



Research Project
Study of communication systems
Used in new generation personal Car.

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Approval Sheet

The project titled 'Study of communication systems
Used in new generation personal Car' by
Avinash Prabhune is approved for the partial fulfillment of
the requirement for the degree of Master of Design in
Product Design.

Guide:

Date:

Declaration

I declare that this written submission represents my ideas in my own words and where others ideas and words have been included ,I have adequately cited and referenced the original sources. I also declare that I have adhered to all the principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the institute and can evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Signature:

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Contents

Introduction	5
Automobile Evolution	6
Types of communication system in cars	8
Wire less communication- technology options	9
Conventional sensor for communication	10
Internal communication	11
Vehicle to Vehicle communication	12
Vehicle to Infrastructure Communication	13
Applications	14
Autonomous Driving System Project	17
Conclusion	20

Introduction

When human discovered wheel and its applications; since then his progress takes a fast track. Today Personal mobility became very important part of our day to day life; although the fuel shortage and global warming going to become big issues in next coming decade. The new revolution in the automobile technology is on the door step, very efficient electric batteries and advance computing technology making automobile very efficient.

The companies like “google” taking interest in the driverless car technology. Very soon we are going to see the smart vehicles which ensuring the safety and fast transportation

In the near future car can predict the traffic density and plan your trip accordingly. The real time data about road, city, car health condition, will be processed by inbuilt computer and helping us to manage efficient transport system. Smart phones allow us to connect anybody in the world, imagine what if your car able to communicate with you and give status updates about maintenance schedule of itself? Isn't it great!

Automobile Evolution

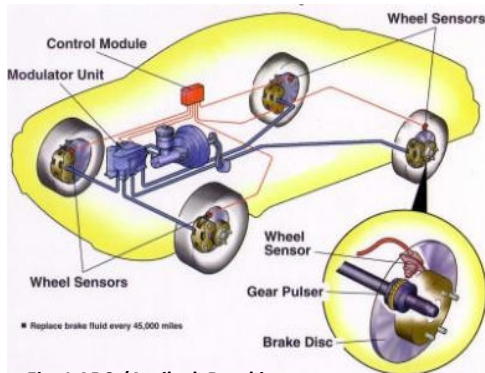


Fig. 1 ABC (Antilock Breaking System)

Here is the fact that, today any car having computing power more than the computing power we required to land 'Neil Armstrong' on the moon in late 60's.

In 80's car makers start using computers and sensors in cars to improve engine efficiency and overall vehicle performance, like MPFI system, ABS (Antilock Breaking System), EBD (Electronic Brake-force Distributor), EPS (Electronic Power Steering), ESP (Electronic Stability Program) are very common now a days.

Other side in manufacturing industry developing their own AGV's (automated guided vehicles) for material handling, from there this idea came about 'un-man vehicles'. Yes, it is very much possible in near future.

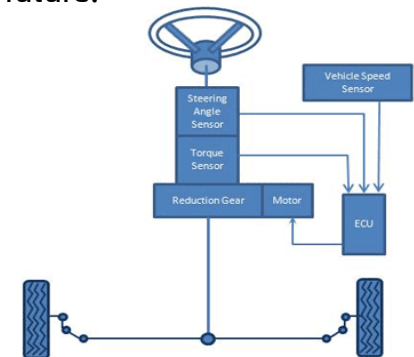


Fig. 2 EPS (Electronic Power Steering)



Fig. 3 Military Drone



Fig. 4 Driver-less Sky bus

US Army already using un-man drones to target terrorist hideout, and it is very successful. It is controlled by remotely from very far distance, hence the human casualty is zero. It is only possible because of high speed long distance communication technology. The same technology will be very useful for on road personal vehicles.

“Around 1.3 million people died annually in car accident in the world and around 20-50 millions are injured or disable”*. Auto pilot technology can help us to reduce this number.

Driver-less technology not new for us. Sky bus which is coming soon in Mumbai is also a driver less.

3.<http://dronewars.net/aboutdrone/>

*<http://www.asirt.org/initiatives/informing-road-users/road-safety-facts/road-crash-statistics.aspx>

4. http://www.kinecogroup.com/product_disp.php?pid=7&catid=1

Types of communication system in cars

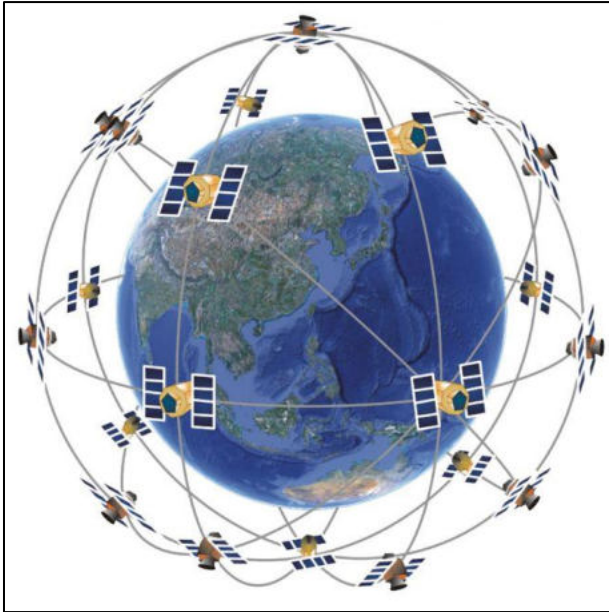


Fig. 5. GPS

GPS (Global Positioning system) allow us to track real time movement of any object which is connected to it. This is the network of satellite around the globe which is used for Telecom sector, navigation.

Today millions of people are connected by this technology. There are manly following types of communication systems we will see in the futuristic personal cars,

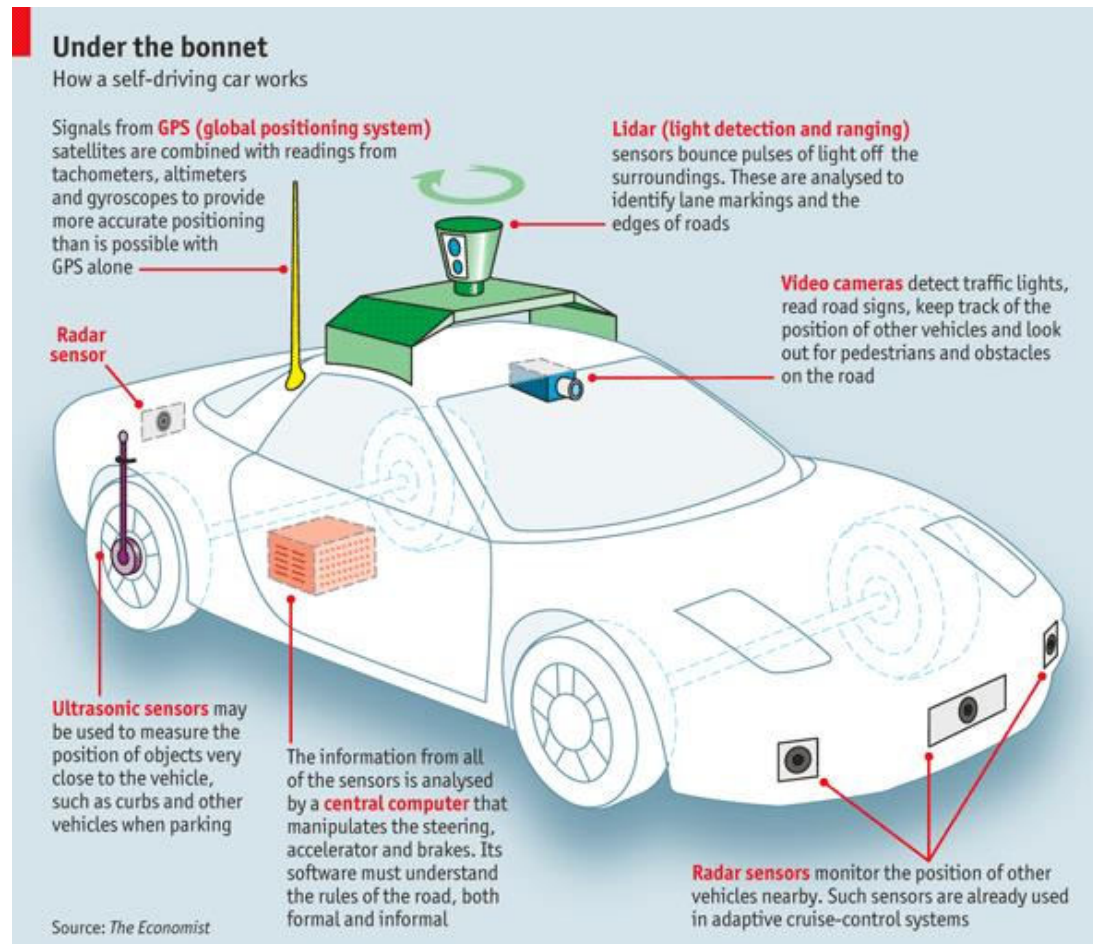
1. Internal Communication system of the Car
2. V2V, Vehicle to Vehicle
3. V2I, Vehicle to Infrastructure

Wire less communication- technology options

Coverage	Technology	Pros	Cons	Trend
Wide Area	Satellite Data/Voice Communication	Global Coverage	Very expensive, Low data rate	↓
	AM/FM Radio	Regional Coverage Ubiquitous Deployment	Only Broadcast, Low data rate, No uplink	→
	Digital Satellite Radio	Continent Coverage Exclusive Data Channel	Only Broadcast, No Uplink	→
	Digital Audio Broadcast	Regional Coverage High Data Rate	Only Broadcast, Not widely deployed yet, No uplink	→
	Cellular	Sufficient Population Coverage, Reasonable data rate (2.5G+)	Relative expensive for data, Low data rate (1 and 2 G)	→
Local Area (Short to Medium Range)	Wireless LAN (WLAN)	No license cost, Inexpensive, High bandwidth, Strong industry support	Hotspot coverage	↑
	Infrared	No license, inexpensive, already established	Limited range, limited bandwidth, only line of sight	→
Personal Area (Immediate Proximity)	Infrared	No license, inexpensive	Limited range, limited bandwidth, only line of sight	↓
	Bluetooth	No license, inexpensive	Limited range, limited bandwidth	→
	UWB	No license, Very high bandwidth	No standards yet	→

Ref. <http://aswsd.ucsd.edu/2004/pdfs/V2VandV2ICommunication-Slides-WHolfelder.pdf>

Conventional sensor for communication



<http://www.economist.com/node/21560989>

Conventional sensors like ultrasonic/RADAR useful for auto park, or detection of near by objects.

Vision and LIDAR (Light Detection And Ranging) system can help vehicle to maintain lane by vision based lane keeping application.

All this sensor have their own limitations....

They can sense only immediate vehicle environment. They are mostly passive (RADAR has limited data capabilities).

They are expensive.

Wireless communication is the new sensor. With the help of this user can connect with larger network in real time..

Here vehicle it self act as a information relays ,information source, and information recipients.

1. Internal communication



Fig. 6 Auto parking

The way driver interact with his car is completely going to change in this internal communication system.

Auto Parking-

Its already a feature in luxury cars. After reaching a destination you don't need to hassle with parking problem. In this feature car will take care of parking, you simply handover the steering to the computer. With the help of small cameras and proximity sensors Car automatically park It self within a few minutes.

Auto Service schedule -

Within next decade car will upload its status of parts condition and forecast its failure to the central data center of manufacturer and schedule its next service date. The service center will have all the diagnosed data about Car status.

2.Vehicle to Vehicle communication

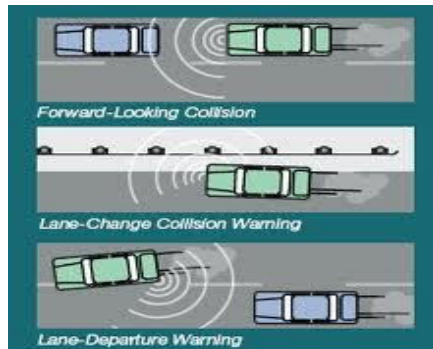


Fig. 7 anti-collision system

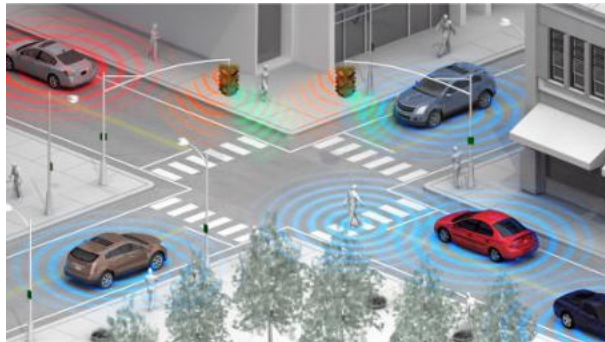


Fig. 8 V2V system

This will be the future of the personal cars. In few years it will become mandatory to have V2V system on your cars. It is the grid of all online vehicle which are traveling. Each car on the highway will be aware about other vehicle speed, direction, speed in real time. If vehicle 'A' suddenly breaks or changes the lane, the vehicle running behind it 'B', will be alerted and the auto braking system will activate and vehicle 'B' will slow down accordingly.

This system will give you all real-time data about vehicle movement. Central traffic administration can control the traffic in peak hours. Each vehicle

will keep updated about traffic ahead. Traffic control room also has data about each vehicle where it is and its activity, speed, etc.

It will be very helpful in countries like India, where new metro cities are developing and in the same amount of time we have old but fully crunched cities where the traffic problem is becoming unmanageable because you don't have space to build new roads and old roads are already exceeding their capacity.

This system is also helpful for avoiding accidents because the system is aware about its surrounding objects, whether it could be a running vehicle or pedestrians.

7.http://usdotblog.typepad.com/secretarysblog/2010/05/coming-intelligent-technologies-promise-greater-road-safety.html#.U7RoK_mSxA0

8.<http://www.gizmag.com/gm-wifi-direct/23478/>

3. Vehicle to Infrastructure Communication

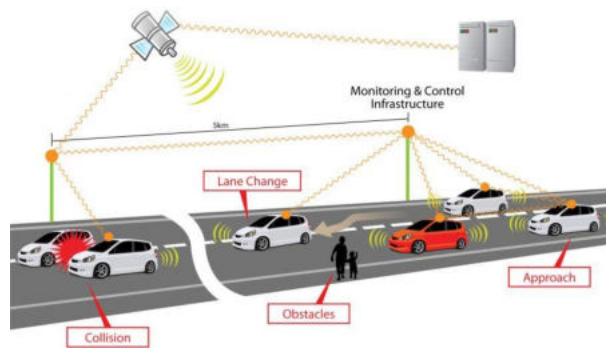


Fig. 9 V2I system

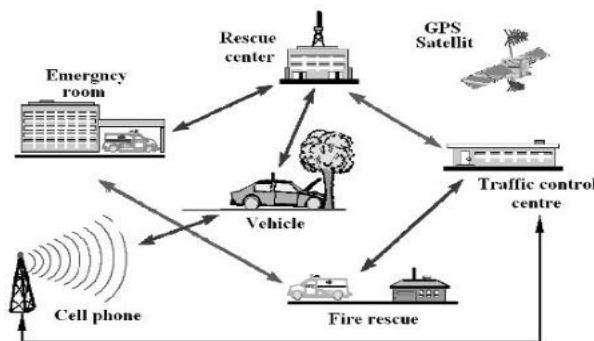


Fig. 10 V2I system in accident scenario.

Its basically a exchange of critical safety and operational data between vehicle and road infrastructure. All vehicles are connected to central command and from there they connected to all infrastructure like ambulance, emergency response team, police, traffic signals, city municipalities etc. this connectivity gives overall picture of environment and help driver to take appropriate decision.

In the emergency condition if any vehicle met accident situation, the ambulance, fire brigade, police get notification at the same time and this system can collaborate together to save maximum life. At the same time

other vehicle also get update about road traffic condition at accident spot so that any other subsequent accidents can be avoided.

9.<http://ericpetersautos.com/2014/01/07/car-doesnt-talk/>

10. http://www.apas.hk/index.php?option=com_content&view=article&id=262%03Avehicle-safety-enhancement-system-based-on-wireless-communication&catid=5&lang=en

Applications



Fig. 11 Traffic Scenario

fig.,11 ref.-<http://www.itsworldcongress.jp/program/showcase/index.html>

Traffic Scenario-

The vehicles which are congested in traffic enable with V2V communication alert vehicle which are coming behind and the system will take care of all traffic movement by notify to up coming cars to start Adaptive Cruise Control (ACC). Driver can reschedule its trip or traffic can divert to words other direction before it started get clogged.

1. Satellite navigation systems can help the car know where it is.
2. A variety of sensors, analyzed by a central computer, can provide a 360-degree view of the car's surroundings.
3. Other vehicles can communicate their behavior and intentions wirelessly.
4. Signs, roads, and other parts of the transportation infrastructure can alert the car to local conditions.
5. Pedestrians and bicyclists can alert the car of their presence.

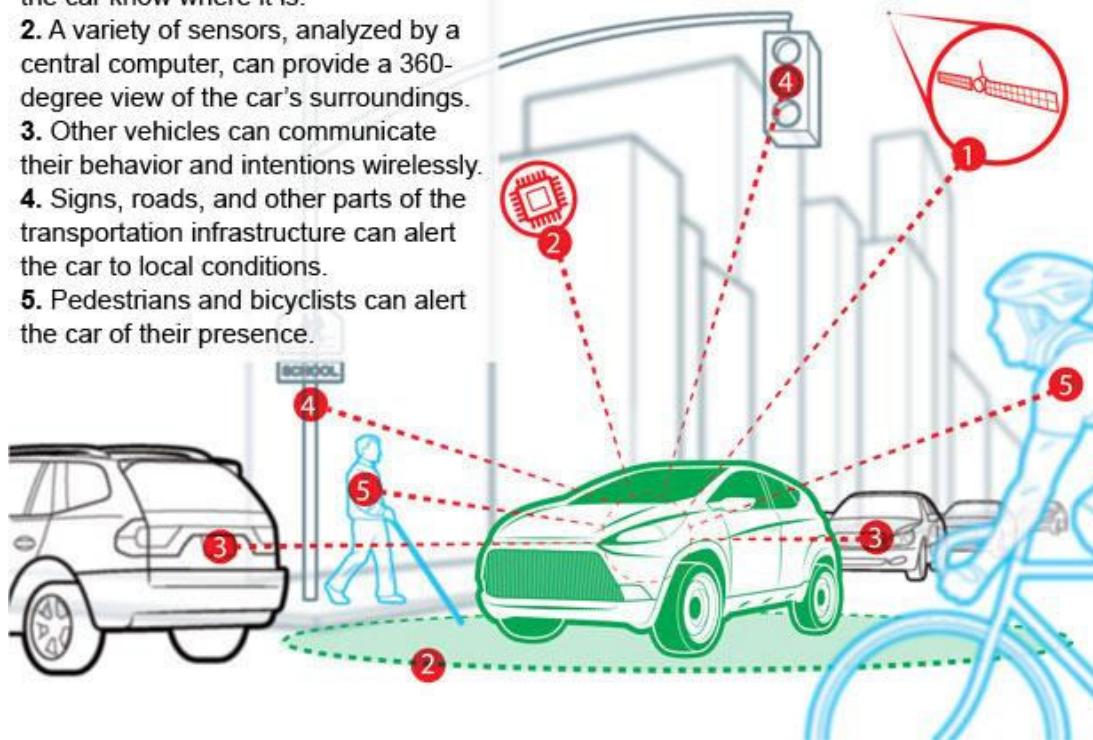


Fig. 12 Simultaneous communication of car with other systems.

Accident warning -

In situation of accident it can alert the local hospitals, emergency response team as well as cars coming behind which is on network can be notify about accident immediately for any precautions need to be taken for them.



Fig. 13 Accident Scenario

Make way for emergency vehicles-

If any emergency vehicle like ambulance are on the way or passing though to the signal it can notify other vehicle to standby for a while.

Autonomous Driving System Project

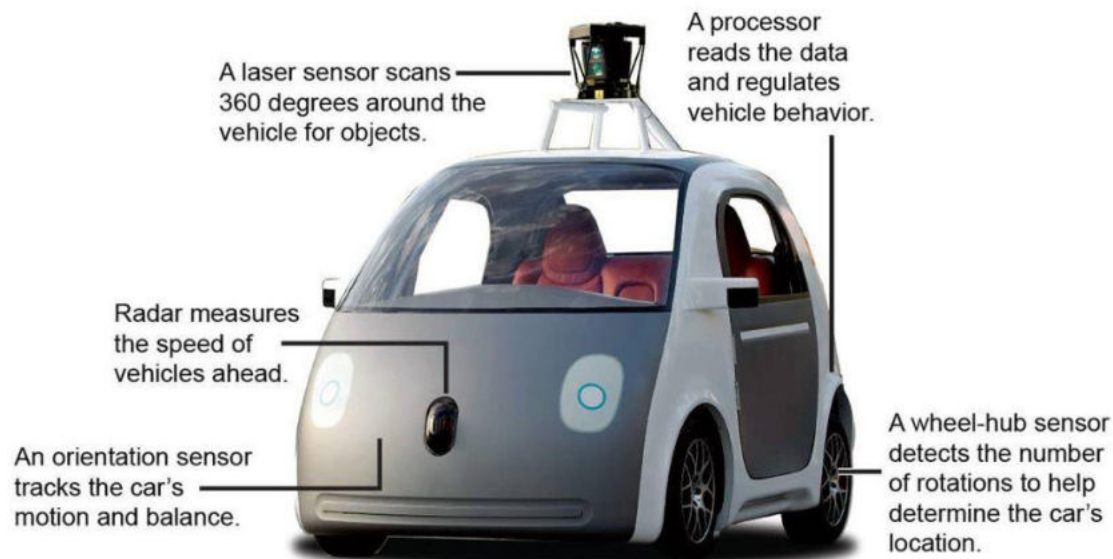
By JSAE-

JSAE (Society of Automotive Engineers of Japan) working on hybrid design of Robots and Cars. This research creating completely new kind of development in vehicle which could be lead us to autonomously driving cars, or advance driver assistance systems.



Fig. 14 Driver-Less car by JSAE

Fig 14. Ref.- <http://www.itsworldcongress.jp/program/showcase/index.html>



Source: Google

Raoul Raïfoa / @latimesgraphics

Fig. 15 Google Concept Car

By Google-

Google is working on driverless Car. Which would be more safe and enjoyable.

The first prototype is ready and they succeed in achieving safe driverless driving. The image shows their prototype. It has no steering either break nor accelerating pedal. It just two seat capacity vehicle. It is computer mouse looking car where you need to just seat and relax all the driving work will be taken care by car it self.



Fig. 16 Google Car Prototype

Fig. 15 Ref.- <http://www.newyorker.com/online/blogs/newsdesk/2012/11/google-driverless-car-morality.html>

Fig. 16.Ref.-<http://techglimpse.com/google-self-drive-car-prototype-details/>

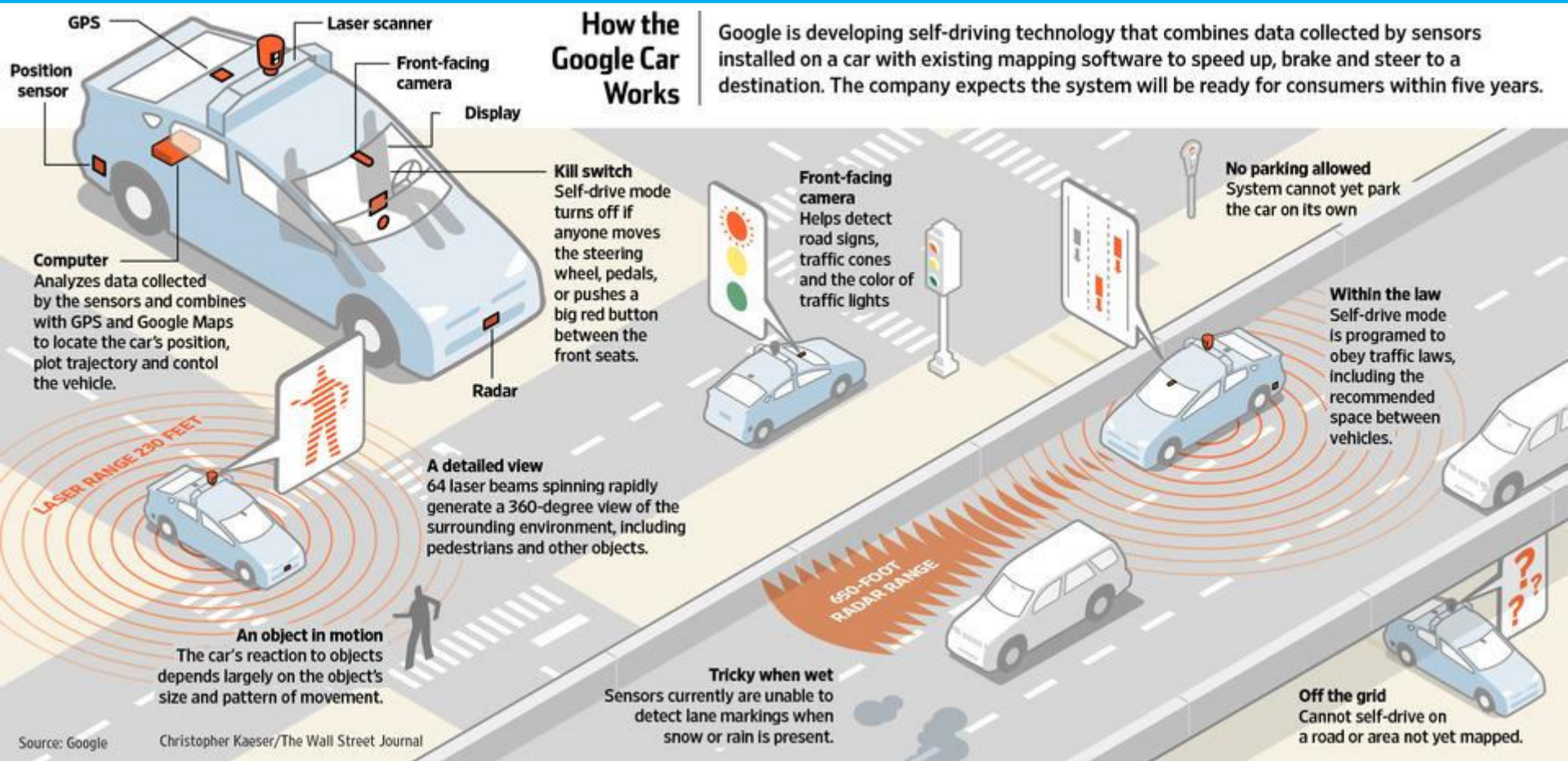


Fig. 17. Ref. <http://evansonmarketing.com/2012/10/13/whats-next-a-driverless-car-from-google/>

Conclusion

The Future-

In the near future transportation field will evolve dramatically. It will be more user oriented, Eco-Friendly, and more economical.

Personal car will change the way we travel today. with enhance technology car will be more safe and became best mode of personal transportation.

Up coming new communication system will connect everything with everyone. this networking help to manage and control the transportation system.

The new age of transportation will be much more eco-friendly and sustainable.



Fig. Ref. -<http://uinfo.wordpress.com/2008/07/31/picture-of-the-future-transportation-system/>