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| 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 :

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.
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 .

# 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.

App.c

HAL.c

MCAL.c

Picgenios

Pic18f452

Physical port

Keypad

Control Buttons

Counter

7SEG

LED’s

Example Usage:

[MyButton](https://doc.qt.io/qt-5/qml-qtquick-controls-textfield.html) {

id: *execButton*

text1:" Exec "

plusarea.onClicked: {

*codetovalidate*=*textField1*.text

*validation*=*fileIO*.validate(*qsTr*(*codetovalidate*))

*console*.log(*validation*);

if (*validation*==1){ *whatcode*=*fileIO*.newCodeGetter()

*console*.log(*whatcode*);}

}

}}

# 4 – Hardware Design ( 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 .

# Revision History

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| --- | --- | --- | --- |
| Rev | Date | Reason / Changes | Approval |
| A | 02.28.2017 | Initial design | RE |