How do self driving cars work and how to make one ?

By MOHAMMAD AAHIL 8B

Introduction

Salam today i will tell you about

Self driving cars
How to make one
And kind of obstacles can the car detect

Purpose for this project

- To help disabled people
- To help people that are in trouble
- Help people that can't walk
-

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What is a self driving car

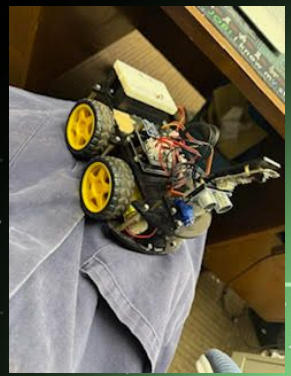
It is a vehicle capable of navigating and driving without human intervention. It uses a combination of sensors, cameras, artificial intelligence (AI), and other technologies to perceive its environment, make decisions, and control the vehicle.
It has a lot of technology and it is a car that can drive by itself and it helps a lot of disabled people .

Some technology it has Equipped with sensors like LIDAR, radar, cameras, and ultrasonic detectors to detect surroundings.
Uses GPS and high-definition maps for navigation. It has a ultrasonic sensor and a lane tracing sensor and a camera.

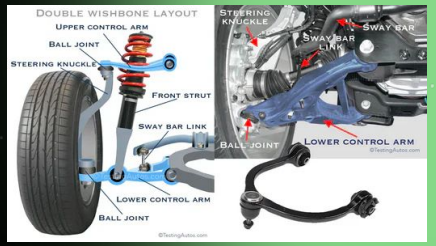
This is a lane tracking sensor

This is a ultrasonic sensor and a camera

This is a self driving car



How to self driving cars work



1. Sensors and Perception

Cameras: Provide visual data for detecting road signs, traffic signals, lane markings, and objects like pedestrians or vehicles.

Ultrasonic Sensors: Used for close-range detection, such as during parking or detecting nearby obstacles.

Lane tracking sensors the sensor will detect a yellow or a white line and will satay in that direction and if it has to turn then the car will detect the other yellow or white line then the will do the indicator and turn

2. Localization

GPS (Global Positioning System): For broad location tracking. In the board there is a tgmpu chip that is a gps for the car

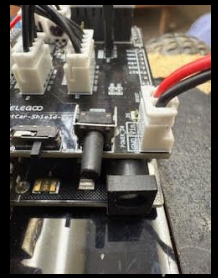
What type of functions are they

Functions of a Self-Driving Car:

- **Navigation:** Plans routes and follows them.
- **Obstacle Avoidance:** Detects and avoids objects like pedestrians, other vehicles, and road hazards.
- **Traffic Compliance:** Adheres to traffic laws, road signs, and signals.
- **Decision-Making:** Makes real-time decisions on when to accelerate, brake, or turn

The sensors and the camera so when the person is sitting inside the car they can see where they are going and if the car is manufacturing there will be a button on the car that he can press the car will stop and the hazard light will be flashing and the people behind will know that the car is not working and they can go another way then a car from a dealership will come with a scanner to find any codes and the scanner will clear all of the codes and the car will be ready to drive if the codes to not clear then the car will be taken to the dealership. And the dealership will

Try to find the code.



This is the button

This is a scanner to find any codes

Advantages part 1

1 The advantages are that i will help a lot of disabled people they have trouble going somewhere and some have doctor's appointment and some have to go to the hospital they can ask the car to take them to the place they what to go so they car will take them and they will not have to drive.

2 Environmental Benefits the car will be electric so it will have **Fuel Efficiency:** Optimized driving behavior (e.g., smooth acceleration, avoiding unnecessary stops) can save fuel and reduce emissions. And it will reduce fossil fuel

3 Emergency Response and Logistics

- **Faster Emergency Services:** self driving vehicles can quickly transport patients, goods, or supplies in emergencies.
- **Disaster Relief:** Self-driving technology can be used in hazardous or inaccessible areas for rescue or delivery missions.

4 Reduced Traffic Violations

Strict Adherence to Laws: Self-driving cars strictly follow traffic rules, reducing instances of speeding, illegal maneuvers, or reckless driving. **Fewer Tickets and Fines:** Reduced human driving errors mean fewer violations and associated costs.

Advantages part 2

4 Reduced Traffic Violations

Strict Adherence to Laws: Self-driving cars strictly follow traffic rules, reducing instances of speeding, illegal maneuvers, or reckless driving. **Fewer Tickets and Fines:** Reduced human driving errors mean fewer violations and associated costs.

Disadvantages part 1

- The cost it will cost a lot to buy the sensors will cost a lot of money the ultrasonic sensor is 80 to a 100 for small car for big it will cost 1000 to 1500 the lane tracking will cost 120 dollars the parts will take a lot time to come they will come from germany or usa or china it total estimate from me is more than 30 000 based on its model.And it will cost a lot of money to program the car.

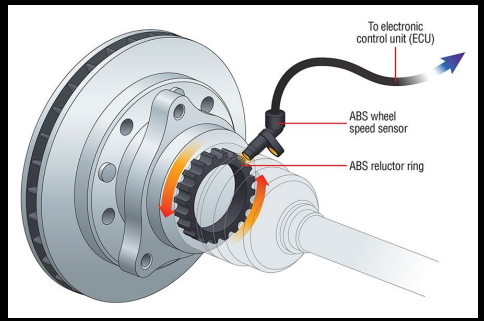
- Technological Limitations **Complex Scenarios:** Self-driving cars may struggle with unpredictable or complex scenarios, such as construction zones, inclement weather, or unusual traffic situations. **Sensor Failures:** Reliance on sensors and cameras makes the system vulnerable to malfunctions or obstructions (e.g., dirt, snow, or fog).
    - **Edge Cases:** Uncommon driving situations (e.g., encountering a sudden object on the road) can challenge AI systems.

Disadvantages part 2

Job Displacement

Impact on Employment: Automation of driving tasks could lead to job losses in industries like trucking, taxi services, and delivery. **Economic Shifts:** Affected workers may face challenges transitioning to new roles in different sectors.

Compare to a normal car self vs normal technology part 1



Technology

Self-Driving Cars:

The have a lot have sensors the have the technology to drive by them self they use a lot of ai . they have ultrasonic sensors they have a camera for the person to see what the car is doing outside they have a very good software high-definition maps, and vehicle-to-everything (V2X) communication. What is a v2x communication it is V2X communication (Vehicle-to-Everything communication) is a technology that enables vehicles to communicate with various elements of their environment, such as other vehicles, infrastructure, pedestrians, and networks. It is designed to improve road safety, optimize traffic flow, and support self driving cars driving by enabling real-time data exchange.

Normal cars they have not a lot of technology they have some sensors the abs sensor the work it does **ABS sensor** (Anti-lock Braking System sensor), also known as a wheel speed sensor, is a critical component of a vehicle's anti-lock braking system (ABS). It monitors the rotational speed of each wheel and sends this data to the ABS control module to prevent wheel lock-up during braking.

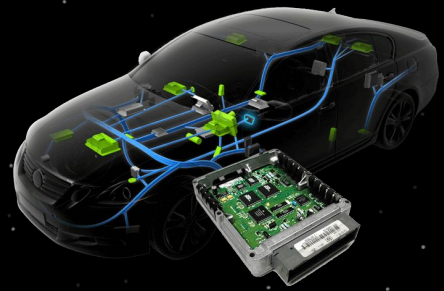
Compare to a normal car self vs normal technology part 2

Normal cars they have not a lot of technology they have some sensors the abs sensor the work it does **ABS sensor** (Anti-lock Braking System sensor), also known as a wheel speed sensor, is a critical component of a vehicle's anti-lock braking system (ABS). It monitors the rotational speed of each wheel and sends this data to the ABS control module to prevent wheel lock-up during braking. The normal cars also have blind spot sensor A **blind spot sensor**, also known as a **blind spot monitoring (BSM) system**, is a safety feature in modern vehicles that helps detect vehicles or objects in the driver's blind spots. These are the areas around a vehicle that are not visible through the side or rearview mirrors, which can pose a risk during lane changes or merging.

Self driving cars don't have this they have a lane tracking sensor it takes the lane they are turning into . They have more sensor .

Driving Control self vs normal part 1

- Self driving cars drive by them self they have the technology to drive by them self they can navigate, make decisions, and drive without human intervention (depending on the automation level).The driver is not always required to take control, particularly in higher levels of automation. The car has a driving control motherboard A driving control motherboard, also known as an Engine Control Unit (ECU) or Powertrain Control Module (PCM) in automotive terms, is a central electronic system in a vehicle responsible for managing various driving and operational functions. It acts as the "brain" of the vehicle, processing data from multiple sensors and controlling actuators to optimize performance, efficiency, and safety.



Driving control self vs normal part 2

Normal car they control with a person sitting in them Fully controlled by a human driver at all times.
The driver's skill, attention, and decision-making are critical. The thing that controls that is the the suspension and the axle the axle rotates the tier and the car drives the axle goes in tha hub and the hub goes in the tier and the engine the hub and the axle go together .
How does the axle move The movement of the **axle** in a vehicle is primarily driven by the **engine** and the **transmission system**, which work together to transfer power to the wheels.
Power is Sent to the Differential From the transmission, the power travels through the **driveshaft** (in rear-wheel-drive or all-wheel-drive vehicles) or directly to the differential (in front-wheel-drive vehicles).

This is a inner tie rod

The tie rod helps the turn left and right A **tie rod** is a crucial component of a vehicle's steering system. It connects the steering rack or center link to the steering knuckle on each front wheel, helping to transmit steering input from the steering wheel to the wheels. There is 2 types of tire rod inner and outer .

This is a outer tie rod

Cost self vs normal part 1 l

The cost to buy a self driving car is a lot because the parts a very expensive and the programing cost a lot to my estimate it will cost 189 thousand dollars with gst and if the self driving car crashes it will cost a lot to fix for the damage you maybe able to buy a new bmw or mercedes the estimate to fix this car is **61,728.05 dollars to fix this car the damage is the front and you can only get the parts from the dealer or if you can buy aftermarket parts only the bumper is 2,863 us dollars the parts are very expensive because the car is very expensive and the suspension is all gone and you know how it will cost to buy a new suspension**

Cost self vs normal part 2

Normal cars do not cost a lot but newer cars are expensive normal have not a lot of technology to drive by them self Lower upfront costs and a more established market for buying and maintaining them. And the if they get in a accident this 2**022 BMW M440I GRAN COUPE XDRIVE has a lot of damage the estimate is 53,325.00 the damage in this car is is the hood left light grill bumper air bags back bumper .**

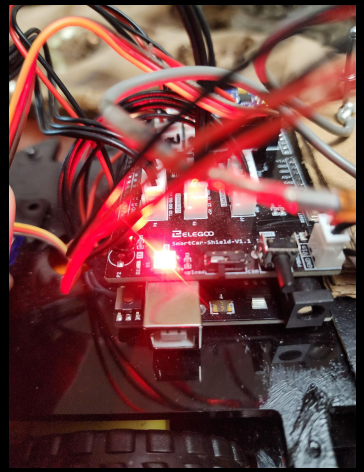
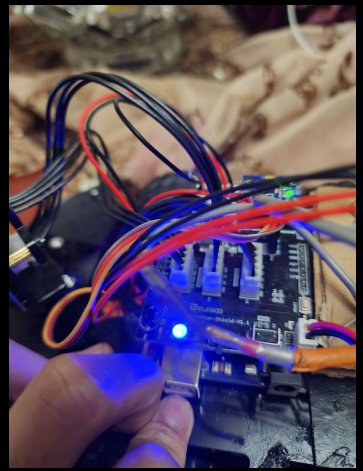
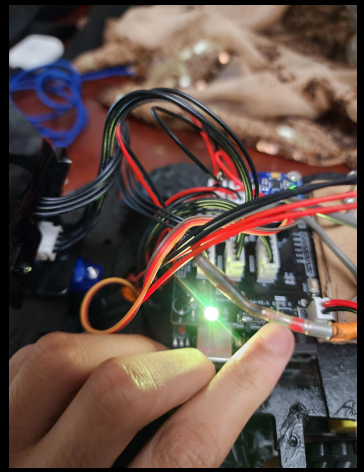
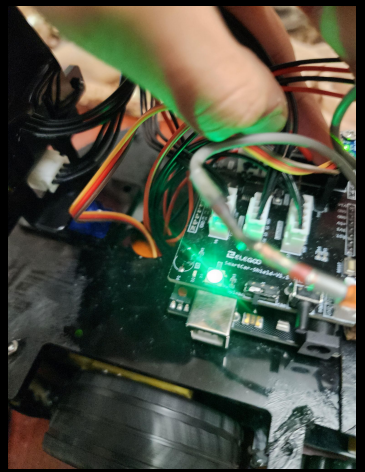
The hood is $ 1,769.93 the left light 427.01 the front bumper is 1,162.01. The grill is the most expensive part why it these stars in them is cost 2 thousand dollars

Benefits of self driving car

The benefits of a self driving car is they help a lot of disabled people the people who don't know how to drive and this is going to be the feature and enhance safety it has a lot of environment benefits self-driving cars operate more efficiently, reducing fuel consumption and emissions. Emergency Response and Disaster Management **AVs can assist emergency responders by quickly navigating to accident scenes or disaster zones. The car has a very good system of tracking obstacles and** lane tracking sensor is very intelligence sensor

How can you tell what mode is the car doing

The car will have a green , blue ,yellow ,and red light
The green light means the car is in lane tracking mode the lane tracking mode is when the car will detect the lane and stay on that lane .
The yellow light is when the car will detect the obstacles the sensor every 5 seconds will turn and will detect any obstacles in front and turn.
The blue light you can use the car to turn or you move your hand forward the car will go forward .
The light light the battery is very low and the car will stop .

How to build a self driving car

The parts you need to build a self driving car and where you can get them

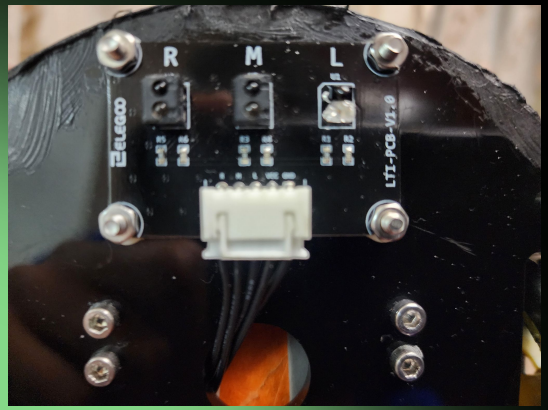
- four tires with motors heavy duty you can get them from temu
- A base for the car and h16 screws 5.5 boult and 3.3 boult from amazon
- A ultrasonic sensor and a lane tracking sensor from ebay
- You will need a breadboard and male duplicated wires
- Elegoo Motherboard
- Hot glue
- Cardboard
- paper clip
- Usb c
- A camera from elegoo
- A motor to spin the camera
- 4by 4 wires
- 3by 3 weirs
- And 2 by 2 connectors for wires
- And pra paint

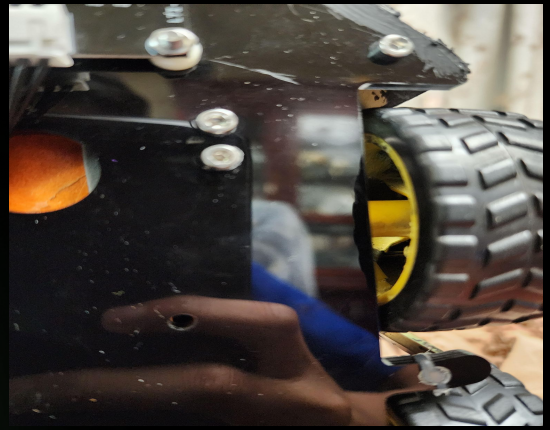
What kind of sensors are they

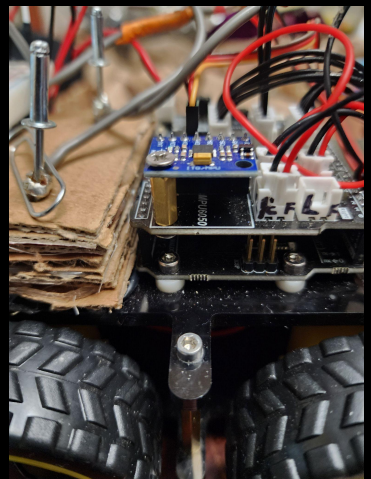
- The sensors you need are a lane tracking sensor a ultrasonic sensor and elegoo camra
- The lane tracking sensor does it tracks the lane you are going in it will detect a black or a yellow line . the ultrasonic sensor does it detects any obstacles in front the sensor will move left and right every 5 seconds to see if there is anything in front it will turn. The camera will tell the person how the car is driving if there is something wrong the car will stop and turn on the hazard lights .

How to assemble the car steps 1 to 4

- Step 1 get the motors and strip the wire and use the 2by2 connectors put the wire in the contector you have to do this for evry moter you .
- Step 2 you have the get the base of the car and put the four mother by h16 nuts and 5.5 boults .
- Step 3 put the lane tracking sensor under the base of the car and put h 16 nutes and 3.3 boult .
- Step 4 get the tgpu chip and the elegoo other board and use the gold nut and h 16 boult to put it together.







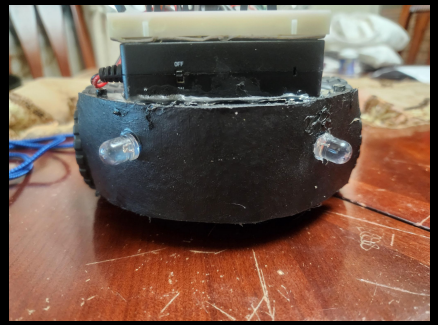
How to assemble the car part 4 to 10

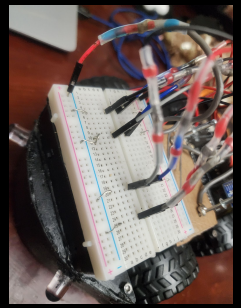
- Step 4 get the elegoo motherboard and the other mother board and connect them together .
- Step 5 connect the batter in the elegoo motherboard.
- Step 6 get the ultrasonic sensor and the camera and the camra plate put them together and the motor for the camera .
- Step 7 then is put the motors wire in elegoo motherboard the camera and the ultrasonic sensor
- Step 8 the led lights use the breadboard you need a battery pack connect positive and negative
- And just put where you what to put the lights .
- Then get some cardboard cut as the size of the car
- And spray paint it black or blue
-

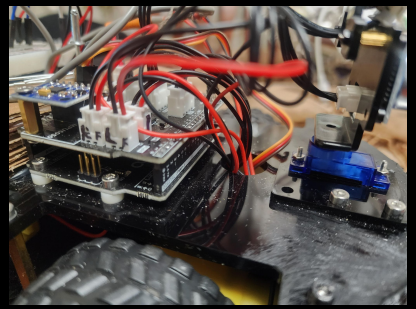
Problems when i was making the car

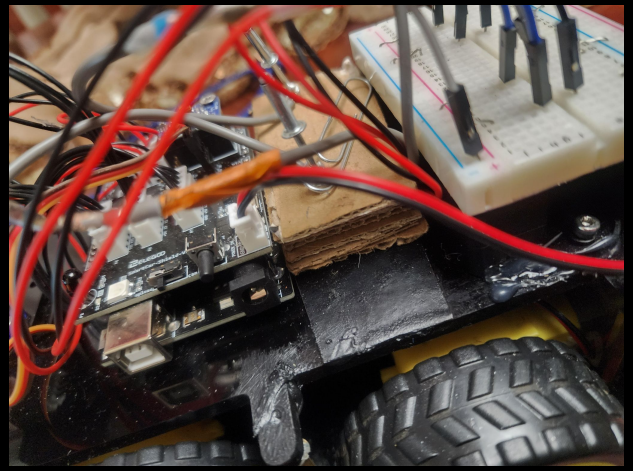
- I had problems with doing the programing the app was always lagging and was deleting the programing
-
- The sensor the small cap always getting of so i hat to put super glue
-
- The lights wire it kept on coming out of the bread board so that is why i put the male duplicated connectors
-
- and if there is more self driving maby the sensor will detect different cars not the one car .

Pictures of making the car









How did i improve my car

I improved my car by adding led lights and programing it the led lights where hard you need a breadboard a battery pack and male duplication wires and 8 normal wires
The pack connect it t positive and negative and put in the led light in se 2 of the wies in positive 5 and negative 5 then see if the light is working then you do this 3 more times.

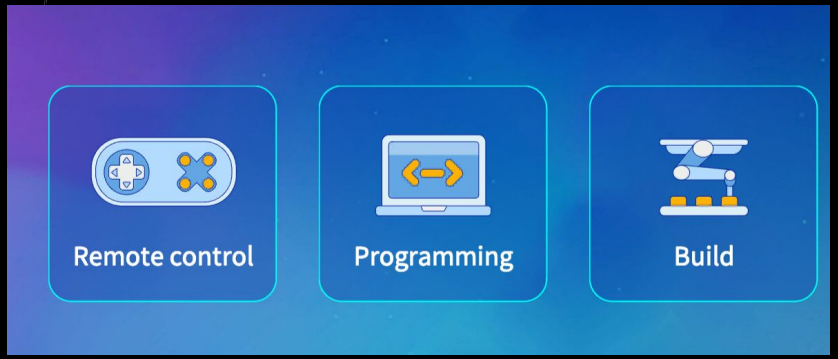
The programming use an app elegoo kit connect your device with the car to the wifi and the camera will show up then go to programing and program the car .

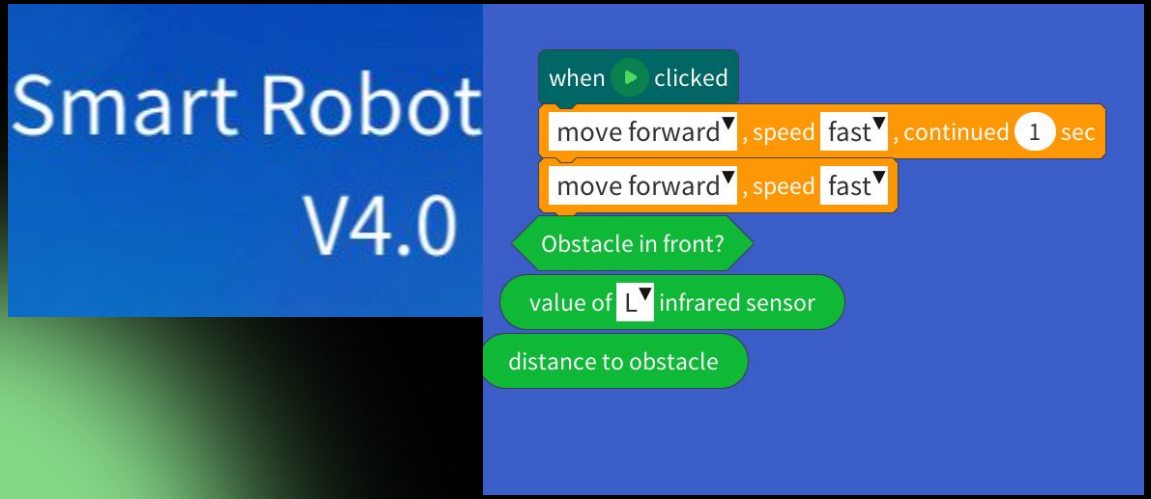
How to do the programing

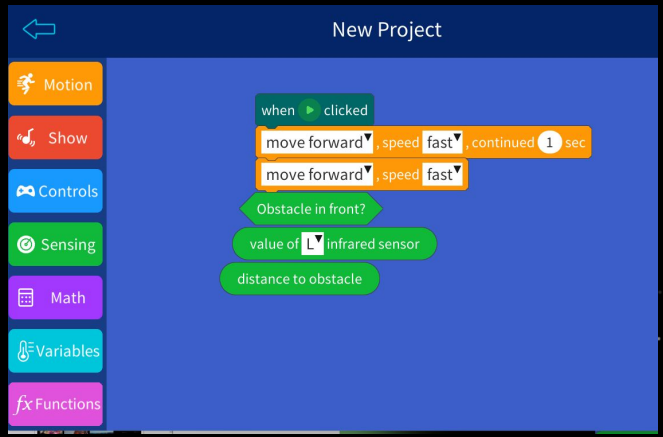
Step 1 go on your google play store or app store

Step 2 go on the app and press the elegoo smart robot
Step 3 then when you press the smart robot go on remot control
Step 4 turn on the car and go on your wifi
Step 5 connect you wife with elegoo database
Step 6 then you can see programing
Step 7 go on that and click new project
Step 8 then i did motion move forward and backward for 5 seconds
Step 8 i did the lane tracking sensor to move
Step 9 the obstacle tracking and i used the elegoo programing
Step 10 then save your project .

Pictures of the programing

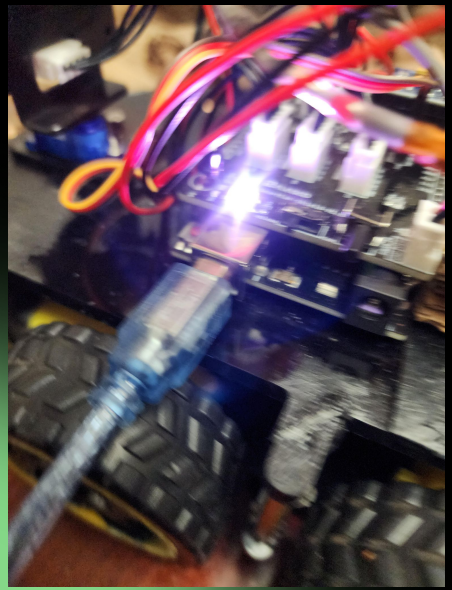






HOW CAN YOU UPLOAD THE PROGRAMING TO THE CAR

When you are done the programing on the app press save your project you need and usb type b plug in the cusb in the car and the laptop and the programing will go in the car .



The experiment time

The variables and hypothesis and the problem .

- Problem Can self-driving cars effectively avoid accidents when navigating through various obstacles?
-
- Independent variable **different obstacles cardboard metal and concrete**
-
- **Dependent variable** **How long will it take the car to see the obstacles**
-

Constant variable and hypothesis

Constant variable the wires the battery the motors the lights the sensor

Hypothesis if we use Cardboard or metal or concrete then the cars speed will change.

Procedure and materials

Materials Cardboard you need 1 big piece of cardboard

- Metal 2 sheets of metal
- And a concrete block 2 big block
- The self-driving car

Steps **Step 1: put a big piece of cardboard metal or 2 bricks .**

Spep 2 put the car in front of the obstacles a little bit far .

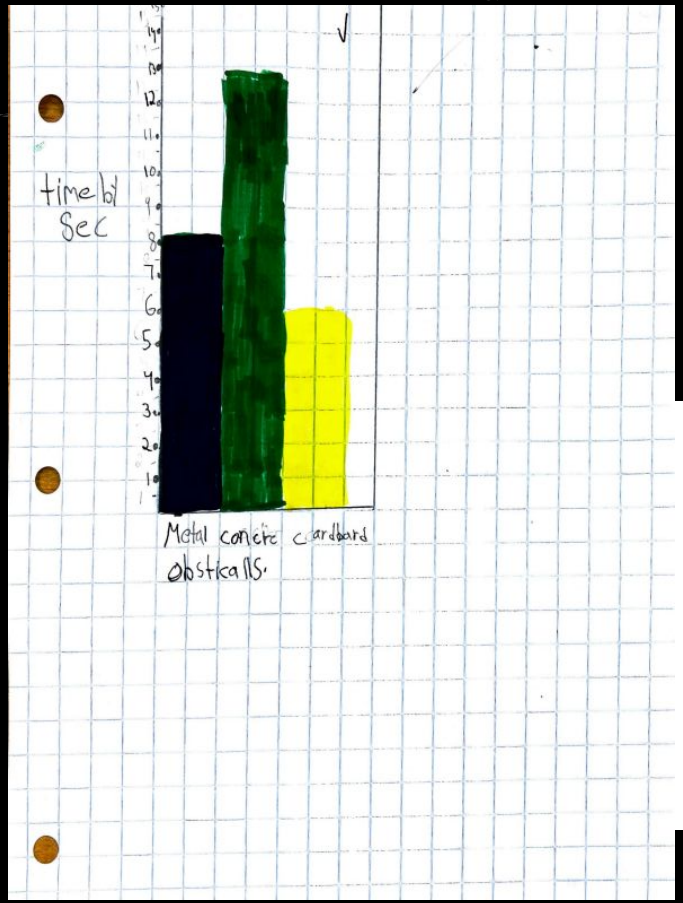
Step 3 turn on the car and the lights

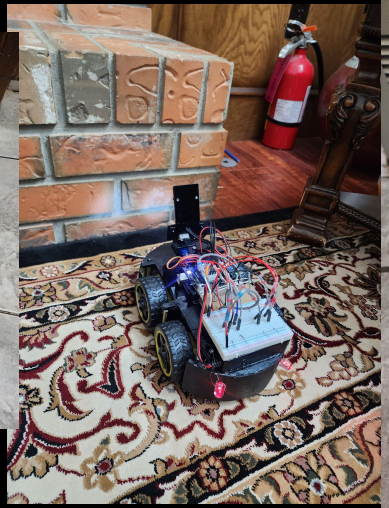
Step 4 turn on the black button and make it go to the yellow light

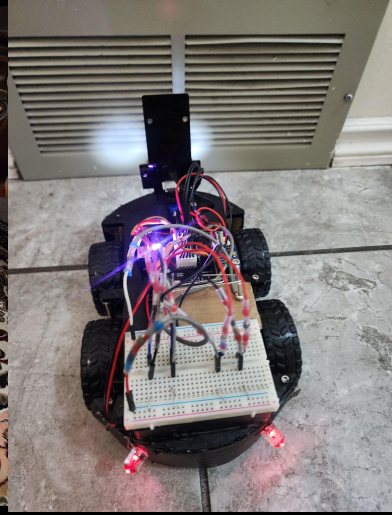
Step 5 the car will detect the obstacles and move .

Step 6 then you will record the time

Graph and table / pictures







B. Data Table: speed

Obstacles	Trial 1	Trail 2	Trail 3	Average
metal	12.06 sec	8.29 sec	6.01 sec	8.7
Cardboard	20.74 sec	11.84	8.61	13.73
Concrete	10.30	8.67	5.30	6.00

B. Data Table: speed

Obstacles	Trial 1	Trail 2	Trail 3	Average
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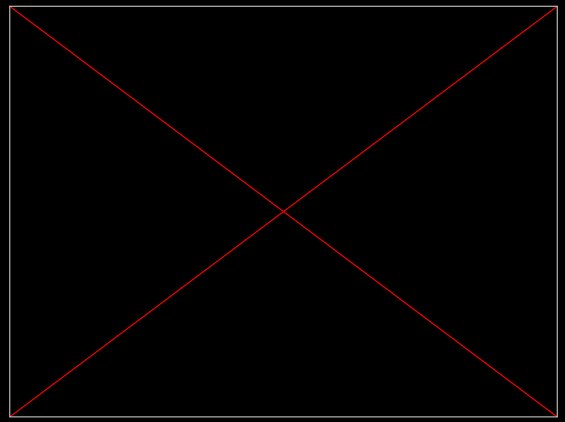
Concrete	10.30	8.67	5.30	6.00

Explanation of the table

- Obstacle 1 metal trial 1 took 12.06 seconds to detect the obstacle and the final trail took 6.01 seconds the average for metal was 8.7 .
-
- Obstacle 2 cardboard I the first trial was 20.74 seconds the 3 trail was 8.61 and the average was 13.73 seconds.
-
- 3 obstacle was concrete 1 trial was 10.30 and the trial 3 5.30 and the average was 6.00

Videos of the experiment

Video of cardboard



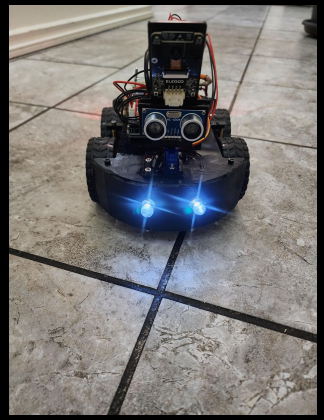
Conclusion part 1

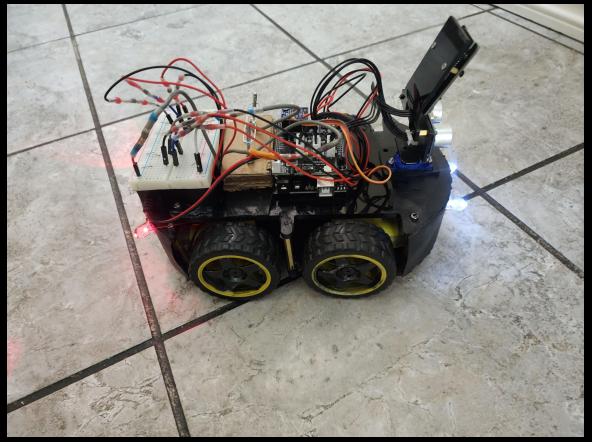
The purpose for this experiment is that I wanted to see if my self-driving car can detect different obstacles and how long will it take for the car to detect the obstacles .
I am using 3 types of obstacles: metal cardboard and concrete .And this is very good with the obstacles.
And in case there is something coming in front of the car .
The car will detect the obstacle in the front and will turn .
And the car will turn and how long will it take and the time between them.
My hypothesis is that if we use Cardboard or metal or concrete then the car's speed will change .
So when I did the experiment for cardboard I thought it would not take less time but after it took a lot of time it took 13 seconds for the car to detect the car. I thought that concrete would take the most time and it took the least time 6 seconds . And for metal i thought i will take the medium time
But took medium time it was very good

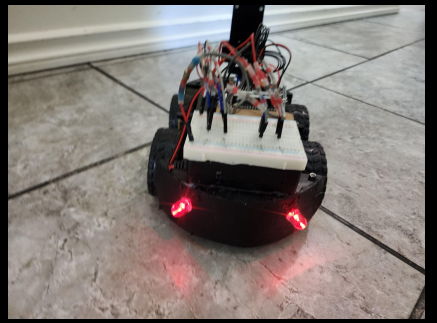
Conclusion part 2

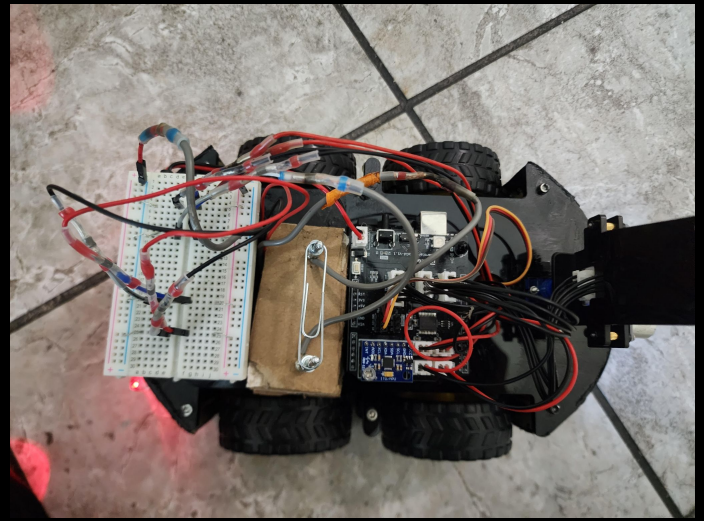
The thing that was unexpected is that when i put the car for the experiment the car had 5 percent battery when i turned it on the car was going very crazy and i charged the battery and it was perfectly fine and another thing is for the cardboard the car when i started the car was moving and the cardboard keep on falling so i put tape it it was very smooth.
What did you learn new from this experiment?
From this experiment i learned that if you need to do this experiment the when it is moving you shold turn on the light because the car is very small it can not see that much stuff in the dark .
And i learned how the car can see different obstacles

Pictures of me working









Pictures









Resource and people that helped me

- Elegoo.kit
- Desi garage
- Desi autobody
- www.elegoo.ord
- I got a lot of help from my dad Asad i got some information and how to do the programing
- I got help from my uncle faisal he helped me put the lights and the electrical he gave me information about the axel and the hub
- My teacher mrs nambiar
- My teacher mrs khaili
- My teacher mrs Bennacer
- Freya from elegoo
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The End
And thank you for listening to my science fair