IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 8.102 ⁜ Vol. 12, Issue 4, April 2023

DOI: 10.17148/IJARCCE.2023.12455

Freshness Analysis of Fruits Using Machine Learning

Gowrav R Hegde[1], Shreelaxmi[2], Shreyitha[3], Sourav N Shetty[4], Prakash L S[5]

Department of ECE, Mangalore Institute of Technology & Engineering, Mangalore, India[1-4]

Assistant Professor, Department of ECE, Mangalore Institute of Technology & Engineering, Mangalore, India[5]

Abstract: Fruit ripening is a normal process. Fruit naturally produces ethylene, which is what causes fruit to mature. But to speed up this process so their product will hit the market earlier and they can optimise profit, dealers and sellers frequently use chemicals like CaC2. Chemicals are used to preserve fruits in storage. This substance reacts with moisture to create ethylene, which causes the berry to ripen. Contrary to when a fruit ripens naturally, which results in uneven ripening because natural ethylene present in fruits is unevenly distributed, when ethylene is present in large quantities and comes into contact with the fruit's surface area, it uniformly causes the fruit to ripen.Therefore, the suggested method obtains a picture of the fruit being tested and compares it to the characteristics of naturally and artificially ripened fruit before providing an output with a probability. This technique uses a smartphone running an Android programme.

I. INTRODUCTION

Modern food goods frequently have "Best By" or "Use By" inscribed on the packaging.The food is tested by the maker in a controlled setting. However, it experiences management errors and temperature swings while being transported from the farm to the refrigerator. The packaging's stated expiration date is therefore inaccurate, and this uncertainty contributes significantly to worldwide food loss. Before dispersing their products to the market, farmers frequently keep their food products in depots for a long time, which causes significant food loss because one spoiled batch typically spoils the entire batch. Farmers suffer significant losses, which raise prices and have a negative impact on the business.Manufacturers, the food processing industry, and stores can use the system in food storage facilities to watch food quality in real-time and assist consumers in gaining full openness about the food they ingest. People can eat, donate, or compost food if they are aware of the precise date that it will go bad. By doing this, food waste is drastically reduced and the Conventional ways of food disposal (which raise CO2 levels) are avoided. A farmer can anticipate and plan the distribution of his product, which is one of the agro-benefits. The grower will be informed when one lot of the product is ripe and ready, at which point he can sell it right away.Bananas are commonly kept together in a storage where ethylene gas released from the first banana starts a ripening wave. This process speeds up the ripening of other fruits as well, causing food to overripen earlier than anticipated.So, reducing food waste requires ongoing surveillance. Banana ripening stages have been identified using computer vision in earlier research, but these techniques are computationally costly and memory-intensive for storing the data and running machine learning algorithms. Instead, we used sensors to identify the emission of combustible gases from the food items, including temperature, humidity, and gas sensors.

II. METHODOLOGY

Fruit ripening is a normal process, but retailers use chemicals to speed it up. The food is put through regulated testing by the manufacturer. However, while being moved from the field to the refrigerator, it encounters managerial blunders and temperature changes. The packaging's stated expiration date is therefore inaccurate, and this uncertainty contributes significantly to worldwide food loss. Instead, we used instruments to identify the emission of combustible gases from the food items, including temperature, humidity, and gas monitors. This approach will enable us to get numerical numbers.

When a farmer can forecast and plan the distribution of his product, agro advantages are evident. The grower will be informed when one lot of the product is ripe and ready, at which point he can sell it right away. Additionally,

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 8.102 ⁜ Vol. 12, Issue 4, April 2023

DOI: 10.17148/IJARCCE.2023.12455

the system will let him know if a lot starts to become overripe so that he can save the other goods. Additionally, this will lessen volatility in the world food market.

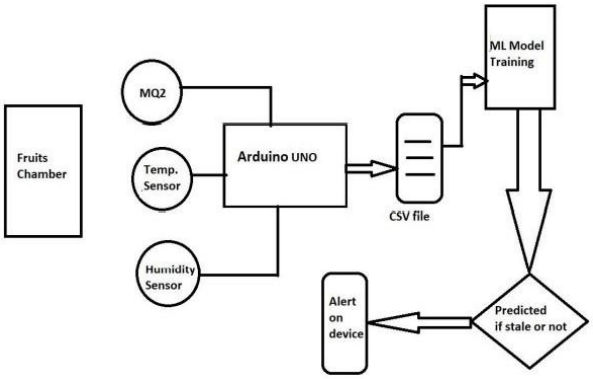


Fig.1:Block diagram offres hness analysis of fruits

III. LITERATUREREVIEW

Singh Gill H et.al.[1]:This article suggests a new deep learning approach for classifying fruit images that employs Convolution Neural Network (CNN), Recurrent Neural Network (RNN), and Long Short Term Memory (LSTM) techniques. The classification precision is affected by the optimal characteristics that were selected and picked. CNN, RNN, and LSTM were all used as deep learning apps to categorise the vegetables.

Sonwani E et.al.[2]: Researchers are creating novel techniques to keep food quality in an attempt to increase the shelf life of grains because they are prone to spoilage as a result of wetness, humidity, temperature, and a number of other factors. Systems that are successful at monitoring food spoilage are required to uphold current standards of food quality. We have developed a prototype to track food quality and regulate home storing systems. First, they used a Convolutional Neural Network (CNN) model to distinguish between the various kinds of fruits and veggies. After that, by keeping an eye on the temperature, humidity, and gas emission levels of fruits and veggies, the proposed system uses sensors and motors to determine the degree of food spoilage.

FaudNet.al.[3]:In this study, two techniques for classifying EEG signals—support vector machines (SVM) and k-nearest neighbour (kNN)—are investigated.For instance, a classifier might build a classification model by using input features acquired from a dataset and tuning parameters to construct a classification model, and then use the model to forecast the matching class of new input in an unknown dataset. EEG data are polluted with various noises and artifacts, are non-stationary, have a poor signal-to-noise ratio, and are non-linear. (SNR).

San M et.al.[4]: The fruit 360 dataset contains images of five distinct classes of fruits, and this paper suggests a features fusion technique to identify them. Next, they undergo preprocessing, boundary extraction, feature extraction, and classification, which are all four steps of processing. The morphological procedure is combined with boundary extraction during pre-processing to remove noise using the median filter. During feature extraction, they have taken two distinct types of features from the image: structural and color features. Color characteristics are taken from the freshness research of fruits using a machine learning RGB color channel. Using morphological procedures, morphological features were extracted from the image that displayed the fruit border.

M.Alongiet.al.[5]:Ready-to-eat greens are extremely perishable and lose quality within 6-7 days, so extending their storage life remains difficult. In this study, fresh-cut lettuce infant leaves were surface-decontaminated using an atmospheric pressure plasma jet (APPJ). As a function of the treatment time, the effectiveness of the APPJ antimicrobial on the native bacteria and its effect on some physicochemical characteristics of cabbage were assessed. (0–30 s).

AnandGet.al.[6]:This essay suggests a feature-fusion method. This paper's goal is to suggest a new breed of

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified ⁜ Impact Factor 8.102 ⁜ Vol. 12, Issue 4, April 2023
DOI: 10.17148/IJARCCE.2023.12455

smart refrigerator that is enhanced with sensors, a camera, and an image recognition system. Food preservation and storage for a long time are frequently done in refrigerators. People's concentration on their jobs has increased as a result of the modern lifestyle, leaving them with less time to think about what they eat every day. They eventually lose awareness of the amount and quality of food kept inside frequently. Food insecurity, particularly in developing countries, and rising greenhouse gas emissions are both caused by food waste.

Akhtar Met.al.[7]:Bread ripening is a common cause of food transit issues. To collect data for this study, we built a prototype that detects CO and CO_2 in bread shopper sacks using an Arduino Nano microprocessor and MQ series sensors. To determine the present state of the bread in these stores, this data is further processed using a number of machine learning techniques. However, the data these instruments gathered was dispersed.

AdekanleMet.al.[8]:The objective of this study was to assess the microbiological viability of raw fruits and vegetables. Twenty different samples of fruits and vegetables were chosen at random from ten different vendors in the Shagamu market in Ogun State, Nigeria. Using standard microbiological techniques, the levels of aerobic plate counts, total coliform counts, yeast and mould counts, and antibiotic resistance research findings were calculated.

KagayaHet.al.[9]:In this study, a convolutional neural network was used to recognize and identify culinary images. (CNN). Due to the vast variety of food types, it is typically very challenging to recognize images of food items. Though CNN is a cutting-edge deep learning method, deep learning has lately been demonstrated to be a very effective image identification strategy. Through parameter optimization, we used CNN to carry out the duties of food identification and categorization.

Salcedo-SanzSet.al.[10]:An overview of the support vector machine (SVM) methodology and how it can be used to solve practical engineering issues is given in this paper. The purpose of this study is to review the SVM technique's current state and to demonstrate some of its most recent successful outcomes in problems that actually exist in various engineering disciplines. The article begins by going over the fundamental ideas behind kernel methods and SVMs.

N.Patel et.al.[11]:This paper introduces a fruit recognition method based on enhanced multiple features. To identify the produce, an algorithm for picture analysis is trained. to efficiently gather characteristics. The algorithm's objective is to choose different weights for the attributes of the incoming test picture, such as intensity, color, orientation, and border.

Lee D et.al.[12]: Considering that the quality of agricultural products is frequently correlated with their color, color grading is an essential stage in the processing of fruits and vegetables that directly impacts profitability. Most presently in use automated color grading systems either use a set of color separating parameters, commonly in three-dimensional color spaces, or directly measure product color against a preset and fixed set of reference colors to assess color quality. These techniques prevent the user from quickly changing their preferred color schemes or scoring standards.

S. Gunasekaran et.al.[13] :Computer vision systems are being used more and more in the food industry for quality monitoring.In essence, these systems take the place of human inspectors in the assessment of a number of raw and prepared food quality characteristics. As a consequence of the quick growth of computer hardware and software, there have been numerous significant advancements in computer vision technology over the past few years.

Civille E et.al.[14]: A crucial component of the suggested system for evaluating food quality is identifying the product. Measures that prove certain attributes and their attributes. Descriptive analysis, used to describe products, and customer feedback, used to gauge affective reactions, both make significant contributions to defining sensory product specification. Descriptive information relates to key consumer attributes, overall consumer approval, and consumer acceptance for appearance, flavor, and texture.

S.P.Burget.al.[15]:According to recent study using gas chromatography, ethylene is always present in a fruit before the respiratory climacteric begins in an amount adequate to encourage ripening. The results of experiments in which fruits were subjected to partial vacuum, different amounts of oxygen and carbon dioxide, or ethylene oxide provide proof in favour of the hypothesis that ethylene is a hormone that promotes fruit ripening.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 8.102 ⁜ Vol. 12, Issue 4, April 2023

DOI: 10.17148/IJARCCE.2023.12455

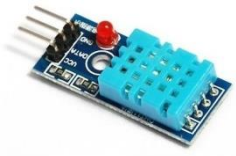
III.PROPOSEDSYSTEM

A. Hardware components

MQ2Sensor

The MQ2 sensor uses an energy of +5V to function. Its conventional output voltage varies from 0V to 5V, and its digital output voltage is either 0V or 5V. Preheating requires 20 seconds. It can serve as a digital or conventional display. The adjuster can be used to modify the strength of the digital pin.

DHT11Sensor



The DHT11 is a tiny gadget that operates between 3 and 5 volts. The maximum current that can be measured with is 2.5mA. The VCC, GND, Data Pin, and a Not Connected Pin are the four lines that make up the DHT11 sensor. An available pull-up resistor ranges from 5 to 10 kilohms for transfer between the sensor and microprocessor.

ArduinoUno

The Arduino UNO microcontroller gadget is built on the ATmega328P platform. The gadget has a 16 MHz ceramic resonator, six analogue inputs, fourteen digital input/output terminals, six of which can be used as PWM outputs, a USB port, a power connection, an ICSP header, and a stop button.

B. Software Components

ArduinoIDE

Users can create and submit code to the Arduino boards using the free, cross-platform Arduino IDE software programme. The Arduino IDE offers a straightforward, text-based programming interface and is made to be simple to use for novices. It includes a library of pre-written code called "sketches" that can be used as a jumping off point for projects and supports many computer languages, including C and C++.One of the key features of the Arduino IDE is its support for third party libraries and hardware platforms. This allows users to easily extend the capabilities of the Arduino boards by adding new functionality and features. The Arduino community has developed a large number of libraries and hardware platforms that can be used with the Arduino IDE, making it a powerful and flexible tool for building a wide range of projects. The Arduino IDE has a number of tools for debugging and evaluating code in addition to being simple to use and supporting third-party frameworks and hardware projects. The Arduino IDE has a number of tools for debugging and evaluating code in addition to being simple to use and supporting third-party frameworks and hardware systems.

It has a built-in simulator that enables users to try code without using real hardware and a serial display that lets users see data being sent to and from the Arduino board.

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified ⁜ Impact Factor 8.102 ⁜ Vol. 12, Issue 4, April 2023
DOI: 10.17148/IJARCCE.2023.12455

Proteus Software

The Proteus Design package is a unique tool set for handling electrical design. The programme is mainly used by engineers and workers to create electronic printouts and designs for printed circuit board manufacturing. ISIS is the name of the programme used to draw diagrams and perform real-time circuit models. The simulation provides real-time modelling by allowing human access while it is running.

III. CONCLUSION

Technologies such as the Internet of Things (IoT) and machine learning can prevent food loss by identifying when food products are about to expire. People operating in a variety of sectors, including gardening, supply chain management, and food preparation, can make the example portable and simple to use. People can use it to let them know when their products will actually expire.

REFERENCES

[1] H. Singh Gill, O. Ibrahim Khalaf, Y. Alotaibi, S. Alghamdi, and F.Alassery,"FruitImageClassificationUsingDeepLearning,"Computers, Materials & Continua, vol. 71, no. 3, pp. 5135–5150,2022, doi:10.32604/cmc.2022.022809.

[2] E.Sonwani,U.Bansal,R.Alroobaea,A.M.Baqasah,andM.Hedabou,"AnArtificialIntelligenceApproachTowardFoodSpoilage Detection and Analysis.," Front Public Health, vol. 9, p.816226,2021, doi:10.3389/fpubh.2021.816226.

[3] M. N. A. H. Sha'abani, N. Fuad, N. Jamal, and M. F. Ismail, "kNN andSVM Classification for EEG: A Review," 2020, pp. 555–565. doi:10.1007/978-981-15-2317-5_47.

[4] M. San, M. Mie Aung, and P. Phyu Khaing, "Fruit Recognition UsingColor and Morphological Features Fusion," International Journal ofImage,Graphics andSignal Processing, vol. 11, no. 10, pp. 8–15,Oct.2019, doi: 10.5815/ijigsp.2019.10.02.

[5] M. Alongi, S. Sillani, C. Lagazio, and L. Manzocco, "Effect of expirydate communication on acceptability and waste of fresh-cut lettuceduringstorageatdifferenttemperatures,"FoodResearchInternational,vol.116,pp.1121–1125,Feb.2019,doi:10.1016/j.foodres.2018.09.056.

[6] G. Anand and L. Prakash, "IoT Based Novel Smart Refrigerator toCurbFoodWastage,"in20183rdInternationalConferenceonContemporaryComputingandInformatics(IC3I),Oct.2018,pp.268–272.doi:10.1109/IC3I44769.2018.9007271.

[7] M. Akhtar and T. Feng, "IoT Based Detection of Molded Bread andExpiryPredictionusingMachineLearningTechniques,"EAIEndorsedTransactionsonCreativeTechnologies,p.173972,Jul.2018,doi:10.4108/eai.27-4-2022.173972.

[8] M. Adekanle, H. Effedua, K. Oritogun, Y. Adesiji, and A. Ogunledun,"Astudyofmicrobialanalysisoffreshfruitsandvegetables,inSagamu markets South-West, Nigeria," Agrosearch, vol. 15, no. 2, p.1, Apr.2016, doi:10.4314/agrosh.v15i2.1.H.Kagaya,K.Aizawa,andM.Ogawa,"FoodDetectionandRecognition Using Convolutional Neural Network," in Proceedings ofthe 22nd ACM international conference on Multimedia, Nov. 2014,pp.1085–1088. doi:10.1145/2647868.2654970.

[9] S. Salcedo-Sanz, J. L. Rojo-Álvarez, M. Martínez-Ramón, and G.Camps-Valls,"Supportvectormachinesinengineering:anoverview," Wiley Interdiscip Rev Data Min Knowl Discov, vol. 4, no.3,pp. 234–267, May2014, doi: 10.1002/widm.1125.

[10] H. N. Patel, Dr. R.K. Jain, and Dr. M.V. Joshi, "Fruit Detection usingImproved Multiple Features based Algorithm," Int J Comput Appl,vol.13, no.2,pp. 1–5,Dec.2011,doi: 10.5120/1756-2395.

[11] D.-J. Lee, J. K. Archibald, and G. Xiong, "Rapid Color Grading forFruitQualityEvaluationUsingDirectColorMapping,"IEEETransactions on Automation Science and Engineering, vol. 8, no. 2,pp.292–302,Apr. 2011,doi:10.1109/TASE.2010.2087325.

[12] S.Gunasekaran,"Computervisiontechnologyforfoodqualityassurance," Trends Food Sci Technol,vol.7, no. 8, pp. 245–256,Aug.1996,doi: 10.1016/0924-2244(96)10028-5.

[13] G. V. CIVILLE, "FOOD QUALITY: CONSUMER ACCEPTANCEAND SENSORY ATTRIBUTES," J Food Qual, vol. 14, no. 1, pp. 1–8, Feb.1991, doi:10.1111/j.1745-4557.1991.tb00044.x.

[14] S. P. Burg and E. A. Burg, "Ethylene Action and the Ripening ofFruits,"Science (1979),vol.148, no.3674, pp.1190–1196, May1965,doi:10.1126/science.148.3674.1190