Remote Control of Robots for Setting Up Mobility Scenarios during Wireless Experiments in the IBBT w-iLab.t

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Abstract. The w-iLab.t is a large-scale generic wireless experimentation facility. Two locations are equipped with in total over 260 wireless nodes. In the w-iLab.t Zwijnaarde location mobile nodes are hosted. The mobile nodes are mounted on top of robots, of which the movement can be fully controlled by the experimenter. Due to a high accuracy positioning algorithm, the exact position of the robots is known at all time during the experiments. This enables us to provide repeatable and controlled mobile experiments to our users.

Keywords: mobile, robots, experimentation, wireless, positioning, testbed.

1 The IBBT w-iLab.t: Mobile Extensions

The w-iLab.t is a large-scale generic wireless experimentation facility. Two locations are equipped with in total over 260 wireless nodes (IEEE 802.15.4, Wi-Fi a/b/g/n, Bluetooth). In the w-iLab.t Zwijnaarde location mobile nodes are available. These mobile nodes are mounted on top of iRobot Roomba vacuum cleaning robots. These nodes are identical to the fixed testbed nodes and are fully configurable by the experimenter. To power the mobile nodes, an extra battery pack was installed on the robot. Thanks to an in-house designed circuit board, it is possible to recharge both the external battery pack and the robot battery through the iRobot Roomba docking station. The board also serves as a bridge between the robot and a wireless sensor node (eZ430) which is used to control the robot movement. Finally, the board can also be used to remotely power on/off the mobile node on the robot. Please see Figure 1 for an example of the w-iLab.t robot configuration. The w-iLab.t is part of the IBBT iLab.t [1].

2 Accurate Positioning Algorithm

The exact position of the robots should be known at all times during the experiments. The basis of the positioning algorithm is dead reckoning: assuming we know the starting position, we use the speed and the angle provided by the

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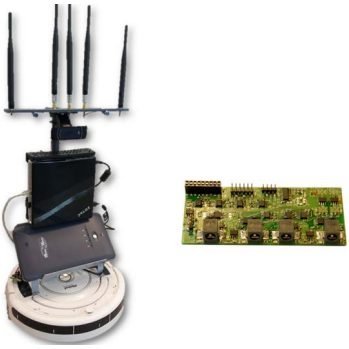

Fig. 1. the IBBT w-iLab.t robot

internal Roomba logic to calculate the new position. Since this approach was not reliable on its own, corrections are made to the robot position by using a taped grid (with a cell size of 1 by 1 meter) on the floor of w-iLab.t Zwijnaarde. The horizontal and vertical lines of this grid are taped in different colours. Using the standard cliff sensors of the robot, the position of the robot is adjusted every time the robot crosses one of these grid lines. Empirical verification shows that the position of the robots never deviates more than 3 centimeters.

3 Controllable and Repeatable Mobile Experiments

The mobility solution is fully integrated into the testbed, which is OMF compatible [2]. Users can very easily include coordinate files into their OMF experiment description files, describing the exact path the robot has to follow during the experiment.

4 Conclusion

The w-iLab.t gives users the ability to easily include controlled mobility scenario's into their wireless experiments. By using the OMF framework, it is very easy for users to repeat these mobile experiments and analyze results afterwards.

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