

# Classification of Organically and Inorganically grown Vegetables

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**Abstract**— In this growing human population, food becomes the key for survival. To satisfy the increasing demand, the foods were prepared artificially using several methods. People these days get deceived by the vendors with respect to organic and inorganic vegetables. Considering few major parameters as the differences between them, an approach is made to build an electronic device for the convenient use of the people. Using the core embedded system and different sensors, the parameters like taste, colour, odour, pressure required to penetrate through the vegetable, soil pH, electrical conductivity and potentiometric analysis are tested, compared and displayed on the LCD. For the software, arduino IDE and for hardware interface Arduino Uno is taken.

**Keywords** — *Embedded system, sensors, LCD, Arduino IDE, Arduino Uno, soil pH*

## I. INTRODUCTION

Today, the organic market is a growing sector of the agriculture industry in many parts of the world and organically produced food in most supermarkets can be easily found. Based on the appearances of vegetables, the difference could be observed. But in the growing technology period, growing inorganic vegetables similar to organic vegetables are no big challenge. So, in order to be more accurate about the difference, the same growing technology could help. Jotting the parameters of difference, a collaboration of technology and agriculture is tried and implemented.

### **Difference between organic and convention farming techniques**

One of the main differences between organic and conventional farming is the use of synthetic chemical fertilizers. Conventional farming allows the use of synthetic fertilizer as well as manure, compost, sewage sludge and other soil amendments. Most certified organic farming only allows the use of manure and compost and other soil additives such as bone or blood meal. The synthetic N, P and K that is prohibited inorganic farming, normally provides nutrients that are readily available to the plants, whereas, in manure, so e of the nutrients have to undergo chemical transformations before

they can be utilized. Therefore, both organic and conventional farming systems can provide the essential macronutrients to the crops, only their source and availability for uptake are different.

The second major difference related to food quality between the two systems is the use of pesticides and herbicides. Conventional farming once again allows the use of any product available on the market (not forbidden by law), while organic farming allows only a few pesticides, and must therefore, rely largely on the use of management practices, such as till age and crop rotations, to overcome pest and weed problems. The pesticides permitted in organic farming are those that are believed not to leave any residue on the products. Few of the categorical examples where IoT is strongly established.

### ELEMENTS MOST OFTEN USED IN DEFINING FOOD CHARACTERISTICS:

**Functional:** food properties appropriating to requirements of handling, storage and processing.

**Sensual:** include characteristics as aroma, flavor, appearance, texture

**Nutritional:** nutrient contents, meet with diet requirements

NOW SOME CONSUMERS ADD MORE ELEMENTS TO DESCRIBE FOOD QUALITY:

**Biological:** include food influence on human physiology, ability to maintain human health

**Ethical:** evaluation of food in social, environmental and political aspects. They are connected with animal welfare, unpolluted environment, and fair trade

**Authenticity:** less processed food, less additives changing products, real food.

## II. LITERATURE SURVEY

“A COMPARISON OF THE NUTRITIONAL VALUE, SENSORY QUALITIES, AND FOOD SAFETY OF

ORGANICALLY AND CONVENTIONALLY PRODUCED FOODS” by Diane Bourn and John Prescott [1]: Paddy. In this paper, it is mentioned that there is significant increase in consumer interest in organic food products, there is a need to determine to what extent there is a scientific basis for claims made for organic produce. Studies comparing foods derived from organic and conventional growing systems were assessed for three key areas: nutritional value, sensory quality, and food safety. It is evident from this assessment that there are few well-controlled studies that are capable of making a valid comparison. Considerations of the impact of organic growing systems on nutrient bioavailability and non-nutrient components have received little attention and are important directions for future research. While there are reports indicating that organic and conventional fruits and vegetables may differ on a variety of sensory qualities, the findings are inconsistent. There is no evidence that organic foods may be more susceptible to microbiological contamination than conventional foods. While it is likely that organically grown foods are lower in pesticide residues, there has been very little documentation of residue levels.

“THE EFFECTS OF ORGANIC MANURE AND CHEMICAL FERTILIZER ON THE GROWTH AND NUTRIENT CONCENTRATIONS OF YELLOW POPLAR (LIRIODENDRON TULIPIFERA LIN.) IN A NURSERY SYSTEM” by Si Ho Han, Ji Young An, Jaehong Hwang, Se Bin Kim & Byung Bae Park [2]: In this paper it mainly concentrated on distinguishing yellow poplar in organic and inorganic fertilizers. According to this, Soil nutrient management is necessary to maintain the constant productivity of nursery systems as well as good quality soil. This study investigated the effects of organic manure and chemical fertilizer treatments on growth performance and soil and tissue chemical properties. Two-year-old yellow poplar (*Liriodendron tulipifera* L.) seedlings were treated with an organic manure (1000 g/m<sup>2</sup>; mixture of poultry manure, cattle manure, swine manure, and sawdust), nitrogen, phosphorus, potassium (NPK) chemical fertilizer (urea, 30 g/m<sup>2</sup>; fused superphosphate, 70 g/m<sup>2</sup>; potassium chloride, 15 g/m<sup>2</sup>), and organic manure plus NPK chemical fertilizer. Organic manure significantly increased the soil pH and the concentrations of nitrogen, available phosphorus, exchangeable potassium, calcium, and magnesium. In contrast, the NPK chemical fertilizer decreased the soil pH and exchangeable calcium concentration, did not affect the soil concentrations of nitrogen and magnesium, and increased the concentrations of available phosphorus and exchangeable potassium. Fertilization treatments increased the seedling height and root collar diameter by 21% and 29%, respectively, and the mean dry weight of the stems and leaves by 72% and 123%, respectively, but a synergistic effect of the organic manure and NPK fertilizer was not observed. Compared to the effects

of the fertilization treatments on the soil properties, the effects on nutrient concentrations in the leaves, stems, and roots were relatively small. These findings indicate that organic manure derived from livestock by products and sawdust can be utilized in seedling production systems.

“NUTRITIONAL QUALITY OF ORGANIC VERSUS CONVENTIONAL FRUITS, VEGETABLES, AND GRAINS” by Virginia Worthington [3]: In this paper it mentioned about the nutrition's that as the distinguishing parameter for organic and inorganic. The objective was to survey existing literature comparing nutrient content of organic and conventional crops using statistical methods to identify significant differences and trends in the data. The comparative measurements of organic and conventional nutrient content were entered into a database for calculation. For each organic-to-conventional comparison, a percent difference was calculated:

$$(\text{organic} - \text{conventional}) / \text{conventional} * 100$$

Organic crops contained significantly more vitamin C, iron, magnesium, and phosphorus and significantly less nitrates than conventional crops. The non significant trends showing less protein but of a better quality and a higher content of nutritionally significant mineral with lower amounts of some heavy metals in organic crops compared to conventional ones. There appear to be genuine differences in the nutrient content of organic and conventional crops.

“CLASSIFICATION OF ORGANIC AND INORGANIC BEANS USING VISION APPROACHES” by Naveena M, Pavithra B S, Hemantha Kumar [4]. In this paper a methodology for classification of organic and inorganic beans is proposed. It is concluded that it is very difficult and still a challenging task to build up an automatic classification of beans method that works effectively in all situation whether the image consists of different orientation, bad image condition or image effected by illumination. From the discussion it is concluded that using our proposed methodology will be more advantageous. Thus our project covers all the factors that contribute to the effectiveness of the classification process of beans image. The proposed method is validated and the results show that their method is good. The goal, robust classification for healthy food habit, classification of organic and inorganic beans based on outer texture, shape and different diseases on them studied during this project work can be implemented to other vegetables organic/inorganic classification.

### III. PROPOSED METHODOLOGY

The proposed device consists of a microcontroller, color sensor, pressure sensor, aroma detection, soil fertility testing and electrical conductivity testing. The microcontroller works like a heart of the designed device.

The microcontroller is programmed using embedded software to gather the datasets of the interfaced sensors to it. The TCS230 senses color light with the help of an 8 x 8 array of photodiodes. Then using a Current-to-Frequency Converter the readings from the photodiodes are converted into a square wave with a frequency directly proportional to the light intensity. Finally, using the Arduino Board we can read the square wave output and get the results for the color. If we take a closer look at the sensor we can see how it detects various colors. The photodiodes have three different color filters. Sixteen of them have red filters, another 16 have green filters, another 16 have blue filters and the other 16 photodiodes are clear with no filters. The color sensor detects the color of the vegetables and compares with set threshold values of its own to define the organic or inorganic.

The pressure sensor measurement system is made up of a sensing element with four strain gauges applied to it. The strain gauges are configured in a Wheatstone bridge, where all 4 resistors are equal, and change by equal magnitude proportionally, when strain is applied. The greater the force or strain (input), the greater the output. A Wheatstone bridge device requires 4 wires for its connection, positive and negative excitation, and positive and negative sensor output.

The aroma detection sensors in the e-nose have a sensitive layer that translates a chemical interaction into a unique signal pattern, which is interpreted by pattern recognition/classification algorithms. Sensor systems incorporate reaction, sampling, preconditioning, electronics, data pretreatment, and pattern recognition and classification. An array of sensors can be in the form of different polymer types or by using metal oxide (MOX) semiconductors.

The electrochemical sensor consists of two electrodes which responds to targeted ion and transforms the reactions to detectable electrical signals. Ion Selective Electrode (ISE) and Ion Selective Field Effect Transistor (ISFET) are the two types of commonly used potentiometric electrochemical sensor for soil nutrient detection. Here ISEs is not suitable for real-time sensing applications because of their time delay (several minutes). An electrochemical sensor consists of a diffusion barrier, a sensing electrode and a counter electrode. In an environment free of chemically reactive gases, oxygen

diffuses into the cell and adsorbs on both electrode. The result is a stable potential between the two in which the little current flows. The cell chemical process at this point, Oxygen enters through the sensor through the capillary where it comes in contact with the cathode and it immediately reduced to hydroxyl ions. This type of electrochemical sensor is based on ISFET technology. The electrochemical sensor has the potential to be produced in batches to very small size by using MEMS-based micro fabrication technology at low costs. Besides, small sized sensors require small volume of reagent and samples, which can also reduce the cost in soil testing.

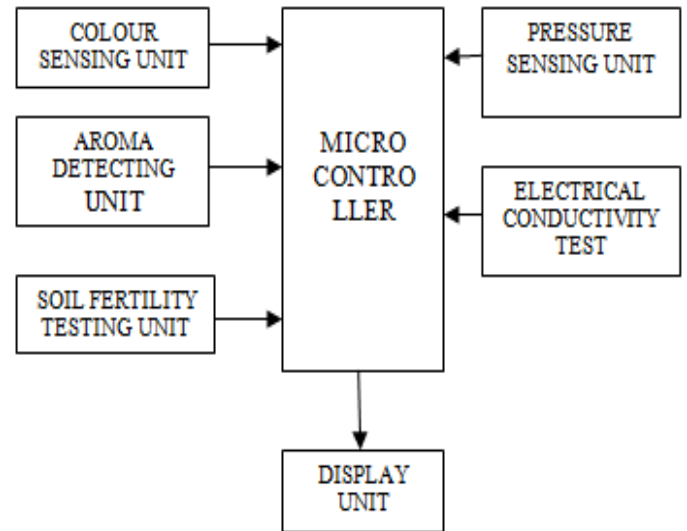


Figure 1: Block Diagram Representation

The basic block diagram of the project is as shown in Figure 1. The controlling device of the whole system is Arduino UNO microcontroller to which all other components are equipped.

Any vegetable is first identified. The vegetable is exposed to colour sensor for identification. By fixing the reference values for colour, both organic and inorganic vegetables are tested. The variation in colour would be sensed by the sensor TCS320 and displayed in the LCD. After vegetable identification, using smell sensor, the vegetable can be differentiated as another parameter. A solution of any pulp is made and heated. The smell sensor detects the heat produced. Based on that LCD displays whether it is organic or inorganic.

Similar tests will be conducted on pH, conduct meter, potentiometer and pressure. The movement of electrons in any

vegetable juice will be determined by the conduct metric analysis. Pressure sensor will determine the amount of pressure required to penetrate through the vegetable. Similarly all other parameters are tested and verified.

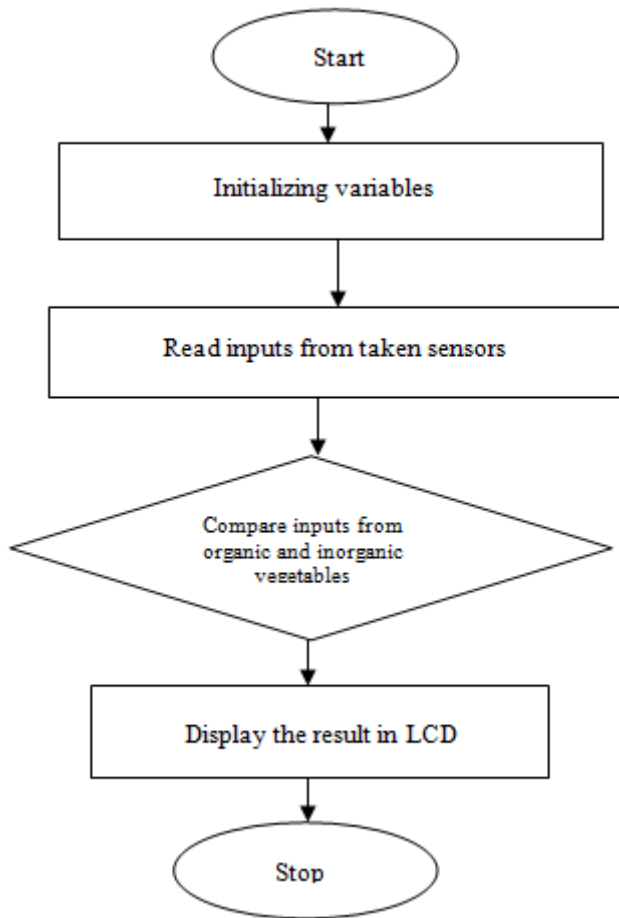


Figure 2: Flow Chart for the working Model.

The Flow chart shown in Figure 2 shows the working model for the proposed model. The selected variables are initialized as required for the working conditions of the system. Once the variables are initialized, the sensors placed in the device starts to record the datasets from the vegetables to its datasets stored in the database of the server i.e. system. Then the datasets recorded by the sensors are starts to compare with the threshold values set for the individual vegetables, depending on its physical and biological characteristics. The algorithm is designed to work based on the designed flowchart. Then the results are displayed on the screen i.e. LCD screen display. By

seeing the LCD display one can come to know that the vegetables selected is an organic or inorganic.

Here the sensors are connected to the analog input port of Arduino controller board and the LCD module is connected to Arduino output port. The sensors connected with vegetable sample are taken as contact point. The power supply is ON, where current passes through the circuit. When the current passes through the sensing point of the sensor. The Arduino get the analog input signal from the sensor point, where the sensor senses the signal present in the vegetables sample and send signal to the Arduino. Then the flow injection analysis (FIA) will be carried out inside the Arduino. It will be programmed using Arduino communication software. After programming, it will be compiled and converted to the machine language. Then this code file will be dumped to the Arduino board. Finally the FIA analysis will be carried inside Arduino controller and the output will be displayed in the LCD and PC through the serial communication.

#### IV. RESULT

- Testing the vegetables with all the considered sensors was achieved.
- Testing the soil fertility using soil pH sensor was successful.

#### V. CONCLUSION

The project produces a simple and cost-effective method of classifying vegetables. Any common person can easily use it for their satisfaction and avoid getting deceived by vendors. The certifying agencies can use this project for confirming whether the harvested vegetable is organic or not.

#### References:

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