EMERTXE TRAINING PROJECT DOCUMENTATION FRAMEWORK

REQUIREMENTS & DESIGN DOCUMENT

Module – Microcontroller

Digital Timer

Contents

1 Abstract

Alarms and Timers are used in any Embedded systems to trigger event in the system for a specific amount of time. Along with showing time it includes a preset timer to remember and trigger an event when the timer expires by generating an alarm. Alarms can be configured for different time intervals say daily or weekly which can trigger different set of actions. The actions can range from blowing a buzzer or switching on a light. The sound of an alarm can be stopped by pressing the button or automatically stop by producing a beep sound in particular time duration.

They are very important for use in industrial control logic circuits. Time Delay Relays have various applications including flashing light control (time on, time off), engine auto-start control, furnace safety purge control, motor soft-start delay control, conveyor belt sequence delay, etc.

As mentioned above the digital timer need to be configured with time and appropriate alerts to be executed. In order to trigger alerts, it may need a different set of protocols thereby this project can be extended to an IoT solution by using internet scale protocols like HTTP or MQTT. The idea of this project is to implement the digital timer by using a Micro Controller (PIC in our case) by using various interfaces like LCD and Keypad. Detailed requirements are given below.

2 Requirements

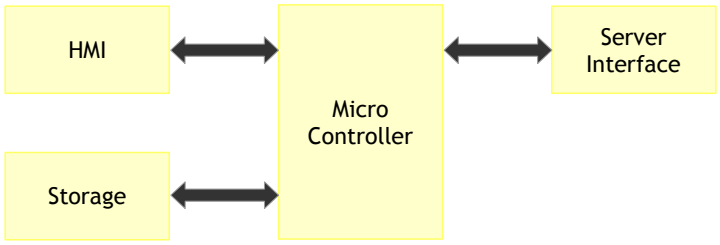
- Default Screen
  - It should display the time and date with the next expected alarm event.
- Config Screen
  - On press of the UP or DOWN (User Keys) keys the system should enter to Config Mode
  - Idle screen for more than 5 secs should switch to default screen
- Config Mode
  - This should contain 2 option
    - Set Time & Date
    - Set / View Alarms
  - The UP / DOWN keys are used to navigate
  - A long press of UP Key should enter the selected menu
  - A long press of DOWN Key should logout
- Set Time & Date
  - Should show the current time and date. The Secs field should blink indicating the field to be changed
  - The UP key should be used to increment the time. Rollover on reaching max
  - The DOWN key will be used to choose the field in a circular manner.
  - A long press of UP Key should take you back to main menu
- Set / View Alarms
  - Should show all available alarms
  - The UP / DOWN keys are used to navigate
  - A long press of UP Key should enter the highlighted Alarm
  - Should be able to edit and delete the alarm

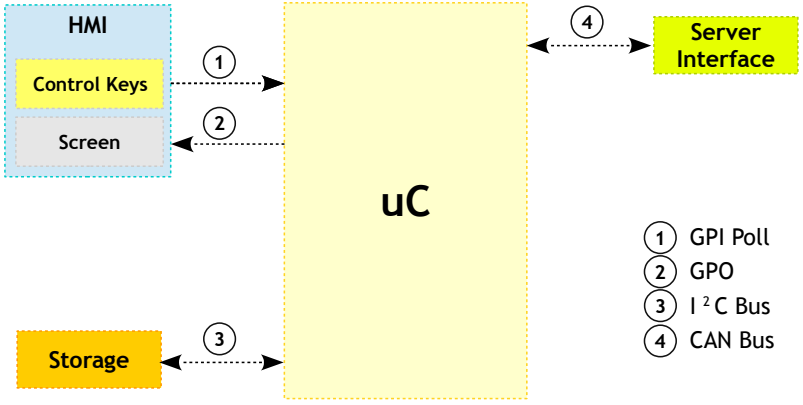
3 Prerequisites

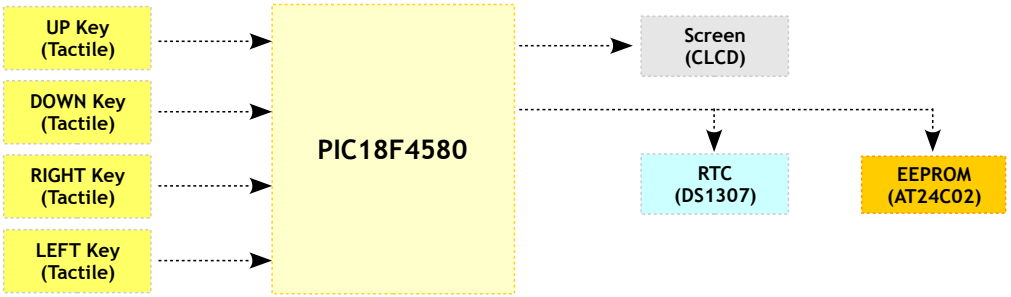
- Embedded C programming
- I2C protocols

4 Design

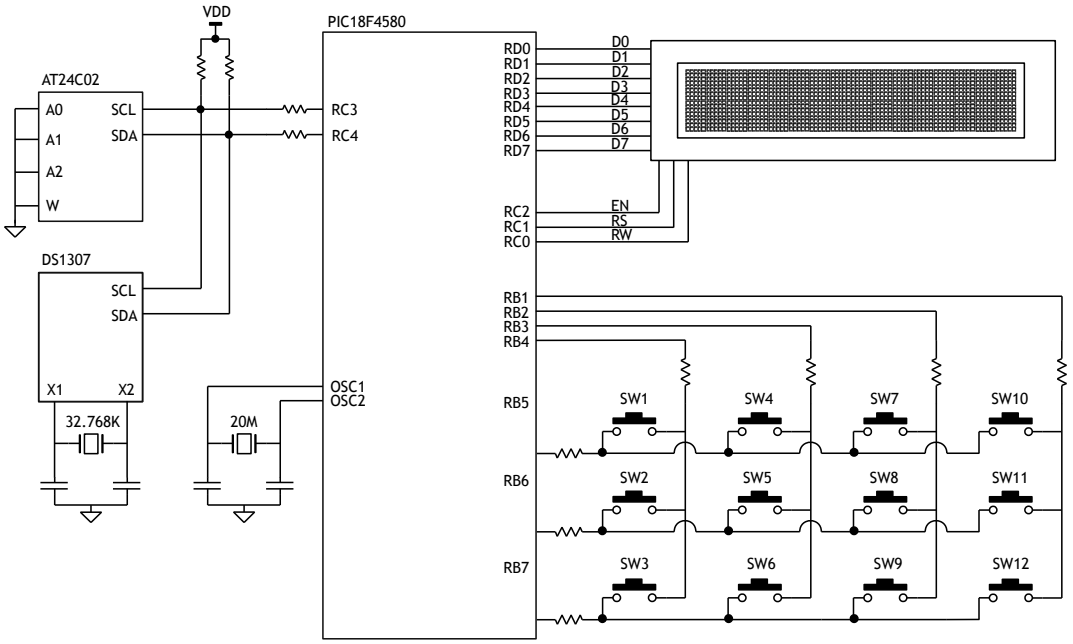
- Block Diagrams







- Schematic


VDD
PIC18F4580
AT24C02
A0
A1
A2
W
SCL
SDA
RC3
RC4
DS1307
SCL
SDA
X1
X2
32.768K
20M
OSC1
OSC2
RD0
RD1
RD2
RD3
RD4
RD5
RD6
RD7
D0
D1
D2
D3
D4
D5
D6
D7
RC2
RC1
RC0
EN
RS
RW
RB1
RB2
RB3
RB4
RB5
RB6
RB7
SW1
SW4
SW7
SW10
SW2
SW5
SW8
SW11
SW3
SW6
SW9
SW12

5 Sample Output

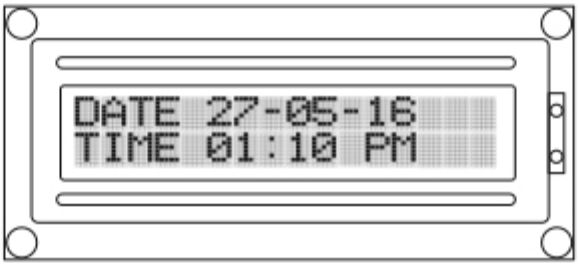


Fig 5 1: Default Screen

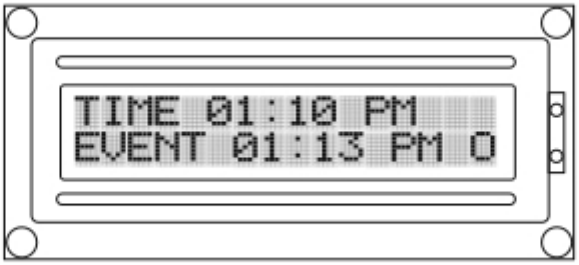


Fig 5 2: Default Screen. The next event should be shown every 5 secs for 2 secs. Observe 'O' for trigger once

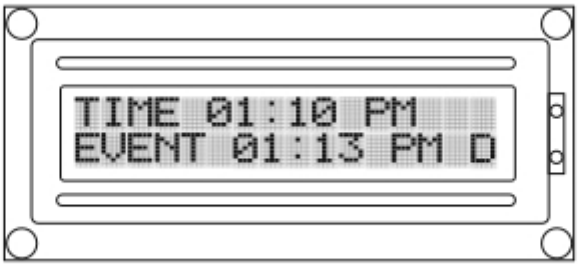


Fig 5 3: Default Screen. The next event should be shown every 5 secs for 2 secs. Observe 'D' for trigger Daily

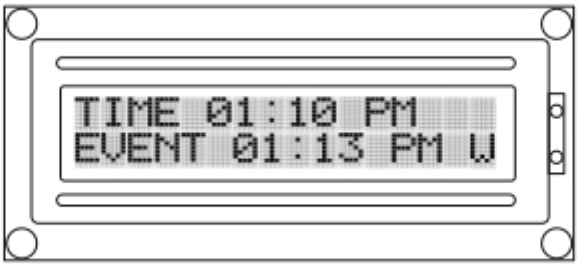


Fig 5 4: Default Screen. The next event should be shown every 5 secs for 2 secs. Observe 'W' for trigger Weekly

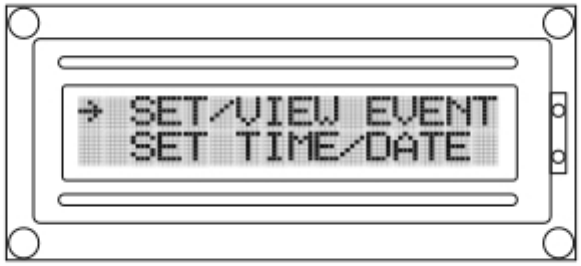


Fig 5 5: Config Screen. You get this screen by pressing either UP or Down Key. If left Idle for 5 Secs, Should go back to Default Screen. Long press of UP should provide the next screen

Fig 5 6: Config Set / View Event Screen. Long press of UP key should provide the next screen. Long press of DOWN key should go back to previous screen

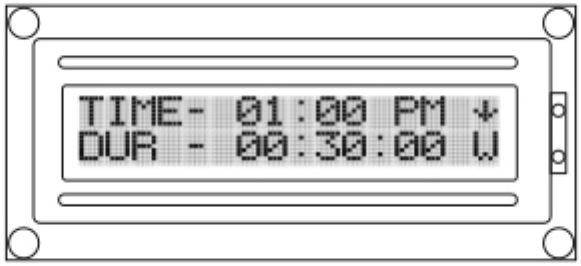


Fig 5 7: Config Set Event Screen. By default the Hours field of time should blink at the rate of 1Hz, use the Left and Right keys to move to different fields

Fig 5 8: Config Set / View Event Screen. Long press of UP key should provide the next screen. Long press of DOWN key should go back to Config Screen

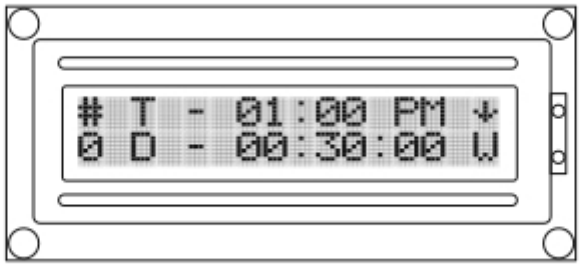


Fig 5 10: Config View Event Screen. Should show all the set events one by one. Use Up or Down Key to navigate, Left key to delete the event, Long press of Right Key should take you to previous screen

Fig 5 9: Config Screen. You get this screen by pressing either UP or Down Key from Default screen. If left Idle for 5 Secs, Should go back to Default Screen. Long press of UP should provide the next screen

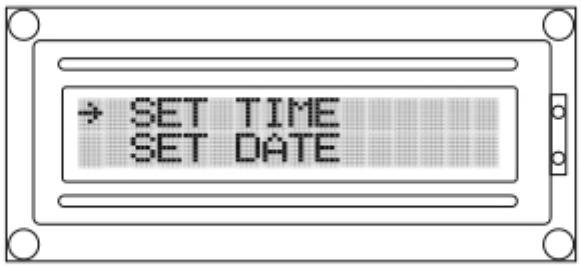


Fig 5 11: Config Time and Date Screen. Long press of UP key should take you to the next screen. Long press of Down Key should take to the previous screen

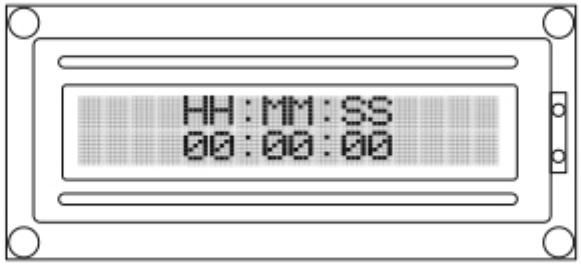


Fig 5 12: Config Set Time Screen. By default the hours field blinks at the rate of 1 Hz

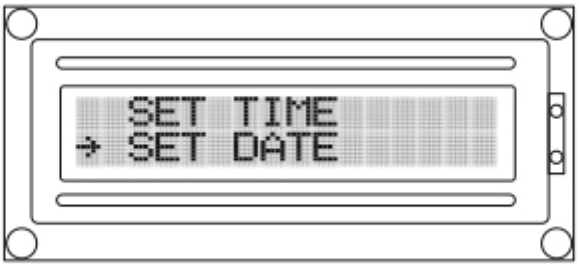


Fig 5 13: Config Time and Date Screen. Long press of UP key should take you to the next screen. Long press of Down Key should take to the Config Screen

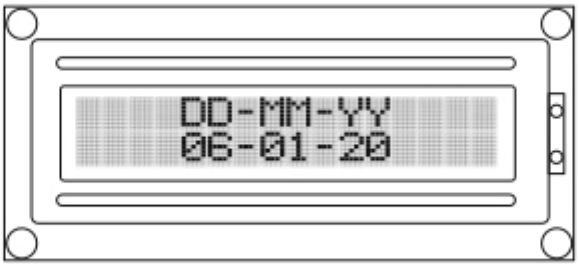


Fig 5 14: Config Set Date Screen. By default the day field blinks at the rate of 1 Hz

6 Artifacts

6.1 Skeleton Code

The skeleton code is a very interesting concept used in Emertxe. By looking into the skeleton code, you will get a clear picture into converting the given requirement into a working solution. This will also take care of important aspects like modularity, clean coding practices, re-usability etc.

- TBD

6.2 References

- Example Product: https://www.gicindia.com/process-control/timers/