Prototyping

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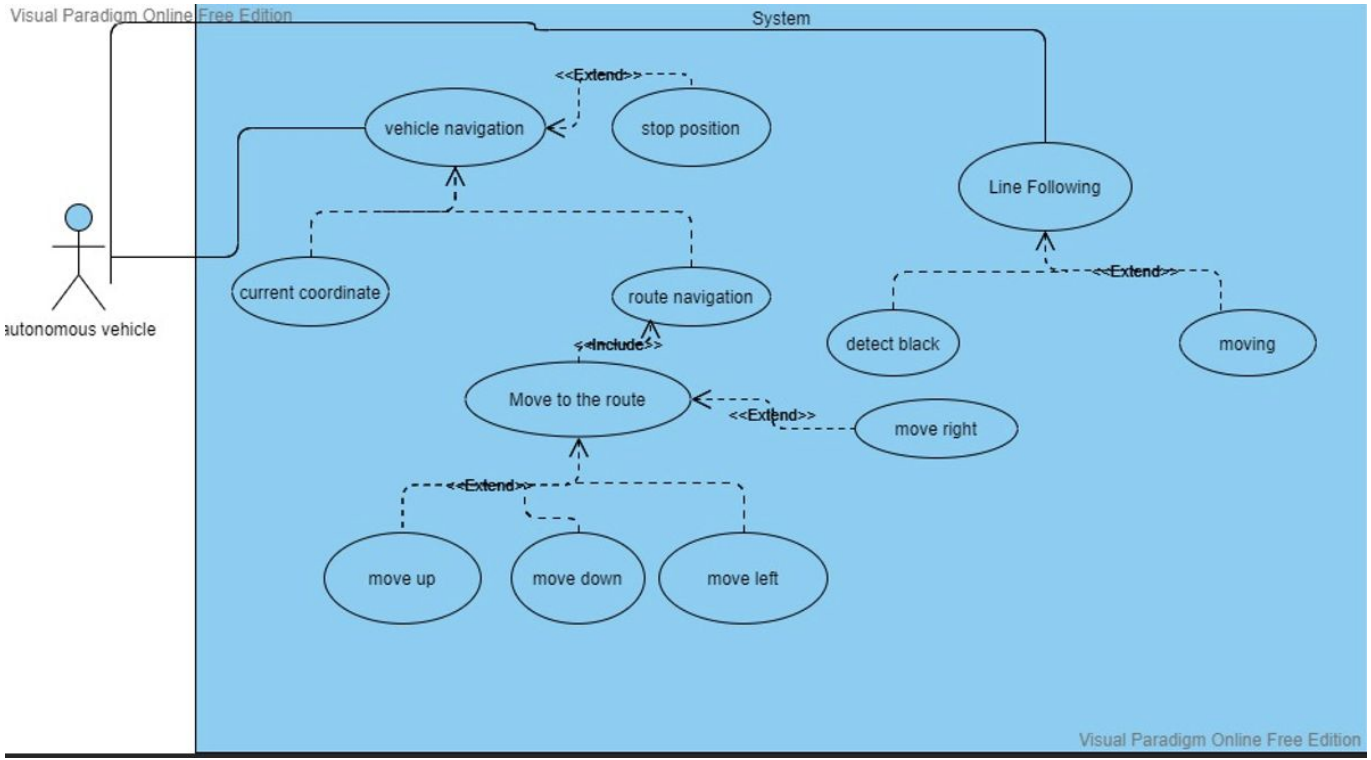
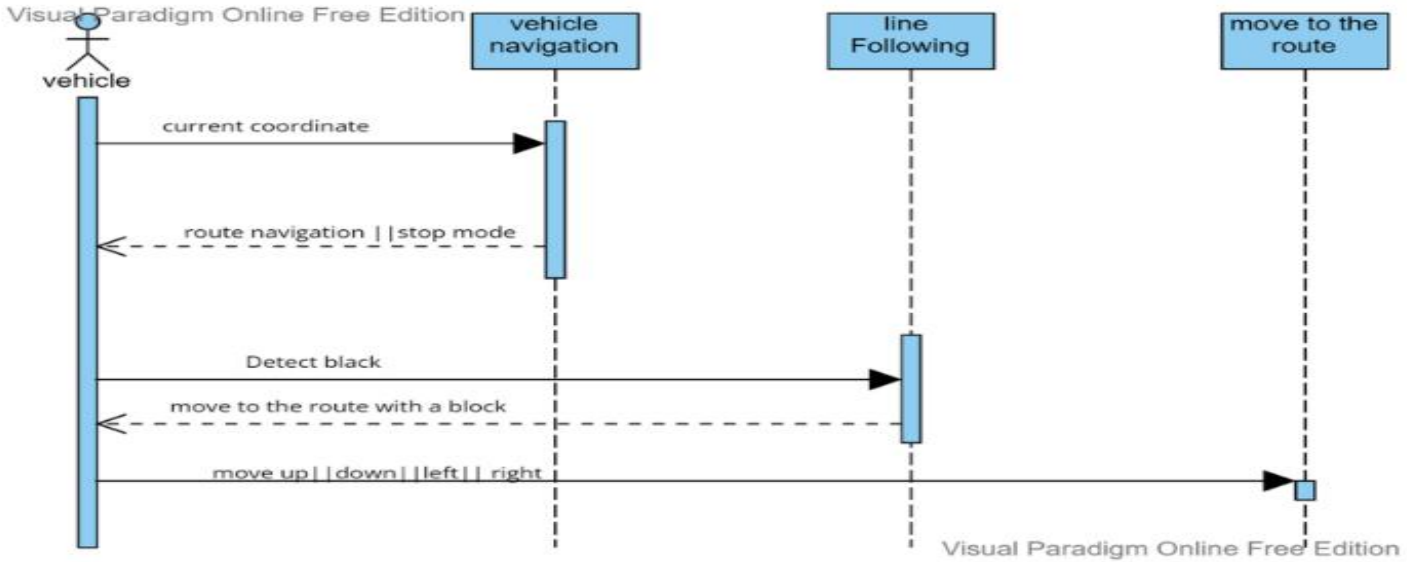
Motivation

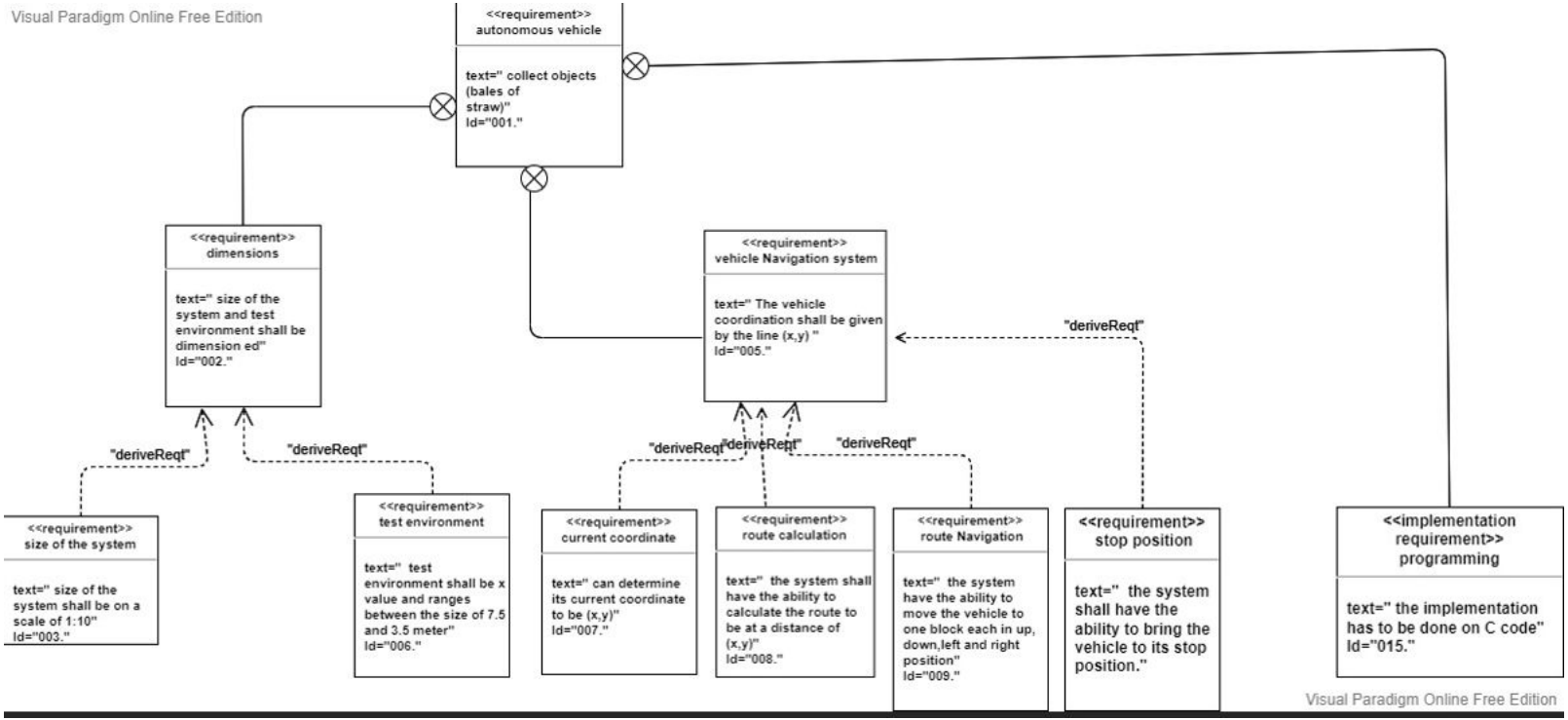
System Engineering
Use Case Diagrams



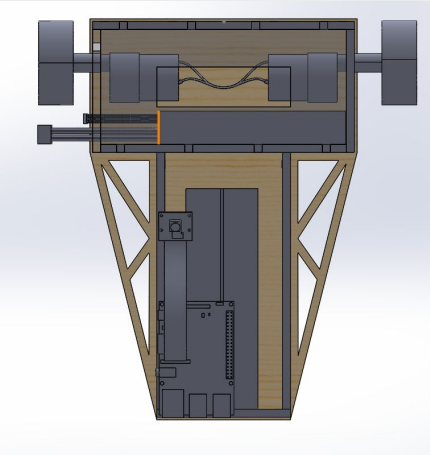
System Engineering
Sequential Diagrams

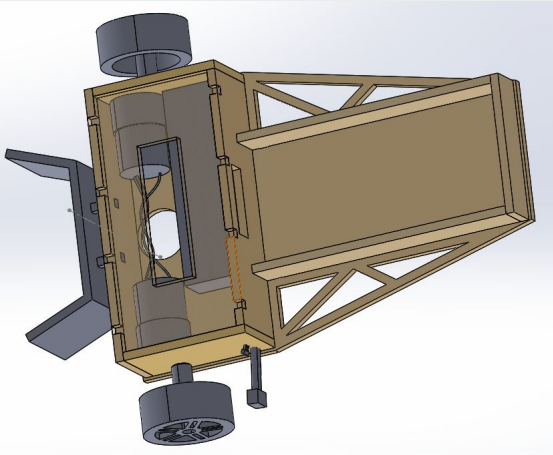


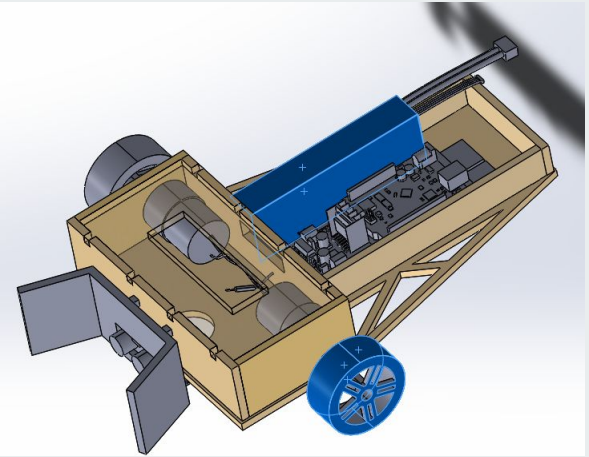
System Engineering Class Diagrams



Design
Evolution of Functional Design





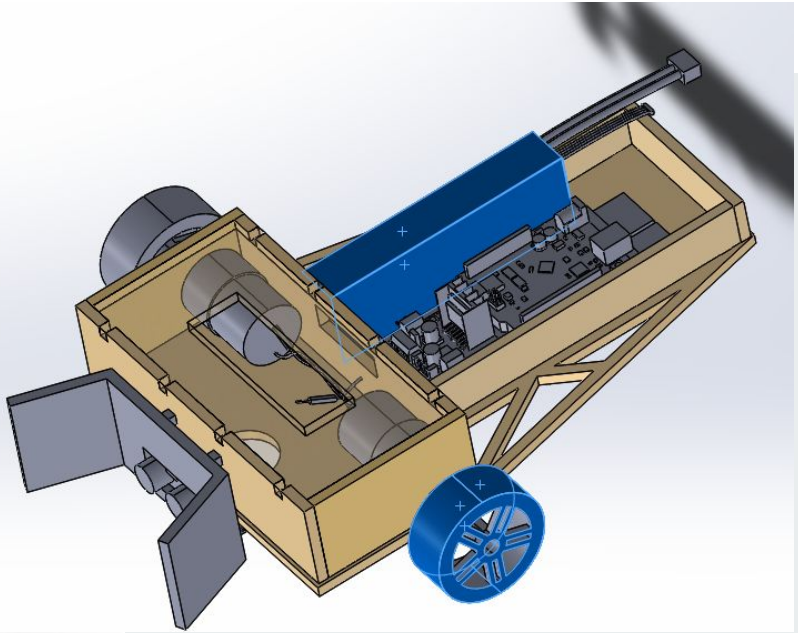


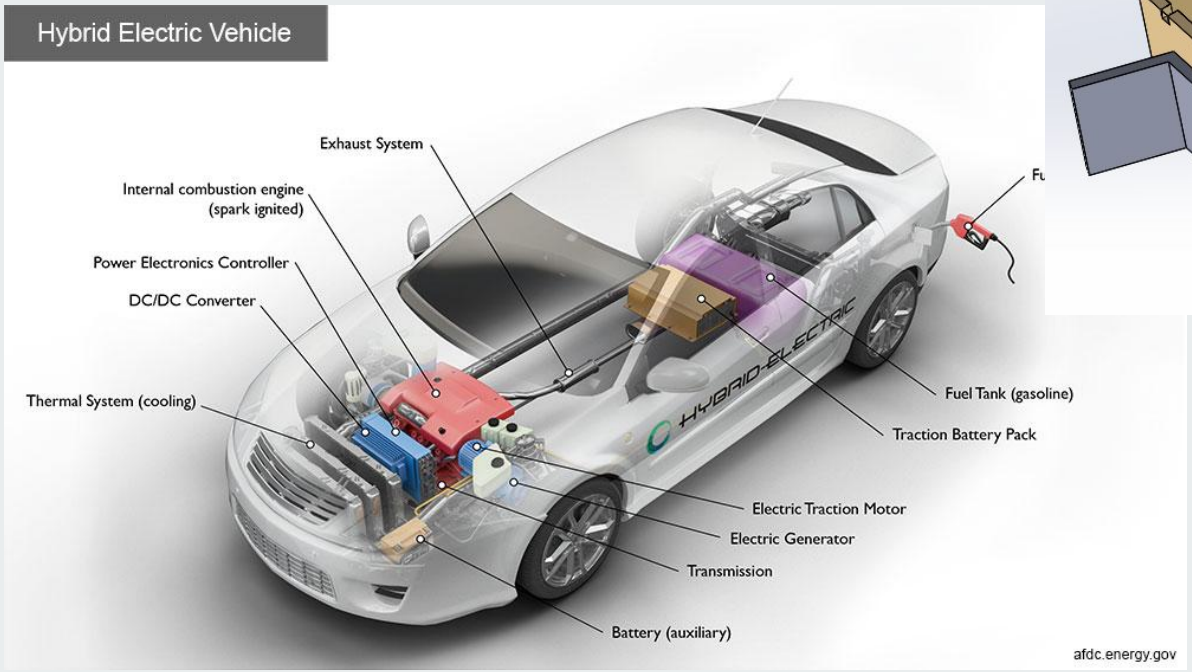
Functional Design
for the First Prototype

Functional Design
for the Second Prototype

Final Functional Design

Design
Assembled drawing of the final design

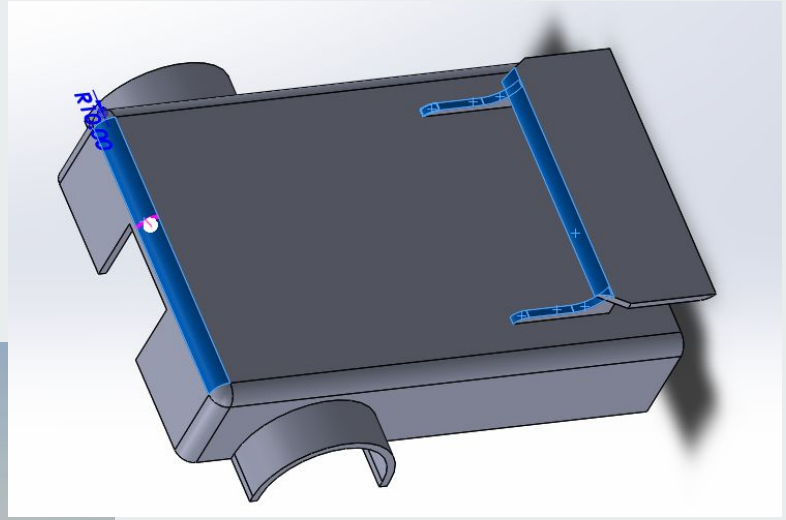




https://afdc.energy.gov/vehicles/how-do-hybrid-electric-cars-work

- Reasons for placing hardware components
- Front Wheel Drive (FWD) vs Rear Wheel Drive (RWD)
- Placing the power source

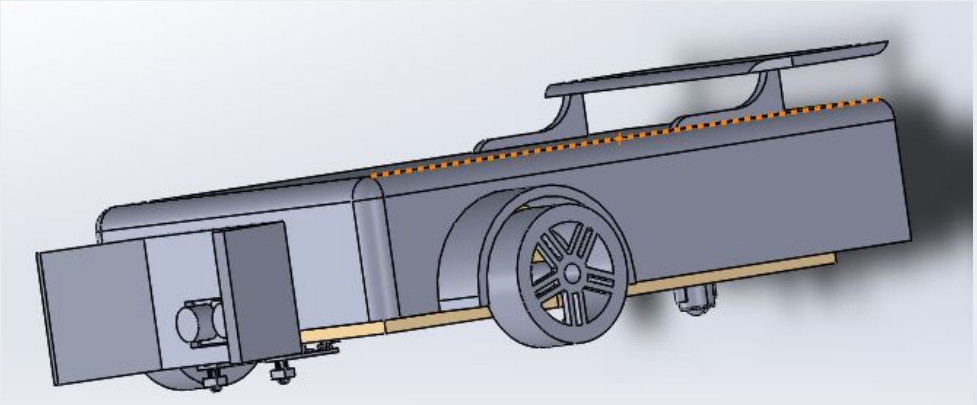
Design
Selected Design Style

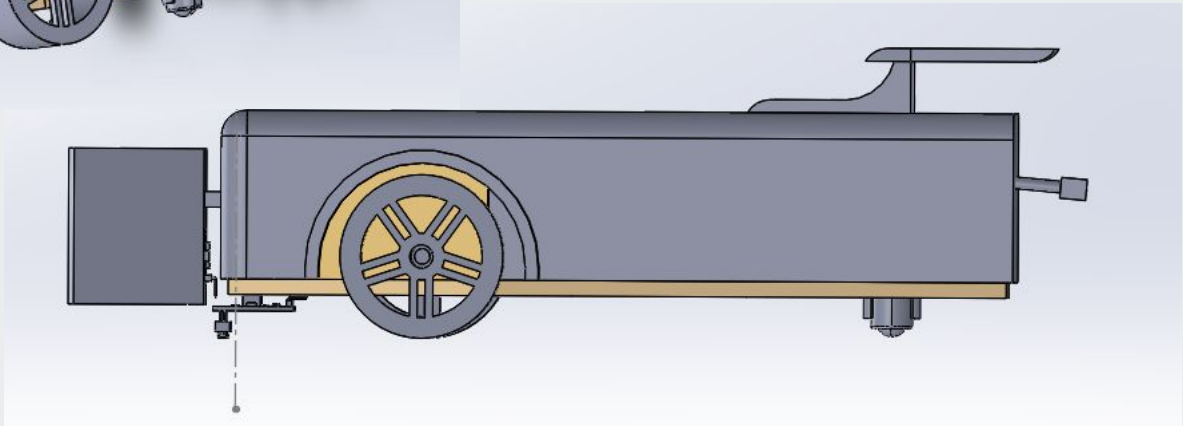


https://www.designnews.com/electronics/nine-red-hot-sports-cars-you-cant-afford/gallery?slide=1

- Streamline
- Spoilers vs Wings
- Wheel Shield

Design
Final Design Style





Code Implementation
Coordinates With X

```
}

//XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

void goTo(int x, int y){
  do{
  Serial.print("X =");
  Serial.println(startX);
  Serial.print("Y =");
  Serial.println(startY);

  while(startX < x){                                                                      //moving up
//ooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooo
    if(direction == Up){                                                                  //pointed up
      followLine();
      if(sensorValueLeft == white && sensorValueRight == white){
        startX++;
        delay(150);
      }
    }
    if(direction == Right){                                                               //pointed right
      if(turned == 0){
        turnLeft();
        turned = 1;
      }
      followLine();
      if(sensorValueLeft == white && sensorValueRight == white){
       direction = Up;
       startX++;
       turned = 0;
       delay(150);
      }
    }
    if(direction == Down){                                                                 //pointed down
      if(turned == 0){
        turnLeft();
        turned = 1;
      }
```

Code Implementation Coordinates With Y

```
  while(startX == x && startY < y){                                              //moving right
//oooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooo
    if(direction == Up){                                                         //pointed up
      if(turned == 0){
        turnRight();
        turned = 1;
      }
      followLine();
      if(sensorValueLeft == white && sensorValueRight == white){
        startY++;
        delay(150);
        direction = Right;
        turned = 0;
      }
    }
    if(direction == Right){                                                      //pointed right
      followLine();
      if(sensorValueLeft == white && sensorValueRight == white){
        startY++;
        delay(150);
      }
    }
    if(direction == Down){                                                       //pointed down
      if(turned == 0){
        turnLeft();
        turned = 1;
      }
      followLine();
      if(sensorValueLeft == white && sensorValueRight == white){
        direction = Right;
        startY++;
    delay(150);
        turned = 0;
```

Code Implementation
Follow Line Function

```
  }while(startX != x && startY != y);                    //At desired coordinates

  vehicleStop();                                         //We stop the car for 2 seconds
  delay(2000);
}

//XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

void followLine(){
     sensorValueLeft = digitalRead(sensorPinLeft);
     sensorValueRight = digitalRead(sensorPinRight);

    if(sensorValueLeft == black && sensorValueRight == white){
      Serial.println("adjusting right");
      rightSlow();
    }

    else if(sensorValueLeft == white && sensorValueRight == black){
      Serial.println("adjusting left");
      leftSlow();
    }

    else if(sensorValueLeft == black && sensorValueRight == black){
      Serial.println("going forward");
      forward();
    }
}

//XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

Conclusion