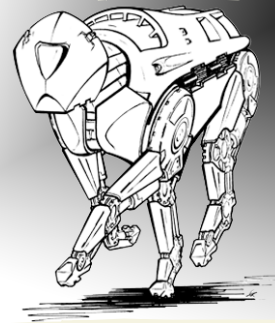


R&D Challenge - Autonomous Vehicles

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R & D CHALLENGE - AUTONOMOUS VEHICLES

The world of autonomous vehicles is changing as we know it. The past of autonomous vehicles is presenting an amazing new future with ways of improving the present. Autonomous vehicles and robots will make human life better and easier. The vehicles and robots of the future will also solve problems for the future.



Big Dog Robot [1]



RiSE V3 Robot [5]

The RiSE V3 robot will help telephone pole workers or even replace them. The autonomous blimp, AeroBot will take us out of this world and onto other planets. Zoe will search for life on other planets. Big Dog will help soldiers carry heavy weights in battle, and Stanley is paving the way for new fully autonomous vehicles.

Why Have Autonomous Vehicles?

You may think, “Why have autonomous vehicles?” Why do we really need them? Well there are many reasons, the main being autonomous vehicles will get you places faster and safer than driving vehicles ourselves. Autonomous vehicles will be able to drive hundreds of miles per hour and be inches from other cars. By doing this autonomous vehicles will get us places faster and eliminate human error so there will be fewer crashes. This will be possible because in the future the vehicles will communicate with each other. This is how they can drive so close to each other without crashing. Not only that, but it will save money because the cars will crash less if not at all therefore saving the car owner money.

Another big reason is that autonomous vehicles will save much time. In the future cars will be going an average of 200 mph. That means you can get somewhere 100 miles away in about 30 minutes all while sleeping or watching T.V. in the car. These are only some of the reasons why autonomous vehicles will be so much better than regular human driven cars.

The Facts:

- * 40,000 people have died each year on U.S. highways for over 15 years. [8]
- * Around the globe nearly 1 million people are killed in car accidents.
- * Car related deaths are the leading cause of death for people 15 - 34.
- * The cost of car crashes world wide is in the trillions per year, \$230 billion just in the U.S.
- * People waste 4-8 billion hours of time in traffic congestion each year.
- * We have around 600 million parking spaces. That's up to 10% of land in cities.
- * The U.S. imports 50 billion gallons of gasoline. We could replace that with 5 billion gallons of plant fuel that could be made right here if we had robot cars that ran on biofuel.

What Can Autonomous Cars Do For Us?

- * Solve the problem of traffic jams.
- * Make the highways safer by preventing crashes and saving lives.
- * Make better use of the inside of the car. You don't have to look out the front windshield if the car is driving itself.
- * Be more economical, especially if the robocars use alternative fuel sources.
- * Take you where you want to go, park itself (or be used by someone else) and then pick you up.
- * Go to the store and pick up things for you while you stay at home.



[7]

ATNMBL - Driverless Car Concept

Electric Powered with Solar Assist

No Driver's Seat, Steering Wheel, or Pedal Brakes

Seats 7

On the Other Hand

Do We Really Want Robocars?

- ◆ We love our cars. Are we going to want to give them up for robocars?
- ◆ How are we going to switch to robocars?
- ◆ Will we need all new highways and special roads?
- ◆ What happens to all the human driven cars?
- ◆ If we share robocars with other people, where are we going to keep all the stuff we have in our cars now?
- ◆ Who gets to own the robocar? How old do you have to be to ride in a robocar?
- ◆ Who is going to be responsible when something goes wrong?
- ◆ What if the software running the robocar fails and the car hits something and causes damage or even kills someone, who is at fault? Who will pay?
- ◆ Will people really trust robocars or be afraid of them?
- ◆ Human driven cars kill 45,000 people a year. Will people accept robocars if they kill only 1000 people a year?
- ◆ Can we really create software that is complicated enough to handle running a robocar safely?
- ◆ Could terrorists use robocars as weapons?
- ◆ If all the robocars are communicating with each other and traffic systems will people be afraid the computer technology is taking over their lives.

Autonomous Vehicles of the Past

In the past autonomous vehicles were good but, they made a lot of mistakes and usually ended up crashing or getting stuck. One of the most notable autonomous vehicles from the very recent past would be Stanley. Stanley came in first place in the DARPA Grand Challenge by driving 132 miles through the desert without human interaction. There were many other robots in this challenge but most ended up crashing. The ones that did make it across the finish line were much slower than Stanley. So don't forget that we wouldn't have autonomous vehicles if it weren't for the advancements of technology made by building past autonomous vehicles. [4]

Present Autonomous Vehicles

We have advanced greatly over the years in autonomous technology but we have a long way to go until we have the perfect autonomous vehicle. Right now there are many autonomous vehicles helping us already. Even at this very second there is a team of experts working to make autonomous vehicles better and safer. At this present time autonomous vehicles are becoming more and more part of our every day lives. Here are a few that we found interesting: Zoe from NASA [10], Big Dog [1] and Rise V3 [5] from Boston Dynamics, and AeroBot Blimp from JPL. [11]

TIME LINE

In the future autonomous vehicles will take us everywhere. So not only will autonomous vehicles get us places faster, but they will make it safer by eliminating human error. New fuels and technologies will help keep our environment clean and use alternative energy sources.

2007		Big Dog is an autonomous dog that follows soldiers by carrying ammo and supplies. [1]	1980		Ernst Eickmanns and UniBW group make the first real robot cars using vision systems and parallel computers. [3]
2006		Another challenge by DARPA and ELROB. It is an Urban Grand Challenge	1979		Shakey, Moravec [3]
2006		European Land Robot Trials Autonomous off-road vehicles [6]	1961		Stanford Cart [3]
2005		DARPA Grand Challenge. Cars drive autonomously using GPS [4]	1939		World's Fair General Motors exhibit called Futurama promotes the 1960s as a World of Tomorrow with autonomous vehicles and 14 lane express highways. [9]
1995		Autonomous Mercedes Car does 1000 autonomous miles. [3]			
1990		Nasa creates an autonomous rover named Robby. [2]			



DESIGNS - AUTONOMOUS STREET SWEEPER



The autonomous street sweeper is a simple vehicle that goes around a neighborhood and cleans the streets as seen in Figure 1. A smaller version is also able to clean areas like schools, malls, or warehouses. At school the auto sweeper could pick up the lunch area or the playground. Different tools could be attached to do a variety of tasks, like picking up cans, bottles, trash and then sorting for recycling.

This is a simple vehicle for two reasons, one is because the speed is very slow, and the other is because it is already autonomous at cleaning the street. The only thing that is left is to make it drive autonomously. That might be easy because it is extremely slow.

The robot's slow enough to run off solar panels. The bad thing is that a regular sweeper today takes up so much of the road that it is hard for drivers to get around and if it rains the street sweeper has hardly any purpose.

To be practical the sweeper would have to be designed to fit on the side of the street so it would be able to get out of the way of traffic when necessary. The great thing about it is that it is healthy for the street and the environment because it is using no fossil fuels. The sweeper would have sophisticated sensor systems in order to be able to find its way along the street. Barcodes with the street, block, and address would be on the sides of the curbs and a stripe of magnetic paint would be on the top of the curb. You can see this in Figure 2.

The sweepers sensors would be able to detect the barcode and read the information. Another sensor would be able to follow the magnetic paint stripe and stay on the right path. All of the information would be relayed to a computer which would control the sweeper's movements. There would also be obstacle avoidance systems to keep the sweeper from hitting anything, causing any damage, or hurting a person.

Benefits:

The sweeper would keep the neighborhood clean. Special cleaning systems will remove any chemicals from the streets and the environment. Trash and other waste will be vacuumed up to be recycled or disposed of properly. By being autonomous the sweeper can run continuously without much human control. It can run at anytime of the day or night. The solar panels collect and store electrical power to run the machine. See our LEGO model of the sweeper in Figure 3.

Figure 1 Street Sweep Design Drawing

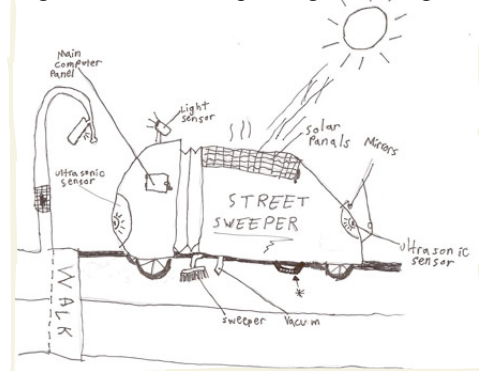


Figure 2 Barcode and Sensor

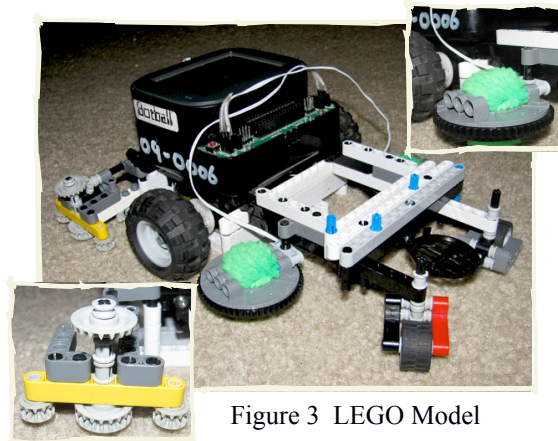
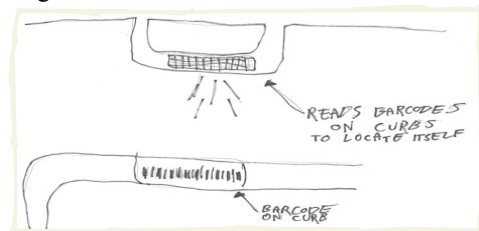


Figure 3 LEGO Model

AUTONOMOUS PLANE

The Autonomous Plane will look like any other plane except for the fact that there is absolutely no human interaction with it. By doing this it eliminates human error and gives the crew more time to check the system to prevent a system malfunction. The autonomous plane will be used to transport people and cargo. The plane will be fueled by air, electricity, and Bio-Diesel. This will help the environment greatly considering a normal cargo plane can burn about 3600 gallons an hour. The autonomous plane will make traveling in a plane, safer, faster, and much more Earth friendly. Figure 4 shows plans for the autonomous control panel.

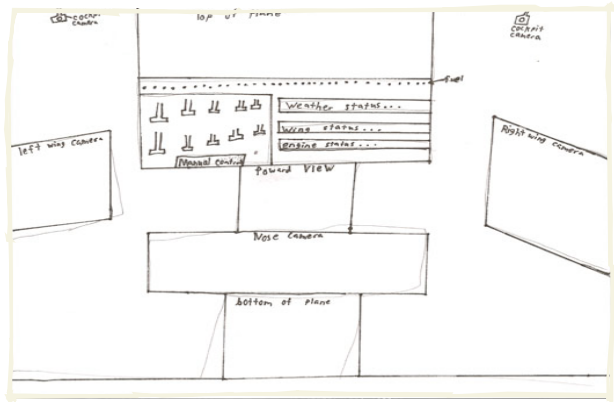
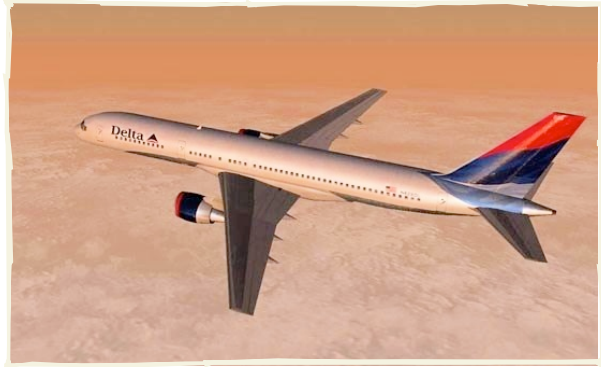


Figure 4 Control Panel Plans

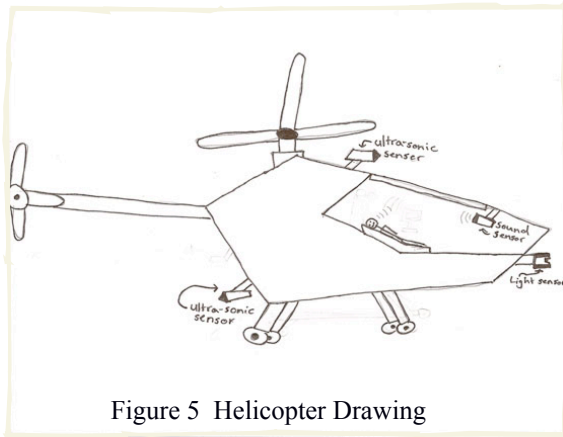


Figure 5 Helicopter Drawing

AUTONOMOUS HELICOPTER

The Autonomous Helicopter's main purpose will be for tourists or people who like to travel. It will show them the landscape all without the possibility of human error from a human pilot. The autonomous helicopter will run off of fossil fuels as it is not polluting as much as a normal vehicle due to it's short period of time being used. See Figure 5. The helicopter will be checked before every flight to make sure there is nothing wrong with the system. Each helicopter will be pre-programmed where to go, the speed, and altitude all before leaving the ground. The autonomous helicopter will make it safer to view the landscape than ever before.



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