CS 3468
Lab 1

Jared Wallace

Introduction to Embedded Systems Programming

Today we are going to cover the overall workflow of the labs we will be completing, as well as gaining familiarity with the equipment we will be using.

Objectives

1. Understand the sensor development environment
2. Learn to compile and install sensor applications
3. Understand the functionality of an embedded system

Tasks

1. Inspect the sensor development kit
    - The development kit includes two Micaz **motes**, one MDA100 **sensor**, one MIB520 **programming board**, one USB cable, and several batteries. The development software has already been installed on the lab computer. *This is a typical development kit for any embedded system.*
    - The **mote** is the actual embedded system that communicates with other motes and runs various kinds of embedded applications. The sensor measures temperature and light intensity of the environment and transmits the sensing data to the attached mote. The mote then processes or sends the data to other motes.
    - The programming board is responsible for loading executable application images onto the mote and for configuring the mote. The programming board also provides interfaces for debugging sensor applications and gathering data from the mote.

- The USB cable connects the programming board with the computer. Sensor applications developed in the computer are transferred to the mote via the USB cable, through the programming board. The reverse is also true, the mote can output data to the computer, through the programming board and the USB cable.
- Now unplug the sensor from the mote. If you inspect the sensor board, you can see the actual sensors for light and temperature. **Note:** The sensor can only acquire data, it cannot communicate with other sensors or process sensing data by itself.
- The mote has one antenna, one embedded processor, and one slot. The antenna is for communicating with other motes. The slot is the interface for plugging in either the sensor or the programming board. If the sensor is plugged into the slot, the mote can obtain data from the sensor. If the programming board is plugged into the slot, the mote can obtain the application image from the computer and use it to program the on-board embedded processor. The programmable embedded processor is the central processing unit. It runs sensor applications and controls all peripherals of the sensor.
- Now, please remove the batteries, if any, from the mote, firmly plug the programming board into the mote, and use the USB cable to connect the programming board to the computer. We are now ready to compile and run our first sensor application.
- ***Always remove any batteries when plugging the programming board into the mote!!***

2. Compile and install the sensor application **Blink**

   (a) Open a terminal, and type the following command:

   ```
   mkdir Embedded
   mkdir Embedded/lab1
   ```

   This will create a directory to store your lab files. Place the lab files from the website into the folder "lab1" that you created.

   (b) Type

   ```
   cd Embedded/lab1
   make micaz
   ```

   to compile and link the Blink application. You will then see some messages in the terminal showing the progress of compilation and linking.

   (c) Now, you can see that a new folder "build/micaz" has been created, in which you will find the executable application images "main.srec" and "main.ihex". However, keep in mind that the image is not executable in the computer. It is only executable in the mote.

   (d) Now, connect the USB cable to the computer and the programming board.

   (e) Now you can type

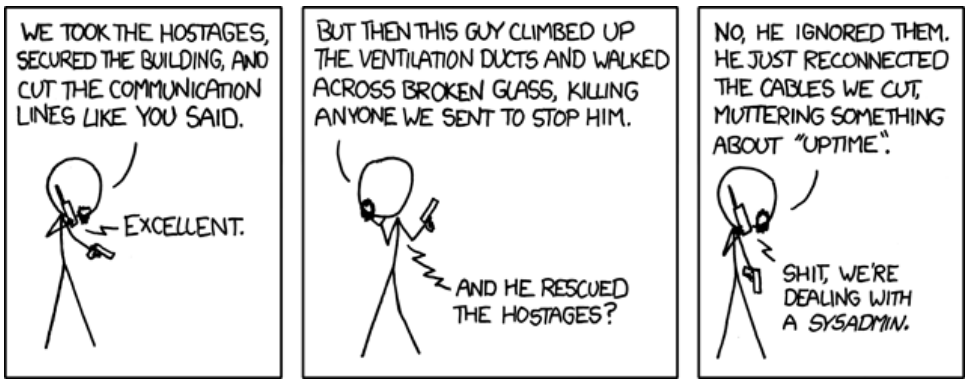
   ```
   su
   (I will give you the password)
   make micaz install mib510,/dev/ttyUSB0
   ```

   to install the Blink application in the mote. (You must be root to install to the hardware). The password is "Embedded". You will see some messages showing that the executable image is being transferred into the mote.

(f) At this point, you should see LEDs blinking on the mote. Unplug the programming board from the mote and insert the two batteries. Make sure you turn the switch on the mote to the "on" position. You should see more LED's blinking.

Lab Report Instructions

No report is required for this lab.



The weird sense of duty really good sysadmins have can border on the sociopathic, but it's nice to know that it stands between the forces of darkness and your cat blog's servers.