FRUIT DETECTION AND CALORIE ESTIMATION USING RASPBERRY PI

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Abstract— Information on the advancements in the field of health management is provided by this initiative. Fruit ripeness estimation methods are now extensively used in digital picture processing. The goal of this study was to investigate the various feature extraction algorithms and techniques currently in use for eliminating features from digital photos that have been captured. The quality of the fruits must therefore be marked on the packaging by the vendors. In this study, the weight, size, form, and colour of the fruit are used to assess its quality. All of these algorithms are implemented on the Raspberry Pi development board, which will eventually become a stand-alone and reasonably priced gadget.A cost-effective embedded system prototype for determining the size, shape, and colour of the fruit will be created by carrying out all of the component interfaces. Other fruits can use the same approach as well. Different classifiers have beencategorised according to their benefits and drawbacks. In addition, this fruit detector is applied to fruit calorie estimation for fruit photos. We use NN as a fruit detector to detect each fruit image, and the fruit calorie of each detected fruit are estimated by image-based fruit calorie estimation. In this way, we estimate fruit calories from a fruit photo of multiple fruit. In this experiment, we collect fruit photos of multiple fruit with total fruit calorie of multiple fruit. Then we estimate fruit calories from fruit photos of multiple fruit by combining the fruit detector and image based fruit calorie estimation.It was discovered that a compromise between high computing complexity and great precision was required.

Keywords—neural network(NN), convolutional neural network(CNN)

I.INTRODUCTION

This paper explains how a Raspberry Pi can be usedto assess the freshness of fruit.As is well known, foodis essential for human survival. The handling andstorage of food improperly might lead to food poisoning. This occurs as a result of the majority of bacteria being undetected and unseen. Additionally, these bacteria normally don't alter the flavour, aroma,or appearance of fruit. Therefore, we should examine the strategies for avoiding food poisoning and promoting the use of fresh foods. The raspberry pi is used in this project's detector system, which checks the freshness of fruits. When fruit is gathered, it should be put on a conveyor belt so that it can travel through a sensor device that can determine the fruit's full freshness state and display it.The most recent developments and applications of image analysis in the field of agricultural and food product quality assessment. In agricultural science, images are crucialsources of data and information. The fundamentalideas and innovations behind computer vision systems, automatic vision-based technology, and tools for image analysis, automated sorting, and automated grading are highlightedThe proposed method begins the procedure by utilising a Raspberry Pi to capture an image of the fruit. The image is then passed along to the stage of processing where the features of the fruit, such as colour, shape, and size of

fruit samples, are retrieved. Fruit photos are then put through training and testing on an artificial neural network. The shape, size, and colour of fruit are detected using a neural network in this proposed article, and the findings show great promise when these three variables are combined.The quality of different fruits are detected and the percentage offruits are displayed in the monitor.

Due to the development in health consciousness, there has been a noticeable increase in the demand for better food options in recent years. Fruits are a vital part of a balanced diet and are a great source of fibre, vitamins, and minerals. It might be difficult to recognise and keep track of the calories in fruits, though. This is where technology can be quite useful.Since the release of the Raspberry Pi, a little computer the size of a credit card that supports numerous programming languages, it has become possible to create original solutions for practical issues. One such solution that can make keeping trackof fruit intake easier and support maintaining a healthy lifestyle is fruit identification and calorie estimate using a Raspberry Pi.Using a camera moduleto take pictures of fruits is part of the Raspberry Pi fruit identification and calorie estimation system. Thetype of fruit shown in these shots is then identified byanalysing the images using computer vision techniques. The system first determines the fruit's type before estimating its calorie count after getting nutritional data from a database.The fruit identification and calorie calculation system built on the Raspberry Pi can be utilised in a variety of locations, including homes, stores, and restaurants. It can assist families keep track of their family members' fruit intake, particularly kids, and support a balanced diet. It can be used to precisely calculate thecalorie content of the fruits sold or served in supermarkets and restaurants, assisting in giving customers with more clear and precise nutritional information.

People who desire to maintain a healthy lifestyle but find it challenging to manually check their calorie consumption can also use the system. By streamlining the procedure and providing precise nutritional data, the Raspberry Pi-based fruit identification and calorie calculation system can help people keep track of their daily caloric intake and maintain a balanced diet.The Raspberry Pi fruit recognition and calorie calculation system offers tremendous opportunities for students and researchers to advance their expertise in computer vision and machine learning in addition to its practical uses. It gives students the chance to work on actual issues and provide original answers that might significantly affect society.

II . SYSTEM ANALYSIS

A. Method

Depending on the food items, the sensors in the sensor plate are activated. Due to the development in health consciousness, there has been a noticeable increase in the demand for better food options inrecent years. Fruits are a vital part of a balanced diet and are a great source of fibre, vitamins, and minerals. It might be difficult to recognise and keep track of the calories in fruits, though. This is where technology can be quite useful.. The usage of a smart sensor plate allows for the detection of the freshness of home goods like meat and prepared foods. The term "smart plate" refers to a flat plate with numeroussensors that, depending on the food item, are triggered. The panel can be used to select the sort of food item after this plate has been placed in the utensil. More functionality is added to the device via smartphones. An app for mobile devices is created to collect data from smart phones and produce advance warnings about the status of the food item. After setting the necessary parameters, the smart plate is placed inside the vessel with the food item to be identified in it.

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Using a camera module to take pictures of fruits is part of the Raspberry Pi fruit identification and calorie estimation system. The sort of fruit depicted in these photographs is then determined by utilising computer vision algorithms to analyse the images. After determining the fruit's type, the algorithm estimates its calorie content after retrieving nutritional information about it from a database.The fruit identification and calorie calculation system built on the Raspberry Pi can be utilised in a variety of locations, including homes, stores, and restaurants.It can assist families keep track of their family members' fruit intake, particularly kids, and support a balanced diet. It can be used to precisely estimate the calorie content of the fruits sold or served in supermarkets and restaurants, assisting in giving customers with more transparent and accurate nutritional information and ultimately determining the quality of food items. An Android application built on Java that accepts user input can be used to activate the smart plate and define the meal item.

III . OUR PROJECT EXPLAINATION

The liquid crystal molecule tends to untwist when an electrical current is given to it; this is the basic idea behind LCDs. As a result, the angle of light travellingthrough the polarised glass molecules and the angle of the top polarising filter alter. As a result, a little amount of light is permitted to flow through a specific portion of the LCD's polarised glass. As a result, that particular spot will become darker than others. The LCD operates on the idea of light blocking. At the back of the LCDs that are built, a mirrored mirror is placedAn indium-tin oxide electrode plane is preserved on top of the device, and polarised glass with a polarising layer is also put to the bottom. A common electrode must completely encompass the LCD's display area, and liquid crystal material must be placed on top of the electrode. The second piece of glass that follows has another polarising film on top and an electrode in the shape ofa rectangle at the bottom. The fact that both parts are maintained at right angles must be taken into account The light will be reflected by the mirror and bounced back as it passes through the front of the LCDwithout any current. The liquid crystals between the common- plane electrode and the electrode shaped like a rectangle will untwist as the electrode is connected to a battery by the current from it. As a result, the light is prevented from passing. That particular rectangle looks to be empty.

A . Visualisation

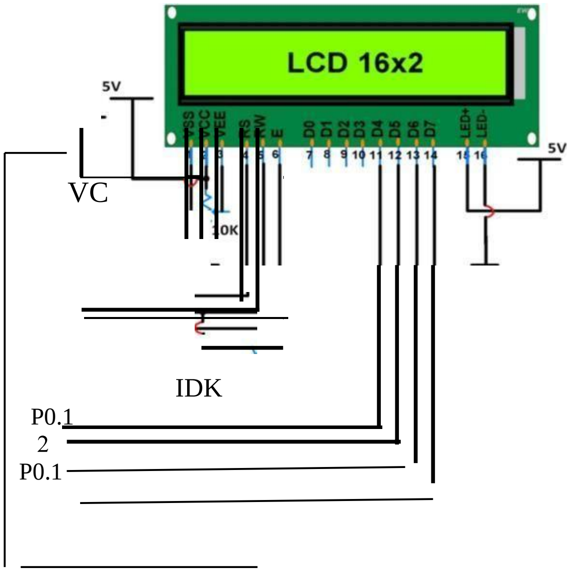

Fig 1 lcd visualization

B:components

RASMINE PI
The Broadcom System on Chip (SOC), which housesan ARM-compatible CPU, on-chip graphics processor, and Vediocore IV, is the brains of the Raspberry Pi.
The distinguishing characteristics of the First to Third Generations are as follows:
The speed of the CPU varies from 700 MHz to 1.2GHz.
RAM on board can be anywhere between 256MB and 1 GB.

- USB slots are distinct from 1 slots.
- 3.5mm phone jack, composite video output, andHDMI.
- GPIO pins, which support popular protocols like l2C (inter-integrated circuit), give low level output.
- 8 Position 8 Contact (8P8C) for Ethernet.ProcessorThe Broadcom BCM28XX serves as the Raspberry Pi's main processor. The Raspberry Pi uses this Broadcom System on Chip (SOC) chip. From the first to the third generation, the CPU includes:
- Raspberry Pi 1: Broadcom BCM2835 SOC with 700MHz CPU speed, 128KB L2 cache, and 32-bitRISC ARM AR1l 76JZF-S compatibility.
- Raspberry Pi 2: Broadcom BCM 2836 SOC, 32-bit quad-core ARM cortex-A7 (ARMv7), 900MHz CPU speed, 256KB L2 cache.
- Raspberry Pi 3: Broadcom BCM2837 SOC with 64-bit ARMv8 instruction set, 1.2GHz quad-core A53 processor, and 512 kb shared L2 cache.

C: Schematic diagram

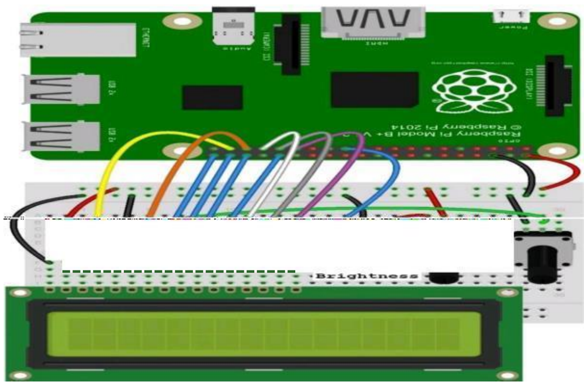

Fig 2 schematic lcd

D:programming language

Numerous programming languages have been adapted for the Raspberry Pi. Python is recommended by the Raspberry Pi Foundation as an excellent programming language, particularly for beginners. Almost any programming language that can be built for ARMv6 is usable on the Raspberry Pi. Therefore, users are not restricted to using Python only. The Raspberry Pi comes with pre-installed versions of several languages, including Ruby, C, C++, Java, andScratch.The Python programming language was developed by Guido van Rossum at the National Research Institute in the late 1980s. Python has grown in popularity and is used extensively in industry.

Python is a powerful and flexible programming language that is very easy to learn and use. Python's straightforward syntax makes it a helpful tool for people who want to learn programming. Because of this, the Raspberry Pi Foundation endorses it. Python is open-source software that can be used on a variety of operating systems. Python can be used on devices running Linux, OS X, and Windows.

Fig 3 fresh apple and rotten apple

Cross-platform compatibility ensures that Python-written programmes run smoothly on many operating systems. There are only a few instances in which the programmes are incompatible. For instance, when Python is instructed to access particular hardware, such the GPIO on a Raspberry Pi.

Python has an autonomous memory management system and a dynamic type system. It features a sizable and thorough library, supports a variety of programming paradigms, including imperative, functional, procedural, and object-oriented. A multi- paradigm programming language is Python. Many of its features also allow functional programming and aspect-oriented programming, including by meta programming and meta objects (magic methods), in addition to fully supporting object-oriented programming and structured programming. Extensions are available for many additional paradigms, such as design by contract and logic programming.

Python is a general-purpose programming language created by Guido van Rossum that quickly gained popularity due to its ease of use and readable code. The programmer is able to express his thoughts in less code without sacrificing readability. Python is slower than other languages like CIC++. But anothercrucial aspect of Python is its simplicity of CIC++ extension.

IV. RESULTS

This code builds a Concolutional Neural Network(CNN) using Keras for the purpose ofclassifying images of fruits into six categories: fresh apples, rotten apples,fresh bananas,rotten bananas, fresh oranges and rotten oranges.

The initial section of the code imports the required libraries and establishes the training batch size.Then, to execute data augmentation and define an Image Data Generator object the training images being resized.Additionally, it specifies the classes, goal size, and directory where the training images are stored.The CNN model is then defined using Keras' Sequential API.The model consists of five convolutional layers, each followed by a max pooling layer, and a fully-connectedlayer with 128 neurons.

Fig 4 fresh banana and rotten banana

The output layer uses a softmax activation function and comprises four neurons, one for each of the four types of fruits. The categorical cross-entropy loss function, the Adam optimizer with a learning rate of 0.0001, and accuracy as the evaluation metric are then used to construct the model. The training epoch count is set at 30.Finally, using the model's fit generator approach, the model is trained on the training set.The accuracy and loss curves are shown using matplotlib, and the training history is kept in a dictionary. After that, the model is stored as a h5 file.

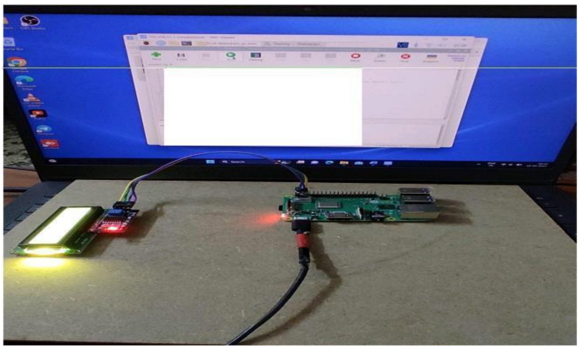

Fig 5 CNN Model

The app uses a user-uploaded photograph that has been preprocessed before being fed into a Keras deep learning model that has already been trained to classify the fruit. The user is then shown the results of the classification.Overall, this code shows how to utilise feep learning for image classification in a straightforward yet efficient manner. The model is made up of five convolutional layers, each followed by a layer with maximum pooling and a layer with 128 neurons that are fully linked. The output layer uses a softmax activation function and comprises fourneurons, one for each of the four types of fruits. The categorical cross-entropy loss function, the Adam optimizer with a learning rate of 0.0001, and accuracy as the evaluation metric are then used to construct the model.

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