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DETECTION OF FOOD SPOILAGE USING IOT

Santhosh .M[1], Dilip.A[2], Madhan Kumar.P [3], Krishnakumar[4]
[1] *UG – Agriculture Engineering, SNS College of Technology, Coimbatore, Tamil Nadu*
[2] *UG -Agriculture Engineering, SNS College of Technology, Coimbatore, Tamil Nadu*
[3] *UG -Agriculture Engineering, SNS College of Technology, Coimbatore, Tamil Nadu*
[4] *Professor, Agriculture Engineering, SNS College of Technology, Coimbatore, Tamil Nadu*
Corresponding Author Orcid ID: https://orcid.org/0009-0006-8286-4882

ABSTRACT
Food safety plays important role in countries economy and human health. The integrated IoT-based online monitoring approach using smart logistics can address the critical needs of reducing food waste, increasing transportation efficiency, and tracking food contamination. Majority of consumers only pay attention to the ingredients used and their nutritional value. The parameters like humidity, bacteria, and temperature are major factors on which the rate of decomposition of food depends on. If the temperature of the storage is between 40F to 140F, it is a danger zone because, bacteria grow rapidly, doubling its number in 20 min. Similarly, the humidity in the food storage room should be around 50-55%.So in this IoT project, a Food Monitoring device is implemented to monitor the real-time values of the temperature, humidity, and methane gas, which are prime measures in food quality, will be measured and displayed.
Keywords— Food safety,IOT,Food monitoring,Food quality

I. Introduction
In this project, a similar food quality monitoring device will be designed that will keep watch of environmental factors like temperature, humidity, gas content and exposure to light The device is built on Arduino UNO which is a popular prototyping board. The Arduino board is interfaced with various sensors like DHT-22 to monitor temperature and humidity, MQ3 to detect gas content and LDR to measure exposure to light. This is an IoT device and sends the measured sensor data to an IoT platform. The ESP8266 Wi-Fi Modem is interfaced with the Arduino to connect it to the internet via Wi-Fi router. The sensor data is also displayed on a character LCD interfaced with the Arduino UNO. The IoT platform used for logging and monitoring of sensor data is Freeboard.io. With the power of Internet of Things, the environmental factors affecting the food storage can be monitored from anywhere, anytime and from any device.

II. Materials Used
1.ARDUINO UNO:
The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.
2.POWER
Power The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack.
3.MEMORY
The ATmega328 has 32 KB (with 0.5 KB used for the bootloader).
4. NODE MCU
The ESP8266 is the name of a micro controller designed by Espressif Systems. The ESP8266 itself is a self- contained WiFi networking solution offering as a bridge from existing micro controller to WiFi and is also capable of running self-contained applications. This module comes with a built in

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USB connector and a rich assortment of pin-outs. With a micro USB cable, you can connect NodeMCU devkit to your laptop and flash it without any trouble, just like Arduino. It is also immediately breadboard friendly.

4.MQ3 GAS SENSOR

Power requirements: 5 VDC @ ~165 mA (heater on) / ~60 mA (heater off)
Current Consumption: 150mA
DO output: TTL digital 0 and 1 (0.1 and 5V)
AO output: 0.1- 0.3 V (relative to pollution), the maximum concentration of a voltage of about 4V
Detecting Concentration: 0.05-10mg/L Alcohol

5.LDR SENSOR

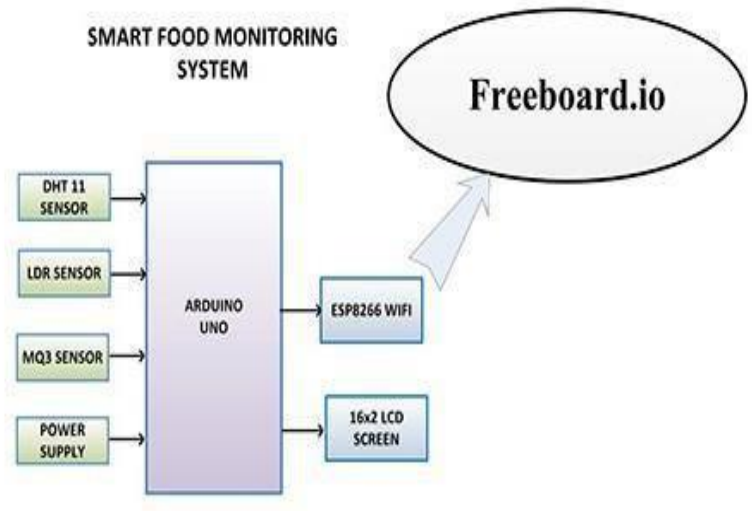
The Light Dependent Resistor (LDR) is just another special type of Resistor and hence has no polarity. Meaning they can be connected in any direction. They are breadboard friendly and can be easily used on a perf board also. The symbol for LDR is just as similar to Resistor but adds to inward arrows as shown above. The arrows indicate the light signals.

6.DHT22 SENSOR

DHT22 output calibrated digital signal. It utilizes exclusive digital-signal-collecting-technique and humidity sensing technology, assuring its reliability and stability.Its sensing elements is connected with 8-bit single-chip computer.

III. METHDOLOGY

There is a sensor unit to monitor the critical environmental parameters like temperature, humidity, light, gas content etc.
The DHT-22 sensor which is a digital sensor will sense the humidity and temperature of the food and give it to the Arduino. MQ3 alcohol sensor is an analog sensor module which is used to detect the presence of ethanol. Ethylene is a natural gas given off by fruits that causes in ripening. Apples and Bananas give off more ethylene than other fruits at the stage of ripening.
LDR is used to sense the intensity of light. LCD [Liquid Crystal Display] is 16x2 dipaly which displays the values from the sensors.
The values from these sensors are given to the Arduino UNO [ATmega328 based microcontroller board]. It has 14 GPIO pins, 6 PWM pins, 6 Analog inputs and an on board UART,SPI and Interface.
The values from the Arduino are given to NODE MCU. NODE MCU is an open source firmware and development board which has an in built Wifi module and this uploads the data into the cloud and the data from the cloud is taken by the BLYNK application.



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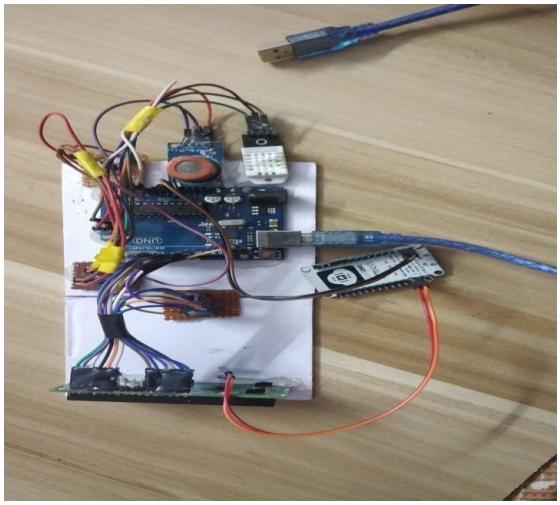
I.RESULTS & DISCUSSION

This picture represents the final product of the machine.



S.no	Condition of Banana (At room temperature)	Gas Value (as shown by the MQ3 sensor) in meter cube
1		Banana is edible [50-58]
2		Banana is edible [60-68]
3		Banana is about to spoil [70-75]
4		Banana is spoiled [More than 75]

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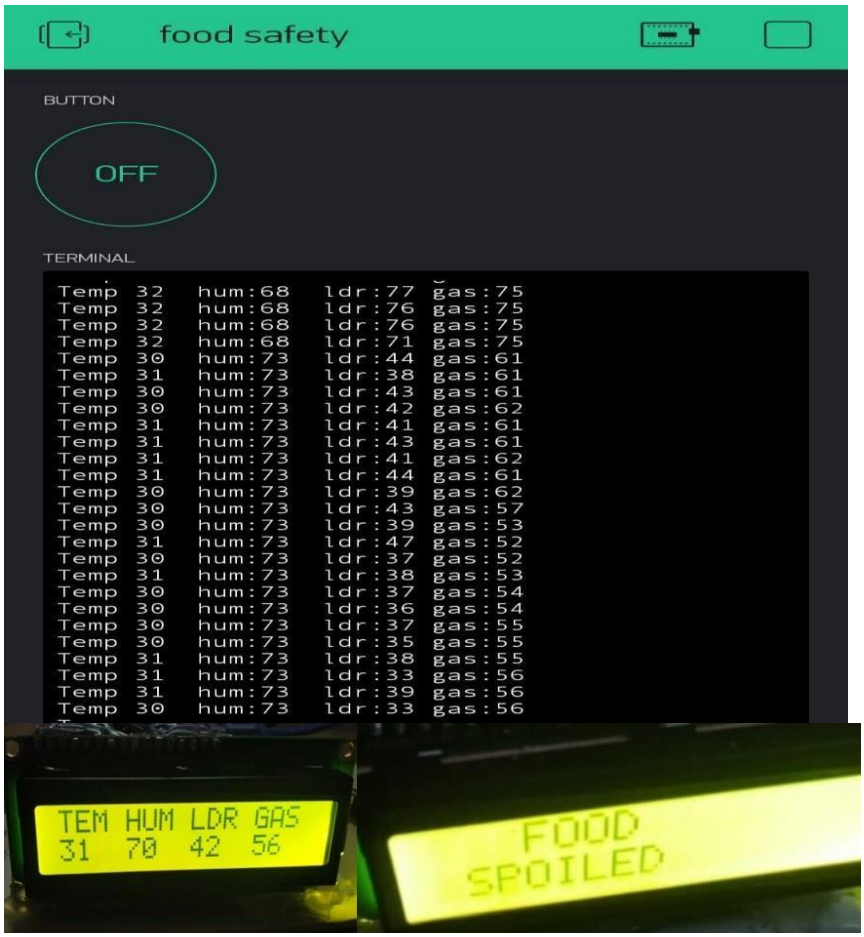

CONCLUSION

The integrated IoT-based online monitoring approach using smart logistics can address the critical needs of reducing food waste, increasing transportation efficiency, and tracking food contamination.The experimentation was a success and from this experimentation we can understand how to measure the temperature and humidity, LDR values, and the ethane gas data given off during the spoilage of food, especially in “BANANAS”. Ethylene is a natural gas given off by fruit that helps in ripening.Too high a temperature destroys enzymes, and too low a temperature can break down the cell walls of the fruit so the contents mix and the fruit oxidizes, browns and softens abnormally. The optimum temperature and humidity conditions for ripening are 62 to 68 degrees Fahrenheit and 90 to 95 percent relative humidity.The food is monitored at different conditions and evaluated on a daily basis. Many such devices can be installed at a location for better monitoring and quality control.So in this IoT project, a Food Monitoring device is implemented to monitor the real-time values of the temperature, humidity, and methane gas, which are prime measures in food quality, will be measured and displayed. If the temperature is at the critical value, user will receive a notification through an app

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Future Enhancements

Food poisoning has been the source of innumerable diseases, to reduce and avoid illness we use biosensors and electrical sensors to determine the freshness of household food items like diary, fruits, to expend the device for more items by adding new sensors and by using existing sensors. User can also get output in the form of notification and also through the lcd display.

References

1. Rajesh Kumar Kaushal, Harini. T, Pavithra Lency.D, Sandhya.T, Soniya.P, “IoT Based Smart Food Monitoring System”, International Journal Of Current Engineering And Scientific Research, Vol 6, Issue 6, 2019, pp. 73-76.
2. https://en.wikipedia.org/wiki/Food_loss_and_waste
3. Jyotshana Upadhyay. "Digital Marketing Practices Adoption in Micro, Small and Medium Businesses for Inclusive Growth". *International Research Journal on Advanced Science Hub*, 4, 04, 2022, 75-80. doi: 10.47392/irjash.2022.021
4. Arti Maurya; Kartick Chandra Majhi; Mahendra Yadav. "One Pot Synthesis of Lanthanum Doped Cobalt Selenate Electrocatalyst for Oxygen Evolution Reaction (OER)". *International Research Journal on Advanced Science Hub*, 4, 04, 2022, 81-87. doi: 10.47392/irjash.2022.022
5. Palash Mondal; Hrittik Dey; Sreetama Paul; Shamik Sarkar; Apurba Das; Amit Karmakar. "Additively manufactured porous titanium alloy scaffolds for orthopaedics: An effect of process parameters on porosity". *International Research Journal on Advanced Science Hub*, 4, 04, 2022, 88-93. doi: 10.47392/irjash.2022.023
6. Kousik Bhattacharya; Avijit Kumar Chaudhuri; Anirban Das; Dilip K. Banerjee. "A Data Mining based study on Dengue Fever: A Review". *International Research Journal on Advanced Science Hub*, 4, 04, 2022, 101-107. doi: 10.47392/irjash.2022.025
7. Bharathi M; Senthil Kumaran S; Edwin Samson P. "Influence of Nano Silica Particles on Quasistatic Mechanical and Low Velocity Impact Properties of Carbon-Glass-Sunn Hemp/Epoxy in Intra-Inter Ply Hybrid Composites". *International Research Journal on Advanced Science Hub*, 4, 05, 2022, 120-133. doi: 10.47392/irjash.2022.032
8. Anukriti Sharma; Navdeep Singh. "Hybrid Modulation for Reduced Switches AC-AC Multi Frequency Converter". *International Research Journal on Advanced Science Hub*, 4, 05, 2022, 134-142. doi: 10.47392/irjash.2022.033
9. Kousik Bhattacharya; Avijit Kumar Chaudhuri; Anirban Das; Dilip K. Banerjee. "Comparison of Recent Data Mining Algorithms to Identify of the factors and effects of Dengue Fever and Ensemble Random Forest, A new Algorithm". *International Research Journal on Advanced Science Hub*, 4, 05, 2022, 143-153. doi: 10.47392/irjash.2022.034
10. Ch Yashwanth Krishna; Y Shanmukha Venkata Sri Sai; Muniyandy Elangovan. "Development of Telemetry system for Student Formula Cars and All-terrain vehicles". *International Research Journal on Advanced Science Hub*, 4, 05, 2022, 154-160. doi: 10.47392/irjash.2022.035

DOI:10.46647/ijetms.2023.v07i03.041 ISSN: 2581-4621

11. Thenmozhi S; Praveen A; Subhavarman S; Jaipriya S; Malathy S. "QoS based Prioritization using Shortest Path and Hamming Residue Method". *International Research Journal on Advanced Science Hub*, 4, 05, 2022, 161-167. doi: 10.47392/irjash.2022.036
12. Ms. Ritu; Preeti Chawla. "Factor Affecting User Acceptance for Digital Wallets: A Developing Country's Perspective". *International Research Journal on Advanced Science Hub*, 4, 06, 2022, 168-174. doi: 10.47392/irjash.2022.041
13. Jagandas S.; Mallikarjuna Rao G; Hitesh Kumar M; Srujan Kumar T. "A Scientometric Review of Na2SiO3/NaOH Versus SiO2/Na2O is above 2.85:1 Alkaline solution Activated Geopolymer Concrete". *International Research Journal on Advanced Science Hub*, 4, 06, 2022, 175-179. doi: 10.47392/irjash.2022.042
14. Muniyandy Elangovan; Mohammed Nayeem; Mohamed Yousuf; Mohamed Nauman. "Energy opportunities for delivery robot during Disaster". *International Research Journal on Advanced Science Hub*, 4, 06, 2022, 180-185. doi: 10.47392/irjash.2022.043
15. R. Devi Priya, R. Sivaraj, Ajith Abraham, T. Pravin, P. Sivasankar and N. Anitha. "MultiObjective Particle Swarm Optimization Based Preprocessing of Multi-Class Extremely Imbalanced Datasets". International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems Vol. 30, No. 05, pp. 735-755 (2022). Doi: 10.1142/S0218488522500209
16. Rajashekhar, V., Pravin, T., Thiruppathi, K.: A review on droplet deposition manufacturinga rapid prototyping technique. Int. J. Manuf. Technol. Manage. 33(5), 362–383 (2019) https://doi.org/10.1504/IJMTM.2019.103277
17. Rajashekhar V S, Pravin T, Thirupathi K, Raghuraman S.Modeling and Simulation of Gravity based Zig-zag Material Handling System for Transferring Materials in Multi Floor Industries. Indian Journal of Science and Technology.2015 Sep, 8(22), pp.1-6.
18. Nagendra Singh; Manoj Kumar Agrawal; Sanjeev Kumar Verma; Ashish Kumar Tiwari. "Study of the effect of ECAPed Method on the Mechanical Properties of AA 5083: An Overview". *International Research Journal on Advanced Science Hub*, 4, 06, 2022, 186-191. doi: 10.47392/irjash.2022.044
19. Muniyandy Elangovan; Mohamed Yousuf; Mohamed Nauman; Mohammed Nayeem. "Design and Development of Delivery Robot for Commercial Purpose". *International Research Journal on Advanced Science Hub*, 4, 07, 2022, 192-197. doi: 10.47392/irjash.2022.047
20. Manikandan N; Swaminathan G; Dinesh J; Manish Kumar S; Kishore T; Vignesh R. "Significant Attention in Industry and Academia for Wire Arc Additive Manufacturing (WAAM) - A Review". *International Research Journal on Advanced Science Hub*, 4, 07, 2022, 198-204. doi: 10.47392/irjash.2022.048
21. https://learnenglish.britishcouncil.org/skills/reading/advanced-c1/a- threat-to-bananas. [4]Available: https://www.nationalgeographic.com/environment/article/food-journeys-graphic
22. Soumya T K et. al , "Implementation of IoT based Smart Warehouse Monitoring System", International Journal of Engineering Research & Technology,Vol6,Issue5,2018,pp.1-4.
23. H. L. Yin, Y. M. Wang, "An Effective Approach for the Design of Safety Fresh Food Supply Chain Networks with Quality Competition", IEEE International Conference on Information and Automation, 2017, pp.921-924.
24. F. Kamoun, O. Alfandi and S. Miniaoui, "An RFID Solution for the Monitoring of Storage Time and Localization of Perishable Food in a Distribution Center", Global Summit on Computer & Information Technology,2015,pp.1-6.
25. Available;http://www.eatbydate.com/fruits/fresh/bananas-shelf-life-expiration-date/
26. https://docs.blynk.cc/