

# **Lab #2**

## **UART Serial Communication**

CSCE 5612 - Embedded Hardware/Software Design  
Fall 2018

**100 Points**  
**Due: 10/05/2018, 11:55 PM**

**Instructions:** TA will be available during the office hours or by an appointment to demonstrate your lab as a team. You are most welcome to demonstrate the lab to the TA as a team before the due date. Please don't wait till the last minute to complete the lab as you may not get the required resources like PCs or boards. Make sure you have a printed lab report (one per team) and turn it in when the demonstration starts. Your lab grader will ask you questions during the demonstration. Questions are worth **20 points** and will be graded according to your answer to the questions. After the demonstration is completed, immediately upload the report and the zipped project to Canvas. **Not following the above instructions could result up to 50% deduction from your lab score. Late demonstrations and submissions are not allowed.**

### **Objectives:**

This lab introduces UART serial communication using ESP8266 and shows how to communicate between two boards using UART protocol.

### **Requirements: (30 Points)**

1. Turn the green LED 2 (connected to ESP8266 Board 2 (B2), port D0) on when push button S1 (connected to ESP8266 Board 1 (B1), port D0) is pressed and turn it off when S1 is again pressed
2. Use strings commands "Turn green LED 2 on" and "Turn green LED 2 off" between the boards B1 and B2 to turn the green LED 2 (connected to board B2, port D0) on and off respectively
3. When there is a communication error or if the string command received is different, indicate it by turning on the red LED 2 (connected to board B2, port D3) for one sec
4. When there is no communication error or if the string received is recognized, acknowledge back to board B1 and turn the green LED 1 (connected to board B1, port D3) on for one sec

5. Avoid debouncing of the switch S1. Do not use any delay functions or delay loops and make sure interrupts are not used.

### **Procedure:**

1. Setup both the ESP8266 Boards on a breadboard and connect the micro USB cable to the USB port of the board. Do not connect to computer
2. Connect the anode of the green LED 2 to port D0 of ESP8266 Board 2 (B2) with a series 1 K $\Omega$  resistor and connect the anode of the red LED 2 to port D3 of board B2 with a series 1 K $\Omega$  resistor. Also, connect the cathodes to ground
3. The red LED 1 connected to port D3 of board B2 will be used to indicate if there is communication error or for wrong commands
4. Connect one pin of the push button (tactile) switch S1 to port D0 of ESP8266 Board 1 (B1). Pull the port D0 to Ground (G) using a 1 K $\Omega$  resistor. Connect the other pin of the switch S1 to 3.3 V
5. Connect the anode of the green LED 1 to port D3 of board B1 with a series 1 K $\Omega$  resistor and connect the cathode to ground. This LED will indicate the receipt of acknowledgment
6. Connect the UART0 bus of board B1 and board B2 so that you can send and receive commands and acknowledgements using the UART bus. Also, connect the grounds of both the boards
7. Arduino IDE reference is available here <https://www.arduino.cc/reference/en/>
8. Use the example codes and the Arduino reference to meet the requirements and complete the lab
9. Record your observations in the report.

### **Demonstration: (30 Points)**

1. Demonstrate turning the green LED 2 (connected to board B2, port D0) on when push button S1 (connected to board B1, port D0) is pressed and turn it off when S1 is again pressed
2. Using serial console connected to board B2, show the strings commands "Turn green LED 2 on" and "Turn green LED 2 off" between the boards B1 and B2 when the Green LED 2 (connected to board B2, port D0) is turned on and off respectively
3. Demonstrate turning on the red LED 2 (connected to board B2, port D3) for one sec when there is a communication error or if the string received is different. Inject an error using the serial console connected to board B1
4. Demonstrate acknowledgement to board B1 and turning the green LED 1 (connected to board B1, port D3) on for one sec when there is no communication error or if the string received is recognized

5. Demonstrate that there is no bouncing of switches when the switches S1 is pressed.

**Deliverables: (20 Points)**

1. Use the lab template posted on the Canvas page
2. Answer all the questions asked in the lab template
3. Type the lab report and turn in the printout of the lab report when the lab is demonstrated.
4. After the demonstration is completed, upload the report (one per team) and the zipped project (one per team) to Canvas.