Pollution Sensing System

(Ankit Kadian | liveankitkadian@gmail.com)

Abstract: Air and water pollution are the causes of global warming. The first step towards controlling pollution is to be able to measure it. We need to know the exact pollution level they are standing in so that we can respond to it. So here we develop a smart pollution sensing system that measures pollution along with displaying time. This battery powered sensing system is designed using a STM32 microcontroller which is based on ARM Cortex M3 architecture.

Components used:

- STM 32 microcontroller
- OLED Display
- Buzzer
- LED
- Switch
- MQ 135 Air Quality Sensor
- MQ 2 Gas sensor
- Analog turbidity sensor
- Analog pH sensor
- MP1584 IC
- Capacitor
- Regiters
- Connecting wires
- Breadboard
- Power supply/Battery

Tasks Completed:

- First gathered all the sensors, microcontroller, MP1584 IC, OLED display and all required components.
- Then interfaced the sensors with STM32, the MQ 2 and MQ 135 sensors are digital sensors while the turbidity sensor is the analog sensor.
- To write the code to the microcontroller the Arduino IDE is used and used by STM32Cube programmers to upload it.
- MP 1584 IC is used to provide fixed 5v power supply to the circuit and the sensors, in case we are not using the power generator.
- Mounted the board and the sensors on the board and built the circuit using conducting soldering wire.
- Used Adafruit SSD1306 library to interface the oled display module with the microcontroller.

- Also created a switch to enhance the functionality of the OLED display module.
- Set up a buzzer and LED warning light, if the pollution values go above a fixed threshold, then the LED will blink and buzzer will go off to warn the user about the higher pollution levels.
- Also connected an external power supply terminal to provide fixed power supply in case of not using the microcontroller with pc.

Working: The air quality sensor is used to detect the amount of air pollution in the air as ppm levels. This data is processed by a microcontroller to get the current air quality. The system also monitors for any flammable gases in the vicinity to detect any flammable gas leakages using a flammable gas sensor. This sensor is constantly monitored by the microcontroller. The sensor data is processed by the controller and displayed on the display module. Similarly we have a turbidity sensor attached to the microcontroller as well . The sensor is used to transmit the water turbidity value to the controller which is displayed on display. Turbidity is used to display water quality of any water body (lake, pond, canal, sea). This allows setting high and low acceptance values of each parameter using push buttons. If any of the values scanned shows up higher/lower than set limits it sounds a buzzer alert as well as displays the alert message on display to the user.

Working of Sensors:

- **Turbidity Sensor**

Turbidity sensors measure the amount of light that is scattered by the suspended solids in water. As the amount of total suspended solids (TSS) in water increases, the water's turbidity level (and cloudiness or haziness) increases.

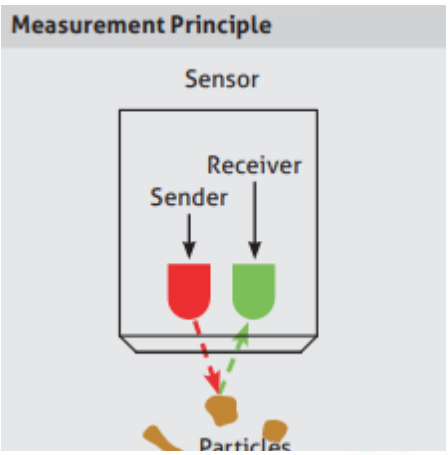
How Turbidity Sensors Work?

A turbidity probe works by sending a light beam into the water to be tested. This light will then be scattered by any suspended particles. A light detector is placed at (usually) a 90 degree angle to the light source, and detects the amount of light that is reflected back at it.

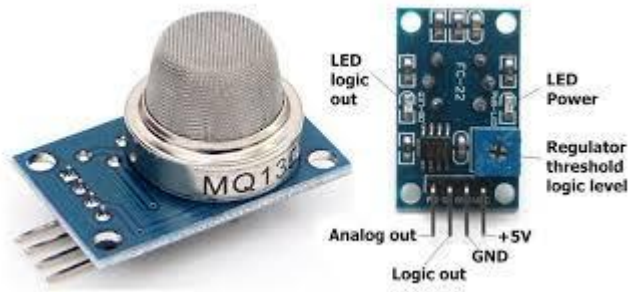
With the use of LED light sources, turbidity metres determine the level of particulate matter in water or other fluids. Anderson-Negele, our turbidity partner, defines turbidity as “the phenomenon whereby a specific portion of a light beam passing through a liquid medium is reflected by undissolved particles. The sensor measures the light that is reflected by these particles to determine their concentration in the liquid.” For example, purified water would have nearly zero undissolved particles, while ice cream mix has a high concentration.

Measuring principle of the relative turbidity metre

An infrared diode irradiates infrared light into the media. Particles in the media reflect the irradiated light which is detected by the receiver diode (backscatter principle). The electronics calculate the relative turbidity of the media according to the received signal.



- **MQ-135 Air Quality Sensor Module**



MQ – 135 Air Quality Sensor

MQ135 Gas Sensor is **an air quality sensor for detecting a wide range of gases, including NH3, NOx, alcohol, benzene, smoke and CO2**. Ideal for use in the office or factory. The MQ135 gas sensor has high sensitivity to Ammonia, Sulfide and Benzene steam, also sensitive to smoke and other harmful gases.

How does the MQ 135 sensor work?

The air quality sensor **detects ammonia, nitrogen oxide, smoke, CO2, and other harmful**

gases. The air quality sensor has a small potentiometer that permits the adjustment of the load resistance of the sensor circuit. The 5V power supply is used for air quality sensors.

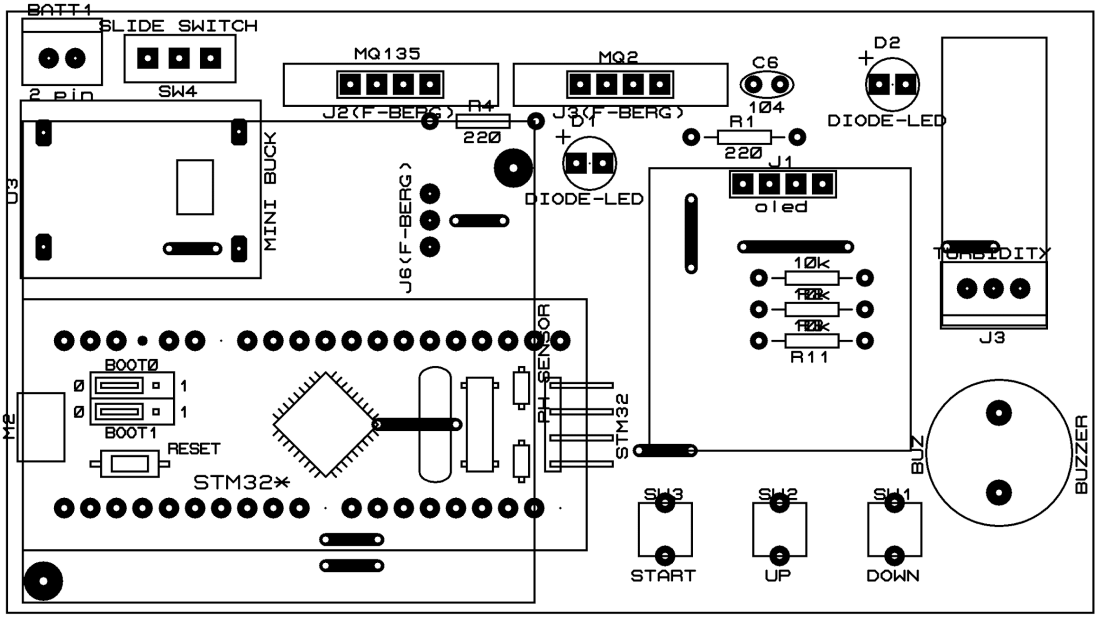
- **MQ-2 Flammable Sensor**

The Grove - Gas Sensor (MQ2) module is useful for gas leakage detection (home and industry). It is suitable for detecting **H2, LPG, CH4, CO, Alcohol, Smoke or Propane.**

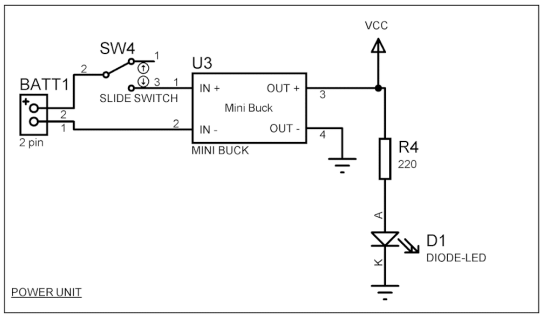
What does the MQ9 sensor detect?

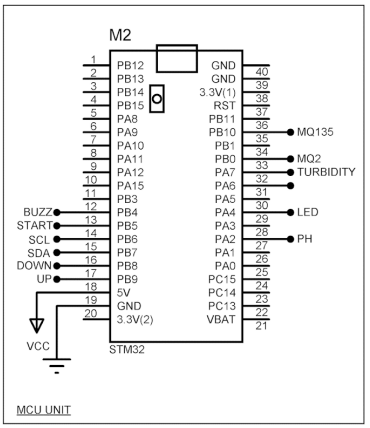
The MQ9 sensor is sensitive to **carbon monoxide and flammable gases**. It can detect carbon monoxide density from 10 ppm to 1000 ppm and flammable gases density from 100 ppm to 10000 ppm.

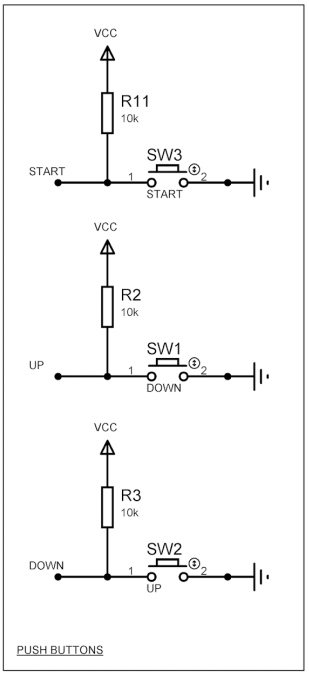
Layout of the System:

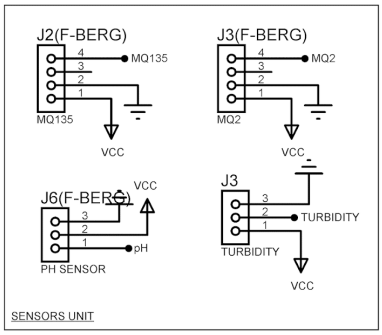


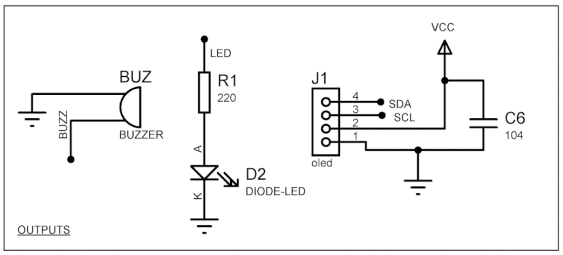
Detailed Circuit Diagram:


SW4
BATT1
SLIDE SWITCH
2 pin
U3
IN +
IN -
OUT +
OUT -
Mini Buck
MINI BUCK
VCC
R4
220
D1
DIODE-LED
POWER UNIT


M2
PB12
PB13
PB14
PB15
PA8
PA9
PA10
PA11
PA12
PA15
PB3
PB4
PB5
PB6
PB7
PB8
PB9
5V
GND
3.3V(2)
GND
GND
3.3V(1)
RST
PB11
PB10
PB1
PB0
PA7
PA6
PA5
PA4
PA3
PA2
PA1
PA0
PC15
PC14
PC13
VBAT
BUZZ
START
SCL
SDA
DOWN
UP
MQ135
MQ2
TURBIDITY
LED
PH
VCC
STM32
MCU UNIT


VCC
R11
10k
START
SW3
START
VCC
R2
10k
UP
SW1
DOWN
VCC
R3
10k
DOWN
SW2
UP
PUSH BUTTONS


J2(F-BERG)
MQ135
VCC
J3(F-BERG)
MQ2
VCC
J6(F-BERG)
VCC
pH
PH SENSOR
J3
TURBIDITY
VCC
SENSORS UNIT


BUZ
BUZZER
LED
R1
220
D2
DIODE-LED
J1
SDA
SCL
oled
VCC
C6
104
OUTPUTS