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Food Spoilage Detection using IOT

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1. ABSTRACT

With the technology evolution and dependency of the people on the smart phones and raising demands of easy and quick way of solving their day-to-day life tasks, it has become vital to have a technological control over the industrial and the domestic applications using IoT. This paper substantially deals with the emerging technologies alongside the internet of things using Arduino which by the way employs the script programming and also the sensors like MQ4 Sensor, Arduino UNO, NodeMCU. We develop a food quality detecting technique, where the sensors will be associated along the Arduino.

Refrigeration is one of the essential techniques for food storage that operates by lowering the reproduction rate of the bacteria present in the food. But at some situations, one may fail to notice the food items that are not used for a long-term storage inside it. This paper is employed to solve the food spoilage problem, with the sensor assistance to identify the spoilage by continuous sensing. Based on the freshness and quality of food, the food spoilage will be displayed to the user through an alert message that is sent to their registered mobile numbers.

Index Terms - MQ4, Arduino IDE, NodeMCU, Blynk, Internet of Things, Data visualisation.

2. INTRODUCTION

The food we take can affect in any form of impurity that may happen due to storage or chemical changes within the food. In some countries, majority of people struggle on daily basis for food, due to preservation of foods and use of chemicals to artificially increase the time span of food causes people illness. It is mandatory to grow a system that can assist people to identify the elegance of food or quality of food items. The quality of the food should check to prevent it from spoiling under different environment conditions like temperature, humidity, vegetable/fruit characteristics, which will be helpful to check quality through different techniques. The sensor senses the food quality through change in its gas-level. There are various signal processing and pattern recognition techniques to detect food intake time through sensors. The rotted or not fit for usage food causes a major food related illness called as food poisoning, this is one of the diseases along with various other such diseases related to spoiled food. One of the main objectives of the food spoiler detector is that it will detect the gas released from the spoiled food and tell the user that the food is spoiled and take a look over food.

3. CIRCUIT DIAGRAM

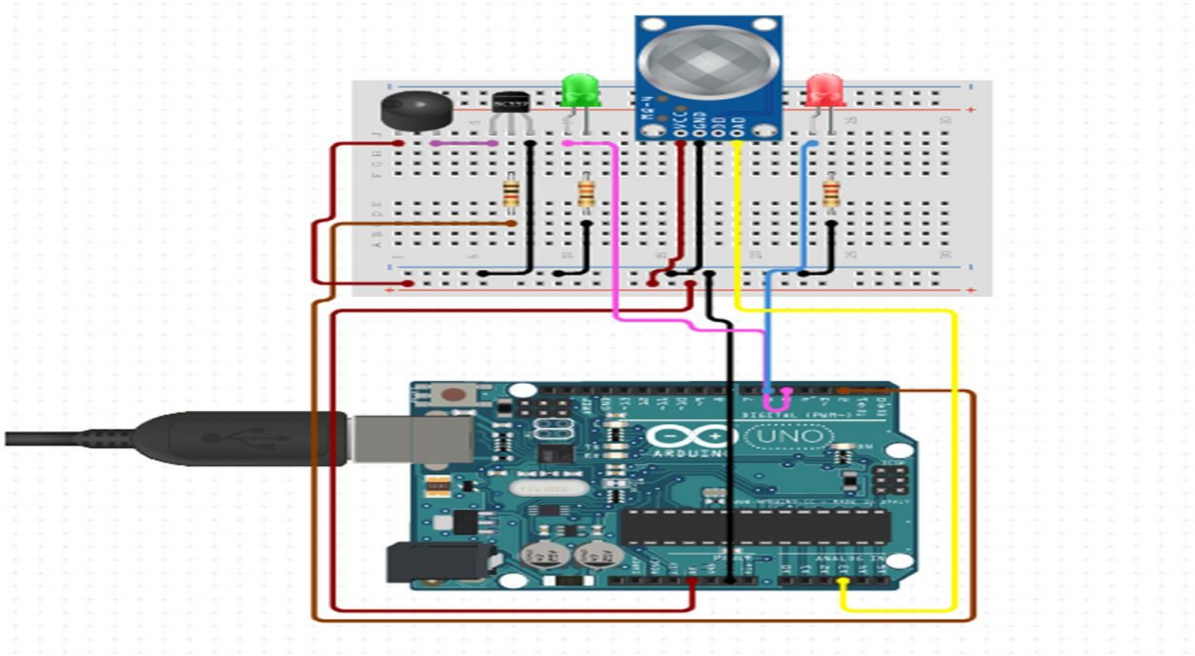


Figure: Proposed Model to predict Spoilage

4. HARDWARE AND SOFTWARE COMPONENTS

NodeMCU (ESP8266)

NodeMCU (ESP8266): It is a development board (Micro- controller) that includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware that is based on the ESP-12E module. It is used for circuiting and allows data transfer using the Wi-Fi protocol.

ARDUINO UNO

Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.

MQ4 SENSOR

MQ4 Methane Gas Sensor detects the concentration of methane gas in the air and outputs its reading as an analog voltage. The concentration sensing range of 300 ppm to 10,000 ppm is suitable for leak detection. For example, the sensor could detect if someone left a gas stove on but not lit.

LED

The lighting emitting diode is a p-n junction diode. It is a specially doped diode and made up of special type of semiconductors. When the light emits in the forward biased then it is called a light emitting diode.

BUZZER

An audio signaling device like a beeper or buzzer main function of this is to convert the signal from audio to sound.

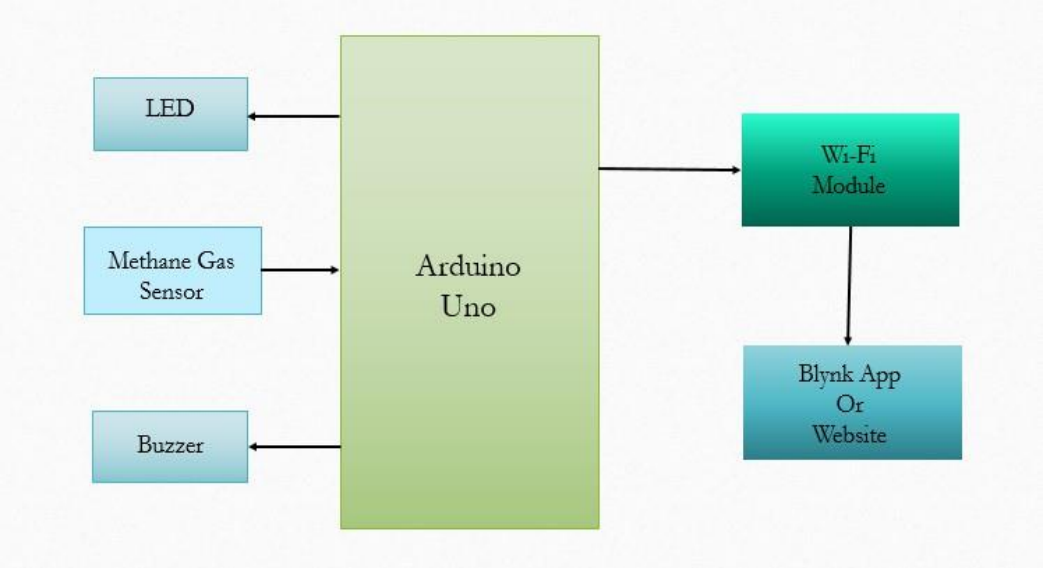
ARDUINO IDE

The Arduino Integrated Development Environment (IDE)is the main text editing program used for Arduino programming. It is where we'll be typing up our code before uploading it to the board you want to program. Arduino code is referred to as sketches.

BLYNK IOT

Blynk IOT powers everything you need to build and manage connected hardware: device provisioning, sensor data visu- alization, remote control with mobile and web applications, OverThe-Air firmware updates, secure cloud, data analytics, user and access management, alerts, automations and much much more.

5. METHODOLOGY



First, we insert the Node MCU, MQ4 Sensor, Buzzer, Green and Red Leds on the Breadboard. Then we make the connections as follow.

Connect the TX and RX pins of NodeMCU to Arduinos Pin 8 and Pin 9.

Next connect the Buzzer's +ve terminal to Pin 10 of Arduino.

Connect the +ve terminal of Green and Red Led to Pin 11 and Pin 12 of Arduino respectively.

Now to get data fron the MQ4 sensor connect its A0 Pin to any Analog Pin of Arduino (we have used A5).

Connect the VCC Pin of the MQ4 Sensor to common +ve on Breadboard and GND to common ground.

Thereafter NODE MCU ESP8266, MQ4, are installed from libraries in Arduino IDE software.

Next create a Blynk IOT account and create project template.

Design your web dashboard with proper visualisation and integrate it with your ESP8266 board.

Download the Blynk IOT application on your Android device with the same user account. Now, the values will also be reflected on your Android device.

Next upload the program to both Arduino and NodeMCU.

Now as soon a Trigger event occurs the threshold value of the given quantity is breached, sends an alert notification to the subscribers via email and pop-up notification on the Blynk app.

```
16:02:26.481 -> Methane Range: 228
16:02:26.528 -> Food Okay Methane Range: 228
16:02:27.474 -> Methane Range: 227
16:02:27.521 -> Food Okay Methane Range: 227
```

Figure: Live Data Stream on Dashboard

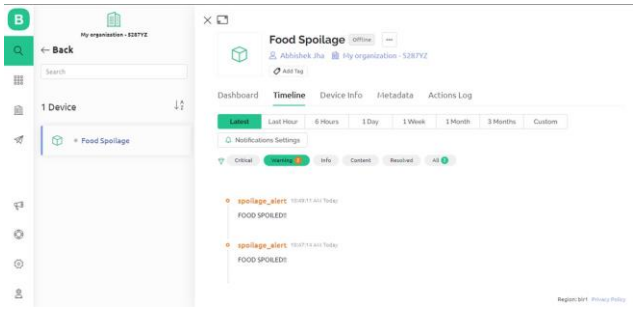


Figure: Food Spoilage Alert on Dashboard

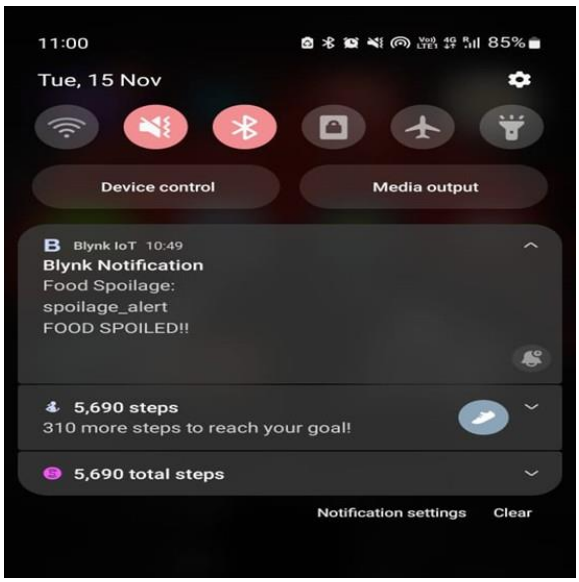


Figure: Food Spoilage Notification Alert via Blynk App

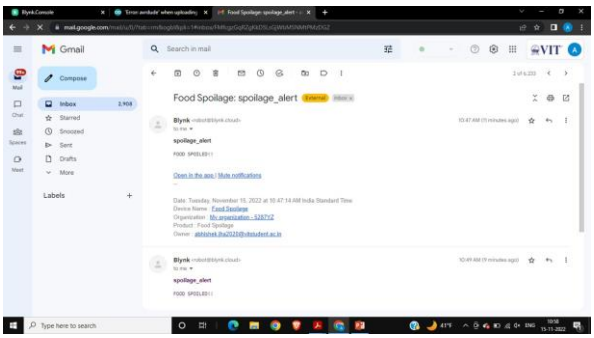


Figure: Food Spoilage Mail

Figure: Food Spoilage Alert on Blynk App

6. CONCLUSION

The Food Spoilage detection system can detect when a food is not edible anymore by checking the levels of methane gas (CH4) it emits which indicates that the food has reached spoilage and it harmful to eat. We upload the data to the BLYNK app, which provides us a warning when the food is spoiled and can even be used to just know the methane levels being emitted by the food.

This system can be expanded upon to have many applications for industry and consumer IOT, for example it can be used in households if we want to keep foods for long periods of time and make sure it is still safe and edible to eat. Food is one of the most important needs which everyone uses in their daily life, regardless of what industry they belong in and thus preservation of food is also extremely essential. We hence aim to target the need for an easy and convenient way to keep track of food spoilage using this system.

7. FUTURE SCOPE

By sensing the levels of methane, we can then take the ratio of methane emitted to some other parameters which we can also measure such as, say weight or humidity. By taking the ratio of these parameters, and see the rate at which it is increasing, we can hence make a rough prediction of how much time it will take the food to get spoiled by comparing to a set of predetermined values of the ratio for which we know the foods will be spoiled.

Machine learning can also be considered, in which we can use a camera to detect the darkening of food and combining the results from other sensors like MQ4 for Methane and DHT for atmosphere conditions we can predict the rate at which it will decay and till what duration it could be edible.

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