

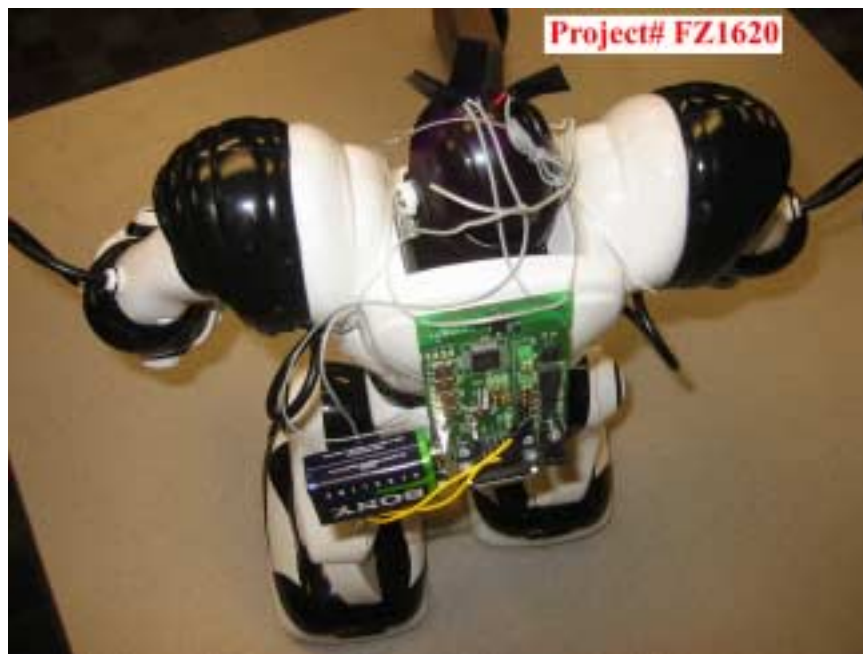
ABSTRACT: Robot Localization and Control

My project uses the ZigBee wireless nodes to simultaneously localize and control a Wow Wee humanoid robotic toy called the Robosapien. In part, this project is only proof-of-concept for the localization of robots using signal strength readings, due to the fact that only the three nodes from the Freescale Developer's Kit were used to complete this entire project. If more nodes were used, the localization process would be both far more accurate and span a wider range. The network model being used for the communications in this project is an application of the broadcast theory with addressing of the packets by which node sent them. The Robosapien is actually controlled using outputs from one of the Freescale nodes which mimic the control signals that the Robosapien would usually receive.

The localization works by having the Robosapien node (R) almost constantly sending out packets which contain accelerometer data from the on-board accelerometers. These packets are received by both the Computer node (C) and the Third node (T), who then read the signal strength and send it to the computer through node C 's serial interface. On the computer, a program is running to receive and interpret the data coming from C and localize node R . A particle filter algorithm written in Java is used to localize the Robosapien, and a GUI displays the location of the Robosapien in relation to the C and T nodes. There is also a simple GUI on the screen that gives the user command options for the Robosapien such as stop, go forwards, turn left, and turn right. When one of these buttons is clicked, the computer sends a packet down the serial port to the C node which contains the command to send to the Robosapien.

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Another part of this project is the actual control of the Robosapien with one of the Freescale nodes. After dissecting a Robosapien, I discovered that the easiest way to control it would be to replace the infrared receiver in its head with a ZigBee node and connect the wires from the ZigBee node to the wires that were used to connect the infrared. Then the Freescale node needs only mimic the commands the Robosapien would normally receive. Here is a picture of the Robosapien with the Freescale node attached:



As mentioned earlier, this project was designed to be proof-of-concept for some larger ideas with many potential applications. The localization would be improved greatly if more nodes were added, which would allow for the control of the robot to be far more accurate. With this control, this project could be expanded to set up a server/client relationship so that other programs could easily be built on top of this platform. The server would provide information to its clients about where the robot is and allow clients to control the robot while the clients work at a much higher level. Here is a block diagram

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of my project, where the green nodes and lines would be the improvement with more nodes, and the rFinger is a potential client program:

