Microwave Project Design Documentation

Revision: A

Date: 02.26.2020

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1 – Introduction

This project was developed as part of the process to apply for an internship @ Swiftact and in case of acceptance this project and all of it's documentation will be considered an intellectual property of Swifact company , otherwise the author have full control .

I designed this project as a showcase of my skill in embedded C development , having that in mind you may find overhead or unneeded solutions, however a microwave is considered a safety critical application and the design is based on layered software architecture :

Important Note: Please refer to each specific file description for code documentation.

1. Micro Controller Abstraction Layer (MCAL)
    provides functionality for Pic18F452 digital input/output ports (DIO) , Timer0 module & interrupts ,typically the microcontroller can not be accessed beyond the scope of the MCAL and the layer was designed so it can accommodate another family of pic or redesigned for another MC by only changing function names and file headers.

2. Hardware Abstraction Layer (HAL)
    Designed specifically for application ease of functionality & configured for PicGenios board , However it can easily work for another board & microcontroller & in any situation HAL can not access MC without MCAL.
    Note: in terms of architecture HAL also serves as System Service Layer

3. Application Layer
    A State machine code that serves the microwave application through HAL functionality , yet due to the nature of Pic it uses MCAL to serve Interrupts .

Important Note : The Project was not compiled as if 3/5/2020 the date of submission , due to environmental and compiler issues probably related to PIC & codeblocks ,

 Please note that this is my first time using PIC and I can get it to work in the following week if possible.

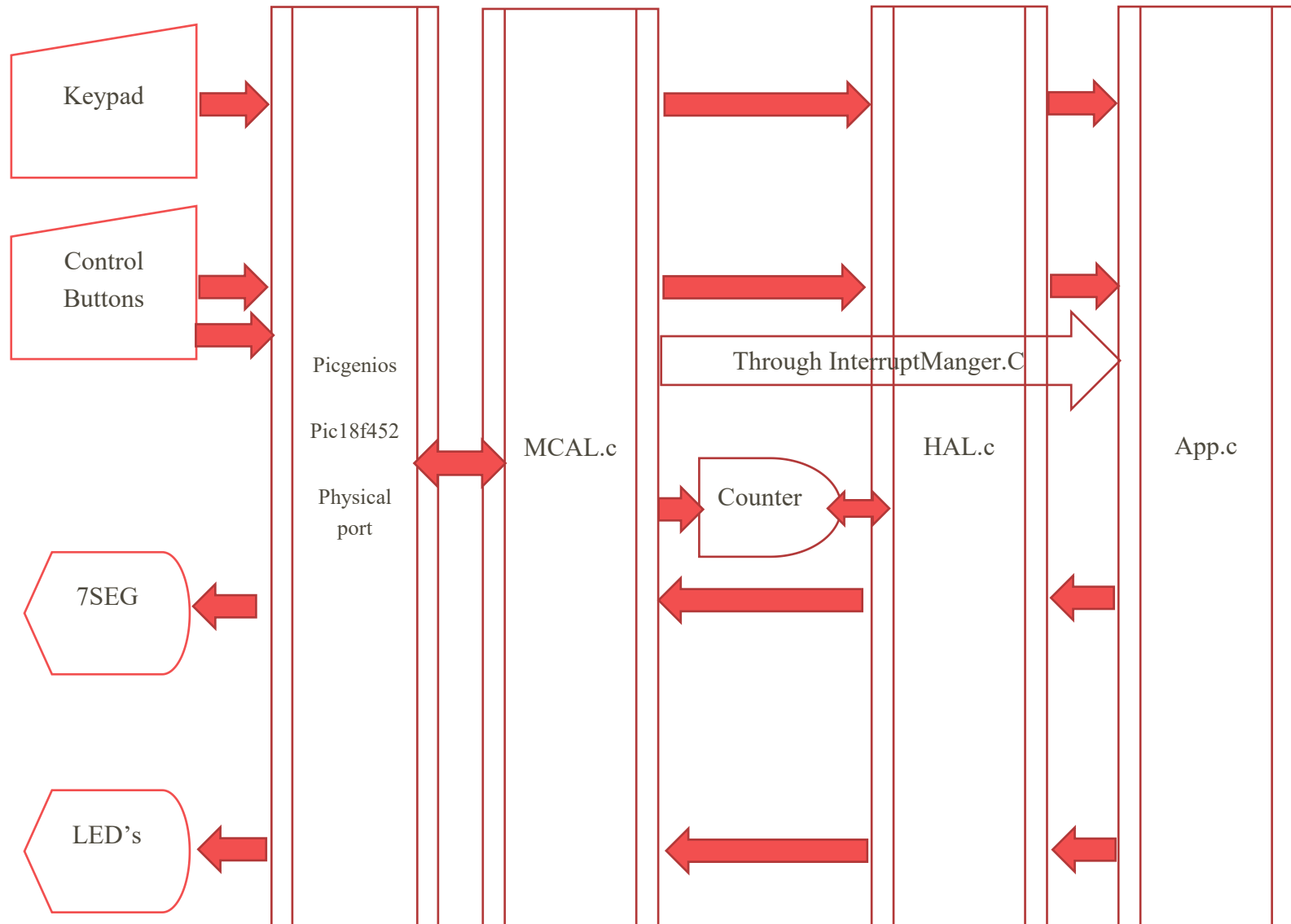# 2 – User & System & Safety Requirement Specifications

As mentioned above Microwave is considered a safety critical application, So based on Microwave Study Document here are the SRS .

Requirement	Type	Functionality	Implementation	Notes
Start button	User Interface User Input	Starts the microwave operation under certain conditions	As part of the Keypad	Dependant on Keypad
Door button	User Interface User Input	Determines the states of the microwave door, activates cancel functionality	Bush button on RB6 as a high priority interrupt onChange source.	*Safety critical requirement , as operating the microwave while the door is open can cause death , in optimal cases it's linked directly to the heater power
Cancel button	User Interface User Input	Stops the microwave operation & clears time settings.	Bush button on RB5 as a low priority interrupt onChange source.	*Safety critical requirement This button only gains it's interrupt source on certain machine states
Keypad	User Interface User Input	Inputs time setting with nums from 1 to 9	Based on Picgenios on port B & D (3*4)	Multiplexed with 7SEG due to Picgenios limitations
Weight indicator	User Interface User Output	Determines the weight status of the microwave	As part of the keypad	*Safety critical requirement Operating an empty microwave can cause explosion in older modules Dependant on Keypad
Heater Indicator	User Interface User Output	Indicates the working status of the device heater	As a led RB4 on PortB	*Safety critical requirement
Lamp Indicator	User Interface User Output	Indicates the working status of the device Lamp	As a led RB3 on PortB	
Motor Indicator	User Interface User Output	Indicates the working status of the device fan		
Display-7SEG	User Interface User Output	Displays time remaining if microwave is heating or time setting if not	4 7SEG on a single port with different enables and operated on a flash operation	Dependant on Keypad,Counter
Counter	System Requirement	Count down inputted time for the operation	Implemented on MCAL based on pic18f452 timer0	Dependant on pic18f452
Interrupt module	System Requirement	Provides interrupt functionality for the system	Implemented on MCAL based on pic18f452 ISR	Dependant on pic18f452

3 – System Architectural Design

The following block diagram shows a simplified architectural design for more details visit pin layout or software functional design.

Keypad		

Picgenios

Pic18f452

Physical port

MCAL.c

Counter

Through InterruptManger.C

HAL.c

App.c

7SEG

LED's

Control Buttons

Example Usage:

```
u8_t Cont_read_keypad(u8_t* Keypad_counter){
u8_t temp_read;
if(!Keypad_Isinit){ Keypad_init();Keypad_Isinit=1;SEG_Isinit=0;}
temp_read=Keypad_read();
   if(temp_read==NOT_PRESSED){return No_Read;}
   else if(temp_read!=StartPressed) {if(temp_read!=WeightPressed){(*Keypad_counter)++;}}
   return temp_read;} }}//HAL Function used by main.c that call a function for Keypad.c
   //Kepyad.c uses MCAL_PIC18F to read itself
```

4 – Hardware Design (Pin Layout)

Important Note : Please refer to manual_picgenios attached files for Pin Layout.

5 – Software Functional Design

Note : mentioned file names can be extended

Please visit each specific file documentation for detailed members (functions , vars..etc) documentation .
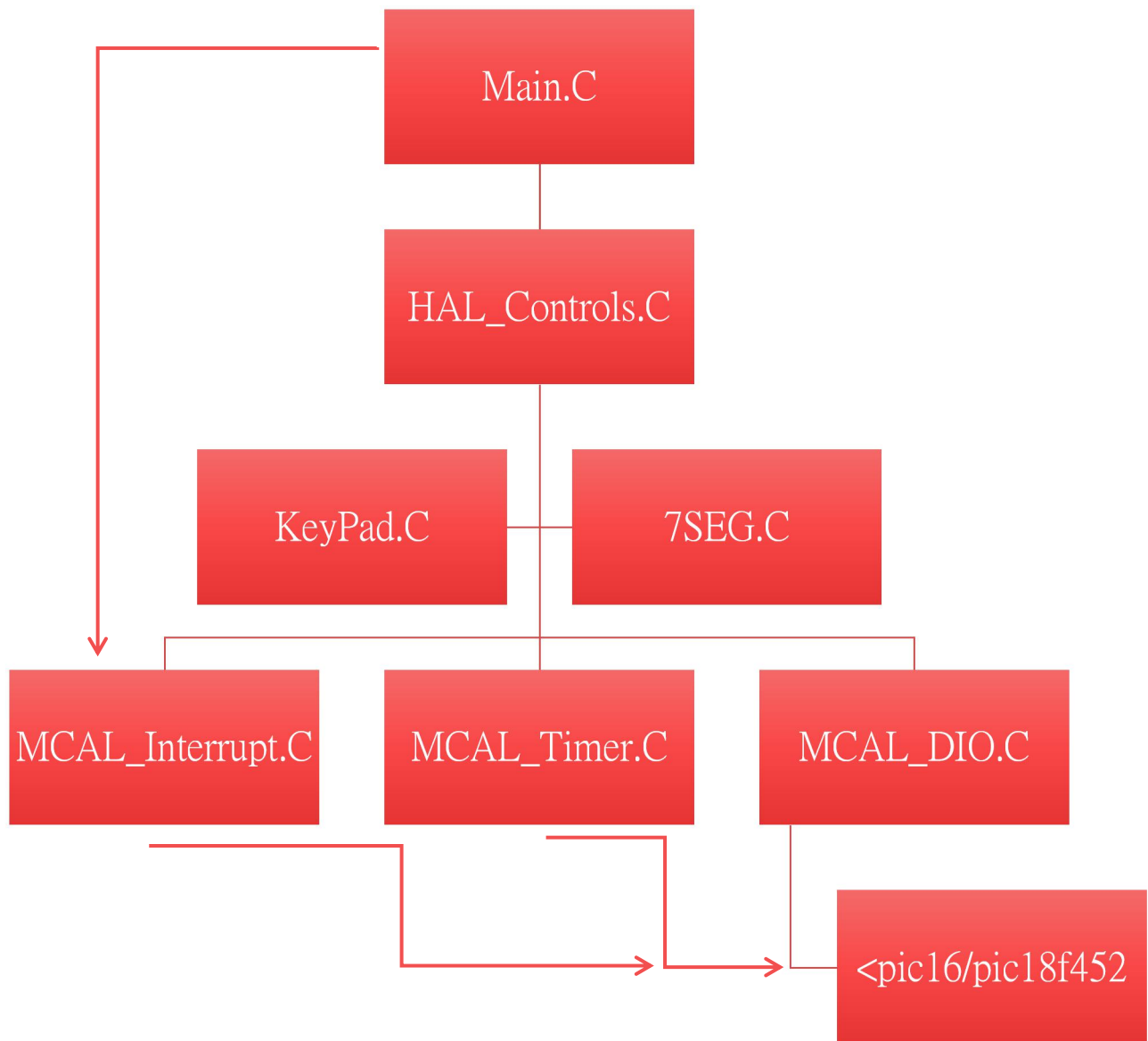
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              ┌─────────│   Main.C    │
              │         └─────────────┘
              │                │
              │         ┌─────────────────┐
              │         │ HAL_Controls.C  │
              │         └─────────────────┘
              │                │
              │      ┌──────────┴──────────┐
              │  ┌──────────┐      ┌──────────┐
              │  │ KeyPad.C │      │ 7SEG.C   │
              │  └──────────┘      └──────────┘
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    ┌──────────────────┐  ┌──────────────┐  ┌─────────────┐
    │ MCAL_Interrupt.C │  │ MCAL_Timer.C │  │ MCAL_DIO.C  │
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Revision History

Rev	Date	Reason / Changes	Approval
A	02.28.2020	Initial design	RE
A	03.05.2020	Initial Submission	N/A