## **Task 2: Short Response Question**

Now that you have explored a real robotics dataset, I want to better understand your creativity. Without Googling/asking an LLM explain how you would design a system that tries to take sensor data as an input and has to steer the car as the output. Some things to consider:

* What should the output of the system be? (There are many right answers)
* What inputs are most/least useful, and why?
* Take a step back and forget about neural networks and ML. What would your answer be without these? (These tend to be the best solutions.)

Please note that it's really obvious when you are consulting an outside source. I care about your own thought process, not you repeating back information I could also search for.



The system I imagine ends with determining the change in the state of the parts of the ego (translation vectors, rotation vectors, etc) which would guide the car forward. I would start to do this by starting with the sensors. From the sensors you can use object detection to determine the existence of unexpected things, as well as the road itself. Some methods of doing so without the use of ML would be through edge detection using the cameras (using either straight delta rgb values or through convolution and max pooling) we can identify roughly the existence of objects and the road. The road would be a little easier, as we can pretty easily overlay the edge detect over the map of the location and what is similar is probably the edge of the road. For determining objects, that is harder. Static objects can be determined through the use of radar and lidar, as they can determine the location of objects in 3D space relative to the sensor. Based on the changing location of the objects, we can determine their velocity. We could additionally fit a higher order position curve, but as most objects we are detecting only matter in fast and close situations, I am not sure of how critical it is.

Through determining the future position of the objects around the car, we can create a set of “safe points” where the car can move. Based on the set, we can also determine a loss function that makes the car want to move in the center of the safe points, while also following the road, and moving toward its destination. This would lead the system to choose the point with the lowest loss, thereby choosing an intermediate point to travel to. Based on the point we decide to travel to, the vehicle can calculate changes needed to be made to the ego state and then do that. This process repeats until the vehicle makes it to its destination.