FLYTBASE ASSIGNMENT

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Goal 1:

The objective of the goal was to make the turtle reach a point specified by the user. The turtlesim_node interface is divided into cartesian coordinates. (0,0) bottom left and (11,11) top right corner. To achieve the motion of the turtle from one point to another, we have defined constants of P(kp), I(ki) and D(kd). The errors are calculated using a feedback loop. Using the errors and the PID Values, the velocity is calculated and pubished to '/turtle1/cmd_vel' topic.

Goal 2:

The Goal requires us to make the turtle move in a grid like formation. So we define the corner points of the grid that the turtle needs to travel. Then make the turtle travel to each of the grid points using the velocity calculation algorithm used in Goal 1. With addition to that the acceleration and deceleration is limited using another function. The Velocity is increased in steps. And each step is checked with time so that it does not increase more than the specifiedn acceleration. Thus acceleration control is achieved

Grid Formation:

1. Go to starting position as fast as possible.
2. Grid Points are declared which is travelled to by the turtle one after the other.
3. The Turtle Orientation is changed after it reaches a location by the specified angle.
4. The grid points declared specify the x, y and angle of the turtle.
5. The turtle comes to the initial point after the last grid point and restarts the process.

Goal 3:

1. The radius and velocity of the turtle is given.
2. The velocity of the turtle is increased in steps like in Goal2.
3. rt_real_pose is publised with the actual pose of the robot every 5 sec.
4. rt_noisy_pose is published with actual pose added with guassian noise generated using the random module of python.

Goal 4:

Launch the `turtlesim_node` with one turtle to begin the chase.

1. Use the `circle` function from Goal 3 to initiate the circling motion of the 'Robber Turtle'.

2. Launch the `turtlespawn` node with a 10-second delay. After the delay, call the `spawn` service with random values to spawn another turtle named 'turtle2'.

3. Launch the `chase_limit_accel` node. The node subscribes to `rt_real_pose` and waits for 5 seconds before receiving its first goal position.

4. the chase is considered complete when the turtles were 3 units apart

5. The problem is sometimes the random turtle is generated already within 3 units of the ‘Robber Turtle’ which results in no motion.

6. The speed of the PT determines how far apart they will be when the next `rt_real_pose` comes in.

7. The size of the circle plays a role as a smaller circle will complete the chase quickly if PT is fast enough.

Goal 5:

Due to the greater velocity of PT (Pursuer Turtle), it will always gain on RT (Robber Turtle) even in small increments, as PT reaches RT's last location quickly and RT does not move far from that location.

If PT reaches a location where RT has been before, RT would have traveled a greater distance than what PT can catch, making it uncertain if PT will catch up in this case.

However, for a circular path, the RT periodically returns to previously visited locations, and the velocity gradients of PT and RT have the effect of closing the gap between them.

The video demonstrates this behavior, where the velocity of RT is 2 and PT is limited to 1.

REFERENCES

1. TurtleBot Spawn Message:

https://docs.ros2.org/foxy/api/turtlesim/srv/Spawn.html

2. TurtleBot to move to a particular location:
https://wiki.ros.org/turtlesim/Tutorials/Go%20to%20Goal#The_Proportional_Controller

3. Random Gaussian Noice Generation:
https://www.geeksforgeeks.org/random-gauss-function-in-python/

4. Turtle Sim Pose Message Structure:

https://docs.ros.org/en/diamondback/api/turtlesim/html/classturtlesim_1_1msg_1_1__Pose_1_1Pose.html