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Department of Mechanical and Aerospace Engineering

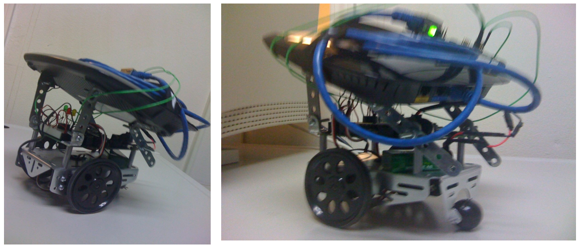
iPhone/iPod Touch as a Data Acquisition and Control Device

Abstract

The goal of this research was a qualitative and eventually a quantitative feasibility assessment of Apple's mobile devices, the iPhone and the iPod Touch, as data acquisition and control devices. The qualitative appreciation for the devices' potential is established with the development of several robotic projects involving the interfacing of the iPhone with both software and hardware components. These robots were constructed in order to demonstrate the implementation of several plausible networking protocols and communication methods. A mobile robot with a Wi-Fi network was built to be controlled remotely over the Web using a server for the Apple device to access. Then, a robot which also contained a Wi-Fi network was interfaced with a microcontroller implementing the open sound protocol (OSC) and this protocol was used for communication between the robot and the iPhone/iPod Touch via OSC messages sent over UDP/IP ports . Software methods are now being studied in order to introduce increased capability beyond what we have seen in other projects utilizing this protocol. Once more effective projects are completed and operating, a quantitative study of the iPhone's performance can be done using measurement tools provided by Apple.

Web-Enabled iPhone-Controlled Robot

- A mobile robot interfaced with a low-cost microcontroller, Parallax's 40-pin Basic stamp 2 (BS2P40) which additionally consists of a test circuitry of 3 LEDs and a piezo speaker
- An embedded web server, Parallax Internet Net burner Kit interfaced with BS2P40
- A Cisco Wireless-G Broadband Router, and
- An Apple iPhone 3G



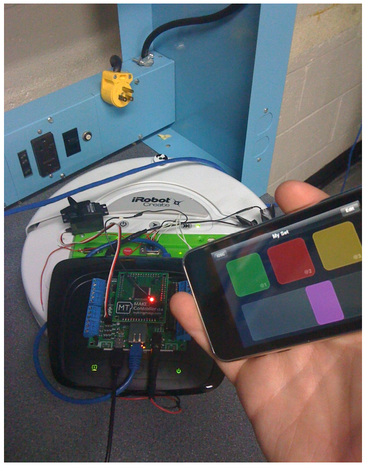
A web-enabled robot prototype, based on the Parallax Boe-Bot robotics kit, with a mounted wireless router and Parallax Internet Net burner Kit (PINK).

The robot and the test circuitry connected to the BS2P40 interfaces with the embedded web server and the wireless router. The iPhone connects to the wireless network, which allows the user to interact with a graphical interface to control the mobile robot in real time. The graphical interface includes sliders and pushbuttons to turn LEDs, piezo speaker, robot servos, etc., on or off. Finally, the BS2P40 microcontroller can also send status information to the iPhone.

Open-Sound-Control (OSC) Robot

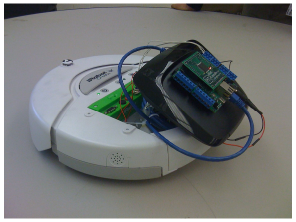
- Currently an iRobot with an Atmel Atmega168 controller was mounted with MAKE controller which implements the open sound control (OSC) protocol over UDP/IP ports
- Through a Wi-Fi 802.11 b/g network, the developed iPhone applications allow the iPod Touch and iPhone to interface with this system by sending OSC messages to the MAKE, which relays the instructions to the robot's Atmega168
- These iPhone applications are still in the process of being written and the software tools utilized to accomplish this are:

Xcode – an integrated development environment to manage, edit, compile, run, and debug projects.
Interface Builder – graphically assembles the user interface.
Instruments - runtime performance analysis and debugging tool.
IPhone Simulator - simulates the iPhone technology stack to test iPhone applications on an Intel–based Mac.



The iRobot with a Linksys wireless router and MAKE controller mounted on it for OSC capability over a Wi-Fi network.

Mechatronics and Controls Laboratory



The iRobot being operated by *iOSC*, an application developed by *recotana*.

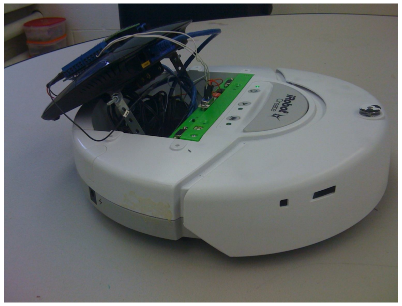
Applications

- Reduction of weight of controlled systems (e.g aircraft projects).
- The ability to modify and control the operation of a system remotely and in the palm of your hand.
- Alternative, increasingly user-friendly control interfaces (e.g touch screens, hand gestures with accelerometers, compass) and more sophisticated forms of control.

Future Goals

Methods are being studied to:

- Send bundles of OSC messages simultaneously
- Send messages bi-directionally between devices
- Programmatically process, record, and display both digital and analog input data on the Apple device.
- Conceptual ideas are being considered concerning laboratory equipment and experimental apparatuses with the potential to share their measurements with the Apple device's user in real time and to be controlled in real time



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