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DETECTION OF CHEMICALS IN FRUITS AND VEGETABLES USING IOT

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ABSTRACT

Fruits and vegetables are important foods for hu- mans because they are very rich in nutrients. Due to its short shelf life, it is extremely perishable. Fruits and vegetables are excellent sources of carbohydrates, proteins, and minerals. It is well known that many foods are contaminated with harmful and dangerous ingredients. They discovered the problem by installing gas sensors to measure chemical levels in fruits and vegetables.When chemicals are detected, the LCD screen alerts the user to their presence and displays the percentage of each chemical present in fruits and vegetables. The technology of Internet of Things (IoT) has been recognized as one of the rapidly growing technologies, which has gained widespread acceptance globally.The Internet of Things involves various tools that are implemented for monitoring and managing the environment, including wireless sensor networks (WSN), radio frequency identification (RFID), and global positioning systems (GPS). With the help of Arduino and the pest detection sensor, it is used to detect pests found in fruits and vegetables in the market. The LCD screen is also used to display pests found on fruits and vegetables. The LCD screen displays the question and indicates the ratio of fruits and vegetables.

Index Terms—Arduino, Gas Sensor, LCD Display.

I. INTRODUCTION

Chemicals known as pesticides are utilized at different stages of crop cultivation and storage after harvesting to protect plants from various diseases, pests, and insects. Pesti- cides are used to prevent damage to food crops and improve plant quality by controlling agricultural pests or unwanted vegetation. Agricultural productivity has been improved by the use of pesticides in commercial agriculture.Despite the many benefits of pesticide use in agriculture, some misuse can lead to products reaching consumers with undesirable levels of the compound. These include poor food pesticide selection, overuse of pesticides, and harvesting before spray residues are washed away. The monitoring of pesticide levels in fruit and vegetable samples has undergone an expansion in recent times, and many countries have established MRLs (maximum residue limits) for pesticides in food. Due to the gradual expansion of urban areas, most people now buy their fruits and vegetables from markets or supermarkets. However, the use of equipment for measuring pesticide residues at these points of purchase is not commonly found. Gas chromatog- raphy (GC), liquid chromatography (LC) or a combination of both are traditional analytical methods for identifying and quantifying pesticide residues.While these techniques do offer precise results when it comes to measuring sensitivity and selectivity, they are typically slow, require significant effort, can be quite costly, and are often challenging to promote and widely adopt.Additionally, they lack the capability to remotely exchange and handle information. Therefore, it is not suitable for rapid detection and tracking of agricultural products. Biosensors can easily identify pesticides in the environment and food matrices.Using biosensors as screening tools is an economical approach that diminishes the quantity of samples that require testing through traditional methods mentioned previously.Smartphones have grown exponentially, and wireless technology and sensors have become fundamental tools for our daily lives, all over the world. The next level of online connectivity is represented by the Internet of Things, which will connect devices, appliances, sensors, meters, and many other objects. IoT enables entities to communicate with each other using various technologies such as QR codes, cloud services, and M2M (machine-to-machine) interfaces. and its scope. IoT is used for this pesticide detection-based pesticide residue detection system.Therefore, this study aimed to de- velop a pesticide residue detection and tracking system for agricultural products. Our goal is to make the system accessi- ble to anyone with programming knowledge. The system can be used in supermarkets, markets and farms. Additionally, the system can be used for supply, storage and transportation as well as for domestic use.

- Harmful substances that remain in fruits and vegetables can be harmful to human health. However, current laser- induced degradation spectroscopy (LIBS) methods are insufficient in detecting these substances in produce..

- We utilized metal nanoparticles on the fruit and vegetable specimens to improve the potential of LIBS to discover microscopic levels of pesticide remains and heavy metals in the sample.
- The technology of nanoparticle-enhanced LIBS has made great strides in achieving much lower detection limits for pesticide residues and better limits for detecting heavy metals than traditional LIBS for fruits and vegetables, with a difference of two orders of magnitude.
- The LIBS method examines the distribution of hazardous chemicals in vegetable leaves. Heavy metals were found to be ubiquitous in the leaves of edible plants, and heavy metal concentrations were found to be higher in leaf veins than in mesophyll.
- By using chemicals, we can increase the quantity of the food production we can decrease the quality of the production.

II. LITERATURE REVIEW

Narenderan, S.T., Meyyanathan, S.N.He Babu, B.J.F.R.I. (2020). The use of pesticides, steroids and fertilizers in- evitably greatly increases the negative health impacts on people. Harmful pesticides enter the human body through fruits and vegetables. Analyzing diseases and pesticides found in fruits consumed by the general public requires a streamlined solution. [1].

- Accurate real-time output for hardware and software design In this project, a prototype system using four sensors and a Node MCU microcontroller was developed to obtain information on the presence of pesticides.The Embedded C program provides a high concentration of insecticide that is safe for animals and humans. If the fruit is detected to be above or below the threshold, it is said to contain the pesticide. Thanks to the Internet of Things, the pesticide levels and the values obtained from each sensor are displayed in the Blynk app.

Using the photosensitive effect and the Internet of Things, a new non-destructive method has been developed to de- tect pesticide hazards in fruits and vegetables.Consumers can therefore be assured of food safety. To solve this problem, a portable, efficient, accurate and easy-to-use device and mobile application called Fresh-O-Sniff has been developed to help consumers choose the best quality fruits and vegetables.[2]

Detecting Pesticide Residues in Fruits and Vegetables A framework for fruit detection was originally proposed by CNN. It uses the size, color, and texture of the fruit to identify each image. A webcam will record images of the fruits and vegetables used. The RGB image of the sample is then compared to a dataset that already contains 90,380 images of different fruits and vegetables, and the sample is identified.

The first module has an infrared sensor that detects the quality of the sample. The second module has an ethyl gas sensor to determine if the fruit has artificially ripened, and the last module has an LDR sensor to detect pesticide residue using the NDVI method. The sensors in the experiment were assigned thresholds. The experimental values obtained are then compared with a threshold. If the value obtained exceeds the threshold, the LCD screen will display ”Reject”, indicating that the fruit and vegetable sample contains pesticides.[3]

M. Villar Navarro and Miguel A. Cabezon [4] We de- veloped a method to simultaneously measure pesticides in fruit using secondary fluorescence data and solved by ex- tended partial least squares in combination with bilinearized residues. A spectrofluorometric technique supported with the aid of chemometrics become advanced for the simultaneous dedication of the obviously fluorescent insecticides carbonyl, carbendazim,and thiabendazole in oranges and bananas. For sample pretreatment, methanol was used. Through the second- order multivariate calibration method, the emission-excitation fluorescence matrix was obtained and fixed.it’s miles derived from an prolonged partial least squares courting and residual bilinearization with 2d-order gain.This allows the willpower of insecticides in culmination even inside the presence of inner filtering results, historical past interactions, and sturdy spectral overlap. Statistically compare the results of real samples with those obtained by HPLC. The detection levels are 0.038, 0.054, and 0.018 mg kg1 (1,044), 0.052, and 0.020 mg kg1 [4].

III. PROBLEM DEFINITION

1) *NECESSITY OF PESTICIDES:* The increase within the population of India has led to an growth in meals call for and a lower in the place of arable land. consequently, to meet the growing demand, food gadgets are adulterated to get greater amount in a quick time. Moreover, farmers use insecticides on plants that exceed felony most residue limits to make more income in less time. even though insecticides are very effective towards pests, they can survive within the environment. In a class of organophosphate insecticides, chlorpyrifos is widely used on vegetables. Chlorpyrifos is poisonous to people, specially to the brain and apprehensive gadget.In this article, a sensor for the detection of pesticide residues was designed

and evolved the use of parameters including conductivity and pH. The relative differences in percentages of electrical conductivity values between samples without pesticides and those with pesticides in bitter gourd, pumpkin, and tomato were 31.4

2) *PESTICIDES IMPACT ON HUMANS:* Pesticides are substances or mixtures of substances that differ in physical, chemical, and identical properties. Therefore, they are clas- sified according to these characteristics. Some pesticides are also divided into different categories as needed.The three most widely used classifications of pesticides are classification by route of entry, classification by action of the pesticide and the pests it kills, and classification by chemical composition of pesticides. According to the toxicity of pesticides, the World Health Organization classifies them into four categories: ex- traordinarily dangerous, very risky, moderately dangerous, and barely dangerous. The indiscriminate use of insecticides will have severe unfavourable consequences on dwelling structures and the surroundings. maximum insecticides do no longer distinguish between pests and other similar accidental life bureaucracy and kill all of them.The toxicity of insecticides to organisms is normally expressed by using the LD50.

IV. METHODOLOGY

- This job is to find the chemical content of fruits and vegetables. To issue early warnings when objects contain harmful chemicals, numerous detectors are deployed, measuring temperatures and gas concentrations. The in- formation is transmitted to their organisation via GSM.
- When harmful chemical substances are detected, an alarm will sound at the same time. This design will adopt the widely accepted mobile communication technology, GSM.
- The Arduino continuously monitors the values of all sensors. If the value is not in the range of values, it determines and indicates to use the GSM network. This person can receive the message sent by GSM and then decide how to handle the necessary steps.
- The use of Arduino and GSM technology will implement a harmful chemical subtraction system. Connect different sensors, such as temperature sensors and gas sensors.

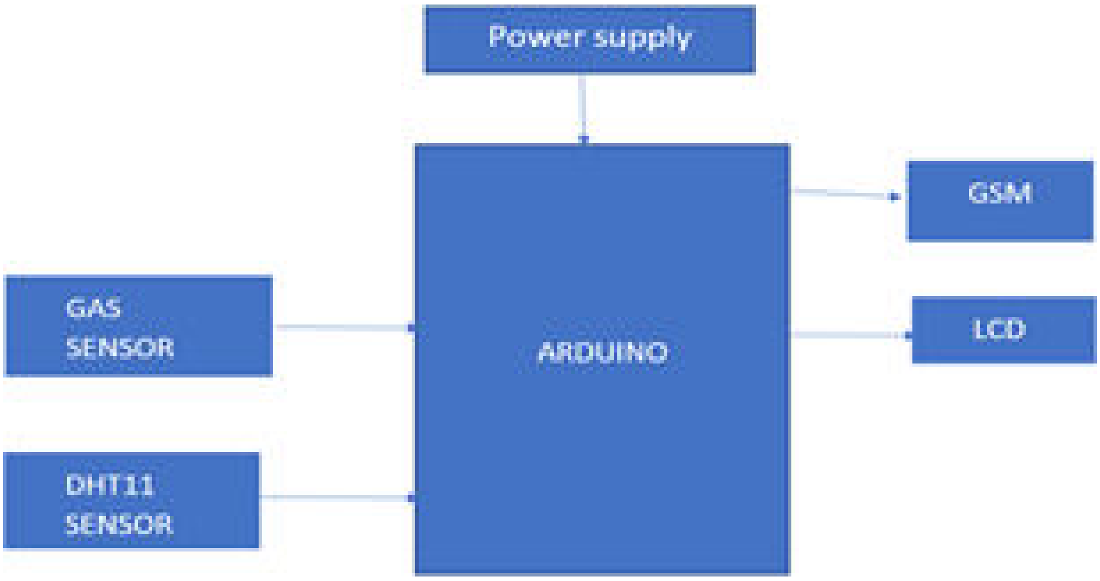

Fig. 1. Architecture diagram of Arduino connection

1) *Steps::*

- We place a fruit or vegetable near the gas sensor.
- The gas sensor sends a signal to Arduino, which compiles the programme and checks the percentage.
- This programme will be executed by Arduino.
- If the chemical percentage is greater than 150, it will display ”Pesticide Found”; if it is less than 150, it will show ”No Pesticide Found”.
- Finally, it will show the chemical percentage of the fruit or vegetable.

Fig. 2. Dataflow diagram for identify the chemicals in fruits and vegetables

2) *Module:*

- Arduino Nano: working for sensors
- DHT11 Temperature and Humidity sensor module: to calculating the temperature and humidity.
- MQ135 Air quality Gas sensor module: To calculating the chemical percentage.
- Jumper wires: Used for connecting the sensors and Ar- duino.
- Cable Wire: Used for connecting the Arduino and laptop.
- Bread Board: Used for building temporary circuits.
- Laptop: Used for making the code and seeing the results.

Fig. 3. Device Connection

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V. EXPERIMENTATION

A. *SYSTEM DESCRIPTION*

The architecture of the system can be divided into three parts, and it can be seen that the sensor detects the percentage of pesticides and indicates the pesticides available in fresh fruits and vegetables on the market. Second, a microcontroller connected from the Arduino to the computer provides the output screen with the program in the Arduino. Finally, the third part is the laptop, which is used to create code. And the Arduino software will also only be installed on the laptop. The code can be transferred from the laptop to the Arduino using a cable. The jumper wires here are also important for connections between sensors.

B. *Hardware Components*

- Sensors
- Arduino nano
- Laptop
- Cable wire
- Jumper wires
- Bread board

C. *Software Components*

- Arduino software

VI. RESULTS AND DISCUSSION

A. *Test Case 1 :*

Sensors that detect chemicals in vegetables and fruits Use the Arduino code to find the chemical percentages of the Arduino to operate the board. By connecting the LCD dis- play to the device with a breadboard, the chemical values are displayed on the LCD display. Using IoT, software will display the percentage of the chemical. I used lemons instead of chemicals. The sensor will check the chemical percentage. If the number of chemicals exceeds 150, this indicates that the chemical was found; otherwise, if the chemical is not found, it is not displayed. Because the lemon no longer contains the chemical, it will say ”No Pesticides Found”.

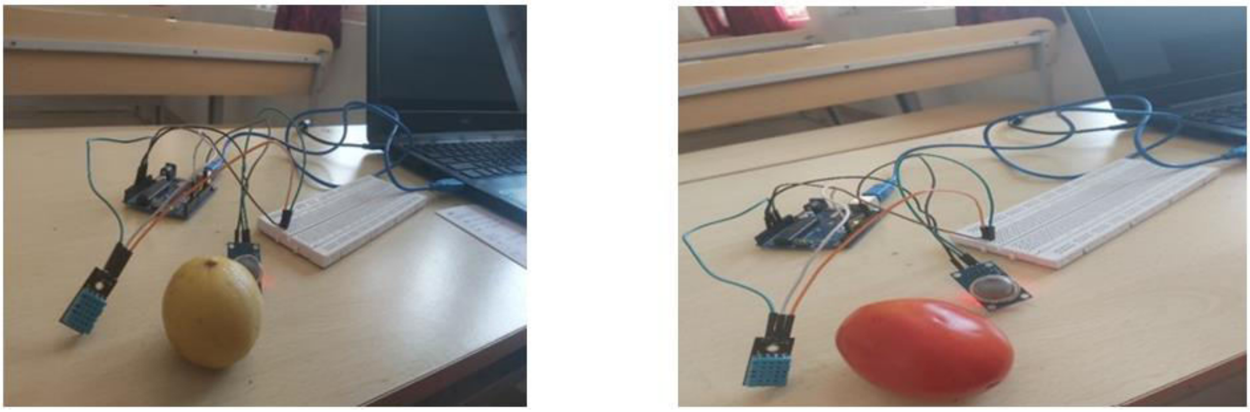

Fig. 4. without chemical

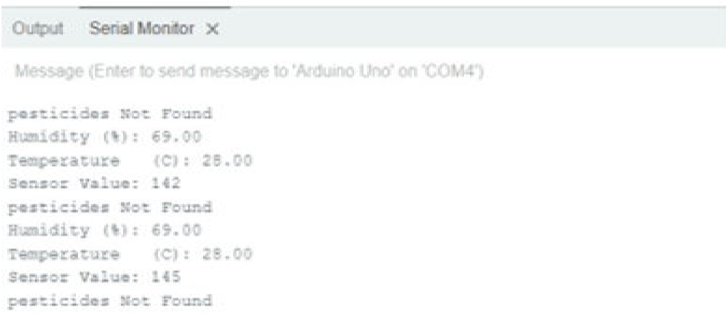

Fig. 5. Output

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B. WITH CHEMICAL

I use tomatoes and chemicals. The sensor will check the chemical percentage. If a chemical's number is greater than 150, the chemical has been found. Then it will say "found pesticides." In the output below, it shows the chemicals as 203 and 182. Both percentages are greater than 150. It will therefore be written "Pesticides found".

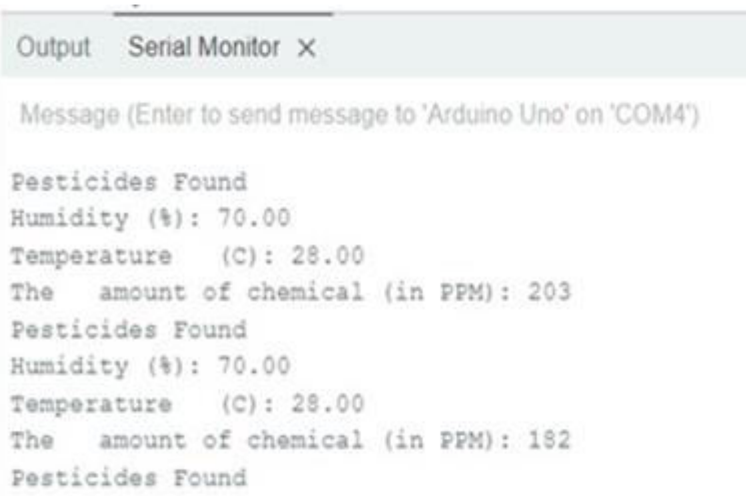

Fig. 6. with chemical

Vegetable Names	Percentage of vegetables with chemicals (<150)	Percentage of vegetables without chemicals (<150)	Result
Tomato	203	-	Pesticide found
Lemon	-	142	Pesticide not found
Carrot	197	-	Pesticide found
Brinjal	213	-	Pesticide found
Cabbage	243	-	Pesticide found

Fig. 8. chemical precentage of fruits anf vegetables

CONCLUSION

- By using pesticides, we can increase the quantity of food in a short time, but not the quality of food.
- The localization of pesticides in food depends on molecu- lar characteristics, type and proportion of plant material, and environmental factors, but usually occurs predomi- nantly outside fruits and vegetables.
- Pesticide-chemical foods spoil in fewer days than organic foods.
- Easily find chemical percentages in fruits and vegetables.
- Thanks to this experiment, we can choose fruits and vegetables with a lower chemical composition.
- Since the presence of pesticides or other unwanted chem- icals varies by plant part, type, and molecular nature and can significantly reduce the quality of most vegetables and fruits, plants must have a chemical trace recognition system to ensure this.
- This system is in high demand and has proven to be very beneficial. Also, in general, vegetables and fruits that contain pesticides or chemicals may not survive as many days as organic vegetables and fruits.
- Since our chemical trace identification system is used on samples under real-world conditions, we have found that the ability to detect pesticide residues or any chemical traces is much higher because we can use the latest Internet of Things via devices using GSM modules and other means of communication.
- Since our system can even easily identify residues, it is possible to predict very well the amount of washing these vegetables and fruits will need to ensure that very negligible chemical traces are close to 0.01.

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- Since we only have a few compounds like nitrates, sulfur, phosphorus, etc. With regard to fruits and vegetables, we hope to identify the chemical constituents in many other fruits and vegetables in the future.

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- I am very grateful to my parents, my friends, and my staff for their support, encouragement, and help in carrying out this project. and Vegetables". 2021 Journal of Emerging Technologies and Innovative Research (JETIR), May 2021, Volume 8, Issue 5.

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