopping at nearby store. The monitoring could be performed by integrated car sensors accessed by smart device remotely.

This technology can be used for home surveillance as well. The existing technologies for home security usually involves expensive fixed devices placed at various locations of the house. Automobile can act as a monitoring device at night and you can place the car appropriately at a location from which you can monitor foot and vehicle traffic. The best advantage of this is the automobile is a mobile device and its ease of use as well.

SMART SELF DRIVING CARS:

If we put a standard camera on all the cars then it could serve car to car communication needs in the future. It is currently being worked on by Google Inc. and they are testing self-driving cars on the road(Fig 4). Also, It could work as a medium for enhanced security monitoring of highway, incidence reporting and a security asset for the government. This can aid in enhancing the features on Real Time Kinematic satellite navigation which is based on the use of carrier phase measurements of the GPS, GLONASS, and/or Galileo signals where a single reference station provides the real-time corrections. Additionally, We could use Light Detection And Ranging(LIDAR) technology. LIDAR is an optical remote sensing technology that measures distance to a target or other properties of the target by illuminating it with light. All this technology can help to create an intelligent car which can not only allow driver to communicate with each other without identifying each other but also make commute less stressful.



Self Driving Car

SMART PROJECTION:

Finally, the last concept which we want to introduce is using the smart device to project on the windshield of the car. A hardware addition can result in significant increase of the

usability of smartphone or tablet. If a hardware similar to projector is added to the device then it could be used to project information directly on the windshield. If someone is calling you and her name and number will pop up on the screen and through your voice command the phone is answered. Looking for directions on windshield (shown below in Fig 5) utility that can be incorporated in the system.



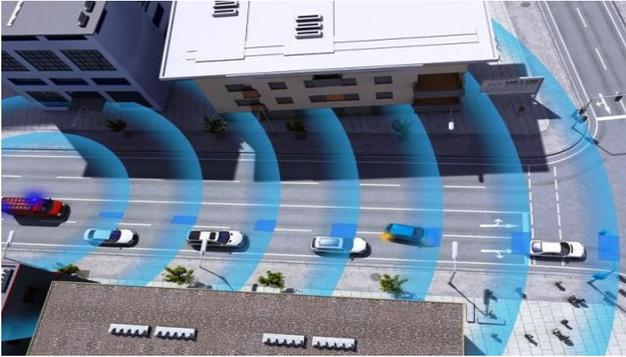
Smart Projection on windshield of the car

C2C (CAR TO CAR) COMMUNICATOR:

Many a times while driving on the road you want to convey a message to the next car but you cannot because of no communication medium. Example while driving to work you notice the trunk of the car ahead is open or a car honk at you and you want to know the reason, It would be great if you can talk directly to the driver ahead of you and convey that the trunk is open or reply back for honk at you in wordings without revealing your identity. Just by using some apps using something like Bluetooth you can place a call to the car(Fig 7) next to you or broadcast a message to all cars within few feet from your car. Receiver car can have full control whether to accept the anonymous call or ignore it. Let us take another scenario with a car accident on the highway. If the message can be broadcasted regarding the incident and the location then it would significantly improve the traffic flow and can improve road safety drastically. Vehicular networks communication(Fig 6) can help in avoiding congestion and finding better routes by processing real time data. This can also save both time and fuel and has significant economic advantages apart from reducing carbon emission due to idling. This can be achieved by two ways.

Broadcasting information: The use of existing mobile technology to broadcast the location and receive

information from the neighbors but without identification just like Traditional Walkie-Talkie.



Propagation on traffic related information

Information Exploration: The solution could be reusing the technologies present in the car like the cameras and distance locator and share the information between the cars. Imagine getting linked to someone's camera on the highway already in the morning and receiving actual traffic information. Incorporating this technology will help in enhancing security, reducing traffic issues and enhance peer to peer communication.

Information exploration provides control in receiver's hand while broadcasting information provides control to message initiator.



Car to car communication

CONCLUSION:

In today's world everyone is heavily dependent on their smart devices. There is an urgent need for integration of the mobile technologies and automobiles. The technology package currently available is expensive and not much customizable. If we can build apps and hardware extensions which could be used directly then it will be highly scalable and would have mass appeal. We are approaching the age of self-driving cars, existing automobile infrastructure has to adapt to needs of future.

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