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Food recognition and analysis using image processing

Dheeraj Belliappa K S

dheerajbelliappa3090@gmail.com

School of Engineering and Technology Jain University
(SET JU), Bengaluru, Karnataka

Karan Vikram Singh Bhatia

karan.vikram7@gmail.com

School of Engineering and Technology Jain University
(SET JU), Bengaluru, Karnataka

Fathima Seher

fathimaseher963@gmail.com

School of Engineering and Technology Jain University
(SET JU), Bengaluru, Karnataka

Chinmita Shetty

shettychinmita@gmail.com

School of Engineering and Technology Jain University
(SET JU), Bengaluru, Karnataka

Asha K S

asha.kps@gmail.com

School of Engineering and Technology Jain University
(SET JU), Bengaluru, Karnataka

ABSTRACT

Some portion of what makes getting in shape so troublesome is that checking calories is a vague science at best. Eating food without knowledge of its composition and nutritional contents prompts poor processing leading to poor health. The Smork is an electronic fork that helps you to screen and track your dietary patterns. Each time you convey nourishment from the device it indeed, even with nutritious data, one needs to screen serving sizes, people are continually searching for approaches to enhance their health and wellbeing. The typical procedure of getting nutritional data is by utilizing google or utilize some application, for example, Coach, Noom, Calorie Counter, and Lose It. In this paper, we proposed to make this procedure more brilliant, speedier, and more proficient by building an electronic device that can demonstrate the nourishment data by just taking a photo of the meal. Using Raspberry Pi board as the core processing unit of the whole system a Weight sensor, HX711 Load Cell Module and a 5MP Raspberry Pi camera attached to the smart fork collects data and transmits it to a food database where it is compared with predefined food values and tallies the image using an image processing technique on Matlab platform. The smart-fork connects to the Android application using Bluetooth. We build up an android reality application to help clients to get nourishing data in a simple way. The data is shown as calorie, fat, starch, and protein per serving. Utilizing this application, clients can get the healthful data just by taking a photo of the food and not withstanding cooking techniques to know exactly how much calories are being expended. SmartFork needs to do all the tallying, compiling, analysis and leave the users of the fork to just do the eating.

Keywords: Raspberry Pi 3, Hx7111 Load Cell, 5MP Raspberry Pi camera, Matlab.

1. INTRODUCTION

The Smork is an electronic fork that helps you to screen and track your dietary patterns. Each time you convey nourishment from the device it indeed, even with nutritious data, one needs to screen serving sizes, people are continually searching for approaches to enhance their health and wellbeing.



Figure -1 Smart Fork Device

1.1 Literature Survey

As individuals over the globe are ending up more keen on watching their weight, eating all the more steadily, and maintain a strategic distance from corpulence, a framework that can gauge calories and food can be extremely helpful. In this paper, we propose a food calorie and nourishment estimation framework that can help patients and dieticians to quantify and oversee everyday food consumption. There have been various proposed strategies for estimating everyday food dietary data. One case, which is normal of current clinical methodologies, is the 24-Hour Dietary Recall. The possibility of this technique is the posting of the day to day food allow by utilizing a configuration a time of 24 hours. This technique requires a prepared questioner, for example, a dietician, to request that the respondent recall in points of interest all the food and beverages she has expended amid a timeframe in the current past (regularly the past 24 hours). The 24HR requires just here and now a memory, and if the review is unannounced, the eating routine isn't changed. Be that as it may, it isn't generally simple for a man to recollect the genuine substance and also the measure of the nourishment consumption. The issue with this manual approach is self-evident: individuals not recalling precisely what they ate, neglecting to observe, and expecting to see a specialist dietician on an extremely visit premise so the dietician can think about how much calories and supplement the individual has taken. To reduce the inadequacies of these clinical strategies, there is a need for an enhanced system. A portion of these methods requires the individual to take a photo of the nourishment before eating it, with the goal that the photo can be handled disconnected, either physically or consequently, to gauge the measure of calorie. An individual advanced assistive (PDA) framework has additionally been proposed for food calorie estimation, where patients utilize the PDA to record their day by day nourishment consumption data on a cell phone. In any case, it has been demonstrated that the after effect of the bit estimation has noteworthy blunder and furthermore it requires a long investment for the client to record the data. The principle drawback of this framework is that it doesn't consider the extent of the nourishment, which is critical. Contrasted with the above strategies, our proposed framework has less of their inadequacies. Our estimation framework additionally utilizes a photograph of the food, taken with the implicit camera of an advanced cell, we at that point apply picture preparing and characterization systems to discover the nourishment parcels, their volume, and their nutritious certainties. It comprises of utensils, for example, fork and a spoon which are battery worked and rechargeable. It can enable you to make your wellbeing and wellness objectives by letting you know precisely what you are eating when you are eating and the amount you are eating. It utilizes signal acknowledgment, so it knows each time you take a nibble. You should simply eat ordinarily. It can be conveyed in an uncommonly planned box and utilized notwithstanding when eating in a hurry with some dispensable plastic heads. Our framework is intended to help dieticians for the treatment of stout or overweight individuals, albeit typical individuals can likewise profit by our framework by controlling all the more intently their day by day eating without stressing over gorging and weight pick up and distinguishing nourishment things in a picture utilizing picture handling and division, food arrangement, food parcel volume estimation, and calorie estimation in light of food divide mass and dietary tables.

1.2 Problem Definition

Obesity is the significant reason for overweight this prompts the sort II diabetes, coronary illness, and malignancy. Estimating the food is imperative for a fruitful solid eating routine. Estimating calorie and nourishment in day to day food is one of the test methods. Obesity treatment needs the patient to see the quantity of the everyday nourishment consumption, however, by and large, it is difficult for the patients to live or administration their day by day allow in view of the shortage of nourishment, training or discretion. Be that as it may, much of the time, lamentably patients confront challenges in evaluating and estimating the measure of food allow because of the abstinence of the issue, absence of wholesome data, the manual procedure of recording this data.

In that capacity, a self-loader checking framework to record and measure the measure of calories expended in a feast would be of incredible cause not exclusively to patients and dietitians in the treatment of weight, yet in addition to the normal calorie-cognizant individual. Without a doubt, various food consumption estimating strategies have been produced over the most recent couple of years. However, the vast majority of these frameworks have disadvantages, for example, utilization challenges or expansive computation mistakes. Moreover, a considerable lot of these techniques are for exploratory practices and not for genuine utilization. In our proposed framework, we utilize a bigger number of highlights than different frameworks, including shading, surface, size, and shape, while most existing techniques around there, utilize just shading and shape highlights. Knowing the measure of calories in our nourishment we could lead a more beneficial and calm life ahead. Accordingly taking in the perfect measure of calories will prompt a sound future.

1.3 Objective

With our Smart Fork gadget, you can know the measure of calories you allow as opposed to consuming the high calories later on. With joining the information gathered utilizing IOT we will need to give shut circle input framework which measures and reviews your everyday calorie admission and consuming. Our framework is intended to help dieticians for the treatment of hefty or overweight individuals, albeit typical individuals can likewise profit from our framework by controlling all the more intently their everyday eating without agonizing over indulging and weight pick up and distinguishing food things in a picture utilizing picture handling and division, nourishment order, food parcel volume estimation, and calorie estimation in light of nourishment divide mass and nutritious tables. Savvy spoon is an instrument used to keep from getting fat and to control human wellbeing. Nourishment quality can be characterized as the level of brilliance of food incorporates factors, for example, taste, appearance, and wholesome quality, and in addition to bacteriological or keeping quality. We give shut circle criticism framework which measures and reviews your day by day calorie admission and consuming. In this way enhancing wellbeing and giving definite investigation of nourishment synthesis.

1.4 Proposed System

Our estimation framework utilizes a photograph of the food, taken with the implicit camera of the Smart Fork, we at that point apply picture handling and order systems to discover the nourishment partitions. It comprises of utensils, for example, fork and a spoon which are battery worked. A picture is characterized as a two-dimensional capacity, $f(x,y)$ that conveys some data, where x and y are known as spatial or plane directions. A computerized picture is made through the procedure of digitization. Pixels are little individual components of an advanced picture. The term computerized picture preparing alludes to procedure of breaking down and controlling a two dimensional picture by an advanced PC. A computerized picture is a variety of genuine or complex numbers spoke to by a limited number of bits. It can help you make your health and fitness goals by telling you exactly what you are eating, when you are eating and how much you are eating. It uses gesture recognition, so it knows every time you take a bite. All you have to do is eat normally.

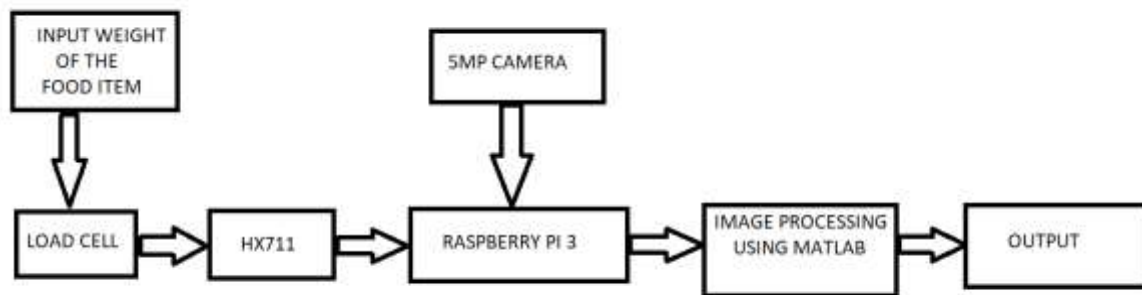


Figure -1.4- Block Diagram and Working

1.5 Software used:

Matlab is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include:

- Math and computation
- Algorithm development
- Modeling, simulation, and prototyping
- Data analysis, exploration, and visualization
- Scientific and engineering graphics
- Application development, including Graphical User Interface building

Matlab is an interactive system whose basic data element is an array that does not require dimensioning. This allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar non interactive language such as C or Fortran. The name Matlab stands for matrix laboratory. Matlab was originally written to provide easy access to matrix software developed by the LINPACK and EISPACK projects, which together represent the state-of-the-art in software for matrix computation. Matlab has evolved over a period of years with input from many users. In university environments, it is the standard instructional tool for introductory and advanced courses in mathematics, engineering, and science. In industry, Matlab is the tool of choice for high-productivity research, development, and analysis. Matlab features a family of application-specific solutions called toolboxes. Very important to most users of Matlab, toolboxes allow you to *learn* and *apply* specialized technology. Toolboxes are comprehensive collections of Matlab functions (M-files) that extend the Matlab environment to solve particular classes of problems. Areas in which toolboxes are available include signal processing, control systems, neural networks, fuzzy logic, wavelets, simulation, and many others. Image Processing Toolbox provides a comprehensive set of reference-standard algorithms and workflow apps for image processing, analysis, visualization, and algorithm development. You can perform image segmentation, image enhancement, noise reduction, geometric transformations, image registration, and 3D image processing. You can accelerate your algorithms by running them on multicore processors and GPUs. Many toolbox functions support C/C++ code generation for desktop prototyping and embedded vision system deployment.

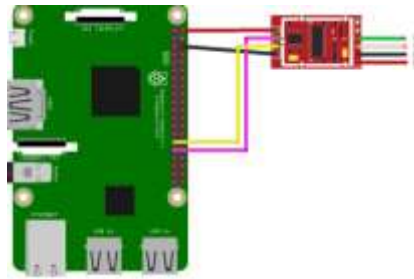


Figure 1.7.1- Raspberry Pi 3 connected to Hx711

Once the weight of the food is obtained, image processing comes into the picture. Our estimation framework utilizes a photograph of the food, taken with the implicit camera of the SMART FORK, we at that point apply picture handling and order systems to discover the nourishment partitions. The camera module v2 connects to CSI -2 camera port and consumes 250mA of power from the board using a short ribbon cable. The incoming camera data is processed and eventually converted to an image on the SD card.



Figure 1.7.2- Raspberry Pi 3 5MP Camera

The Raspberry Pi Camera Module is a 5 megapixel specially crafted add-on for Raspberry Pi, including a settled concentration focal point. It's equipped for 2592 x 1944pixel static pictures, and furthermore bolsters 1080p30, 720p60 and 640x480p60/90 video. The board itself is minor, at around 25mm x 20mm x 9mm. It likewise weighs a little more than 3g, influencing it to ideal for versatile or different applications where size and weight are vital. It associates with Raspberry Pi by a method for a short strip link. The sensor itself has a local determination of 5 megapixels and has a settled concentrate focal point on-board. Regarding still pictures, the camera is fit for 2592 x 1944 pixel static pictures.

A photo is described as a two-dimensional limit, $f(x,y)$ that passes on a few information, where x and y are known as spatial or plane headings. An automated picture is made through the methodology of digitization. Pixels are minimal individual parts of a propelled picture. The term automated picture getting ready insinuates technique of separating and controlling a two-dimensional picture by a propelled PC. A mechanized picture is an assortment of certifiable or complex numbers addressed by a set number of bits.

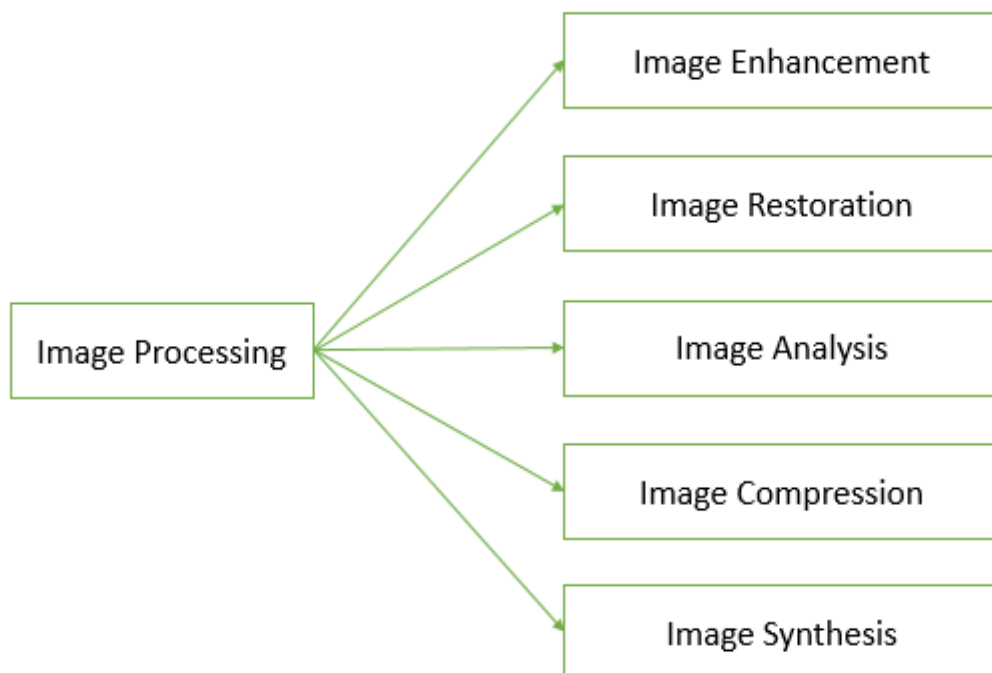


Figure 1.7.3- Image Processing Flow

Our image processing technique works using the following steps to get laser sharp results and make sure that the food matches with it are identical appropriate database. Hence, it first get's enhanced and restored for clarity lost during transmission. Next, it is analyzed for different parameters and then compressed and synthesized.

A biased maximum margin analysis (BMMA) and a semi supervised BMMA (Semi BMMA) is used based on the graph-embedding framework The BMMA differentiates positive feedbacks from negative ones based on local analysis, whereas the Semi BMMA can effectively integrate information of unlabeled samples by introducing a Laplacian regularizer to the BMMA. With the incorporation of BMMA, labeled positive feedbacks are mapped as close as possible, whereas labeled negative feedback are separated from labeled positive feedbacks by a maximum margin in the reduced subspace.

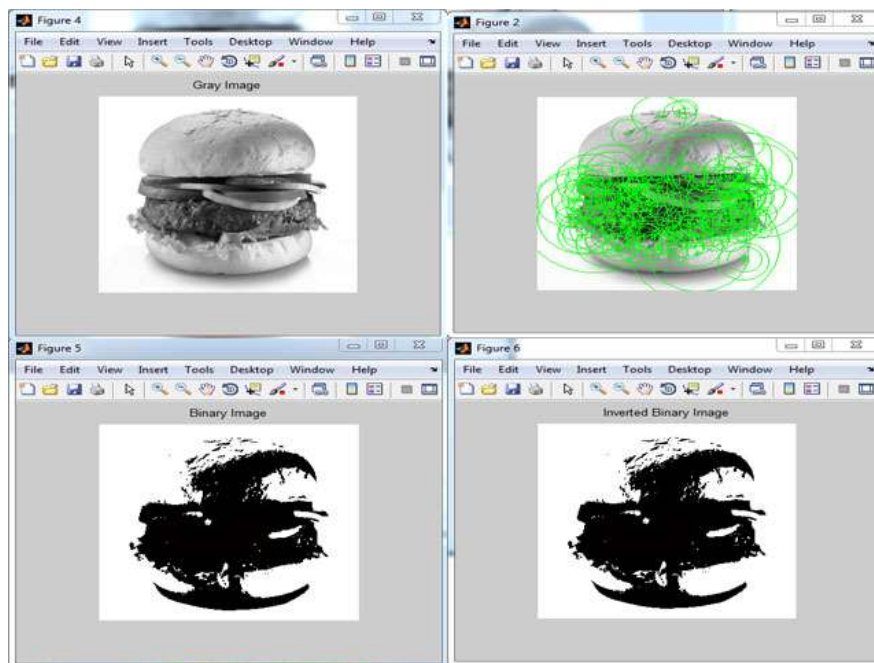


Figure 1.7.4- Steps involved in Food Recognition

Once the food is recognized, it is compared with the database. A database consists of pre-loaded nutrition information about various food items. Therefore along with the weight of the food and the type of the food, the amount of calorie intake along with the nutritional gain can be obtained with the help of the database. It can help you make your health and fitness goals by telling you exactly what you are eating when you are eating and how much you are eating. It uses gesture recognition, so it knows every time you take a bite. All you have to do is eat normally.

2. CONCLUSION

With the help of data, that is the weight of each bite of food obtained from the HX711 load cell sensor, the amount of food that is consumed can be known and with the photograph from the camera linked with the raspberry pi and with the help of image processing which compares the data with the preloaded database, the exact nutritional information of the food item consumed can be obtained. This unique method will lead to relatively accurate results without the difficulties of other methods. Our results will show that the accuracy of our system is acceptable and it will greatly improve and facilitate current manual nutrition measurement techniques.

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