Conceptual Design:

Establish Functions

1. Gesture controlled driving
2. Voice controlled driving
3. Speed regulation System
4. Collision avoidance system
5. Self driving (predefined maneuvers)

Establish Requirements (function specs)

1. **Gesture controlled driving:** The car will be controlled by a gesture user interface (accelerometers).

2. **Voice controlled driving:** The user will be able to give specific commands to the vehicle via speech.

3. **Speed regulation system:** The vehicle will be able to sense what speed it is travelling at and regulate its speed by adjusting its output to its motors.

4. **Collision avoidance system:** The vehicle will detect obstacles that are in its path and stop to avoid collisions.

5. **Self driving:** The user will be able to command the vehicle to execute a predefined maneuver.

Establish means for functions:

1. **Gesture controlled driving:** The user will have a controller with an accelerometer sensor. The controller will read input from the accelerometer and transmit the user's gestures wirelessly to the microcontroller on the vehicle. The vehicle will use this input to control output to the individual motors. Portable batteries are required to provide power to both the vehicle and the user controller.

2. **Speed regulation system:** The vehicle will be equipped with a sensor that can determine how fast it is traveling. The vehicle will try to maintain a constant speed and accelerate between speeds smoothly.

3. **Voice controls:** The user controller will be equipped with a microphone and a voice recognition component. The controller will send commands to the vehicle if a voice command is recognized.

4. **Collision avoidance system:** Ultrasonic sensor mounted on the front and back of the vehicle will allow the microcontroller to detect obstacles in its path. The vehicle will monitor these sensors and prohibit the vehicle from driving into stationary obstacles.

5. **Self driving:** The vehicle will be programmed with specific maneuvers such as pivoting or travelling forwards/backwards a specific distance. The user will be able to invoke these maneuvers with their controller.

Generate design alternatives:

1. **Gesture control**
    a. Eliminate the vehicles ability to drive backwards so that the gesture controller can be used for different controls.

2. **Voice control**
    a. Use buttons instead of voice controls.

3. **Collision avoidance system**
    a. Have the vehicle find a way around obstacles.

4. **Self driving:**
    a. Utilize voice commands instead of buttons to initiate maneuvers.
    b. Allow the user to program their own maneuvers.

5. **Speed regulation system:**
    a. Have the user regulate speed with voice controls.
    b. Have the user regulate speed with motion controls.
    c. Have user regulate speed with additional controls, buttons/switches/knobs.

Refine and apply metrics to design alternatives:

- sceptical of how well voice recognition components will perform.
- vehicle will be lightweight, therefore might not need to regulate speed while travelling hills.
- adding too much to the user controller may make operating the vehicle too complicated and takes away from the original client statement.
- Eliminate vehicle's reverse monition so that the gesture controller can be used to control the vehicles forward motion better by also controlling speed.

client statement:
Create alternative controls and assisted driving systems that allows users, who are unable to use conventional controls, to fully operate a vehicle

conventional controls:

1. steering wheel
2. foot pedals
3. gear shifter
4. joystick, thumb stick
5. buttons?

Choose a design

Gesture Control: There will be 9 gestures that the user will be able to perform to control the vehicles motion. These gestures will be performed by tilting the controller forwards/backwards and left/right.

Gestures

Forward/left	Forward	Forward/right
Left	Flat	right
Backwards/left	Backwards	Backwards/right

Motion 1

Turn left	Forward	Turn right
Pivot Left	Stop	Pivot right
Turn left	Backwards	Turn right

Motion 2

Turn left fast	Forward fast	Turn right fast
Turn left slow	Forward slow	Turn right slow
Pivot left	Stop	Pivot right

Have not decided what motions to perform for these gestures. However, Motion 1 is preferred. If the voice controller is not able to set speed well enough, we may choose to do Motion 2.

Voice Control and Self Driving: Use voice controls to invoke preset maneuvers and adjust speed.

Collision Avoidance: The vehicle will use its ultrasonic sensor to detect objects and try to find a way around the object if possible.

Speed Regulation: The vehicle will be able to sense its own speed and adjust its output to the motors to maintain a constant speed. The user will be able to change the speed that the vehicle travels at.