# Design and Fabrication of Lemon Sorting Machine

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*Abstract*— This paper describes the new technique used for the RGB color detection. The proposed technique illustrate the new methodology that can be used for the primary color detection and applications in various industries. It is color sensor that sense mainly red green and blue color. This color sensor is designed by basic elements like primary color LED and light sensing device like LDR or photo diode. Basic principal of working are reflectivity of the light emitted by the LEDs from the object under test.

***Key words:*** Lemon Sorting Machine

## I. INTRODUCTION

The Embedded Technology is now in its prime and wealth of knowledge available is mind-blowing. An Embedded system was a special purpose computer system designed to perform a dedicated function. Embedded system is fast growing technology in various fields like industrial automation, home appliances, automobiles, aeronautics etc. Embedded technology uses pc or a controller to do the specified task and the programming was done using assembly language programming or Embedded C. Industrial automation and robotics were at a high demand in the industry as both of them directly affect the growth of the industry. Quality and flexibility of the product was the important criteria of the industry. Use of industrial robots will lead automation industry to another transition. Colorbased sorting was extensively used in many industries for sorting purposes to ensure the quality of the object is up to the mark for e.g. Food processing industries, pharmaceutical industries, automotive industries, agriculture industries. Such sorting reduces the human effort, labour cost and also time of operation. Most of the errors caused by humans was due to their limited potential which can be reduced by using automated system supported by color based sorting. Efforts have been made to use a single assembly line for the classifying and sorting of different objects using electronic systems and advanced sensors. The work is considered to sort objects such as lemon depending on its physical attributes such as outer stain color intensity. Thus by using fully automated system the time needed for the sorting process was reduced to the great extent, so proposed system is fast, accurate, economical, robust and cost efficient.

## II. LITERATURE REVIEW

Khojastehnazhand and etal studied grading systems give us many kinds of information such as size, color, shape, defect, and internal quality. Among these color and size are the most important features for accurate classification and/or sorting of citrus such as oranges, lemons and tangerines. Basically, two inspection stages of the system can be identified: external fruit inspection and internal fruit inspection. The former task is accomplished through processing of color images, while internal inspection requires special sensors for moisture, sugar and acid contents. In this paper, an efficient algorithm for grading lemon fruits is developed and implemented in visual basic environment. The system consists of two CCD cameras, two capture cards, an appropriate lighting system, a personal computer and other mechanical parts. The algorithm initially extracts the fruit from the background. The samples of different grades of lemon are situated in front of the cameras and are calibratted off-line. Then information on the HSI color values and estimated volumes of fruits are extracted and saved in a database. By comparing the information during sorting phase with the available information inside the database, the final grade of the passing fruits are determined. This algorithm can be easily adapted for grading and/or inspection of other agricultural products such as cucumber and eggplant.

A.R. Jiménez and etal studied an automatic fruit recognition system and a review of previous fruit detection work are reported. The methodology presented is able to recognize spherical fruits in natural conditions facing difficult situations: shadows, bright areas, occlusions and overlapping fruits. The sensor used is a laser range-finder giving range/attenuation data of the sensed surface. The recognition system uses a laser range-finder model and a dual color/shape analysis algorithm to locate the fruit. The 3-dimensional position of the fruit, radius and the reflectance are obtained after the recognition stages. Results for a set of artificial orange tree images and real-time considerations are presented.

S. Mahalakshmi prepared in this paper gives an insight into the results of a survey based on fruit identification and classification. The survey depicts the credibility of choosing the appropriate classifier and the feature extraction methods for correct and exact recognition of the fruits. It also reports on the accuracy and performance of each method implemented in the papers taken into consideration. Morphological features, color features, intensity based features and other features are extracted from the fruit images and these are subject to various types of classifiers like Probabilistic Neural Network(PNN), Support Vector Machine(SVM), Back Propagation Network(BPN) and K-Nearest Neighbour(KNN) algorithm. The goal of this paper is an overview of the techniques implemented in fruit identification and classification.

Monika Sharma and etal studied the quality needs to be defined firstly in terms of parameters or characteristics, which vary from product to product. In previous years, several types of image analysis techniques are applied to analyze the fruit images for recognition and classification purposes. The proposed method can process, analyze, classify and identify the fruits images, which are selected and sent in to the system based on colour, shape and size and surf features of the fruit. The FCM algorithm is the appropriate and effective classification algorithm to be used in the Fruits Recognition System. The recognition system that has been developed is able to recognize all the test fruit images which are being selected by a user from the fruit selection menu which is based on GUI block in MATLAB on the system

Jyoti Jhawar studied and prepare that each fruit changes its color in its life span; including stages not ripe, semi ripped, completely ripped or at the end rotten. Hence, we can grade/sort the fruits by processing its color images and then applying pattern recognition techniques on those images. In general, various parameters for grading of a fruit are its' size, ripeness, sweetness, longetivity, diseased/rotten. This paper discusses the research work for automated grading of lemons using multiple pattern recognition techniques applied on color images of lemons. This research is carried out on 150 Lemon fruits of 5 different breeds, collected from varied geographical locations in Vidarbha Region of Maharashtra. System designed can automatically classify a lemon given its color image of 640 × 480 pixel resolution taken inside a special box designed with 430 lux intensity light inside it, by a digital camera. The various pattern recognition techniques used are Nearest Prototype Classification, Edited Nearest Neighbor and Linear Regression.

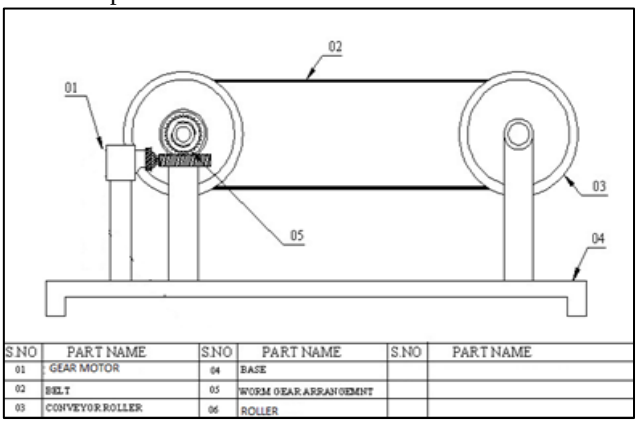
## III. DESIGN

### *A. Conveyor*

A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another. Conveyors are especially useful in applications involving the transportation of heavy or bulky materials. Conveyor systems allow quick and efficient transportation for a wide variety of materials, which make them very popular in the material handling and packaging industries. Conveyor systems are used widespread across a range of industries due to the numerous benefits they provide. Conveyors are able to safely transport materials from one level to another, which when done by human labour would be strenuous and expensive. They can be installed almost anywhere, and are much safer than using a forklift or other machine to move materials. They can move loads of all shapes, sizes and weights. Also, many have advanced safety features that help prevent accidents. There are a variety of options available for running conveying systems, including the hydraulic, mechanical and fully automated systems, which are equipped to fit individual needs. In this project we have used belt conveyor.

### *B. Basic Principles of Operation*

A gear motor can be either an AC (alternating current) or a DC (direct current) electric motor. Most gear motors have an output of between about 1,200 to 3,600 revolutions per minute (RPMs). These types of motors also have two different speed specifications: normal speed and the stall-speed torque specifications. Gear motors are primarily used to reduce speed in a series of gears, which in turn creates more torque. This is accomplished by an integrated series of gears or a gear box being attached to the main motor rotor and shaft via a second reduction shaft. The second shaft is then connected to the series of gears or gearbox to create what is known as a series of reduction gears. Generally speaking, the longer the train of reduction gears, the lower the output of the end, or final, gear will be. An excellent example of this principle would be an electric time clock (the type that uses hour, minute and second hands). The synchronous AC motor that is used to power the time clock will usually spin the rotor at around 1500 revolutions per minute. However, a series of reduction gears is used to slow the movement of the hands on the clock. For example, while the rotor spins at about 1500 revolutions per minute, the reduction gears allow the final second hand gear to spin at only one revolution per minute. This is what allows the second hand to make one complete revolution per minute on the face of the clock.




| S.NO | PART NAME | S.NO | PART NAME | S.NO | PART NAME |
|---|---|---|---|---|---|
| 01 | GEAR MOTOR | 04 | BASE | | |
| 02 | BELT | 05 | WORM GEAR ARRANGEMENT | | |
| 03 | CONVEYOR ROLLER | 06 | ROLLER | | |

Fig. 1:

## IV. CONCLUSION

In this paper, we presented a novel approach for development of a sorting system for grading lemon based on color and size. The calibration of system is done by samples of different grades of fruit. The volume and color of fruit determined and saved in database during calibration stage. During sorting stage, the calculated color and volume compared with saved information in database. The final grade of fruit was determined and its center of gravity calculated to be later used for automatic sorting through phenematic mechanism. A single color image of lemon is sufficient to predict its maturity/ ripeness measure, as it ripens in almost uniform way. Out of various techniques used Linear Regression proved to give best results. Damaged lemon detection is one big challenge which not handled in this research. It was observed that damages like Bruises, Rugs, Fungal Infections, Hail Stone marks, etc. produces marks on the skin of the lemons. Plot indicates it is possible to predict the ripeness just by using single feature 'Gavg'. Damaged lemon detection is one big challenge which not handled in this research. It was observed that damages like Bruises, Rugs, Fungal Infections, Hail Stone marks, etc. produces marks on the skin of the lemons.

## V. FUTURE SCOPE

This work can be enhanced in future by other researchers in following ways:

1) This dissertation focuses on the some basic parameters of fruit like colour , shape , size and surf points but in future by adding more parameters for example texture , skin of fruit , more accuracy can be achieved and as well as more study on this fruit determination system is required.
2) In future, some new features, which are local and based on the appearance of the object at particular interest points, and are invariant to image scale and rotation. In addition to these properties, which are highly distinctive,

relatively easy to extract and allow for correct object identification with low probability of mismatch. So easy matching against a (large) database of local features on the basis of fruit recognition systems can be done.

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