American International University- Bangladesh

Department of Electrical and Electronic
EEE4103: Microprocessor and Embedded Systems Laboratory

Title: **Building a fire alarm system using Arduino and DHT11 sensor.**

Group**: 06**

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Objective: The main objective of this experiment is to get acquainted with Micro-controller-based fire alarm system using Arduino and sensors. The parameters used in this case are temperature and humidity. This system is essential for the security of the people. Proteus has been used to complete the experiment and run the implemented software simulation. The fire alarm system is used to sense the surroundings for the occurrence of fire with help of the DHT11 sensors which can detect the changes in temperature and humidity. When the temperature or humidity level exceeds a certain value, the sensor senses it and the alarm starts to ring.

Theory and Methodology: The DHT11 is a commonly used Temperature and humidity sensor. The sensor comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The sensor is also factory calibrated and hence easy to interface with other microcontrollers. The sensor can measure temperature from 0°C to 50°C and humidity from 20% to 90% with an accuracy of ±1°C and ±1%. DHT11 meets these requirements, compensating for temperature and humidity to detect fire and smoke. The ideal relative humidity for health and comfort is somewhere between 30-50% humidity. If it goes up to 85% then it can be considered as smoke.

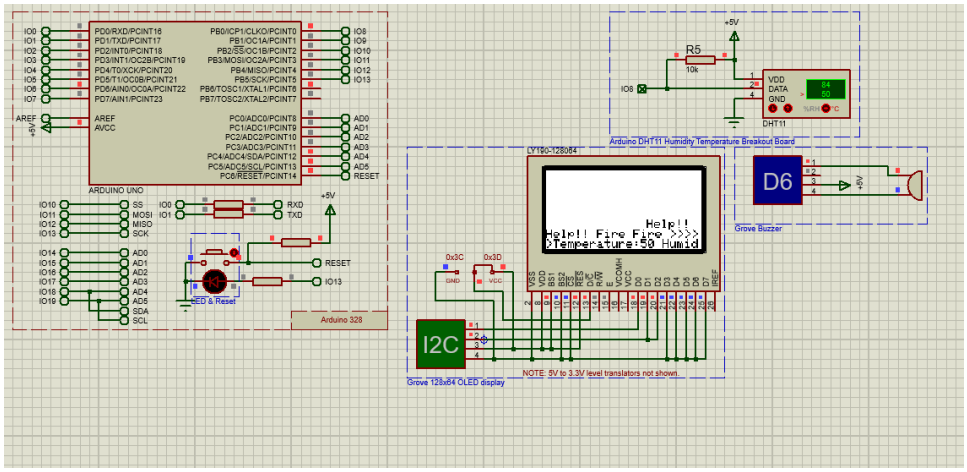
Algorithms for fire-detection Simple Approach:

If current temperature is greater or equal to 50-degree Celsius
Or current humidity is greater than 85% then the alarm will trigger.

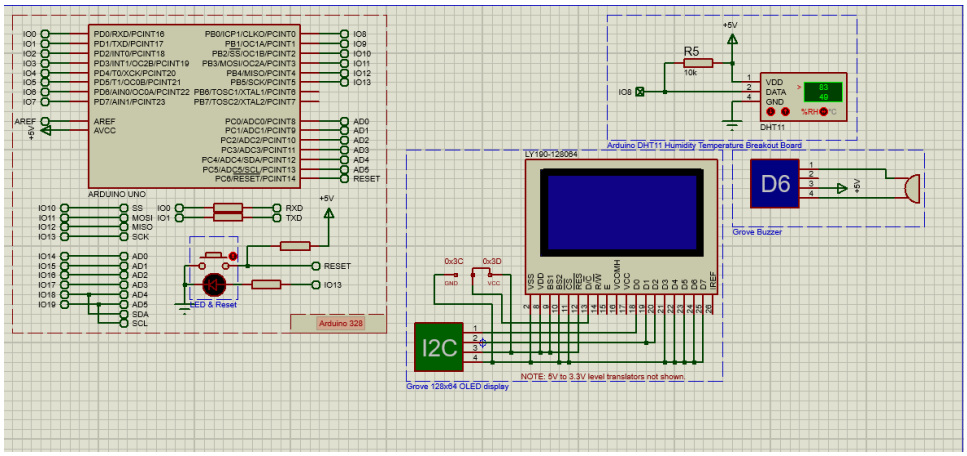
Apparatus:

- Arduino Uno Board
- DHT11
- 0.96-inch OLED 128X64
- Buzzer
- Breadboard and Jump Wires

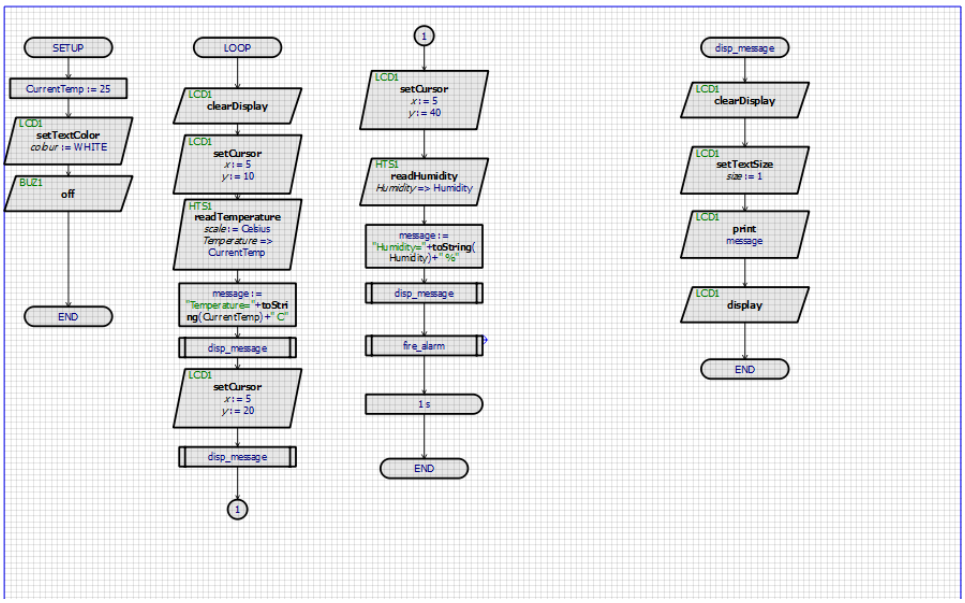
Simulation Setup: Students will be adding pictures of their implemented hardware circuit connection in this section.

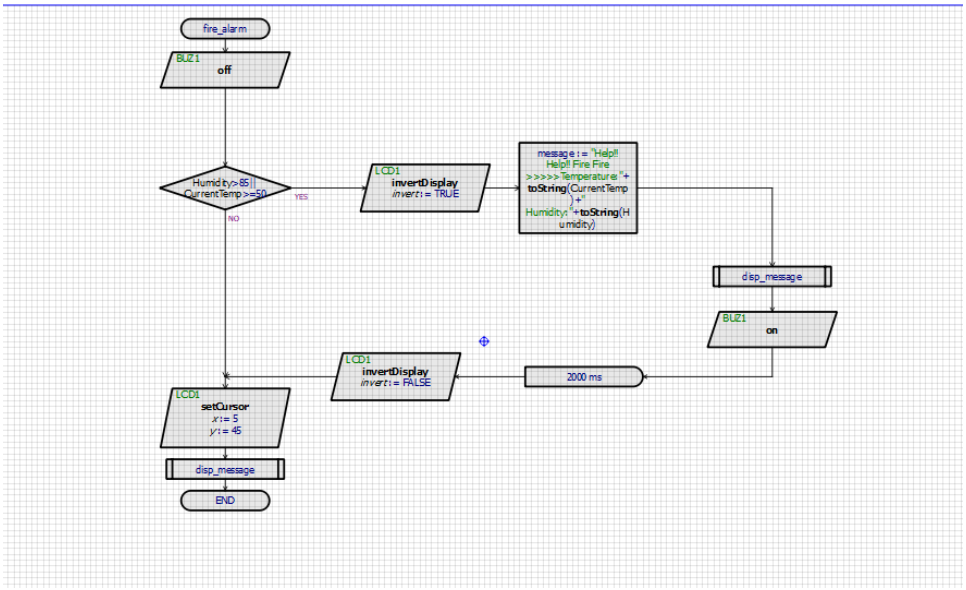


Schematic diagram: Students will be adding schematic diagram from Proteus simulation in this section.



Flowchart: Students will be adding flowchart from visual designer section of Proteus simulation in this section.


SETUP
CurrentTemp := 25
LCD1 setTextColor colour := WHITE
BUZ1 off
END
LOOP
LCD1 clearDisplay
LCD1 setCursor x:= 5 y:= 10
HTS1 readTemperature scale := Celsius Temperature => CurrentTemp
message := "Temperature= "+toString(CurrentTemp)+" C"
disp_message
LCD1 setCursor x:= 5 y:= 20
disp_message
1
1
LCD1 setCursor x:= 5 y:= 40
HTS1 readHumidity Humidity => Humidity
message := "Humidity= "+toString(Humidity)+" %"
disp_message
fire_alarm
1 s
END
disp_message
LCD1 clearDisplay
LCD1 setTextSize size := 1
LCD1 print message
LCD1 display
END


fire_alarm
BUZ1 off
Humidity>85|| CurrentTemp>=50
YES
NO
LCD1 invertDisplay invert:= TRUE
message := "Help!! Help!! Fire Fire >>>>> Temperature= "+ toString(CurrentTemp)+" Humidity= "+toString(Humidity)
disp_message
BUZ1 on
2000 ms
LCD1 invertDisplay invert:= FALSE
LCD1 setCursor x:= 5 y:= 45
disp_message
END

Data collection table / comparison table based after results: The students will be including their collected results and make a data table for analysis.

Analysis		**Output**
Current Temperature Degree Celsius	**Current Humidity%**	
30	84	Buzzer: Off OLED Display: (Temp: 30 C, Humidity: 84 %)
35	85	Buzzer: Off OLED Display: (Temp: 35 C, Humidity: 85 %)
45	86	Buzzer: On OLED Display: (Fire!!! Fire!! Temp: 45 C, Humidity: 86 %)
50	84	Buzzer: On OLED Display: (Fire!!! Fire!!! Temp: 50 C, Humidity: 84%)
50	86	Buzzer: On OLED Display: (Fire!!! Fire!!! Temp: 50 C, Humidity: 86%)

Discussions: This project is simulation-based and is done online using Proteus software. We did not use live fire-related data or sensors. We faced some problems that were solved by recorrecting the logic and using correct mathematical formulas in the flowchart. We must be careful while building the circuit and logical flowcharts. The whole project is free while implementing as it is done online completely. We have implemented the project based on the temperature of Bangladesh. So, the temperature must be calibrated based on the temperature of the country.

References:

[1], Z. S. Obanda, “Multi-sensor fire detection system using an Arduino Uno microcontroller,” Strathmore.edu. [Online]. Available: https://su-plus.strathmore.edu/bitstream/handle/11071/5686/Multi-sensor%20fire%20detection%20system%20using%20an%20Arduino%20Uno%20microcontroller%20%282%29.pdf?sequence=3&isAllowed=y. [Accessed: 02-Dec-2021].

[2], M. Shazali Dauda and U. S. Toro, “Arduino based fire detection and control system,” International Journal of Engineering Applied Sciences and Technology, vol. 04, no. 11, pp. 447–453, 2020.

[3], “Relative humidity in Dhaka, Bangladesh,” Climatemps.com. [Online]. Available: http://www.dhaka.climatemps.com/humidity.php. [Accessed: 02-Dec-2021].