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EECE 251 Dr. Douglas Summerville

EECE 251 Final Project: Stopwatch and Timer

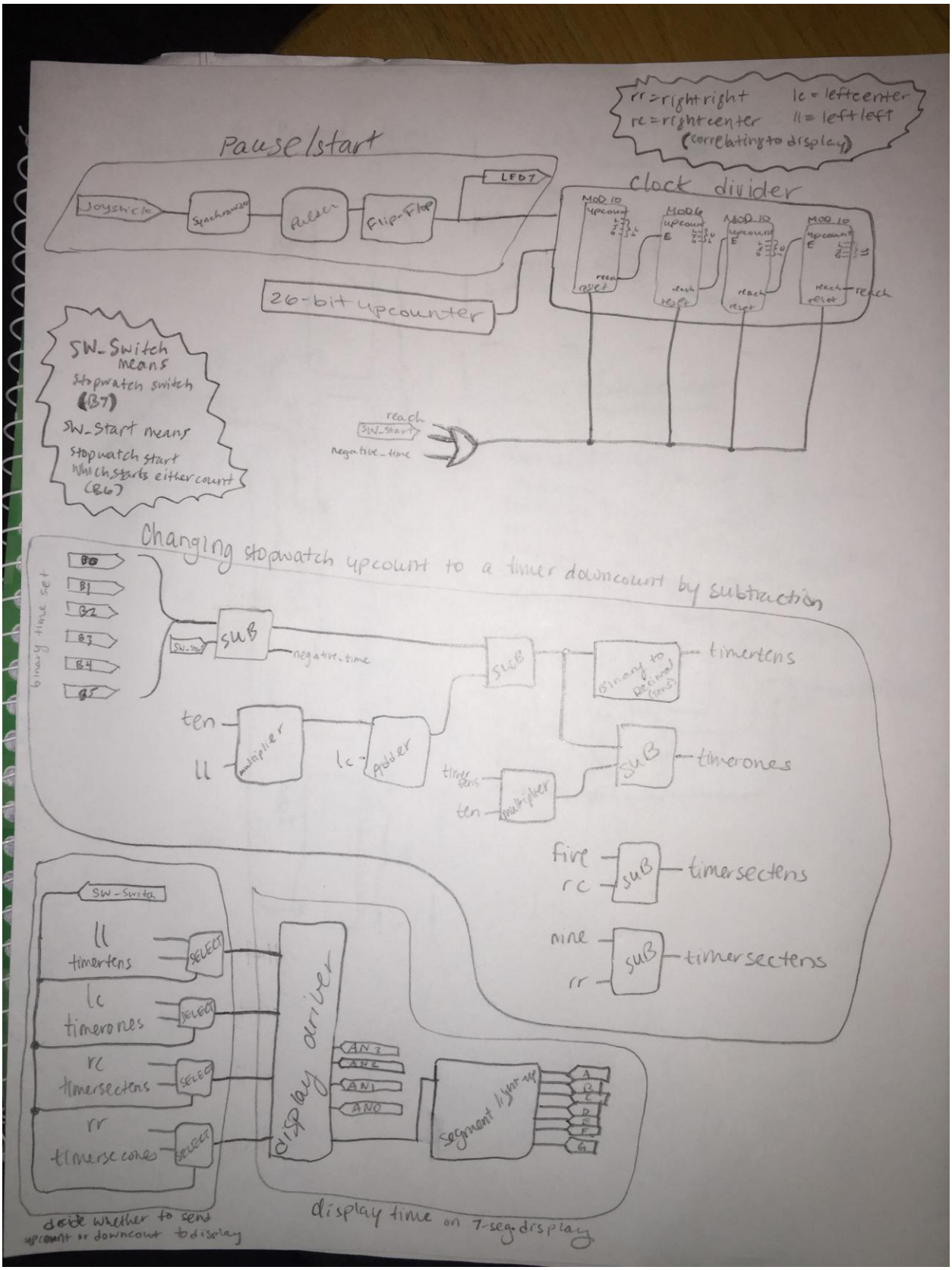
Our design allows the user to utilize the Papilio board as a stopwatch or a timer via the seven-segment display.

By flipping the leftmost switch the user can decide between activating the stopwatch (HIGH), where time counts upward, and the timer (LOW), where the time counts downward from a specified number of minutes.

The second-to-leftmost switch is multifunctional. When the stopwatch mode is activated, the switch acts as a start (HIGH) and reset (LOW). Start activates the clock to begin counting upward in seconds, then minutes. Reset brings the time back to 0. When the timer is activated, the switch acts as a start (HIGH) and a time-set (LOW). When in time-set mode, the user has the ability to flip the 6 remaining switches to set a number of minutes (in binary) to count down from, and the number is shown on the seven-segment display. Then switching to start begins the countdown.

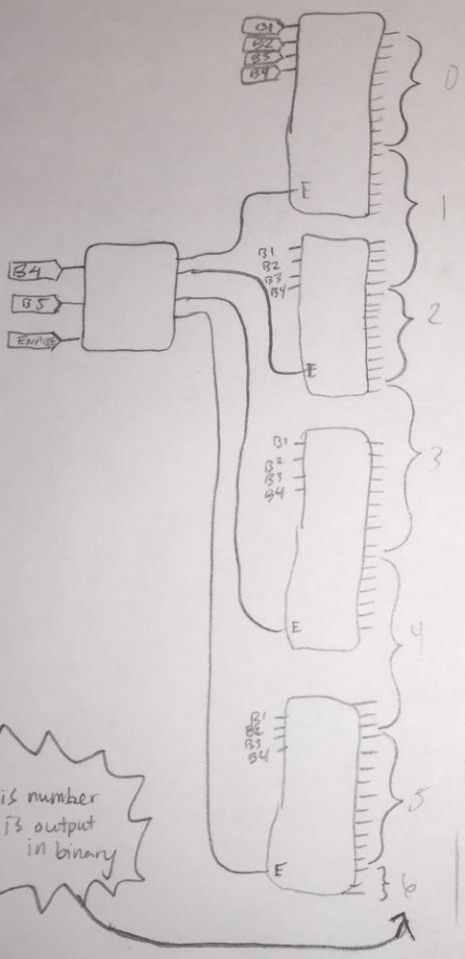
Aside from the switches there is one more functional input the user can utilize: the joystick. Pressing the center of the joystick pauses the timer or stopwatch and keeps the current time shown on the seven-segment display. The leftmost LED is a pause indicator. Since it isn't obvious by looking at the joystick whether the time is paused or not, the leftmost LED lights up to show notify the user when the time is paused.

Below is the block diagram. This project had a lot of upper level components, so perhaps it appears too detailed for a block diagram. However, the overall processes are lightly outlined and captioned.

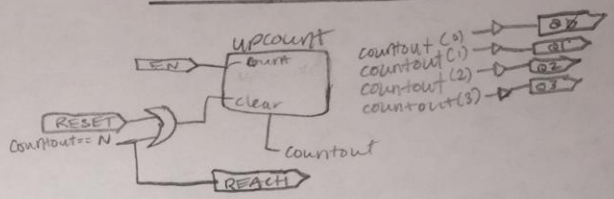

rr = right right
rc = right center
lc = left center
ll = left left
(correlating to display)
Pause/start
Joystick
Synchronizer
Pulser
Flip-Flop
LED7
clock divider
MOD 10 upcount
MOD 6 upcount
MOD 10 upcount
MOD 10 upcount
reach reset
reach
26-bit upcounter
SW_Switch means stopwatch switch (B7)
SW_Start means stopwatch start which starts either count (B6)
reach
SW_Start
Negative_time
Changing stopwatch upcount to a timer downcount by subtraction
binary time set
B0
B1
B2
B3
B4
B5
SW_Switch
SUB
negative_time
SUB
binary to decimal (tens)
timertens
ten
ll
multiplier
lc
adder
timertens
ten
multiplier
SUB
timerones
fire
rc
SUB
timersectens
mine
rr
SUB
timersectens
SW_Switch
ll
timertens
lc
timerones
rc
timersectens
rr
timersecones
SELECT
display driver
AN3
AN2
AN1
AN0
segment 7 array
A
B
C
D
E
F
G
decide whether to send upcount or downcount to display
display time on 7-seg display

The Mod N Counters, the Binary to Decimal Converter, and the Select Component are all self-made components. The inner workings of these can be seen below:

Binary to Decimal (Tens)



Mod N upcount



Select