

MICROPROCESSOR AND INTERFACING DESIGN PROJECT

Group B163

Fire Alarm System

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

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- **System to be Designed:** Fire Alarm System
- **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 two smoke sensors placed on the ceiling of the room. When both detectors get turned on, the alarm system is activated.

Specifications of the problem:

1. Two smoke detecting sensors are placed in the ceiling which detect the smoke content in the room.
2. A fire alarm that is sounded when smoke exceeds normal levels.
3. Two doors, four windows and valves are controlled by motors.
4. The motors and alarms are activated only when both the sensors detect an abnormal level in smoke levels.

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 - 8k
 - ROM1 08000H - 09FFFH
 - RAM1 0A000H – 0AFFFH

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 both the sensors exceed a threshold value then only doors, windows and valve are opened. In addition to this, an alarm is also sounded.
5. As long as both the sensors 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.
6. 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, which can be programmed through our code.

Components used:

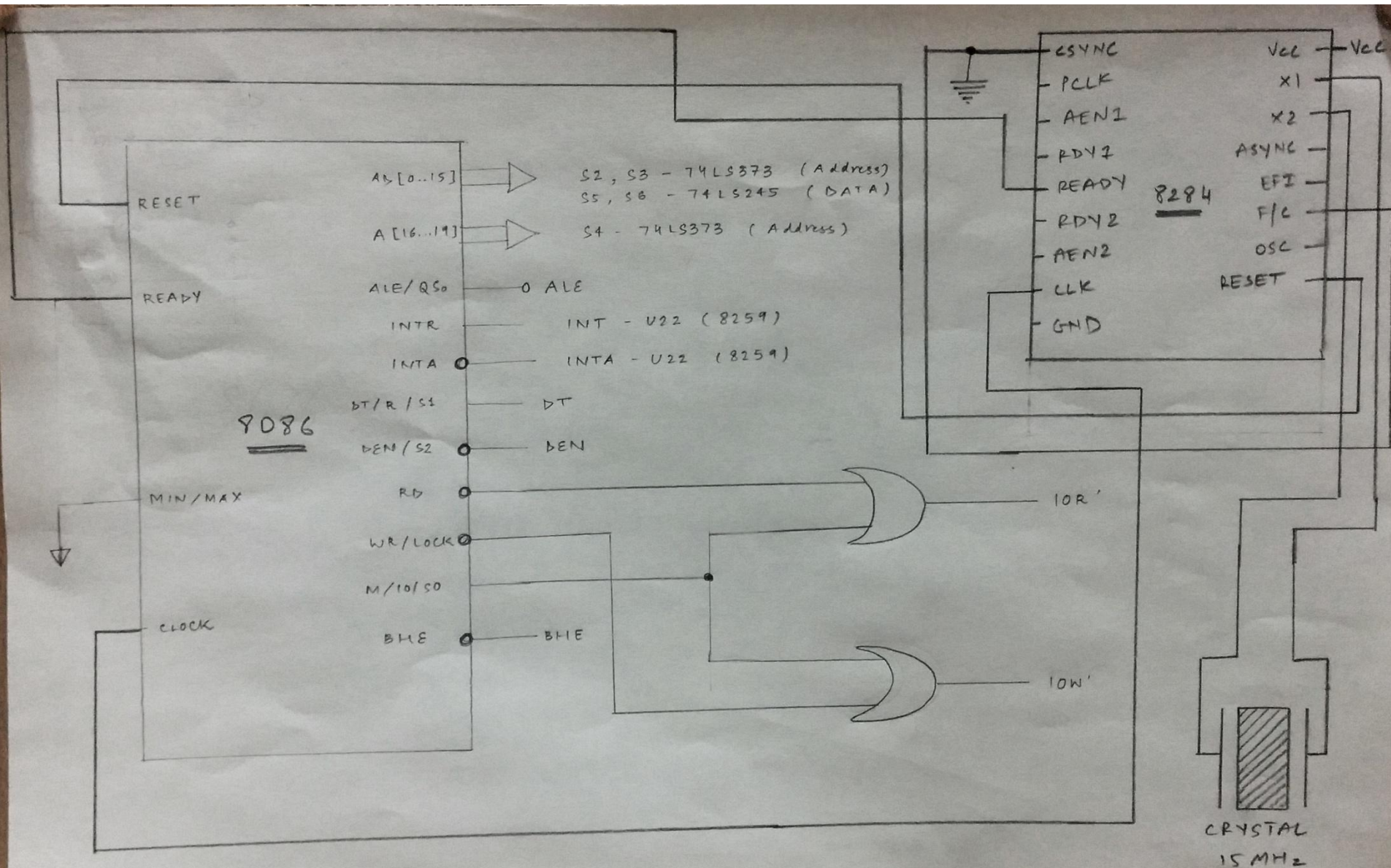
- **6116 (RAM)**
 - 2 units used
- **2732 (ROM)**
 - 2 units used
- **ADC0808 (1 unit):**
 - 8-bit ADC
 - 8 channel
 - 1 MHz clock input
- **8253 (Programmable interval timer)**
 - 24 pin IC
 - 1 counter used with a count value of 18
 - Counter operated at a clock speed of 1Hz
- **8255 (Programmable 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 100 micro 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)**
 - 2 not gates used.
- **74LS32 (OR Gate IC)**
 - 8 OR Gates used
- **74LS08 (AND Gate)**
 - 1 AND Gate used

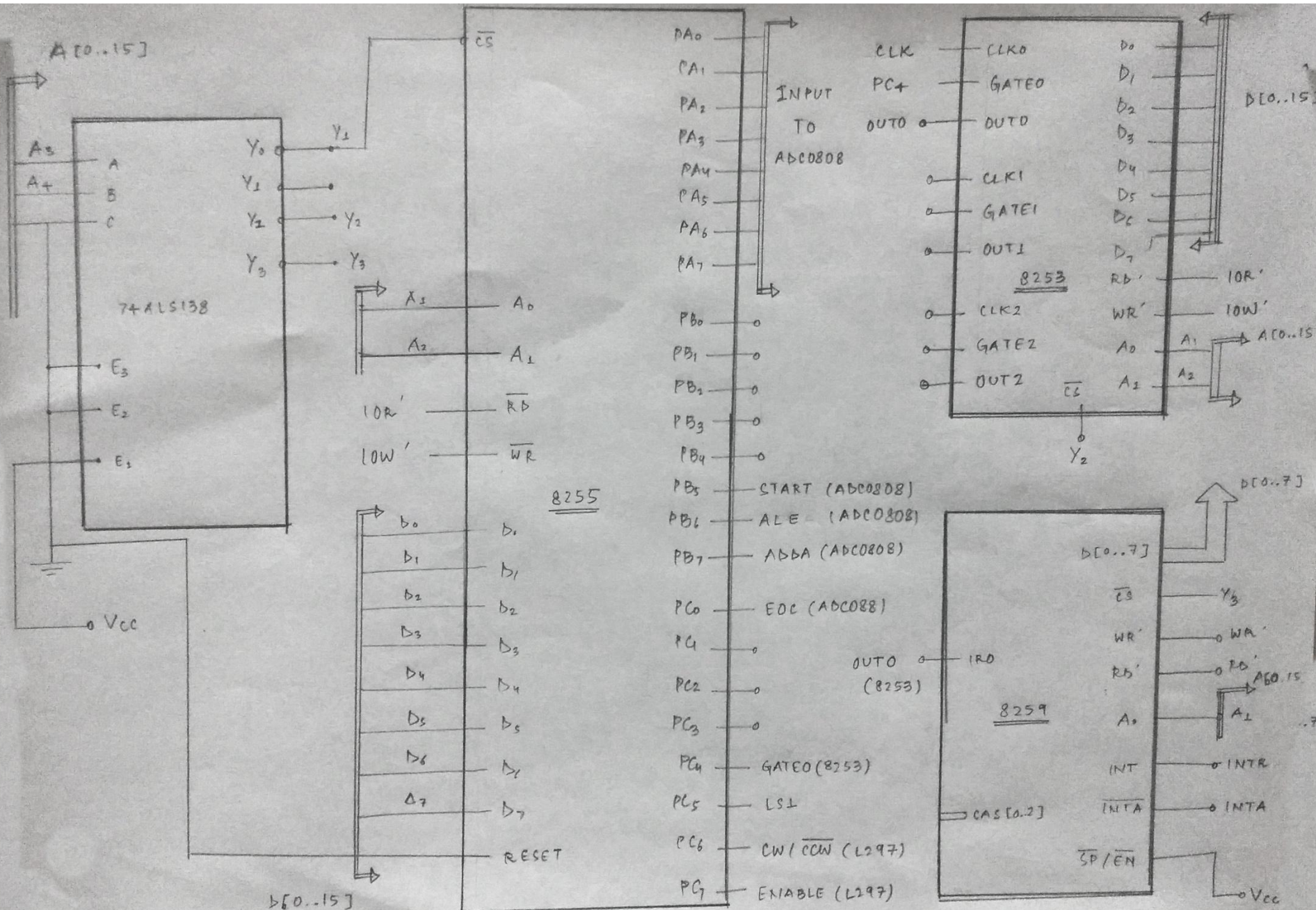
- **L297 (Stepper motor controller):** Signals from your microprocessor and translates them into stepping signals to send to the L298.
- **L298 (Motor driver)**
 - Drives the stepper motor
 - 4 output pins connected to one motor
- **Smoke Sensor MC145010**
 - Used with an infrared photoelectric chamber

Schematic Diagram

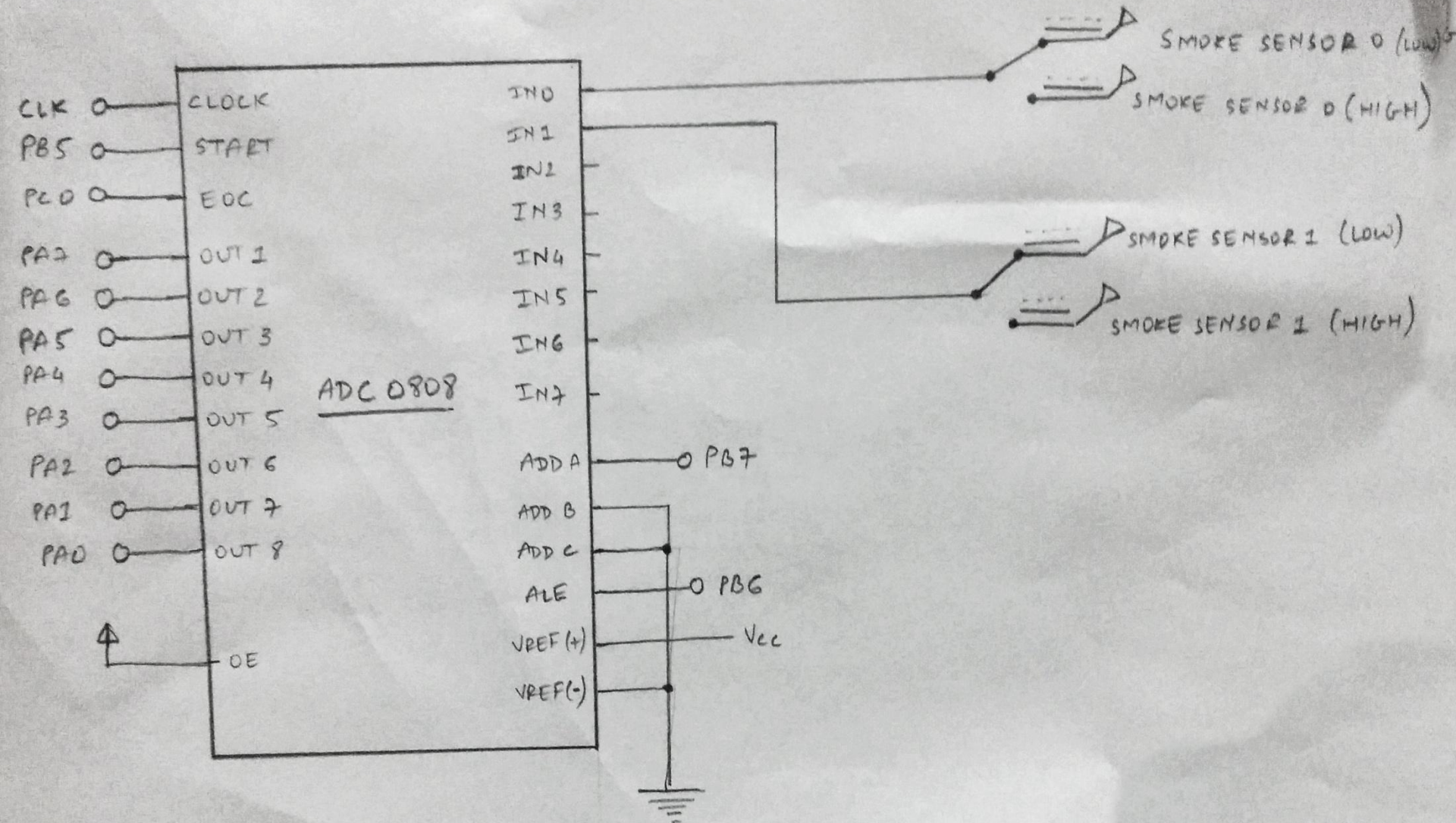
8086 and 8284



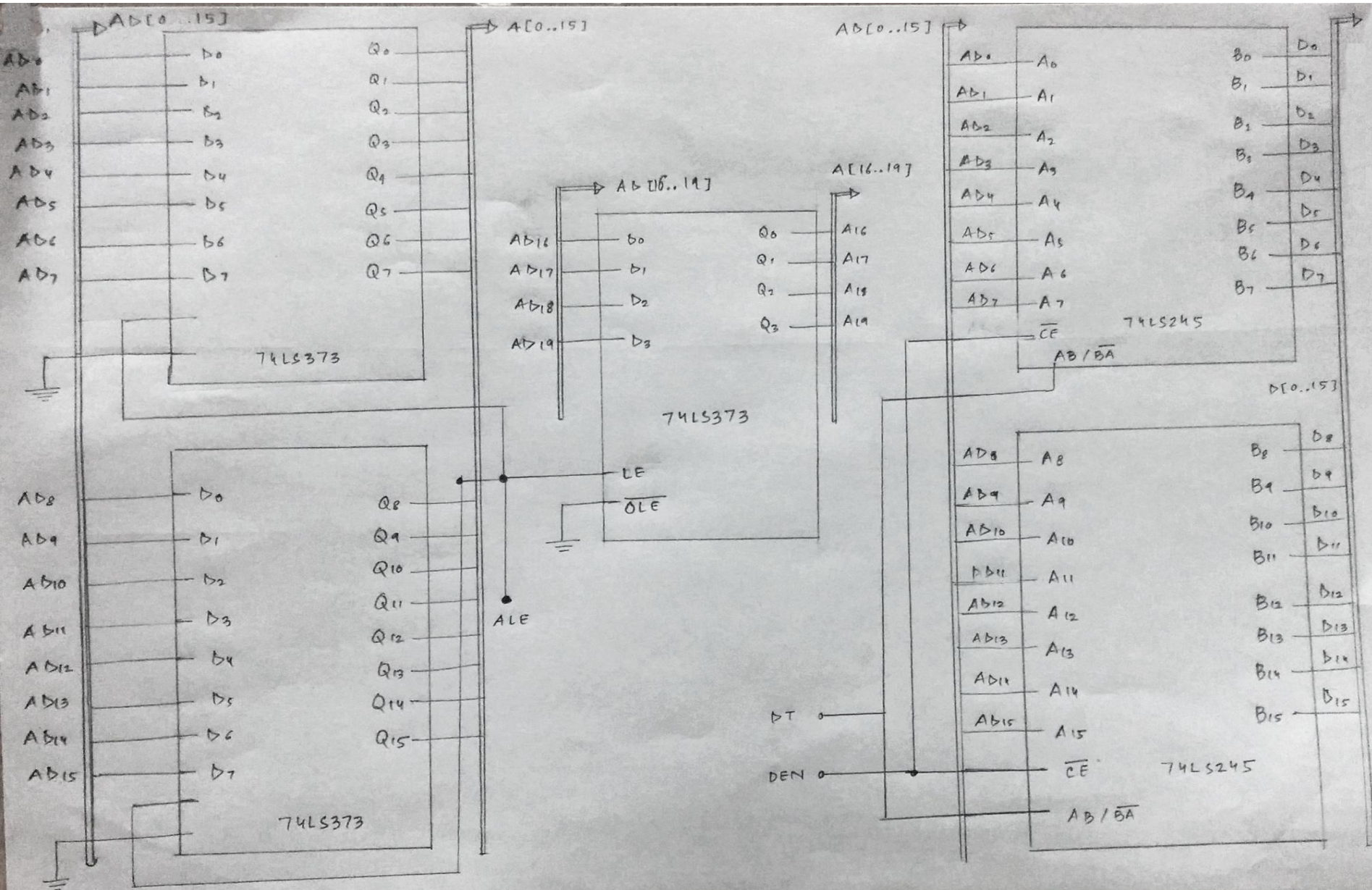
74LS138, 8253, 8255 and 8259



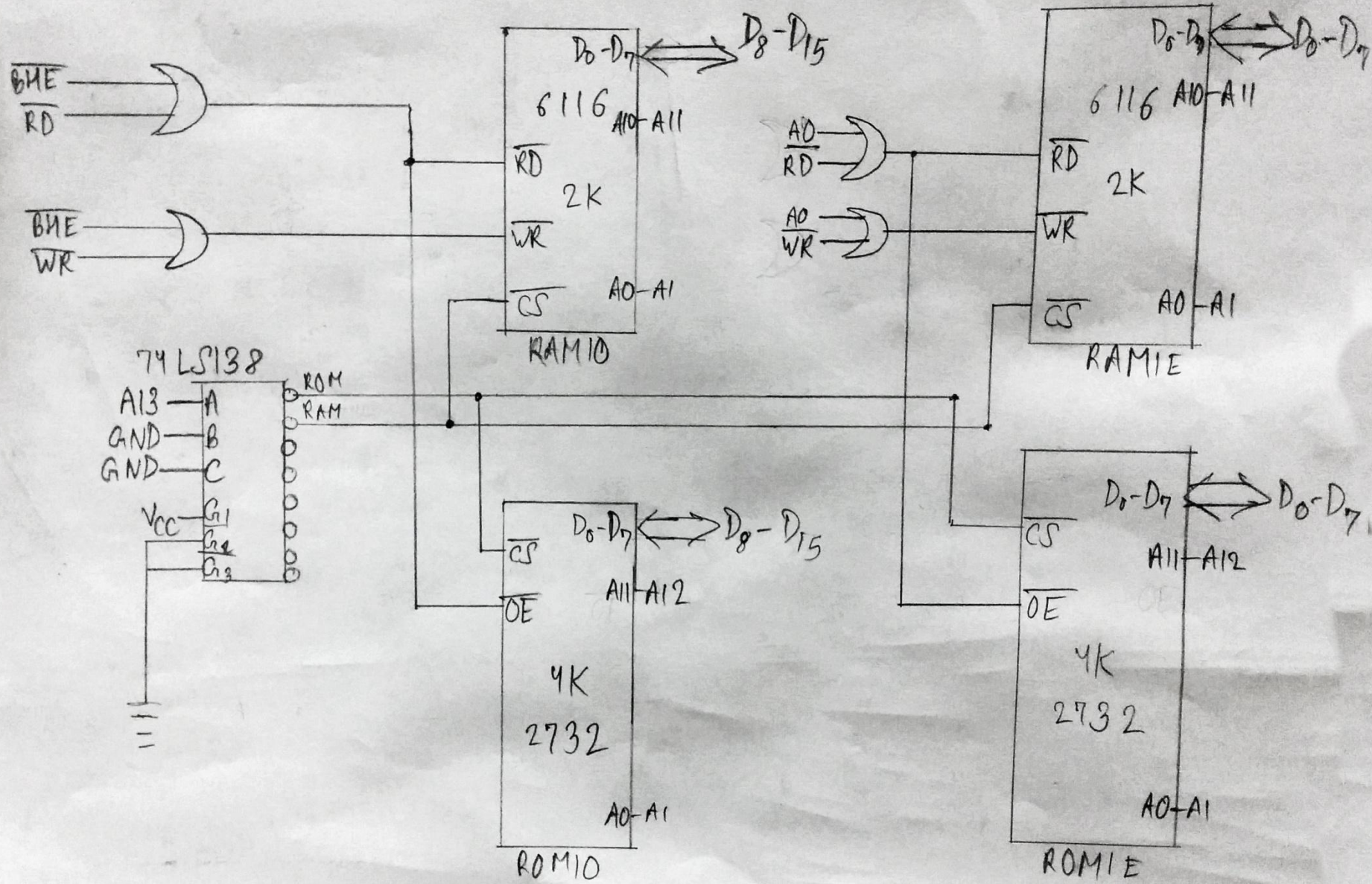
ADC0808 and Sensors



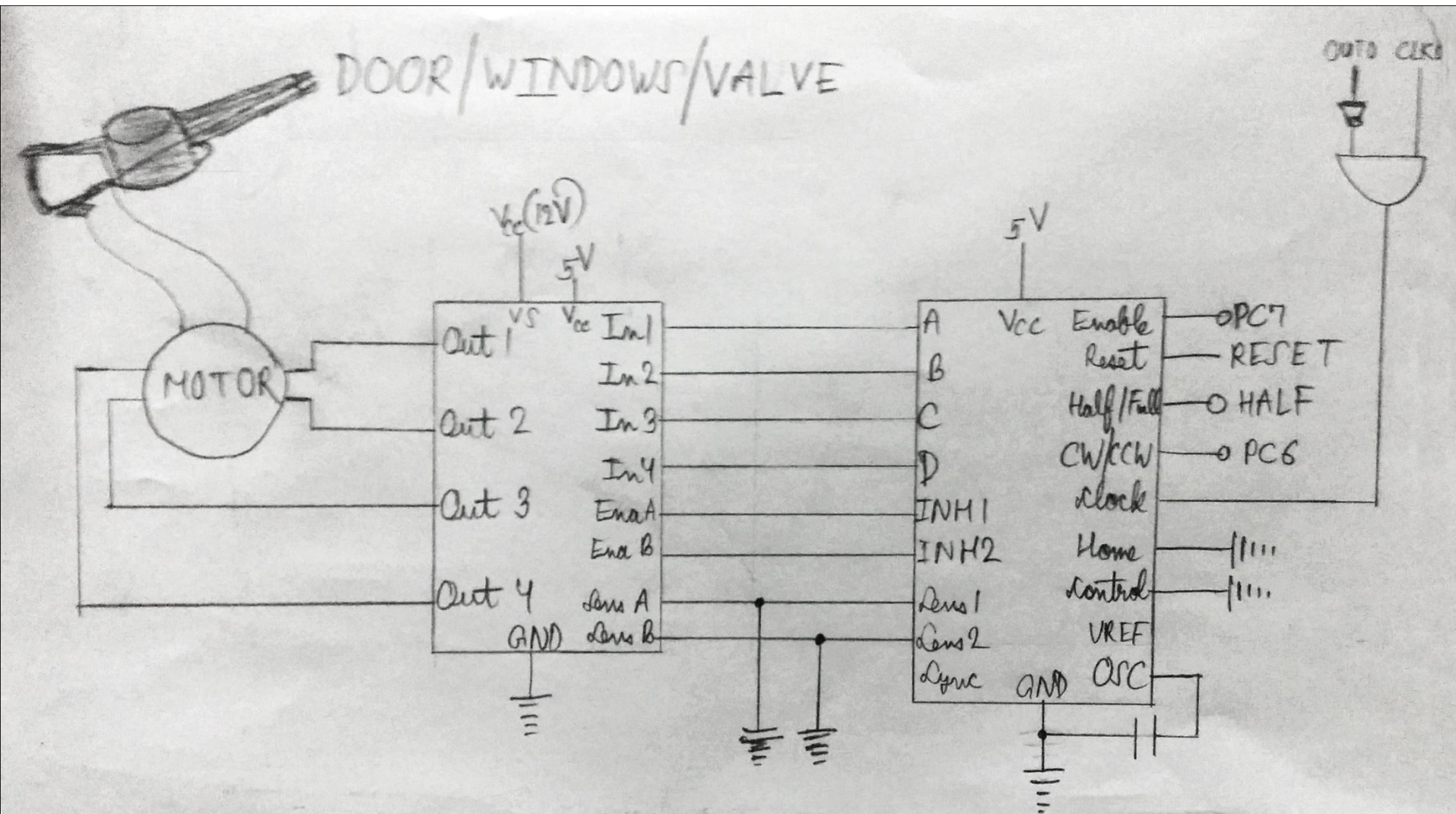
Bus amplification latches and buffers



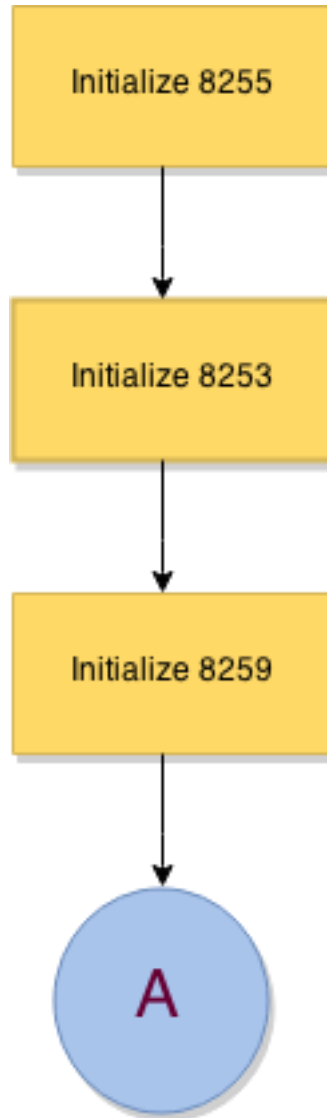
Memory Interfacing



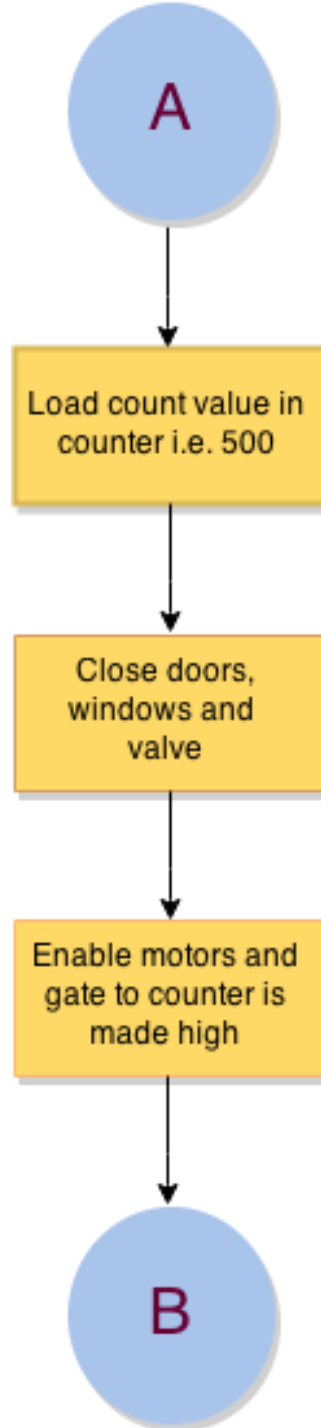
Motor and actuator arm

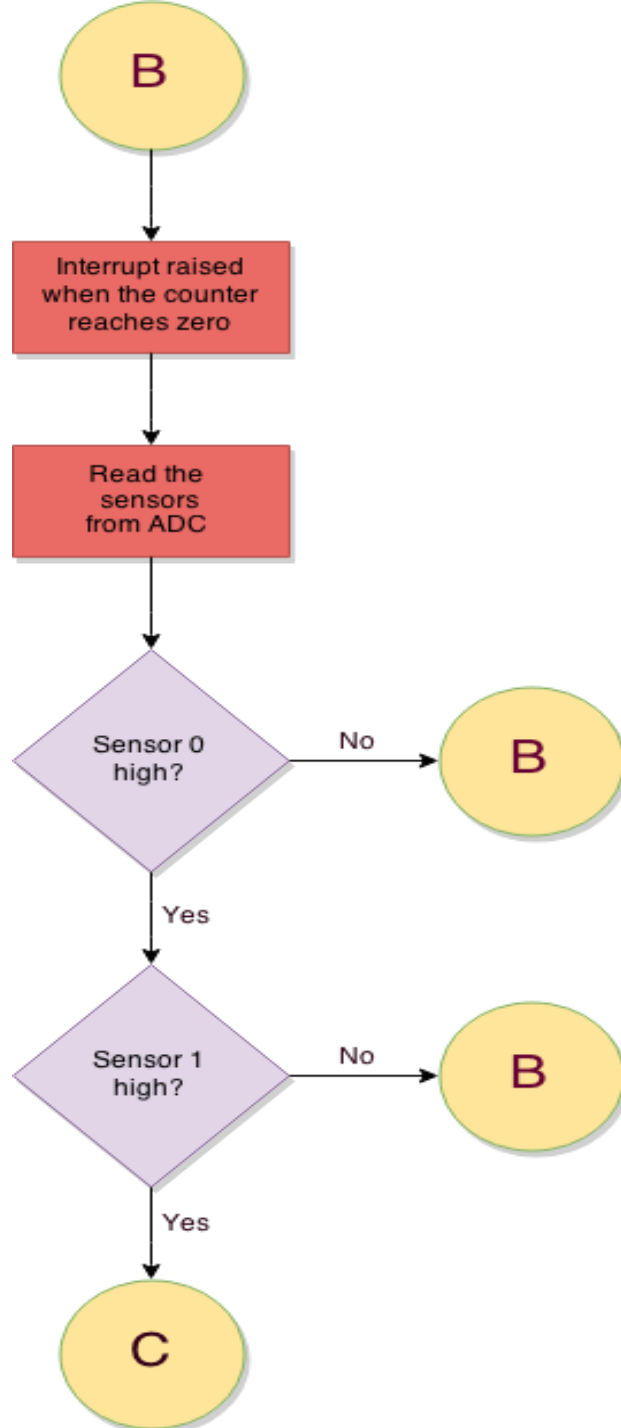


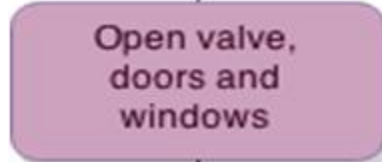
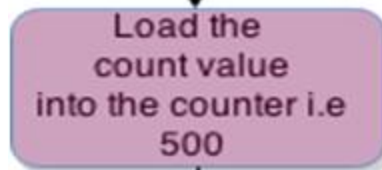
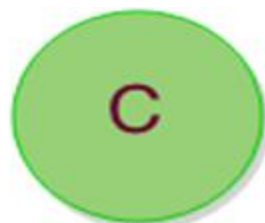
FLOW CHART

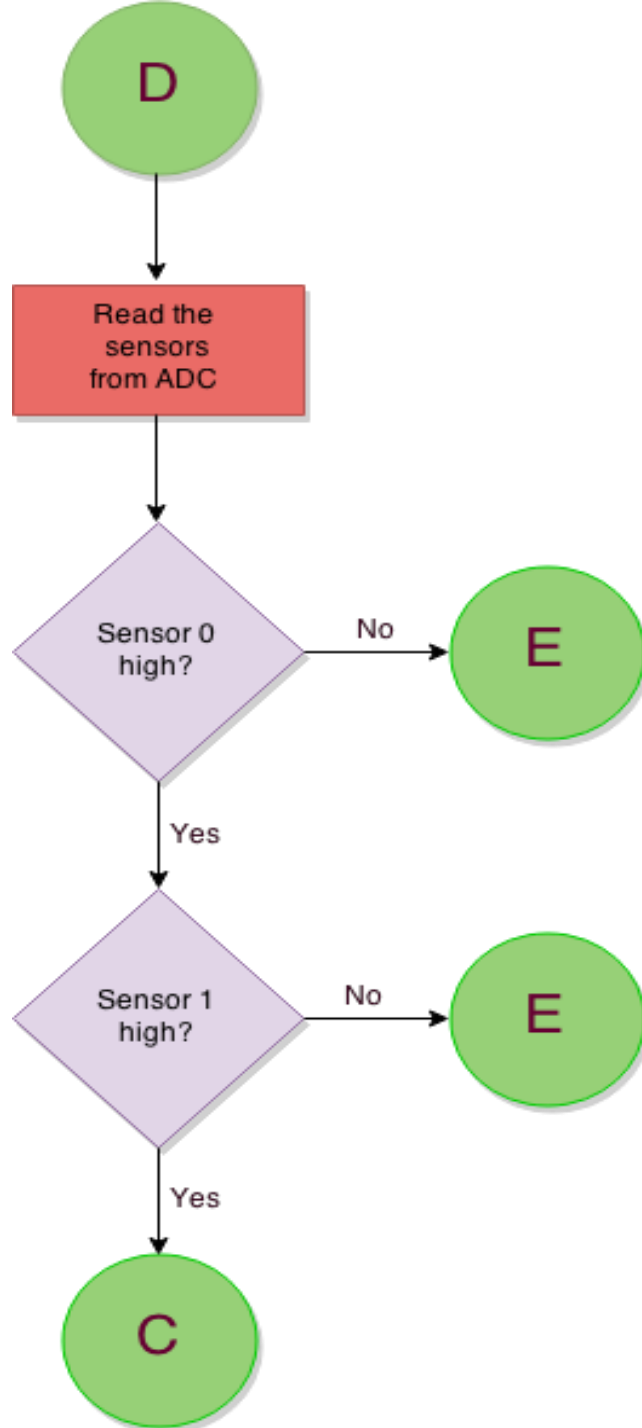


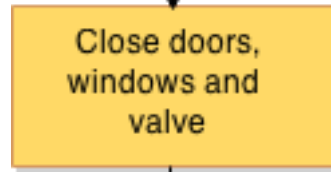
Initialize I/O devices











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 μ A

The pin assignment is as follows:

