



CALIFORNIA STATE UNIVERSITY, LONG BEACH

CECS 447

Project 4

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A project that demonstrates the HC-05 Bluetooth module.

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1 Introduction

The purpose of this project is to demonstrate the capabilities of the HC-05 Bluetooth module. This module communicates via the Universal Asynchronous Receiver-Transmitter (UART) protocol. It allows microcontrollers such as the TM4C123GH6PM to communicate wirelessly with any Bluetooth-compatible terminal. In this project, I am using the module to change the color of an RGB LED on the Launchpad through my laptop.

2 Operation

There are two parts to this project. The first part is setup: I have created a command-line user interface (UI) in where the user can input any command he or she wants in order to program the HC-05 to specifications. For example, if the user wishes, he or she can change the name of the HC-05 module so it shows up as that name when pairing to a device. There are many options that the user can input.

The second part is the actual “working” part; this is the part where the HC-05 interfaces with a Bluetooth terminal. The program has the following functions:

- Inputting a character **w** causes the LED to turn green.
- Inputting a character **s** causes the LED to turn blue.
- Inputting a character **a** causes the LED to turn yellow.
- Inputting a character **d** causes the LED to turn purple.
- Inputting a character **t** causes the LED to turn off.

Below are links to the videos showing the two different parts.

- Part 1: <https://youtu.be/bUotwPjU1Nk>.
- Part 2: <https://youtu.be/Zd212nrnqZw>.

3 Theory

The first part of this project works by having the Launchpad be a sort of translator or buffer. The user inputs a command through a regular serial terminal (such as PuTTY). This is done through a UART port (UART0). The Launchpad then translates this command into a command that the HC-05 can understand (the Launchpad communicates with the HC-05 through UART1). The HC-05 then sends a response, which the Launchpad delegates to the user. To avoid issues, the Launchpad rejects any commands that are not formatted correctly.

The second part of the project is much simpler. All the wireless magic is done by the HC-05. As far as the Launchpad sees, it is simply communicating with just another UART device; in fact, if one would change the code to use UART0 instead of UART1, the exact same behavior could be achieved using a standard serial terminal instead of a special Bluetooth terminal.

4 Hardware Design

Figure 1 is a schematic diagram of the project. The switch S1 is used to switch between Command and Data mode. If S1 is closed, the HC-05 is in Command mode, which is used to give commands to the module; this is the mode used for Part 1 of the project. If S1 is open, the HC-05 is in Data mode; this mode can communicate with the Bluetooth terminal to receive data in order to change the LED on the Launchpad.

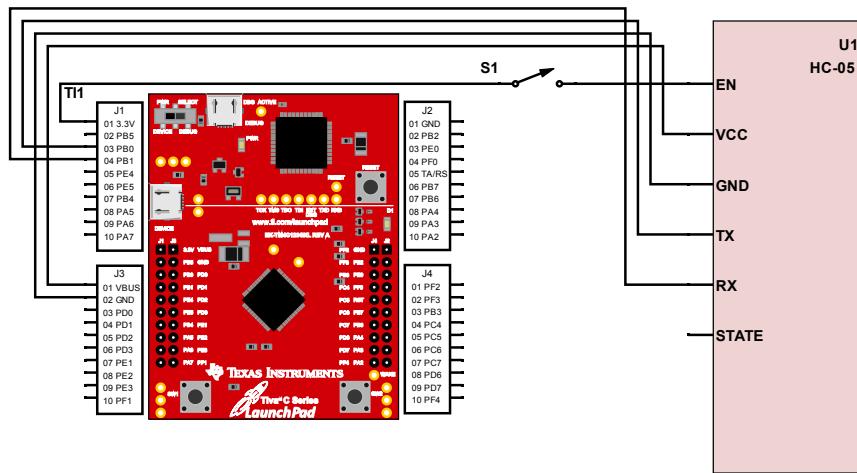


Figure 1: The schematic diagram for the Project.

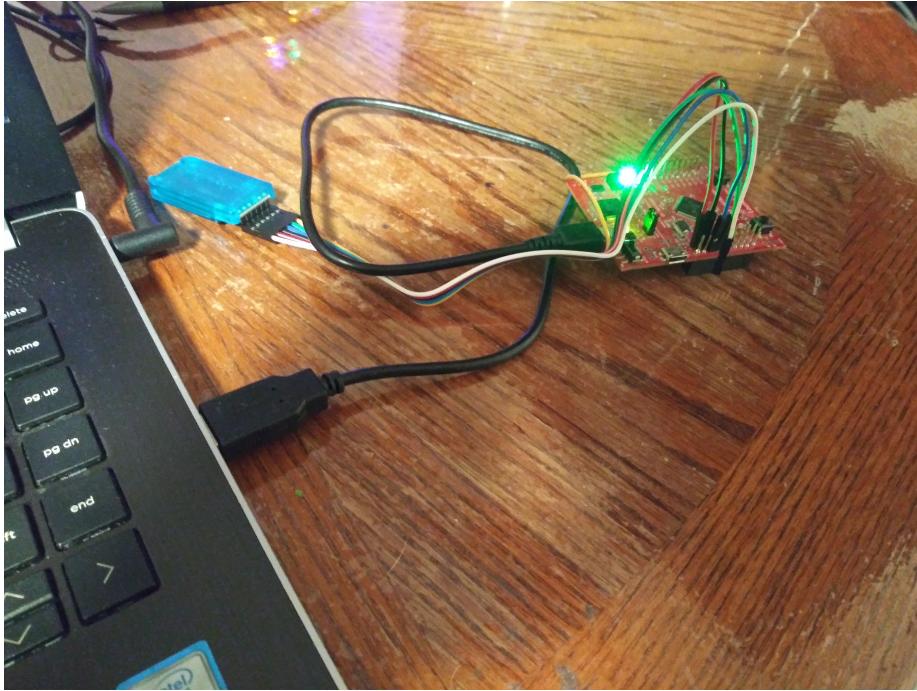


Figure 2: Picture of embedded system in action.

5 Software Design

The design for Part 1 was comparatively harder than Part 2. Part 2's software only consists of setting up the GPIO and UART modules on the Launchpad for communication with the HC-05. As I said before, the Launchpad only sees a UART module, and does not differentiate between a standard serial terminal or the HC-05.

Part 1's design is a bit harder. It has to check if the command is correctly formatted before sending it to the HC-05.

6 Conclusion

I had a few issues while making this project such as my first HC-05 not working due to it having v4 firmware, but after I got my second HC-05 with v2 firmware and I bug-tested my code, I was able to complete the project.