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Conveyor – Modern System for Fruit Categorization

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Abstract

Nowadays classical way of farming is being replaced by the advanced technology so as to get better productivity and effectiveness on many fronts. Such fast sorting system helps farmer or industry personnel with minimum human involvement. In this paper, system for sorting and segregating for fruits is proposed. Camera is being used for capturing the images of fruits. It identifies between desired and undesired fruit moving on conveyor belt and separates in different boxes. It also maintains the record of bulk of fruits in each pack. For the implementation of system image processing techniques on python software are used. Raspberry pi is utilized for sorting mechanism. Knowledge base is quite high for Raspberry pi.

Keywords*: sorting, desired, undesired, image processing.*

I. INTRODUCTION

Better health is central to human happiness and well-being. It also make an important contribution to economic progress of our nation, as healthy populations live longer, are more productive, and save more. Many factors influence health status. Good quality food is main in this. Our proposed system distinguishes between healthy and unhealthy fruits. To help the farmers and industry people, for sorting of quality fruits from bulk of fruits. The system proposed makes this segregation process speedily and effectively. Many business industries are now days involved in import and export of fruit items and it has become one of the prominent businesses. The best example is tomatoes-export. Classification of tomatoes is based on colour variations, size, desired and undesired. As these parameters are measured manually it takes lot of time, contains human errors and reduces time to market. Automation is the best solution to it. The relevance of the proposed system is more for farming and packaging automation. The image of the fruit is captured by the camera. For the segregation purpose, fruits are being moved on conveyor belt and are processed by the processor. The colour and size of the fruits are being measured. The decision based on these parameters is taken for segregation. Further number of count of fruits in each pack is also monitored. Thus the process of segregation has become faster and more accurate with little involvement of human

II LITERATURE SURVEY

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Sr. No.	Reference	Purpose	Merits	Demerits
1]	Colour based quality analysis of fruits for automatic grading using Raspberry PI (P. R. Chavan, Dr. S. V. Rode)	Detection of fruit quality based on colour and size. To implement automatic fruit size grading.	Accurate, reliable and consistent system. Can handle large volumes.	The initiated system is a demo vision.
2]	Determination of ripeness and grading of tomato using image analysis on Raspberry Pi (Ruchita R. Mhaski, P. B. Chopade, M. P. Dale)	Inspecting quality of tomato based on shape, size and degree of ripeness.	Cost effective system	It is applicable for grading of tomato only.
3]	Improved quality detection technique for fruits using GLCM and Multiclass SVM (AishwaryaChandini, Uma Maheshwari B)	To detect and segregate best quality fruits.	The work can be further extended. The system exhibits better performance.	The accuracy of system is 85.64%.
4]	Automatic fruit quality inspection system (Manali R. Satpute, Sumati M. Jagdale)	Sorting and grading of tomato. Detection of defected tomato.	The accuracy of defect fruit detection is up to 90%.	It is applicable for grading of tomato only.
5]	Identification of fruit size and maturity through fruit images using OpenCV-Python and Rasberry Pi (IzadoraBintiMustaffa, SyawalFikri Bin Mohd)	Identification of maturity of mango fruit. To determine size and colour of fruit.	It is better alternative to manual classification which is tedious.	It focuses on identification of maturity of mango fruit.
6]	Vision Based Fruit Sorting System Measures of Fuzziness and Degree Of Matching	Fuzzy algorithms were integrated with machine vision guiding robotic sorting system for fruits.	Fuzzy method was superior to the traditional statistical methods and gives 93.3% of	Sorting of fruits is purely based on fuzziness of fruits only.

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	(Sinn-Cheng Lin*,Pai-Yi Huang *,Yung-Yaw Chen*)		accuracy.	
7]	Authentication of Herbal Medicinal Leaf image Processing using Raspberry Pi Processor (Vijayashree. T, Dr. A. Gopal)	To classify the plants according to its medicinal usage using real time processor Raspberry pi with the image of the leaf.	The work can be extended to neural networks, techniques such as KNN-K Nearest Neighbor ,Probabilistic Neural Network(PNN),fuzzy logic.	Classification is limited to only medicinal usage of leaf.
8]	Object Sorting Automated System using Raspberry Pi (SushrutNageshKulkarni, Sanjay Kumar Singh)	To examine the utility and effective use of Raspberry pi as a mechanical system in sorting of objects.	Reduces human labour and hence accuracy increases.	Flash light and Light Dependent Resistor were required to get the clear image of the object.
9]	Portable Smart Sorting and Grading Machine for Fruits Using Computer Vision (HadhaAfrisal*, Muhammad Faris, GuntuUtomo P.,LafionaGrezelda,IndahSoesanti, MochammadAndri F.)	To develop a portable fruit sorting and grading machine based on computer vision for small agro-industries.	The system can do sorting of fruits in 500 ms with precision result.	This is only applied for the oranges.
10]	An Automated Machine Vision Based System for Fruit Sorting and Grading (Chandra Sekhar Nandi, BipanTudu, chiranjibKoley)	To develop a computer vision based system for automatic grading and sorting of agricultural product like Mango based on maturity level.	Low cost, more intelligent system	Speed of the system is limited due the use of conveyor belt.
11]	Identification of Artificially Ripened Fruits using MATLAB (Miss. Nikita S. Hatmode, Prof. M. N. Thakare)	To identify the artificially ripened fruits using MATLAB software.	Efficiency is very high.	It can detect the ripeness only by its image.
12]	A Consumer –	To describe a	Machine Learning	Smartphone is required

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	Friendly Machine Learning Based Mechanism to Recognise the Quality of Commercially Available Fruits (Deepti C.,Arjit Jindal, Prudhvi Reddy, Amrutha D.)	nondestructive method to detect artificially fruit ripening.	is used to identify among fruits.	for running of the application.
13]	Tomato grading system based on colour models by using neural network (PrathameshAwalekar, L. S. Admuthe)	To grade tomatoes using neural network trained on the colour parameters like red and green.	This system uses ML algorithm of neural network and back propagation hence it is real time application. This system is helpful due to mixture of hardware and software. Grading of tomatoes is performed.	The system uses user defined database of tomatoes to train model. System requires more time to train model.
14]	Identification of artificially ripened fruits using smartphones (S. Maheshwaran, S. Sathesh, P. Priyadarshini)	Sorting of artificially ripened fruits from naturally ripened fruits using smartphones is performed.	The proposed system has an efficiency of 91% in the identification. The system identifies the fruits ripened by artificial means.	The system requires smartphone which runs android application.
15]	Oranges sorting using arduino microcontroller (VikasChakole, PranayIlamkar, RupeshGajbhiye, SuhasNagrale)	Sorting of oranges based on colour and size using TCS 3200 colour sensor &arduino microcontroller.	Includes colour sorting and shape and size detection system. Makes use of TCS 3200 colour sensor &arduino microcontroller.	Perfect technique for orange sorting is not discussed. Survey on different colour based sorting is discussed.

III METHODOLOGY

The proposed system is divided into two phases:

1. Processing of captured image using python and identifying the fruits which are desired and undesired
2. The segregation of required fruits using Raspberry-pi and conveyor belt.

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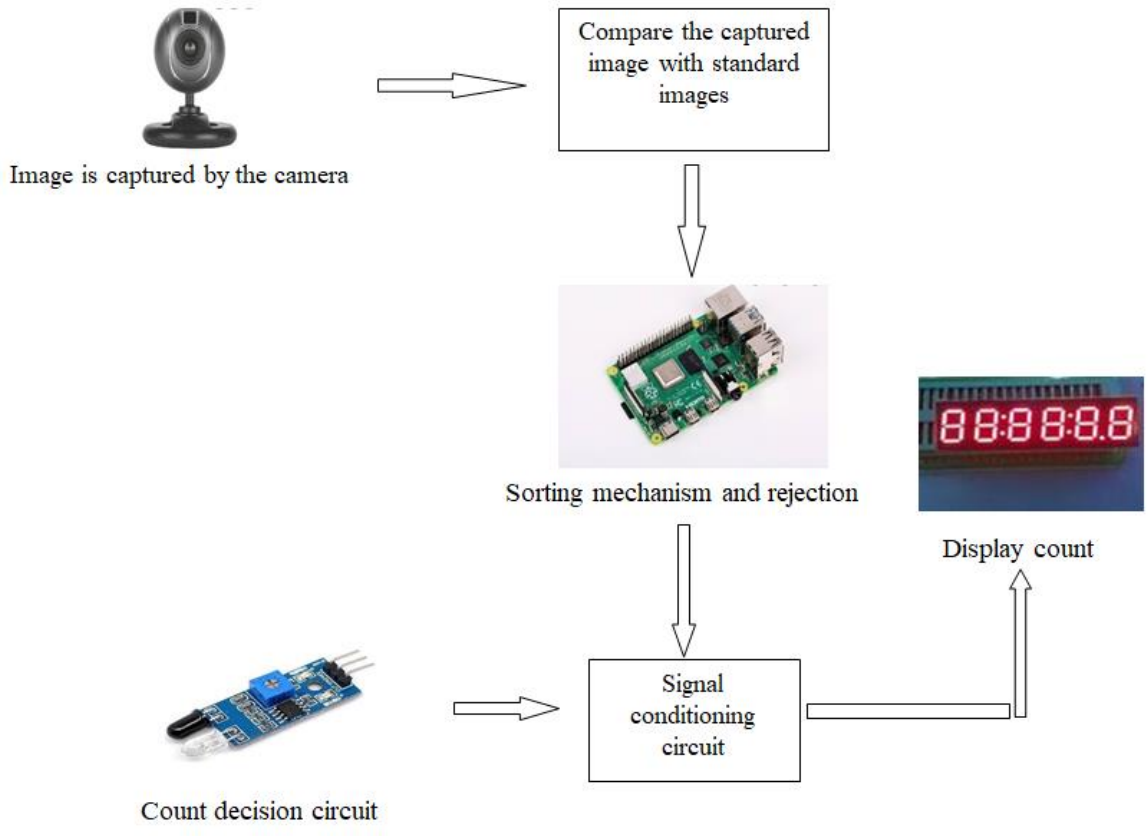

Fig 1: Block Diagram

The work description in detail is given below –
Put the fruit below the camera and it will capture the image of fruit. It will send to image processing software where colour of the fruit and size will be checked. Accordingly, it will send message to processing board. If fruit is desired and does get matched with the specifications, it will be passed in clockwise direction on conveyor belt, otherwise it will move in anticlockwise direction and it is dropped into a box. Count sensor will check continuously the count. Once the required count is reached, then signal is given and the box is ready to be packed. The count sensor senses the fruits and the logic circuit maintains the count of the fruits. Signal conditioning circuit converts the incoming signal from sensors to signal compatible to the logic circuit. Count decision logic triggers the display/alarm to mention the fullness of the box of fruits. Sorting mechanism consist of conveyor belt along with drive and the rejection/acceptance mechanism/actuators.
The system's software process as follows:

1. Development of GUI: First button is to open the web camera and capture the image. Second button is to select the image input. Third button is close web camera button.
2. Keyboard interrupt is given and the image is being stored in memory.
3. Dataset of tomatoes are given with 0 and 1 format in which 0 indicates desired and 1 indicates undesired fruit.
4. First training of the module is done.
5. Comparison between the images from memory card and dataset.
6. Result of the comparison comes out to be 0 or 1 (desired or desired).
7. Display the prediction.

The system's hardware process as follows:

1. The outcome of the software is given to the either dc motor or stepper motor of conveyor belt.
2. If the fruit is desired then conveyor belt moves 30 or 40 rounds / time delay of 5 seconds in clockwise direction.

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3. If the fruit is undesired then conveyor belt moves in anticlockwise direction.
4. Thus the proposed system performed the sorting .

IV HARDWARE AND SOFTWARE

The hardware used as follows:

1. Raspberry-pi
2. Webcam
3. Conveyor belt
4. IR sensor

The software used as follows:

1. Python -version 3
2. Tkinter library for GUI
3. Tensorflow for object detection

V CONCLUSION

Conveyor- fruit categorization system is being implemented with automatic control and segregation process. The number of fruit count is also monitor by the system. The system is programmable hence it is possible to modify for the better speed and accuracy. The prime utility is in such applications where less human intervention is expected. The system is relevant because it has high accuracy and speed.

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