I2C-Compatible LED and LCD Controllers

Emmett
Sebastian

01

Background

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- **Overview:** Use a keypad read by an MSP430FR2355 to control LED patterns driven by a MSP430FR2310 and information on an LCD driven a different MSP430FR2310, all networked with I2C.
- **Primary Goal:** Enable users to unlock the system with a 4-digit code and select time-varying LED patterns via keypad input and display the pattern name and information on an LCD.
- **System Functionality:** Features keypad input, LED bar output, and RGB LED status, and an LCD, networked with I2C, programmed in C.
- **Purpose:** Aims to teach keypad polling, LED interfacing, and PWM control for embedded systems, I2C networking, and LCD interfacing.

02

Development Process

Development Process

01 FLOWCHART

Both:
Designed main state machine
Tested new hardware

Emmett:
Built flowcharts for keypad, led bar, & I2C

Sebastian:
Built all other flowcharts

02 REINTRODUCED HARDWARE

Emmett:
Integrated keypad, LED bar, and RGB LED.
Implemented I2C networking

03 LCD

Emmett:
Networked with I2C

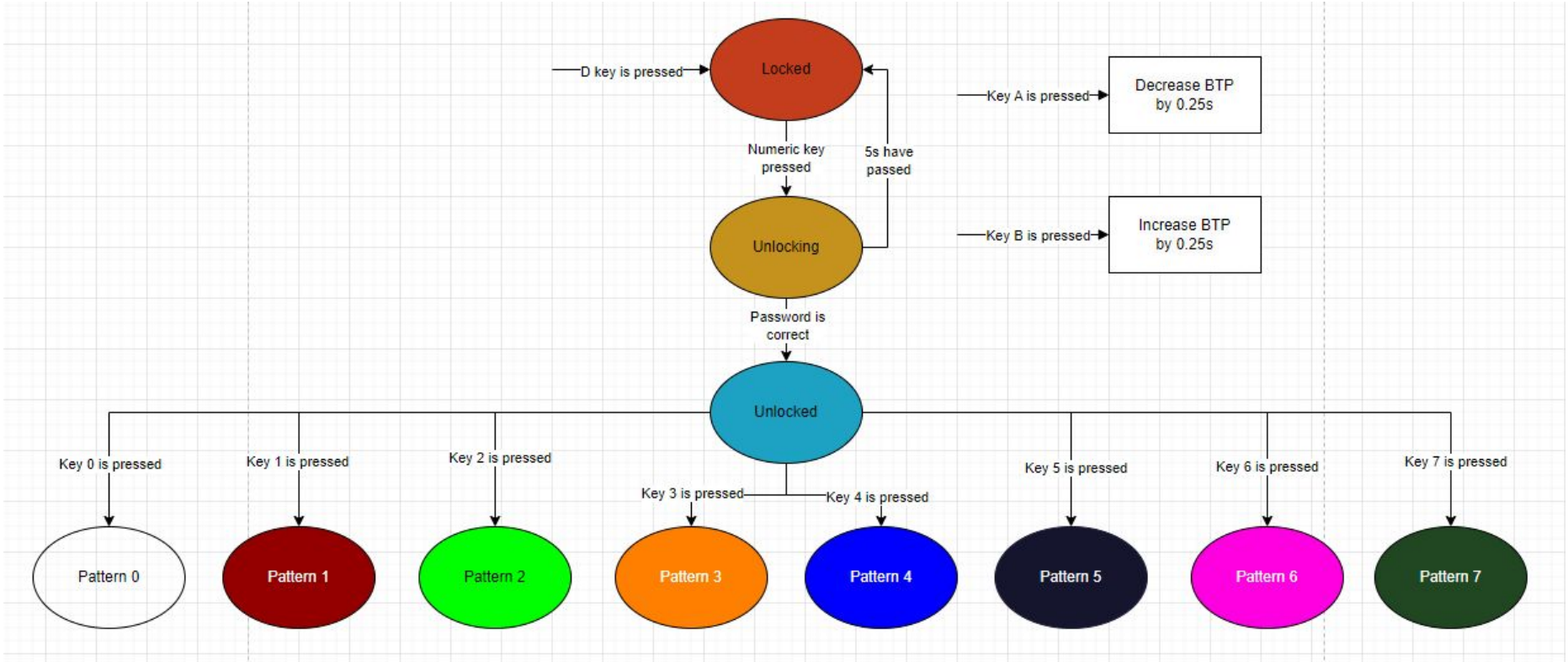
Sebastian:
Developed LCD Driver
Implemented all LCD Logic & Requirements

Requirement/specification	Points	Emmett	Sebastian
Presentation			
Introduction	1	X	
Circuit diagram	2	X	
System architecture diagram	2	X	
Controller high-level flowchart	1	X	
LED peripheral high-level flowchart	1	X	
LCD peripheral high-level flowchart	1		X
Professional demo	2	X	X
LED Patterns			
LED patterns work correctly	1	X	
LCD Display			
LCD is blank when the system is locked	0.5		X
LCD displays current keypress when unlocked	1		X
LCD displays LED pattern name	2		X
Pressing "C" toggles the cursor state (on or off)	1		X
Pressing "9" toggles the cursor's blink state (blinking or not blinking)	1		X
Main controller			
System must have a status indicator that indicates whether system is locked, being unlocked, or unlocked	0.5	X	
The system should respond quickly to a key press	1	X	
The system must communicate to the LED peripheral when a pattern button is pressed	2	X	
The system must communicate to the LCD peripheral when any key is pressed	2	X	
LED bar peripheral			
Status indicator must indicate when the system has received data	0.25	X	
Status indicator must indicate when the system has not received data for some time	0.25	X	
System must be controlled via i2c	2	X	
LCD peripheral			
Status indicator must indicate when the system has received data	0.25		X
Status indicator must indicate when the system has not received data for some time	0.25		X
System must be controlled via i2c	2	X	
System must be able to write characters to all 32 segments	4		X
System must be able to write all characters between 00100011 and 01111111 in the Character Font Table	4		X
LCD contrast is adjustable	2	X	X
LCD must be able to be cleared	1		X
LCD cursor can be turned off and on	1		X
LCD cursor's blink functionality can be turned off and on	1		X
Total	40	20	20

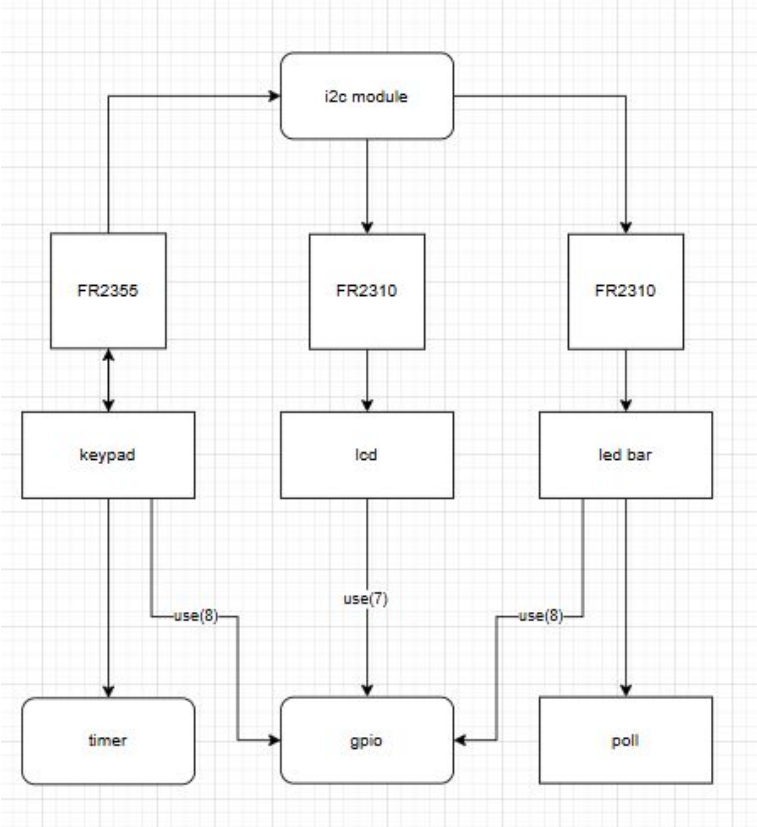
03

Development Documentation

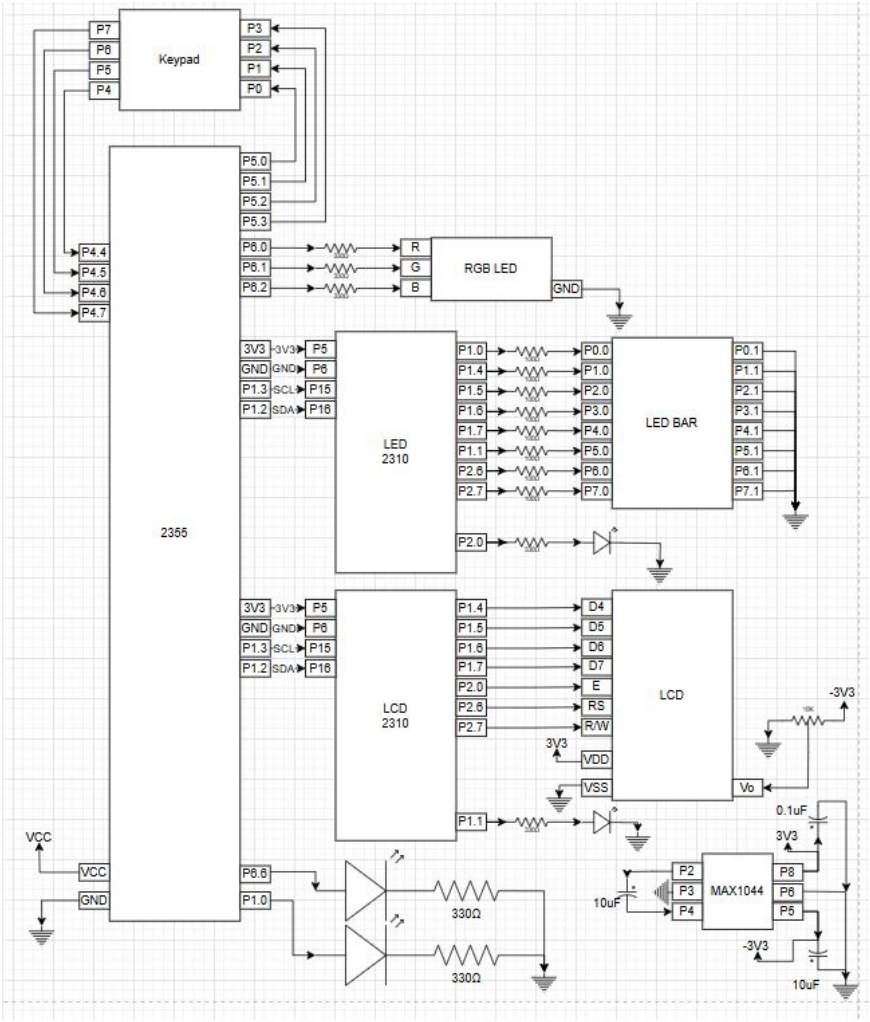
State Machine



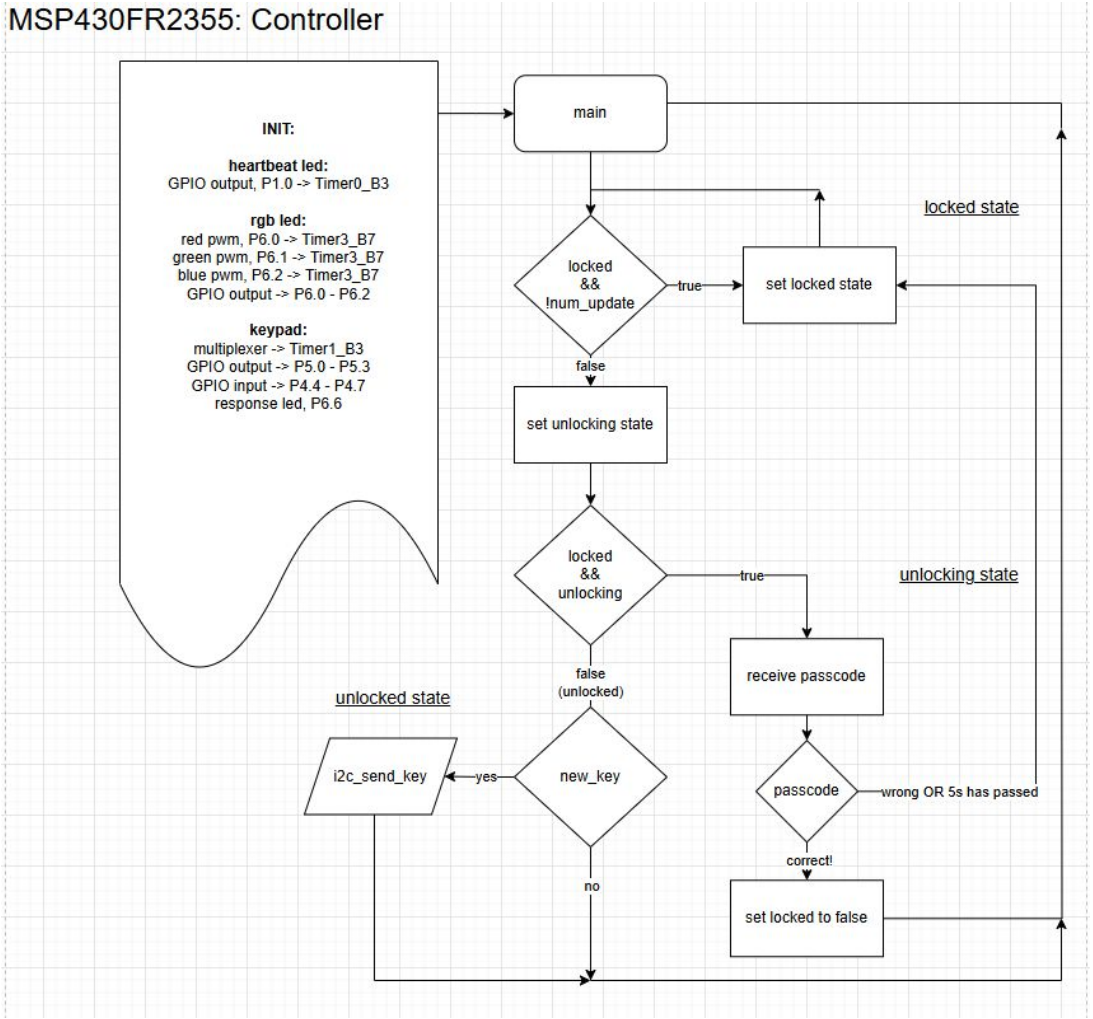
Software Architecture



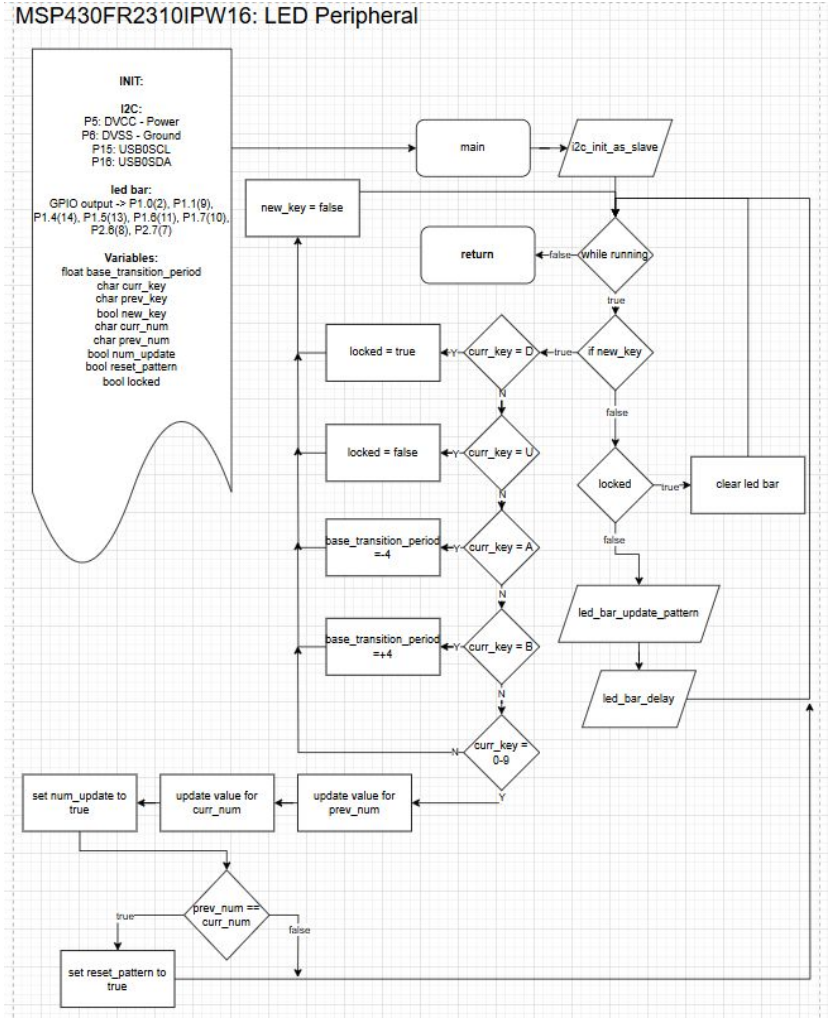
Circuit Diagram



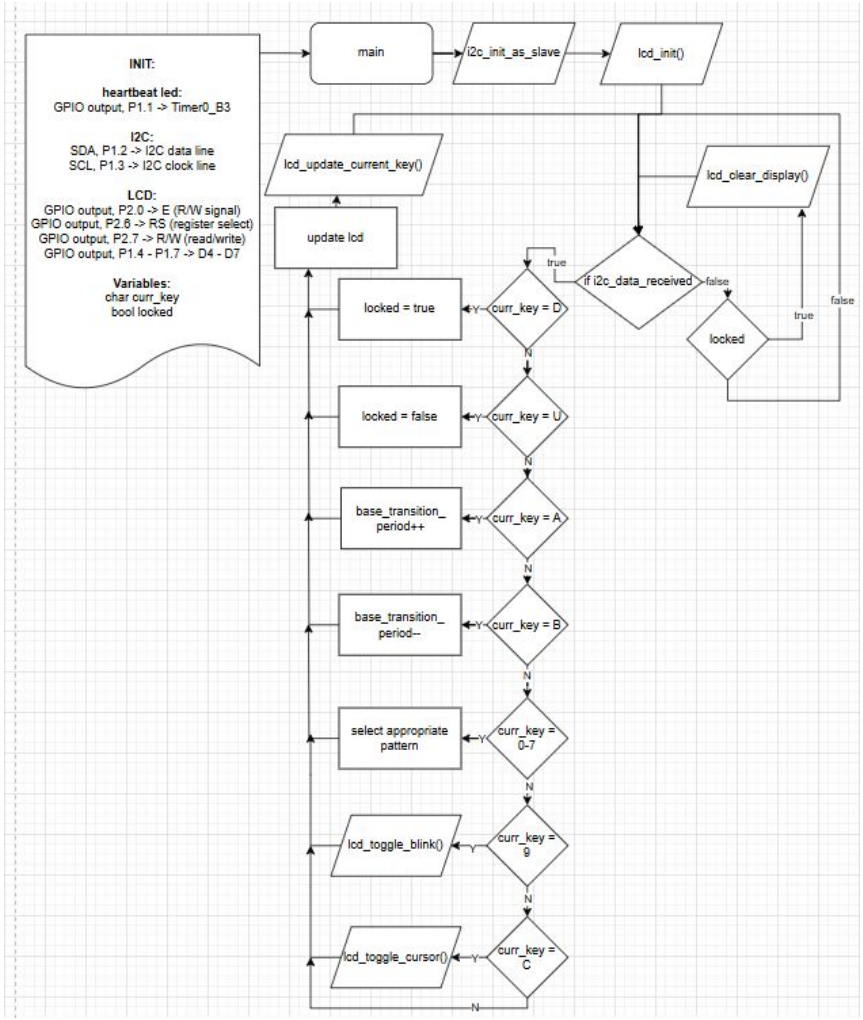
Controller Main Flowchart



LED BAR Main Flowchart



LCD Main Flowchart



04

Demo

05

Extra Credit

Extra Credit

- (+1) The LCD will display the LED pattern base transition period.
- (+0.5) The system must detect the key press within 0.25 s.
- (+0.5 x 2) The system must complete the requested operation within 0.5 s of receiving the I2C command.
- (+0.5) System must be able to write every character in the Character Font Table.
- (+2) Create and display a custom character on the LCD.

TOTAL: +5

THANK YOU

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