CHALLENGING TASK – 3

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Q.2) Use a MQ-135 gas sensor to monitor air quality, temperature and humidity values and perform regression line for the data.

Read MQ-135 sensor and temperature , humidity values via Raspberry Pi.

Format the data in a structured way

- **msg.payload = { "gas_level": msg.payload, // Sensor output "time": new**
- **"temperature": msg.payload[0], "humidity": msg.payload[1]**
- **"time": new Date().getTime()};**
- **return msg;**

· **get the 10 readings**

Train a Multi-linear Regression Node with the temperature-humidity and Gas level data.

Obtain the equation for the data set

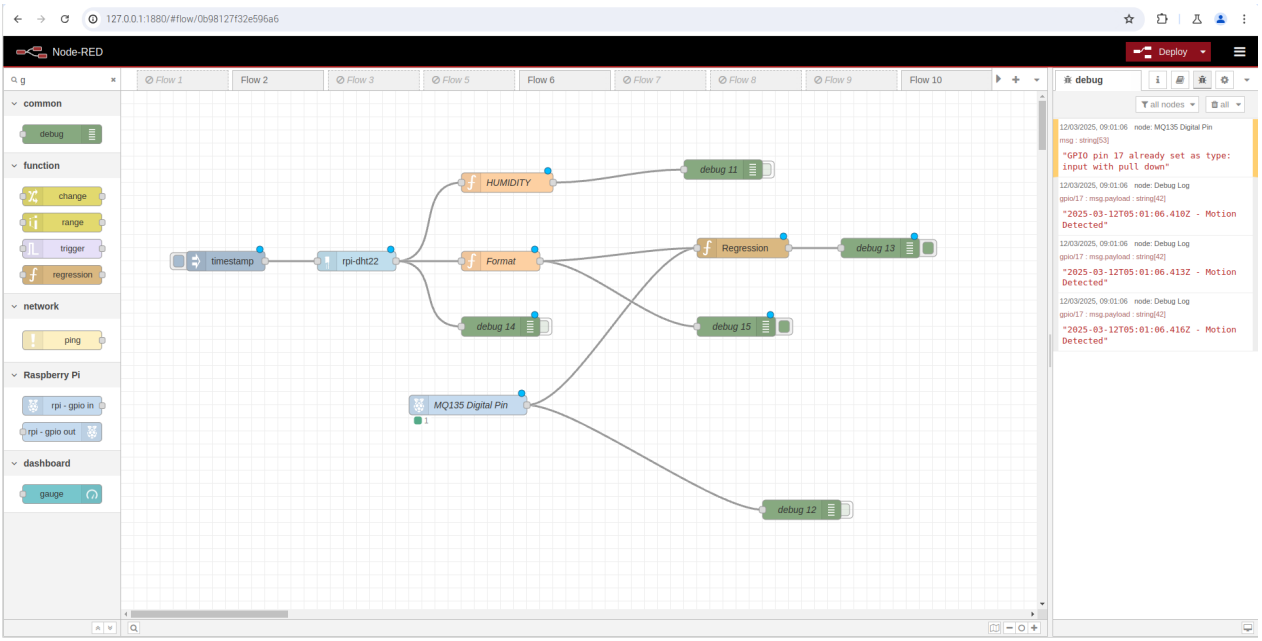
AIM:

To monitor temperature, air quality, and humidity using an MQ-135 gas sensor connected to a Raspberry Pi and to perform a multi-linear regression analysis to derive a predictive equation for the collected data.

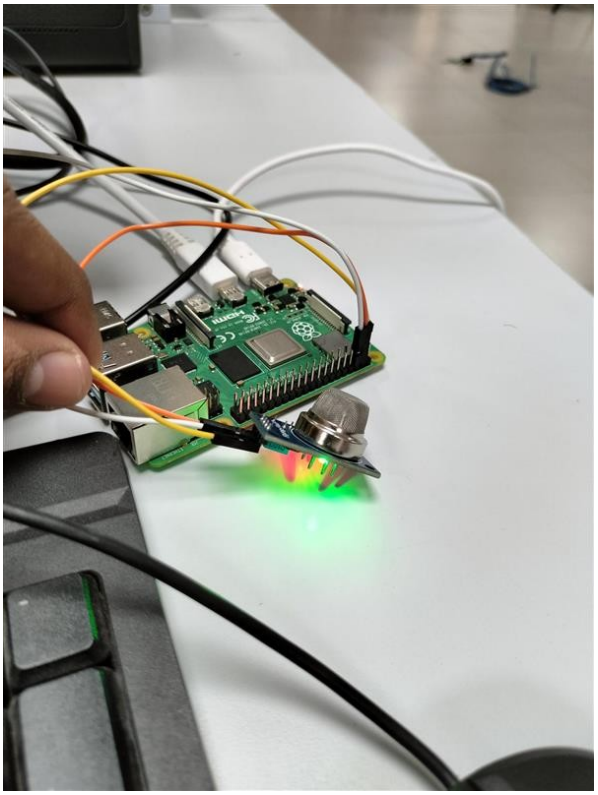
PROCEDURE:

- First, connect the MQ-135 gas sensor and a DHT11/DHT22 sensor to the Raspberry Pi
- Install necessary libraries from the Manage Pallate for data acquisition.
- Read gas concentration from the MQ-135 sensor and temperature-humidity values from the DHT sensor at regular intervals.
- Format the data in a structured JSON format, including gas level, temperature, humidity, and timestamp.
- Collect 10 readings at a fixed interval and store them in a CSV or JSON file.
- Use Python's sklearn.linear_model. LinearRegression to train a multi-linear regression model with temperature, humidity, and gas level as input variables.
- Extract the regression coefficients to derive the equation in the form: Gas Level = a + (b × Temperature) + (c × Humidity).
- Finally, display the regression equation and optionally visualize the data trends using Matplotlib.

NODE-RED Configuration:



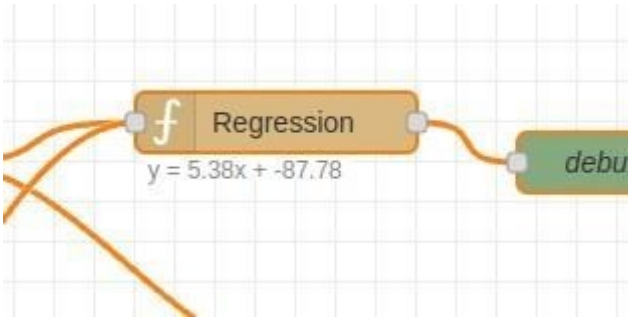
Raspberry Pi Connections:



Sensor Readings in Debug Window:

Regression Equation Obtained:

$$Y=5.38x + -87.78$$



JSON CODE:-

```
[
    {
        "id": "0b98127f32e596a6",
        "type": "tab",
        "label": "Flow 11",
        "disabled": false,
        "info": "",
        "env": []
    },
    {
        "id": "mq135_digital",
        "type": "rpi-gpio in",
        "z": "0b98127f32e596a6",
        "name": "MQ135 Digital Pin",
        "pin": "17",
        "intype": "up",
        "debounce": "25",
        "read": true,
```

```
    "bcm": true,
    "x": 530,
    "y": 480,
    "wires": [
        [
            "6fd595a5e51018d2",
            "0431b5fe827709e5"
        ]
    ]
},
{
    "id": "3867648c596a6b90",
    "type": "rpi-dht22",
    "z": "0b98127f32e596a6",
    "name": "",
    "topic": "rpi-dht22",
    "dht": "11",
    "pintype": "0",
    "pin": 4,
    "x": 360,
    "y": 260,
    "wires": [
        [
            "3f50c164ef4f4994",
            "a45eecadc20f10ec",
            "c51c1f7db8aa6e80"
        ]
```

```
  ]
},
{
    "id": "46d910d48b67f899",
    "type": "inject",
    "z": "0b98127f32e596a6",
    "name": "",
    "props": [
        {
            "p": "payload"
        },
        {
            "p": "topic",
            "vt": "str"
        }
    ],
    "repeat": "",
    "crontab": "",
    "once": false,
    "onceDelay": 0.1,
    "topic": "",
    "payload": "",
    "payloadType": "date",
    "x": 160,
    "y": 260,
    "wires": [
```

```
            [
                "3867648c596a6b90"
            ]
        ]
    },
    {
        "id": "3f50c164ef4f4994",
        "type": "function",
        "z": "0b98127f32e596a6",
        "name": "HUMIDITY",
        "func": "msg.payload= msg.humidity;\nmsg.payload.y = msg.humidity;\nreturn msg;",
        "outputs": 1,
        "timeout": 0,
        "noerr": 0,
        "initialize": "",
        "finalize": "",
        "libs": [],
        "x": 590,
        "y": 140,
        "wires": [
            [
                "0a2b3a19e9297576"
            ]
        ]
    },
```

```
 {
    "id": "0a2b3a19e9297576",
    "type": "debug",
    "z": "0b98127f32e596a6",
    "name": "debug 11",
    "active": false,
    "tosidebar": true,
    "console": false,
    "tostatus": false,
    "complete": "false",
    "statusVal": "",
    "statusType": "auto",
    "x": 920,
    "y": 120,
    "wires": []
},
{
    "id": "6fd595a5e51018d2",
    "type": "debug",
    "z": "0b98127f32e596a6",
    "name": "debug 12",
    "active": false,
    "tosidebar": true,
    "console": false,
    "tostatus": false,
    "complete": "false",
    "statusVal": "",
```

```
    "statusType": "auto",
    "x": 1040,
    "y": 640,
    "wires": []
},
{
    "id": "0431b5fe827709e5",
    "type": "regression",
    "z": "0b98127f32e596a6",
    "name": "Regression ",
    "dataSetSize": 0,
    "regressionType": "linear",
    "polynomialOrder": 2,
    "precision": 2,
    "xInputField": "payload.temp",
    "xInputFieldType": "msg",
    "yInputField": "payload.humidity",
    "yInputFieldType": "msg",
    "yOutputField": "payload.humidity",
    "yOutputFieldType": "msg",
    "functionOutputField": "output",
    "functionOutputFieldType": "msg",
    "resultOnly": true,
    "x": 950,
    "y": 240,
    "wires": [
```

```
    [
        "41a3f236096d4de0"
      ]
    ]
},
{
    "id": "41a3f236096d4de0",
    "type": "debug",
    "z": "0b98127f32e596a6",
    "name": "debug 13",
    "active": true,
    "tosidebar": true,
    "console": false,
    "tostatus": false,
    "complete": "false",
    "statusVal": "",
    "statusType": "auto",
    "x": 1160,
    "y": 240,
    "wires": []
},
{
    "id": "a45eecadc20f10ec",
    "type": "debug",
    "z": "0b98127f32e596a6",
    "name": "debug 14",
    "active": false,
```

```
        "tosidebar": true,
        "console": false,
        "tostatus": false,
        "complete": "false",
        "statusVal": "",
        "statusType": "auto",
        "x": 580,
        "y": 360,
        "wires": []
    },
    {
        "id": "c51c1f7db8aa6e80",
        "type": "function",
        "z": "0b98127f32e596a6",
        "name": "Format",
        "func": "msg.payload = {\n\t\"temp\" : msg.payload.temp,\n\t\"humidity\" :
msg.humidity,\n\t\"time\" : new Date().getTime()\n};\nreturn msg;",
        "outputs": 1,
        "timeout": 0,
        "noerr": 0,
        "initialize": "",
        "finalize": "",
        "libs": [],
        "x": 580,
        "y": 260,
        "wires": [
```

```
            [
                "9bc4eb242f373ea9",
                "0431b5fe827709e5"
            ]
        ]
    },
    {
        "id": "9bc4eb242f373ea9",
        "type": "debug",
        "z": "0b98127f32e596a6",
        "name": "debug 15",
        "active": true,
        "tosidebar": true,
        "console": false,
        "tostatus": false,
        "complete": "payload",
        "targetType": "msg",
        "statusVal": "",
        "statusType": "auto",
        "x": 940,
        "y": 360,
        "wires": []
    }
]
```