Abdullah Aljandali

EE 454 - I2C Battleship

4/4/2019

Statement of the project

This project uses STM32L432KC microcontroller and other components to make a two-player battleship game. Communication between the two players is done through the two I2C buses on the board.

Possible utility or purpose

The purpose of this project is to get familiarized with I2C communication. Try for 3 hours, fail, take a break, try for another 3 hours, fail, and hope to learn something in the process.

Identification of specifications

The project satisfies the requirements for an A-level project, as it is a two player battleship that uses 2 I2C busses that can act as both a master and a slave.

Identification of design issues and solutions

First, I used I2C1 to output some data and saw it on the oscilloscope. Once that succeeded, I did the same thing with I2C3. I then made sure that I can send and receive data from I2C1 (master) to I2C3 (slave). Later, I used interrupts instead of while loops for the communication. Now, both buses can be both master or slave. I used two LEDs to display messages received by each bus.

To make battleship work, I used Dip Switches. The Dip Switch has 4 inputs. I used 3 of these as location selected by the user (decoded from 3 → 8 in software), and used the fourth one as a submit button. Each player had their own Dip Switch and the same Dip Switch was used for both placement and guesses. For placement, the location selected indicated the first of the three indices of the ship. For each Dip Switch, there are 4 LEDs indicating which of the buttons have been clicked, as an error handling feature because the Dip Switches were not always doing what they are supposed to do.

A smarter way to do this that I was planning to do if time allowed would be the following. I would have used three buttons total for both players, in addition to 8 LEDs. One button for “right”, one for “left” and one for “submit”.The 8 LEDs would indicate where the current selection is by lighting up only one of them. When wanting to place a ship, three adjacent LEDs will light up indicating where the ship placement is, and all three will move if the player

clicks the right or left button. Using software, I could switch between turns so that both players can use the same hardware components by taking turns.

As for the I2C communication in the battleship, player1 (I2C1) sends their guess to player 2. Player2 evaluates the guess and replies with a hit or not.

Information resource:

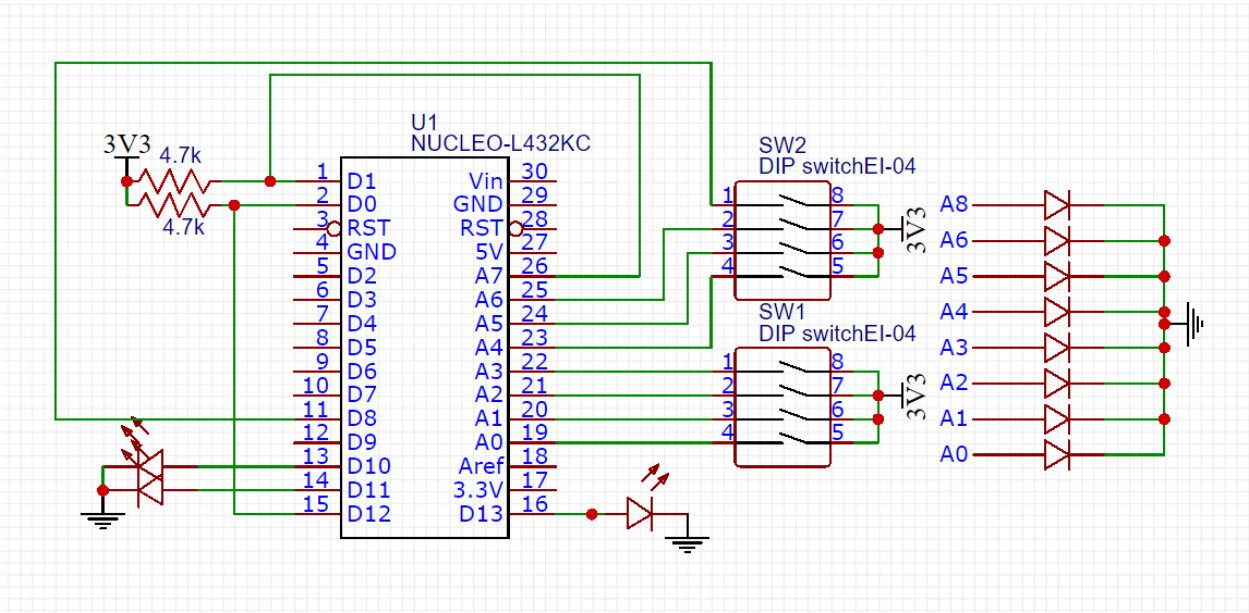
Embedded Systems with Arm Cortex-M Microcontroller book by Yifeng Zhu

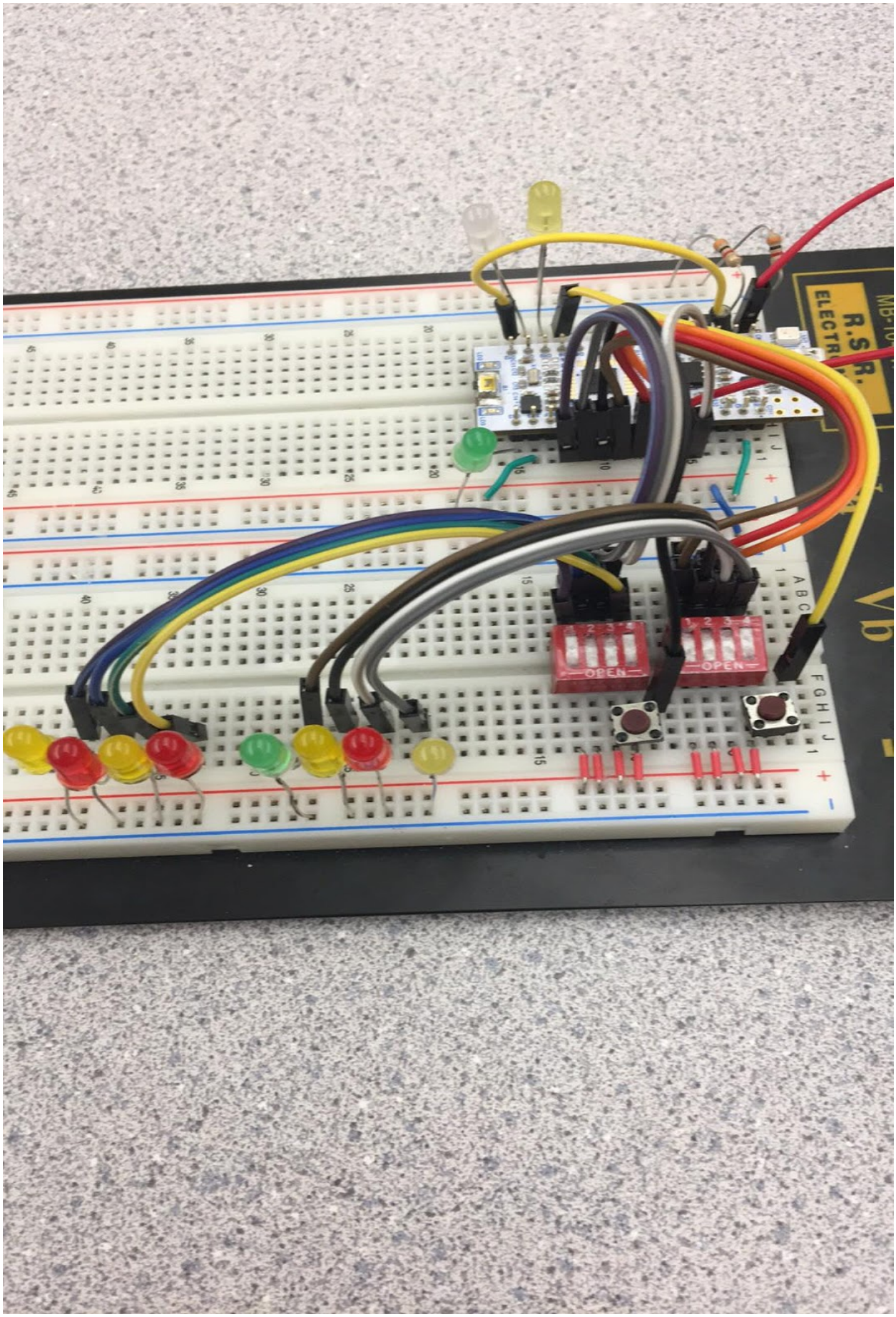
Hardware Details

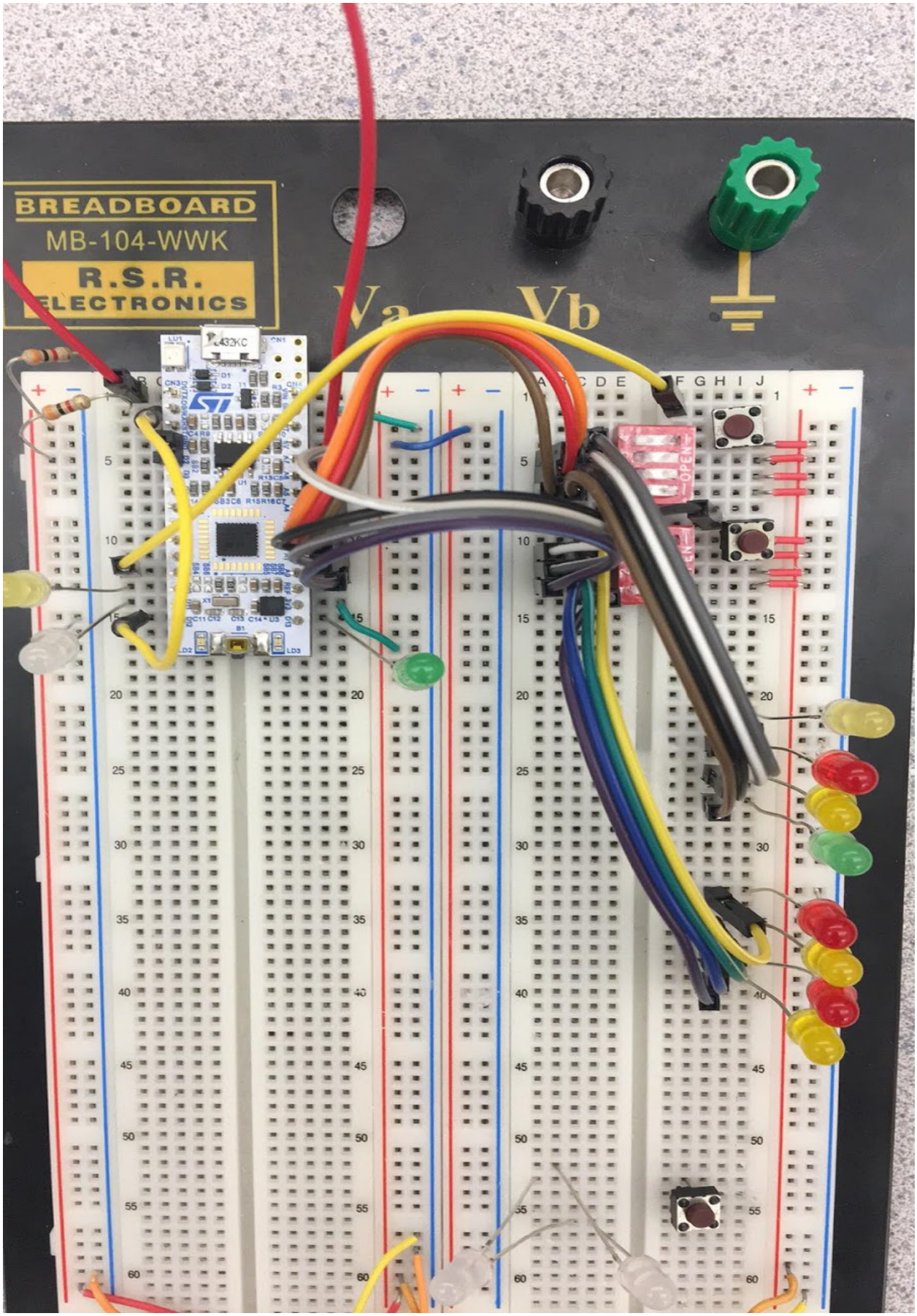
Components used:

- STM32L432KC Microcontroller - x1
- Dip Switch - x2
- Buttons - x2
- 4700 Ohms Resistor - x2
- Color LED - x11

Circuit Schematic




R.S.R.
OPEN
OPEN


BREADBOARD
MB-104-WWK
R.S.R.
ELECTRONICS
Va
Vb