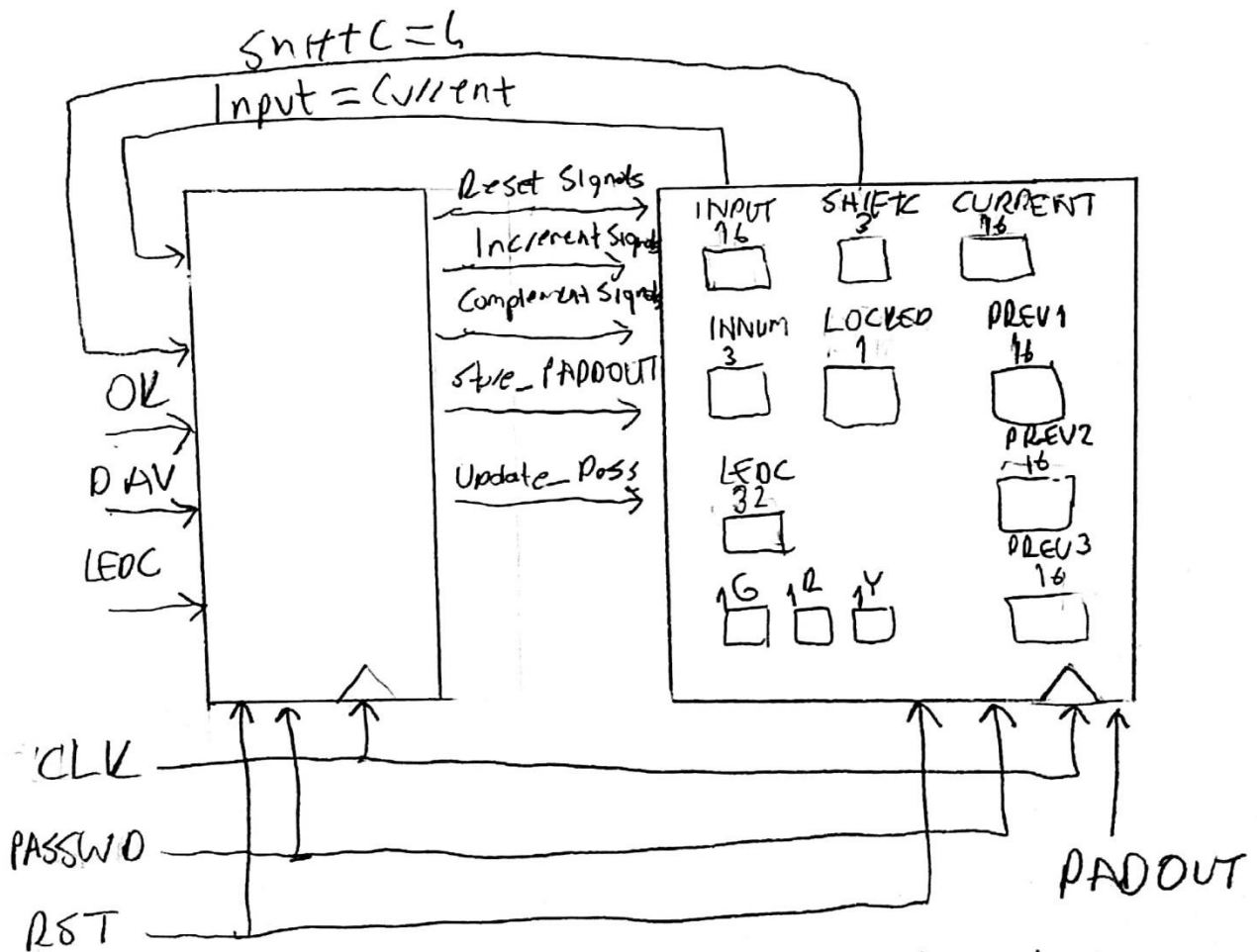


# 1. Block Diagram:



Input: Register to store the output of keypad

Current: Current password

Prev #: Previous values to check

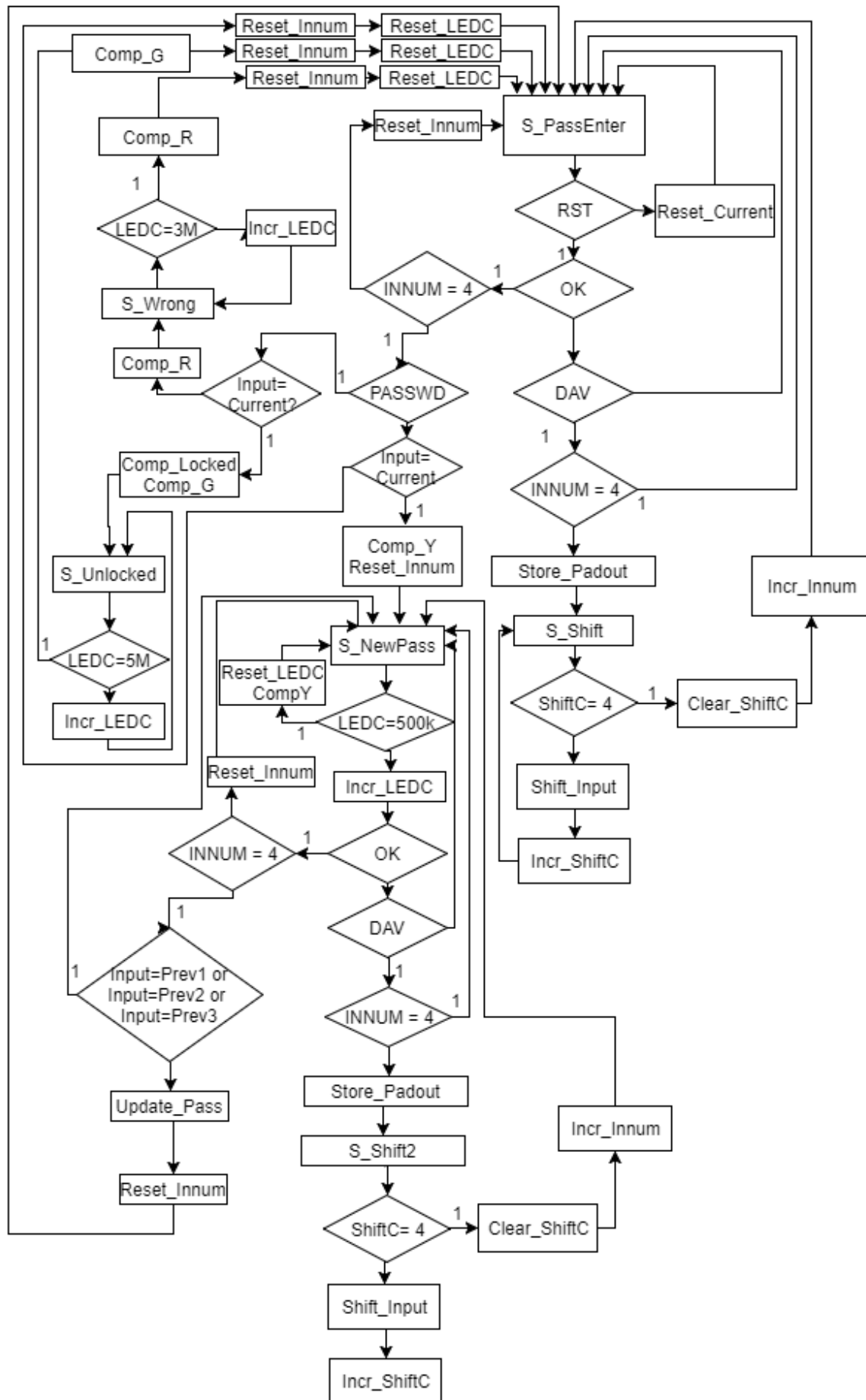
Innum, ShifTC, LEDC: Counters for the control system

ShifTC=6, Input=Current: Comparison signals to make decisions

LED Count comparisons were omitted.

All signals of a category are shown together to avoid clutter.

### 3: ASM Chart of the system



State Table:

	G <sub>2</sub>	G <sub>1</sub>	G <sub>0</sub>	EST	OK	Poss	DAV	INNum	SHIFTC=1	Input = 0/1/2	Next State G <sub>2</sub> G <sub>1</sub> G <sub>0</sub>
S_PassEnter	0	0	0	1	X	X	X	X	X	X	0 0 0
S_PassEnter	0	0	0	0	1	0	X	0	X	1	0 0 0
S_PassEnter	0	0	0	0	1	0	X	1	X	1	0 0 1
S_PassEnter	0	0	0	0	1	1	X	0	X	1	0 0 0
S_PassEnter	0	0	0	0	1	1	X	1	X	1	1 0 0
S_PassEnter	0	0	0	0	0	X	0	X	X	X	0 0 0
S_PassEnter	0	0	0	0	0	X	1	0	X	X	0 1 1
S_PassEnter	0	0	0	0	0	X	1	1	X	X	0 0 0
S_PassEnter	0	0	0	0	1	0	X	X	X	0	0 1 0
S_PassEnter	0	0	0	0	1	1	X	X	X	0	0 0 0
S_Unlocked	0	0	1	X	X	X	X	X	X	X	0 0 0
S_Wrong	0	1	0	X	X	X	X	X	X	X	0 0 0
S_Shift	0	1	1	X	X	X	X	X	0	X	0 1 1
S_Shift	0	1	1	X	X	X	X	X	1	X	0 0 0
S_NewPass	1	0	0	X	0	X	0	X	X	X	1 0 0
S_NewPass	1	0	0	X	0	X	1	0	X	X	1 0 1
S_NewPass	1	0	0	X	0	X	1	1	X	X	1 0 0
S_NewPass	1	0	0	X	1	X	X	0	X	X	1 0 0
S_NewPass	1	0	0	X	1	X	X	1	X	X	1 0 1
S_Shift 2	1	0	1	X	X	X	X	X	0	X	1 0 1
S_Shift 2	1	0	1	X	X	X	X	X	1	X	1 0 0

LEDC signals were omitted, they only effect the timing of the system. The decision paths all function the same without them.

Implementation of system;

The system for controller part is very complex to draw by hand so, only datapath is given.



The signal connections are also rather complex so please check flowchart and source code to understand what is connected to what. Please also note that, there are 6 comparators to produce the control signal "Input = Current", "Innum = 4", "ShiftC = 4" and "LEDC = X" signals.

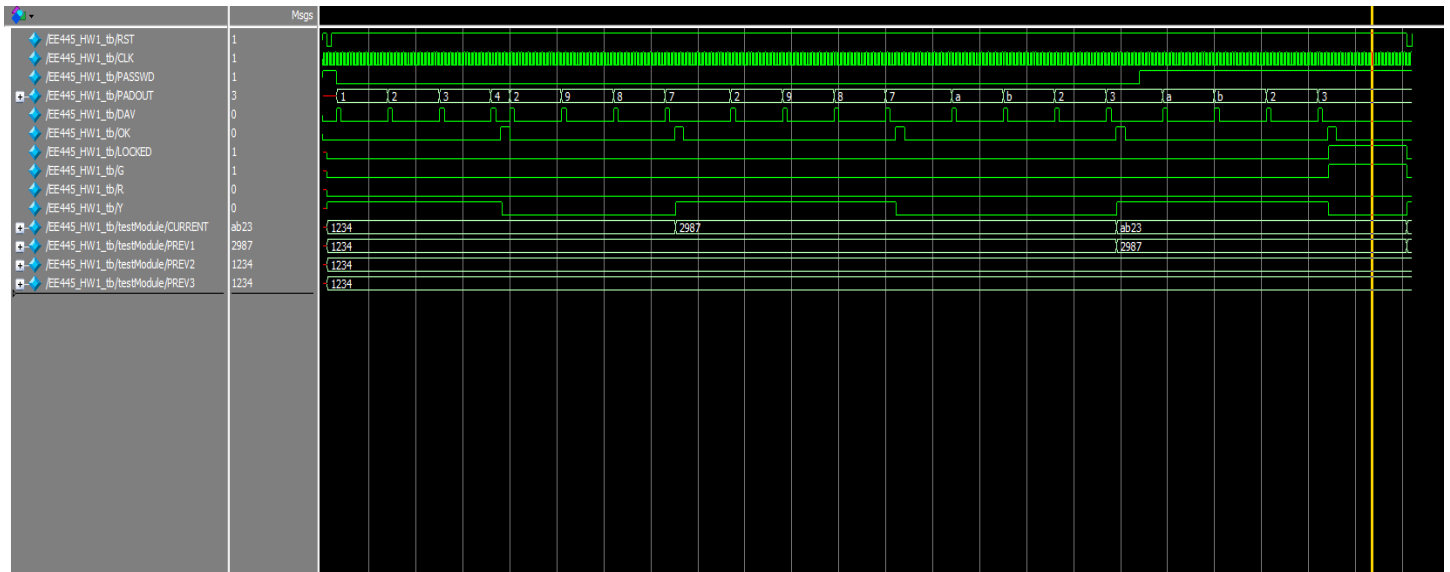
## Implementation Details:

On the Pass Enter state the system waits for inputs from the keypad and when a button is pressed number of inputs after the last okay is checked and if the number is less than 4 the new input is stored on INPUT register. If the number is more than 4, the input is ignored. After an input is stored on the register the system goes to Shift state and shifts the input register left 4 times to make space for the next input. The shifting is not done for the 4<sup>th</sup> input since it is already in place.

When OK button is pressed if less than 4 inputs came to system since the last OK the input is ignored, and the system stays in the Pass Enter state to wait for the next input. If the INPUT is not the same as CURRENT password if PASSWD switch is off, then the system goes to Wrong state. If PASSWD switch is on the input is just ignored. If the input is correct PASSWD switch is checked and the state is changed to New Pass if the switch is on and Correct state if it is off.

On the Correct and Wrong states, the corresponding LED is lit for the amount noted and then the system returns to Pass Enter. If the system is on the New Pass state then a new 4 digit input is waited like before and if it is correct the INPUT is compared with previous passwords and if it differs it is set to CURRENT and the previous inputs are updated.

## Simulation results:



Reset signal is sent to initialize the system. Password switch is on to enter the new password.

The old password is entered first (1234) and then new password is entered (2987)

Please note that since Y should blink every 0.5 seconds but when the simulation time exceeds second it takes too much time to wait for the waveforms to show so we see Y as low only during password change but after the password is entered we observe the change back to Y=1.

After the password change we keep password switch on and enter another password to observe the changes on the previous password values. After doing the same steps as above we clearly see the change on the CURRENT value (2987 to AB23) and PREV takes the old value of CURRENT (2987). The password switch is back off and the system returns to usual operation.

When the correct password is entered LOCKED becomes 1 to indicate the lock opens and G becomes 1 while Y becomes 0.