* **Hardware specification**

STM32F103C8T6 32 bit Microcontroller

Op-Amp based ADC sensors

Digital IO relays

ESP32 Wi-Fi Board

* **Micro controller Peripherals:**

UART Port for Esp32 interfacing.

UART for Modbus RTU communication.

4 optional Inputs

4 optional Outputs

ADC based light sensor

ADC based Humidity sensor

Digital Tempreture Sensor

RTC and I2C EEEPROM.

Push button for Power Init

Push button for reset.

* **Process:**

1. **For ADC Sensors :**

We can use timer schedule base of 10ms to count 500ms samples to filter analog value. So In this case we can use 10msCount variable when it reached to the 50 count we can make averaging of filter value which is actual value of the sensor.

1. **Runtime instance:**

The run time instace is actual object in which there are all kind of attributes which are update from sensors and excute the action and all measuring data which are in the end pass to the ESP32 wifi module.

1. **PageBuffer Mechanism:**

It the mechanism which is used to collect the slave device runtime structure and pass it the Wi-Fi module as zone – N.

1. **Semi auto FOTA:**

It can detect the firmware file over the esp32 when selected boot push button is pressed and firmware get updated. So user need to acknowledged the firmware update.

* **SOP:**

System is working as state machine which has INIT,RUN,STOP.

INIT STATE:

System is in ideal mode nothing happen it wait for either boot mode switch or push to start switch action. When user press to start switch system goes in to RUN State. If user press Boot switch system check weather firmware update signal is available from ESP side if it is then firmware update process start otherwise nothing happen.

RUN STATE:

System start Output devices and sense from the input sensor and pass all input and output data to Wi Fi module. This state has frequency of every 10ms.It has below operations are performed in each interval.

Input\_Filtering\_Fun

Pid\_Output\_Control\_Fun/Output\_Control\_Fun

Send\_Data\_To\_WiFi + Page\_Buffer Mechanism.

Note: All above function can be call by funPtr method so we can pass function reference in each interval.

Input\_Filtering\_Fun:

In this sensoors reading is averaged every 50 counts and final value is taken.

Pid\_Output\_Control\_Fun:

In this Output is control by input sensors reading value of temperature .and outputs are control ON /OFF as per requirements and set point condition.

Send\_Data\_To\_WiF , Page\_Buffer Mechanism,Modbus Req & Response:

This function send runtime instance complete data over the Wifi module. There is another function also which req runtime instance from slave device as zone – N over the UART(Protocol Modbus RTU). And received instance also send over the wi fi network.

STOP STATE:

System get stop all outputs and all conditions are in reset status.

NOTE: in backend watch dog timer also run which is acknowledge by application loop at the end which reset the watch dog if ECU stack then watch dog timer reached to the threshold value and reset the system.