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Food Quality Monitoring System Using IoT

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Abstract

In recent year's food wastage has become major problem due to contamination. This is mainly due to the process of storage methods and lack of knowledge on a biotic environmental factors such as temperature, humidity and sunlight. Hence it is necessary for one to maintain food quality throughout the food supply chain. Effective food quality maintaining mechanisms are essential to safeguard the food quality. Therefore, we have interfaced different sensors to monitor the food products. These innovations have led to improved food quality, usability and food safety. The environmental factors can be monitored by DHT11 sensor and MQ3 sensor that are interfaced with Arduino UNO. In this project the real-time data of environmental factors is collected through cloud and are monitored. If the monitored value of any of the factors crosses the threshold value then the person monitoring will be notified via sms through SMTP gateway service and he can them through the mobile application.

Keywords: *IOT, Food quality, monitoring system, Arduino UNO, DHT-11 sensor, Linode cloud, blynk app.*

1. Introduction

The effective maintenance of food storage area plays a vital role in food safety and security. Food may be subjected to contamination and wastage by inappropriate food handling methods and by the environmental parameters. There are many other reasons that is responsible for food contamination like food poisoning and changes in temperature and humidity values. The condition at which the food products are stored plays an important role in maintaining the quality of food.

The food from its production phase has to pass several other phases until it reaches the consumers. After the food product -ion it is subjected to aggregation and then is transported to respective storage area. In that process food may be subjected to contamination because of unhygienic condition or traditional food handling methods.In this process maintaining the food quality is very important with all its nutrient values. This has led us to build an IOT model that not only monitors the environmental factors like temperature and humidity and exposure to light but also manages in controlling these factors.

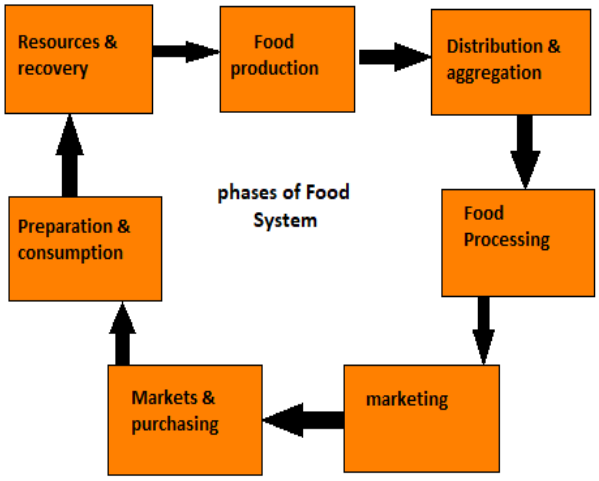

Figure 1: phases of food system

It is possible to monitor the factors by the individual residing far away from the food storage area and he will be notified via SMS if the environmental condition gets worse. Then the controlling is done with help of mobile application called blynk app by increasing or decreasing the value depending on the fixed threshold value.

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2. Related Work

The food quality monitoring system aims at providing better quality and safety of a food product. The similar monitoring systems proposed are as follows: IOT framework for smart food monitoring system. The proposed solution senses all the environmental factors like temperature, humidity and exposure to light. The data values are then compared with threshold values of respective factors and these values are stored in web server. An mobile application is used for user interaction where the data values of environmental factors can be monitored that facilitates user interaction.

3. Methodology

In this project we have proposed a food quality monitoring system which monitors the environmental parameters like temperature, humidity and to detect the presence of alcohol content as these factors affect the nutritional values of a food product. The system is built using arduino UNO which is interfaced with DHT11 sensor, MQ3 Sensor, Node MCU and LCD display

The Arduino UNO is a microcontroller based on ATmega 328P. The board is provided with sets of digital and analog input/output (I/O) pins that may be interfaced to various boards (DHT11 Sensor, MQ3 Sensor, LCD display) and other circuits. The board consists of 14 digital I/O pins, 6 analog I/O pins, and the code for the board is written in Arduino IDE. It IS powered by the USB cable or by an external 9-volt battery.

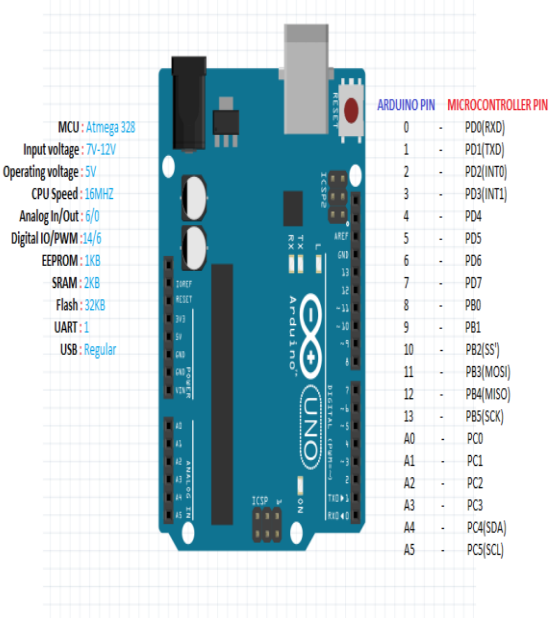

Figure 2: Arduino UNO

The LCD display is an electronic display module that displays visible images using liquid crystal. The 16*2 LCD displays 16 characters per line in a 2 rows. here we are displaying temperature, humidity and odor data.

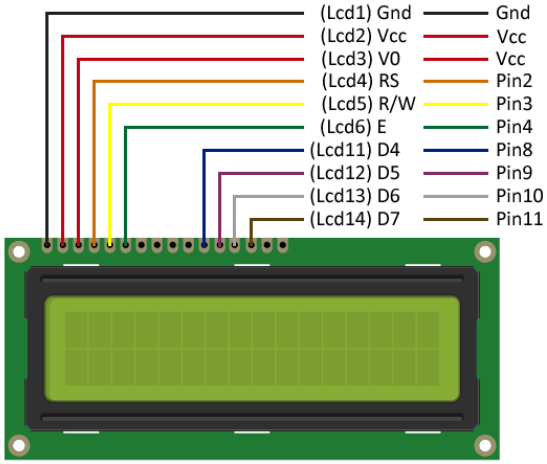

Figure 3: 16*2 LCD display

The DHT11 is a temperature and humidity sensor.DHT11 sensor is made up of a capacitive humidity sensing element and a thermistor for sensing temperature. The capacitor has two electrodes with a moisture holding element as a dielectric material between them. When the humidity in the surround changes the capacitive value also changes. The IC present in it changes this value to digital form. Temperature is measured using negative temperature coefficient thermistor; its function is to decrease the resistance value as the temperature increases. The voltage required is 3 to 5 volts.

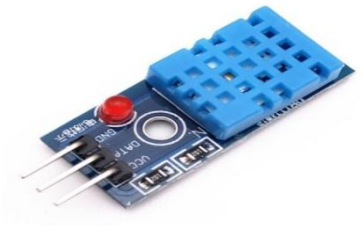

Figure 4: DHT11 Sensor

MQ3 is alcohol sensor using to detect the presence of alcohol whose concentrations ranges from 0.05 mg/L to 10 mg/L. SNO2 is the chemical substance used, its conductivity is less in clean air. The conductivity of the chemical increases as the concentration of alcohol gases increases. It has both digital and analog outputs. This sensor can be easily interfaced with arduino and other boards.

Figure 5: MQ3 sensor

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The node MCU is an open source platform based on ESP8266 WIFI SoC. It is a Wi-Fi module kit which has Analog (i.e. A0) and Digital (D0-D8) pins on its board. It provides serial communication protocols i.e. UART, SPI, I2C etc. with the help Using such serial protocols it is possible to connect it with serial devices like I2C enabled LCD display, Magnetometer HMC5883, MPU-6050 Gyro meter, Accelerometer, RTC chips, GPS modules, touch screen displays, SD cards etc.

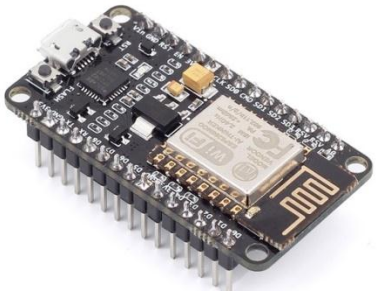

Figure 6: Node MCU

Software requirements

- Arduino IDE.
- Blynk app.

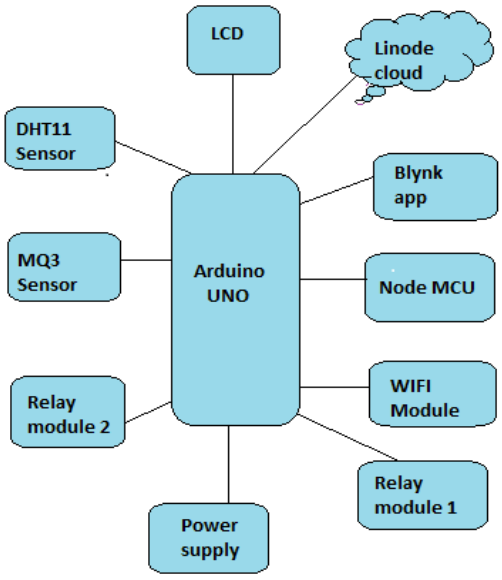

Figure 7: Block diagram

The controller i.e. arduino collects the real-time data from the DHT-11(temperature and humidity) and MQ3(odor) sensors and coverts the data from analog to digital, these values are displayed on 16*2 LCD display screen. Using Wi-Fi module with the help of an API the data is sent to the Linode cloud. UI web page is created to monitor the real-time data in the cloud. We can monitor these real-time data through an IP address provided as a link Threshold values are set for the food products based on testing. If the updated value in the cloud crosses the threshold values they can be set/monitored in accordance to the user. A SMS gateway service is deployed where the user's phone number will be registered and the notification will be sent to the that registered number The cloud stores the sensor values in its variable like field1 and field2 and threshold condition is defined, if the value crosses the threshold value, the SMS function is called in the SMS gateway which sends SMS to the registered mobile number. With the help of Node MCU which consists of ESP8266 Wi-Fi module is connected to blynk app. Blynk is an android app which is freely available on the Googleplay store. A project is created in this app which generates a token. User's device hotspot name, password and the token generated are implemented in the Arduino IDE software. A bulb is provided to produce heating effect in the system as temperature in the system crosses the threshold value notification is sent and with the help of app the individual can turn on the fan which is installed to provide a cooling effect. Once the temperature decreases below threshold value again the light is turned on using the same app.

4. Literature Survey

[1] Alexandru Popa, 13 March 2019. To serve the fundamental information needed for evaluating the quality of the packed food products RFID tags are used. These tags in the form of bar code are put upon these products. The radio waves transmit data (such as manufacturing date etc.) from the tag to a reader then to the computer program. Drawback of using these tags is that sometimes the data provided would not be definite and hence there can be chances of food rotting. The Wireless sensor network (WSN) that are used to record the environmental conditions such as temperature, humidity etc. is not secured. They have a short battery life and speed is also very poor, on the other hand, wired networks have good speed of communication. ["An Intelligent IoT-Based Food Quality Monitoring Approach Using Low-Cost Sensors"] [March-2019]

[2] Asif Bin Karim, August 2018. Cold storage is an environment where our food products are set at a temperature of our choice. It is monitored using Arduino and can fetch real-time data from the sensors. It also as IDE software. Using Arduino is not really efficient where it requires separate coding for Wi-Fi. Instead, Node MCU module which consists of ESP8266 Wi-Fi can be used for its compactness and robustness. Thing Speak is an open source IOT platform that collects data from sensors and store in the cloud which can be retrieved whenever user wants. This platform provides app that lets us analyze and visualize data in MATLAB.["Monitoring food storage humidity and temperature data using IoT"] [August-2018]

[3] Rajini K V, Aaliya Ashfaaq, May 2018. Consumption of contaminated/ preserved food results in food poisoning. Different sensors such as PH sensor, gas sensor and temperature sensor are used with ARM7 microcontroller to check the food quality. Data/values are displayed on a LCD screen and can be prevented from

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harmful diseases. The major disadvantage of this project is that they are only detecting the constraints about food quality and not monitoring the detected item. ["Embedded based Food Quality Detection with Sensor Technology"] [May-2018]

[4] Professor Rajesh Kumar Kushal, 2019. Tracking and monitoring food condition is a great task. GSM module is used to communicate between a computer and a GSM system of a vendor/owner. It is also a part of wireless mobile telecommunications and hence is a kind of a flaw because if the network services are low/down there would be delay in the notification. GSM requires a sim card just like a mobile phone to activate communication with the networks and acts as an extra device implementation which is not much worth to use it. ["Iot Based Smart Food Monitoring System"] [2019]

5. Experimental Results

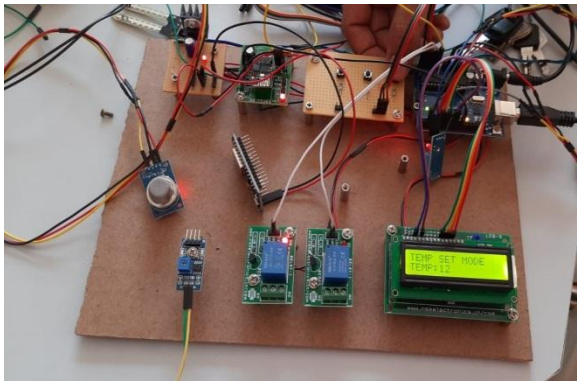

Figure 8: proposed model

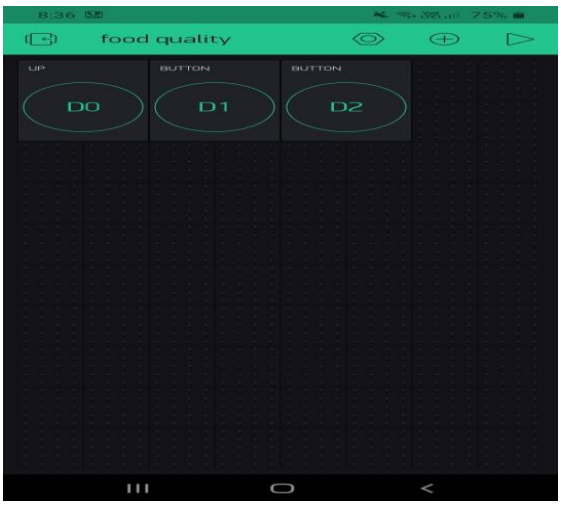

Figure 9: Blynk App

6. Conclusion

The Internet of Things(IOT) has greater impact in our everyday life. It makes one's life smooth and better. In this project, we can understand that the proposed system can determine the food quality and the real time value is monitored through a UI provided by Linode cloud. Once the value crosses the threshold notification is sent to the person who is monitoring. Because of SMS gateway service one can take quick actions and make immediate changes of values. Once the person gets the notification he can control the values using blynk app connected to node MCU. This can be implemented in factories, restaurants etc.. Making it centralized helps us in terms of cost-efficient.

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