STERILIZATION UNIT

Submitted by Group 95

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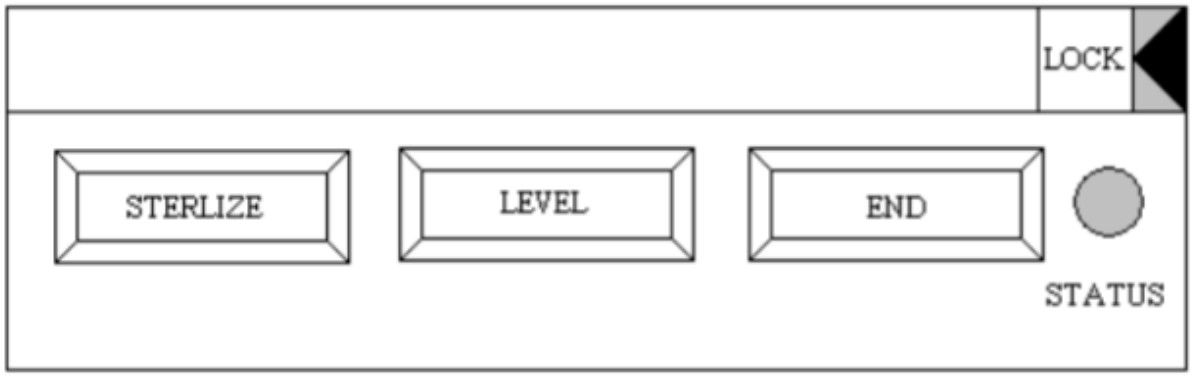
User Requirements

Description: This unit performs sterilization by increasing temperature to maximum value (X°C). The temperature has to be maintained at the maximum value for 2 minutes before it is brought gradually to a nominal temperature value (Y°C). The time taken for bringing down the temperature can be varied between four different values used as decided by the user. A Push Button switch (Level) is available for this purpose. The number of times the key is pressed decides the speed at which then temperature should be brought down.

1 press – 3 Mins
2 presses – 5 Mins
3 presses – 7 Mins
4 presses – 10 Mins



Technical Specifications

While the sterilization process is taking place the door to the unit must remain locked. The door can be opened only when user presses END

User interface: Status LED glows as long as the sterilization process is being done. Once 30^{O}C has been reached then the LED goes off and the door mechanism unlocks. Once the door is closed again the temperature has to be brought back to 30^{O}C

Assumptions and Justifications

The following assumptions have been made with respect to the system design:

- Key debounce is 20ms
- The maximum number of presses the user can do is 4. If it exceeds beyond it then it is considered as 4
- The door closing is manually operated by the user and the status of the door is indicated by a door led which takes input from the ir sensor. The servo motors can open the door after the process is over
- User cannot press end until the sterilization is over as it would interfere with the cooling rate
- The ambient temperature is considered to be 30°C(X°C)
- The nominal temperature value(Y°C) is considered to be 120°C as the sterilization process has to be maintained at this temperature for a minimal time to kill the microorganisms
- The door is only unlocked after the sterilization process is over when the user presses End button.
- Default value of the key is taken as Level 1 (3 min)
- The heat chamber used is perfectly insulated and there is no heat loss when the User maintains the temperature of 120°C for 2 minutes
- The chamber temperature can go below 30°C when the door is unlocked hence it will be brought back to 30°C when it opens
- The motor for the cooler fan and the door requires an external voltage of 12V
- The Pulse Width Modulations (PWMs) are used for controlling the cooler fan
    1. Level 1: 80% duty cycle for cooling from Y°C to X°C in 3 min
    2. Level 2: 60% duty cycle for cooling from Y°C to X°C in 5 min
    3. Level 3: 40% duty cycle for cooling from Y°C to X°C in 7 min
    4. Level 4: 10% duty cycle for cooling from Y°C to X°C in 10 min
- The cooler fan will cool the unit within the exact rate mentioned
- The microprocessor and its other peripheral devices get exactly 5V as high
- Only one temperature sensor will be needed (because the sterilisation chamber is not that big) and it would be kept a distance away from the heater to ensure that only the temperature of the sterilisation unit is recorded and so that it gets heated to at least 120°C

Components Used

Chip No.	Qty	Function
Microprocessor (8086)	1	Central Processing Unit
Programmable Peripheral Interface (8255)	1	Connected to various I/O device
Programmable Interval Timer (8253)	2	Perform timing and counting function and generate PWM
Priority Interrupt Controller (8259)	1	To generate the interrupt after the specific time interval
Clock Generator (8284)	1	Generate clock of frequencies 5 and 2.5 MHz
2K ROM (2716)	4	Read Only Memory
2K RAM (6116)	2	Random Access memory
Analog-Digital Converter (ADC0802)	1	Converts analog signal to digital
Octal latch (74LS373)	3	Latch the address bus
Bidirectional buffer (74LS245)	2	Buffer data bus
3:8 Decoder (74LS138)	2	Choosing from multiple I/O
Push Buttons	3	For selecting the steriise, end and level
LEDs	2	Represent the status and whether door is locked
Temperature Sensor (LM35)	1	To detect the temperature in the unit
Solid state relay (Omron G3MB)	1	For turning ON/OFF the heater
AND IC(7408)	1	Bitwise AND
NOT IC(74LS04)	2	Logical inversion
Centrifugal Fan (RS Pro DC ODB5115-12MB)	1	For cooling the container
Heatrex Quartzone Infrared Heater 1154	1	For heating the container
12V Servo Motor	1	For the Door Closing and Opening Mechanism

Address Mapping

Memory:

ROM1: 00000H – 00FFFH
RAM 1: 01000H – 01FFFH
ROM2: FF000H – FFFFFH

I/O:

8255

PORT A	00h
PORT B	02h
PORT C	04h
Control Register	06h

First 8253 (8253A)

COUNTER 0	08h
COUNTER 1	0Ah
COUNTER 2	0Ch
Control Register	0Eh

Second 8253 (8253B)

COUNTER 0	20h
COUNTER 1	22h
COUNTER 2	24h
Control Register	26h

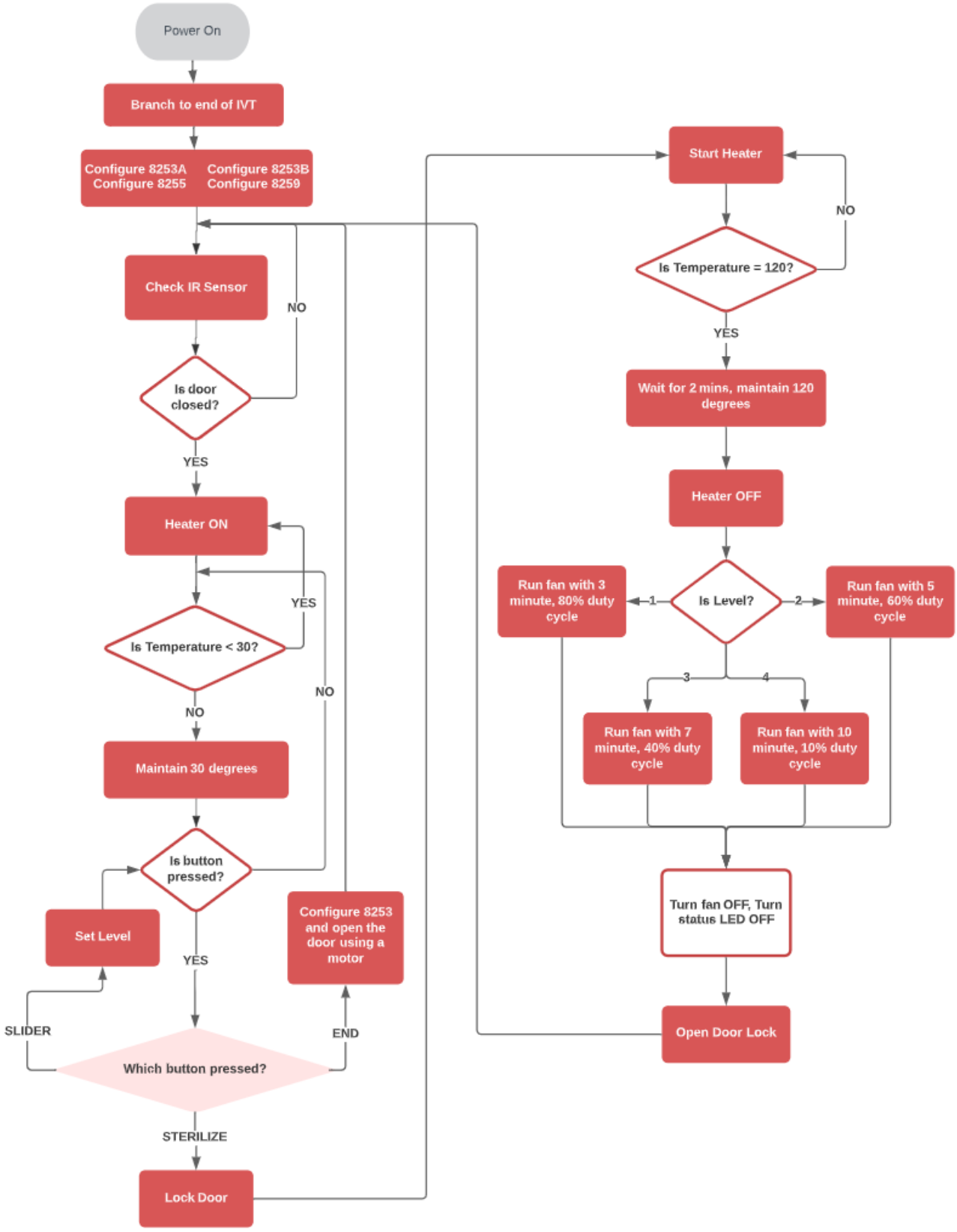
8259:

8259	10h,12h

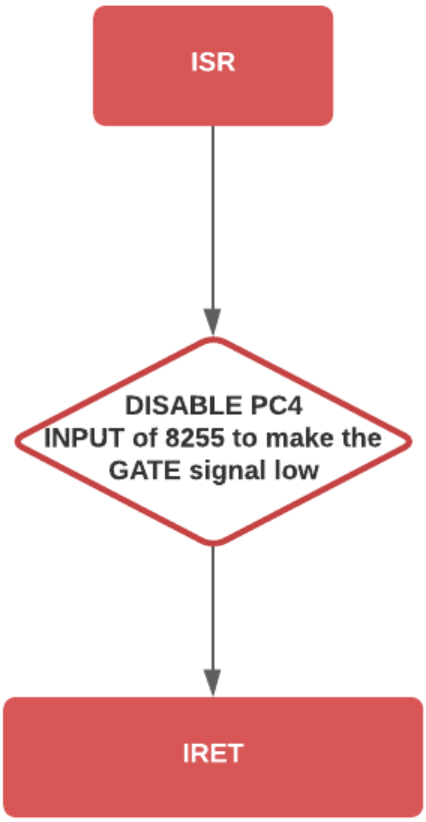
Design

A document with the complete hardware design has been attached with this report.

Main Program Flowchart



ISR Flowchart



Variations in Proteus Implementation with Justification

- ROM is in 00000 as proteus allows us the change the reset address
- 2732 used instead of 2716 in proteus as it wasnt available in proteus
- Proteus wasn't able to simulate the number of presses in real time so we decided to use toggle switches for it
- Instead of the LM35 sensor we are using the temperature sensor of the oven itself.
- Instead of the heater a default oven provided by proteus is used
- Instead of stimulating a door we toggle a switch to show that the door is open or closed
- We are not using 8253A instead we are providing a clock of 10kHz to the ADC and CLK1 of 8253B and providing a clock of 1kHz and 100Hz to the gate 1 and CLK0 of 8253B to not put excessive CPU load on the software.
- 8259 has been placed on the proteus design but its functionality is limited.

Firmware

The implementation of the design has been attached as an EMU8086 .asm file along with the compiled .bin file.

List of Attachments

The following has been attached with this document packaged as G95.zip:

1. Hardware design document (G95HW.pdf)
2. Proteus File (G95design.dsn)
3. EMU8086 ASM file (G95code.asm)
4. Binary File after assembly (G95code.bin)
5. Manuals for
    1. 8086
    2. 8284
    3. 8253
    4. 8255
    5. 2716 ROM
    6. 6116 RAM
    7. Quartzone_heater
    8. DC radial blower
    9. LM57 sensor