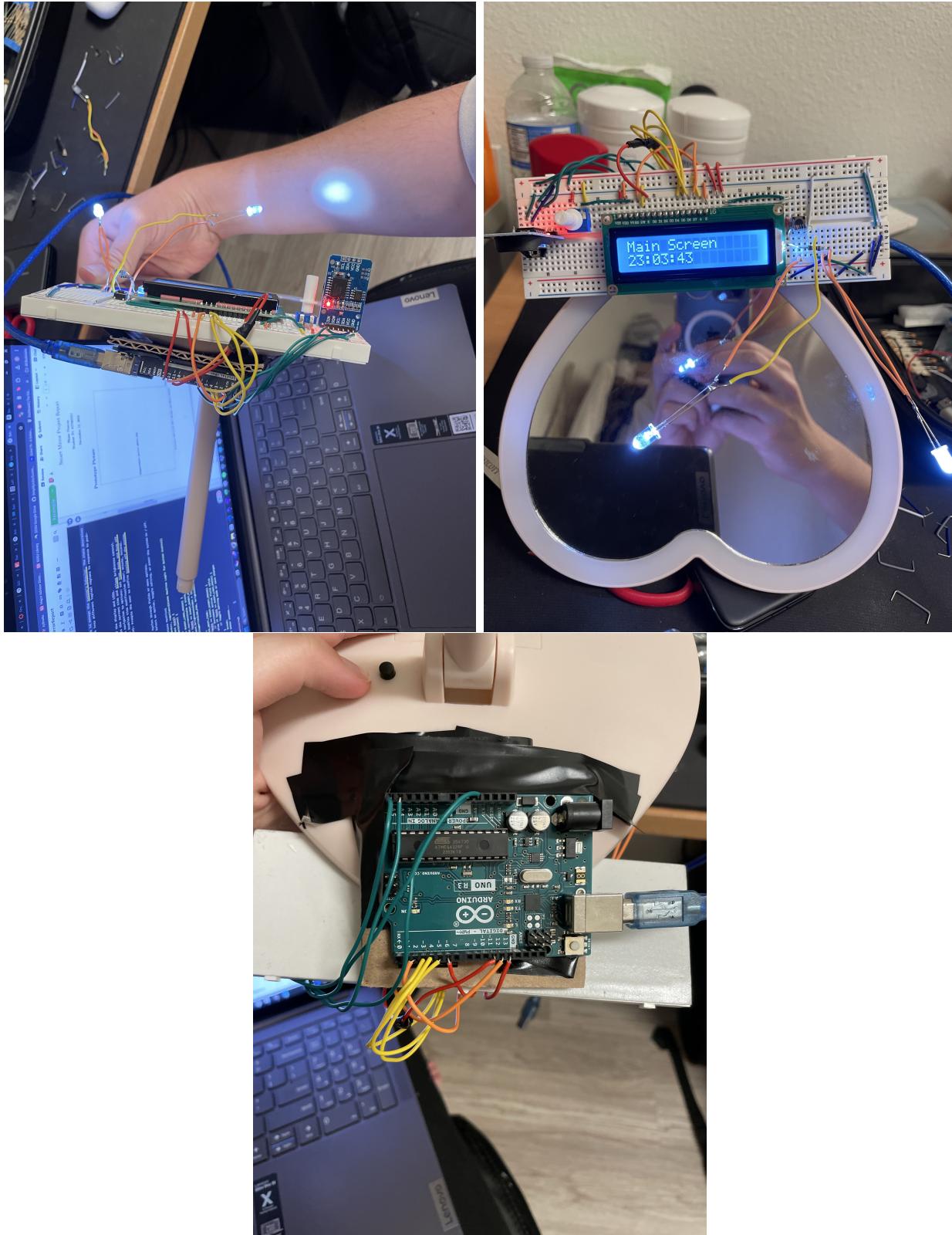


Smart Mirror Project Report

Blaise Duncan
Student ID: 827062321

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Prototype Pictures



Top, Front, and Back views of the Smart Mirror Prototype.

Brief Description

The smart mirror integrates a real-time clock (RTC) module, an LCD display, and an Arduino Uno to provide time display, LED brightness control, and a simple user interface. Users interact via a single button that detects short and long presses, enabling navigation through menus to set the time, control the LED brightness, and power the mirror on/off.

Hardware Used

- Arduino Uno (Microcontroller)
- 16x2 Liquid Crystal Display (LCD)
- RTC DS3231 Module (Real-Time Clock Module)
- Push Button (Single input for UI control)
- LED (For adjustable backlighting)
- Mirror Surface (Prototype mount)
- Connecting Wires and Breadboard
- USB for power

Software Used

- **Wokwi Simulator:** Used for early prototyping and debugging
- **Arduino IDE:** Main platform for programming, compiling, and uploading code to the microcontroller.
- **Libraries:**
 - LiquidCrystal.h (LCD control)
 - RTClib.h (RTC management)

Program Organization

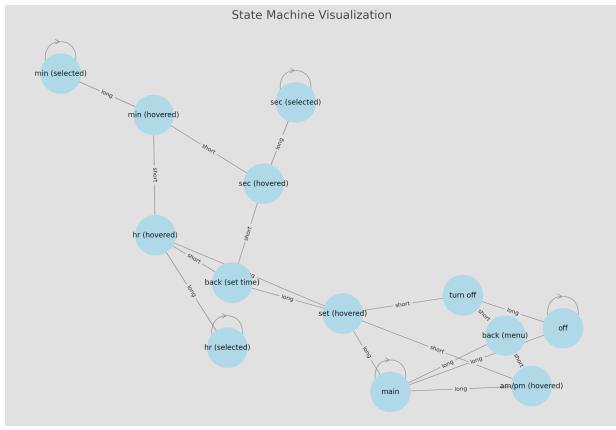
The software is organized into a state machine to manage the system's behavior. The state determines which menu is displayed and is used to branch into different logical regions in response to push-button events.

Core States

- **STATE_OFF**: Turns off the display and LEDs.
- **STATE_MAIN**: Displays the current time and allows brightness control.
- **STATE_MENU**: Allows navigation to options: Set Time, Back, and Turn Off.
- **STATE_EDIT_TIME**: Enables time modification (Hour, Minute, Second).
- **STATE_OFF_CONFIRM**: Prompts the user to confirm turning off the system.

State Machine Diagram

States	Input (Long Press/Short Press)	Next State	Addl. Behavior
off	long	main	turn on
	short	off	does nothing?
main	long	set (hovered)	
	short	main	cycle light
set (hovered)	long	hr (hovered)	
	short	am/pm (hovered)	
am/pm (hovered)	long	main	toggle time disp mode
	short	back(menu)	
back (menu)	long	main	
	short	turn off	
turn off	long	off	shut off lights and display
	short	set (hovered)	
hr (hovered)	long	hr (selected)	save current time as time to modify; freeze clock at that time
	short	min (hovered)	min (hovered)
min (hovered)	long	sec (hovered)	min (selected)
	short	sec (selected)	sec (selected)
sec (hovered)	long	back(set time)	sec (selected)
	short	set (hovered)	back (set time)
back (set time)	long	set (selected)	set (selected)
	short	hr (selected)	hr (selected)
hr (selected)	long	hr (hovered)	hr (selected)
	short	hr (selected)	hr (selected)
hr (selected)	long	min (selected)	hr (selected)
	short	min (selected)	min (selected)
min (selected)	long	sec (selected)	min (selected)
	short	sec (selected)	sec (selected)
sec (selected)	long	sec (selected)	sec (selected)
	short	sec (selected)	sec (selected)

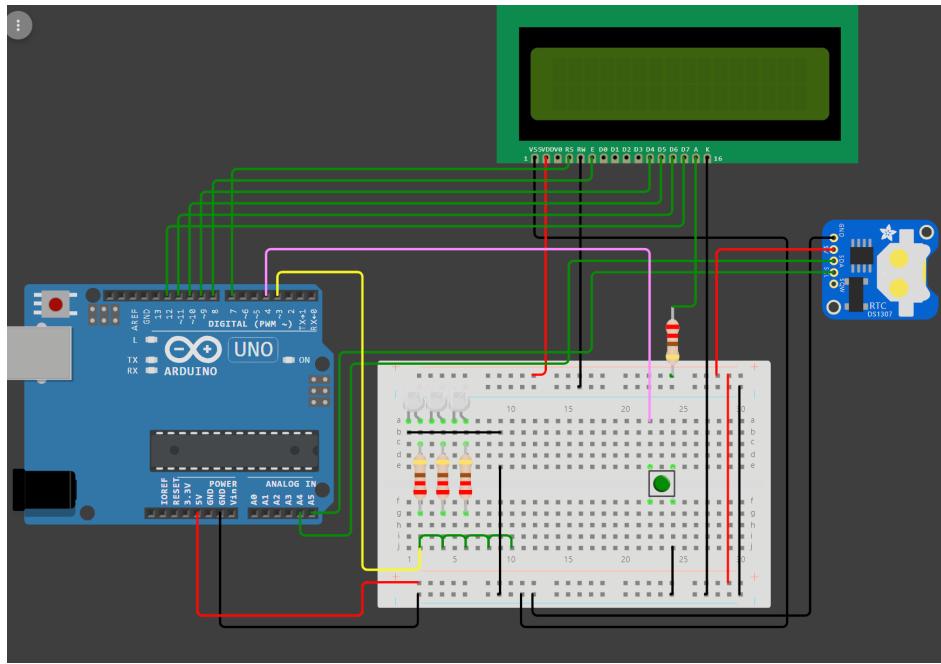


State Machine Diagram and Visualization for Smart Mirror UI Navigation. This is an early rendition, and in final version number of states was reduced and similar states (like selected vs. hovered) were handled with structs representing the data used in these similar states.

Design of Prototype

The physical layout of the prototype includes:

- Mounting the LCD, RTC module, and pushbutton onto the mirror surface with a large breadboard.
- Using the Arduino Uno as the controller for handling inputs and outputs, mounted on the back of the mirror to allow more mirror surface to be exposed.
- Wiring the push button and LEDs wired in parallel to the Arduino's digital pins.



Used wokwi online arduino simulator to plan out the wiring and program logic, allowing me to make significant progress even while I was still procuring the necessary parts.

Testing and Results

The following functionalities were tested:

- **Time Display and Retention:** Verified the RTC module retains the time after power loss.
- **Brightness Control:** Tested LED adjustments using short presses.
- **Menu Navigation:** Confirmed accurate navigation through Set Time, Back, and Turn Off options.
- **Time Setting:** Validated hour, minute, and second modifications with visual confirmation on the LCD.
- **Time Retention:** Validated that time remains accurate after loss of power.

Conclusion

This project fulfills the purpose of solving the problem I set out to fix. I want to be able to have a mirror I can use in the morning that can tell me the time at a glance so I don't lose track of time. If I had longer cables I could position the LEDs in more convenient spots along the mirror, and if I had a power supply it could be more portable, but even given all of that, I still find it to be surprisingly functional for a prototype.