Microprocessors and Interfacing

Project-Question no.17

Smart Overhead Tank

Batch 62

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Submitted To:

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An assignment submitted in partial fulfillment of the course requirements for

Microprocessor Programming and Interfacing

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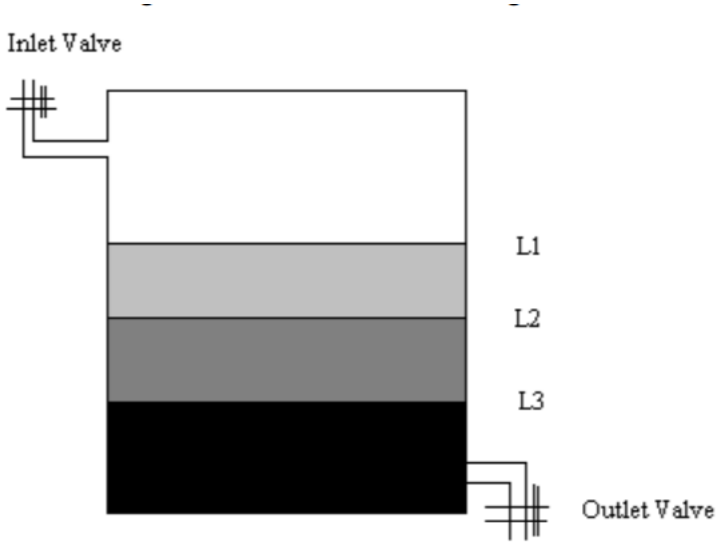
PROBLEM STATEMENT

Description: This is a tank system in which the water level is maintained according to the time of the day. The water level should be maintained at three different values according to the time of the day.

Peak Hours: Maximum Level of Tank Peak Hours is between **6:00 AM to 10:00 AM** in the Morning and **5:00-7:00 PM** in the evening.

Low Hours: Minimum level. The rest of the time it is maintained at **a nominal level**. Low hours are between **12:00 Midnight and 5:00 AM** in the morning.



The inlet valve draws water from the main-tank system and the outlet valve sends the surplus water back to the main tank. The water in the main tank must be maintained at a constant value, if the level drops the motor must be turned on. The water tank is used for supplying water to bathrooms and kitchen – sensors used must be noncontact.

DESIGN SPECIFICATIONS

Water Sensor

- Water sensor YWK-5S.
- Non-contact sensor.
- Working voltage: 5Vdc.
- Working current: 25μA.
- Digital Output: 1(Water detected), 0(Not detected).
- Working temperature range: -25 - 155°C.

Pump

- Crompton Greaves CMB 10NV.
- Power consumption: 0.75kW.
- Inlet/Outlet size: 25mm.
- Working voltage: 180-240V.
- Speed of motor: 1500 RPM.
- Discharge range: 4920-1200 LPH.

Solenoid Valve

- Grainger 4EKU8.
- Pipe-size: 0.75”.
- Working voltage: 12V
- Max pressure differential: 90psi.

Relay

- Panasonic ALZN1F24W.
- AC Rating: 250V AC, 16A.
- DC Rating: 24V, 16A.

Overhead Tank

- Syntex Titus.
- Capacity: 1000L.
- Dimensions: 110 x 110 x 121.9 cm.

ASSUMPTIONS

- Initialization time of the system is 00h:00m.
- Time is re-initialized correctly if the system powers off and on again.
- The pump is of sufficient power to restore the water level quickly.
- Maximum pressure differential does not exceed 90psi, the limit of solenoid valve.
- Water in the reservoir does not run out.

SYSTEM DESIGN

Time of day is maintained inside system which is incremented every hour.The slot is selected according to time: Peak hours, Normal hours or Low hours. One of the three water levels is chosen based on the time slot and the respective water sensor is made active.

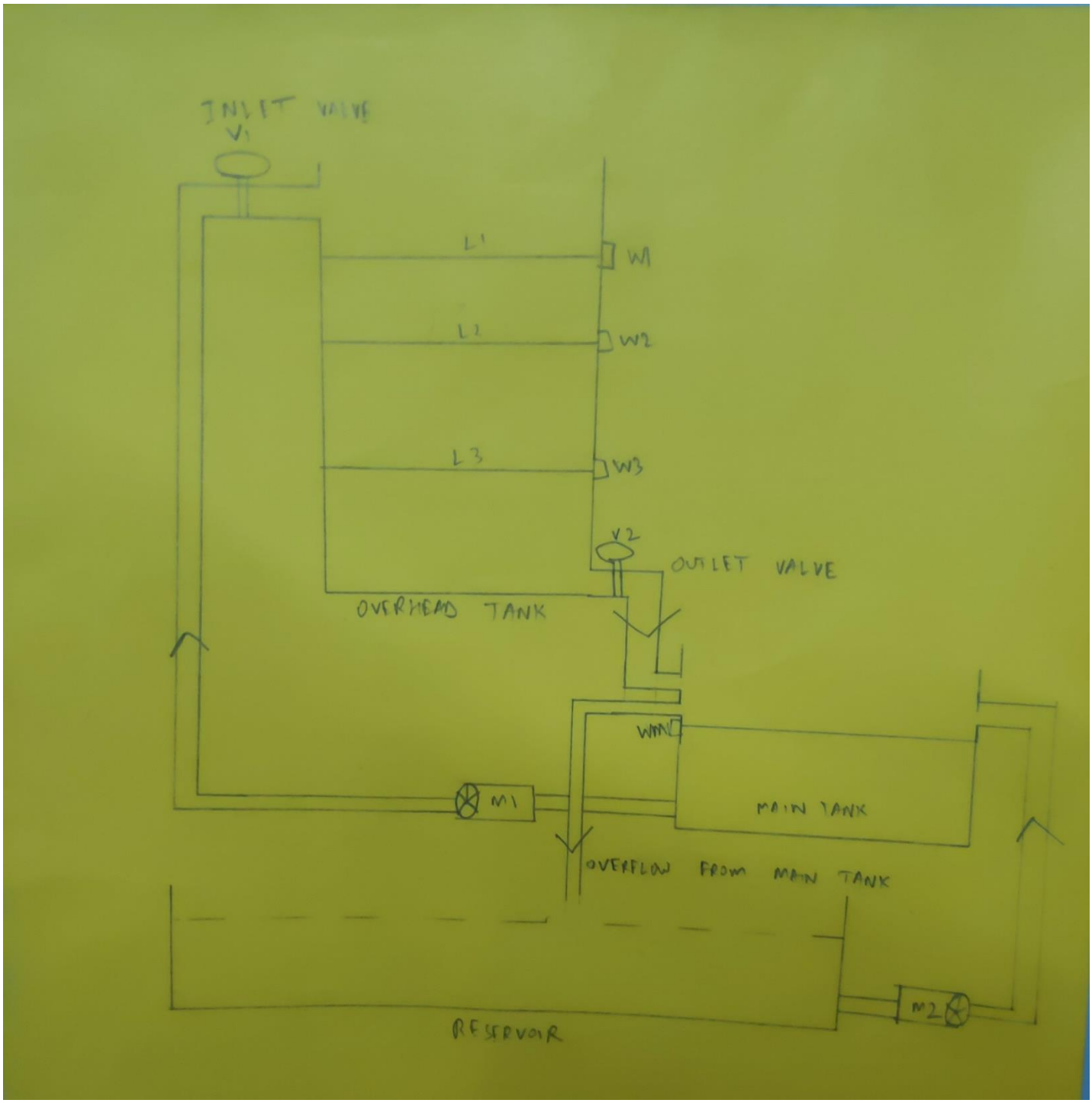
At every transition of time slot, the water level is adjusted to the new level. Then the system waits till the water level drops, which raises an interrupt, and the pump is turned on to restore the water level. The pump stops when the water level reaches the required level and another interrupt is raised.

Similarly, main tank is maintained at a constant level using one sensor.

COMPONENTS USED

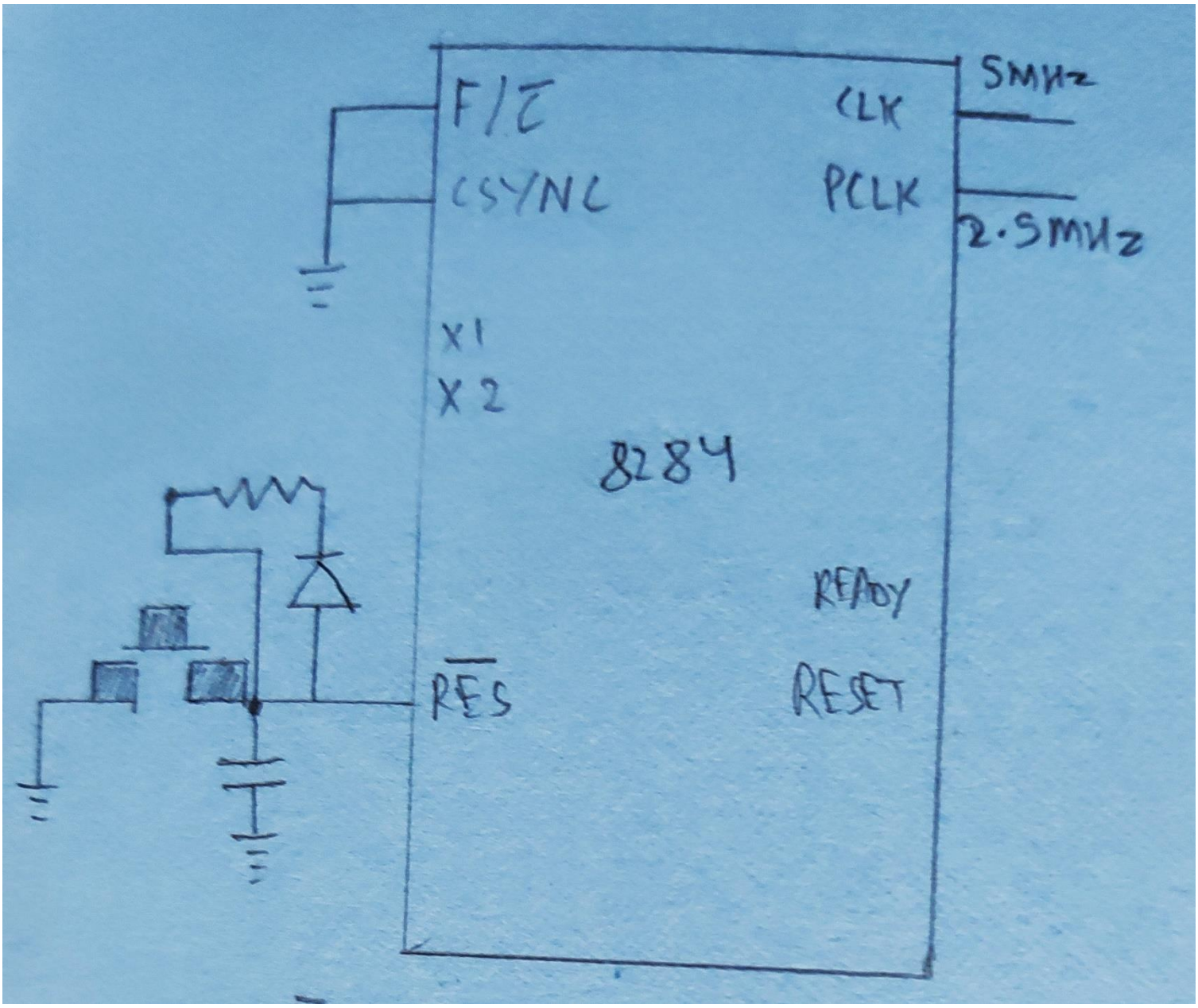
Sr. No.	Components Used	Quantity	Purpose
1.	8086	1	Central Processor
2.	8284	1	Clock generator
3.	8254	1	Timer device
4.	8255	1	Programmable Peripheral Interface (PPI) for I/0
5.	6116 RAM	2	RAM for the Memory
6.	2716 ROM	4	EPROM
7.	74LS373	3	Latching the Bus
8.	74LS245	1	Bi-Directional Buffer
9.	LS244	1	Buffer
10.	LS139	1	Decoder
11.	LS153	1	Multiplexer
12.	8259A	1	Programmable Interrupt Controller
13.	ULN2803	1	Darlington Pair Transistor
14.	Relay (Panasonic ALZN1F24W.)	1	General Purpose Relay

OVERALL DESIGN

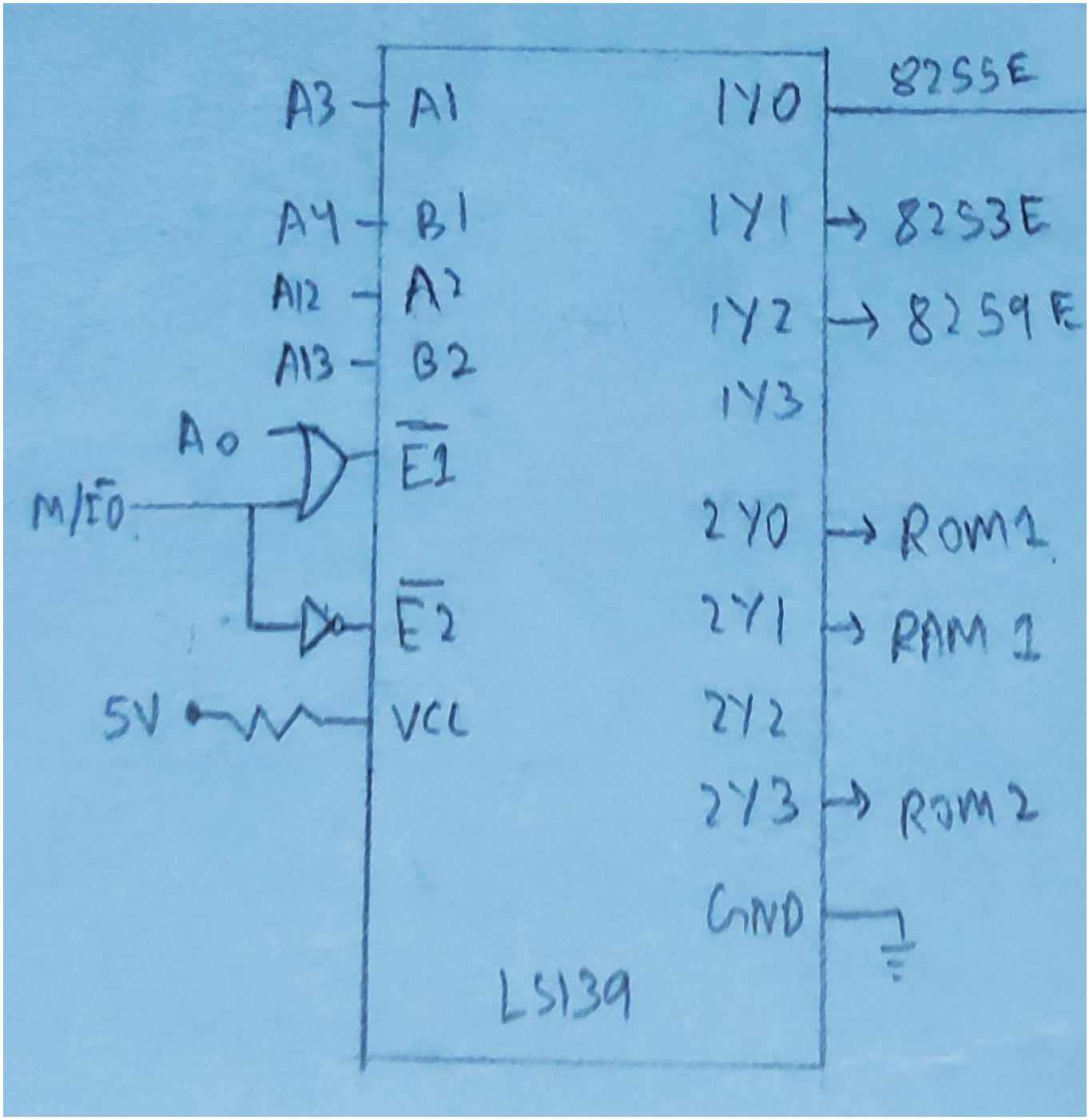


HARDWARE DESIGN

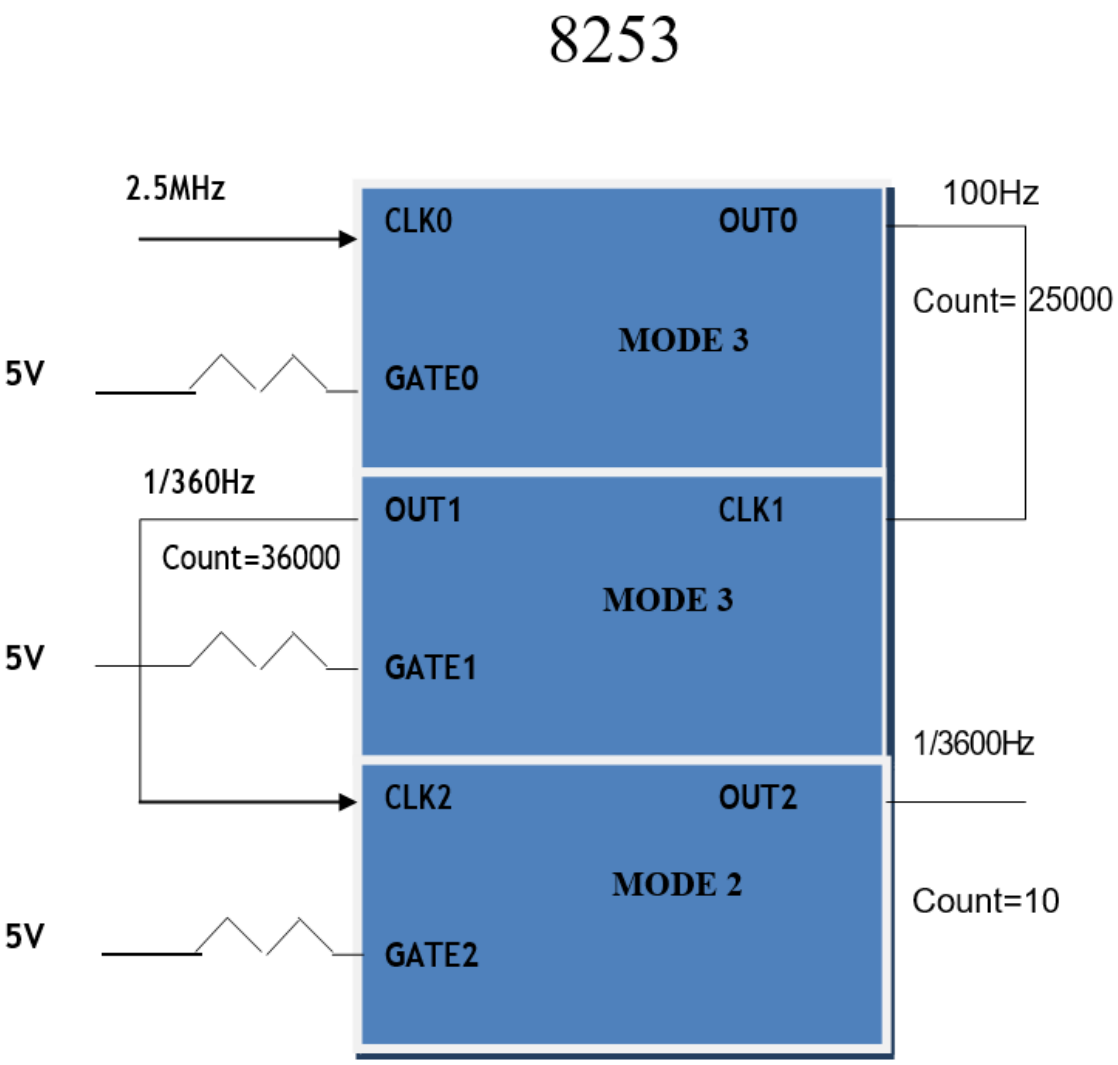
CLOCK GENERATOR



I/O & Memory Decoding



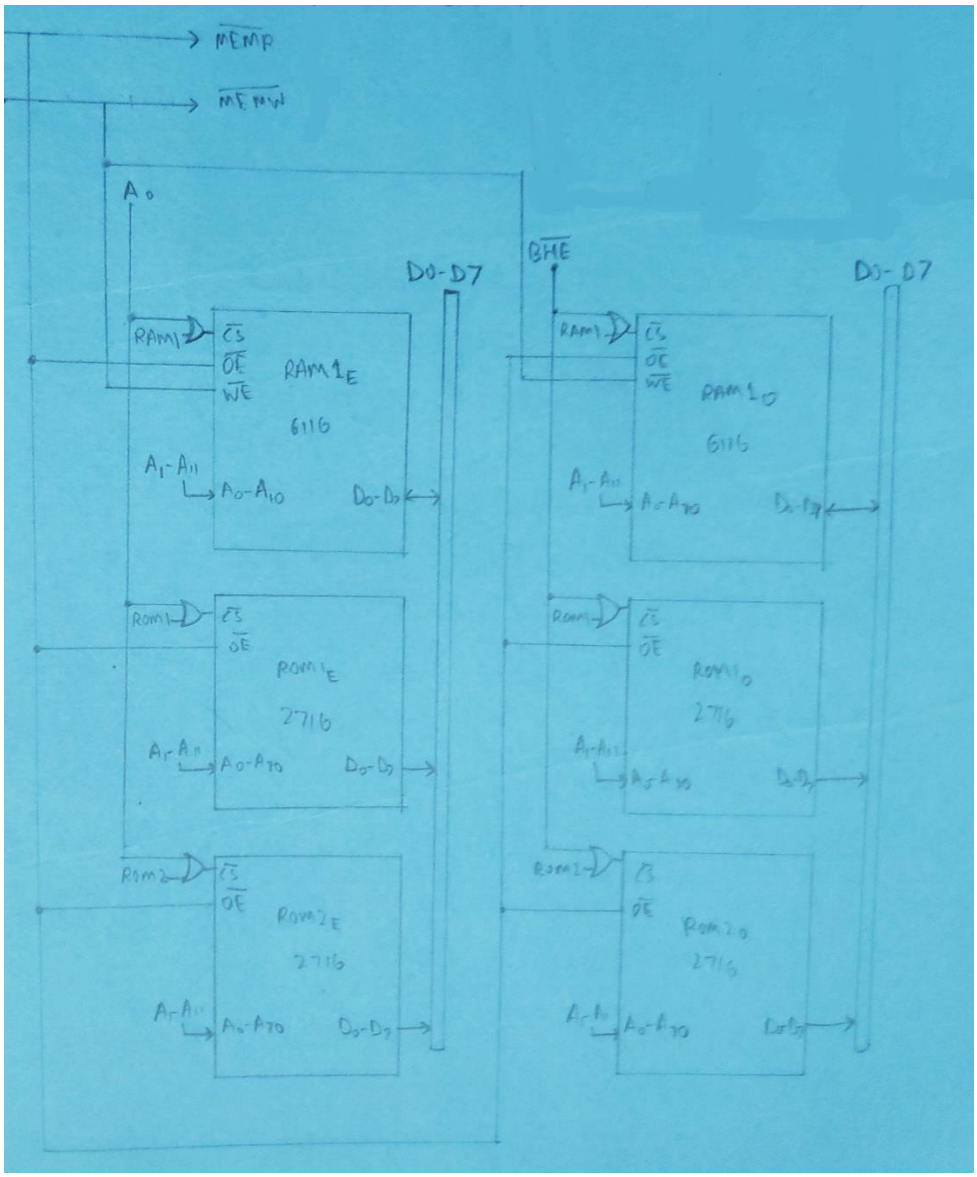
Timer


8253
2.5MHz
CLK0
OUT0
100Hz
Count= 25000
MODE 3
5V
GATE0
1/360Hz
OUT1
CLK1
Count=36000
MODE 3
5V
GATE1
1/3600Hz
CLK2
OUT2
MODE 2
Count=10
5V
GATE2

MEMORY INTERFACING

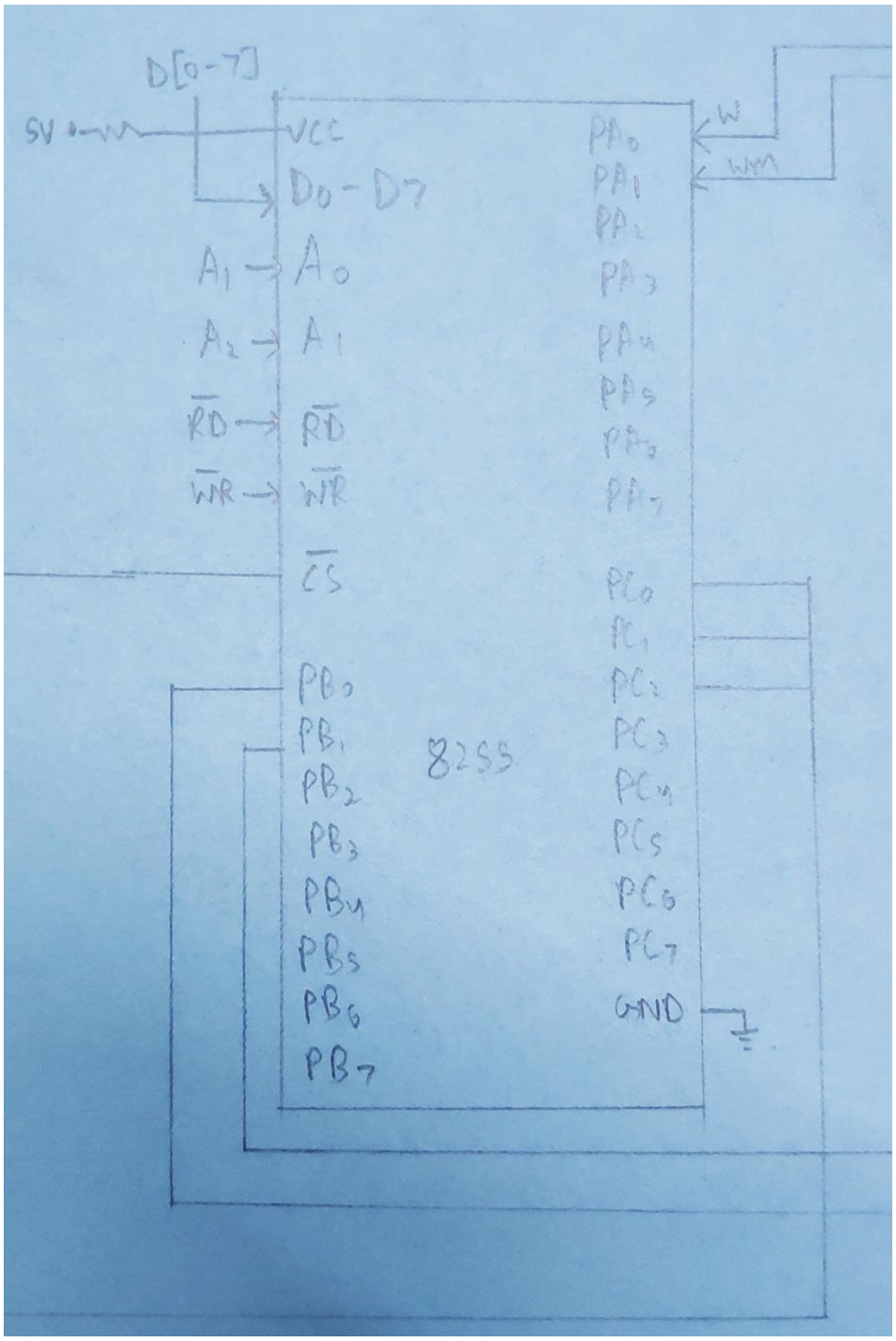
ROM 1 : 00000h - 00FFFh (4K)
ROM 2 : FF000h - FFFFFh (4K)
RAM : 01000h - 01FFFh (4K)

Memory Bank :-

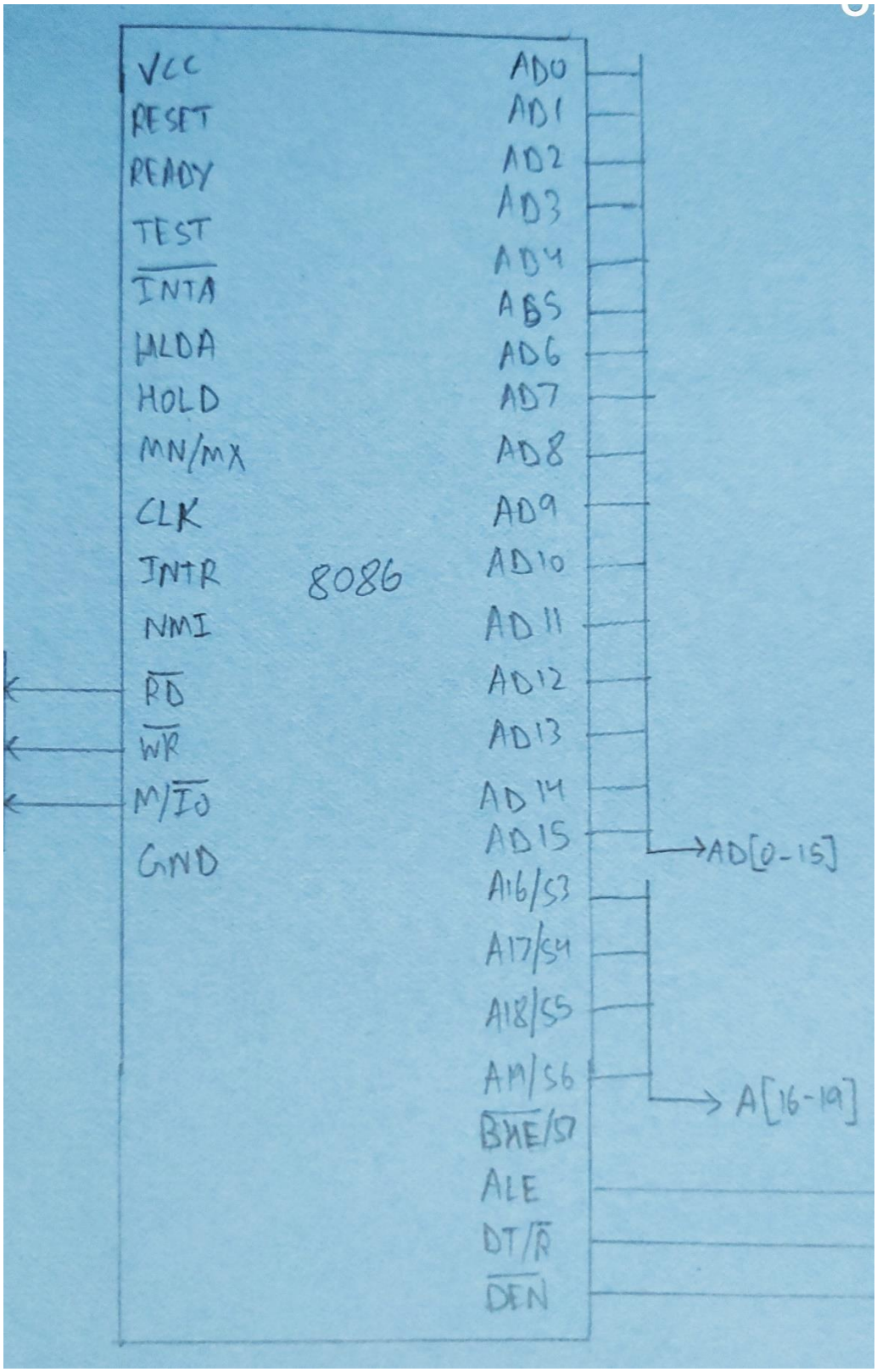


PPI For I/O

8255

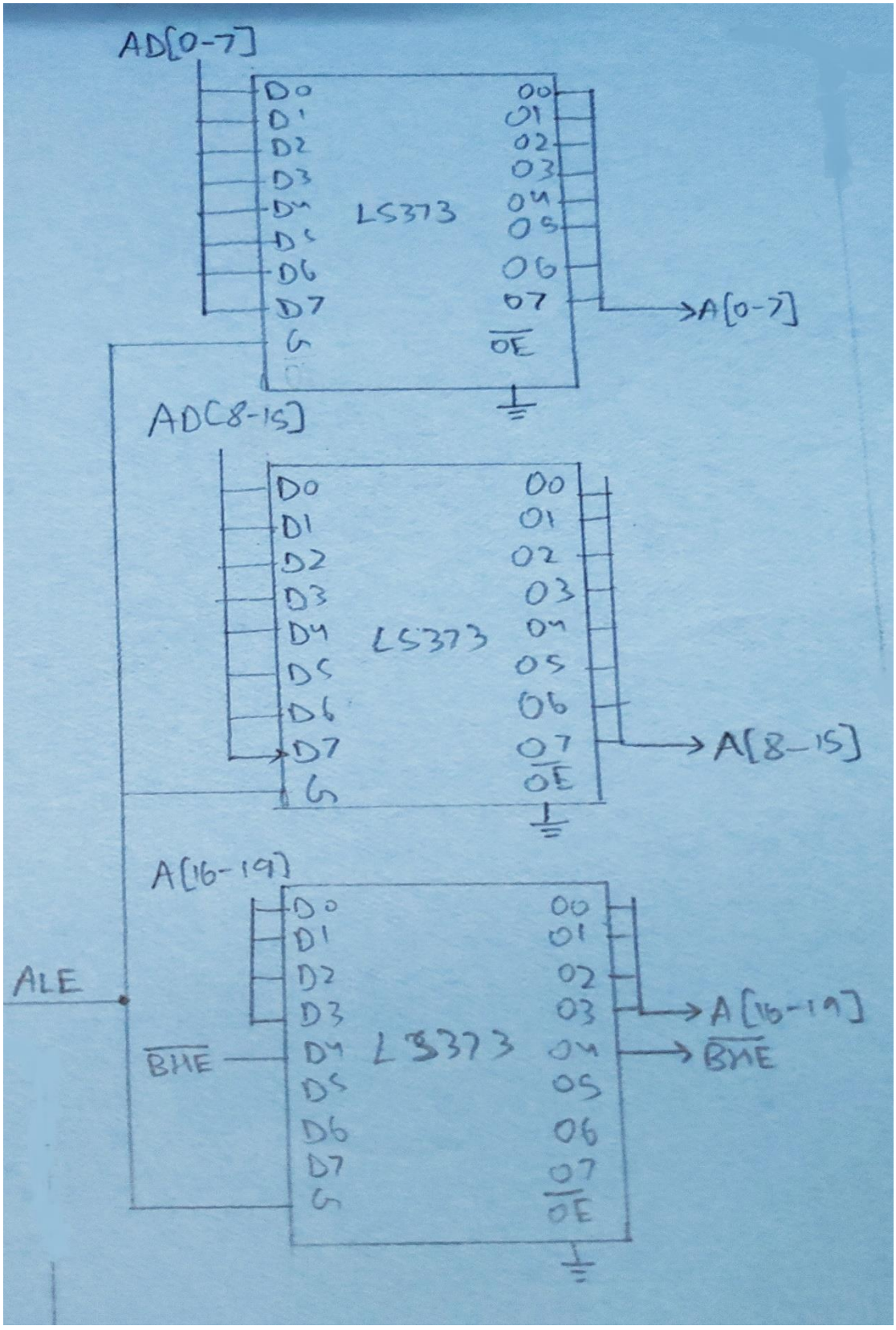


8086

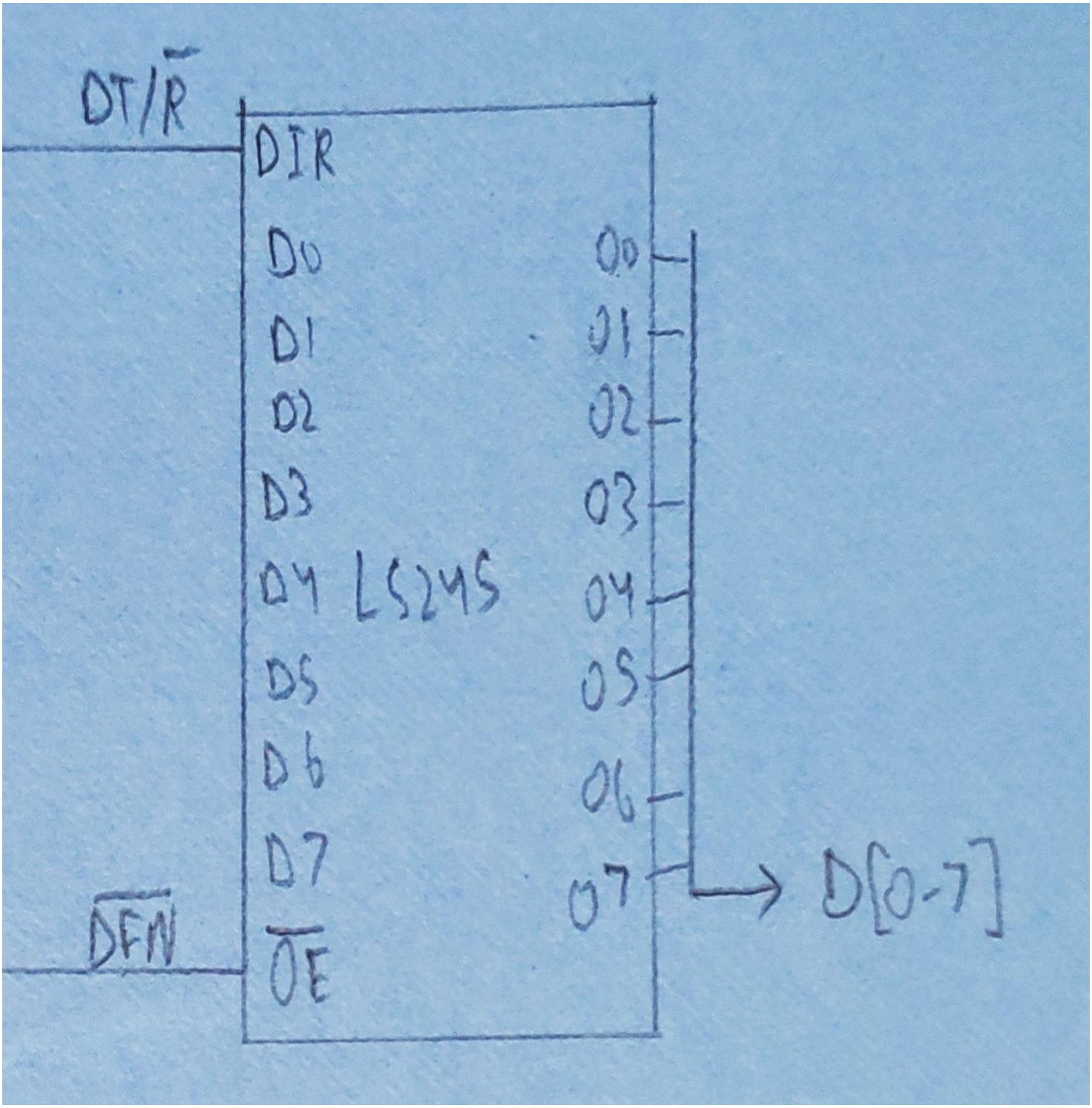

VCC
RESET
READY
TEST
INTA
HLDA
HOLD
MN/MX
CLK
INTR
NMI
RD
WR
M/IO
GND
8086
AD0
AD1
AD2
AD3
AD4
AD5
AD6
AD7
AD8
AD9
AD10
AD11
AD12
AD13
AD14
AD15
A16/S3
A17/S4
A18/S5
A19/S6
BHE/S7
ALE
DT/R
DEN
AD[0-15]
A[16-19]

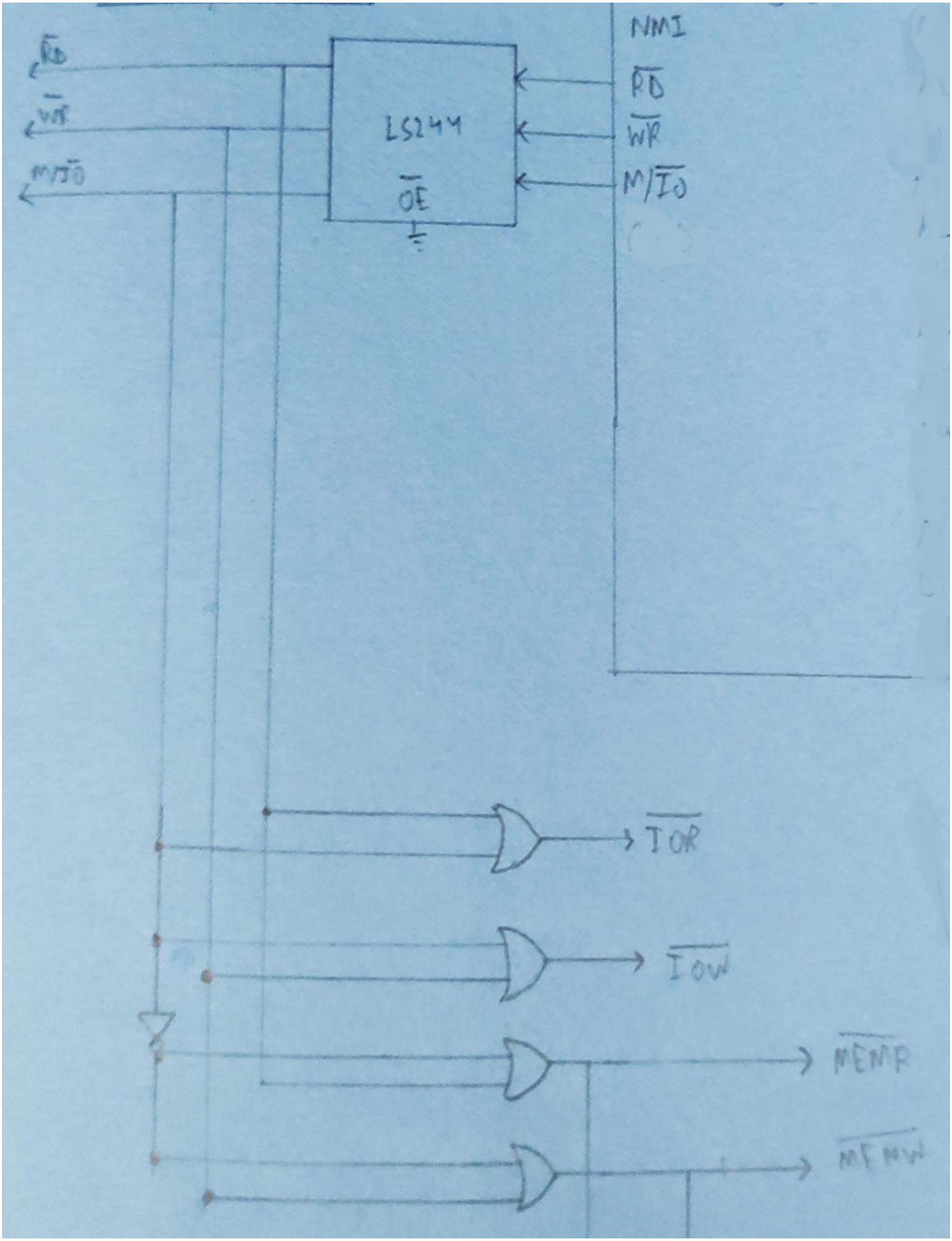
SYSTEM BUSES OF 8086

Address

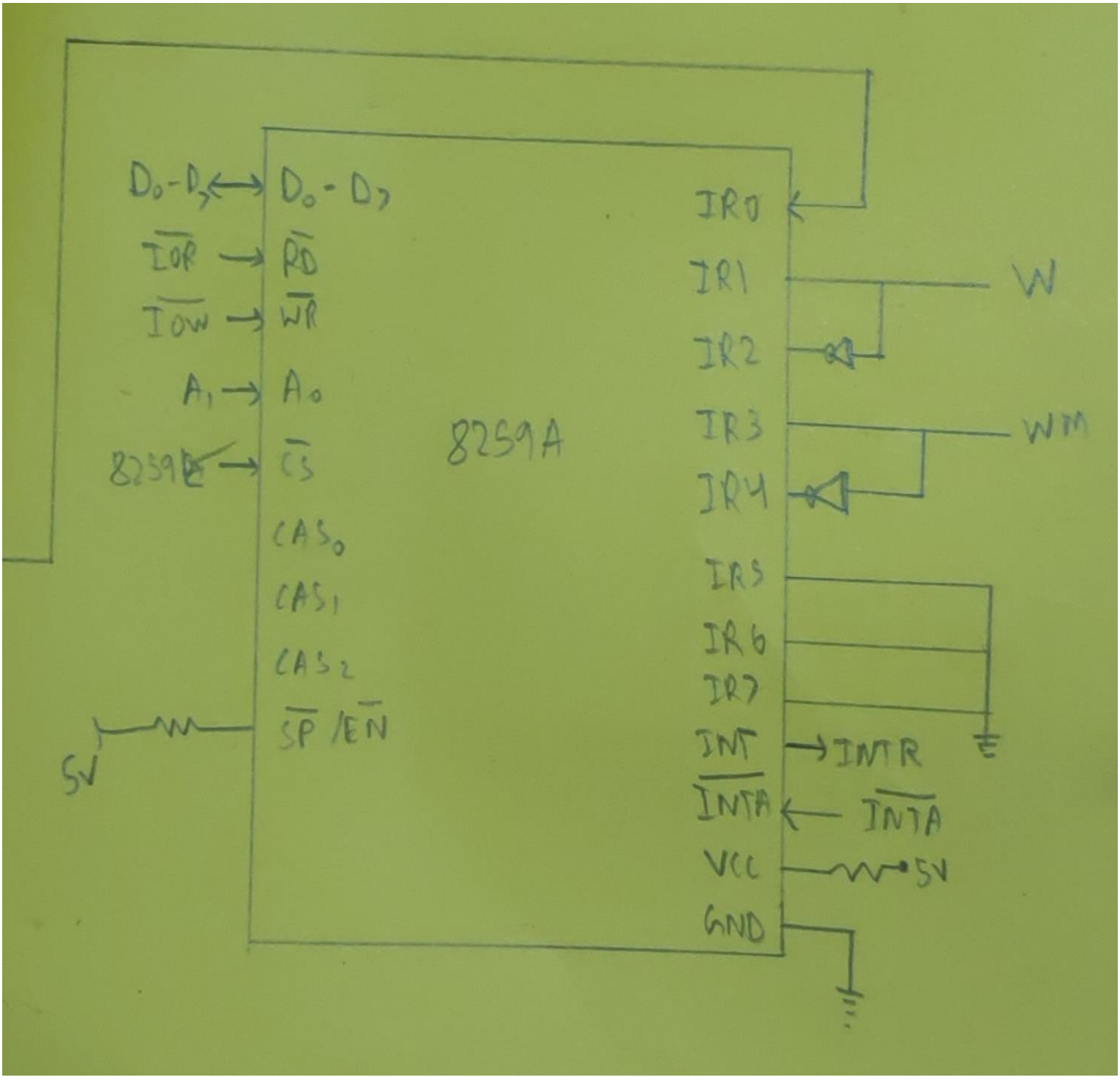


Data & Control

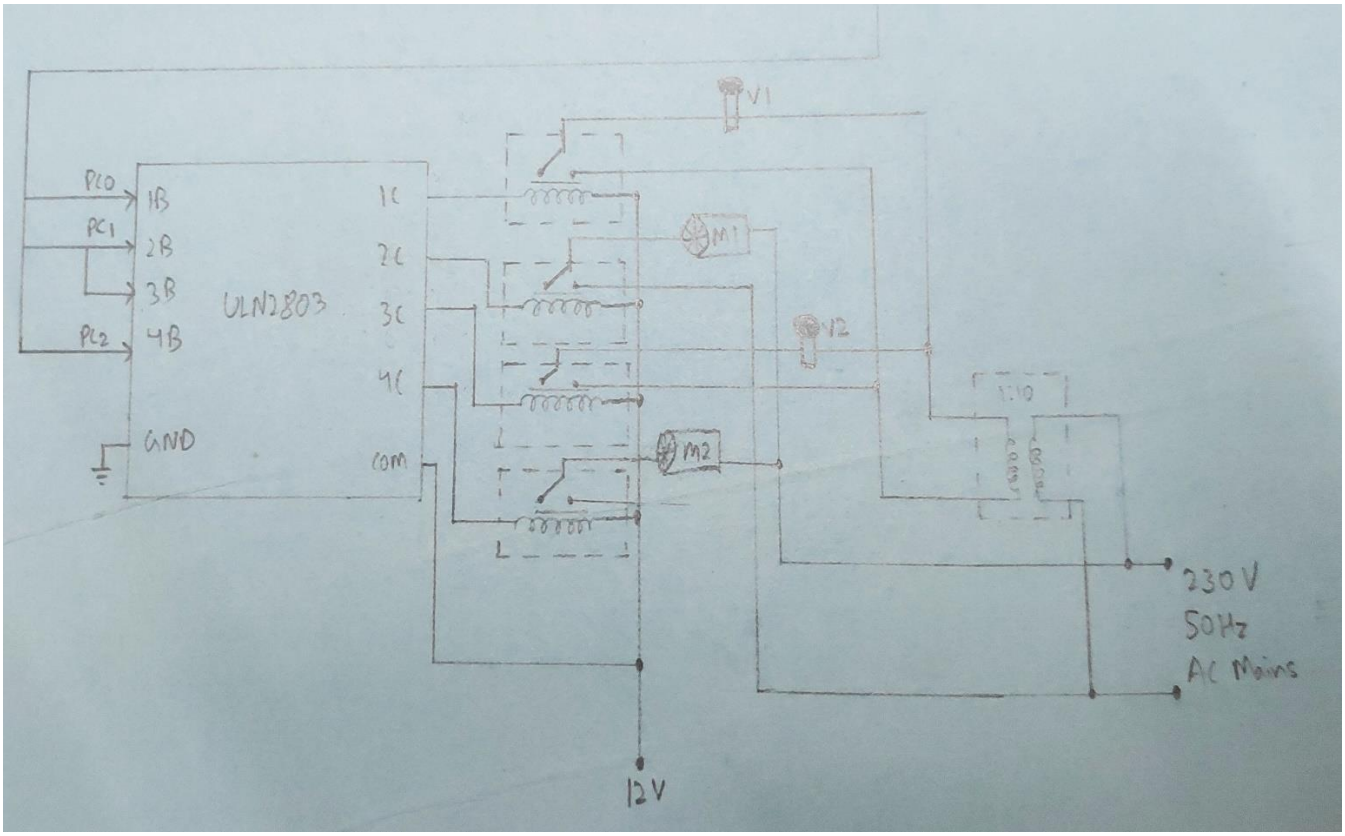



NMI
RD
WR
M/IO
LS244
OE
IOR
IOW
MEMR
MEMW

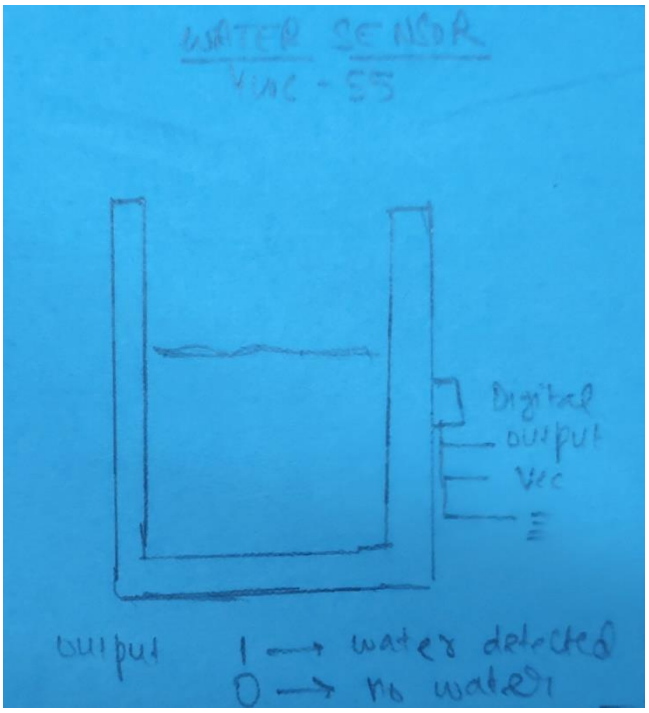
8259A


D0-D7
D0 - D7
IOR
RD
IOW
WR
A1
A0
8259A
CS
CAS0
CAS1
CAS2
SP/EN
5V
IR0
IR1
W
IR2
IR3
WM
IR4
IR5
IR6
IR7
INT
INTR
INTA
INTA
VCC
5V
GND

ULN 2803(Darlington Pair Transistor)

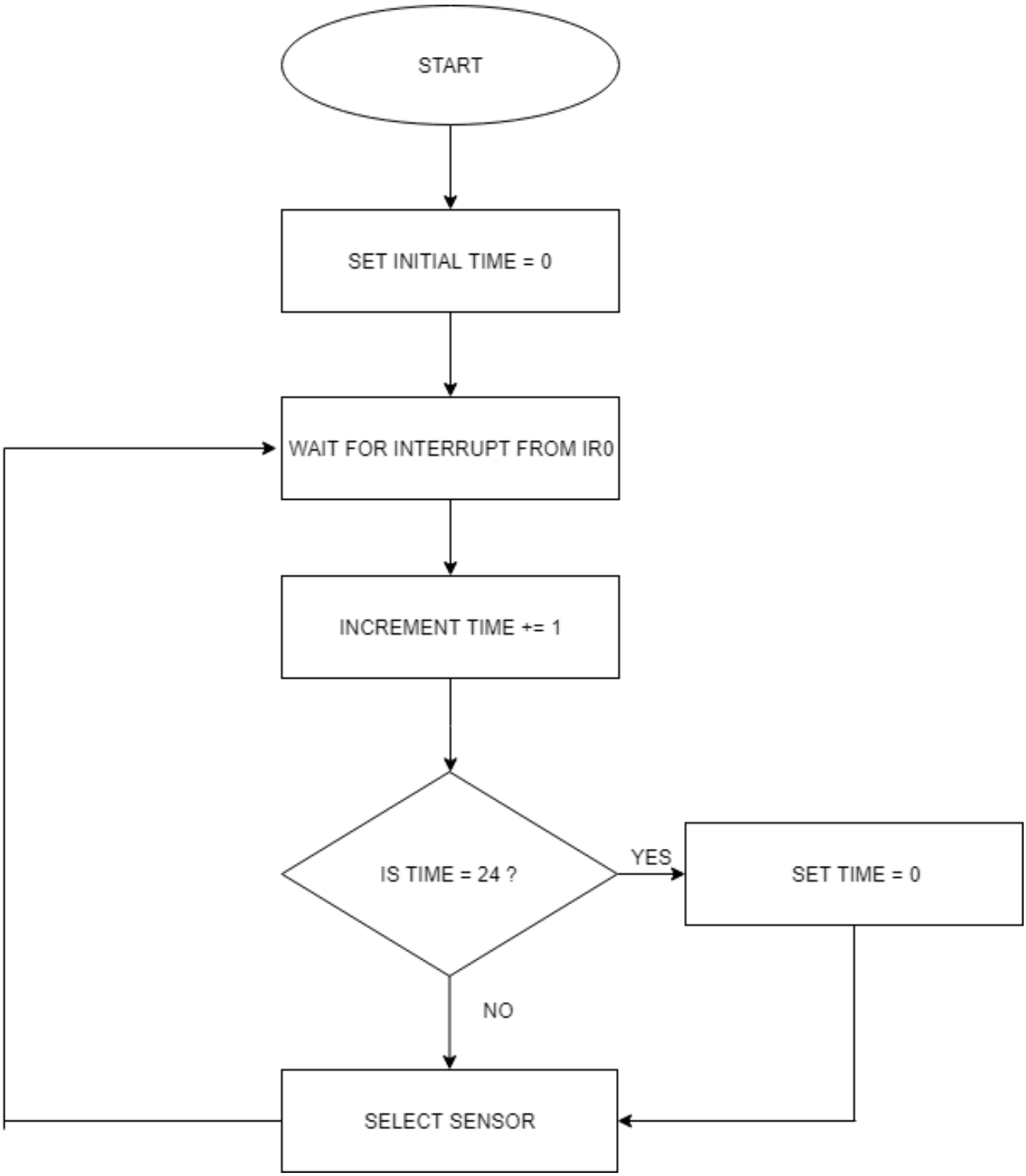


Water Sensor

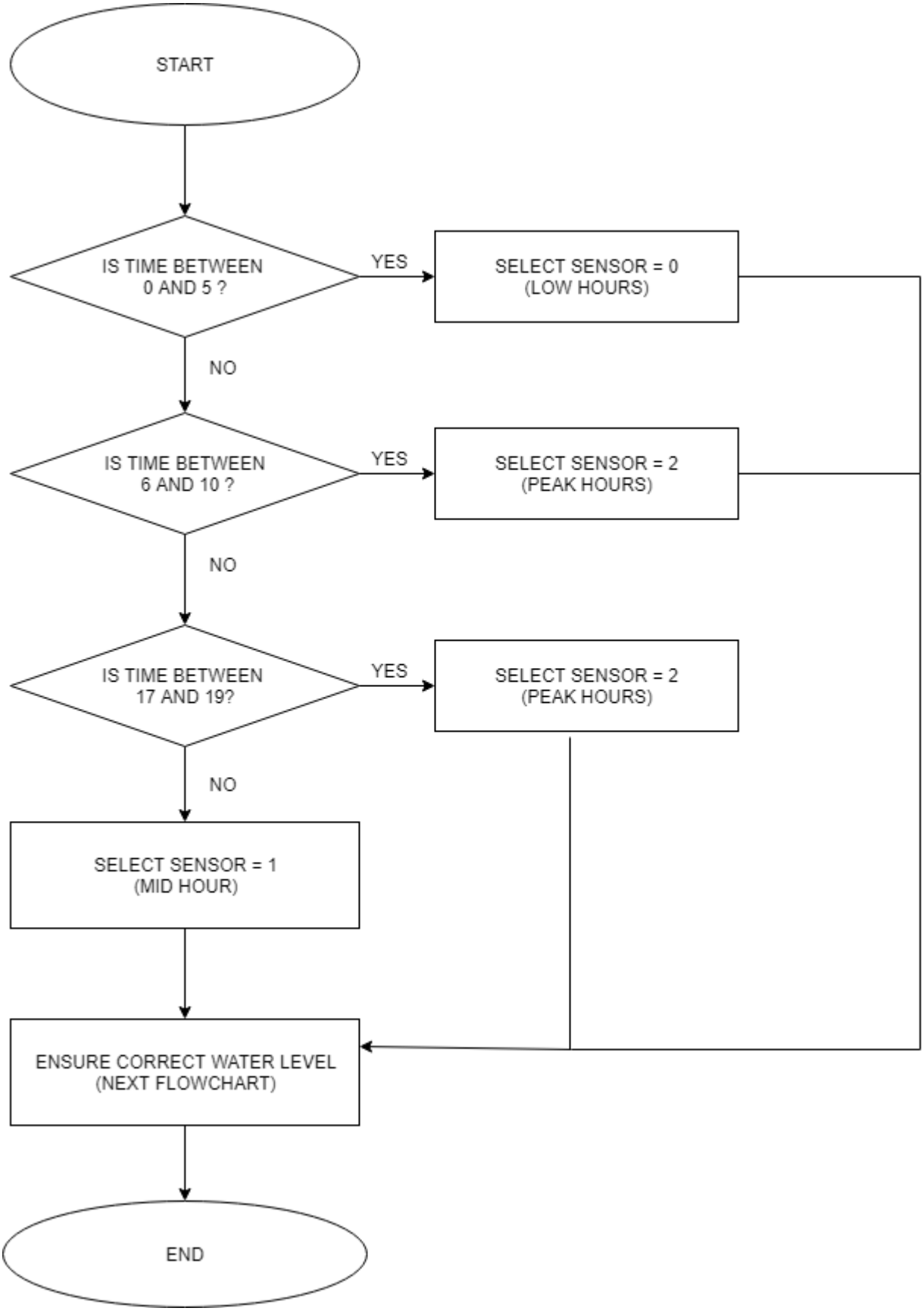


FLOW CHART

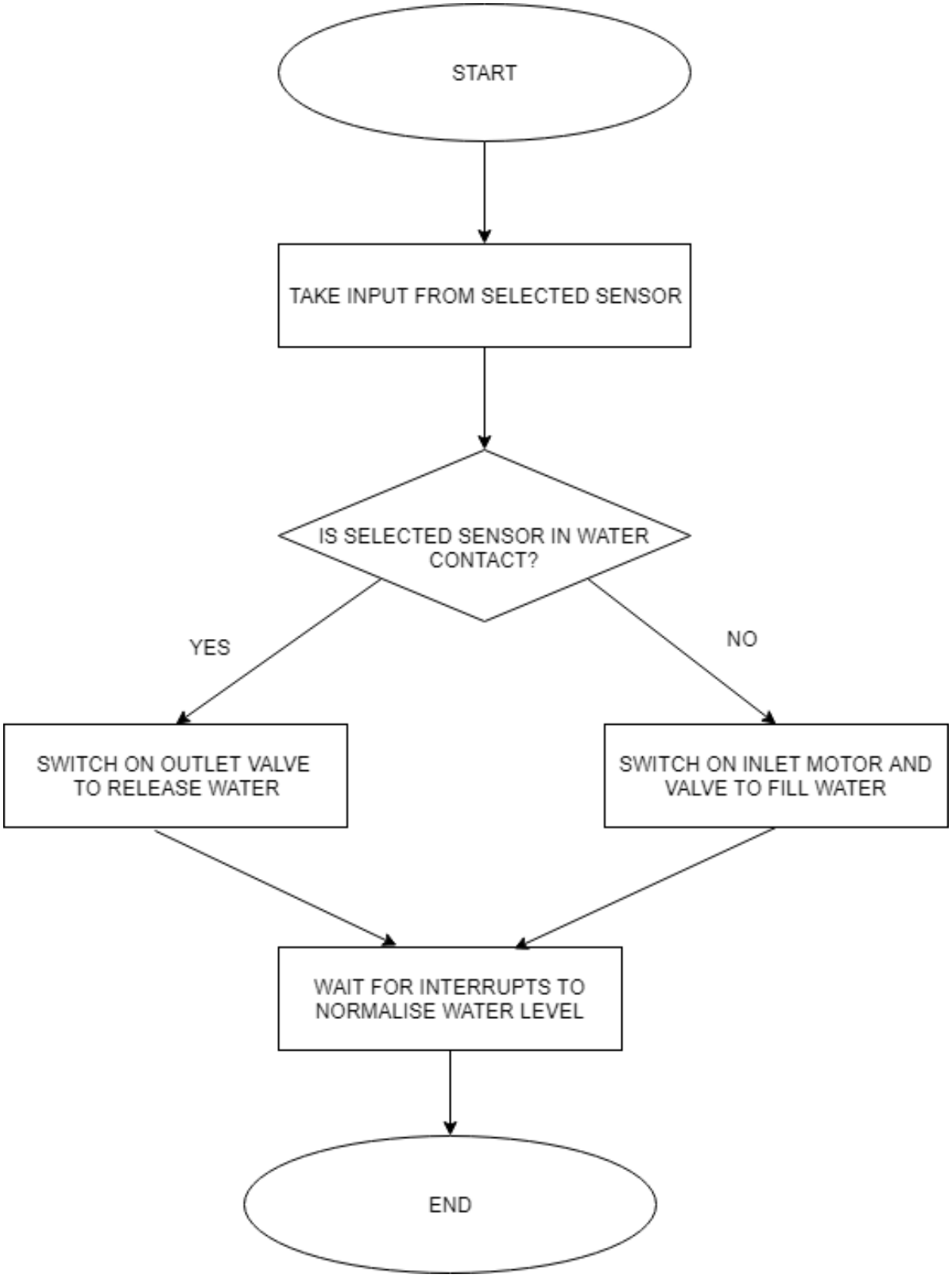
- Updating time



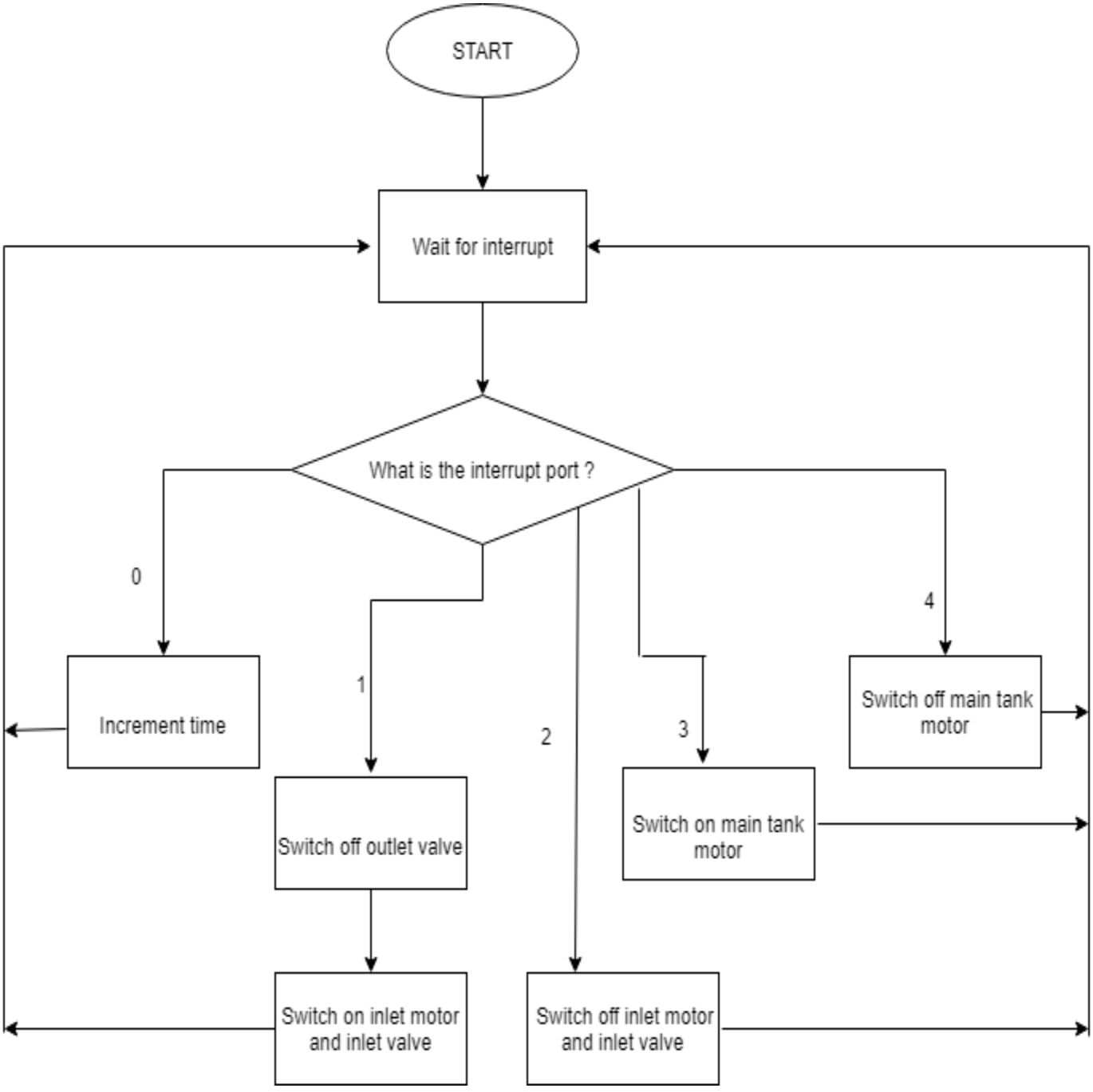
- Selecting active sensor



- Initializing water level



- Interrupt actions (valve and motors)



APPENDIX

The appendix contains the list of all datasheets of the chips used.

8086:

http://www.datasheet-pdf.com/datasheetdownload.php?id=544568

8284:

https://www.alldatasheet.com/datasheet-pdf/pdf/124124/INTEL/8284A.html

8255 :

http://www.alldatasheet.com/datasheetpdf/pdf/66100/INTEL/8255A.html

8259A :

http://www.alldatasheet.com/datasheetpdf/pdf/66107/INTEL/8259A.html

8254:

http://pdf.datasheetcatalog.com/datasheet/Intel/mXtwvqq.pdf

LS139 :

http://www.alldatasheet.com/datasheet-pdf/pdf/5657/MOTOROLA/74LS139.html

LS373 :

http://www.alldatasheet.com/datasheet-pdf/pdf/192081/TI/LS373.html

LS245 :

http://www.alldatasheet.com/datasheetpdf/pdf/44472/SIEMENS/BF245.html

LS244:

https://www.alldatasheet.com/datasheet-pdf/pdf/46211/SLS/LS244.html

LS153:

https://www.alldatasheet.com/datasheet-pdf/pdf/18648/PHILIPS/PLS153.html

ULN2803:

http://www.ti.com/lit/ds/symlink/uln2803a.pdf

Panasonic ALZN1F24W:

https://www.mouser.com/datasheet/2/315/mech_eng_lzn-1323403.pdf