IDENTIFICATION OF CHEMICALS IN FRUITS AND VEGETABLES USING IoT

Minor project report submitted
in partial fulfillment of the requirement for award of the degree of

Bachelor of Technology
in
Computer Science & Engineering

By

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June , 2022

CERTIFICATE

It is certified that the work contained in the project report titled ”IDENTIFICATION OF CHEMICALS IN FRUITS AND VEGETABLES USING IoT” by ”ANKITA SAHA (19UECS0059), AKULA VENKATA NARAYANA (19UECS0031), Y SAI PRAKASH (19UECS1067)” has been carried out under my supervision and that this work has not been submitted elsewhere for a degree.

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DECLARATION

We declare that this written submission represents my ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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APPROVAL SHEET

This project report entitled IDENTIFICATION OF CHEMICALS IN FRUITS AND VEGETABLES USING IoT by (ANKITA SAHA (19UECS0059), (AKULA VENKATA NARAYANA (19UECS0031), (Y SAI PRAKASH (19UECS1067) is approved for the degree of B.Tech in Computer Science & Engineering.

Examiners **Supervisor**

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Place:

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We express our deepest gratitude to our respected **Founder Chancellor and President Col. Prof. Dr. R. RANGARAJAN B.E. (EEE), B.E. (MECH), M.S (AUTO),D.Sc., Foundress President Dr. R. SAGUNTHALA RANGARAJAN M.B.B.S.** Chairperson Managing Trustee and Vice President.

We are very much grateful to our beloved **Vice Chancellor Prof. S. SALIVAHANAN,** for providing us with an environment to complete our project successfully.

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ABSTRACT

Fruits and vegetables are highly nutritious and form as key food commodity in the human consumption . They are highly perishable due to their low shelf life.Fruits and vegetables are the important source of carbohydrates, proteins and minerals. These food commodities are reported to be contaminated with toxic and health hazardous chemicals. To detect that, gas sensor has placed and estimate the chemical levels present in fruits and vegetables. If any chemicals detected immediate alert is sent through GSM to the owner. In most of the hostel mess and government schools' kitchen everybody is getting affected by the food they consume. Milk, fruits like banana and other foods used in daily life, as all of them do not offer quality since their moisture harmful gases vary from time to time. To ensure food safety it should be monitored at every stage of the chain.

Keywords: GSM,Commodities,Consumption,Perishable

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

GSM	Global System for Mobile communication
IoT	Internet of Things
LIBS	Laser-induced breakdown spectroscopy
MRL	Maximum Residue Level
LCD	Liquid Crystal Display

TABLE OF CONTENTS

Chapter 1

INTRODUCTION

1.1 Introduction

Residues of harmful chemicals in fruit and vegetables pose risks to human health. Ordinary laser-induced breakdown spectroscopy (LIBS) techniques are unsatisfactory for detecting harmful chemicals in fruit and vegetables.We applied metal nanoparticles to fruit and vegetables samples to improve the ability of LIBS to detect trace pesticide and heavy metal residues in the samples. The nanoparticle-enhanced LIBS technique gave pesticide residue detection limits for fruit and vegetables two orders of magnitude lower than achieved using standard LIBS and heavy metal detection limits markedly better than achieve using standard LIBS. LIBS technique to study the distributions of harmful chemicals in vegetable leaves. We found that heavy metals are distributed unevenly in edible plant leaves, the heavy metal concentrations being higher in the veins then in the mesophyll. By using chemicals we can increase the quantity of the food production we can decrease the quality of the production.

Pesticides are chemical substances applied to crops at various stages of cultivation and during the post-harvest storage of crops. The use of pesticides is intended to prevent the destruction of food crops by controlling agricultural pests or unwanted plants and to improve plant quality . Pesticide use in commercial agriculture has led to an increase in farm productivity. Despite the wide ranging benefits of using pesticides in agriculture, several incorrect applications can result in high and undesirable levels of the compounds in the produce that reaches consumers. These include inappropriate selection of pesticides used on foodstuffs, over use of pesticides and harvesting the crops before the residues have washed off after application.

1.2 Aim of the project

The aim of the project is to tell and how to identify and calculate the chemical percentage in fruits and vegetables. By using gas sensor and dht11 sensor to identify

the chemical level. If anyone has spreading the chemicals on the object by using GSM we can alert from the message.

1.3 Project Domain

The Internet of Things plays a vital role in the field of chemical Detection. The term used for that is chemical detection in vegetables and fruits. IoT applications monitor a wide variety of pesticide monitoring function by detecting vegetables fruits.

1.4 Scope of the Project

The scope of the project is to find the chemical level in fruits and vegetables and we have to eat nutritious food which has doing in a organic farming manner.

Chapter 2

LITERATURE REVIEW

[1] Szadzinska, J,Lechtanska, J, Pashminehazar, R.; Kharaghani, A.; Tsotsas, 2019, E. Microwave- and ultrasound-assisted convective drying of raspberries: Drying kinetics and microstructural changes. Dry. Technol. 154,89-96. Monitoring of pesticides in fruit and vegetable samples has increased in the last years since most countries have established maximum residue level (MRL) for pesticides in food products. Despite the wide ranging benefits of using pesticides in agriculture, several incorrect applications can result in high and undesirable levels of the compounds in the produce that reaches consumers. These include inappropriate selection of pesticides used on foodstuffs, over use of pesticides and harvesting the crops before the residues have washed off after application .

[2] Arrutia, F. Adam, M. Calvo-Carrascal, M.A. Mao, Y. Binner, 2001, E. Development of a continuous-flow system for microwave- assisted extraction of pectin-derived oligosaccharides from food waste. General Food Processing factors (PF) estimate the effect of processing methods pesticide on residue levels and the disposition of the residues in the processed products, calculated and considered by the joint FAO/WHO meeting on pesticide residues as follows PF = Residues in processed products mg Kg-1. PF values lower than 1 indicate a reduction in the residue level and higher than 1, a concentration effect. Foods 18 of 38 Friuts and Vegetables, like other foods, are treated through culinary and food processing before they are consumed.

Chapter 3

PROJECT DESCRIPTION

3.1 Existing System

Pesticides are detected by Chromatographic methods like Gas Chromatography, Liquid Chromatography and Mass Spectrometry. They are time consuming processes since samples can only be treated in laboratory and requires lot of manual work.

DISADVANTAGES:

1.lack of integrity
2.lack of availability
3.continuity of service
4.lack of accuracy

3.2 Proposed System

Chemical contents are detected IR Emitter and biosensor. It is portable and consumes less time to predict.

ADVANTAGES:

- Does not depend on Temperature.
- Can be used by anyone.
- Simple to use.
- Very effective usage.
- Reducement of causing diseases.

3.3 Feasibility Study

3.3.1 Economic Feasibility

This study is carried out to check the economic impact of the system. As the developed system was well within the budget and this was achieved because most of the sensor technologies are economically friendly.

3.3.2 Technical Feasibility

This study is carried out to check the technical feasibility, that is the technical requirements of the system. We have developed a very good out structured such that it can be operated with minimum knowledge on that.It includes finding out technologies for our project, both hardware and software.

3.3.3 Social Feasibility

This study is proposed to social awarness in chemical and toxic vegetables,fruits to residue the pesticides.

3.4 System Specification

3.4.1 Hardware Specification

- Arduino Nano
- ESP8266 NodeMcu WiFi Development Board
- MQ-135 Air Quality Gas Sensor Module
- DHT11–Temperature and Humidity Sensor

3.4.2 Software Specification

- Arduino Software (IDE)

3.4.3 Standards and Policies

Aurdino

It's like an open source web application that allows us to share and create the documents which contains the live code, equations, visualizations and narrative text. It can be used for data cleaning and transformation, numerical simulation, statistical modeling, data visualization, machine learning.

Standard Used: ISO/IEC 32346

Chapter 4

METHODOLOGY

4.1 General Architecture

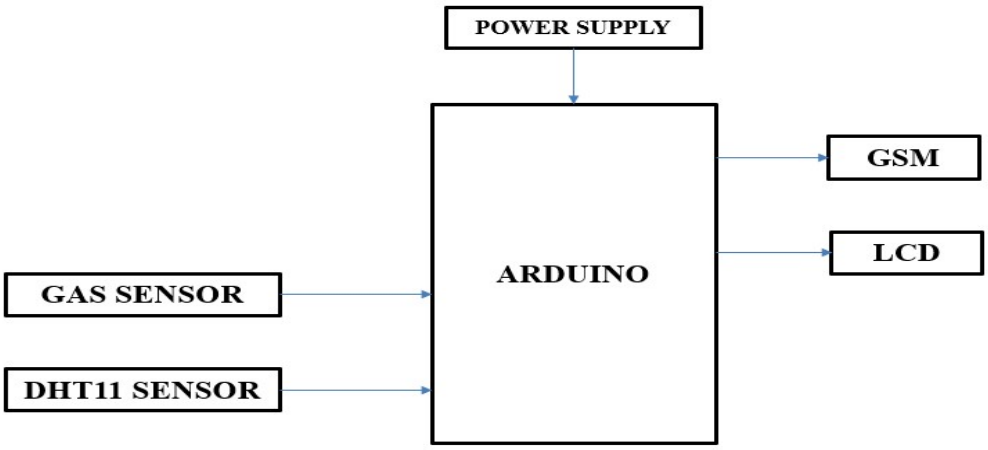


Figure 4.1: **Architecture Diagram**

Description

4.2 Design Phase

4.2.1 Data Flow Diagram

Figure 4.2: **Data Flow Diagram**

Description

4.2.2 Use Case Diagram

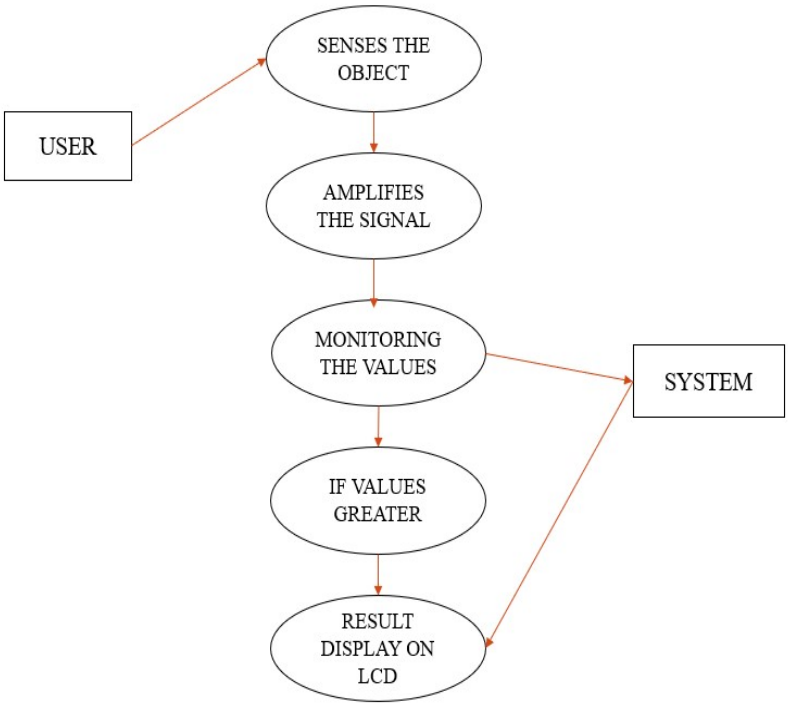


Figure 4.3: **Usecase Diagram**

Description

4.2.3 Class Diagram

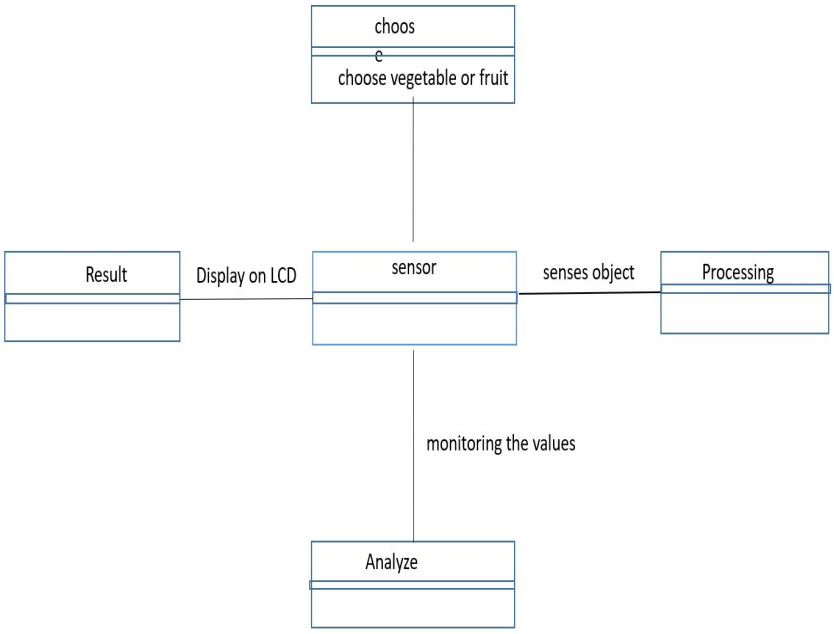


Figure 4.4: **Class diagram**

Description

4.2.4 Collaboration diagram

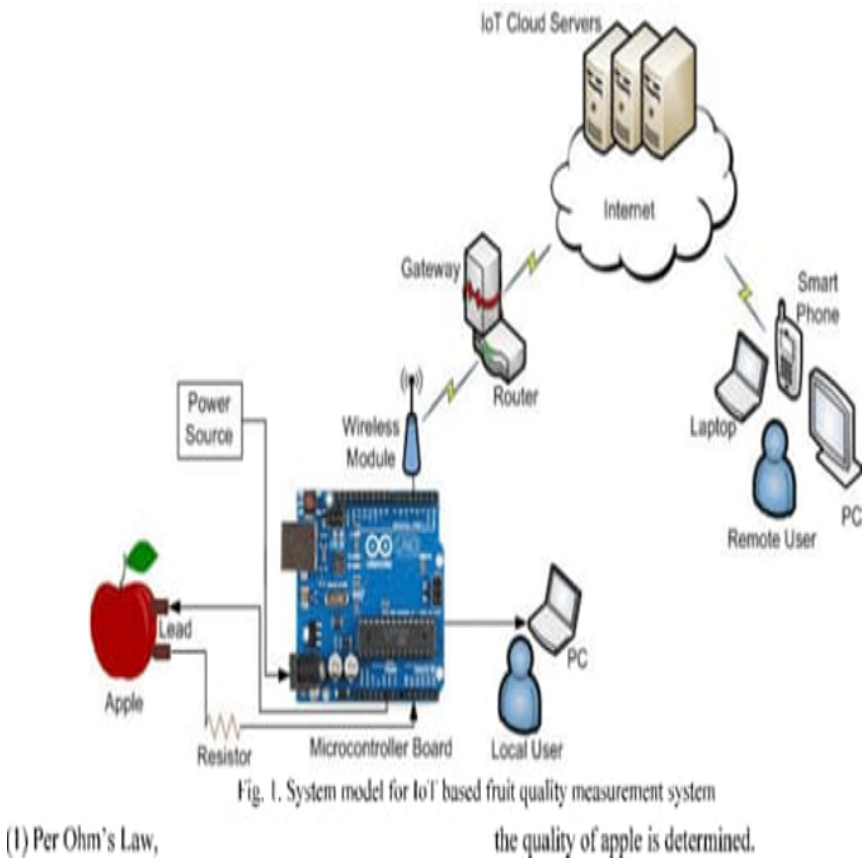


Figure 4.5: **Collaboration Diagram**

Description

4.3 Algorithm & Pseudo Code

4.3.1 Algorithm

•No Algorithm used in this project.

4.3.2 Pseudo Code

4.4 Module Description

4.4.1 Module1

•Collection of Required Components:
1)Arduino Nano.

Figure 4.6: **Arduino Nano**

2)DHT11 Temperature and Humidity sensor module.

Figure 4.7: **DHT11 SENSOR**

3)MQ135 Air quality Gas sensor module.

Figure 4.8: **MQ135 SENSOR**

4)NODEMCU – ESP8266 Wifi Development board.

Figure 4.9: **NODEMCU - ESP8266 WIFI DEVELOPMENT MODULE**

4.4.2 Module2

Connecting the Components

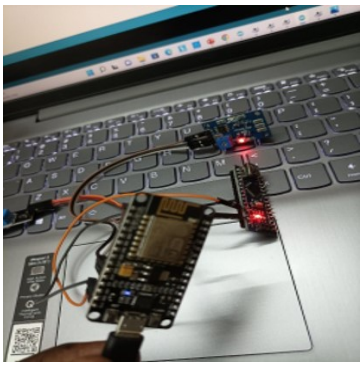


Figure 4.10: **Connecting the Components**

4.4.3 Module3

Validation and Testing

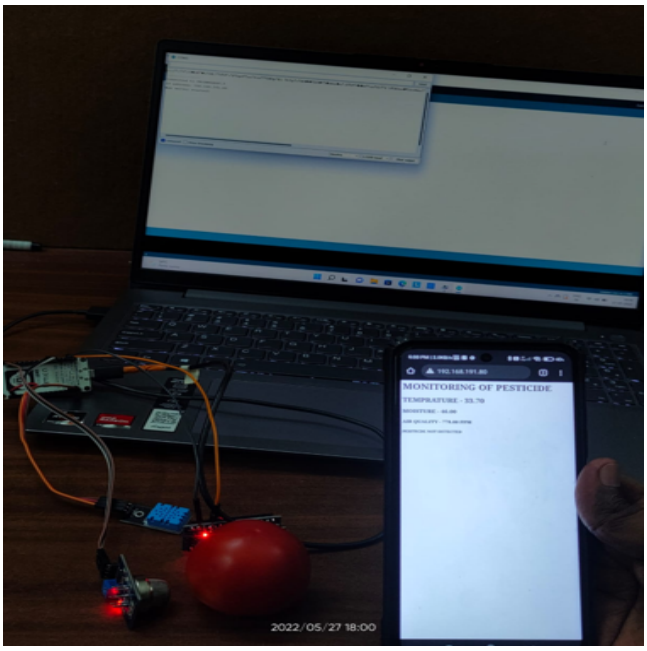


Figure 4.11: **Validation and Testing**

4.5 Steps to execute/run/implement the project

4.5.1 Step1

Connecting the sensor components as per required manner.

4.5.2 Step2

Run the Arduino IDE compiler.

4.5.3 Step3

After testing the model we need to know the pest detection and Temperature and also display moisture percentage.

Chapter 5

IMPLEMENTATION AND TESTING

5.1 Input and Output

5.1.1 Input Design

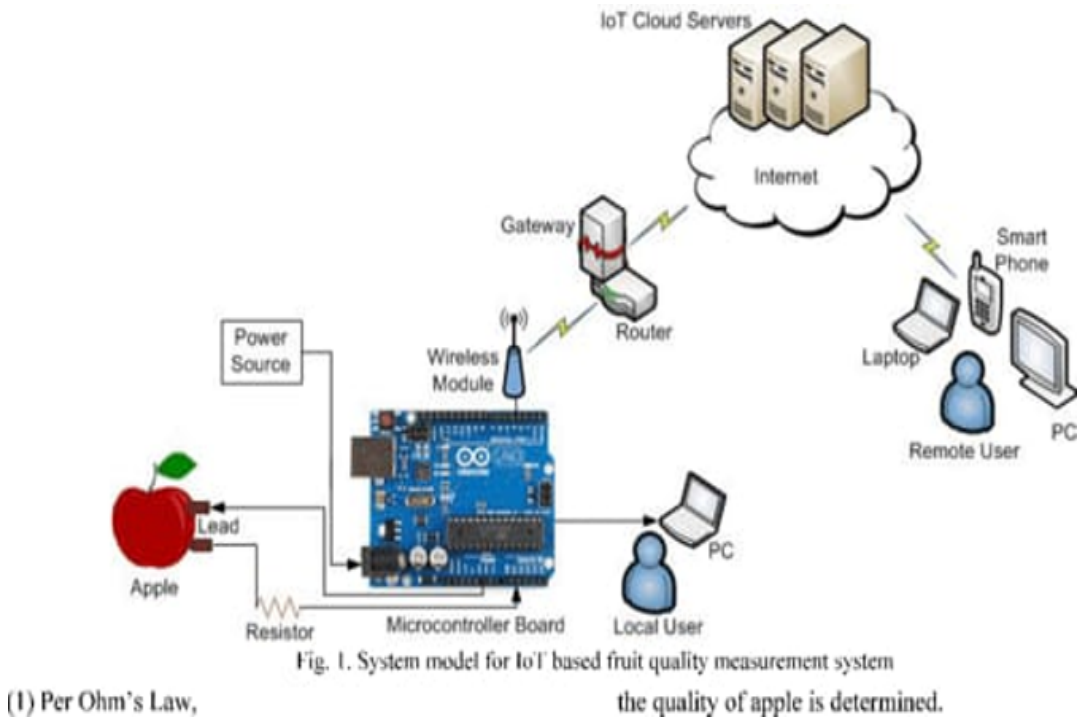


Figure 5.1: **Input Design**

5.1.2 Output Design

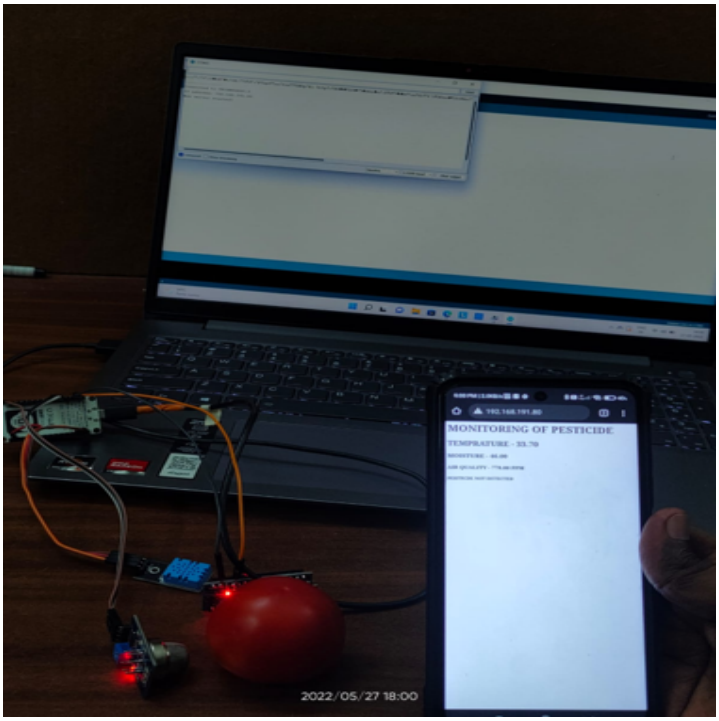


Figure 5.2: **Output Design**

5.2 Testing

5.3 Types of Testing

5.3.1 Unit testing

Unit testing is designed to test small pieces of functionality rather than the systems as a whole. Unit testing can be performed from the bottom up, starting with smallest and lowest level models and proceeding one at a time. For each module in bottom up testing a short program is usd to execute the module and provides the needed data, so that the module is asked to perform the way it will when embedded with in the larger system.

Input

```
1  Elimination of bugs.
2  Detection of Errors.
```

Test result

•Bugs are eliminated and Errors are detected.

5.3.2 Integration testing

It is defined as a type of testing where software modules are integrated logically and tested as a group. A typical software project consists of multiple software modules, coded by different programmers. The purpose of this level of testing is to expose defects in the interaction between these software modules when they are integrated. Integration Testing focuses on checking data communication amongst these modules.

Input

```
1 User friendliness.
2 Consistent Menus.
```

Test result

• User friendly.

5.3.3 System testing

The main focus of System testing is on the validation of your functional requirements. System testing gives abstraction from code and focuses on testing effort on the software system behavior. System testing facilitates testing communication amongst modules.

Input

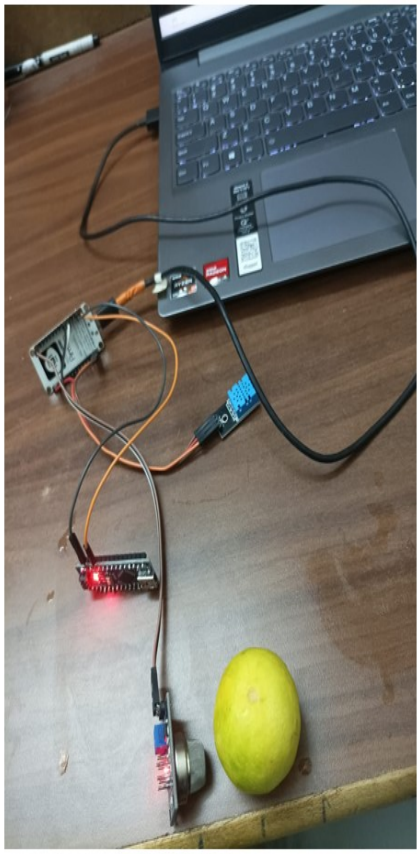
```
1 IF -THEN-ELSE
2 DO -WHILE
3 CASE -SWITCH
```

Test Result

•All loops are testing

5.3.4 Test Result

INPUT:



OUTPUT:

Figure 5.3: **Test Image**

Chapter 6

RESULTS AND DISCUSSIONS

6.1 Efficiency of the Proposed System

The proposed method is a promising approach so that the chemical IOT technology can be monitoring the agricultural food products easier, automatic, effective. The establishment and application of agricultural products quality and safety system is based on IOT technology, will provide the whole process of tracking and detecting the food products and meet the public needs of high-quality and safe agricultural products. In recent years, IOT technology has been applied in different areas, but less adoption in monitoring quality and safety of agricultural products. Through review on the technology of IOT and the applications in monitoring agricultural products are quality and safety from production, processing circulation, sales of the whole supply chains, it shows that consumers can required agricultural products more informative for risk management and traceability, and producers can get high quality and yield products with low input through precision agriculture based on the IOT technology. The application of this pesticides detection devices has been performed on real samples.

6.2 Comparison of Existing and Proposed System

Existing system:(Lab Testing)
Pesticides are detected by Chromatographic methods like Gas Chromatography, Liquid Chromatography and Mass Spectrometry. They are time consuming processes since samples can only be treated in laboratory and requires lot of manual work.
Proposed system:(Using IoT)
Chemical contents are detected IR Emitter and biosensor. It is portable and consumes less time to predict.Proposed system is implemented using the IoT so that the accuracy is more when compared to the existing system.

6.3 Sample Code

```
  Arduino     Code
int count=80;
void setup(){
Serial.begin(9600);
}
void loop() {
int s=digitalRead(2);
if(s==0)
{
count=count-15;
Serial.print(Percentage of pesticides)
Serial.println(count);
delay(1000);
}
}
```

Output

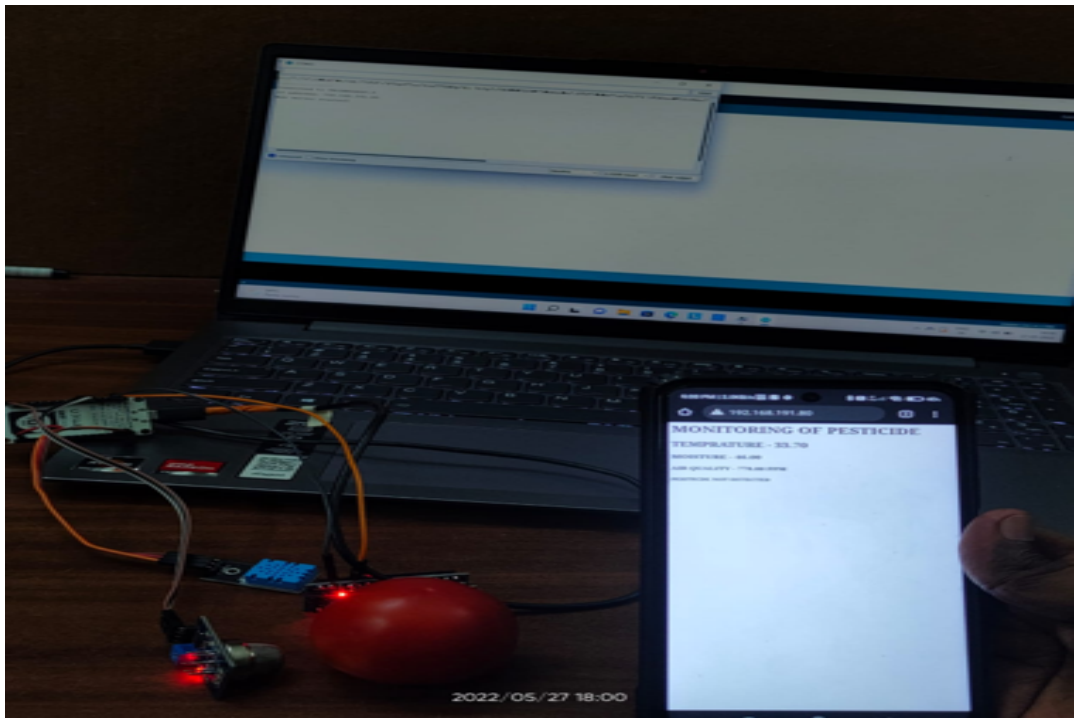


Figure 6.1: **Output 1**

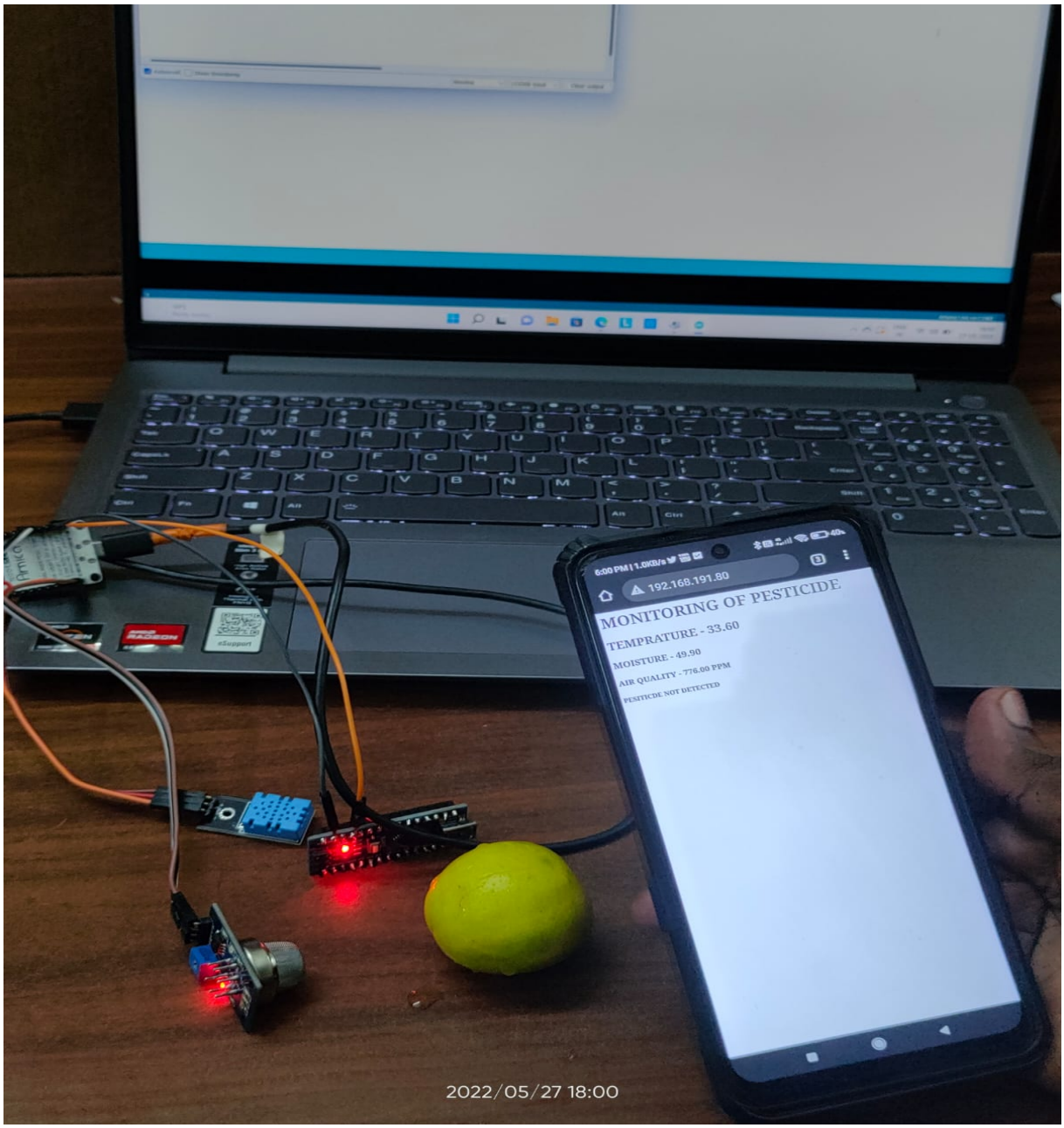


Figure 6.2: **Output 2**

Chapter 7

CONCLUSION AND FUTURE ENHANCEMENTS

7.1 Conclusion

The localization of pesticides in foods varies with the nature of molecules, type and portion of plant material and environmental factors, but are usually mostly present in their outer parts of fruits and vegetables. By using pesticides, we can increase the quantity of food, but not the quality of the food in a short period of time. Pesticide chemical food will spoil in less days than using organic manner.

The application of this pesticides residues detection instrument has been performed on real samples. The system showed to be successful in pesticide residues detection and agricultural products traceability. By detecting through the process it informs that how much residues of pests present so that the fruits and vegetables are washed more than twice still it reaches to 0.01. The application of this pesticides residues detection instrument has been performed on real samples. The system showed to be successful in pesticide residues detection and agricultural products traceability.

7.2 Future Enhancements

This project predicts three chemical compositions like Nitrate, Sulphur and Phosphorous in fruits and vegetables. In future, more number of chemical contents will be found and make experimentation with various fruits and vegetables.

Impact of Intensification Technologies on Pesticide Reduction PEF treatment has been applied as an effective method for reducing pesticide residues, their degradation level affected by electric field strength and the number of pesticide residue degradation.

Chapter 8

PLAGIARISM REPORT

ATTACH ONLY SUMMARY PAGE OF PLAGIARISM REPORT

Chapter 9

SOURCE CODE & POSTER PRESENTATION

9.1 Source Code

```
#include<LiquidCrystal.h>
int count=80;
LiquidCrystal lcd(12,7,5,4,2);
void setup(){
Serial.begin(9600);
}
void loop() {
  int s=digitalRead(7);
if(s==0)
{
count=count-15;
lcd.print(  Percentage    of pesticides );
lcd.println(count);
delay(1000);
  }
 }
}
```

9.2 Poster Presentation

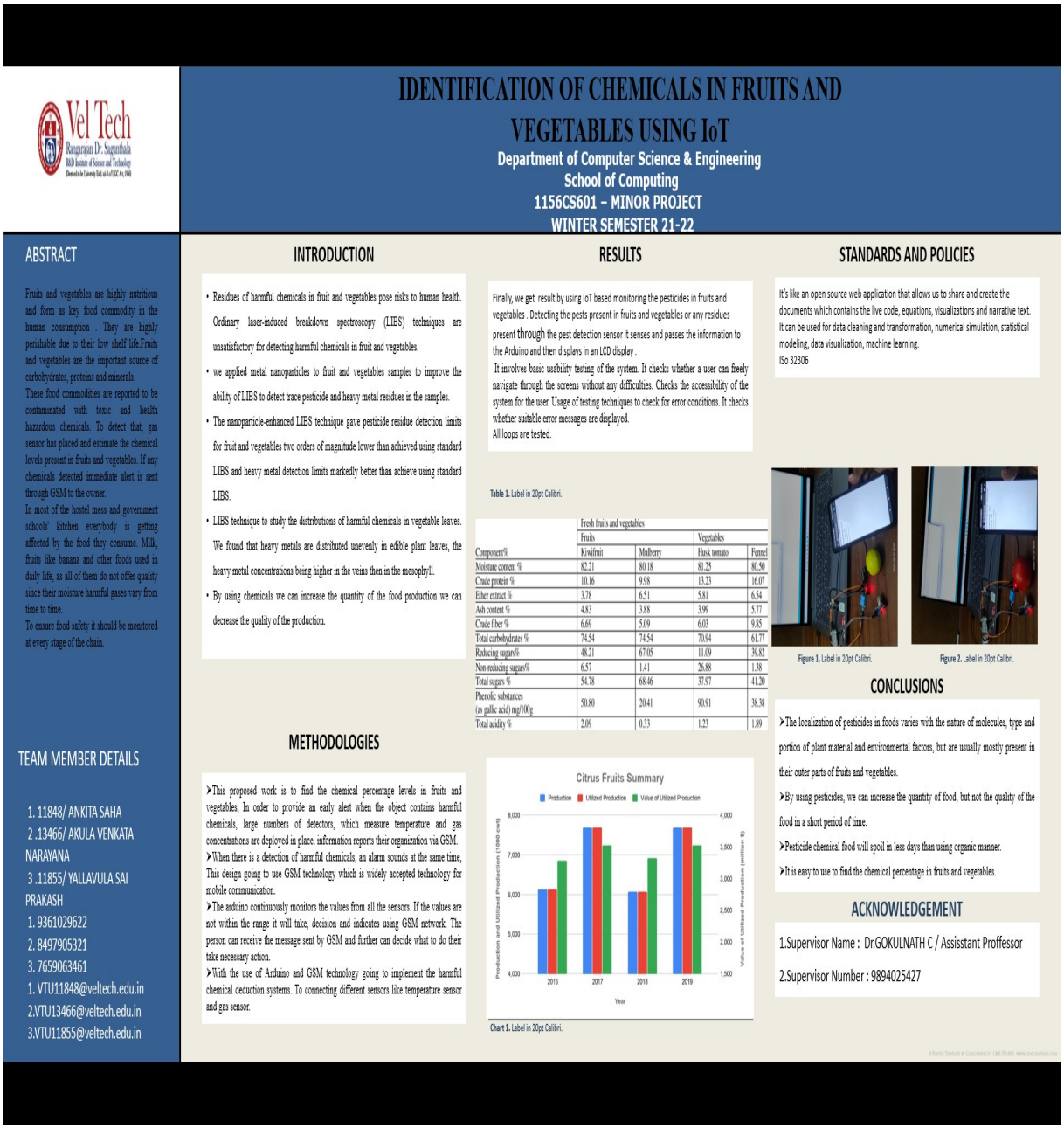


Figure 9.1: **Poster Presentation**

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[1] Arrutia, F.; Adam, M.; Calvo-Carrascal, M.Á.; Mao, Y.; Binner, E., 2001, Development of a continuous-flow system for microwave-assisted extraction of pectin-derived oligosaccharides from food waste. 352,182-186.

[2] Szadzinska, J,Lechtanska, J, Pashminehazar, R.; Kharaghani, A.; Tsotsas, 2019, E. Microwave- and ultrasound-assisted convective drying of raspberries: Drying kinetics and microstructural changes. Dry. Technol. 154,89-96.

[3] Belluzo M.S., Ribone M.E., Lagier C.M. Assembling Amperometric Biosensors for Clinical Diagnostics. Sensors. 2008;8:1366–1399.

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[5] Mustapha F. A. Jallow, Dawood G. Awadh, Mohammed S. Albaho, Vimala Y. Devi, and NisarAhmad"Monitoring Of Pesticide Residue In Commonly Used Fruits And Vegetables In Kuwait"Int J Environ Res Public Health. 2017 Aug.

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