Binary Calculator

**Team Members**

Tallon McAbee (Team Leader)

Katherine Reed

Ashton Little

**Project Description**

The purpose of our project is to create a circuit that functions as a binary calculator with the use of a Raspberry Pi, a keypad for the input, and LED lights on a breadboard for the output. At a minimum, we would like for the calculator to be able to add two binary numbers (maximum 4 bits per number), but the ultimate goal is for it to be able to perform binary addition, subtraction, multiplication, and division on two binary numbers. We will design the calculator in such a way that the user will enter the first binary number, then the operator (+, -, \*, %), and then the second binary number using a numeric keypad that is connected to a Raspberry Pi. The program on the Raspberry Pi will then perform the calculation and generate the binary number output, which will be transmitted to a breadboard. The output will be reflected using multiple LED lights that will be placed in a single row on the breadboard. Each LED light will represent a position in the binary number output (i.e., the LED light furthest to the left will represent the MSB, and the LED light furthest to the right will represent the LSB). An illuminated light will indicate a “1” in that position, and a light that is off will indicate a “0” in that position. The program will perform the calculations by using code to implement full adders and full subtractors. For example, the program will perform stepwise binary addition by calculating (bit1 XOR bit2 XOR carry bit) for the sum and ((bit1 AND bit2) OR (carry bit AND (bit1 XOR bit2))) for the carry bit.

**Programming Environment and Requirements**

IDE – Geany on the Raspberry Pi

Language – Java

Library – Pi4J (Java I/O library for the Raspberry Pi)

**Parts**

Raspberry Pi 3 Model B – personal property

SD card – personal property

Breadboard – personal property

Jumper wires – personal property

ONN USB Numeric Keypad – purchase from Amazon for $11.97

Resistors – purchase from Amazon for $4.99

LED lights – purchase from Amazon for $5.99

**Timeline**

**Week No Dates Activity**

|  |  |  |
| --- | --- | --- |
| 1 | Jan 11 – Jan 17 | Brainstorm ideas and design project; write project proposal |
| 2 | Jan 18 – Jan 24 | Purchase equipment; start designing program logic |
| 3 | Jan 25 – Jan 31 | Start building circuit; start writing code for addition |
| 4 | Feb 1 – Feb 7 | Continue building circuit; continue writing code for addition |
| 5 | Feb 8 – Feb 14 | Finish building circuit; finish and test code for addition |
| 6 | Feb 15 – Feb 21 | Start writing code for subtraction |
| 7 | Feb 22 – Feb 28 | Start writing progress report; continue writing code for subtraction |
| 8 | Mar 1 – Mar 7 | Finish progress report and turn it in |
| 9 | Mar 8 – Mar 14 | Finish and test code for subtraction |
| 10 | Mar 15 – Mar 21 | Start writing code for multiplication |
| 11 | Mar 22 – Mar 28 | Finish and test code for multiplication |
| 12 | Mar 29 – Apr 4 | Start writing code for division |
| 13 | Apr 5 – Apr 11 | Finish and test code for division |
| 14 | Apr 12 – Apr 18 | Test entire system and start writing final report |
| 15 | Apr 19 – Apr 25 | Present project; finish final report and turn it in |