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Iot Based Food Quality Checking System

[1]Ms. P.Ananthi, [2]Ms. R.AnbuMaheswari, [3]Ms. K.Manimegala
[1]Assistant Professor, [2,3]Final Year Students,
Department of Electronics and Communication Engineering
Sree Sowdambika College of Engineering, Chettikurichi, Virudhunagar, Tamilnadu

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ABSTRACT: Food and safety hygiene are among the key concerns in order to prevent the wastage of food.However,for lack of technology and ignorance about the effect of humidity, temperature, exposure to light and alcohol content of foods,food safety is not maintained well enough in all places.This has led to massive losses in many food stores resulting from food decay.Currently, majority of food stores and warehouses still rely on manual monitoring of the atmospheric factors related to food quality.These conventional food inspection technologies are limited to weight,volume, colour and aspect inspection and as a result do not provide a lot of information needed on quality of food.The quality of the food needs to be monitored and it must be prevented from rotting and decaying by the atmospheric factors like temperature, humidity and dark.This paper is focused on such food monitoring system which suggests systematic use of various sensors to perform quality monitoring and control of food materials.More precisely,this system consists of gas, temperature,light and humidity sensors, which provides the essential information needed for evaluating the quality of the packed or stored product.This information is transmitted wirelessly to a computer system providing an interface where the user can observe the evolution of the product quality over time using the Internet of Things technology.This IOT system holds the potential to transform food quality control and ensure refer food products.

KEYWORDS: Arduino UNO,MQ3 gas sensor,MQ6 gas sensor,MQ135 gas sensor,LCD,Wifi module ESP8266,RFID card reader.

I. INTRODUCTION

In this paper the food contamination can occur in the production process, but also a large part caused by the inefficient food handling because of inappropriate ambient conditions when the food is being transported and stored. There are many factors leading to food poisoning, typically changes in light intensity, temperature, alcohol content and humidity are important factors. A monitoring system capable of measuring temperature and humidity variability during transport and storage is of prime importance.True yeast metabolizes sugar producing alcohol and carbon dioxide gas. This process is known as fermentation. Hence by checking on alcohol quantity content one can detect the quality of food. This system proposesan intended food quality monitoring system. In this paper, a similar food quality monitoring device will be designed that will keep watch of emission of gases in the food.Spoiled food is very harmful for people and should therefore not be consumed. Often, the growth of spoilage organisms results in the loss of whole batches of food. Food safety and quality has been a major challenge in the food supply chain, stores and warehouses. It is the responsibility of all food service establishments, stores and ware houses to ensure proper safety and quality of food to ensure the health of their customers.

Their primary focus should be on implementing the required quality assurance guidelines and standards resulting in process monitoring systems and preventive control measures. It serves the purpose of preventive consumer health protection by maintaining the required standard ambient conditions needed to preserve the quality of food. However, existing systems have been unable to provide food safety guarantees. Currently the performances and analysis of routine measurements, aimed at detecting changes in the nutritional or health status of the food does not guarantee that.Information collected through monitoring and surveillance must be analyzed and transmitted to decision-makers in an appropriate format and in a timely fashion if it is to be of real value.These quality monitoring devices keep a watch on the environmental factor that cause or pace up decay of the food.The proposed solution is designed to use an IoT platform which is used for logging and monitoring of sensor data. With the power of Internet of Things, the environmental factors affecting the

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food storage can be monitored from anywhere, anytime and from any device.The proposed system should be able to detect the emission of ethanol type of gases,collect data from all the sensors and pass to LCD for display,monitor the sensor data visually online.

- **ARDUINO UNO**

Arduino UNO is a low-cost, flexible, and easy-to-use programmable open-source microcontroller board that can be integrated into a variety of electronic papers. This board can be interfaced with other Arduino boards, Arduino shields, Raspberry Pi boards and can control relays, LEDs, servos, and motors as an output.The Arduino UNO is the best board to get started with electronics and coding. The UNO is the most used and documented board of the whole Arduino family.It is mostly used by the beginners that can use in electronics project and do programming in this board. The board has regular innovation and a bug fix in the design of the board to make the board suitable for the project's use. The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller (MCU) and developed by Arduino.cc and initially released in 2010.The microcontroller 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. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by a USB cable or a barrel connector that accepts voltages between 7 and 20 volts, such as a rectangular 9volt battery. It has the same microcontroller as the Arduino Nano board, and the same headers as the Leonardo board. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.The word "uno" means "one" in Italian and was chosen to mark a major redesign of the Arduino hardware and software.

- **MQ3 Gas Sensor**

Alcohol Gas Sensor MQ3 is a low cost semiconductor sensor which can detect the presence of alcohol gases at concentrations from 0.05 mg/L to 10 mg/L. The sensitive material used for this sensor is SnO_2, whose conductivity is lower in clean air. It's conductivity increases as the concentration of alcohol gases increases. It has high sensitivity to alcohol and has a good resistance to disturbances due to smoke, vapor and gasoline. This module provides both digital and analog outputs. MQ3 alcohol sensor module can be easily interfaced with Microcontrollers, Arduino Boards, Raspberry Pi etc.

This alcohol sensor is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer. It has a high sensitivity and fast response time. Sensor provides an analog resistive output based on alcohol concentration. The drive circuit is very simple, all it needs is one resistor. A simple interface could be a 0 to 3.3V ADC.

- **MQ6 Gas Sensor**

The MQ6 module is used in gas leakage detecting equipment in family and industry. This module has high sensitivity to LPG, iso-butane, propane and LNG. It can also be used to detect the presence of alcohol, cooking fumes, and cigarette smoke.The module gives out the concentration of the gases as an analog voltage equivalent to the concentration of the gases. The module also has an onboard comparator for comparing against an adjustable preset value and giving out a digital high or low. It can be easily interfaced with your Arduino or Raspberry Pi.This is a simple-to-use MQ6 Liquefied Petroleum, iso-butane, propane gas Sensor module, suitable for sensing LPG (composed of mostly propane and butane) concentrations in the air. The MQ6 can detect gas concentrations anywhere from 200 to 10,000ppm.This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance. Sensitive material of MQ6 gas sensor is SnO_2, which with lower conductivity in clean air.

- **MQ135 Gas Sensor**

The MQ135 Gas sensor can detect gases like Ammonia (NH_3), sulfur (S), Benzene (C_6H_6), CO_2, and other harmful gases and smoke. Similar to other MQ series gas sensor, this sensor also has a digital and analog output pin. When the level of these gases goes beyond a threshold limit in the air the digital pin goes high. This threshold value can be set by using the on-board potentiometer. The analog output pin, outputs an analog voltage which can be used to approximate the level of these gases in the atmosphere.The MQ135 air quality sensor module operates at 5V and consumes around 150mA. It requires some pre-heating before it could actually give accurate results.The MQ135 is one of the popular gas sensors from the MQ series of sensors that are commonly used in air quality

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control equipment. It operates from 2.5V to 5.0V and can provide both digital and analog output.

- **LCD**

LCD is a flat panel display technology that is commonly employed in television sets and computer
monitors.LCD means Liquid Crystal Display that can show 16 characters in each of its two rows, providing a total of 32 characters of information. It is commonly used to display alphanumeric information in various electronic devices.LCDs are lit by a backlight, and pixels are switched on and off electronically while using liquid crystals to rotate polarized light.It is lighter, thinner and flexible. LCD provides excellent resolution, brightness, and contrast so the picture quality is crystal clear. LCDs can be suitable with CMOS integrated circuits so making an LCD is very easy. It gives perfect sharpness at the native resolution.It has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. But the most used one is the 16*2 LCD.

- **Wifi module (ESP8266):**

Wi-Fi module is a device made up of a microcontroller, Medium Access Control, baseband and radio frequency front end. An ESP8266 Wi-Fi module is a SOC microchip mainly used for the development of end-point IoT (Internet of Things) applications. It is referred to as a standalone wireless transceiver, available at a very low price. It is used to enable the internet connection to various applications of embedded systems.Expressive systems designed the ESP8266 Wi-Fi module to support both the TCP/IP capability and the microcontroller access to any Wi-Fi network. It provides the solutions to meet the requirements of industries of IoT such as cost, power, performance, and design.It can work as either a slave or a standalone application. If the ESP8266 Wi-Fi runs as a slave to a microcontroller host, then it can be used as a Wi-Fi adaptor to any type of microcontroller using UART or SPI. If the module is used as a standalone application, then it provides the functions of the microcontroller and Wi-Fi network.The ESP8266 Wi-Fi module is highly integrated with RF balun, power modules, RF transmitter and receiver, analog transmitter and receiver, amplifiers, filters, digital baseband, power modules, external circuitry, and other necessary components.

- **RFID Card Reader**

An RFID reader is a radio frequency device that emits a signal through an antenna. This signal is received by RFID tags that respond to interrogation by the reader. Responses are read by the reader, and through a variety of protocols the reader can communicate with all the RFID tags in its field.The RFID reader is a network-connected device that can be portable or permanently attached. It uses radio waves to transmit signals that activate the tag. Once activated, the tag sends a wave back to the antenna, where it is translated into data. The transponder is in the RFID tag itself.RFID devices use electromagnetic fields to automatically identify and track compatible RFID tags. The tags contain unique electronically stored information, which is read by the RFID readers.It is a technology that uses radio waves to passively identify a tagged object.RFID cards work by emitting a radio signal that a scanner can read. The scanner emits a signal that the card receives, which then responds by transmitting the information stored on the card. This process allows the card to be read without having to be physically touched by the scanner.

- **Arduino programming language**

The Arduino language is merely a set of C/C++functions that can be called from your code.The Arduino environment performs some minor pre-processing to turn your sketch into aC++ program.Your sketch undergoes minor changes (e.g.automatic generation of function prototypes)and then is passed directly to a C/C++compiler (avr-g++).All standard C and C++ constructs supportedby avr-g++ should work in Arduino.It is open source: The Arduino software and hardware are open source. In essence, this means users have access to the source code and can modify it to suit their needs. It is based on C++: The Arduino programming language is based on C++, a widely used and well-known programming language.Fig 1 shows theblock Diagram of Proposed System

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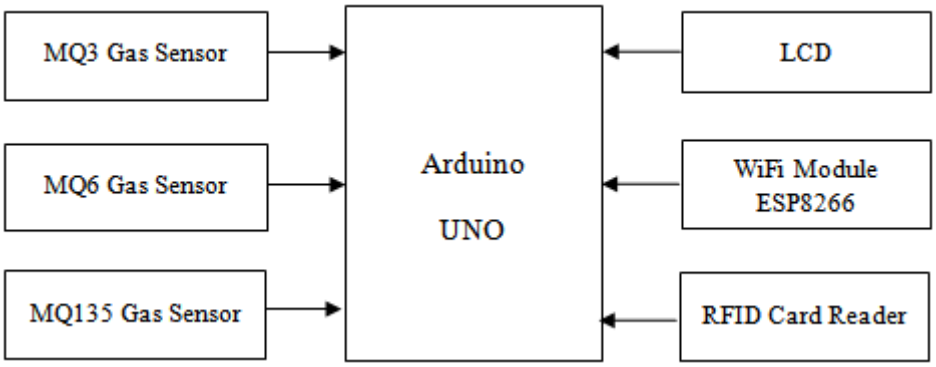

Fig 1:- Block Diagram of Proposed System

- **IMPLEMENTATION**

The IoT based food monitoring system has to be installed in a food store. Once it is installed properly and then it is powered ON. The device connects through the internet via modem, and it starts collecting the data from the surrounding where it is stored. The DHT-11 sensor senses the temperature and humidity of the food storage and displays the information through the LCD display and the same sent in telegram app also. The different gas sensors which are connected to the Arduino board also reads the gas liberated by the food samples and compares it with the threshold value. The gas sensors like MQ3 and MQ6 sensors are connected to the Arduino through ADC channel. The sensor data are passed to the LCD display in the form of character. The data uploads to the server by using ESP8266 Wi-Fi module connected to the Arduino. The analog pin of Arduino gets information from analog output of Arduino which has inbuilt ADC that converts analog to digital value. Fig 2 shows the Interfacing of all sensors to Arduino

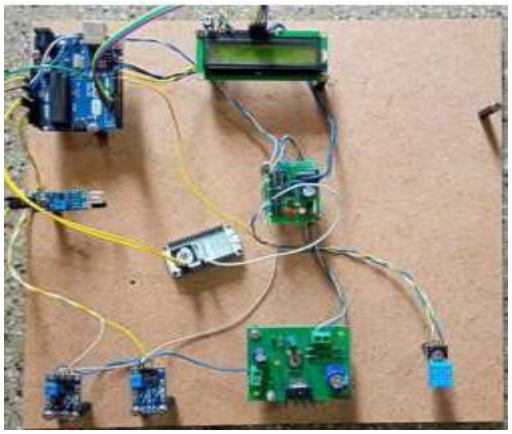

Fig 2:- Interfacing of all Sensors to Arduino

II. RESULTS

During phase one testing, only gas sensor was connected to the Arduino board and the food quality was tested. Gas sensor is connected to Arduino and it is subjected to take values for the food which is in good condition. Along with this LED's are also connected to indicate in initial conditions. When a food is in good condition and its gas emitted value is less than the threshold value then green LED is on and also the same can be observed on the computer (which says "Food is good"). In the next phase of testing, LCD is connected to gas sensor and Arduino. This is the result of testing a fresh food by the gas sensor. The result of which can be seen in LCD which says "Food is good" and also gives the gas value emitted in PPM. The result of which can be seen in LCD which says "Food is bad" and also gives the gas value emitted in PPM. Here rotten Channa was tested. It includes temperature, humidity sensor and 3 gas sensors(MQ3, MQ6 and MQ135) a node MCU to send messages through Telegram application. Message is send through Telegram App to the phone. This is done by the Node MCU that is connected to the Arduino.

III. CONCLUSION

The food quality monitoring system was able to detect the emission of ethanol type of gases. It was also able to collect data from all the sensors and pass to LCD for display and lastly monitor the sensor data visually online.The food monitoring system using IoT has awide range of applications in food processing industry. This addresses the critical issues like food waste, food contamination etc. The threshold value of the device is maintained according to the food sample as each food has its own different threshold value. The array of gas sensors helps in reducing the chances of inaccurate readings. The device can be customized and can be used for other applications also.This project uses

many low cost sensors which will reduce the cost and improves the efficiency.

REFERENCES

[1]. C. Arun, K. Lakshmi Sudha "Agricultural Management using Wireless Sensor Networks – A urvey" 2012 2nd International Conference on Environment Science and Biotechnology IPCBEE vol.48 (2012) © (2012) IACSIT Press, Singapore

[2]. Bhargav Vijendra Sangam, Jayashree G R,Dr.Giris V.Attimarad,Volume7,Food monitoring system using IOT,2022.

[3]. Soumya T K, "Implementation of IoT based Smart Warehouse Monitoring System", International Journal of Engineering Research & Technology, Vol 6, Issue 5, 2018, pp. 1-4.

[4]. Y. Gu, W. Han, L. Zheng and B. Jin, Using iot technologies to resolve the food safety problem--an analysis based on chinese food standards, 2012, pp. 380-392.

[5]. L. a. Z. H. a. H. W. a. Z. X. Zheng, J. He, Z. Zhang, Y. Gu, J. Wang and others, "Technologies, applications, and governance in the internet of things," 2011.

[6]. A.Azad, S. Akbar, S. Mhaisalkar, L. Birkefeld and K. Goto, "Solid-state gas sensors: A review," Journal of the Electrochemical Society, vol. 139, no. 12, pp. 3690, 1992.

[7]. C.-J. Du and D.-W. Sun, "Learning techniques used in computer vision for food quality evaluation: a review," vol. 72, pp. 39-55, 2006.

[8]. K.Mohanraj, S.Vijayalakshmi, N.Balaji, R.Chithrakkannan, R.Karthikeyan, "Smart Warehouse Monitoring Using IoT", International Journal of Engineering and Advanced Technology, Vol 8, Issue 6, 2019, pp. 3597-3600.

[9]. Y. a. H. W. a. Z. Y. a. L. L. a. W. J. a. Z. L. Liu, "An Internet-of-Things solution for food safety and quality control: A pilot project in China," vol. 3, pp. 1-7, 2016.

[10]. Z. Pang, Q. Chen, W. Han and L. Zheng, "Value-centric design of the internet-of-things solution for food supply chain: Value creation, sensor portfolio and information fusion," Information Systems Frontiers}, vol. 17, pp. 289-319, 2015.