LOGIC DESIGN PROJECT

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WASHING MACHINE CONTROLLER

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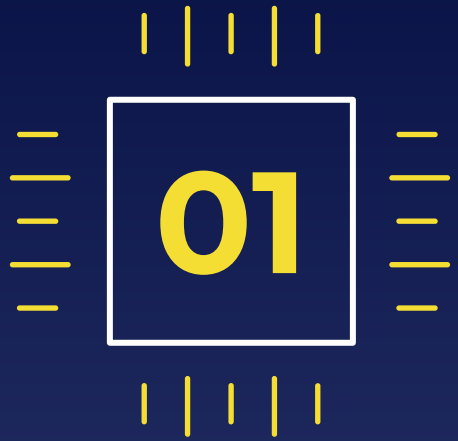
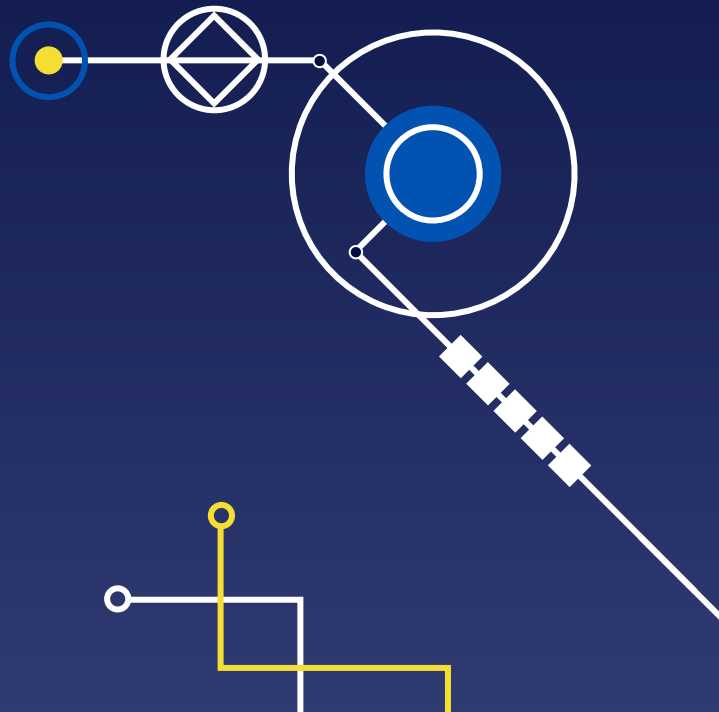


DESIGN SPECIFICATIONS

Requirements

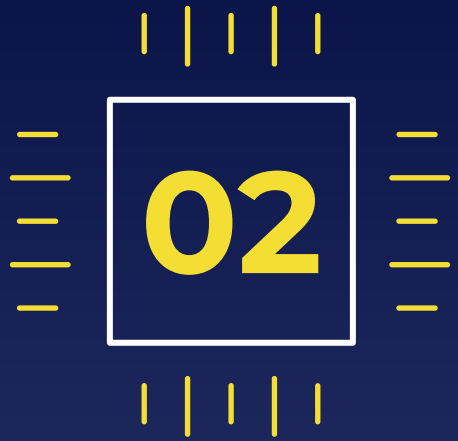
- The system should provide automatic mode and manual mode.
- Under fully automatic mode user intervention requirement should be zero.
- In manual mode continuous intervention of user is required.
- The system should provide easy options for upgradeability of new features.



Basic features

FILL WATER — HEAT WATER — WASH

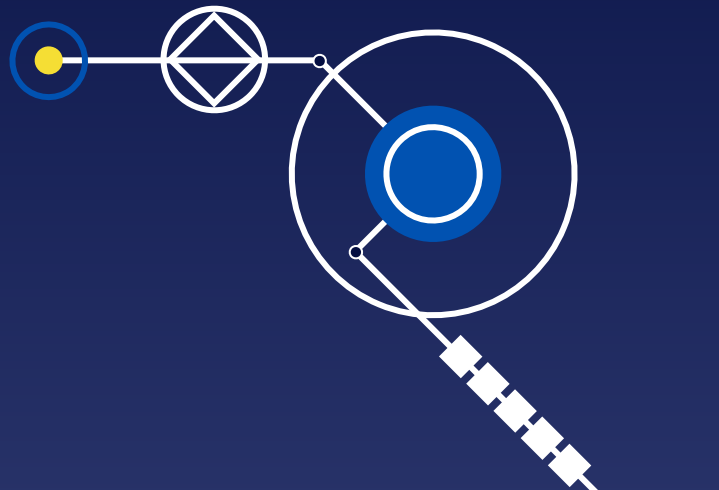
RINSE — SPIN



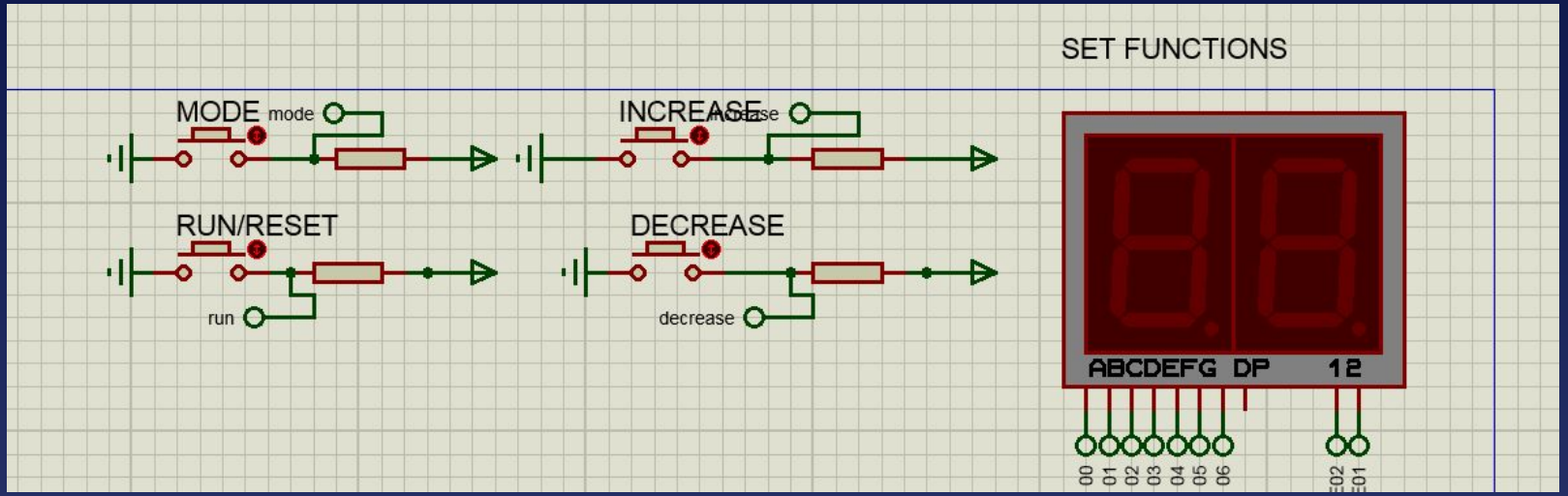
HARDWARE DESIGN

Electrical components and Functions

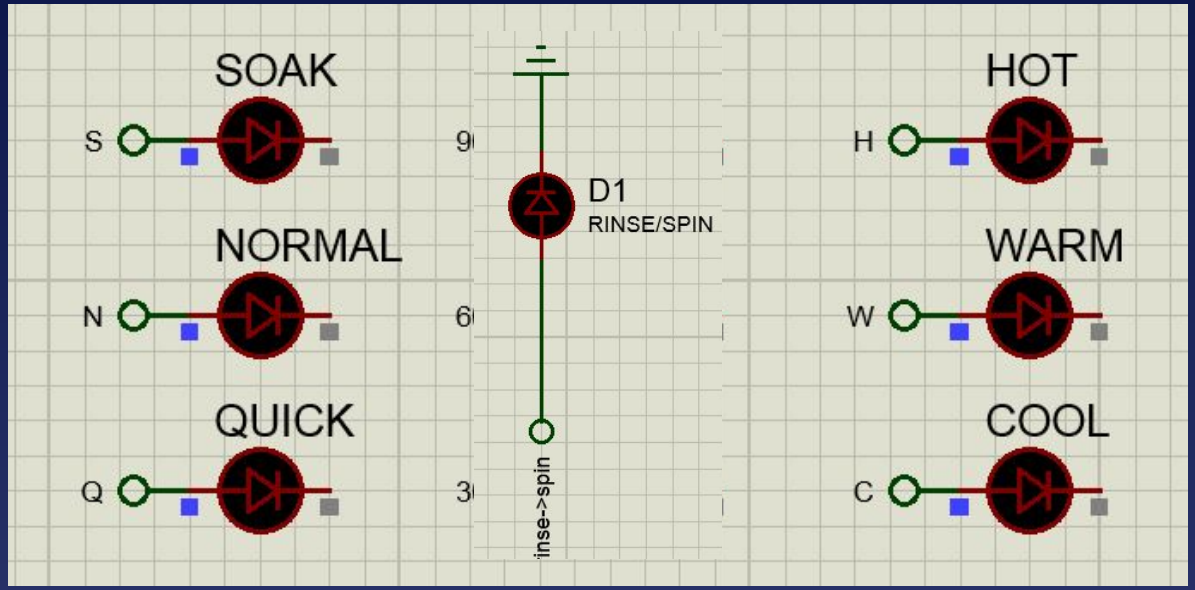
Components	Amount	Function	
STM32	1	1	Controller
Buttons	4	1	RUN/RESET
		1	MODE
		1	INCREASE
		1	DECREASE
7 segment LEDs	4	2	Display state
		2	Display remained time
Single LEDs	10	3	Present washing mode
		3	Present water rate
		3	Present water temperature
		1	Error detection



Buttons and two first 7-segment LEDs



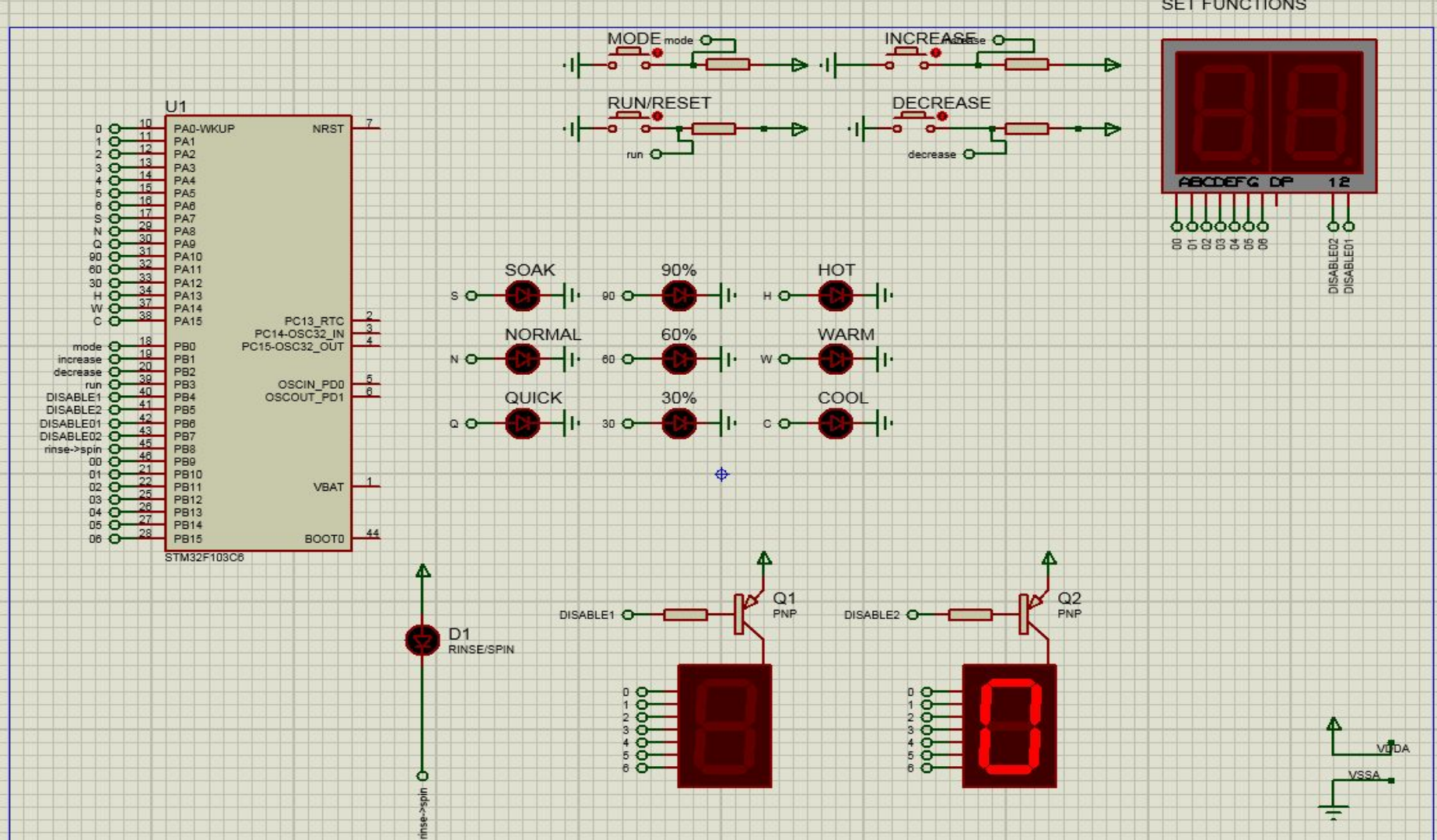
LED display

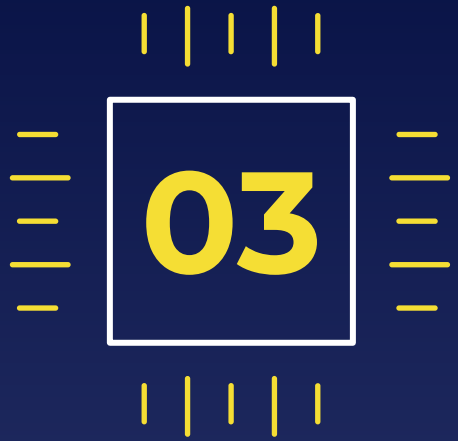

SOAK
S
NORMAL
N
QUICK
Q
D1
RINSE/SPIN
inse->spin
HOT
H
WARM
W
COOL
C

Countdown digital clock

```
//Washing mode
#define SOAK_DURATION       50  //500ms
#define NORMAL_DURATION     30  //300ms
#define QUICK_DURATION      20  //200ms
//Water level
#define L90_DURATION        90  //900ms
#define L60_DURATION        60  //600ms
#define L30_DURATION        30  //300ms
//Temperature level
#define HOT_DURATION        50  //500ms
#define WARM_DURATION       30  //300ms
#define COOL_DURATION       20  //200ms
//Rinse
#define RINSE_DURATION      40  //400ms
//Spin
#define SPIN_DURATION       30  //300ms
//
```

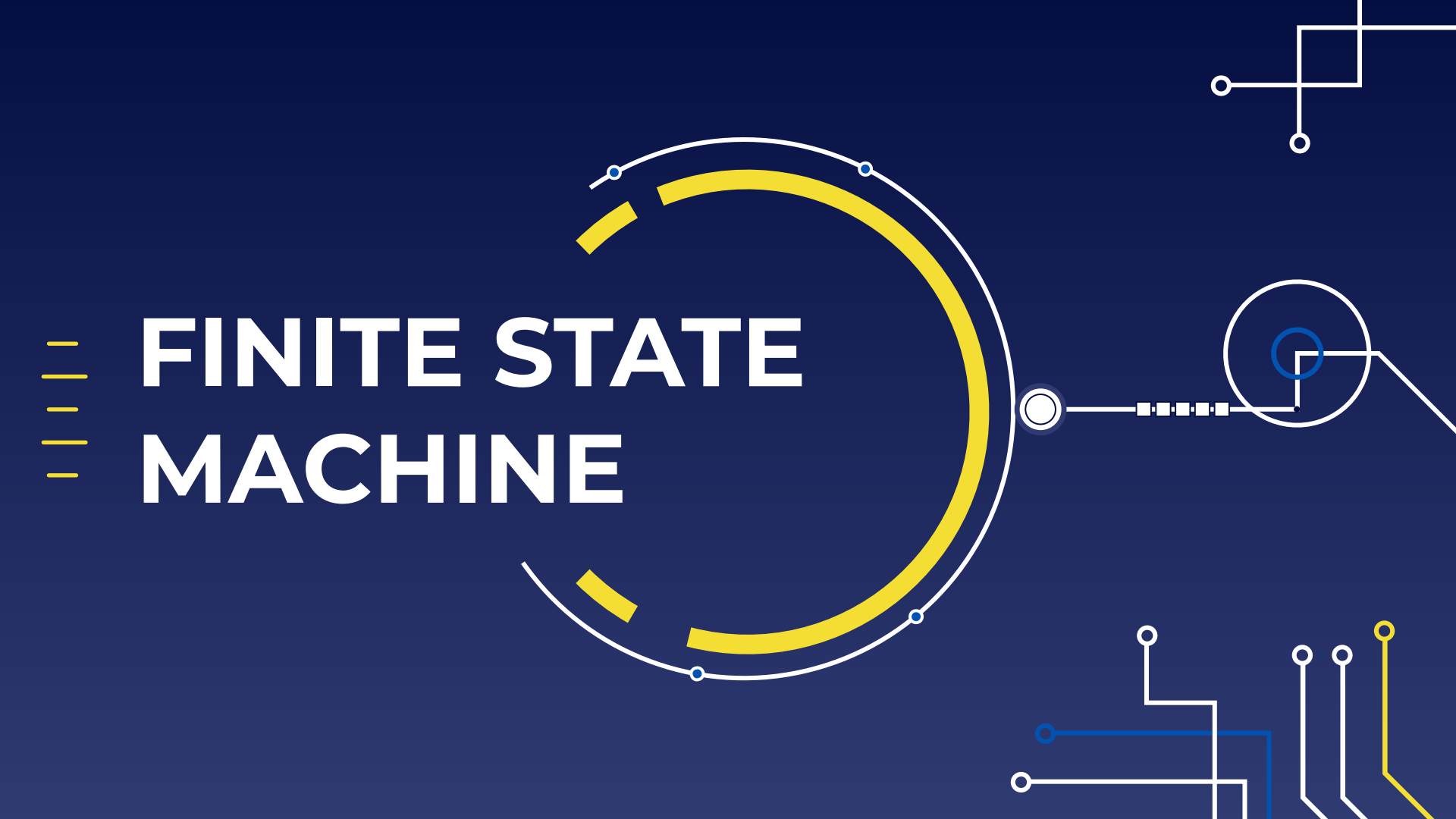
SET FUNCTIONS





CONTROLLING STATES

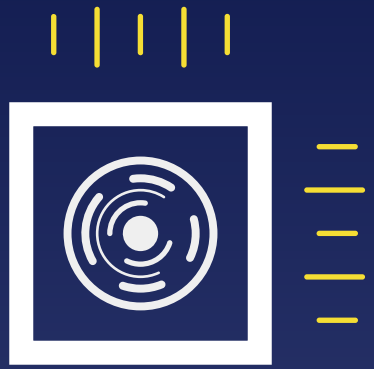
FINITE STATE MACHINE



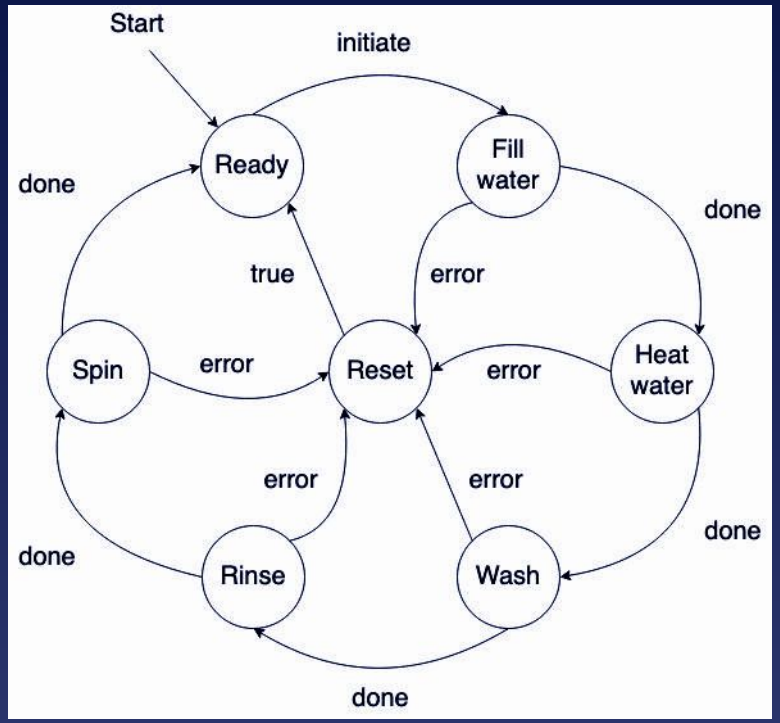
Finite State Machine

Advantages of Finite State Machine (Mealy FSM)

- Finite state machines are flexible
- Easy to move from a significant abstract to a code execution
- Low processor overhead
- Easy determination of reachability of a state



WASHING MACHINE



WASHING MACHINE MODE

DEFAULT

Washing mode:
Normal
Water level: 60%
Water temperature:
Warm

CUSTOM

Washing mode: Soak, Normal, Quick
Water level: 30%, 60% 90%
Water temperature:
Hot, Warm, Cool

ERROR

Return to “Reset mode” and “Turn off” the machine

DEFAULT MODE SUMMARY

READY

3 single LEDs of Default mode “blink”
[Normal, 90%, Warm]

FILL WATER

Two 7_SEG_LEDs Q1, Q2: 00->09

HEAT WATER

Two 7_SEG_LEDs Q1, Q2: 00->03

RESET

All LEDs turn “on”
7_SEG_LEDs display: 0

WASH

Two 7_SEG_LEDs Q1, Q2:
00->03

RINSE

Two 7_SEG_LEDs Q1, Q2:
00->04

SPIN

Two 7_SEG_LEDs Q1, Q2:
00->03

CUSTOM MODE SUMMARY

READY

3 single LEDs of Custom mode “blink”
Example: [Quick, 60%, Warm]

FILL WATER

Two 7_SEG_LEDs Q1, Q2: 00->06

HEAT WATER

Two 7_SEG_LEDs Q1, Q2: 00->03

RESET

All LEDs turn “on”
7_SEG_LEDs display: 0

WASH

Two 7_SEG_LEDs Q1, Q2:
00->02

RINSE

Two 7_SEG_LEDs Q1, Q2:
00->04

SPIN

Two 7_SEG_LEDs Q1, Q2:
00->03

ERROR MODE SUMMARY

READY

Jump to Reset state

FILL WATER

Jump to Reset state

HEAT WATER

Jump to Reset state

RESET

All LEDs turn “on”
7_SEG_LEDs display: 0

WASH

Jump to Reset state

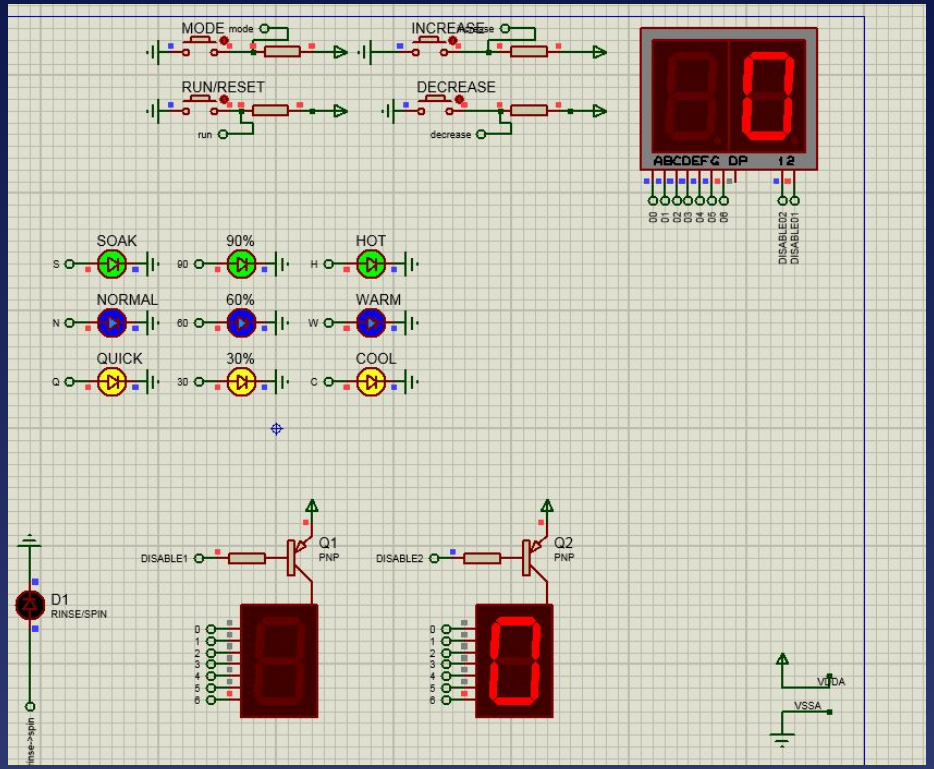
RINSE

Jump to Reset state

SPIN

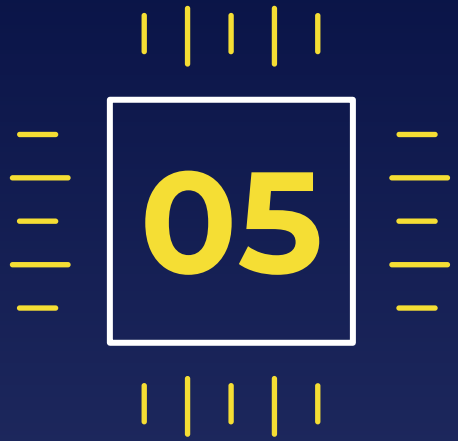
Jump to Reset state

DISPLAY FORM OF ERROR MODE



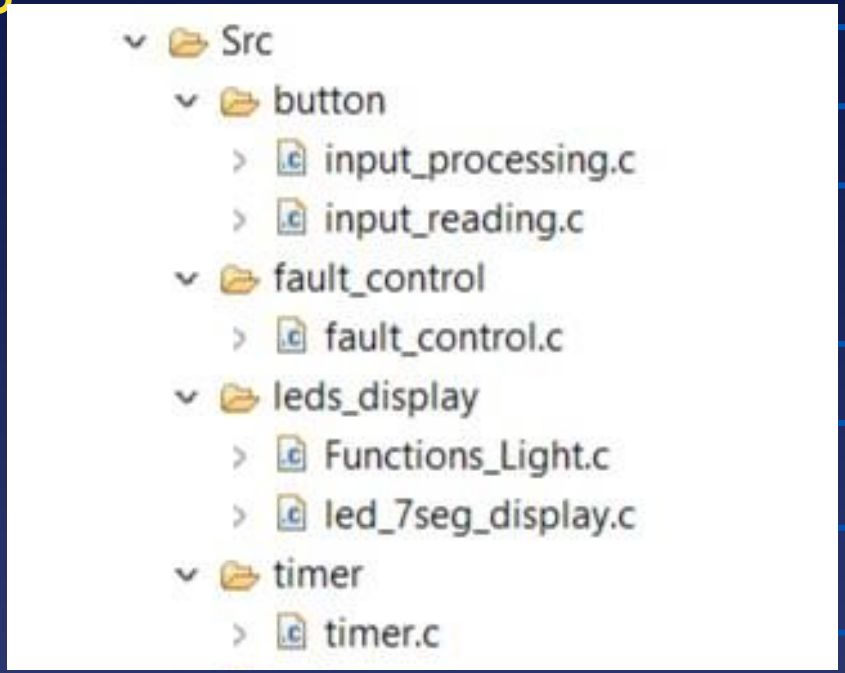
04

SIMULATION



FUNCTION EXPLANATION

FUNCTION



-fsm_for_input1_processing() // button FSM

- reading_button(void) // reading button data

-Washing_Light_Init(wState State)// Initialize Washing Light

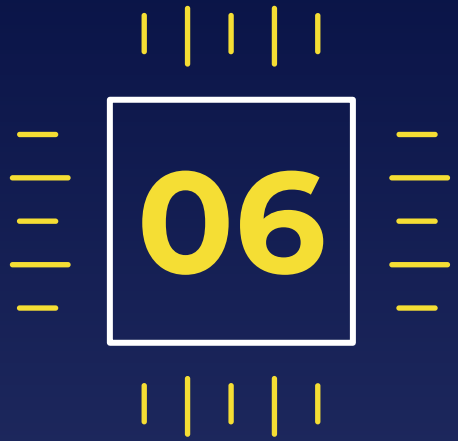
-void Washing_Update()

-void Washing_Light_Update()

-void update_mode_led(uint8_t number)// handle data from buttons

-void Run(uint16_t washing_mode, uint16_t water_level, uint16_t temperature_level)// when start is triggered

-void Reset_Set_Funtion()// when restart is trigger



CONCLUSION

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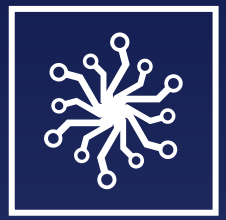
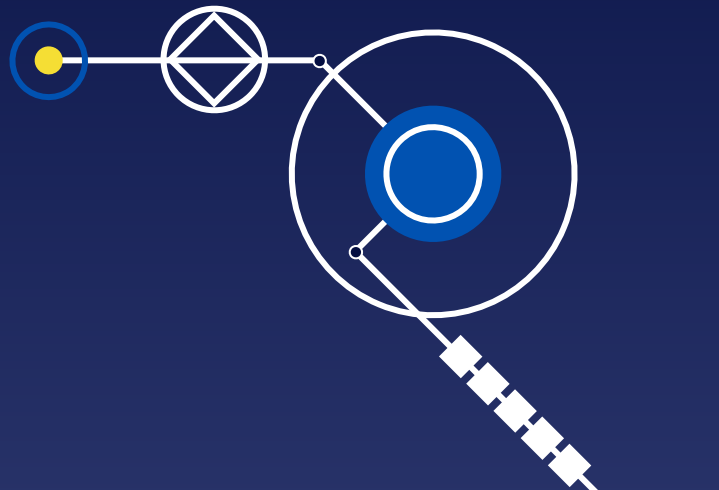


RE-EVALUATION

FUTURE UPGRADE

RE-EVALUATION

- The system should provide automatic mode and manual mode ✔
- Under fully automatic mode user intervention requirement should be zero ✔
- In manual mode continuous intervention of user is required ✔
- The system should provide all basic features of a washing machine ✔
- The system should provide easy options for upgradeability of new features ✔



FUTURE UPGRADE

INTERNET

Using the Internet to control Washing Machine

PROCESSING FASTER

Improve the algorithms

NUMBER OF PIN

Using the Decoder technique to reduce output pin

BETTER Display

Using better monitor (led matrix 8x32,...)

THANK YOU!