Universidad
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Mobile Robotics (III). Obstacle Avoidance.

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Introduction.

In this project, we will solve the obstacle avoidance problem.

To do it, we implement the VFF algorithm. This works like a force compensation, where attractive forces are generated by our target, and repulsive forces by any obstacle detected.

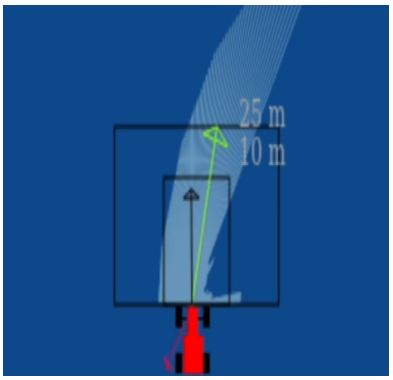

Fig 1. Force representation.

Attractive force

The first step is to obtain the force generated by our sub objective (target). To do it, we need to use the relative pose with respect to the car.

Once we get it, we must differentiate between x and y components.

In this case I've decided to use constant value for x component (vertical, defines velocity of the car), because we want to hit more than one sub objective, and we want to optimize our lap time.

On the other hand, the y component (horizontal, defines direction), is multiplied by an adjusted value, to smooth the behaviour.

Repulsive force

In order to follow the VFF theory, we establish one value per laser measure.

To adjust it, we have to define an inverse proportionality dividing the distance with a tested factor K.

Next, we get again x, y components oriented properly, and we sum all together to obtain a repulsive resultant. This overwrites far away values, giving importance to near obstacles.

Last step is to compensate the importance of the actuation between every component. To do it, I've added another factor to reduce x interaction and avoid minimum local problems.

Resultant force

Finally, we join attractive and repulsive parts and we use that to command linear velocity (x part) and angular velocity (y part).

Conclusions and comments.

After adjusting every characteristic, VFF works properly, avoiding obstacles and also reducing velocity when the car approaches to one of them.

The best lap time result was scoring approximates 2 min 37 seconds, anyway, the lap with all recording programs running in background scores 2 min 58 seconds lap time.

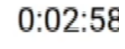

Fig 2. Lap Time.