Towards Developing an Automated Freshness and Defection Detector

Sumaiya Kashmin Zim, Zannatul Ferdous, Eusha Khan, Fardeen Ashraf, Md. Shahir Zaoad
Department of Computer Science and Engineering, Military Institute of Science and Technology, Mirpur Cantonment, Dhaka-1216, Bangladesh
Email: zannatul207@gmail.com, skashminzim@gmail.com, eushakhan911@gmail.com, fardeenashraf98@gmail.com, shahir.glhd@gmail.com

Abstract- One of the biggest problems in the food industry is that it faces food spoilage and these spoilt items are going undetected and onto the hands of the consumer. The process of checking of quality of items is done manually depending on human eye which in most of the cases fails to give an accurate result. The general process of detecting defection of fruits and vegetables is inefficient and high time consuming for industrial uses. This automated defect detection project intends to create an automated system to identify raw and stale elements and separate them from the fresh ones.
Index terms- Fruit freshness detector, fruit defection detector, fruit separator, image processing

I. Introduction

In our country almost in every aspect of food marketing food is judged on site based on human evaluation. Each time a customer buys fruits he has to evaluate each fruit to make sure he is getting fresh fruits. Again an important sector of agriculture business is the production and supply of the fresh fruits and vegetables to the vendors and markets. The growing demand for effective food production and quick and safe supply to the market has led to the development and use of various innovative technologies in this industry [4]. On the other hand industries or factories that are working with fruits are also judging fruits depending on the evaluation of workers and the process of separation is done by hand. Whereas for regular customer evaluating food isn't a very big deal but at an industry level it is highly inefficient and time-consuming. So instead of hand picking fresh fruits, industries can incorporate an automated system using conveyor belt, camera for detecting food and mechanical separator to separate fruits. And using image processing and deep learning models [1]-[3] the system will be capable of detecting food and separate and automatically, which is more correct value than of hand picking system and overall efficient and time saving.

II. Literature Review

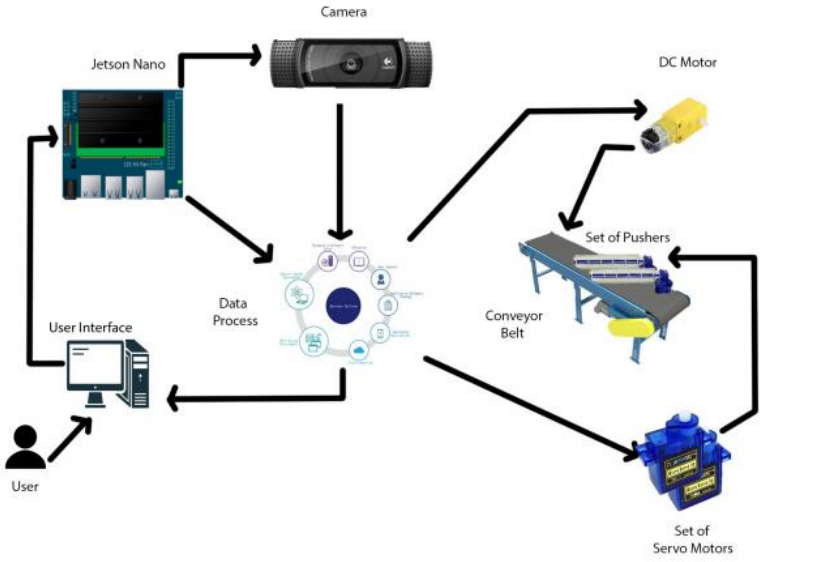
Main challenge of this system is the implementation of an algorithm that will be able to detect fruit efficiently. Deep learning is one of the latest trends in Machine Learning and Artificial Intelligence research [5]. Many significant breakthroughs have been made in this field throughout the world. In the field of agriculture, deep learning was applied to classify the maturity of oil palm fruit [6] which is then developed to automate the palm fruit picking machine that can harvest palm fruit according to its level of maturity. Other studies showed that deep learning can be used as an automatic system for plant counting [7-8].
Deep learning is also useful for various domains, For instance, in medical diagnostic imaging, it can reduce delays in diagnosis and provide a better level of accuracy than other analytical techniques , classify videos on knowledge management systems in an organization, for batik pattern recognition [9], remote sensing , and even for protein modeling. This superior performance of deep learning is obtained from its capability to automate

feature discovery, which differs from the classical image processing that needs handcrafted features [10-11]. However, this excellent performance comes at a cost of requiring a huge amount of data to train the model.
In deep learning, Convolutional Neural Network is a class on deep neural networks that is most commonly applied to analyze visual images. It is used to perform image recognition, image classification, object detection, and face recognition. CNN consists of neurons that have weights and biases that can be learned. Each neuron can receive several inputs, by producing a point as a product and optionally following it with non-linearity. The whole network still expresses a single score function that can be distinguished from raw image pixels at one point to class scores at the other end.

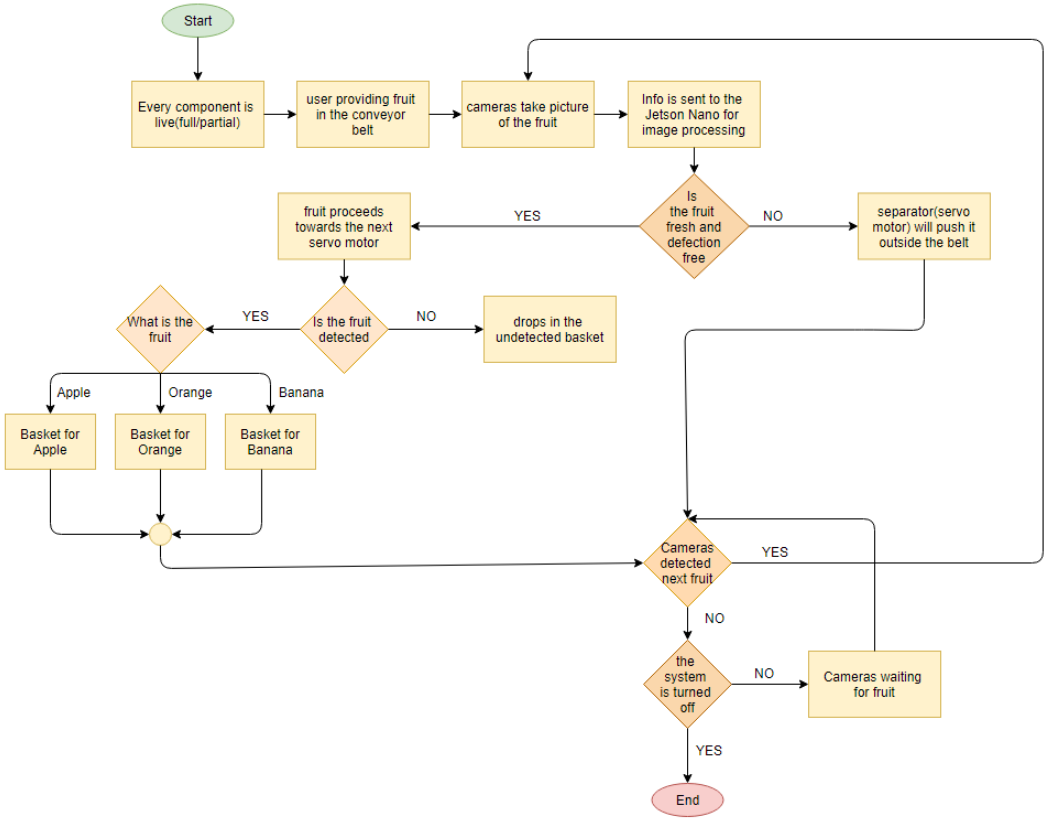
In the algorithm, CNN is a deep learning model that can take pictures as input, by determining the value of weights and biases that can be learned from various aspects/objects in the image and can distinguish one from another. Pre-processing required by CNN is far more economical compared toother classification algorithms. While in the previous method the filter was manually engineered, while CNN with sufficient training, was able to learn the filters/characteristics of an object. CNN hasthe advantage of computational efficiency which uses convolution operations, spatial integration, anduses parameter sharing. Thus, it allows CNN models to run on any device including mobile devices. Inthe history of the development of the first CNN is LeNet then followed by AlexNet, GoogLeNet, VGGNet, Inception-V3, Inception-V4, ResNet-50, MobileNet, MnasNet, and many more.

III. Concept Design and Architecture

The system architecture is basically consist of three part- Hardware, software backend and software frontend (UI). The hardware is a conveyor belt system where camera will be incorporated to detect fruits. Backend of software is basically consist of database to store fruits images and result of detection and image processing algorithm. And lastly UI will be an interface among hardware and software.



Owner/worker can start the system by navigating the web application. After starting the conveyor belt system workers will start to provide food to the conveyor belt. Then upon detection camera will send data to micro-controller (jetson nano) and it will calculate whether the food is fresh or stale. It it detects that the foot is not



fresh it will separate it to a bucket. Upon detection fresh food the system will the separate the food based on their classification, such as we are working on three fruits (apple, banana and orange). So if the system detects that a particular fruit is fresh then it will put it on a specific bucket of its type. And this process will continue until there is no food or the system is turned off. Apart from that owner can view the daily states of fruits from web application.

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