Environment Monitoring System with STM32F401CCU6

Introduction

This project implements an environment monitoring system using the STM32F401CCU6 microcontroller. The system monitors environmental temperature, humidity, and air quality and displays the results on an OLED screen. If air quality parameters exceed safe thresholds, the display shows a 'DANGER' message; otherwise, it shows 'SAFE.'

Components

Microcontroller

STM32F401CCU6: Serves as the main processing unit, interfacing with sensors and the OLED display.

Sensors

1. DHT11

Measures temperature and humidity.
Digital output, connected to GPIO PA1.

2. MQ-135

Detects harmful gases (e.g., ammonia, nitrogen oxides, alcohol, smoke, CO2).
Analog output connected to the STM32 ADC.

Display

OLED12832I2C

128x32 I2C interface OLED display.
Connected to pins PB6 (SCL) and PB7 (SDA).

System Features

1. Real-Time Monitoring

Temperature and humidity are continuously measured using the DHT11.

Air quality levels are monitored using the MQ-135 sensor.

2. Safety Status Display

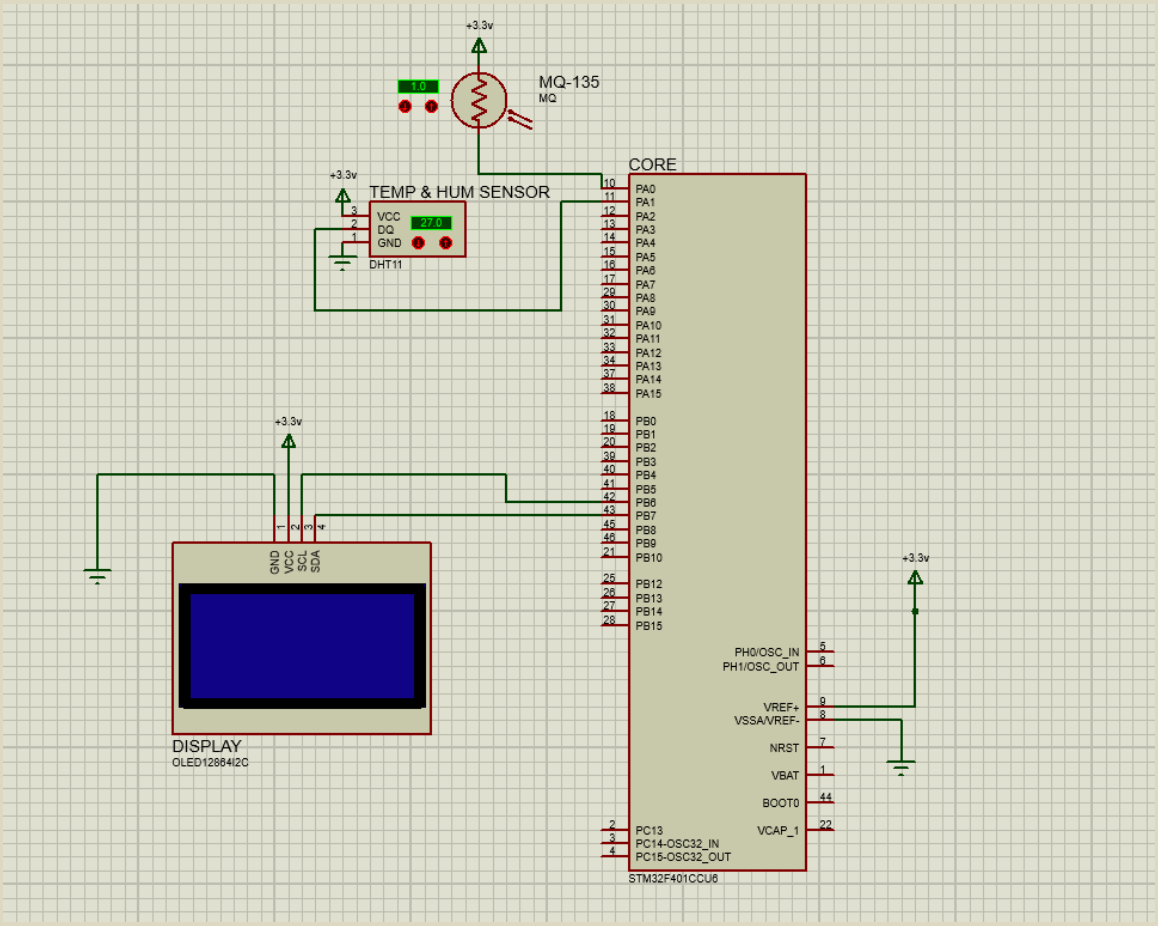
Displays 'SAFE' if temperature, humidity, and gas levels are within safe thresholds.

Displays 'DANGER' if any value exceeds its safety limits.

3. User-Friendly Output

Clear and concise information on OLED for quick assessment.

Circuit Diagram



Software Design

Development Environment

IDE: Keil

Programming Language: C

Workflow

1. **Initialization:**
   Configure I2C for OLED.
   Set up GPIO for DHT11 and ADC for MQ-135.
2. **Data Acquisition:**
   Read temperature and humidity from DHT11.
   Sample and process analog output of MQ-135.
3. **Processing:**
   Compare sensor readings against predefined thresholds.
4. **Output:**
   Display 'SAFE' or 'DANGER' on the OLED.

Results

1. Alerts users visually when conditions are unsafe.

Conclusion

The project demonstrates a simple yet effective system for environmental monitoring. It is easily extensible for more sensors or additional display options.

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