**IoT Based Chemical Detection in Fruits and Vegetables**

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**ABSTRACT**

Internet of Things (Iot) technology has been identified as one of the emerging technologies which is widely used in all walks of life in the world. It is a system of interrelated computing devices, mechanical and digital machines provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. It has a wide range of applications in agriculture and food industry.

Increase in the population of India, results in higher demand for food as well as decrease in land for farming. Hence to fulfil the increased demand, food is adulterated to get more quantity in short period of time. Also, pesticides in crops are using above the legal maximum residue limit by farmers to gain more profit in short period of time.

Organophosphate is one of the most applied class of pesticide in agriculture. Among the class of organophosphate pesticides, chlorpyrifos is widely used in vegetables. Chlorpyrifos has toxic effects on the human body particularly on brain and nervous system. For these reasons, need of detection method for the determination of traces of harmful pesticide like Organophosphate compound is must. The use of pesticides will increase in future if the good and sophisticated methods are not adopted. Also Chemicals like calcium carbide / ethephon and oxytocin are reportedly being used in fruit andvegetable farms for artificial ripening of fruits for increasing the size of fruits respectively.

By using IoT, we can monitor the fruits and vegetables and determine it is organic or not, also can identify which chemicals are used in it. With the help of a ph sensor and a gas sensor, we are detecting the chemical contents in each fruit and vegetable. The results should be stored in our computer, it can be analysed and we can select the fruit/vegetable that is harmless to our health.

**BLOCK DIAGRAM**

**PC**

**GAS Sensor**

**Arduino 2560 Microcontroller**

**ph Sensor**

**Buzzer**

**Fruits &**

**Vegetables**

**Motor**

**Procedure:**

The method to detect chemical content in various samples are explained under:

Here, IoT based Arduino 2560 Microcontroller is used which can drive by 5V DC supply. A ph sensor, gas sensor, motor, buzzer and pc are connected with the microcontroller. Mango, tomato and grapes are taken as samples for the analysis.

Samples of mango, tomato and grapes, which is inorganic was taken and cleaned it by using pure water with the help of a motor. After cleaning, the obtained water is used for the detection of chemicals in the samples. Also, we can analyse organic samples of these fruits and vegetables.

In the case of tomato and grapes, the ph sensor is used to detect the ph value of the water after cleaning. If the water is pure as it is in the beginning, then the ph value will be 7, otherwise the value will be less than 7 or greater than 7 which indicates the taken sample contains chemical content in its skin. In the case of mango, we can use ph. sensor and gas sensor together.ph sensor works like the same. The gas sensor is used to detect the gas that is produced when the chemical is dissolved in the water. Usually, calcium carbide is applied in mangoes to artificially ripen it. once calcium carbide is dissolved in water, acetylene gas is produced. It can be detected using the gas sensor. When the gas is detected the buzzer will be blown. Then the result of the analysis will be stored in the pc and we can further analyse it in future.

**LITERATURE SURVEY**

**1.Pesticide exposure from fresh tomatoes and its relationship with pesticide application practices**

Tomato pesticides health risk was assessed in Meru district of Arusha region, one of the key tomato producers in Tanzania. Tomato samples and consumption information were collected from 50 farmers using Food and Drug Administration standards and twice administered twenty-four-hour recall questionnaire respectively. Analysis for pesticide residues was done using Gas Chromatography Mass Spectrometry. Dietary pesticide exposure was estimated deterministically by combining pesticide residue levels and tomato consumption levels. Pesticides were detected: permethrin, chlorpyrifos and ridomil in 81% of samples. This implies that, lifetime consumption of fresh tomatoes can pose health risk for chlorpyrifos, permethrin and ridomil.

**2.Stay away! Artificially ripened mangoes can land you in hospital, by Indiatoday news**

Most mangoes that are currently being sold in every nook and corner in Delhi have been artificially ripened using harmful chemicals. Their consumption causes several harmful effects, including neurological disorders, doctors and experts claim. Mango dealers in the Capital also agree with the fact that calcium carbide-ripened fruits may harm consumers. Dr. Varun Aggarwal of the Lady Hardinge Medical College, explains: "Calcium carbide, once dissolved in water, produces acetylene gas. Acetylene acts as an asphyxiant and may affect the neurological system by inducing prolonged hypoxia. This leads to headaches, dizziness, mood disturbances, sleepiness, mental confusion, memory loss and seizures." He adds: "Excessive consumption of calcium carbide labelled fruits can even be fatal."

As per Ashwin Bhadri, use of calcium carbide for artificial ripening is prohibited by FSSAI, considering the health problems they pose. The traces of arsenic and phosphorous hydride cause additional damage to the hormonal functioning. The fruit quality falls substantially with the use of calcium carbide; the fruit is overly soft, lacks the natural sweetness that otherwise it might have and rot quicker than the natural pace. Since the quantity of calcium carbide depends on how raw the product is, the level of toxicity increases considerably.

**3.** **Analysis of Pesticide Residues in Grapes by LC-MS/ MS with Time-Managed MRM and Status Of Pesticide Residue In Grapes Of Bijapur (Karnataka)**

A large variety of pesticides are used in grape production throughout its growing season to control pests and diseases in vineyards and to increase crop yield. Most of the grapes available in Karnataka market contain one or the other pesticide. Epidemiology studies on pesticide have found association with hematological cancer, neurotoxin effects, neurobehavioral disorders, reproductive problems including birth defects and infertility, new born deaths etc.