AR:IN

Autonomous Robotics: Intersection Navigation

GROUP 11
REQUIREMENTS (Revision 0)

Derek Arts
Jonathan Klawunn
Kate Keskikyla
Kerianne Rikley
Nabil Hamza
Trent Stevenson

Purpose

The technological advancement associated with full car automation has many benefits and there is a large amount of potential for profit. Along with money the full automation of cars will aid in the reduction of hazardous greenhouse gasses by increasing the efficiency of car travel. Car automation also can give a large community of people freedoms. People with physical and mental disabilities as well as the elderly can now have the freedom of personal transportation and can minimize their reliance on other people. All these factors and more are why the automation of cars are extremely valuable.

For the automation of cars, driving through an intersections are a crucial part of this. This advancement requires effective car communication as well as the ability to handle a large variety of scenarios. The automation of intersections has tremendous benefits as well, in the 2010 report done by the department of transportation national highway traffic safety administration they showed that 40% of the crashes during 2008 involved an intersection, and 96.1% of intersection related crashes were at the fault of the drivers as opposed to car failure or environmental reasons. This is why the automation of cars through intersections is an extremely important technological advancement

Scope

Our project will consist of making two cars that will be able to detect and follow and change lanes while avoiding oncoming traffic. The cars will be able to detect other cars, intersections and other obstacles and be able to stop sufficiently ahead of them. In the case of driving the car will monitor the location of nearby obstacles and cars, as well as follow the laws of the road. Approaching an intersection, the cars will be able to detect a stop sign and stop within an appropriate distance and time. At an intersection it will detect other cars and either wait for that car to go or to go in advance depending on right of way as well as car ID if the arrival times are the same between the cars. The car will successfully drive through the intersection. The cars will also be able to communicate with cars made and designed by other groups using a regulated protocol system.

Monitored and controlled and constant variables (with units)

Type	Name	Units
Monitored	Obstacle locations	m with rad
Monitored	Distance until intersection	m
Monitored	Speed	m/s
Controlled	Acceleration	m/s2
Constant	Safe stopping distance	m
Monitored	Center of lane	rad
Controlled	Direction	Rad (deg)
Monitored	Other car outputs	none
Controlled	Personal outputs	none
Contant	Car id	none

Behaviour

The automation of the car will will be able accelerate on command, stopping, maintaining speed as well as turning in a controlled manner. The automated vehicle will drive in a sensical manner avoiding unnecessary lane changes as well avoid illegal actions and safely navigate intersections. The car will also be able to visually detect lane lines as well as other objects and intersections and act accordingly. The car will send and receive information via a predetermined protocol.

Normal operation and undesired event handling

The car will work under normal circumstances as described here. It will use proper lighting akin to a sunny day and be able to properly detect stop signs, as well as lane lines. The lanes will be clearly marked and will not be faded ensuring that the lines are definitively where they are. The sign will be at a reasonable angle as to not skew the octogonal shape that the car uses detect the sign. The car will be able to compensate for not perfect conditions and will use its past knowledge to accommodate. In addition to the prefered conditions the car will be able to handle cars or other objects abruptly appearing directly in front and then will therefore be able to perform an emergency stop. The car will detect other moving objects and if it is unsure of what the object is doing

then it will slow down and increase the gap between the car and the object to ensure safety.

List of requirements

requirement	Qualifier	Likely to change
Efficient inter car communication	Within x sec	no
Car velocity relative to other objects	Safe distance	yes
Stop at intersection / obstacle	Within x m	no
Effectively follow lanes	x% of time	no
Ability to identify stop sign based on shape	Within x sec	no
Ability to identify stop sign based on colour	Within x sec	yes
follow laws	Success / fail	yes?
Manual override	Success / fail	yes

References

-https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/811366