

PROBLEM STATEMENT

Three different types of cool drinks can be dispensed by the machine. The cool drink is available in three different quantities: Small, Medium and Large.

There are three buttons available to select the cool drink type and another three buttons to select quantity.

The user selects the drink, the quantity and then presses a button labelled dispense. LEDs are available with each button. When a choice is made the corresponding LED glows and turns off when the dispensing is completed. There are three more LEDs available that are used to indicate when a particular type of cool drink is not

available. The cost is Rs.5.00, Rs.10.0 and Rs15.0 respectively. There is a coin slot that accepts five rupee coins only.

User can select type of cool drink, desired quantity and then drop the required number of coins. Each type of cool drink has its own dispenser. Based on the user's choice of drink the corresponding outlet will be open. The quantity of drink dispensed has to be accurately monitored. The quantity of drink is based on user's choice and the number of coins dropped in by the user.

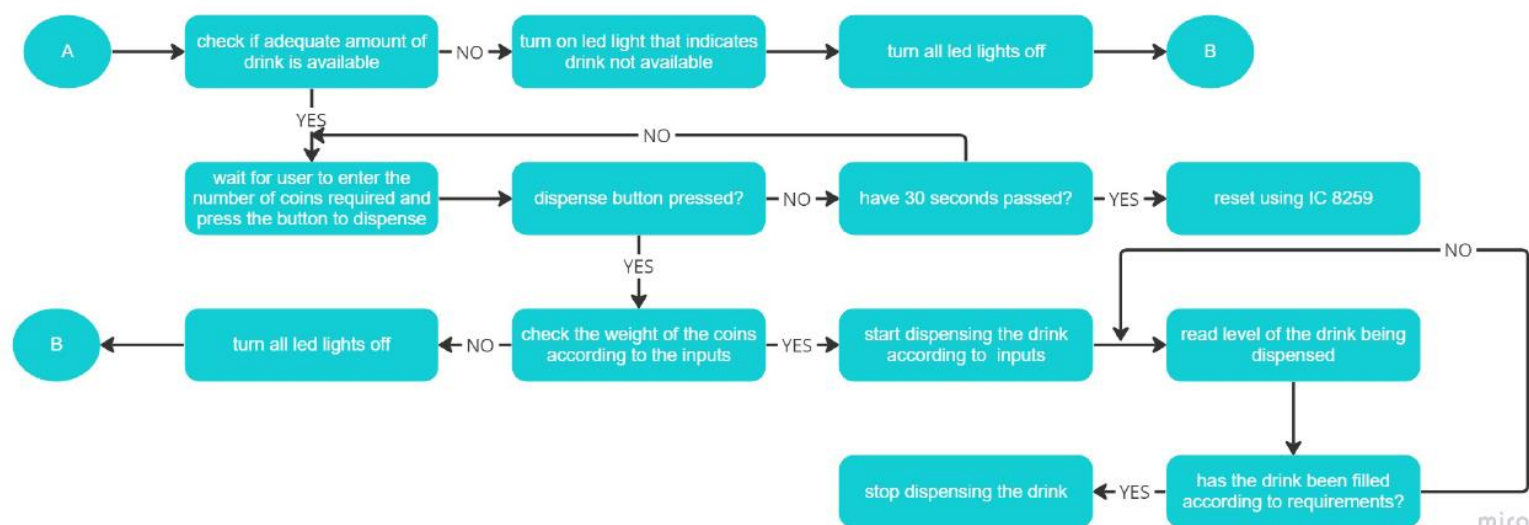
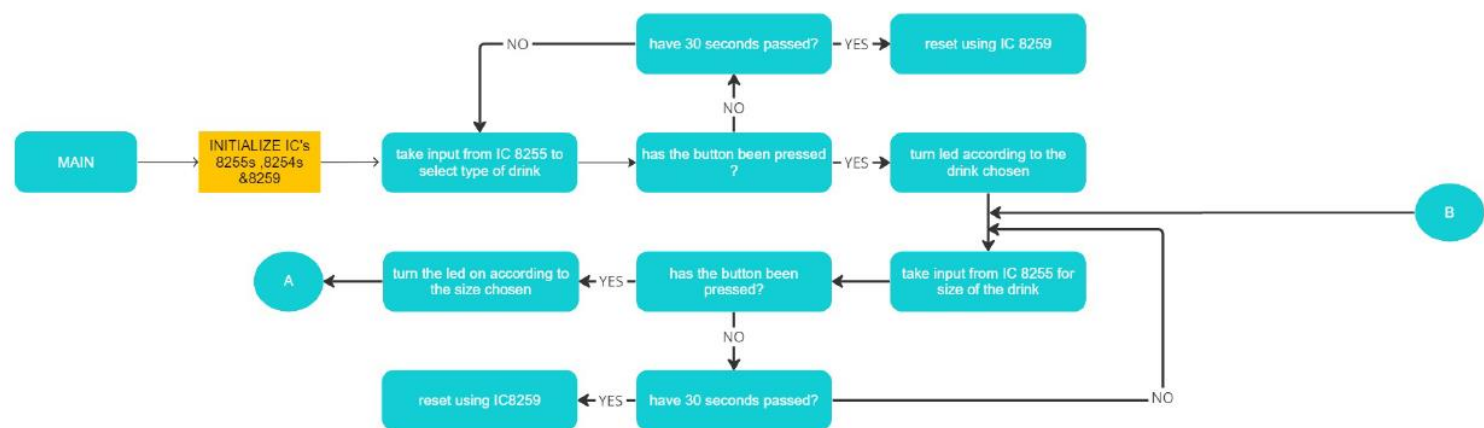
ASSUMPTIONS

1. The 3 cold drinks come in 3 quantities each: small (100ml), medium(200ml), large(300ml) and the user can order only 1 drink at a time of selected type and size. All 3 tanks are 10cm (length) x 10cm (breadth) x 15cm (height), and the initial height of liquid in all tanks is 10cm (1 litre).
2. User selects desired drink from a list of 3 drinks and presses the corresponding button and likewise for the desired quantity; an LED is switched on, once a selection is made.
3. The coins are entered after pressing the dispense button.
4. If a user exceeds a time interval of 30 seconds after pressing dispense button, the system automatically resets. This applies to the coin sensor (pressure sensor for measuring the number of coins) as well. If 30 seconds are up

(before entering the required number of coins for the selected quantity of drink), then the inserted coin/s is/are automatically lost (if any entered).

5. If the number of coins inserted is more than what is required based on the user's selection, drink is dispensed based on keypad selection and the excess coins are lost. If the user inserts less coin/s than what is/are required, then the dispense LED does not glow hence no liquid will be dispensed and the coin/s will be lost.
6. The coin slot dimension is the same of the Indian 5 rupee coin (To prevent foreign currency and rupee coins of other dimensions).
7. The flow rate of soda from each tank is constant. If quantity of any of the drinks is not sufficient enough to fulfil the user's choice, the insufficient LED will glow and user can change the type or size of the drink.
8. When dispensing, 100ml is dispensed in 5 seconds, 200ml in 10 seconds and 300ml in 15 seconds taking constant flow rate into consideration.
9. The Ultrasonic Sensor (HCSR 04) is used to detect the quantity of soda left in each of the tanks and also has an inbuilt visible insufficiency LED to indicate refill requirement.

Flowchart



HARDWARE UTILISED

CHIP NUMBER	CHIP	USE
8086	Microprocessor	Central Processing Unit
8284 x 1	Clock Generator	Generates CLK for 8086 and 8253
6116 x 2	RAM – 2K	Random Access Memory
2716 x 4	ROM – 2K	Read Only Memory
8255 x 2	Programmable Peripheral Interface	Connections to various input and output devices (The six sensors and the LED as well as the buttons)
8259	Programmable Interrupt Controller	Generating Maskable Interrupts
IC 7404 x 1	NOT gate	Logical circuit
IC 7432 x 8	OR gate	Logical Circuit
74LS138 x 2	3:8 Decoder	For interfacing memory as well as I/O
74LS373 x 3	8-bit latch	Latching Address Buses
74LS245 x 2	8-bit buffer	Buffering Data Buses
ADC0808 x 1	Multi-channel 8-bit A/D converter	Digitalising values from HC-SR04 Ultrasound Level Sensor
8253 x 2	Programmable Interval Timer	Providing CLK for ADC & Timer for Relay
HC-SR04 x3	Ultrasonic Height sensor	To continuously monitor the quantity of Soda in respective tanks
MPX 4250 x1	Pressure Sensor	Checks whether the coin entered by user is a 5 rupee coin or not by detecting weight.

L293D x 3	Push-Pull 4 channel	Control Stepper Motor
Stepper-Motor x 3	Unipolar Stepper Motor	To dispense drink

The system includes 7 switches (3 for Drink Selection, 3 for Quantity Selection, 1 for Dispensing Drink) and 10 LEDs (7 for each switch, 3 for Drink Level Indication) and Resistors used.

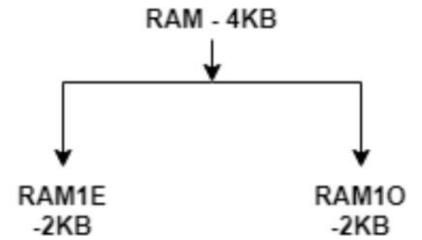
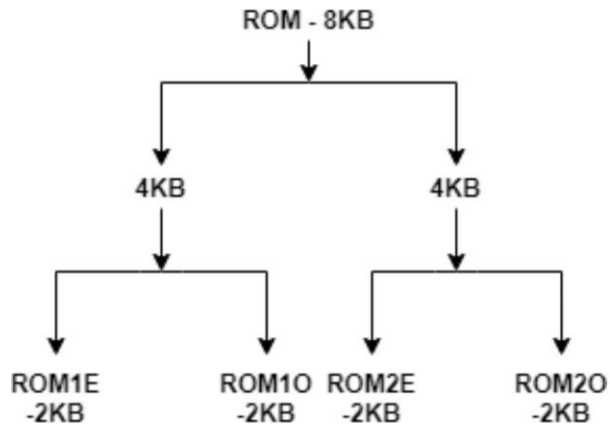
Memory Interfacing:

The 8086 based system uses 4KB of RAM and 8KB of ROM. Both consist of two chips of 2KB size each. They are organized into even and odd banks to facilitate both byte size and word size data transfers.

Number of memory chips required:

Size of 2716 ROM is 2KB. Size of 6116 RAM is 2KB.

Hence the number of 2716 required is 4. Hence the number of 6116 required is 2.



1. Random Access Memory 1:(4KB)

Starting address - 00000h

Ending address - 00FFFh

RAM 1E: 00000h, 00002h,,00FFEh

RAM 1O: 00001h, 00003h,,00FFFh

2. Read Only Memory 1:

Starting address - 08000h

Ending address – 08FFFh

ROM 1E: 08000h, 08002h,,08FFEh

ROM 1O: 08001h, 08003h,,08FFFh

3. Read Only Memory 2:

Starting address - 09000h

Ending address - 09FFFh

RAM 1E: 09000h, 09002h,,09FFEh

RAM 10: 09001h, 09003h,,09FFFh

RAM 1: 00000H – 00FFFH

[illegible]

ROM1: 08000h – 08FFFh

[illegible]

ROM2:

09000h – 09FFFh

[illegible]

I/O Interfacing (Using I/O Mapped I/O)

1st 8255

Port	Port Address	Mode	Input/Output	Connected to
A	00H	0	Input	Switches to select drink type & size (PA0-PA6) and dispense button
B	02H	0	Output	3 LED to indicate insufficient condition (PB0-PB2)
C Lower	04H	0	Output	LED for type of drink (PC0-PC2) and small drink (PC3)
C Upper	04H	0	Output	LED for Medium & Large Drink (PC4&5) and Dispense button (PC7)
Control Word	06H			

2ND 8255

Port	Port Address	Mode	Input/Output	Connected to
A	10H	0	Input	Digital input from ADC0808
B	12H	0	-	-
C Lower	14H	0	Output	PC0-PC2 to AD0-AD2 PC3 to OE' of ADC0808
C Upper	14H	0	Output	PC4 to SOC', PC5 TO ALE' of ADC0808
Control Word	16H			

8259

ADDRESS 0	30H
ADDRESS 1	32H

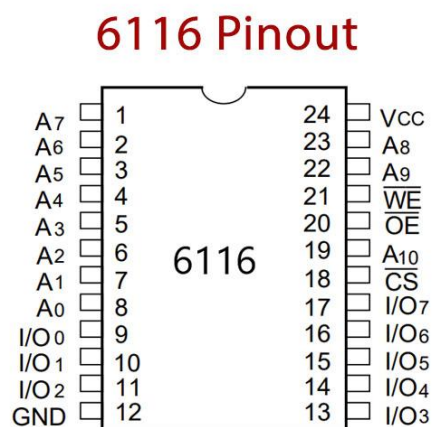
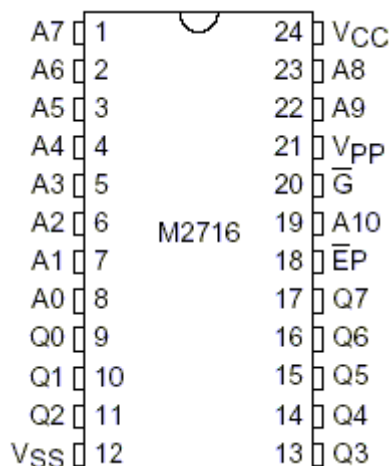
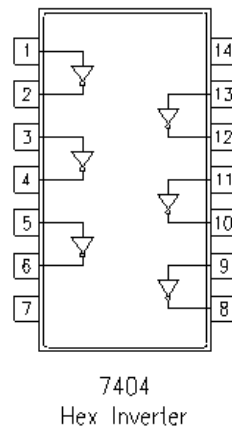
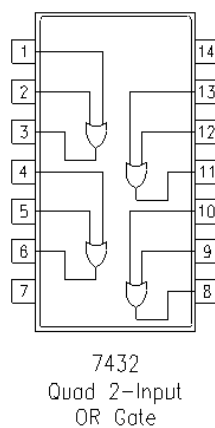
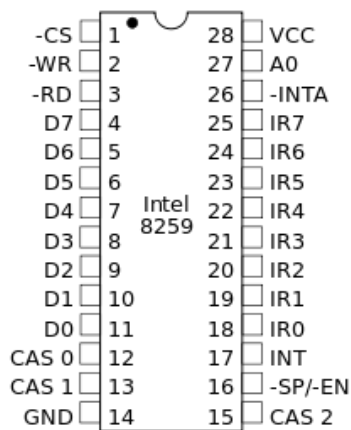
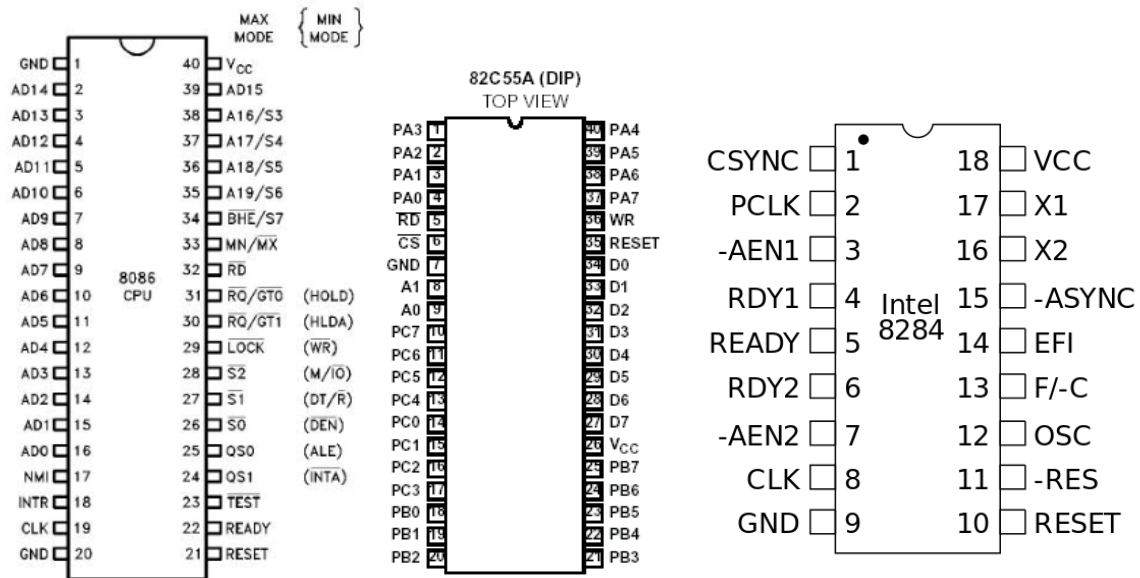
1st 8253

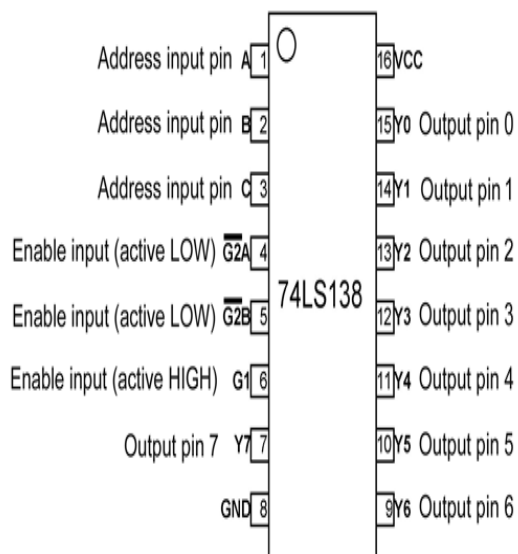
Counter	Counter Address	Mode	Gate	CLK	Output
Counter 0	20H	0	5V	N_CLK (10Hz)	Time for Relay for Motor 1
Counter 1	22H	0	5V	N_CLK (10Hz)	Time for Relay for Motor 2
Counter 2	24H	0	5V	N_CLK (10Hz)	Time for Relay for Motor 3
Control Word	26H				

2nd 8253

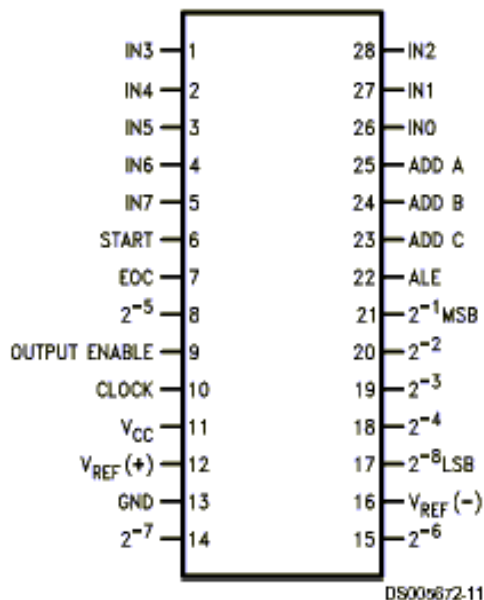
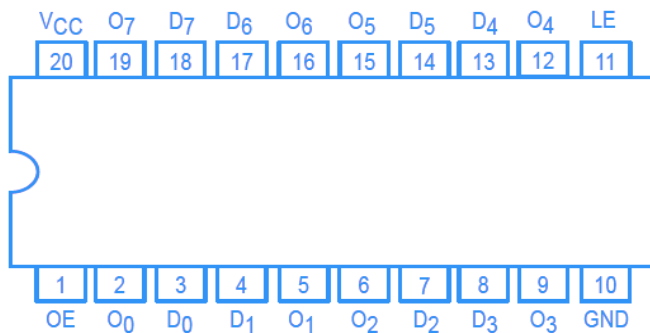
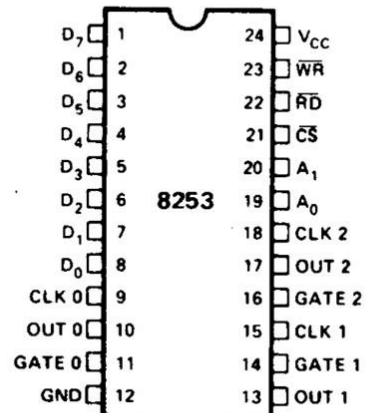
Counter	Counter Address	Mode	Gate	CLK	OUT
Counter 0	40H	3	5V	P_CLK (5MHz)	Input to ADC CLK
Counter 1	42H	0	5V	P_CLK (5MHz)	N_CLK (1 st 8253)
Counter 2	44H	0	Dispense Switch	P_CLK (5MHz)	Echo for Ultrasonic Sensor
Control Word	46H				

PIN CONFIGURATIONS





8253 Pinout



74LS245 Octal Tri-state Buffer

