A Report On
A Microprocessor Based: Fan Speed Sensing and Control
Hardware Design and ALP

Done In Partial Fulfillment Of the Course

Microprocessor Programming and Interfacing
CS-F241

Members:

VITTHAL BHANDARI - 2017A7PS0136P

PRAKALP TIWARI - 2017A7PS0137P

SHEFALI TRIPATHI - 2017A7PS0139P

KESHAV SHARMA - 2017A7PS0140P

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE-PILANI

Problem statement:

System to be designed- Fan Speed Sensing and Control

Description: This system senses the speed at which the fan is rotating and adjusts the speed, based on the user input. The user can select three different speeds of the fan. The current speed should be sensed and the control mechanism should gradually increase the speed to the desired speed.

User Interface:

1. The fan starts when the user presses the ‘Start’ button.

2. User can then set the required speed by using a keypad interface. This speed value should be displayed on the display.

3. After setting speed initially, the user should be able to change the fan speed setting by an up and down switch. Each press on this arrow button increases/ decreases the speed by 1 unit. Min speed value is 1, whereas the maximum speed value is 5 Units. Pressing ‘UP’ button after reaching to value 5, should not change the display value or setting of fan speed. Same is true for the lower bound.

4. The fan can be stopped by pressing the ‘Stop’ button.

5. User can also set the mode of the fan as ‘Auto’ mode besides a ‘Regular mode’ setting.

In Auto mode, the user should be able to enter the value of time in terms of hours after which the Fan has to be switched off automatically. (For example, if the value entered is 2, then the Fan should switch off after 2 hours from the time this setting is applied).

LIST OF HARDWARE USED:

COMPONENTS	QUANTITY
8086 MICROPROCESSOR	1
OCTAL LATCH 74LS373	3
OCTAL BUS TRANSCEIVER	2
3:8 LINE DECODER 74LS138	1
ROM 2732	2
RAM 6116	2
74LS04 NOT GATE	3
74LS32 OR GATE	6
8255(PROGRAMABLE PERIPHERAL INTERFACING DEVICE)	2
LED 7 SEGMENT DISPLAY	2
D/A CONVERTER DSE_8	1
PUSH BUTTONS	16
DC FAN	1
SWITCH SINGLE POLE DOUBLE THROW	1
DC VOLTAGE SOURCES(5V)	4

MEMORY MAPS:

ROM-2732(4KB)

ROM1 (Even): 00000H - 01FFEH

Starting Address:

A_{19}	A_{18}	A_{17}	A_{16}	A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9	A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Ending Address:

A_{19}	A_{18}	A_{17}	A_{16}	A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9	A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0
0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0

ROM2 (Odd): 00001H - 01FFFH

Starting Address:

A_{19}	A_{18}	A_{17}	A_{16}	A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9	A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Ending Address:

A_{19}	A_{18}	A_{17}	A_{16}	A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9	A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0
0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1

RAM-6116(2KB)

RAM1 (Even): 02000H-02FFEH

Starting Address:

A_{19}	A_{18}	A_{17}	A_{16}	A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9	A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Ending Address:

A_{19}	A_{18}	A_{17}	A_{16}	A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9	A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0
0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0

RAM2 (Odd): 02001H - 02FFFH

Starting Address:

A_{19}	A_{18}	A_{17}	A_{16}	A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9	A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1

Ending Address:

A_{19}	A_{18}	A_{17}	A_{16}	A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9	A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0
0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1

INPUT OUTPUT PORT ADDRESS:

FIRST 8255A PORT:

PORTA:	00H
PORTB:	02H
PORTC:	04H
CONTROL REGISTER:	06H

SECOND 8255A PORT:

PORTA:	08H
PORTB:	0AH
PORTC:	0CH
CONTROL REGISTER:	0EH

IMPLEMENTATION PROCEDURE:

1. A hex-keypad has been created to control the buttons of the fan speed and the increase and decrease speed functions of the regulator are implemented as switches.

2. All the buttons, the buttons which assign the value of the speed as well as those which control the speed increment and decrement are integrated within this hex keypad.

3. The operation can be divided into the following parts:-

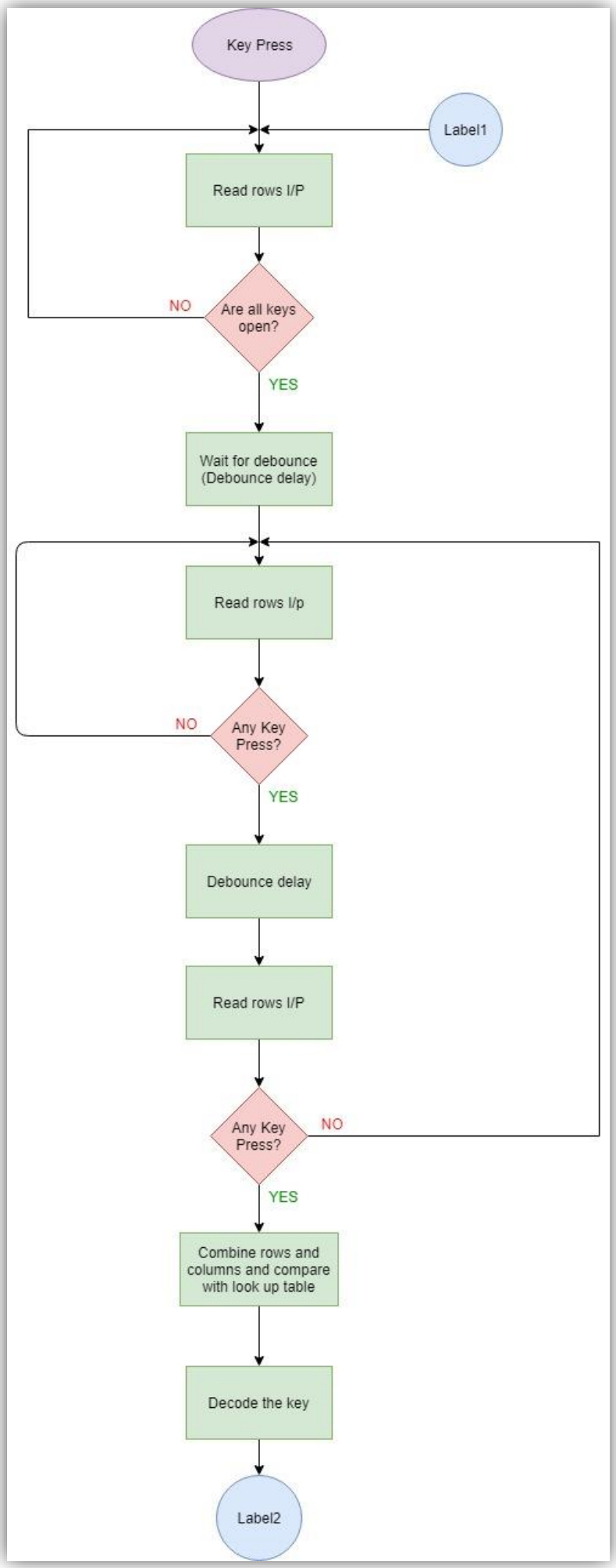
   i. By pressing the START and STOP buttons, the user can control the switching ON and OFF of the fan.

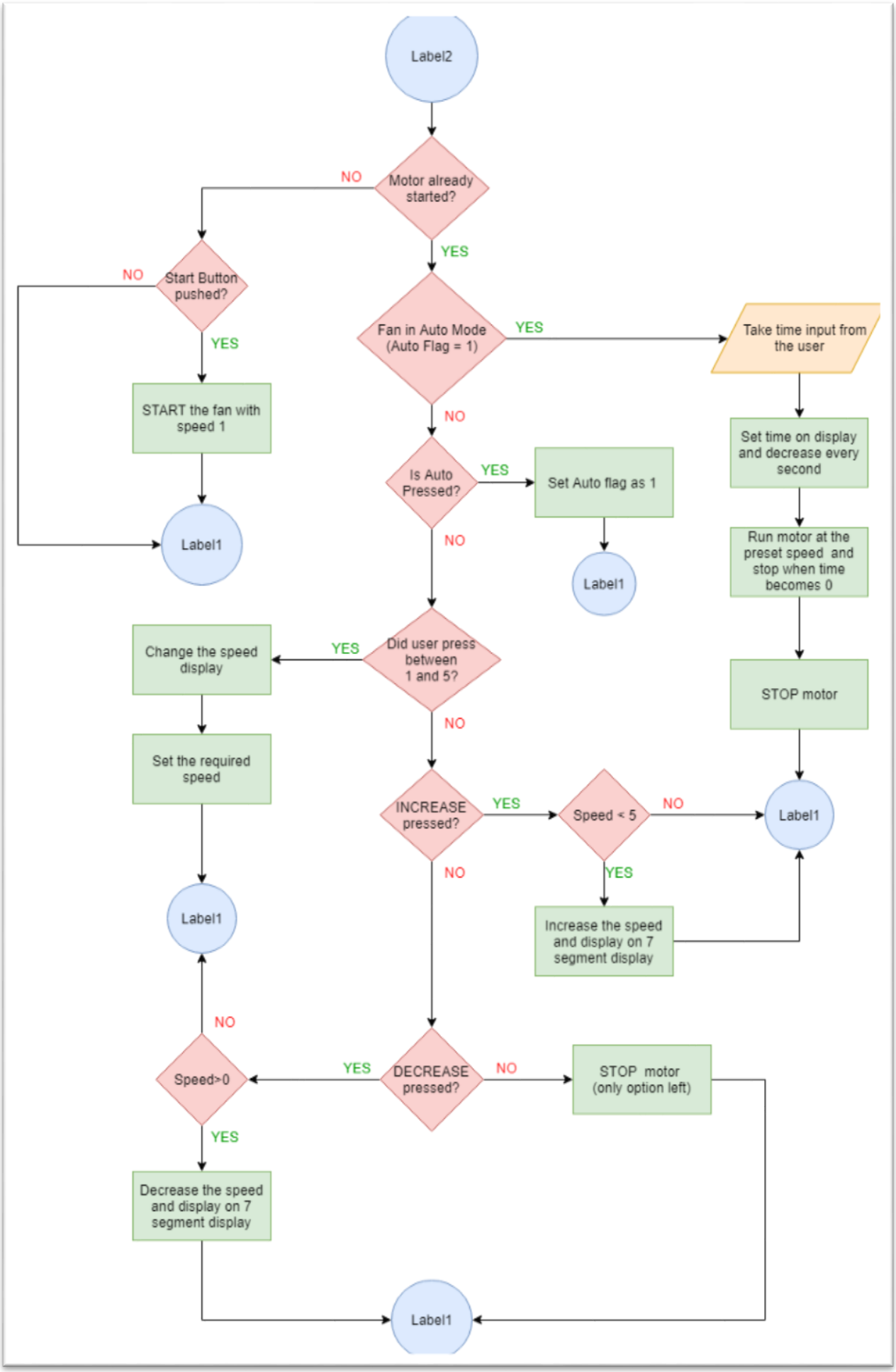
   ii. User can directly input the values of the speed which he wants as long as the user inputs between 1 and 5, and this speed is displayed onto the 7 segment display (Red).

   iii. The user can also control the speed of the fan by the INCREASE or DECREASE buttons which INCREASE or DECREASE the speed of the fan by 1 unit respectively. The user can't increase the speed beyond 5 and reduce the speed below 1.

   iv. The fan can also work in the AUTO mode where the user first sets the speed in which he wants the fan to rotate and then presses the AUTO button. After that, he presses a number ranging from 0 to 10(A) on the hex keypad which denotes the number of seconds after which the fan will stop and this number is displayed on the 7 segment display (Green). This number decreases after every hour denoting the time lapse and the fan stops once 0 is displayed.

FLOWCHARTS:


Key Press
Label1
Read rows I/P
NO
Are all keys open?
YES
Wait for debounce (Debounce delay)
Read rows I/p
NO
Any Key Press?
YES
Debounce delay
Read rows I/P
Any Key Press?
NO
YES
Combine rows and columns and compare with look up table
Decode the key
Label2


Label2
Motor already started?
NO
YES
Start Button pushed?
NO
YES
START the fan with speed 1
Label1
Fan in Auto Mode (Auto Flag = 1)
YES
Take time input from the user
NO
Is Auto Pressed?
YES
Set Auto flag as 1
Label1
Set time on display and decrease every second
Run motor at the preset speed and stop when time becomes 0
STOP motor
NO
Did user press between 1 and 5?
YES
Change the speed display
Set the required speed
Label1
NO
INCREASE pressed?
YES
Speed < 5
NO
Label1
YES
Increase the speed and display on 7 segment display
NO
DECREASE pressed?
YES
Speed>0
NO
YES
Decrease the speed and display on 7 segment display
NO
STOP motor (only option left)
Label1

ASSUMPTIONS:

1. The user can start the fan by only pressing the START button and can stop only using the STOP button.
2. The fan starts at the speed 1 on pressing the start button.
3. At a time the user can only press one of the keys.
4. The user can vary the speed only between 1 and 5.
5. Auto mode allows the user to enter a number between 0 and 10 both inclusive.
6. The time set by the user is scaled down from hours to seconds.
7. The user should first set the speed and then go to the Auto mode.
8. All the VCC and MIN/MAX' are connected to +5 V and the GND is connected to 0 V.
9. Once the user has set the time in AUTO mode, he can't change the speed of the fan or switch off the fan.