



Excellence in Compliance Testing

Certification Test Report

Frequency Hopping Spread Spectrum Transceiver

FCC ID: VPU-4970726505

FCC Rule Part: 15.247

ACS Report Number: 07-0439 - 15C

**Manufacturer: Georgia Institute of Technology
Model: Fluke-5**

Installation Guide

The Fluke Robot Upgrade Module – Users Manual



Fluke Robot upgrade module installed on a Parallax scribbler robot.

Introduction

There is a lack of low-cost robots available which satisfy the functional requirements of an educational environment. The Fluke robot upgrade module is a device by which low cost robots are reprogrammed to support Microsoft Robotics Studio (MSRS) and expanded to provide the capability that instructional lessons depend upon. The specific areas of the robot which are upgraded include computation, wireless communication and sensors. The sensors which are included on the robot upgrade module include a camera, IR sensors and battery voltage detection.

Operation of the robot upgrade module is fully automatic. Once attached to the scribbler robot the module uploads the MSRS device server into the scribbler's internal program memory. The module then provides a wireless link between the student's computer and the scribbler robot.

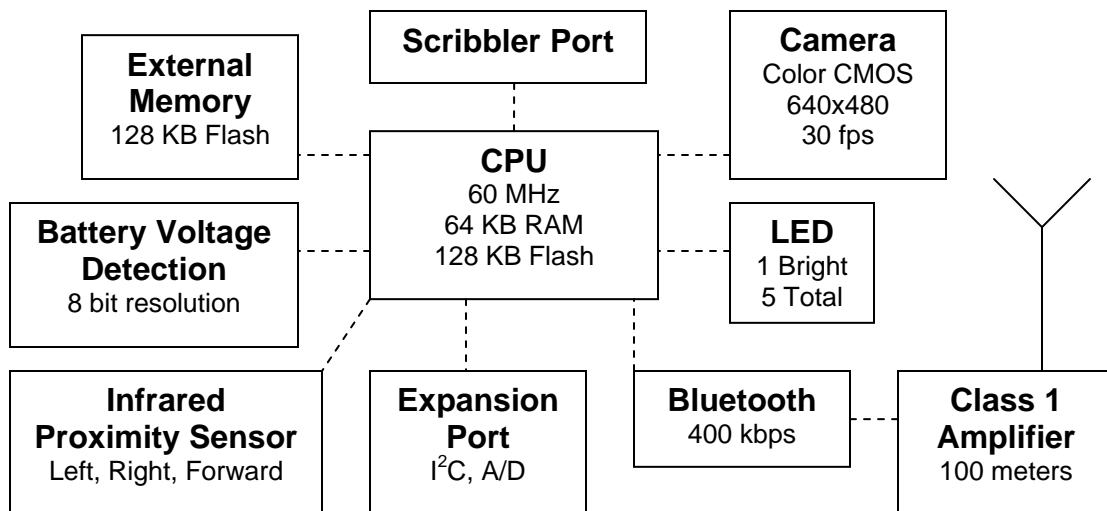
Most robots include a complex onboard computer which increases the price of the robot and becomes obsolete before the rest of the robot. An obsolete computer renders the entire robot much less useful, even though there is still value in the robot's mechanical systems. Our robot upgrade module bypasses the robot's onboard computer and controls the robot directly from a desktop computer. By leveraging the power of desktop computers and Microsoft robotics studio our module allows for the use of extremely cheap base robot platforms.

Our robot upgrade module functions as a hardware component of Microsoft Robotics Studio and removes barriers to adoption for the software.

Hardware Description

A robot must satisfy a minimum set of capabilities in order to be useful as an educational tool. A rich suite of sensors provides an engaging input stream for student written programs. Wireless control increases the fun factor and helps maintain student interest.

Development of the module centered on reducing its cost. To provide the desired capabilities within the cost constraint required minimizing the number of components and eliminating any pre-engineered modules. The camera and bluetooth radio are available as prebuilt modules which ease the development effort but incur a cost penalty. For our robot upgrade module each subsystem is designed from scratch and uses the lowest-level chipsets available.



Major components of the robot upgrade module.

Connecting to the Device

1. Make sure your bluetooth device on the PC is enabled.
2. Open Bluetooth Devices in the Control Panel.
3. In the Devices pane select the “Add...” button.
4. Follow the wizard selecting the dongle (it may be labeled IPRE-XXXXX).
5. Use the passkey: 1234.
6. Once finished the wizard, click the “COM Ports” Panel.
7. Note the “Outgoing COM port”.

Interacting with the Device

Although the device can be commanded with any serial program, using the myro software package (<http://wiki.roboteducation.org>) is the recommended path. Myro is a python software library available for Windows XP and Vista, Mac, and Linux. A typical myro session looks like:

```
from myro import *
initialize('COM7')

p = takePicture()
show(p)

setLEDBack(240)
print 'Battery Voltage:', getBattery()
setLEDBack(0)
```

Communications Protocol

Format: 8N1 with hardware flow control

Command Sequence	Response	Description
82	[hsize] [lsize] data	Segmented and run-length encoded image
83	data	256x192 image in YU YV format
84 [window]	data	Windowed image
85	[hbyte] [lbyte]	# of returned pulses when emitting left
86	[hbyte] [lbyte]	# of returned pulses when emitting center
87	[hbyte] [lbyte]	# of returned pulses when emitting right
88 [window]	[hbyte] [lbyte]	Total intensity (sum of Y's) in the window
89	[hbyte] [lbyte]	Battery voltage
90 [hpage] [lpage] [hoffset] [loffset]	[byte]	Read serial memory
91 [haddr] [laddr]	[byte]	Read scribbler program buffer
92 [addr]	[byte]	Read camera parameter
116		Turn on forward LED
117		Turn off forward LED
118 [delay] [smooth] [ylow] [yhigh] [ulow] [uhigh] [vlow] [vhigh]		Set RLE parameters
120 [power]		Set output power of the IR emitters
121 [hpage] [lpage] [hoffset] [loffset] [byte]		Write value to serial memory
122 [haddr] [laddr] [byte]		Write value to scribbler program buffer
123		Initiate scribbler programming
124		Reset scribbler
125 [hpage] [lpage]		Erase page of the serial memory
126 [value]		Set the backward LED (one byte brightness value)
127 [window] [xlow] [ylow] [xhigh] [yhigh] [xstep] [ystep]		Set the window parameters
128 [direction]		Set the forwardness direction
129		Set the white balance
130		Unset the white balance
131 [addr] [value]		Set camera parameter

Regulatory Information

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THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS.

(1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRE OPERATION.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

RF Exposure

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

NOTE: THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY RADIO OR TV INTERFERENCE CAUSED BY UNAUTHORIZED MODIFICATIONS TO THIS EQUIPMENT. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.