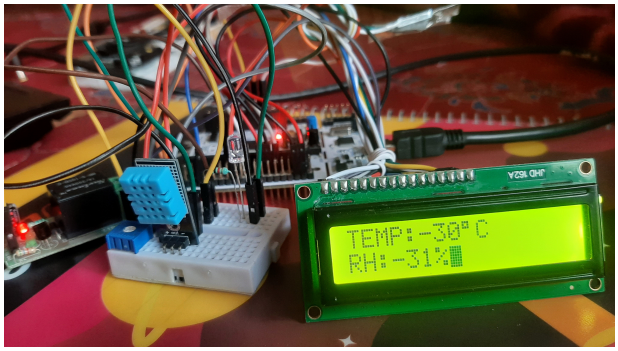
Name of Document

“Temperature and Humidity Monitoring”



Version: xPx

Customer: xxxxx

Project Co-ordination Team

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Contents

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3.0 Overview

Using this project, we try to solve the real time Temperature and Humidity Issue using *DHT11, 16x2 LCD, stm32 and RTOS*. There are many benefits of using RTOS as **Timing requirements, Multitasking, Resource management, Stability, Power consumption** so for achieving this benefits we use here RTOS in my project.

Main motto of our project is Using Real Time Operating System and the above components, we try to build a system where we use two *state* like **IDLE STATE** and **ALERT STATE**. In the *IDLE STATE* sensor can read the ***Temperature and Humidity*** and will send the data to the LCD. And there is some *Reference temperature/humidity* which can be set by USER, when the sensor data touch to the Reference temperature/humidity the state suddenly change to *ALERT STATE* and give some **ALERT** and turn *ON* the **FAN** which maintains the Temperature/Humidity.

Currently the device has the ability to send the data through UART and in future it can be access by over internet through MQTT using WE10.

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4.0 Scope of work

We made this project with as minimal cost with high efficiency, as it use real time engine so chances of failure rate is very low and as RTOS follows this strict RULE:- "**tasks must be executed within strict timing constraints**". So for that we can use this device where time and cost should minimal. For example it can use in Aerospace temperature management, Agricultural field, Machinery, Defence System, anywhere we can use this device where time is burden.

For this timing it display the sense value to the LCD and can transmit the data through USART protocol, but in future we are planning to add WE10 Wi-Fi module and MQTT, which is a USART based transmitter through this we can enable our data through the INTERNET.

For this timing this Device can measure up to "Humidity measuring range: 20%~90%RH(0~50 degree (temperature compensation). Temperature measuring range: 0~+50degree. Humidity measurement accuracy: ±5.0%RH".

And also we many more plan as like we will use some push buttons for the History and **refer_temp/refer_humi** can be changed through the button or through MQTT also. And also there is a plan like we will send the data through MQTT in every 20 munities and also it can change through MQTT and the buttons.

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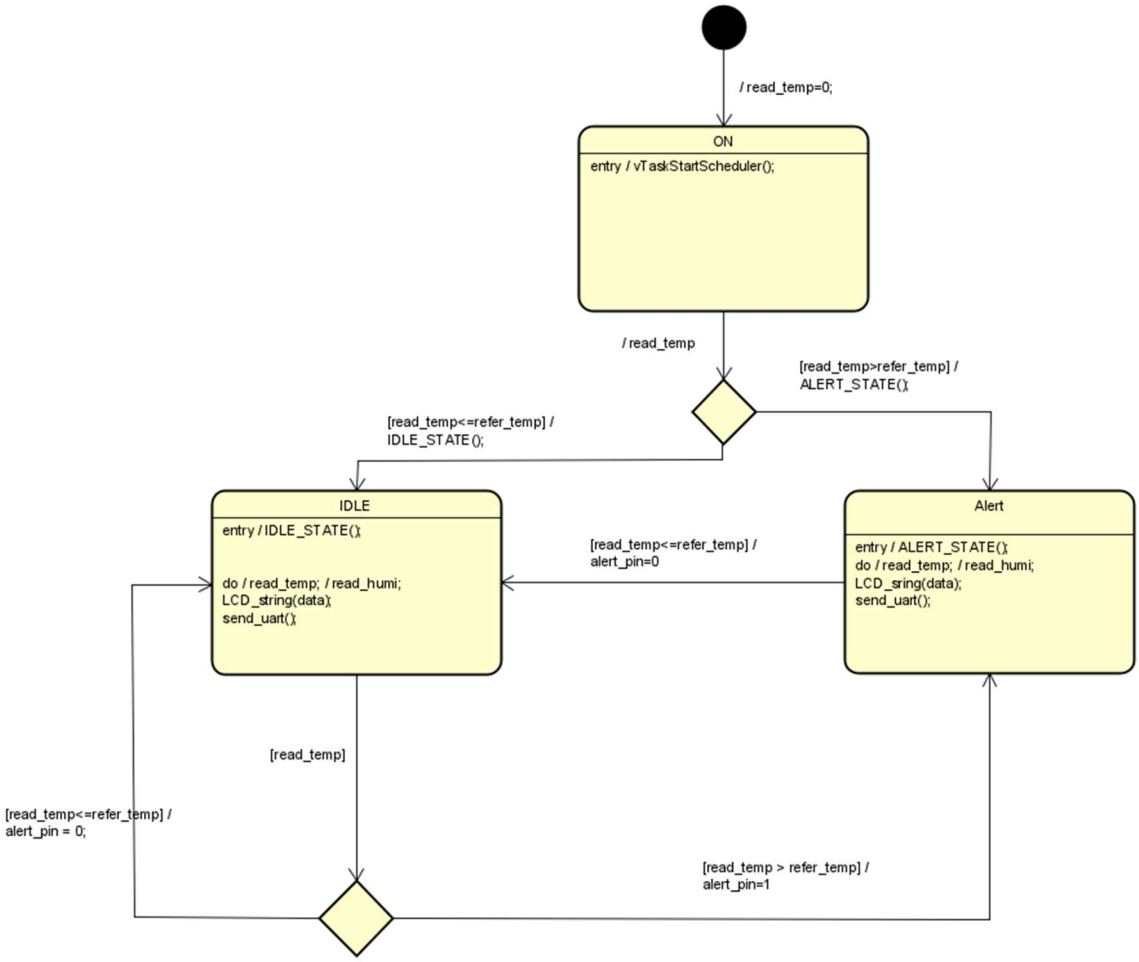
5.0 Software Architecture

5.1 UML Diagram



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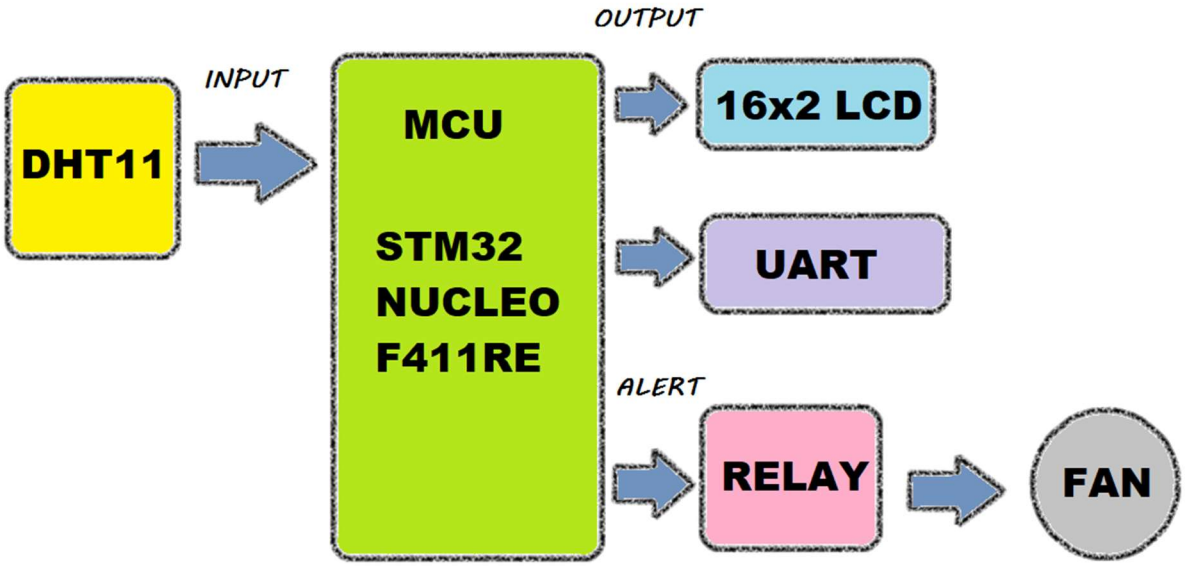
5.2 BLOCK Diagram



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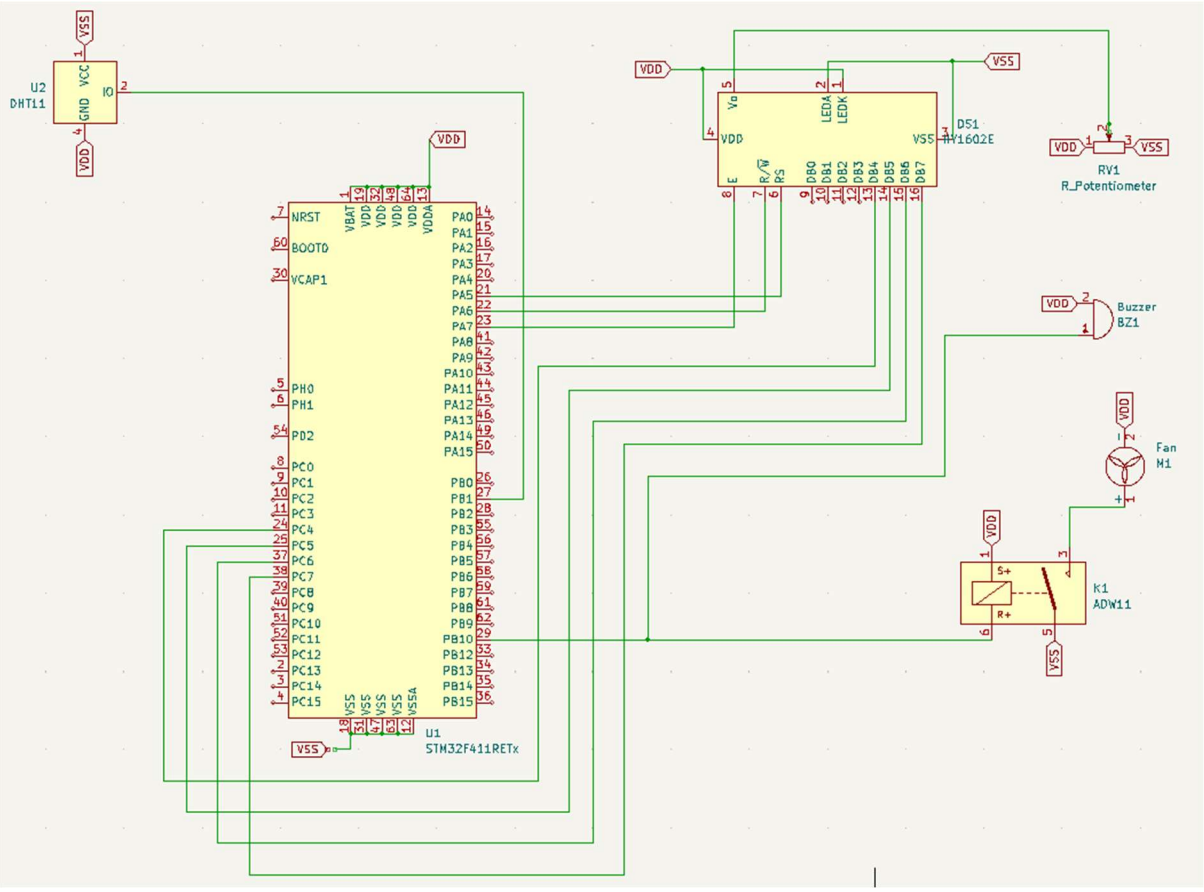
5.3 CIRCUIT Diagram



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5.4 CODE Flow

In this project we have use freeRTOS, first we have created two Handler named as ***IDLE_STATE_handler ( );*** and ***ALERT_STATE_handler ( ); which*** can called by ***vTaskStartScheduler ( );*** and here I have use ***co-operative scheduling*** with same priority so one state will **YIELD** after another.

- ***vTaskStartScheduler ( );*** will call ***IDLE_STATE_handler ( );*** which is in ***xTaskCreate ( );*** because it is the first handler so inside this handler it call to ***IDLE_STATE ( );*** and in this state the ALERT_Pin =0; and it will call to ***sense_value ( );*** function which is present over ***DHTxx.h*** header file its work is it will start the mechanism of taking sensor value from DHT11, and here we use TIM1 as delay generator and ***sense_value ( );*** return the ***read_temp*** and ***read_humi*** value and these value can be taken by LCD and UART. Then there is a ***refer_temp*** value which is always compare with ***read_temp*** and if it is **false** then **IDLE_STATE ( );** will not yield/not switch to the next state.

- And if the **read_temp > refer_temp** then state will yield to the **ALERT_STATE ( );** and in this state the ALERT_Pin =1; and it will turn on the FAN/BUZZER till the temperature goes to **refer_temp <= read_temp** and then the state call to ***sense_value ( );*** function and show the sensor value. Then there is a ***refer_temp*** value compare with ***read_temp*** and if it is **false** then **ALERT_STATE ( );** will not yield/not switch to the next state and if the **read_temp<=refer_temp** then *the alert state will yield to idle state.*

- So, all the data can be access through 16x2 LCD and UART protocol, in future we will use WE10(UART) for transferring the data through MQTT.

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6.0 Appendix

- ***vTaskStartScheduler ( );***

  It will Schedule the Task according to the priority.

- ***xTaskCreate ( );***

  It will create the Task and we can create task using this below format,
  xTaskCreate(IDLE_STATE_handler,"IDLE_STATE",200,NULL,2,&IDLE_STATE_handle);

- ***IDLE_STATE_handler ( );***

  This handler handle the IDLE STATE.

- ***IDLE_STATE ( );***

  This is the idle state if the (read_temp<=refer_temp) then this state will run infinitely.

- **ALERT_STATE ( );**

  This is the alert state if the (read_temp>refer_temp) then this state will run infinitely.

- ***sense value ( );***

  In this function we call the Temperature and Humidity value.

- ***ALERT_Pin***

  This is a variable is not used in the program, I write here for in the behalf of **(read_temp > refer_temp)** and if the read_temp is greater than refer_temp then it will go to alert state nor it stay in idle state.

- ***TIM1***

  We use this TIMER for generate the us_delay.

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- ***DHT11***

This is the Temperature and Humidity Sensor.

- ***read_temp***

This will read the Temperature value.

- ***read_humi***

This will read the Humidity value.

- ***LCD***

Output Display Unit.

- ***UART***

Universal Asynchronous Receive Transmit is a protocol where we transmit our data Serially using two pin(Rx Tx).

- ***WE10(UART)***

This is a WI-FI module which use UART for Communication.

- ***MQTT***

It is a lightweight, publish-subscribe, machine to machine network protocol for message queue/message queuing service.

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7.0 Reference

https://controllerstech.com/using-dht11-sensor-with-stm32/
https://freertos.org/
https://www.st.com/en/microcontrollers-microprocessors/stm32f411re.html

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