Scrolling LED Display

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***Abstract*— The brief summary of the scrolling LED display is that it takes a four letter word and has it rotate through all eight displays on the Nexys board. As a group we felt that the purpose was that it could display information quickly for people. These displays can also be used at any time of day so that would be really helpful at night. We created this scrolling display using shifter, 7 segment, multiplexer, FSM, and decoder. For major findings, we found how display the words on the screen, also found how to have the words scroll across the display and also how to change the word completely. In conclusion, the understanding of many components were used, getting to use a large shifter, and successfully getting the words to scroll. For future recommendations learning how to display more than one word would be nicer, having a nicer board to where we can include all letters because the Nexys board can't display certain letters, and to be able to shift in a different direction for maximum viewing.**

I. INTRODUCTION

The scope of this project is to explain how we created a scrolling LED display. Within the introduction we will explain why it was made, what we used from our class knowledge and what the applications of the project are. First, the motivation of the scrolling LED display was to further our knowledge and to create a useful, everyday application. The implication of the project is that we could use this to impact a large population by sharing information on a display and you could add multiple lines of info. The topics that we have learned in class that was used to complete the code were: shifter, hex to 7 segment, decoder, mux, and a counter. The topics that we learned on our own include a 32-bit shifter, how to complete a counter, and how to use a finite state machine to control the LEDs.

II. METHODOLOGY

This is the body of your report. Here you explain how you designed your project.

A. Brainstroming

The first step of every project is to discuss ideas that have practical applications. When brainstorming for project ideas we ran into some issues because our first idea was already taken, but after discussing with the professor, a practical project was found.

B. Implimetation

Once our idea was finalized the coding began. We first looked through the class notes for ideas on how to put together certain components to complete the scrolling LEDs. In the first attempt, we used two state machines to switch through the "words" but after experimental testing we ran into a roadblock. The state machines would overlap and cause the words to go through a "loop" which made a single letter appear and not move. After reviewing the code for a shifter, we decided that was the best option to get the "words" to display on the 7 segment. After selecting the shifter to get our words to display we began writing the rest of the code. A brief explanation on how the code works: On the top level there is an enable switch, an srt switch, and word switches. Whenever the word switch is chosen, it is coded to load up a four letter word, from there because there is 8 LEDs we have 4 addition signals that go to nowhere (0). They were all concatenated together into the shifter input. There is a signal for the shifter called Win (3 down to 0) which is important, as that the shift in to the shifter is the last four of the previous output (4 bit) that enables the word to continuously shift on the LED's. On the first attempt to code the shifter, the shift in was four 0s, so it would shift over and not repeat on the display. However, it was later decided that the Win would need to be the last four bits of the previous shifter output in order for the word shifting on the screen would stay in a loop. The 32-bit output is separated to 8 different 4 bit signals and each 4 goes to one of the 8 displays. Then, the finite state machine has an enable of the output of a nanosecond clock, which ensures the LEDs flashed for 1 nanosecond each which meant the letters weren't flickering. Thus, the finite state machine had 8 states and it would change states every nanosecond. At each state the signal S was the output of the finite state machine. The signal had two purposes, it determined which 7 segment display was on using a multiplexer and it went to the corresponding 8-bit display and it also went through a decoder which choose which 8-bit displayed was enabled. Because four of the signals were always four 0s, we modified the 7 segment display so that when 0's came it would show no display.

III. EXPERIMENTAL SETUP

To run the experiment, we used the Nexys 4 DDR board with the software ISE Design Suite Xilinx. The specific configurations we used were: 7 segment display, LED's, switches, and the reset button. To test the code, we had to synthesize and implement the code in Xilinx. There were multiple "trial and error" runs where we would implement the code thinking it was right, only to find then it wouldn't work, even though it would synthesize correctly. After finally getting no errors, we had to create a constraint file and test bench. After the board was programmed we tested the

switches and button to make sure the words loaded correctly and would shift across the displays without glitches.

IV. Results

Results from things we learned in class include the successful use of clocks, counters, 7segment display, mux, decoder and FSMs. In response to the question if the results were as expected, we can say yes, the results were what we expected. The 7 segment display shows the words that we included in our test bench and the words successfully run across the displays in a continuous loop. As for the unexplainable results, any unexplainable results that occurred during the implementation stage were accounted for and therefore re-evaluated and worked through, so we could therefor explain it and account for it in later code and implementation.

Results for our code can be viewed in the YouTube link provided below. (A few more keys were added after uploading this video)

https://youtu.be/kX_rAnXPkWk

Conclusions

In conclusion, the take away's from this project would be our understanding of key components studied in the course. We learned that a larger shifter could be used to get the display we want and that we also learned how to make the words continuously scroll across the LED display. As for future improvements, they include: a bigger budget for a nicer 8 LED display that would allow us to include certain letters we couldn't include now, for example, R and N. We also wish to learn how to add different directions for the outputs. One last improvement we wish to make was to have the words flash across the display to better grab the attention of the people.

References

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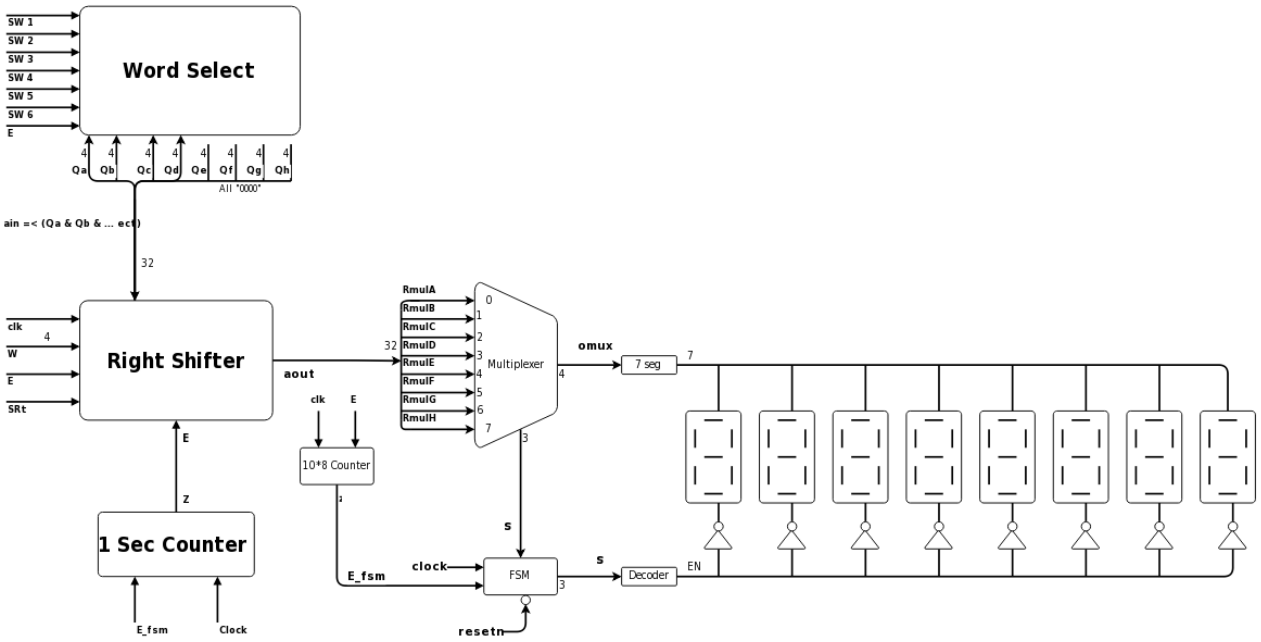

Figure 5: Top Level Diagram of Scrolling LED's Across 7 Segment Display

As the preset words are called each letter is loaded into the multiplexer and send to the 7 segment display. Using 2 counters we are able to allow each 7 segment display to turnoff and the next to turn on. One counter corrects the flicker issue and the other to turn each display on and off.