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An IOT Based System to Test Ripening of Fruits on Physical and Bio-Chemical Parameters

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A B S T R A C T

In. the present study ripeness of the fruit will be examined through proper mechanism to test physical and biochemical properties of fruit so it will be more precise and the result will be more clear.*IOT based system has been developed to test Ripening of fruits on physical and Bio-Chemical Parameters.*

1 Introduction:

In past days people used to check the ripeness of fruit by naked eye but that is not the true identification of ripened fruit we have a lot of parameters which will help in test the ripening of the fruit. Some of the physical parameters as well as some of the checial parameters gives the true ripeness report of the fruit. This chapters includes the introduction to physical and biochemical properties to test the ripeness of fruit and its inclusion with IoT.

1.1 ***Physical properties of a fruit:***

1.1.1 **Color:** The color is the basic feature of the fruit and almost all the fruits changes its color from the unripen stage to the ripen stage.

1.1.2 **Firmness:** The second physical parameter which we are using is firmness. Normally penetrometer is used to examine the firmness of the fruit.

1.2 ***Bio-Chemical Properties of a fruit:***

1.2.1 **Total Soluble Solids**: Total soluble solids is the biochemical property of the fruit that is determined by using a hand refractometer (0-30 % range). For this the juice of the fruit need to passes to the refractometer and then a reading is taken from the refractometer, we will convert the work of refractometer to an automated system.

1.2.2 **Acidity**: Acidity is a bio-chemical property that is determined by using certain volume of juice and diluting it with distilled water and then titrating it against standard 0.1N NaOH solution by using phenolphthalein as an indicator until faint pink color appeared. The results generated will be expressed in terms of percent acidity of the fruit juice in citric acid by using the below given formula-

$$\text{Acidity (\%)} = \frac{0.0064 \text{ X Volume of 0.1N (ml) NaOH}}{\text{Volume of the juice taken (ml)}} \text{ X } 100$$

(1 ml of N NaOH=0.0064 g of citric acid)

1.2.3 **Vitamin C**: Vitamin C is an important content in the fruit. To calculate the presence of vitamin C we need to take Ten gm finely chopped fruit flesh was mixed in pestle and mortar containing 10 ml of 3 percent metaphosphoric acid. The final content obtained by using the above process will be transformed into 100ml volumetric flask and then the final volume will be made by adding metaphosphoric acid solution. Aliquots of the filtrate (5 ml) were titrated against 2, 6, dicholorophenol indophenol dye to light pink end point which persisted for 15-20 seconds. The results thus obtained will be expressed as ascorbic acid mg/100g of the fruit pulp.

1.2.4 **Total sugars:** To find the presence of Total sugars in fruit we use fruit juice. Ten milliliter of juice will be taken in conical flask. Then One-gram of lead acetate will be added to the juice as external material. Again, one gm. of potassium oxalate will be added to remove excess lead from juice. Then the process of hydrolysis will be done with HCl to convert non-reducing sugars to reducing sugars. Then the mixture will be neutralized for excess acid with 40 % NaOH (0.1 N was used at final neutralization). Prepared aliquot will be used for recording total sugars by titrating it against the standard Fehling solution using methylene blue indicator. Finally as the color changes to brick red. The percent total sugars were deliberated by using the following formula-

$$\text{Total sugars (\%)} = \frac{\text{Fehling factor (0.05)}}{\text{Volume of filtrate used}} \times \frac{\text{Dilution made - I}}{\text{Volume of juice taken}} \times \frac{\text{Dilution made - I}}{\text{Volume of aliquot taken}}$$

1.3. ***What is ripening?***

Ripening is the process by which fruits achieve their flavor, color, quality and other textual properties. The process of ripening of fruits is directly related to the change in the biochemical composition of the fruits that is, conversion of starch into sugar. The ripened fruit can be judged by its color, firmness, and biochemical properties like total soluble solids, vitamin C, and Acidity or Total sugars.

We have two different kinds of fruits available in the market. First, Climacteric fruit and non-climacteric fruit. Climacteric fruits continue to ripen even after they get harvested while non-climacteric fruits do not ripen after it get harvested.

1.4 ***What is the current process of testing ripen fruits?***

Currently ripening of fruits is tested with the help of its color by a manual collection of color code known as Horticulture color code, by the firmness of the fruit with the help of a penetrometer that is also a manual process. Ripened fruits can also be tested with the help of some bio-chemical test like testing TSS (Total Soluble solids), Vitamin C, Acidity and Total Sugars.

1.5 ***What are the challenges in the current technique?***

The current technique is a manual process in which the color of the fruit is compared with the chart, but there is specific color code minimization of human eye variability to judge colors so the result may vary from person to person. Other techniques that is given to test firmness, TSS (Total Soluble Solids) is done with the help of device but that is too manually. To test firmness we insert a needle like tool in the fruit but that too depends upon the pressure applied and also it is a manual process so accuracy may vary. Similarly to test the TSS we need to extract the juice of the fruit then we supply that juice to a refractometer and then by using our naked eyes we read the range on a scale of 0 to 30% so this manual reading may affect the correct reading of results.

1.6 ***How much accuracy it has achieved?***

Most of the time the result produced by testing the biochemical or physical properties of the fruit is accurate but it is done manually and for each kind of test we need a separate set of devices which is a challenging thing and also time taking.

1.7 ***What is IoT?***

IoT is the short form of Internet of Things. It is a group of physical devices connected to each other and can be accessible through the internet. The term 'thing' in IoT refers to anything like heart monitor or any object that have certain IP address assigned and have the ability to calculate, collect and transfer data over the network without any manual assistance.

1.8 ***What are sensors?***

A sensor is a device that is used to detect and give response to a system after getting some kind of input in the physical environment. The input type given may be heat, light, motion, moisture, pressure or any other king of input from environmental phenomena. The output given by the sensor is generally a kind of signal that will be displayed on the human readable display.

1.9 ***How the new approach will be helpful to handle current challenges?***

The new approach or the proposed approach will examine the ripening of fruit from two main properties or parameters i.e. physical and bio-chemical properties. The new system will be an automated and IoT based system to test the ripening of fruits. All the test will be carried out automatically by just supplying the sample to the system.

2 Discussion:

With the help of the above introduction we concluded that the ripeness of the fruit can be examined through naked eye but if there is a proper mechanism to test physical and biochemical properties of fruit it will be more precise and the result will be more clear. Color and firmness are the fundamental features or the natural features to detect the ripening of fruit. The color of the fruit can be detected with the help of color sensors and image detection. As we all know that fruits are available in multiple colors but they have certain set of properties like its acidity, sugar content etc. which is also included in the current project. We have a list of features related to the fruit or vegetable or crop but out of all the features the color is the fundamental feature that helps us to decide the ripened fruit. In industry different features like color size texture are combined together for the applications. Both the color and texture as well as size and shape of fruits and vegetables plays an important role in the discrimination of fruits from ripened to unripen. One of the primary thing that we must keep in our mind is that a customer accepts or rejects a fruit on the basis of its color, so color is the most important feature for accessing the quality of fruit.

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