MICROPROCESSOR AND INTERFACING DESIGN PROJECT

Group 6

Fire Alarm System

Submitted in partial fulfillment of the course
Microprocessors and Interfacing
(INSTR/EEE/ECE/CS F241) by

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- **System to be Designed: <u>Fire Alarm System</u>**

Description: This system checks for abnormal smoke content in a room and under such conditions throws open all exit doors and windows and opens a valve that releases the gas to put-out the fire. An Alarm is also sounded; this alarm is sounded until the smoke level in the room drops to an acceptable level. The room has two doors and four windows. The smoke detection system is made up of three smoke sensors placed on the ceiling of the room. When at least two of three detectors get turned on, the alarm system is activated. If only one of them is activated a different alarm sound is produced indicating probable malfunction of alarm. The system can be activated or de-activated using a single switch.

Specifications of the problem:

1. The system can be activated/deactivated by a single switch.
2. Three smoke detecting sensors are placed in the ceiling which detect the smoke content in the room.
3. A fire alarm that is sounded when smoke exceeds normal levels for at least two sensors.
4. Two doors, four windows and valves are controlled by motors.
5. The motors and alarms are activated only when two of three sensors detect an abnormal level in smoke levels.
6. If one them is activated, a single alarm is sounded.

Assumptions made:

1. Clockwise direction closes all doors, valves and windows and anticlockwise direction opens all doors, valves and windows.
2. We are using MC145010 as the smoke sensor. The IC is used with an infrared photoelectric chamber and detection is accomplished by sensing scattered light from minute smoke particles

or other aerosols. The output of the smoke sensor ranges from 0V to 5V. An ADC connected to variable voltage source is used in the design to model the output of the smoke sensor.

3. We have interfaced memory as follows:

   RAM – minimum 2k chip - 4k

   ROM – minimum 4k chip - 16k

   ROM1 00000H - 01FFFH

   RAM1 02000H - 02FFFH

   ROM2 FE000H- FFFFFH

4. When we power on the system, all the doors, windows and valve are closed by passing the appropriate control signals through PPI. After this, interrupts are continuously raised to measure the sensor outputs. If two of the three sensors exceed a threshold value then only doors, windows and valve are opened. In addition to this, an alarm is also sounded.
5. If only one sensor is active then a malfunction alarm is sounded.
6. As long as two/three of the sensors activated are above threshold value, all the doors, windows and valve will remain open. If any sensor falls below the threshold value then close all the doors, windows and valve and alarm is also turned off.
7. The opening of all doors, windows and valve is controlled by a stepper motor which operates in steps with the use of gears. A stepper motor can be programmed to stop rotating after a certain number of steps.

Components used:

- **6116 (RAM)**
  - 2 units used
- **2732 (ROM)**
  - 4 units used
- **ADC0808 (1 unit):**
  - 8-bit ADC
  - 8 channel
  - 1 MHz clock input
- **8253 (Programmable interval timer)**
  - 24 pin IC
  - Counter operated at a clock speed of 10kHz
- **8255 (Programmable Peripheral Interface (PPI) chip)**
  - Contains three 8-bit ports.
  - 24 input/output pins.
  - Port A and Port C lower are input lines
  - Port B and port C upper are output lines
- **8259(Programmable Interrupt Controller)**
  - Interrupt generated at interval of 1 seconds.
- **8086(Microprocessor)**

– Operating Clock Speed – 5MHz

– 40 pins

– 20 de-multiplexed Address Lines and 16 de-multiplexed Data lines

- **74LS373(octal latch)**

  – 3 Latches used

- **74LS245 (Octal Bus Transmitter/Receiver)**

  – 2 units used

- **74LS04 (Hex inverter)**

  – 1 not gate used.

- **74LS32 (OR Gate IC)**

  – 10 OR Gates used

- **74LS08 (AND Gate)**

  – 1 AND Gate used

- **L297 (Stepper motor controller):**

  Signals from your microprocessor and translates them into stepping signals to send to the L298.

- **L298 (Motor driver)**

  – Drives the stepper motor

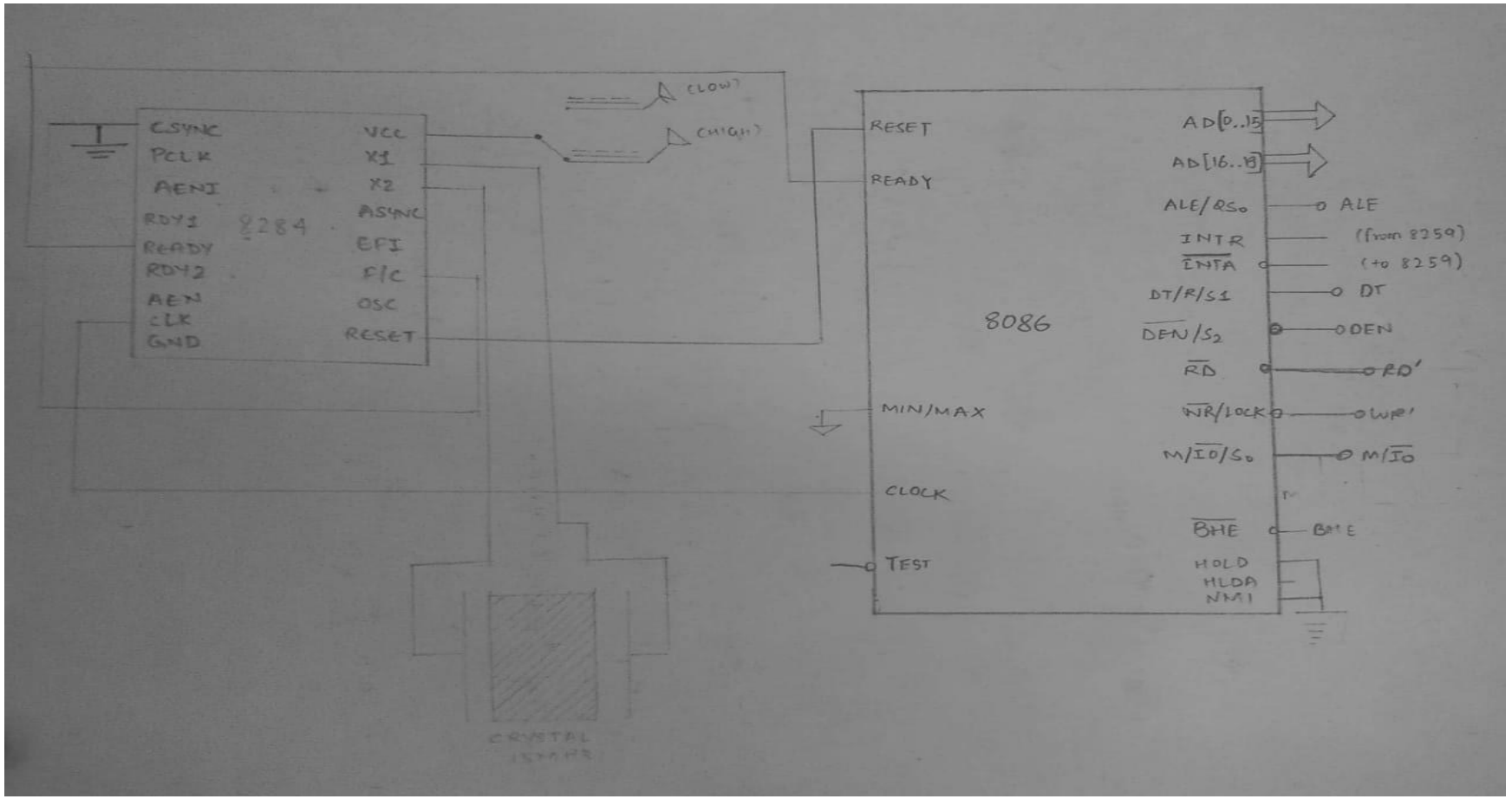
  – 4 output pins connected to one motor

- **Smoke Sensor MC145010**

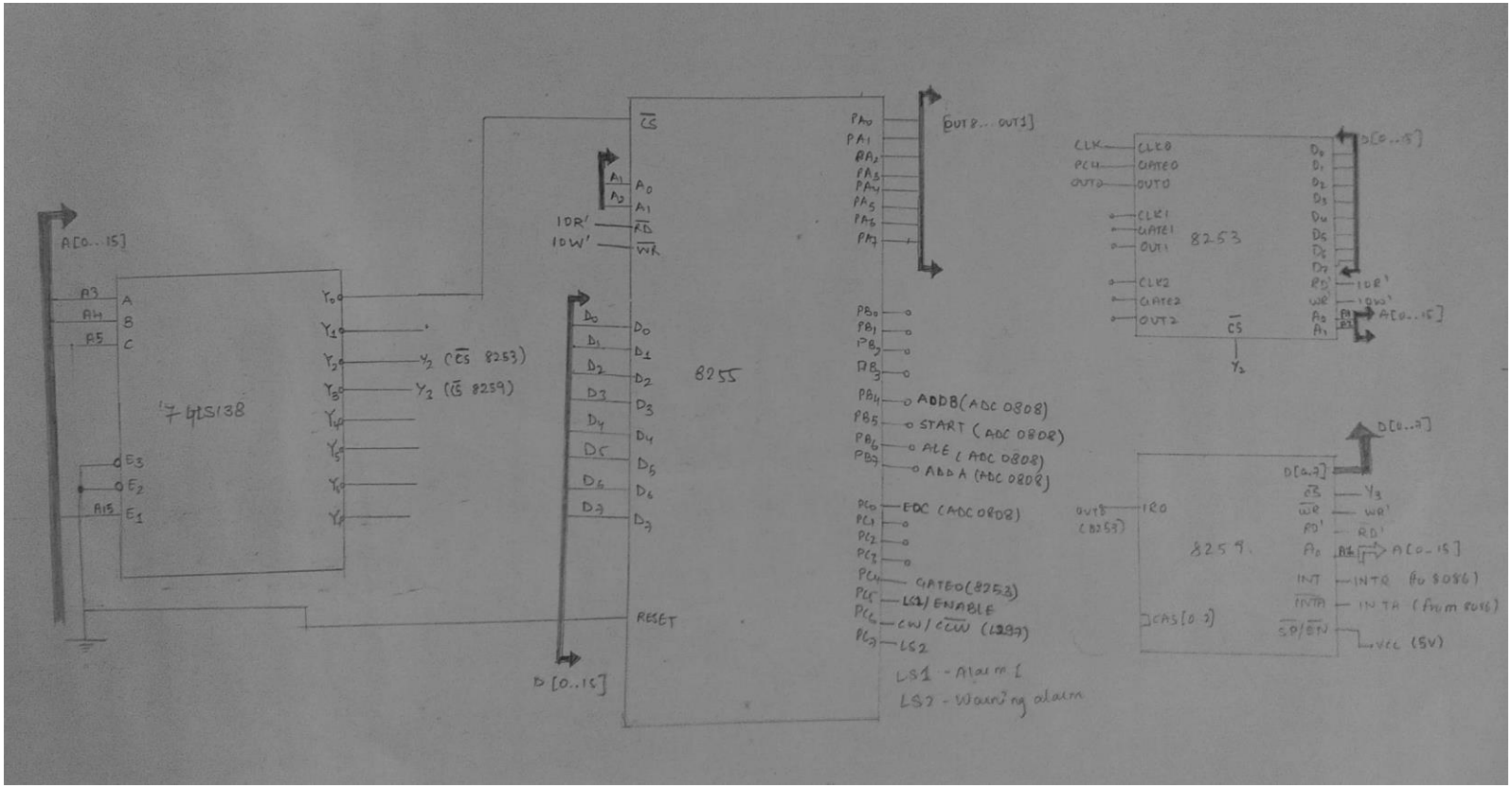
  – Used with an infrared photoelectric chamber

Schematic Diagram

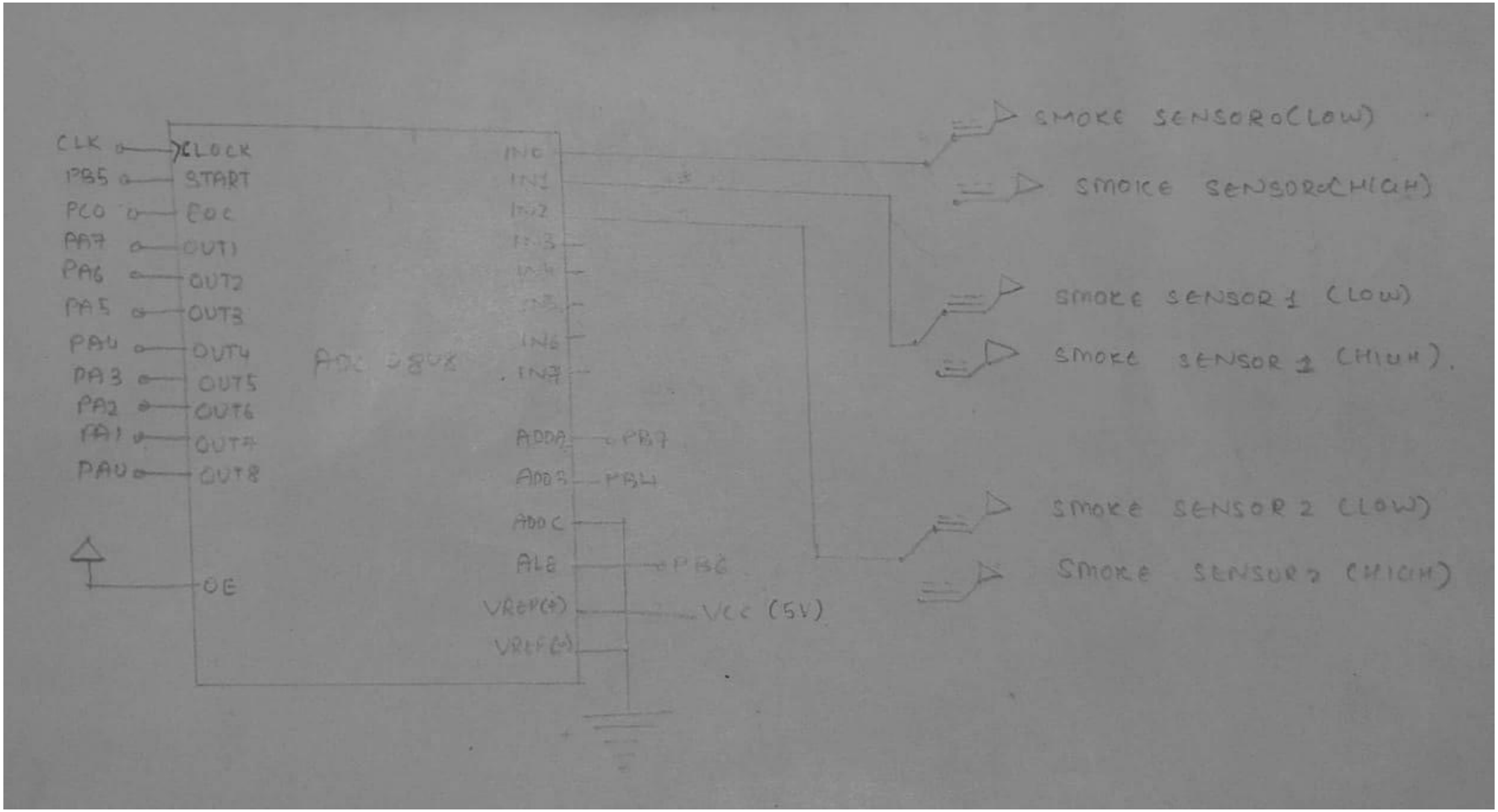
8086 and 8284



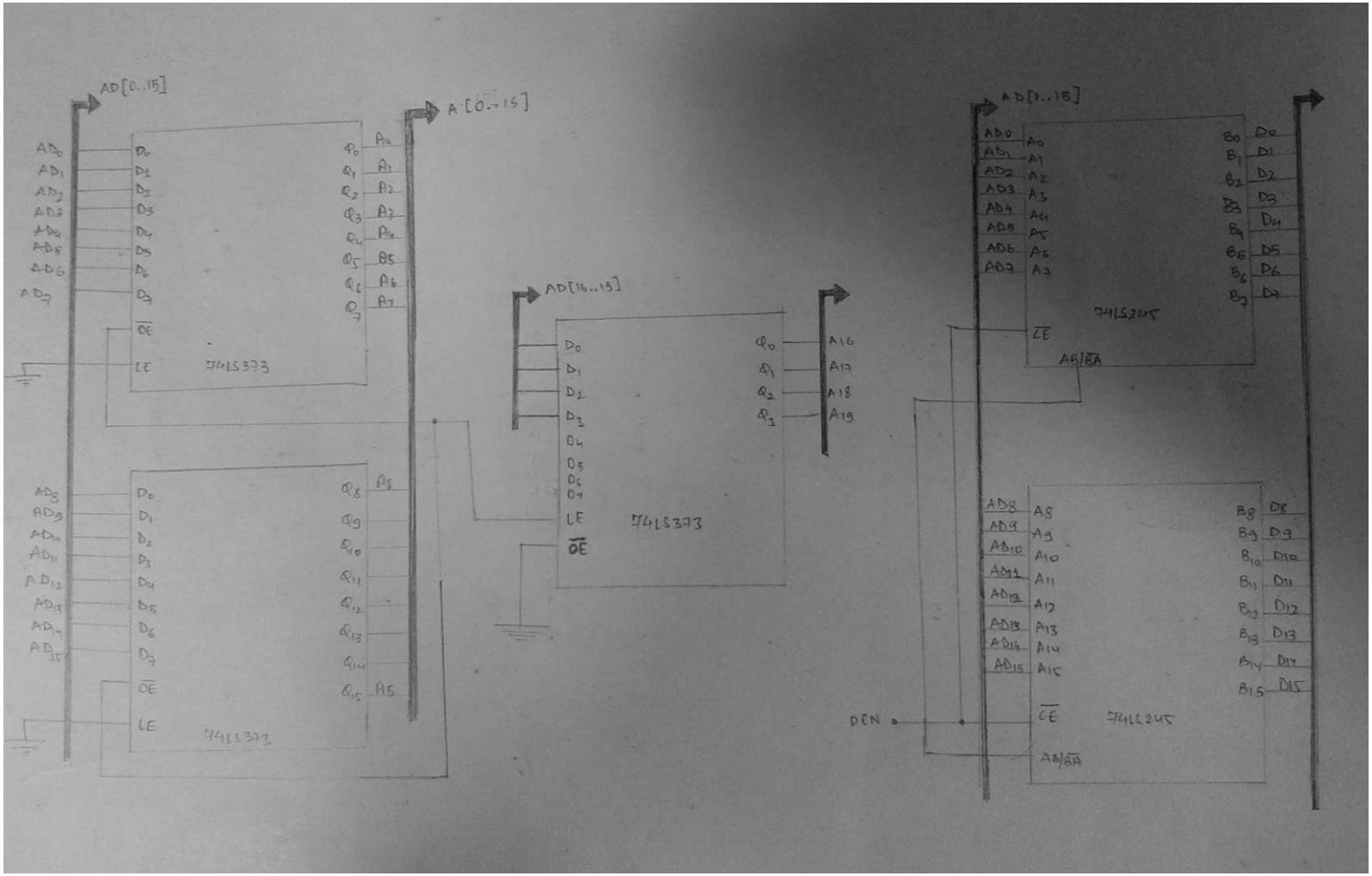
74LS138, 8253, 8255 and 8259



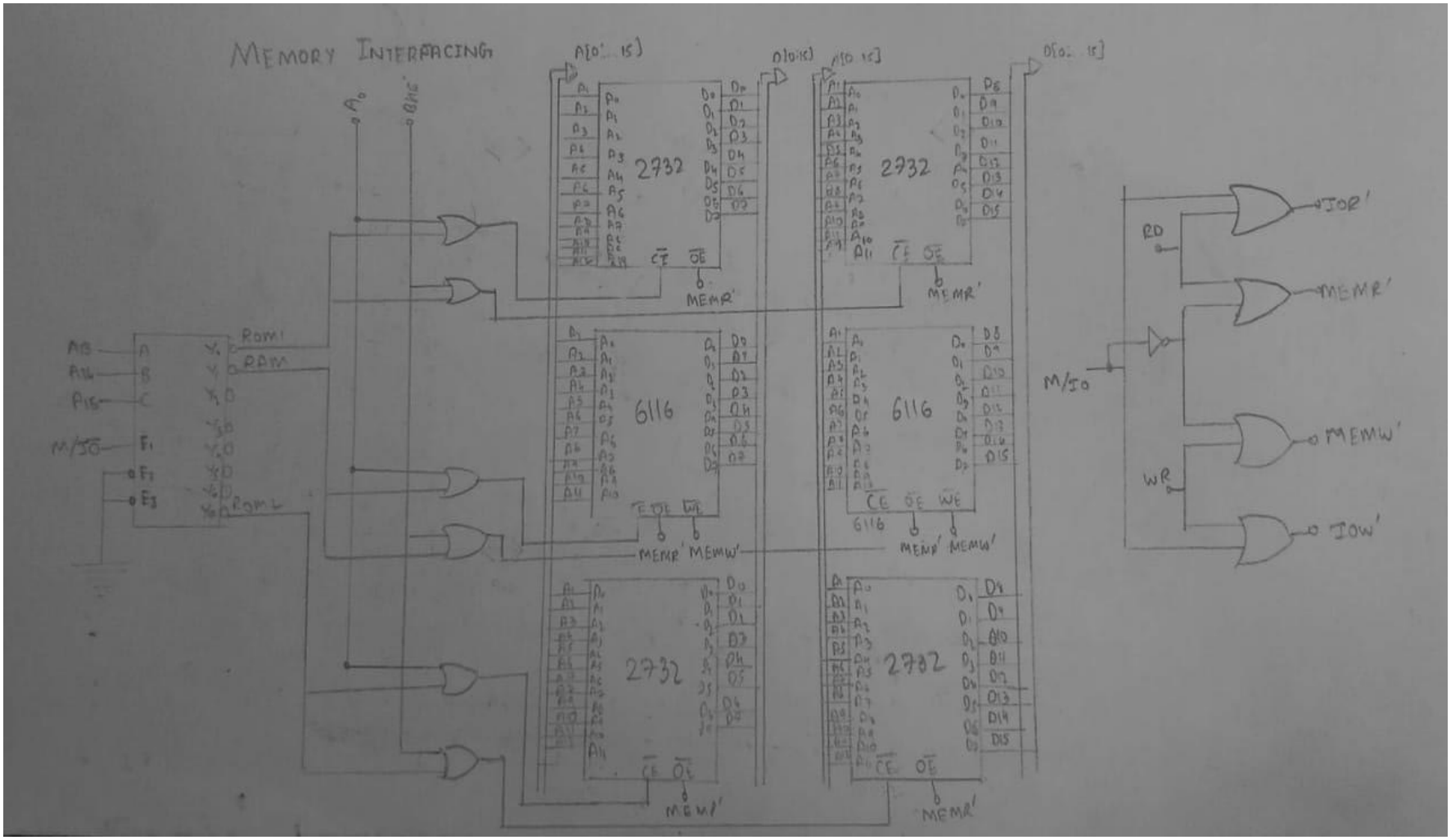
ADC0808 and Sensors



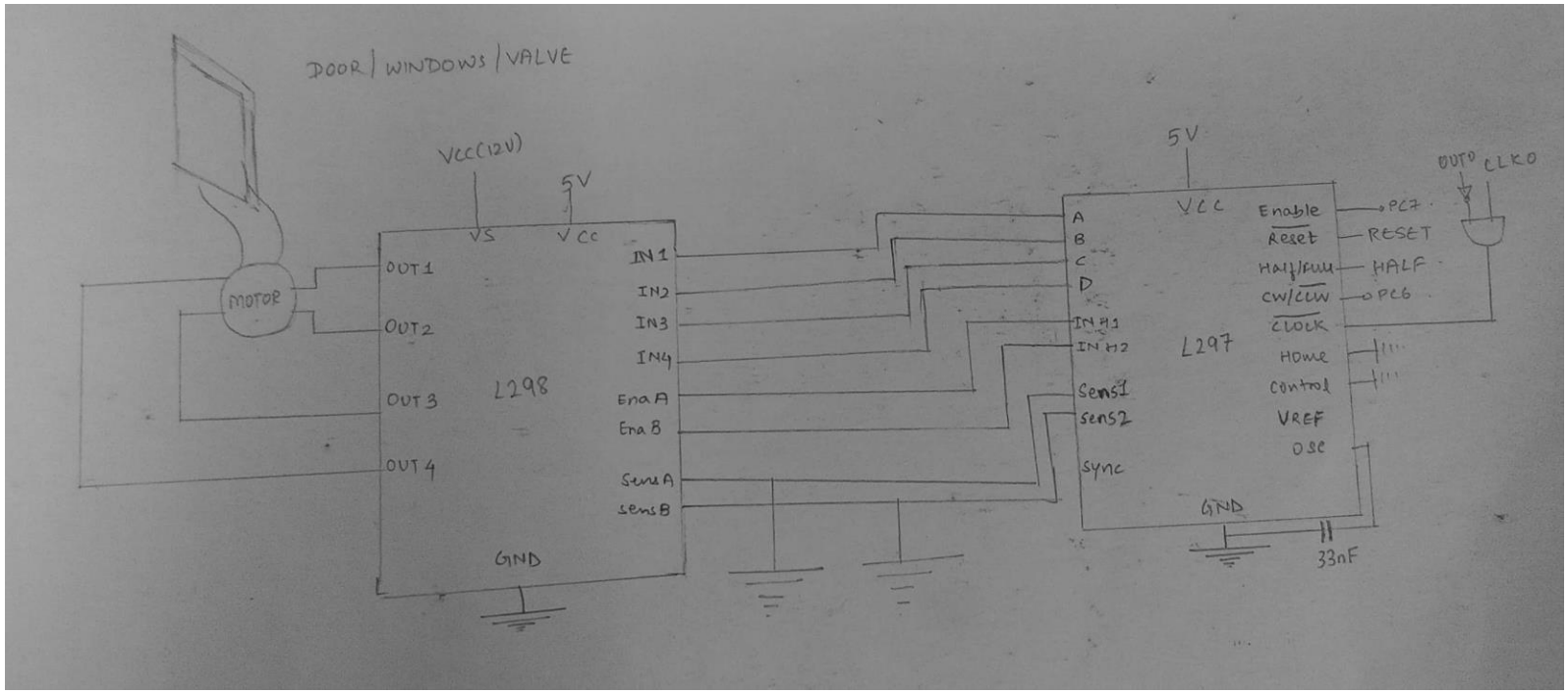
Bus amplification latches and buffers



Memory Interfacing

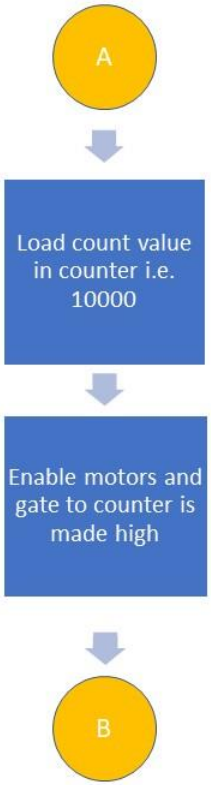


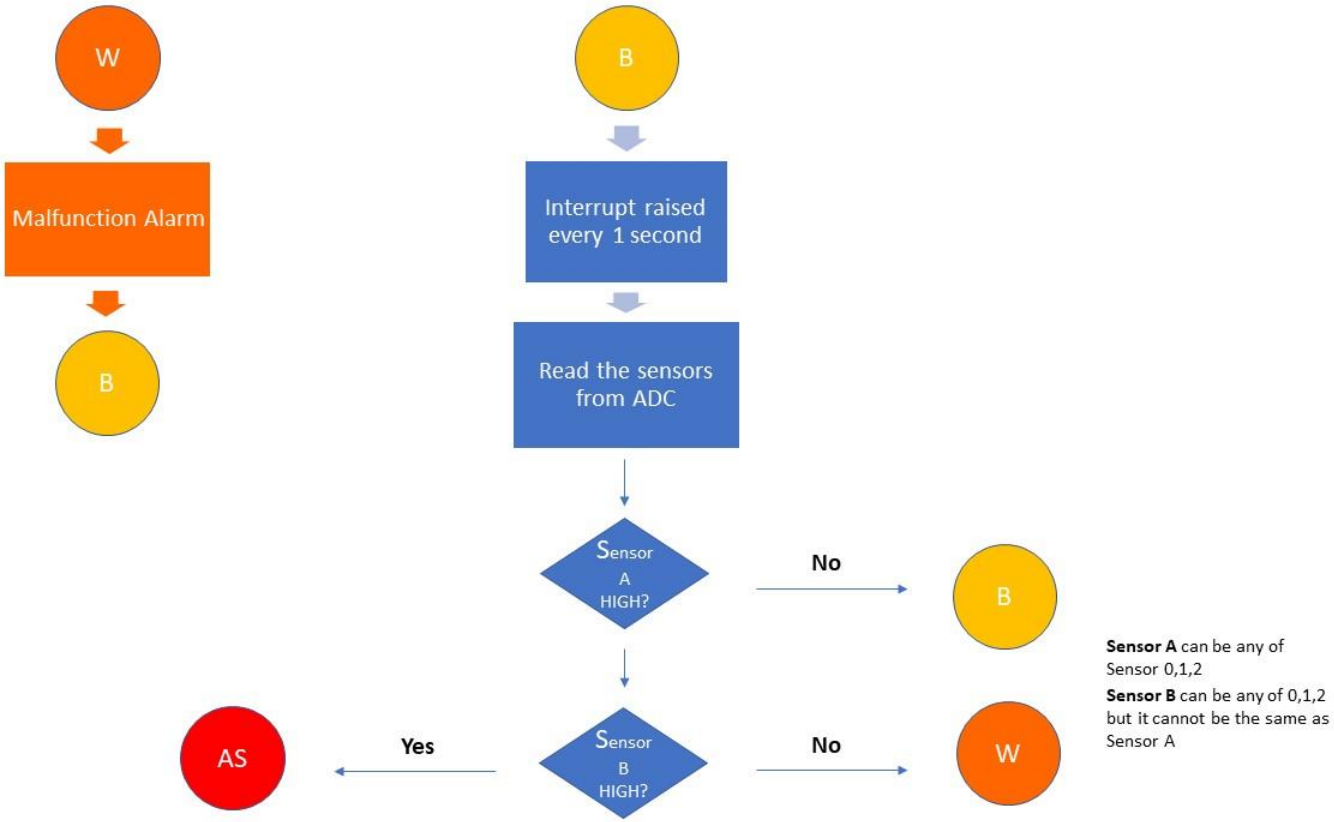
Motor and actuator arm

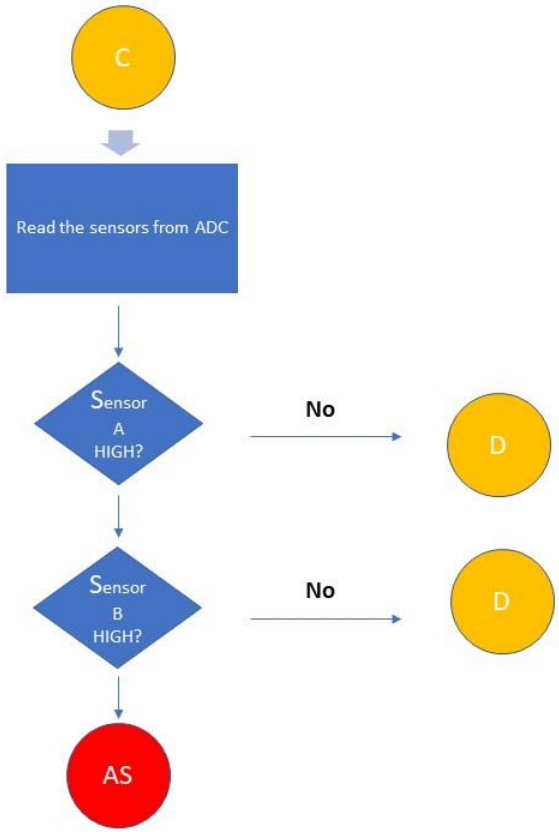


FLOW CHART

INITIALIZE I/O DEVICES

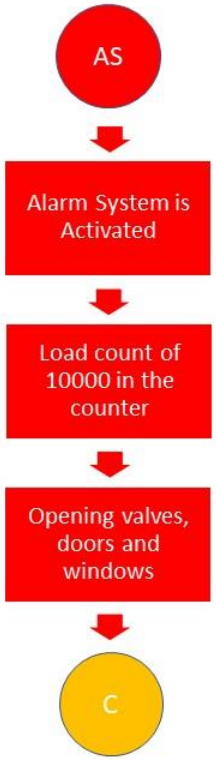

A
Load count value in counter i.e. 10000
Enable motors and gate to counter is made high
B


W
Malfunction Alarm
B
B
Interrupt raised every 1 second
Read the sensors from ADC
Sensor A HIGH?
No
B
Sensor B HIGH?
Yes
AS
No
W
Sensor A can be any of Sensor 0,1,2
Sensor B can be any of 0,1,2 but it cannot be the same as Sensor A



Sensor A can be any of Sensor 0,1,2

Sensor B can be any of 0,1,2 but it cannot be the same as Sensor A


AS
Alarm System is Activated
Load count of 10000 in the counter
Opening valves, doors and windows
C


D
Close doors, windows and valves
B

SPECIFICATIONS OF THE SENSOR:
MC145010

1. Operating Voltage Range: 6V to 12V
2. Operating Temperature Range: -10°C to 60°C
3. Average Supply Current: 12 µA

The pin assignment is as follows: