Executive Summary, Phase 1

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1. **A description of the deliverable, its functionality, and demonstration**

The goal of Phase 1 was to create a circuit modeling a statemachine and to develop a first draft of the bot spec for the bot that we would create along the semester.

State Machine

The state machine was required to have the following states

- On: Blinks Red LED at 10Hz
- Off: No functionality
- Run: Both Max intensity and frequency can be modulated by potentiometers
  - Default: Fade Green Led (spec referes to Blue led, but this is probably a mistake) for 6 seconds. Flash 2 times at 1Hz
  - On Switch 1 Rising Edge: Flash at 10Hz
  - On Switch 2 Falling Edge: Turn on Red LED
- Sleep: Flash Blue LED at 4Hz for 1 second. Fade for 1 second. Repeat
- Diagnostic:
  - Mode 5: Blinks Red LED 5 times to indicate 5 problems
  - Mode 8: Blinks Red LED 8 times to indicate 8 problems

Two potentiometers control the frequency and maximum brightness of the Green LED while in the run state.

We took several liberties while planning the functionality of the state machine.

The spec made no mention of how to implement state transitions, so we went with the most simple solution, and did a round robin (On -> Run -> Sleep -> Diagnostic). State transitions were triggered by button press. At any time, the user could push a second button to enter the off state and pressing the button once more would then return them to the On state.

In the Diagnostic Phase, the spec makes no mention of what triggers Mode 5 or Mode 8, so we had it toggle between the two upon entry to the state.

The spec also suddenly refers to a Blue LED as if it were the green led aforementioned. We took that as an error and worked as if all mention of a Blue LED was the Green LED.

Bot Spec

We followed the listed guided to provide a draft specification for the bot we would build.

2. **The duration of the design tasks for the phase showing the original planned dates and any delays or changes from the original projections.**

State Machine was started on 1/17. We estimated that we could finish on 1/25. We were able to complete the State Machine a day early and deliver on 1/24.

The bot spec was started after we delivered the the state machine on 1/25. We projected that we could finish on 1/29, but later revised that date to 1/30. We delivered on 1/30.

3. **A brief description of the conceptual and design activities.**

Conceptual and Design Activities revolved around the completion of the Prestudio assignements. Prestudio assignments provided the initial push to start thinking about how we would approach this design sprint, like the problem we were trying to solve and the requirements that we would have to meet.

Once finished with the Prestudio assignments, we would also meet to discuss and plan all the details of how we would implement the state machine.

4. **A short technology summary of the theory of operation for the team's design, any drawings, sketches, schematics, block diagrams, and flow charts to clarify the design that are appropriate to convey the design intent of the team**

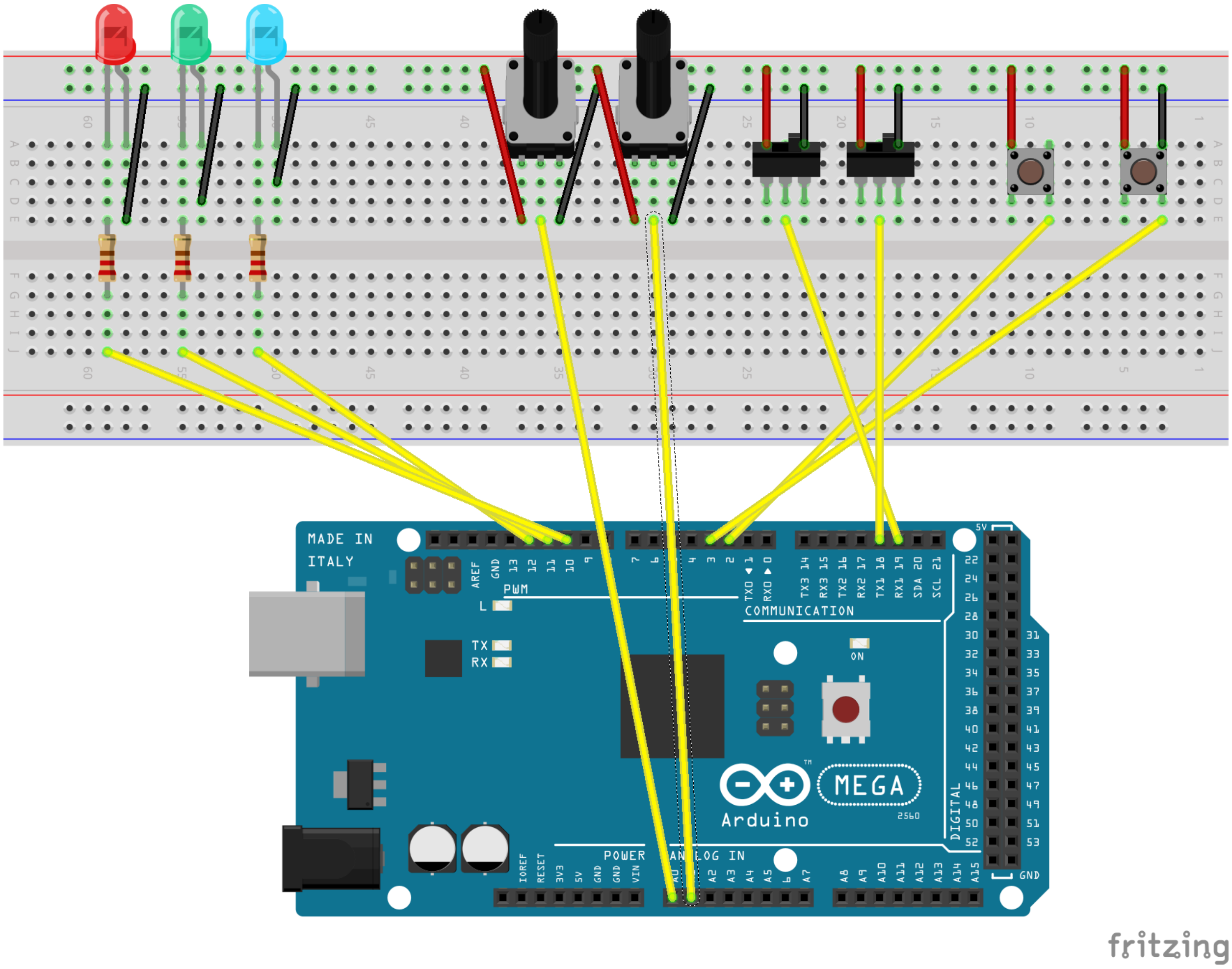

Figure 1: Circuit Diagram

Our circuit performed none of the logic for the state machine, instead relying on the microcontroller.

The software modeled the state machine as a list of states (functions). Global variables served to record the current state of the machine (current state, whether the board was on, whether it should switch to a new state, etc...). Each of the state functions defined the corresponding behavior of the state machine, as described in the section on functionality. The buttons were associated with interrupt service routines that either cycled through the current state, or toggled the power state of the state machine.

5. **A complete list of the experiments performed, the success or failure,an assessment of the quality of the reflection on failure,and the learning that occurred from the experiments. Consult the reflection on failure rubric to perform the assessment.**

To verify that we had a circuit that met the spec, we designed several tests to verify the functionality of our circuit

Fade Test

In software, we designed a subsystem that could smoothly modulate the brightness of an LED between two brightness values over a specified period of time. To perform this test, we had to qualitatively judge the brightness of the LED and the transitition, but we used a chronometer to measure the duration of the transition. We encountered several failures before we were satisfied with the results. We ran into the problems that the LEDs would sometimes flicker instead of smoothly transitioning, and that the LEDs wouldn't shine brightly enough. With debugging we found the flickering was due to us forgetting to tie the groudn on the microcontroller to the ground of the powersupply that we were using to power the LED. By using analogWrite instead of digitalWrite, we were also able to get the brightness of the LED to an acceptable level.

Blink Test

We also used software to develop a subsystem that could flash on LED at a given frequency. To test this, we had the microcontroller output the current time in milliseconds over a serial connection every time it lit the led. We could then determine the period of the flashing, and from there the period. We encountered no significant failures in this test

State Transition Test

We then ran several tests to verify that we could transition between all states in a round robin fashion, enter the off state from all of them, and subsequently enter the run state. We had an initial failure where instead of going from the last state (Diagnostic) to the first state, our program would instead hang before the board reset itself. This was due to an order of operations error preventing a modulo operator from performing as expected.

State Functionality Test

We went through each state to verify that each state functioned according to spec. This was trival for the ON, and Sleep state, since they solely depended on Fade and Blink which we had already tested. We set Diagnostic to toggle between Mode 5 and Mode 8 each time we entered that state. We went through all of the behavior required for the run state, verifying that the various triggers (potentiometers and switches) produced the correct effect. There were no significant failures during this testing phase.

6. **A list of who was assigned which tasks and the quality of their work.**

General Design Tasks (Prestudio) were divided equally between all team members. Our design was well suited for the spec and allowed for efficient completion of the deliverable.

Circuit Design - David Janowsky. The circuit worked perfectly and performed all required tasks to spec.

Software Design - Kevin Destin. The software was adequate and also met the spec.

Bot Spec was completed as a team and resulted in a good first draft.

7. **The cost of the bot by phase to-date versus its estimated cost.**

Not applicable. We incurred no costs directly related to bot construction in this phase.

8. **Team stage assessment: strengths, weaknesses, difficult personality types present on the team, improvement plan, and success of respect and working together.**

As a whole, the team is functioning well. We are respectful of each other, communicate well, and are respectful of each other's time. We are able to bounce design ideas off each other well, discussing the merits of various ideas to finally settle on the best ones. We have not faced problems related to personalities, but moreso in terms of expertise. Both team members have strengths skewed to either facets of this project (hardware and software). As such, it has been the natural to divide the work along those lines, allowing each member to work at what they are best at. The disadvantage has been that this limits each members exposure to the topic they are weaker at.

9. **Recommendations to the next project leader on how team operation and design work may be improved. For subsequent executive summaries after the first one, a statement of how the recommendations were implemented, or the reasons for discarding them must be included.**

It would probably be worth having each team member switch to the part of the project they are less apt to.