BONN-RHEIN-SIEG UNIVERSITY OF APPLIED SCIENCES

Scientific Experimentation and Evaluation
- Assignment 01 -

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1 Design of Experiment

1.1 Consider how to best record the end poses of the three times 20 runs of the robot.

This experiment is about getting a model of the movement of robot. So we are interested in the end pose of the robot after applying a motion command to a robot standing in the start pose. As for one part's position of the robot will not be enough to specify the orientation of the robot, we consider the positions of all three wheels when specifying the pose of a robot.
To measure the end position of the robot, we need to specify and record the end pose of the robot with respect to some coordinate system. As for we are interested in the movement with respect to the starting pose, we define this as the origin of our system.
To reduce measurement errors and make the measurement process easier, we use a grid on the paper ground. To avoid to much (unnecessary) work in advance we use a coarse grid of 10cm x 10cm sized cells. To determine the exact position we use a ruler within these cells.

1.1.1 Experimental Terms

Measurement System

- The ground paper with the grid
- Measurement tools (ruler)
- Robot

Measuring Facility

- The ground paper with the grid (see figure **??**)
- Measurement tools (ruler)

Measurand:

- Travelled distance

Measured (quantity) values:

- Position of left wheel
- Position of right wheel
- Position of front wheel

Measurement Result:

- Robots end pose specified by three wheel-positions

Device under Test (DUT):

- Robot (see figure 1.1)

Sensitivity:

- Millimeters

Display:

- Gridded paper ground

1.2 Describe in writing the robots design, the measurement process and the expected problems.

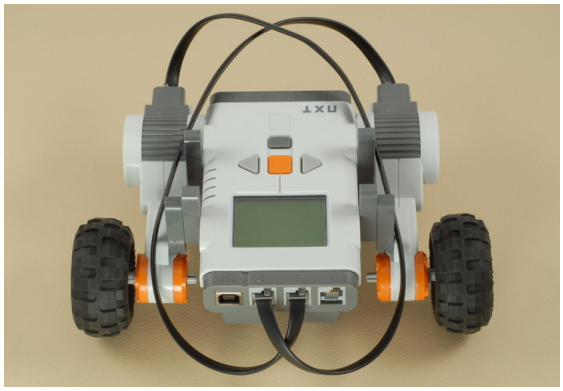

Figure 1.1: The five minutes robot : http://www.nxtprograms.com/five_minute_bot/DCP_8899.JPG

1.2.1 The Robot's Design

Our robot is the 5 minutes bot as can be seen in figure 1.1. It consists of two actuated wheels on the sides of the robot and one free spinning wheel in the front.

1.2.2 The Measurement Process

We first fix and mark the robot's starting pose on the paper ground. For each run we place the robot's wheels exactly on their marks and run the movement program. After the robot has reached its end position, we mark the wheel positions and then use our grid and a ruler to get the values of their positions. Each value gets recorded.

1.2.3 Expected Problems

One problem will be the exact measurement of the wheel poses. There will probably already be small inaccuracies when marking the wheel positions, but also using the ruler to determine the values of the positions will yield additional inaccuracies.
Another problem will be the exact positioning of the robot in the start pose.

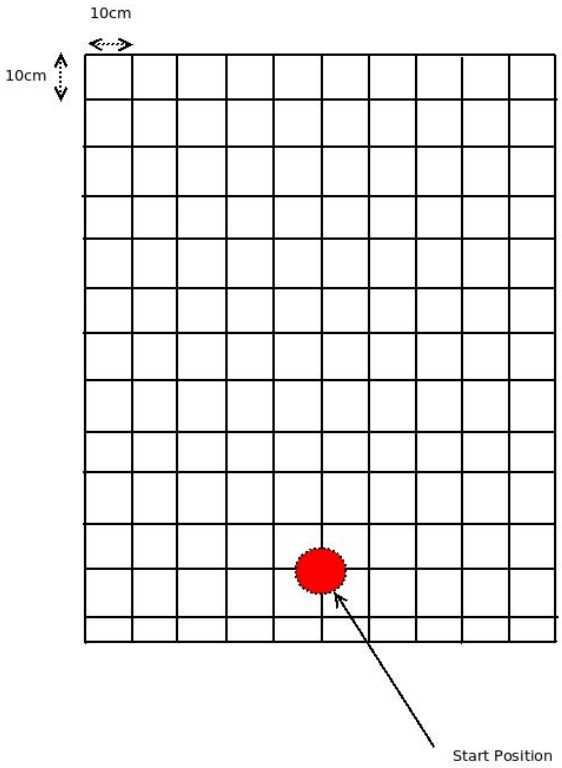

Figure 1.2: The measurement facility: gridded paper

1.3 Give a rough (but justified by some arguments) estimation of the expected accuracy and precision of your measurement process.

As humans we are probably able to place the robot in its start pose and to mark its end pose with only a few (5mm) millimeters off. The measurement using a ruler and our grid will probably hold another one or two millimeters. So we expect errors within the range of roughly a centimeter.