

To: Dr. Keith Hoover

From: Michael McDonald CM 704, Christopher Nelson CM 740, Ryan Oliver CM 754

Subject: ECE 331 Final Project Proposal

Date: January 27, 2013

1 Introduction

In light of the recent creation of a Morse code keyer, and due to the relative difficulty that many in the class faced in encoding and decoding morse code, we have decided to create a Morse code encoder, and if time permits, we will pursue creating a decoder. This encoder will take ASCII based input from a serial terminal program running on an external PC and transmit it over UART to the microcontroller, which will generate the corresponding Morse code representation and output it via a buzzer, as well as be available to be transmitted to other devices. Since some Amateur Radio bands are CW only bands, this would allow an operator to quickly and easily send (and possibly eventually receive) Morse code messages, without the headache of having to encode and decode these messages by hand.

2 External Specifications: User Manual

The main flow for using this project is as follows. The user powers the project board up and connects an RS232 to USB cable between his or her computer and the project board. They then set the blue potentiometer on the project board to their desired Morse code speed (in WPM). Next, they can set up the serial terminal to the proper com port and connect at 115200 baud 8N1. After that, they can send a message via carriage return delimited strings. Valid characters are explained in section 2.3, below. After the user has sent his or her message, the buzzer will begin to sound the correct Morse code tones, and the additional output line will be driven appropriately.

While simple in concept, this problem is not as trivial to implement as one might expect. There are several areas that must be fleshed out before implementation can begin. Additionally, we must specify protocols that will be used by users on either end of the system, so that the system is accessible to all who want to use it.

2.1 Morse Code Standards

- Implement ITU Morse Code, as this is the standard which Amateur Radio enthusiasts use. See Appendix A for more details.
- Transmit at a reasonable WPM (between 5 and 50).
- User should be able to define this speed via a potentiometer on the project board.

2.2 UART Standards

- Use 115200-8N1 baud for communicating between the terminal program and the microcontroller.
- Characters will be sent to the microcontroller on the press of a carriage return, stored in an array, and processed in a First In, First Out (FIFO) fashion, so that data is transmitted in chronologically correct order.

2.3 Input and Output

- Input
 - ASCII characters for all letters (though they will all be converted to the proper case internally), as well as the period, exclamation point, and question mark.
 - No “special” ASCII characters will be allowed as inputs, other than the ‘n’ character (for ending a line).
- Output
 - Variable speed output of ITU Morse code.
 - Buzzer will buzz at approximately 500Hz, 50% duty cycle.
 - System will also have a single line output available for communication to other microcontrollers or a radio.

3 Hardware Block Diagram and Schematic

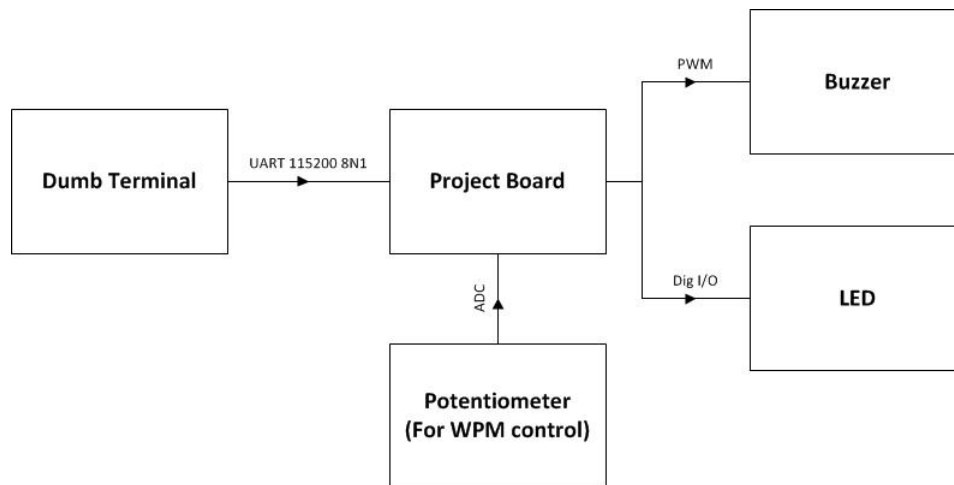


Figure 1: Hardware Block Diagram for UART to Morse code

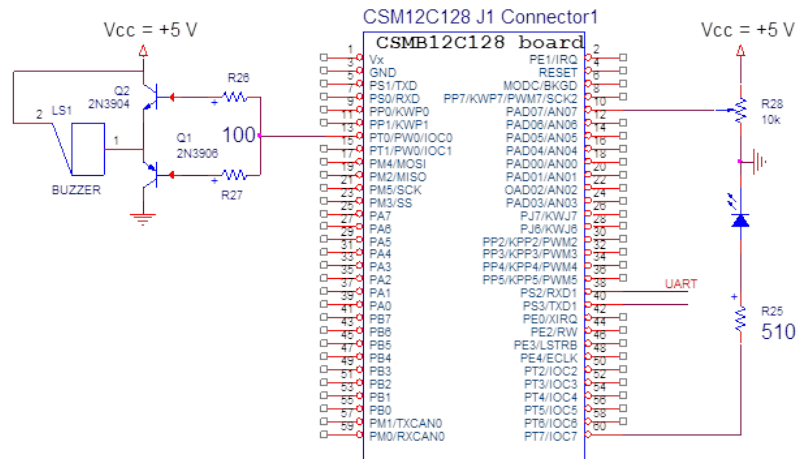


Figure 2: Schematic for UART to Morse code

4 Budget

Since this project is primarily based on existing hardware, there are no associated parts that need to be purchased outside of the microcontroller boards that we already purchased. The project board (primarily for its buzzer and RS232 UART output) and an external RS232 Serial to USB converter are used, but both of these can be borrowed from the ECE parts room, and therefore cost nothing.

Michael McDonald

Christopher Nelson

Ryan Oliver

5 Appendix A: International Morse Code

International Morse Code

1. The length of a dot is one unit.
2. A dash is three units.
3. The space between parts of the same letter is one unit.
4. The space between letters is three units.
5. The space between words is seven units.

A	• —	U	• • —
B	— • • •	V	• • • —
C	— • — •	W	• — —
D	— • •	X	— • • —
E	•	Y	— • — —
F	• • — •	Z	— — • •
G	— — •		
H	• • • •		
I	• •		
J	• — — —		
K	— • —	1	• — — — —
L	• — • •	2	• • — — —
M	— —	3	• • • — —
N	— •	4	• • • • —
O	— — —	5	• • • • •
P	• — — •	6	— • • • •
Q	— — • —	7	— — • • •
R	• — •	8	— — — • •
S	• • •	9	— — — — •
T	—	0	— — — — —

Figure 3: International Morse Code Standard