North South University

Department of Electrical and Computer Engineering

CSE331L: Microprocessor Interfacing and Embedded System Lab

Semester: Summer 2025

Section: 7

Assignment Type: Project Proposal

Submitted To:

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The Mini Weather & Safety Station :

Project Overview

The Mini Weather & Safety Station is an embedded system designed to monitor environmental conditions and provide real-time safety alerts for indoor spaces. The system uses the STM32F103C8T6 microcontroller to read data from three sensors:

DHT11: Temperature & humidity

Soil Moisture Sensor YL-69: Soil wetness

IR sensor: Motion detection

These readings are displayed on a 0.96” OLED display.

Additionally, the system integrates LED indicators to show environmental status (safe, warning, danger) and a buzzer to notify users during emergency situations such as high temperature, extremely low soil moisture, or unsafe motion detection.

This project demonstrates practical applications of sensor interfacing, data processing, decision-making, and multimodal user feedback in embedded systems.

Required Sensors and Components:

Hardware	Purpose
STM32F103C8T6	Main controller (MCU)
ST-LINK V2	Programmer/debugger for STM32
0.96” OLED	Displays readings and warnings
DHT11	Measures temperature & humidity
Soil Moisture Sensor YL-69	Measures soil wetness
IR Sensor	Detects motion/presence
LEDs (Green, Yellow, Red)	Indicate safe/warning/critical status
Buzzer	Audible emergency alert

Jumper wires / Breadboard	Hardware connections

Functionalities:

- Reads temperature & humidity using DHT11.
- Measures soil moisture level using YL-69.
- Detects motion using IR sensor.
- Displays real-time readings on OLED display.
- Controls LED indicators for quick visual alerts:
- Green → Safe conditions
- Yellow → Warning (threshold near limit)
- Red → Critical (danger)
- Activates buzzer in emergencies (critical values or unsafe motion).
- Generates warnings if:
- Temperature is high
- Humidity is extreme
- Soil moisture is too low

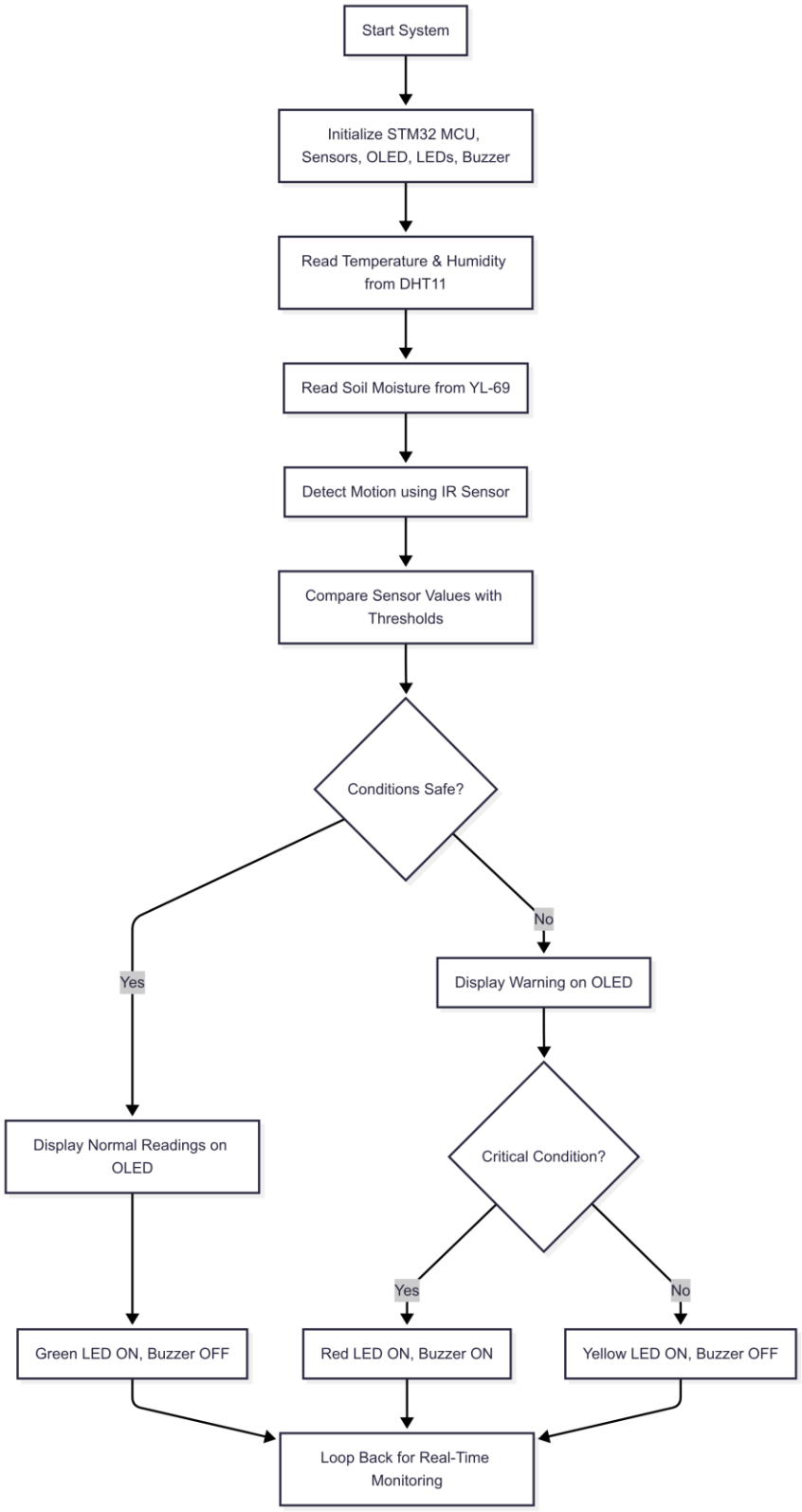
Sample Input and Output:

Temperature	Humidity	Soil Moisture	Motion (IR)	OLED Output	LED Status	Buzzer
29 °C	55%	40%	Yes	TEMP:29 HUM:55 / SOIL: OK / SAFE	Green ON	OFF
35 °C	70%	20%	Yes	WARNING: SOIL DRY / HIGH TEMP	Red ON	ON
32 °C	60%	30%	No	TEMP:32 HUM:60 / SOIL: LOW / CAUTION	Yellow ON	OFF

System Design Plan:

- Initialize STM32 MCU, sensors, OLED, LEDs, and buzzer.
- Read temperature & humidity from DHT11.
- Read soil moisture level from YL-69.
- Detect motion using IR sensor.
- Compare readings against predefined thresholds.

- Display readings & warnings on OLED.
- Control LEDs to show status (safe/warning/critical).
- Activate buzzer if emergency condition is detected.
- Loop continuously for real-time monitoring.


Start System
Initialize STM32 MCU, Sensors, OLED, LEDs, Buzzer
Read Temperature & Humidity from DHT11
Read Soil Moisture from YL-69
Detect Motion using IR Sensor
Compare Sensor Values with Thresholds
Conditions Safe?
Yes
No
Display Normal Readings on OLED
Display Warning on OLED
Critical Condition?
Yes
No
Green LED ON, Buzzer OFF
Red LED ON, Buzzer ON
Yellow LED ON, Buzzer OFF
Loop Back for Real-Time Monitoring

Why This Design Was Chosen:

- Fully compatible with STM32.
- Multimodal alerts (OLED, LEDs, buzzer) ensure quick user awareness.
- Demonstrates essential embedded system concepts:
- Sensor interfacing
- Data processing & decision-making
- Multimodal output (display, visual, audio)
- Integrates multiple sensors and outputs, fulfilling extended course requirements.

Relation to Course Topics:

- Demonstrates interfacing of multiple sensors with STM32 (DHT11, Soil Moisture YL-69, IR Sensor).
- Uses STM32CubeIDE for sensor data acquisition, processing, and display.
- Applies threshold-based decision-making logic for alerts.
- Implements I2C communication for OLED display.
- Reinforces real-time monitoring, actuator control, and embedded system design principles.
- Extends course learning by adding LEDs & buzzer as actuators.