DTU Electrical Engineering
Department of Electrical Engineering

Squid II - An autonomous walking robot

Developed as part of course 31384 - Modular Robotics, 2012

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Abstract – The Squid robot is made for the purpose to get through the route made in laboratory. The mechanics is made for simple direction movement going forward and to sides. It uses a simple decision making machine which always want to go forward. In normal speed it reaches the goal all the time. In double speed it only reaches in 40 % of the cases.

Introduction

The four legged robot, Squid, is working in two modes. Remote controlled mode which is described in [1] and autonomous mode which will be described in this poster.
The Squid is running its motors with the sinusoid algorithm, where each motors has its own frequency, angle, amplitude and offset.
Description of this and flow chart of the main robot movement control in robots main loop is shown in [1].

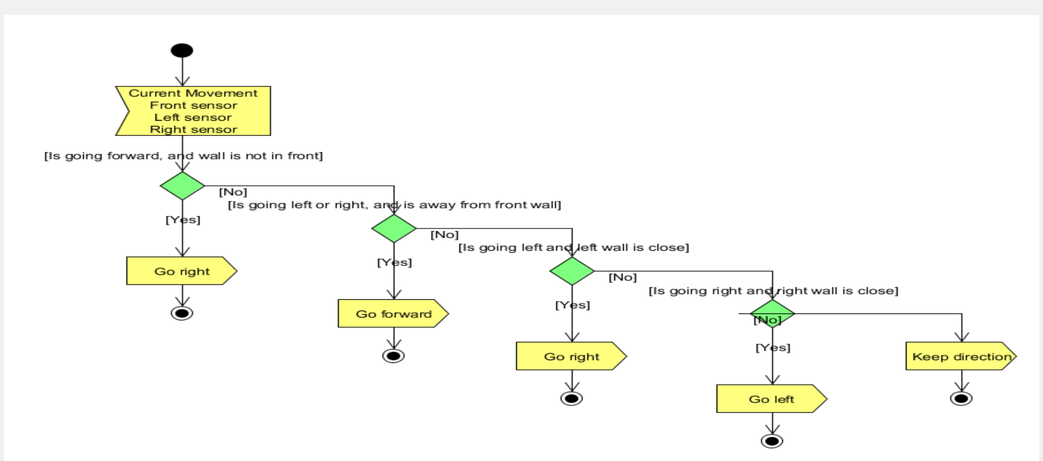
Case specific decision making

The way the robot makes its decisions is based on the task on getting through an already known route.
With the existing decision machine the robot would not reach its goal in case the route was mirrored

A picture of the robot, Squid. The Squid looks equally in remote controlled and autonomous mode, but only in autonomous mode the three sensors is used.

The mechanics for autonomous decision making

The autonomous decision making for this robot, has been chosen because of the robots mechanical way of working.
The robot does not have the physically possibility to going forward and at the same time having an offset for going also in a left or right direction.
It is one direction at the time.
The robot has mounted three sensors for making the decision engine possible. One long distance sensor in front, placed on the battery in middle of the robot, and a left and right IR sensor places on each leg.



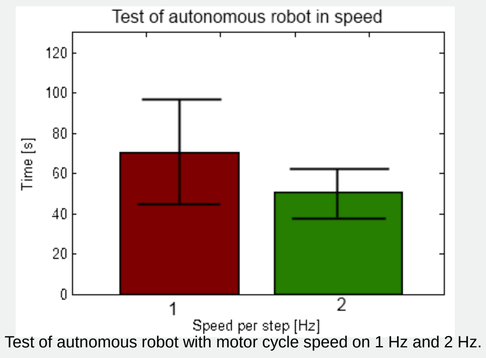
UML diagram shows the decision making for the autonomous Squid robot. This is a flowchart of the state “Generate direction from sensor inputs” from [1] flow char diagram.

Autonomous movement

The decision making machine, is always preferring go forward. For the robot forward is the way to get to the goal. The front is also the direction where the robot observes the environment best with its long range sensor.
Should the robot meet a wall in front, it will go right until the front road again is free.
Should the robot be going to left or right and end up finding a wall on its way, it will go the opposite direction.

Observations

Doing the tests, the robot ended up closing down, due to low battery.
All 6 motors has made a full move, going from start to end position and back for each step the robot takes.
In this case around 13 cm (a bit less when going to left or right).
For each turn at least two motors has to carry the weight of the robot
It seems the robot is using a high amount of power to move. Compared to a “walking” robot which moves for each step each leg takes, in this case all legs has to take a full step to finalize one step.



Test of autnomous robot with motor cycle speed on 1 Hz and 2 Hz.

Results

Going through the route with the robot in standard chosen mode with 1Hz cycle on all motors, I robot went to the goal all 10 of 10 times. The average time was 71.9s.
The second test, making the autonomous decision while robot going in double speed, its shown a better average time value for on 52.5s. But 3 out of 5 times the robot did not find the route end. The robot ended up going the wrong direction due to the robot in double speed mode jumped more then walking resulting is was not going straight forward, left and right.

Related Work

[1] Hans-Peter Wolfs poster “Squid – The remote-controlled walking robot”

31384 – Modular Robotics
3-weeks course in June, 5 ECTS
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