PROBLEM STATEMENT

Problem:

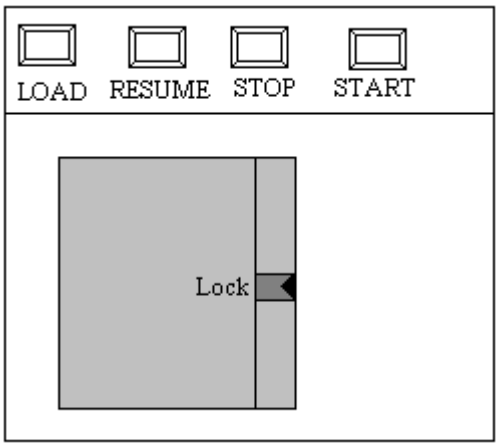
Description: An Automatic washing machine with Dryer.

The Washing Machine can handle three different types of load: Light, Medium and Heavy.
The Washing Machine has three different cycles: Rinse, Wash and Dry.
Depending on the load the number of times a cycle is done and the duration of the cycle varies.

Light Load: Rinse- 2 mins, Wash- 3 mins, Rinse – 2 mins, Dry Cycle –2 mins
Medium Load: Rinse- 3 mins, Wash- 5 mins and Rinse – 3 mins Dry Cycle –4 mins
Heavy load: Rinse- 3 mins, Wash- 5 mins and Rinse – 3 mins, Wash- 5 mins and Rinse – 3 mins, Dry Cycle – 4 mins

- The Washing Machine is a single tub machine.
- The Washing machine is made of a Revolving Tub and an Agitator.
- The Agitator is activated during the Rinse and Wash cycle; revolving tub is active only during the Dry cycle. The door of the washtub should remain closed as long as the agitator is active.
- Before each cycle the water level is sensed. At the beginning of the cycle the water level should be at the maximum possible level, the water should be completely drained during dry cycle. The cycle should begin only when the water level is correct.
- At the end of each cycle a buzzer is activated. The user should drain the water at the end of the rinse/wash cycle and refill the water for the next cycle; once this has been completed the user can press the resume button.
- At the beginning of the wash cycle the user should add the detergent.
- At the end of the complete wash process the Buzzer is sounded.
- User can turn off system by pressing STOP Button.
- Different sounds are used for different events.

User Interface: The User Interface is shown in fig below



The number of times the load button is pressed determines load: 1press- light; 2 presses – medium and 3 presses –heavy.
To begin washing process START is pressed.
Pressing STOP can stop the process.

HARDWARE SPECIFICATIONS / COMPONENTS USED

S. No	Hardware	Type
1	Octal Latch	74LS138
2	Bi-Directional Buffer	74LS245
3	Octal Latch	74LS273
4	Erasable Programmable ROM	2716
5	RAM	6116
6	NOT Gate	7404
7	2 Input OR Gate	7432
8	Programmable Peripheral Interface	8255
9	Intel Microprocessor	8086
10	Buzzer	KPI 1410/2210/2610
11	Button	COM 10302
12	Resistor	
13	Agitator	J22TX462
14	Revolving Tub (Motor)	J22TX463
15	SW-SPST	
16	SW-SPDT-MOM	
17	Relay	

ASSUMPTIONS

- User fills the Water at the start of the process
- User adds the detergent on his/her own before the Wash Cycle.
- Assume that the door is locked when the agitator is running. Before the agitator starts running, the program checks if door is locked or not
- Agitator and revolving tub are modelled by single-phased induction motors
- The user will have to hold the door in place before the Rinse cycle begins.

MEMORY MAPPING

ROM chip used: 2716
RAM chip used: 6116

ROM1:4KB = 2KB(even)+2KB(odd)

- ROM1 (Even Bank): 00000H,00002H, ...,00FFCH,00FFEH
- ROM1 (Odd Bank): 00001H,00003H, ...,00FFDH,00FFFH

RAM1:4KB = 2KB(even)+2KB(odd)

- RAM1 (Even Bank): 20000H,20002H, ...,20FFCH,20FFEH

- RAM1 (Odd Bank): 20001H,20003H, ...,20FFDH,20FFFH

ROM2:4KB = 2KB(even)+2KB(odd)

- ROM2 (Even Bank): FF000H,FF002H, ...,FFFFCH,FFFFEH
- ROM2 (Odd Bank): FF001H,FF003H, ...,FFFFDH,FFFFFH

	A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0
ROM1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
RAM1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
ROM2	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

I/O MAPPING

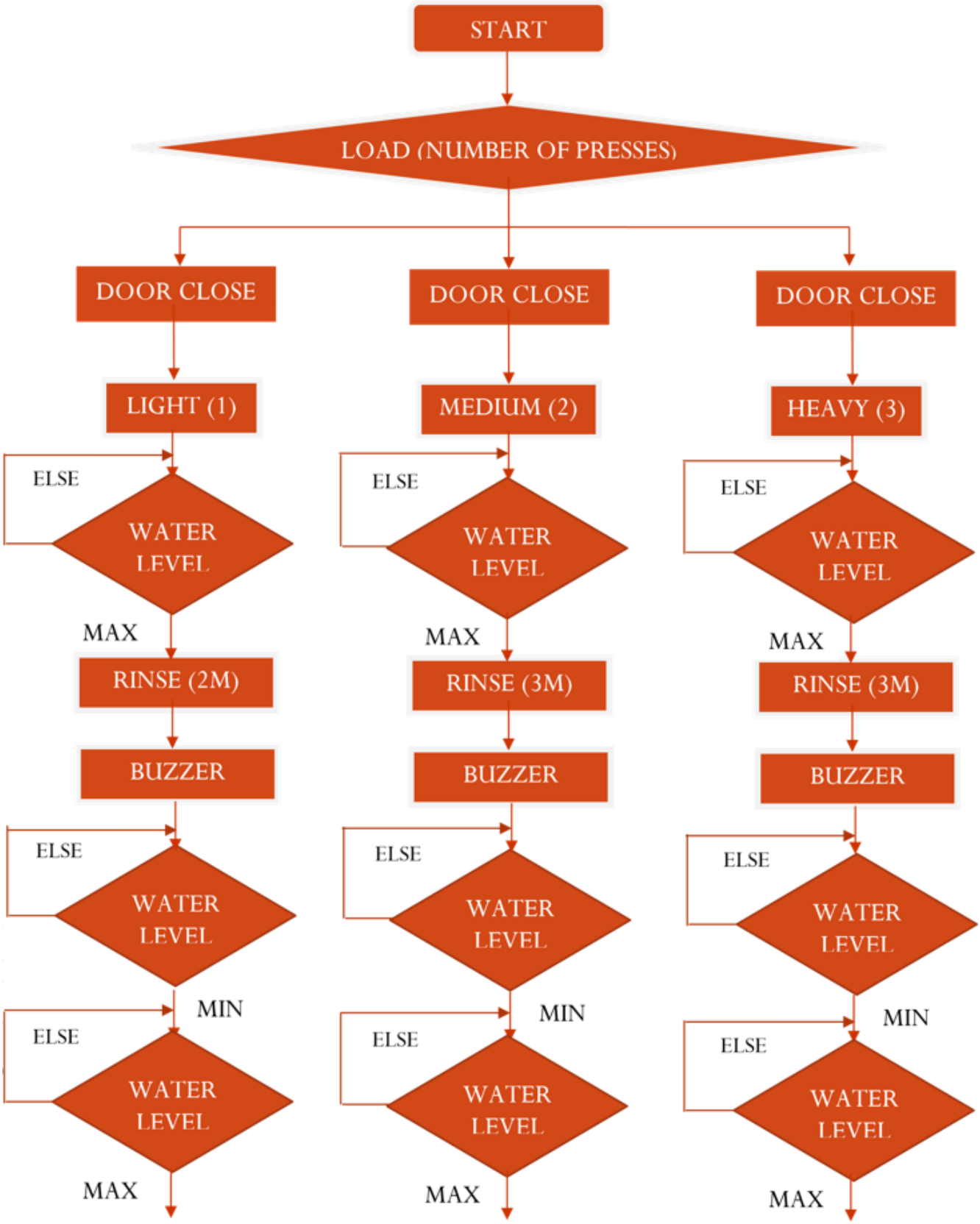
8255(Programmable Peripheral Interface) – 00H to 06H
8253(1) (Programmable Interval Timer) – 40H to 46H
8253(2) (Programmable Interval Timer) – 80H to 86H

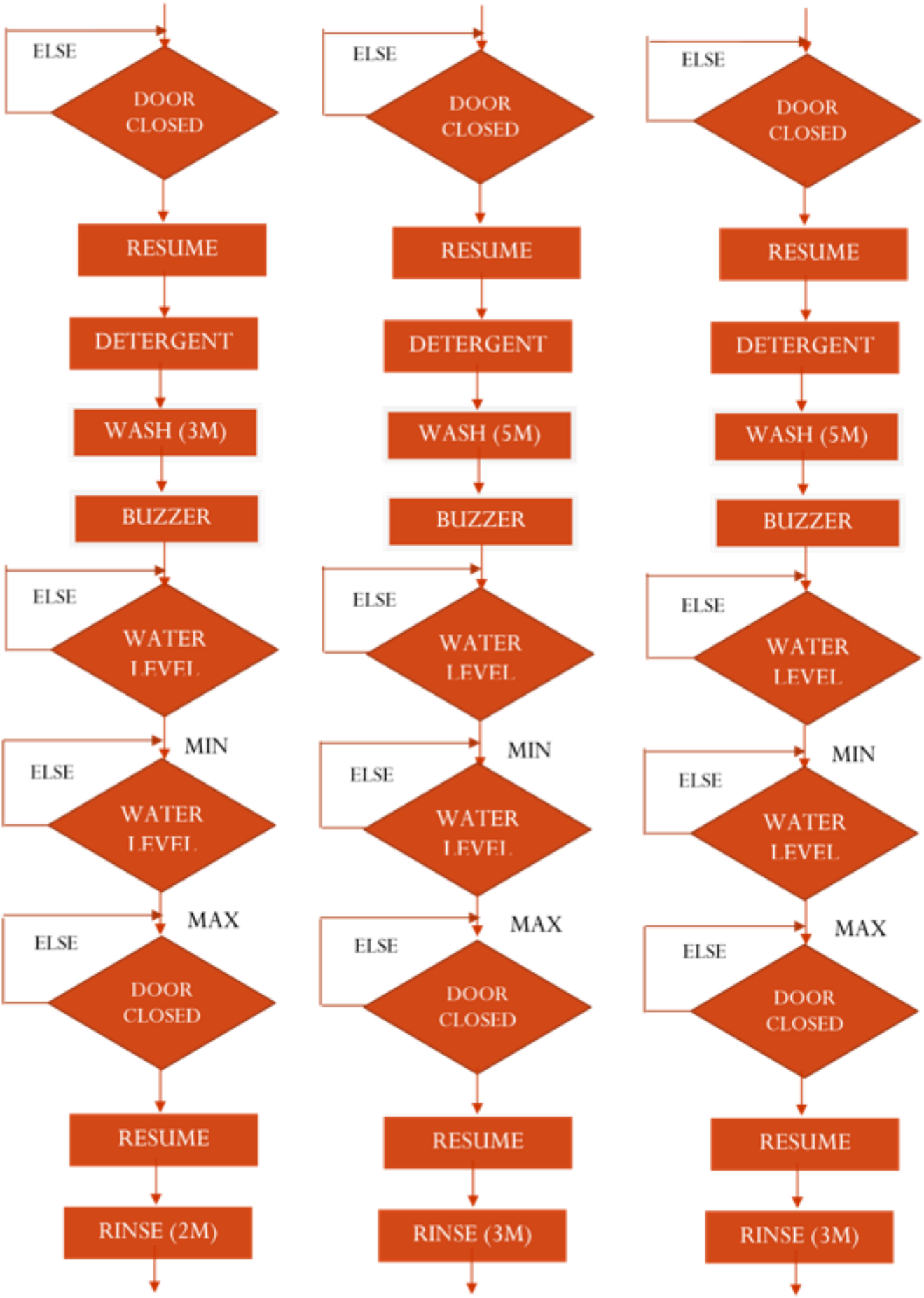
PORT A (Input)
PA0- Start Button
PA1- Stop Button
PA2- Load Button
PA3- Resume Button
PA4- GND
PA5- GND
PA6- GND
PA7- GND

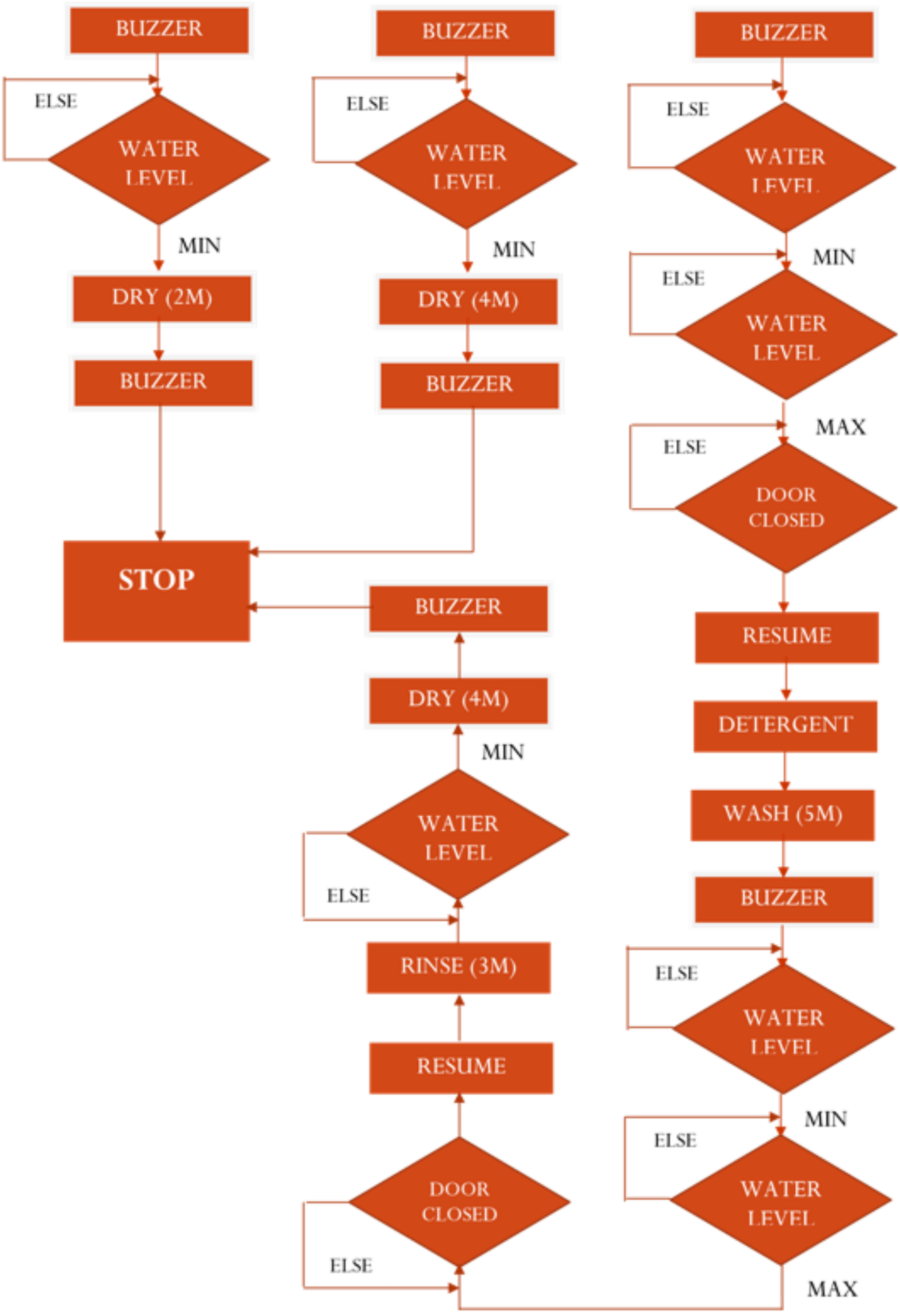
PORT B (Output)
PB0- Door Lock
PB1- Water Out Valve
PB2- Buzzer - Dry
PB3- Buzzer - Wash
PB4- Buzzer - Rinse
PB5- Water In Valve
PB6- Open
PB7- Open

PORT C (Lower – Input, Upper – Output)
PC0- Water Level Max
PC1- Water Level Zero
PC2- Door Lock Sensor
PC3- Rotation Stop (Wash/Rinse/Dry)
PC4- G1
PC5- O1
PC6- G2
PC7- O2

FLOWCHART


START
LOAD (NUMBER OF PRESSES)
DOOR CLOSE
DOOR CLOSE
DOOR CLOSE
LIGHT (1)
MEDIUM (2)
HEAVY (3)
ELSE
WATER LEVEL
MAX
RINSE (2M)
RINSE (3M)
RINSE (3M)
BUZZER
BUZZER
BUZZER
MIN


ELSE
DOOR CLOSED
RESUME
DETERGENT
WASH (3M)
BUZZER
ELSE
WATER LEVEL
MIN
ELSE
WATER LEVEL
MAX
ELSE
DOOR CLOSED
RESUME
RINSE (2M)
ELSE
DOOR CLOSED
RESUME
DETERGENT
WASH (5M)
BUZZER
ELSE
WATER LEVEL
MIN
ELSE
WATER LEVEL
MAX
ELSE
DOOR CLOSED
RESUME
RINSE (3M)
ELSE
DOOR CLOSED
RESUME
DETERGENT
WASH (5M)
BUZZER
ELSE
WATER LEVEL
MIN
ELSE
WATER LEVEL
MAX
ELSE
DOOR CLOSED
RESUME
RINSE (3M)


BUZZER
ELSE
WATER LEVEL
MIN
DRY (2M)
BUZZER
BUZZER
ELSE
WATER LEVEL
MIN
DRY (4M)
BUZZER
BUZZER
ELSE
WATER LEVEL
MIN
ELSE
WATER LEVEL
MAX
ELSE
DOOR CLOSED
RESUME
DETERGENT
WASH (5M)
BUZZER
ELSE
WATER LEVEL
MIN
ELSE
WATER LEVEL
MAX
STOP
BUZZER
DRY (4M)
MIN
WATER LEVEL
ELSE
RINSE (3M)
RESUME
DOOR CLOSED
ELSE

BRIEF DESCRIPTION

- The user will first press the start button.
- He / She will then proceed to press the Load button 1, 2, or 3 times depending on the Light, Medium or Heavy Load.
- The User is expected to add the detergent manually before the Wash Cycle, when the machine is waiting for the Resume button to be pressed.
- The Washing Machine will lock the doors automatically before the Rinse Cycle begins for every kind of load. Note that the user will have to hold the door in place before the Rinse cycle begins.
- The Cycles will be taken care of by the Washing Machine's Microprocessor.
- The machine will pause after every cycle and wait for the Resume button to be pressed, before moving on to the next cycle.