

DESIGN ASSIGNMENT: MICROWAVE OVEN

In partial fulfillment of the course
MICROPROCESSOR PROGRAMMING AND INTERFACING



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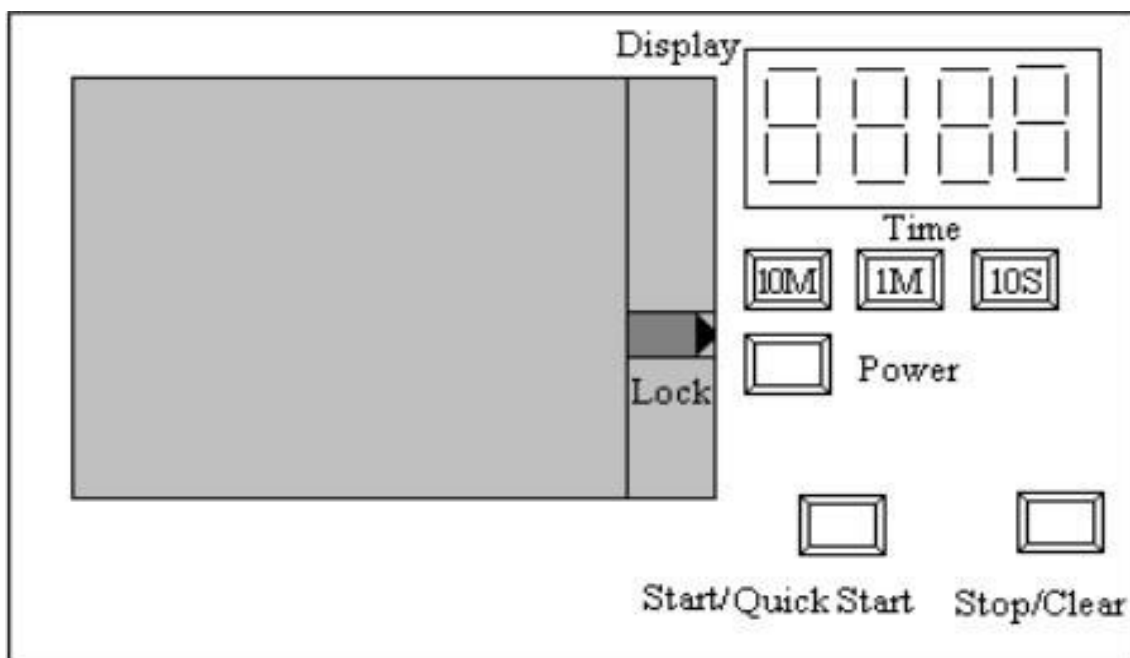
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1.PROBLEM STATEMENT

Description

A Simple Microwave Oven without grill. User Interface is shown in the following figure.



- User can cook at 5 different Power levels: 100%, 80%, 60%, 40 % 20%
- Every press of the Power Button decrements the power level by 20 %
- 1 Press - 100%; 2 Presses – 80% ; 3 Presses – 60%; 4 Presses – 40 %; 5 Presses – 20%
- 6 Presses – Brings the power level back to 100 %
- The Default power level is 100%
- Power Level is varied by controlling the amount of time for which the microwave is turned on.

- Time of cooking is broken up into 10-sec slots if power is 60% then for 6 secs the microwave is on and rest of the 4 secs the microwave is off.
- Time is set as multiples of 10 Mins, 1Min, 10 Secs. For e.g., if the cooking time is 12 Minutes and 40 secs- the 10 Minutes button has to be pressed once, 1 Minute Button has to be pressed Twice and 10 seconds button has to be pressed four times.
- Once Time has been set Power cannot be modified.
- When the user is setting power level or Time, the value being pressed should be displayed, and when the user presses the Start button, the cooking process begins and the time left for cooking to complete is displayed.
- Once the cooking begins the door gets locked and should open only when the cooking process is terminated.
- User can terminate cooking anytime by pressing the STOP button.
- When Stop button is pressed once cooking is aborted, the timer is stopped, not cleared; cooking can be resumed by pressing Start.
- When the stop button is pressed twice, cooking is aborted and the timer is also cleared.
- When cooking time elapses, a buzzer is sounded; pressing the Stop Button stops the buzzer.
- A Quick Start mode is available where timer or power need not be set, just Start button needs to be pressed, the default power value is taken and time is set as 30 secs, for every press of the start button time is incremented by 30 seconds.

2)ASSUMPTIONS MADE

·The user can only press one button at a time.

Max cooking weight allowed is 2.7kg.

·The user cannot change time or power during cooking (unless in Quick Start mode).

·The user cannot set the time without having set the power first

·User is expected to cook for a time less than 59:59.

Multiple presses of the start button are not allowed if the time and power are set

3)USER GUIDE

The Microwave can be used in two modes: Quick Start and Normal.

Ø In Normal mode of operation:

Set the Power at which the microwave is to be operated

Set the time of cooking

Press Start and wait until the cooking is done

Ø For the Quick Start mode of operation:

·For each press on the Press Start button the time is incremented by 30 seconds

·When you're done, wait until the cooking starts

In quick start mode the power is 100%

Ø Don't open the microwave while the cooking is being done. If you need to pause it in-between you should press the start button. Again, to resume cooking press the Start button.

Ø After you are done cooking, the microwave is automatically reset. If you wish to reset it midway press the stop button twice

4)LIST OF ICs/COMPONENTS USED

Chip Number	Number of chips	Name	Purpose
8086	1	Microprocessor	Central Processing Unit
8284	1	Clock Generator	Generates a clock pulse of 5MHz and 2.5MHz (peripheral clock)
8253	2	Programmable Interval Timer	To produce stable frequency clock signals using various modes.
8255	2	Programmable Peripheral Device	Interface between various I/O devices and the processor.
74LS373	3	8-bit Latch	To latch the address bus.
74LS245	2	8-bit Buffer	To buffer the data bus.
74LS138	1	3 to 8 Decoder	To generate chip select signals for I/O devices.
74LS244	1	3-state Octal Buffer	Used to generate control signals.
7432	6	OR Gate IC	Used to find the binary OR of 2 inputs
7447	4	BCD to seven segment decoder	Generates signals for a seven segment display when given a BCD value as input.

7 segment displays	4	LED Display	Used for the time and power displays on the microwave.
6116	2	RAM - 2k	Random Access Memory
2732	2	ROM - 2k	Read Only Memory
7404	3	NOT Gate IC	Used to invert the binary input

5)OTHER HARDWARE USED

Resistors : Used for controlling current in various parts of the system.

Buzzer : 12 Volt Piezo– Buzzer(ABI-007-RC)



All data at 25C unless otherwise specified

Specifications	ABI-007-RC Piezo Indicator
Rated Voltage	12V DC
Operating Voltage	3V to 16V DC
Rated Current at Rated Voltage	8mA
Sound output at 30cm, at rated voltage	$\geq 90\text{dB}$
Resonant frequency at rated voltage	$3700 \pm 500\text{Hz}$
Operating Temperature	-20 to $+60^{\circ}\text{C}$
Storage Temperature	-30 to $+80^{\circ}\text{C}$

PART NUMBER TABLE

Description	Part Number
Piezo Buzzer, 12V DC, PCB	ABI-007-RC

HEATING ELEMENT:Magnetron (2M229 Series)

Absolute maximum rating

	Minimum	Maximum	
Filament voltage (Note 1)	3.0	4.0	V
Cathode preheating time	0	-	sec
Peak anode voltage	-	4.2	kV
Average anode current	-	250	mAdc
Peak anode current	-	1.0	A
Anode input power	-	1.0	kW
Load VSWR(Note 2)	-	4	
Anode temperature(Note 3)	-	300	°C
Antenna seal temperature(Note 4)	-	320	°C
Capacitor temperature(Note 5)	-	120	°C
Storage temperature	-30	60	°C

Typical Operation

Power supply: Single phase full wave rectified without filter

Frequency	2460	MHz
Filament voltage	3.3	V
Peak anode voltage(Note 6)	4.0	kV
Average anode current	300	mAdc
Output power(matched load, Note 6)	850	W
Cooling air flow	800	l/min
Pressure drop(Approx)	80	Pa

6)MEMORY MAPPING

ROM : 00000H - 00FFFH

ROM	A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0
	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

RAM: 01000-01FFF

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

ROM: FF000H - FFFFFH

ROM (even)	A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0
From 00000h	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
To 00FFEh	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

7)I/O MAPPING

8253: 10_H-16_H

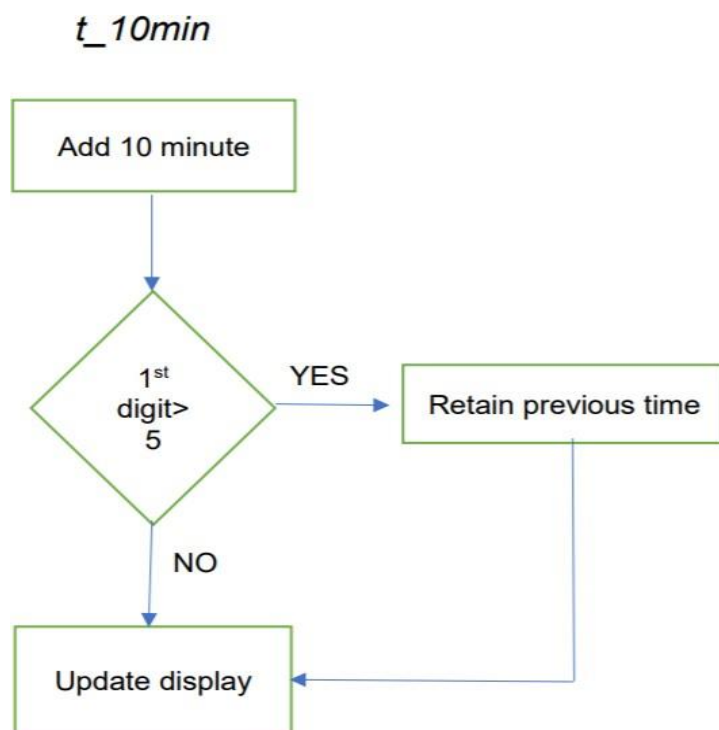
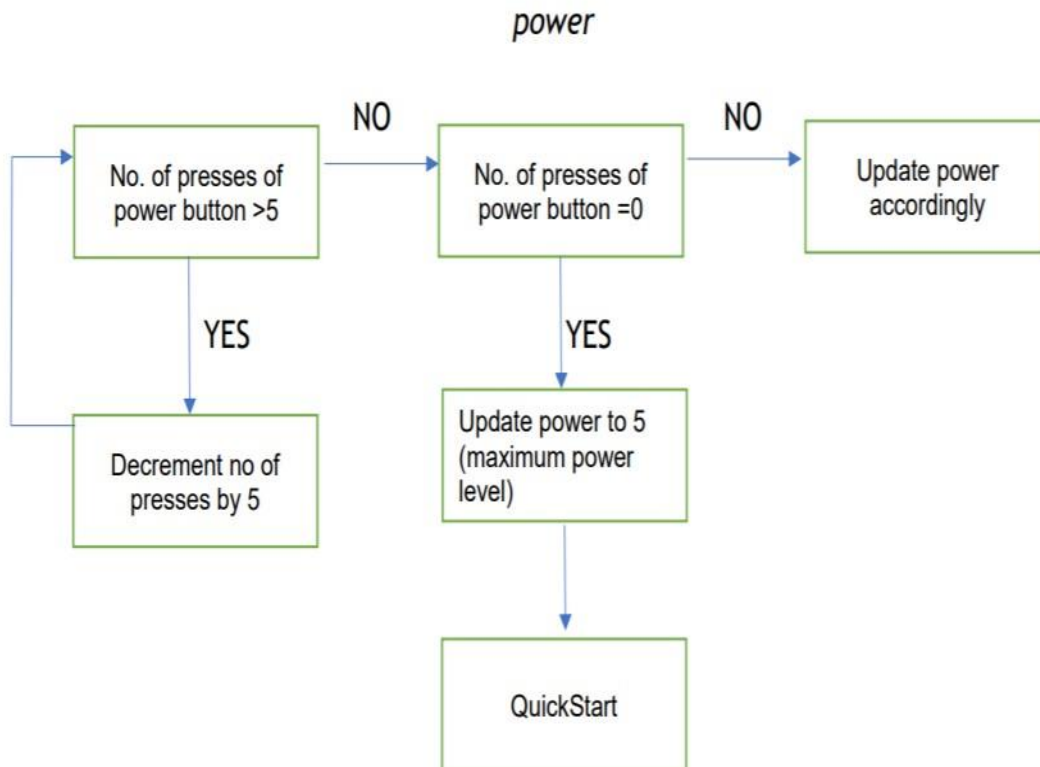
8259: 18_H -1A_H

8255: 20_H-26_H

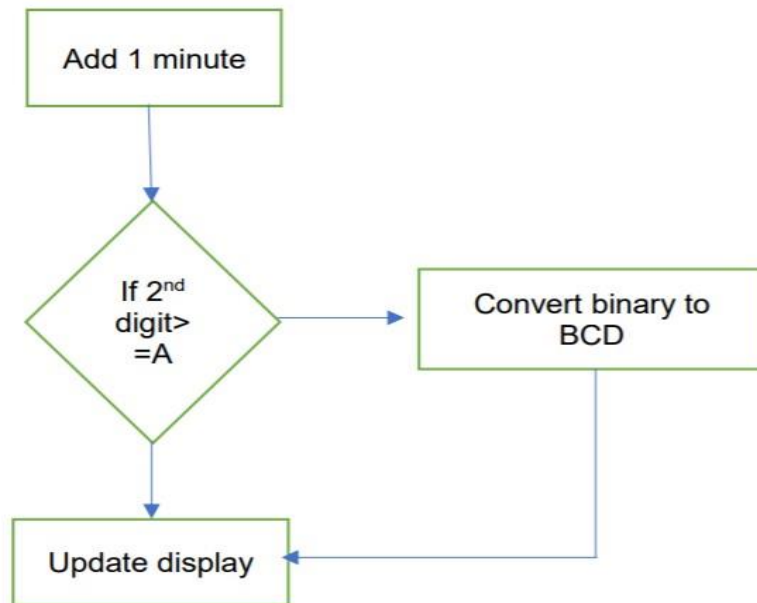
8) INTERRUPT VECTOR TABLE

Vector No	Associated with
40h	10 min button
41h	1 min button
42h	10 sec button
43h	Start
44h	Power
45h	Stop
46h	Timer 1 sec

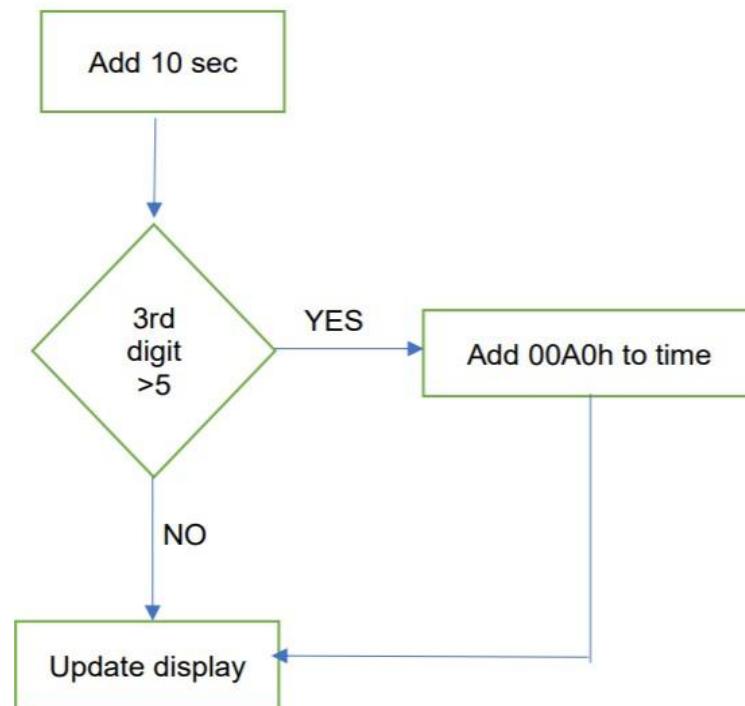
9)FLOWCHARTS



t_{1min}

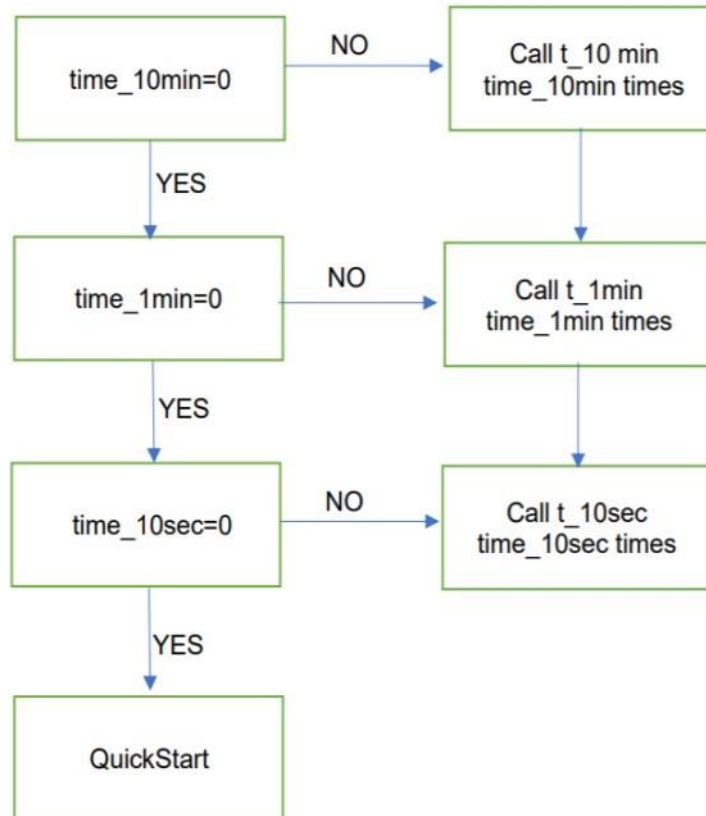


t_{10sec}

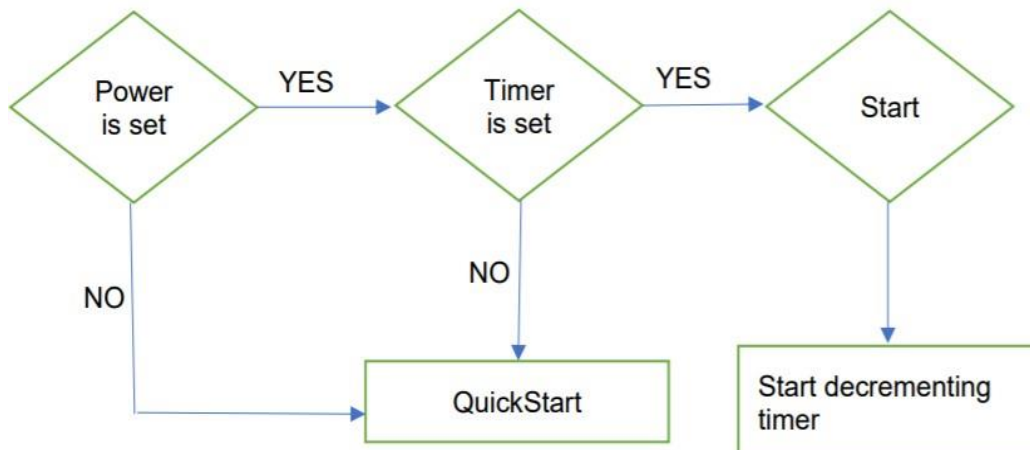


time

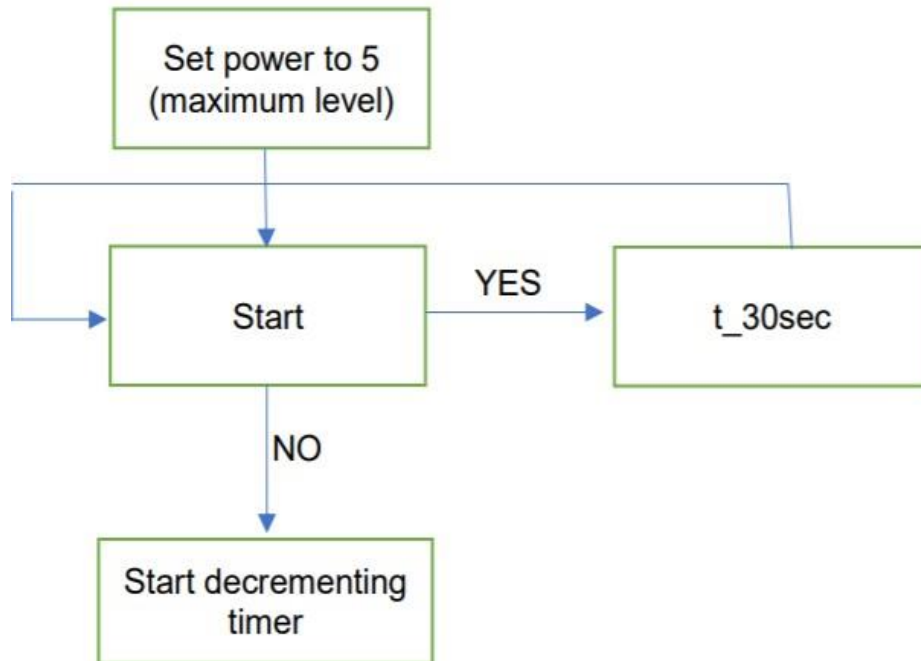
time_10min: No. of presses of 10 min button
time_1min: No. of presses of 1 min button
time_10sec: No. of presses of 10 sec button



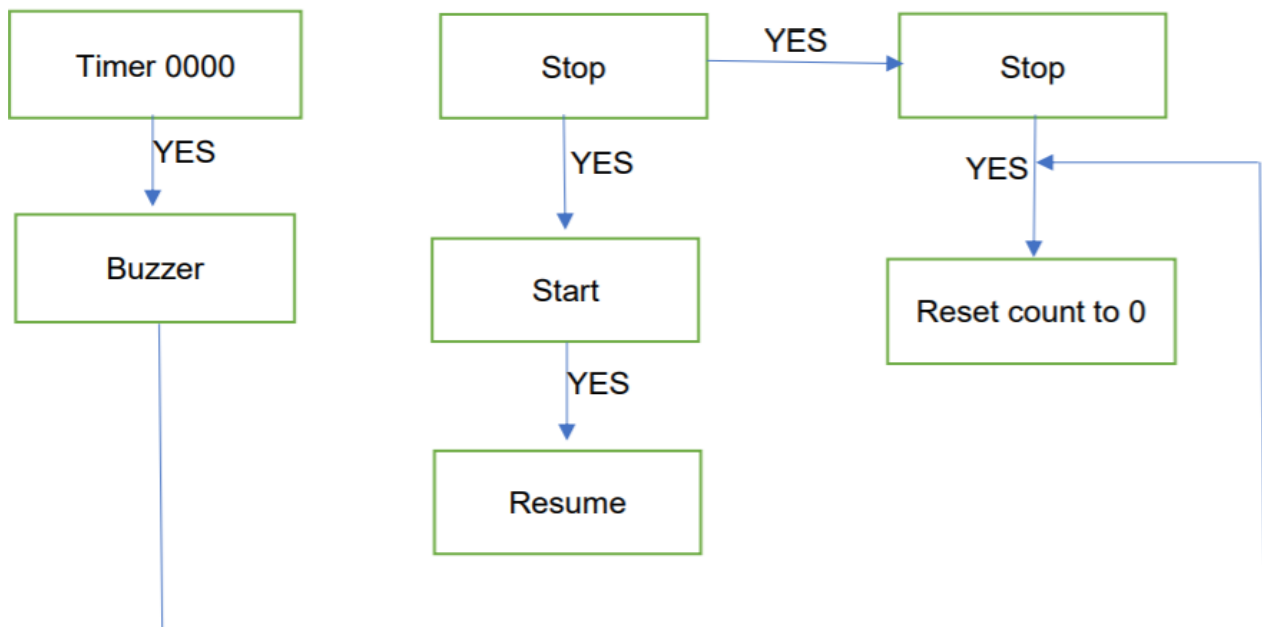
start



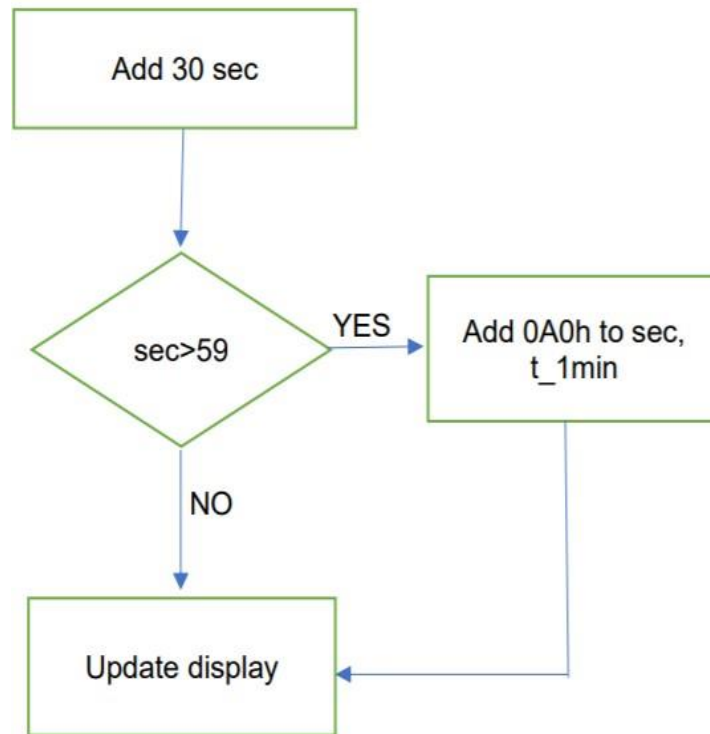
QuickStart



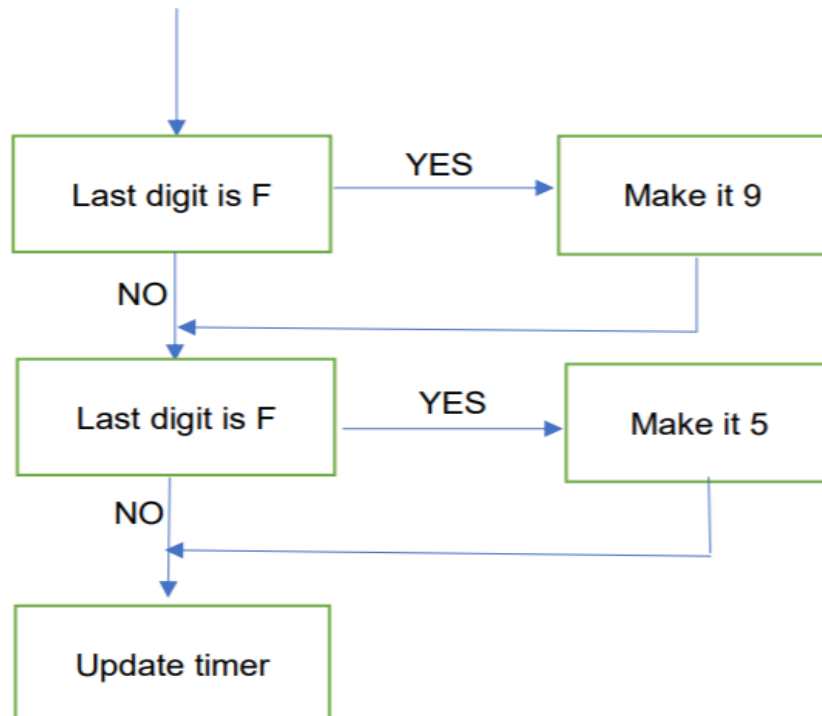
Stop



t_30sec



Decrement timer



10)LIST OF ATTACHMENTS

- 1.Complete Hardware Real World Design – example.pdf
- 2.Manuals
 - ADC 0808
 - ATS 2000A
- 3.Proteus File – adc.dsn
- 4.EMU8086 ASM File – adc.asm
- 5.Binary File after assembly – adc.bin