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Food Quality Detection And Calorie Estimation Using Machine Learning

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Abstract - *Many states in India lack proper food supply to the poor. Many NGOs and non-profitable organizations work towards feeding the homeless and needy. But they lack funding and hence proper food storage facilities and maintenance is scarce. This project mainly focuses on helping these organizations to keep the food in check and serve unspoiled food. It also keeps track of the calories so a well-balanced diet food is given.*

***Key Words*: food safety, calorie estimation, machine learning, oxygen sensor, MQ3 sensor, IOT.**

1. INTRODUCTION

In this modern era of science of technology, the food sector is facing one of the major problems that is food spoilage. food items such as fruits, vegetables and meat are going stale .The bigger problem is these spoiled items going undetected and onto the hands of the consumer . Hence, there is a need for an automated process that would not only increase the accuracy of spoiled food detection, but also estimating calories present in it.

This project mainly focuses on helping NGO's and organizations to keep their food in check and serve unspoiled food. It also aims at keeping track of the calories so a wellbalanced diet food is given. We are also designing a mobile app which can be used to fetch data about calories of different vegetables and fruits for the users by uploading the image of any vegetables or fruits so as to keep track of their calories and maintain a healthy balanced diet.

In details, to automate this process, we are planning on using a collection of smart sensors like temperature sensor, MQ3 sensor with microcontroller like the Node MCU. On detection of a spoiled or stale food item, a sound buzzer will ring and a

LED light will glow to draw attention, we developed an app, as an application of IoT. This enables consumers to view the name of fruit or vegetable and also with the help of developing app we can estimate the amount of calories present in it.

In addition, the app classifies the image, predicts the name of the fruit or the vegetable and gives the calories associated with it. The frontend-backend is handled by the Streamlit. The user can visit the application by URL. The user can use the upload button upload button to upload the image.

2. LITERAUTRE SURVEY

There have been previous papers on different fields on food spoilage and calorie estimation.[1] An Arduino sensor-based approach for detecting the food spoilage A project on monitoring temperature in a small server room have been implemented previously. The data is sent online and if the values exceed a limit, the system turns the conditioning systems on and makes the temperature in the threshold values This paper is an IOT based consisting of a microcontroller Arduino Uno, Bluetooth module, electrical and biosensor like pH sensor, dampness sensor, and gas sensors. DHT- 11 is used to measure temperature and moistness, MQ2 to distinguish liquor content is linked with Arduino board. This is an IoT based system, sends necessary information to user through ESP8266 Wi-Fi. Here they focus on keeping the food storage surrounding to the optimal conditions [2] Iot based smart weighing system for crate in agriculture. [3] A new deep learning based food recognition system for dietary assessment on an edge computing service infrastructure.

Chang Liu, Yu Cao , Senior Member, IEEE, Yan Luo, Member, IEEE, Guanling Chen, Member, IEEE, Vinod Vokkarane, Senior Member, IEEE, Ma Yunsheng, Song qing Chen, Member, IEEE, This paper focuses on nutritional estimation of food using the visual based food recognition algorithms using edge computing. The project uses a visual sensor for capturing the food image, the mobile phone for the image preprocessing and segmentation and the server (cloud layer) with the pre trained CNN model and image classification. The multiple-stage food recognition system includes Image preprocessing in the front-end component and the Image segmentation in the front-end component (CNN based food image analysis) Every living being on earth is essentially dependent on nutrition to stay alive. Each individual cell needs energy to continue its vital activities such as growth, development and renewal of damages. Environmental conditions, for instance humidity and temperature allow organisms to spread inside food, these bacterial activities cause unwanted food spoilage which may be harmful for human health. [1].In India Data analysis showed that states of West Bengal (31.22),

Karnataka (29.11) and Gujarat (22.67) reported maximum average outbreaks and contributed to 31.5% illnesses and 8.7% deaths. Detecting food spoilage from production to consumption stages is very crucial. There is indeed an urgent need for fast and accurate systems, while conventional spoilage detection techniques are slow and time consuming [2]. As a result, new vision based techniques and algorithmic approaches have been proposed in the last decades. The most recently developed methods for detecting. Food spoilage are based on digital image processing, by using nano technology and state-of-the-art machine learning, which have already proven their high potential in the food industry. Here for food spoilage detection we are using nanotechnology,[3]. Nanotechnology based sensing approaches are capable of providing selective and specific information on the presence and amount of pathogens and toxins.in this project we are using MQ3 sensor [4].This MQ3 sensor that is used to detect the presence of toxic gas acetone and ethanol in the spoiled food. And also we are using oxygen sensor which tells us that [5] if food item is inhabited by germs ,the oxygen levels in the immediate surrounding is going to be lower than it normally is .The introduction of these sensors into food detection technology has paved the way for smart food detection. These sensors will be integrated with [6]Arduino uno board which is a popular prototyping board measures and sends data to iot platform.

3. PROPOSED MODEL DESCRIPTION

In our proposed work, we aim at detecting spoilage in food items as a part of hardware and estimating calories in food as a part of software. With the help of sensor nodes placed near food items methane range and temperature data can be collected at regular intervals. In this project we have used industrial MQ3 and temperature sensors. NodeMCU is with Arduino Uno boards.

In the block diagram, MQ3 and oxygen/temperature sensor is connected to the Arduino boards and hence gets connected to the Node MCU. Finally the data is shown on the blynk app and at the same time the buzzers are turned on to indicate spoilage of food if the values exceed the threshold.

For the software part, it is a simple web application in which the user needs to upload the Image of any fruit or vegetable. The system next automatically classifies the Image and gives the prediction about the name of the fruit or vegetable, and also gives the calories of the object. The frontend-backend will be handled by the Streamlit. The user can visit the application by URL. There will be upload button for the user to upload the image.

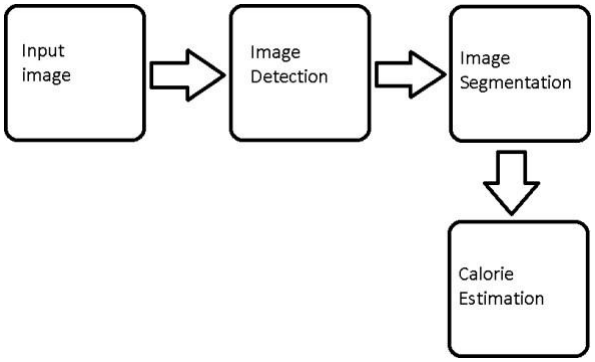

Fig -1: Process Flowchart

4. TECHINCAL SPECIFICATIONS

Our proposed work consists of 2 parts – hardware and software The hardware consists of a MQ3 sensor along with temperature for methane extent and temperature measurement respectively, Arduino UNO and nodeMCU for acquiring data from sensors and sending to the Arduino IDE. A buzzer and two LED, s are connected to the Arduino UNO for indicating the spoilage of the food and blynk app for displaying the methane and temperature data.

The frontend and backend of the web app is handled by the StreamLit. It is a simple web application in which the user needs to upload the Image of any fruit or vegetable. The system next automatically classifies the Image and gives the prediction about the name of the fruit or vegetable, and also about their respective calories.

The user will first upload the Image. That image Will be stored into the local system. Then pillow will resize the image according to our model shape, it will convert into vector. Now this vector will be passed to our model, our model will classify the class of category. We will get the ID of category, now we need to map the labels according to the ID. Now our system will do web-scrap the calories for predicted object. Our application will display the Result and Calories into our application.

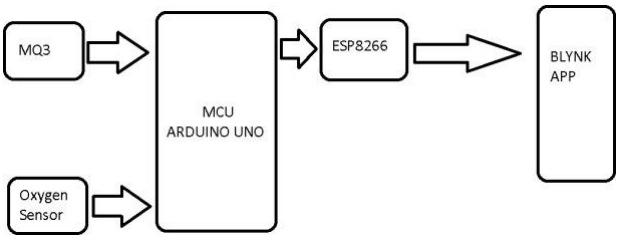

Fig -2: Flowchart

5.HARDWARE

5.1. Arduino UNO

Arduino is an open source platform used for building electronic projects.it is a company.it is basically a microcontroller. generally a microcontroller is difficult to use and programming needs some experience. whereas it comes as module with necessary pins and sockets connected with microcontroller along with IDE in easy programming language making it easier for small project applications.

5.2. MQ3 sensor

MQ standards for having sensitivity towards gas. It is made up of metal oxide semiconductors. MQ sensor are called chemo resistor because sensor values change according to change in resistance of gas. Specifications of MQ3 sensor are it operates 5V dc and draw 800 Mw, sensor resistance from 1M to 8MΩ, load resistance is 200kΩ. This module has 4 pins Analog Output (A0), Digital Output (D0), VCC, GND pins. The A0 pin output will be varied according to concentration of gas, when concentration of gas is high, output of A0 pin is high and vice versa for low concentration of gas.

5.3. ESP8266 Node MCU

NodeMCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module. Later, support for the ESP32 32bit MCU was added.

5.4. Piezoelectric Buzzer

A piezoelectric speaker is a loudspeaker that uses the piezoelectric effect for generating sound. The initial mechanical motion is created by applying a voltage to a piezoelectric material.

5.5. Temperature sensor

A temperature sensor is a device used to measure temperature. This can be air temperature, liquid temperature or The temperature of solid matter. The basic principle of working of the temp. sensors is the voltage across the diode terminals. If the voltage increases, the temperature also rises, followed by a voltage drop between the transistor terminals of base and emitter in a diode. Here we have used a thermistor in this project model.

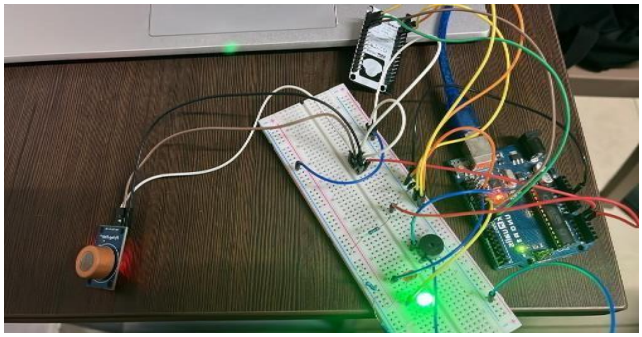

Fig -3: Hardware Circuit

6.SOFTWARE

6.1.PyCharm

PyCharm is an integrated development environment used in computer programming, specifically for the Python programming language. It provides code analysis, a graphical debugger, an integrated unit tester, integration with version, and supports web development with Django as well as data science.

6.2.Kaggle

Kaggle is world's largest data set community with powerful tools and resources to help to achieve one's data science goals. It allows users to find and publish data sets, explore and build models in a web-based data-science environment, work with other data scientists and machine learning engineers, and enter.

6.3.Web App

The web app contains a signup, login and main webpage. which the user needs to upload the Image of any fruit or vegetable. The system next automatically classifies the the Image and gives the prediction about the name of the competitions to solve data science challenges. Fruit or vegetable and also about their respective calories.

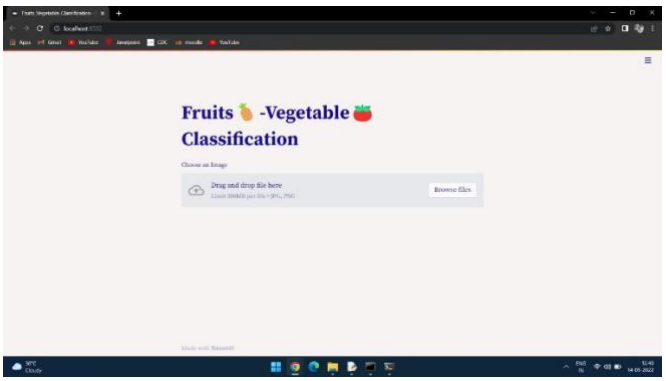

Fig -4: Calorie estimation Web App

7. RESULTS

7.1.Hardware

All the connections are successfully made and Arduino and nodeMCU is turned on. The sensors are brought close to a sample of food. The sensors connected to the Arduino polls data from both the sensors. This data is sent to the nodeMCU which the sends the data to the blynk app via IDE code. On detection of a spoiled or stale food item a buzzer sound will ring and a LED light will glow, notified through blynk app via the Arduino.

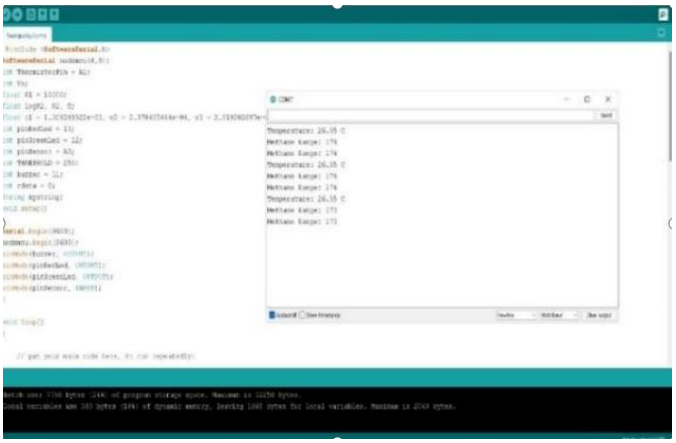

Fig -5: Arduino IDE code

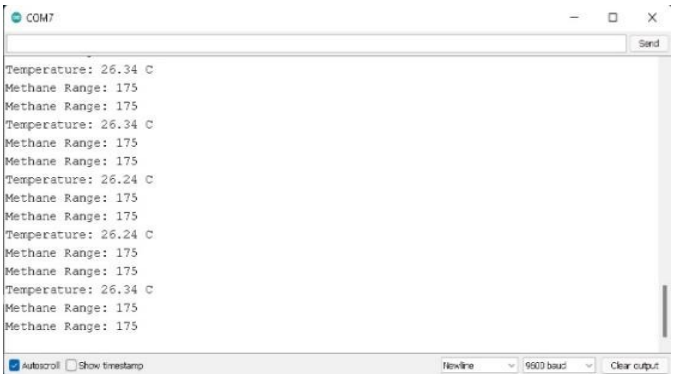

Fig -6: Methane And Temperature data values

Fig -7: Food Spoil Alert

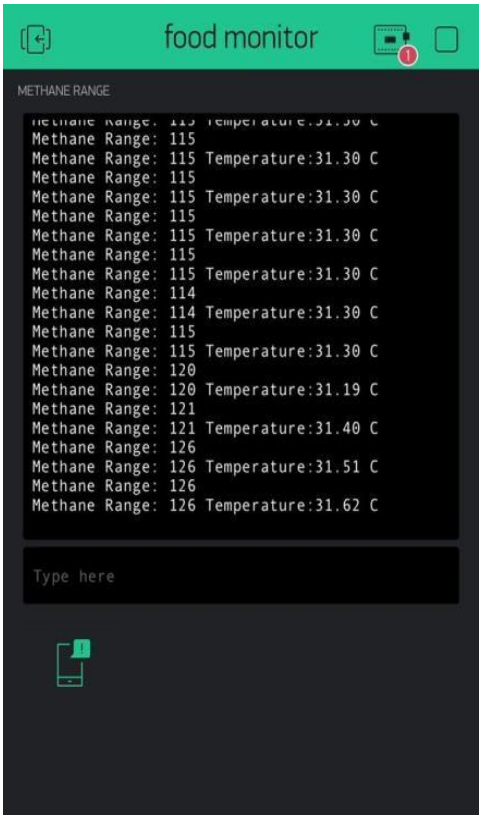

Fig -8: Blynk App output reading

7.2.Software

The user will first upload the Image. That image Will be stored into the local system. Then pillow will resize the image according to our model shape, it will convert into vector. Now this vector will be passed to our model, our model will classify the class of category. We will get the ID of category, now we need to map the labels according to the ID. Now our system will do web-scrap the calories for predicted object. Our application will display the Result and Calories into our website.

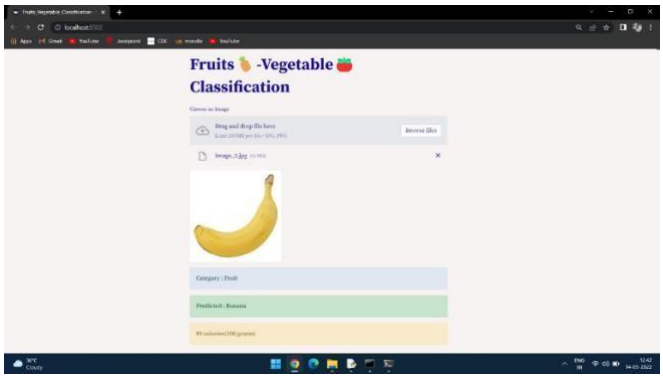

Fig -9: Prediction and calories estimation of banana

The user will first upload the Image. That image Will be stored into the local system. Then pillow will resize the

image according to our model shape, it will convert into vector. Now this vector will be passed to our model, our model will classify the class of category. We will get the ID of category, now we need to map the labels according to the ID. Now our system will do web-scrap the calories for predicted object. Our application will display the Result and Calories into our application.

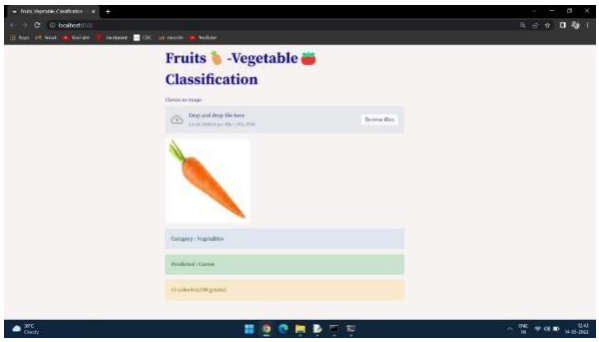

Fig -10: Prediction and calories estimation of carrot

8. CONCLUSION AND FUTURE SCOPE

We were able to detect spoilt food with the help of the proposed hardware model and also able to predict and calculate calories of different fruits and vegetables with the help of the software model. We can further detect spoilage of food for wider range of food items by increasing the number and types of sensors used in the project. For the software model we can further make it accurate for detection spoilage of food when uploaded a real time picture of a spoilt or stale food.

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