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Topic	Embedded Systems

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Robot Testbed

An Approach to test the movement of a two-wheel robot

Existing Hardware

System Structure
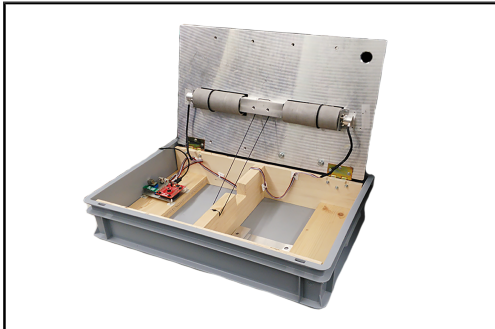
Graphical User Interface

Problem: When designing an autonomous robot, it is important to compare the pilot command and the actual movement in order to achieve a precise relative navigation system. The most intuitive way to test the robot is to measure the movement directly on the ground. However, this method has several disadvantages. For example, the absolute position of the robot is always changing. So it is difficult to test some robot functionalities because the robot often has to be connected with cables for communication or power supply in an ongoing project. Moreover, manual measurement of the movements could be complicated and inaccurate. Thus an embedded, microcontroller based testplatform was implemented on which the global position of the robot is not changing anymore. With the robot testbed the virtual position of the robot can be tracked and calculated continuously. To configure the robot settings and to illustrate its coordinates dynamically, a Windows-based graphical user interface (GUI) has been developed with the QT Framework.
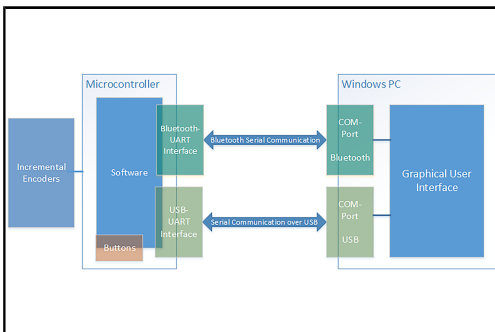
Objective: The Robot Testbed is a platform that aims to validate and test the movement of a two-wheel robot. The wheels of the robot are placed on two axis-fixed cylinders. With the rotation of the wheels, two rotary Encoders attached to the cylinders sense the rotation of the cylinders and send increments to a microcontroller. The used Texas Instruments TM4C123GH6PZ microcontroller includes two quadrature encoder interface (QEI) modules. With this microcontroller, an odometry algorithm is applied for processing the data from the QEI modules and calculating the rotation distance of the cylinders as well as the movement of the robot.
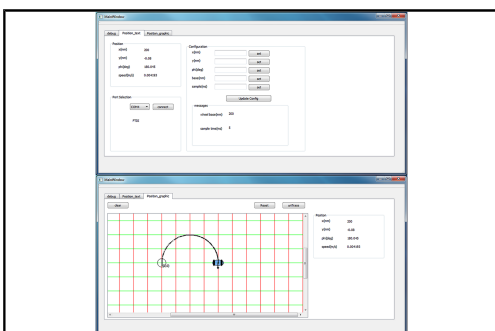
Solution: While the odometry algorithms are implemented on the microcontroller, a GUI is also implemented to illustrate the position of the robot and allow the user to be send commands to the testbed. Thus, a communication method was implemented in order to realize the data exchange between the two parts. The GUI is developed for the Windows operating system. Users are able to type commands, see both text and graphical illustration of the robot's position through the GUI, and change the communication approach as well.