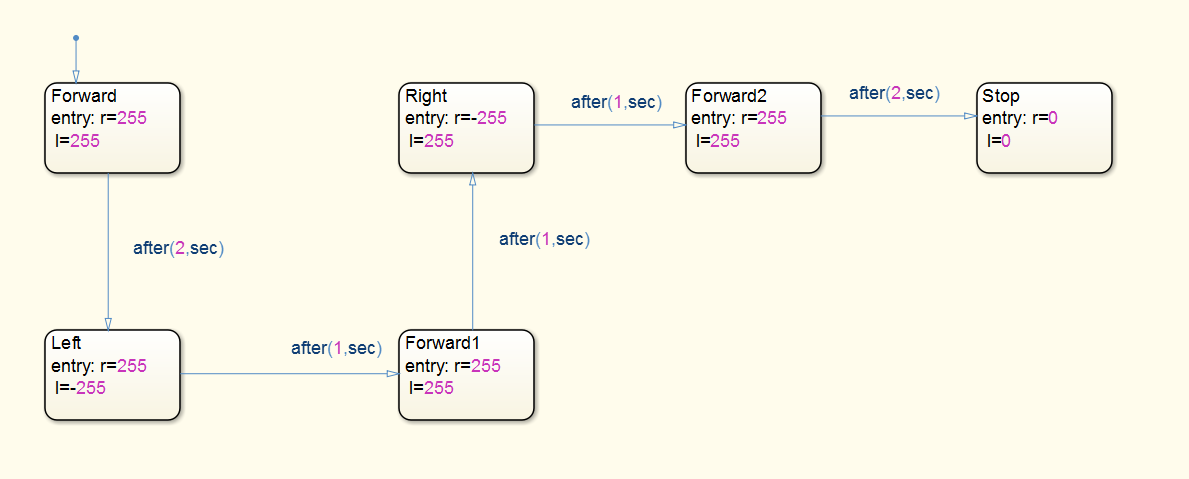
Goals: To introduce students on how to create a chart in Simulink.

Standards: (f), (i), (j)

Sequence:

1. Students locate the motor blocks for the MiniQ in simulink and drag this into the workspace. *(2 min)*
2. This motor block will then be attached to a chart block. Walk around and ensure that everyone has the chart block selected correctly *(5 min)*
3. Create the first straight section of the Simulink Dead Reckoning program in the chart or reference students follow. Then add in the left turn to the Simulink model which then gets the robot to stop. Deploy the model to hardware and then the classroom tests their MiniQ robots.
4. Discuss the results and why the behavior occurred during dead reckoning. *(40 min)*
5. Alternatively reference SimulinkDeadReckoningWithCharts.slx and guide students through each section of the chart *(20 min):*



Evaluation:

1. At this point students must have a good understanding of the outputs the charts are creating and also the angles the robot turns relative to the function, “after(1,sec).” Propose the idea that distance can be measured for how far the robot travels during a “after(1,sec)” period, angles as well (90 degrees, for example). Experimenting with these first and then recording some results is likely to make the dead reckoning process easier.

Activity:

1. Situate mini tunnels around the classroom. This can be as simple as an arrangement of chairs. From an established starting point students will program robots to tunnel these chairs and during this process everyone’s Simulink model will be adjusted from the original template created as a group. (60 min+)

Extra Dead Reckoning Activities:

1. Create triangular movement
2. Create star movement
3. Go under a bridge. The bridge is a 3D printed component which can be placed out in an open area and must be passed under by the miniQ robot. The location of the tower can be changed.
4. MiniQ under the bridge challenge: MiniQ has to go under a mini bridge at a specified distance and angle. Students have only a certain amount of attempts to reach the project objective.

Creative Commons License

This work is licensed under a [Creative Commons Attribution-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/).