International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 05 | May 2021 www.irjet.net p-ISSN: 2395-0072

Mechanized System: For Grading of Fruits and Fruit-Vegetables

Sahane Sanchit J.[1], Baraskar Chaitanya V.[2], Zulkanthiwar Aishwarya R.[3], Netake Akshay D.[4]

[1]*Dr.D.Y. Patil Institute of Technology, Pimpri, Pune.*
[2]*Dr.D.Y. Patil Institute of Technology, Pimpri, Pune.*
[3]*Dr.D.Y. Patil Institute of Technology, Pimpri, Pune.*
[4]*Dr.D.Y. Patil Institute of Technology, Pimpri, Pune.*

Abstract – *As India is an agriculturist country stands at 2nd next to China in fruit and fruit-vegetable production. Owing to this good level of mechanization is adopted. Yet, it is not reach up to the very downtrodden farmer, marginal farmers due to socio-economic discrepancies [1]. In line with this our research deals with agriculture in general and size-wise grading, sorting in particular. eventually it is less costly, this proposed model work efficiently to segregate the produce without using electricity plus less manpower to sorting. As it contains two meshes of suitable dimensions and crank assembly also mitigate the time consumption as well.so the aim of 'minimum input and maximum output produce' can be achieved with quality-accuracy hand in hand.*

Key Words: **New mechanism for size sorting and grading, two mesh with ideal dimensions, agricultural apparatus, less costly device, high accuracy, reduce time, low manpower**

1.INTRODUCTION

The green revolution of the 1960s and 1970s ended chronic food deficits and while cereals still command the attention of policy makers, fruit production has surged impressively, making India the second largest global producer behind China. Annual growth in horticulture has seen fruit production largest segment of agriculture. The stellar performance of fruits has attracted attention. The robust growth of horticulture indicates a growing demand within the country too. There is scope for further growth as while India lies second in the list of major producing countries featuring China, USA, Brazil, Spain, Mexico, Italy, Indonesia, the Philippines and Turkey, its productivity lags most of these countries. India's success in horticulture lies in small towns and districts. In 2018-19, Chittoor and Anantapur in Andhra Pradesh, Baramulla in Jammu and Kashmir, Nalgonda in Telangana, Pune, Aurangabad, Jalgaon and Sangli in Maharashtra shone on India's fruit map. Among this most of the farmer are of low income and marginal class. (see infographic fig 1) [2]

Need of hour is to mechanized every single and small work. In order to top the list and maintain high forex reserve. Mechanized system for grading of fruits and fruit vegetable will help in this direction immensely.

After the harvesting fruit and fruit vegetable are set for segregation, sorting and grading. This will increase the market value and quality of product.

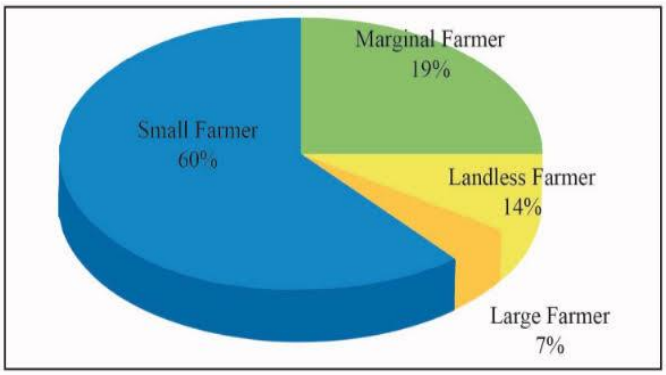


Figure.1. Infographic

Our Proposed mechanism will help farmer in their sorting i.e., grading process. So here above the complete overview of ideology is enshrined.

1.1. Problem Statement

Due to conventional method and modern technology method number of issues arises. Some of those are enlisted below.

With Conventional method;

I. Loss of manpower for grading.
II. Low accuracy.
III. It is a time-consuming process.

With modern technological method:

I. Requirement of electricity which is impossible in farm and remotest area.
II. Large space, infrastructure for equipment installation.
III. Requirement of skilled workforce.
IV. Complex mechanical arrangement.
V. Costlier equipment.

These are some lacunas in the earlier governing systems.

1.2. Objectives

Our objectives can be cited as;

I. To Minimize required manpower
II. Eliminate use of electricity.
III. Reduce time consumption.
IV. Enhance accuracy and quality of process.
V. Cost mitigation.
VI. To make it more portable.

1.3. Scope

Scope of mechanized grading machine is

I. It provides comfort to farmers mostly those are in low income and marginal class.
II. Eliminate the efforts required for grading.
III. Easily replace conventional method.
IV. Portable and easy design aspect.
V. Required maintenance for this system is negligible.
VI. Construction cost is less than 1000 Rs.

1.4 Methodology

Adopted methodology can be depicted in flow as follows;

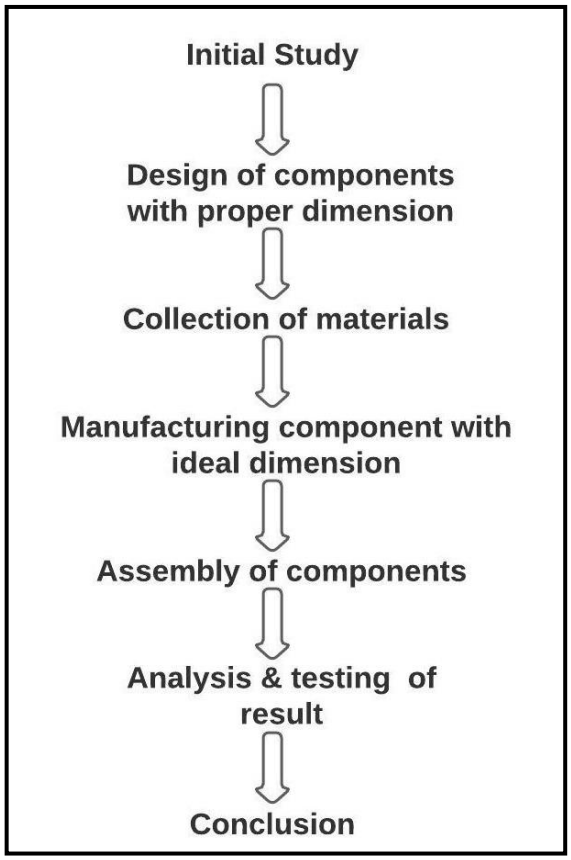


Figure.1.4. Flow of methodology

1.4.1 Steps in Methodology

II. Study and analysis of conventional methods.
III. Study different grading system that are existing in market.
IV. Searching drawbacks of different existing system up to grass root level farmer.
V. Inventing new systems that overcome the drawbacks of early systems.
VI. Design of new system to help public at large.
VII. Collection of material which are required for manufacturing new system.
VIII. Assembly of the different parts with proper dimensions.
IX. Analysis and testing new system.
X. Conclusion of new invented system.

2. LITERATURE REVIEW

Literature review for the studied three papers is elaborated in given paras;

No.	Title and year of publication	Name of author	Key findings
1.	Grading and sorting of apple by using image processing. (Mar 2019) IRJET	Kamble Apeksha B, Pandav Pornima T, Patil Sudarshan, Prof. Salunkhe	Grading by automated system using image processing.
2.	Machine vision technique based smart fruit grading system. (Mar 2021)	S. Sivachandran, C. Pavithra, T. Preetha, V. Silpa, S. Sriranjani	Arduino-Uno microcontroller Is used in proposed model.
3.	Identification, classification & grading of fruits using machine learning& computer intelligence: a review (Mar 2020)	Santi Kumari Behera, Amiya Kumar Rath, Abhijeet Mahapatra, Prabira Kumar Sethy	Study is compared with different techniques for identification, classification and grading of fruits. also outlines the current achievements, limitations, and suggestions for future.

Table.2. Summary of literature review

2.1. Grading and sorting of apple by using image processing. (Mar 2019)

Kamble Apeksha B, Pandav Pornima T, Patil Sudarshan, Prof. Salunkhe;[3]

Basically, it is an electrically operated device.it takes image of fruit and then by image processing grading takes place. The machine vision inspection system essentially involves three main processes namely image acquisition, image processing and decision-making. Cameras under appropriate lighting conditions carry out image acquisition. The visual information is converted from analogue to digital format. The acquired images are analysed by image processing hardware and software to extract the required object features and quality parameters. Based on these results, a decision on the fruit quality is taken by software considering the end user's requirements.

First by keeping the apple on conveyor belt it detected through IR sensor. Then by stopping motion of belt, control transferred to MATALB for capturing images.by two cameras image being captured then it calculates the parameter which are set before start. Then it sorts the apple in appropriate way.

Image acquisition are occurred through the various steps most of them are of using high costly devices such as cameras and other sensing apparatus which makes it costly and unbearable for 80% farmers.

2.2. Machine vision technique based smart fruit grading system. (Mar2021).

S. Sivachandran, C. Pavithra, T. Preetha, V. Silpa, S. Sriranjani;[4]

Proposed model uses various 21st century high end technologies such as python coding language also it uses devices such as raspberry PI, memory card, HDMI VGA cable, Zebronics cameras to detect the fruit and then grade it accordingly.in this many fruit images were pre captured which is good and bad as well. RGB image is converted to HSV color space.by this lower and upper grade defined. Further pixel analogy is used to detect. Yet it is simple but hard to use for bulk quantities of produce.

This is also electrically operated mechanism which indirectly not much helpful to farmer and other associated micro small medium enterprises.

2.3. Identification, classification & grading of fruits using machine learning& computer intelligence: a review. (Mar 2020)

Santi Kumari Behera, Amiya Kumar Rath, Abhijeet Mahapatra, Prabira Kumar Sethy.[5]

This gives clear idea as, the image processing technique is a rapid, consistent and objective inspection technique, which has expanded into the fruit industry nowadays. The use of image processing for the grading of fruits has increased during recent years. Grading involves categorization of fruits, with consideration of the severity of the disease, defects, size wise sorting and contamination on fruits. Grading is an important step in the post-harvest process. Grading of fruits manually is a time taking and unreliable process. Therefore, it is needful to adapt the automated faster system in this regard. Khojastehnazhand et al. (2010) developed an efficient algorithm for grading lemon fruits and implemented in visual basic environment. The manuscript summarizes various studies to automate identification, classification and gradation of fruits using Machine learning and image processing techniques. The survey shows, most of the researcher work on inspection and/ or of fruits have common workflow.

3. PROPOSED MODEL: MECHANISED SYSTEM FOR GRADING OF FRUIT AND FRUIT VEGETABLE.

Premia facie need proposed model is analyze the standard ideal sizes (according to their bulb diameter) for grading fruits and fruit vegetables. Which are generally in grade 1, grade 2, grade 3. are tabulated below: [6]

Bulb grade	Bulb diameter (mm)	% Proportion in a good crop
Grade 1 (Large)	>60	40-50
Grade 2 (medium)	50-60	30-40
Grade 3 (small)	35-50	10-20

Table.3. Ideal grade size diameters.

Proposed system can be elaborated in two sections are construction and modus operandi respectively.

3.1. Construction

Ironically, this is portable system, so there is very easy method for construction. Two mesh, 4 iron bar, crank mechanism, 4 wheels, channel for base are key components. (Refer fig 3.1.1)

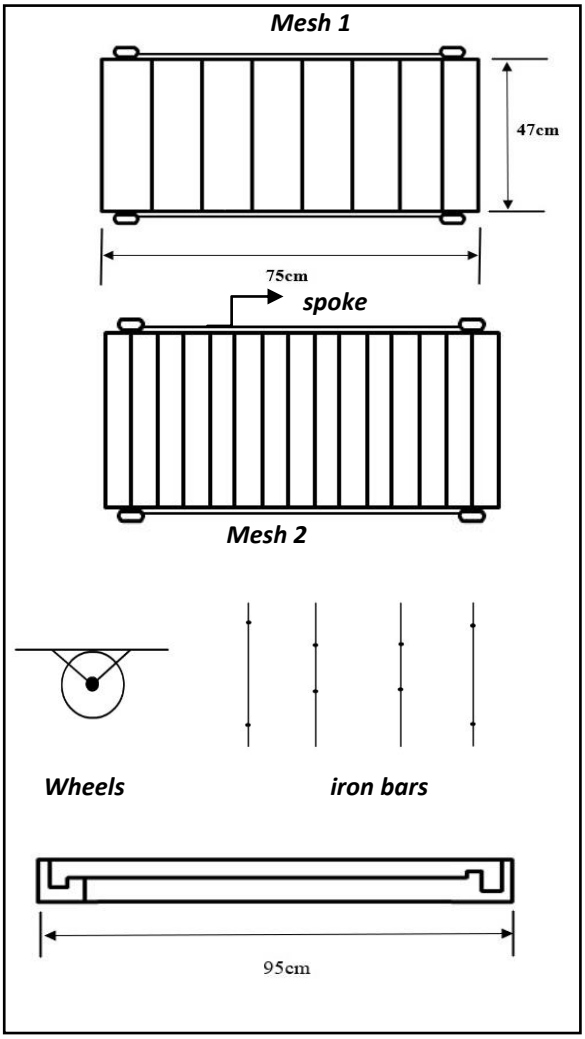


Figure.3.1. Assembly parts

These components are so assembled as shown in figure. Ensure that this is just portable mechanism which can make and break easily.

For construction of Mesh 1: (From table.3.)

To construct Mesh 1 gap of 59 mm kept between two spokes. and fixed by wielding. This is so that bulb grade A fruit can by-pass process 2. appropriate dimensions are to be followed to enhance accuracy level.

For Construction of Mesh 2:(From table.3.)

For the construction of mesh 2 by keeping gap of 49 Cm in order to bypass grade 2. By constructing two meshes are so tilted in angle so fruit can sweep easily. (Ideally 30-degree slope). Crank can be taken as per the channel where it provides motion. Given table shows expected length and breadth of each component.

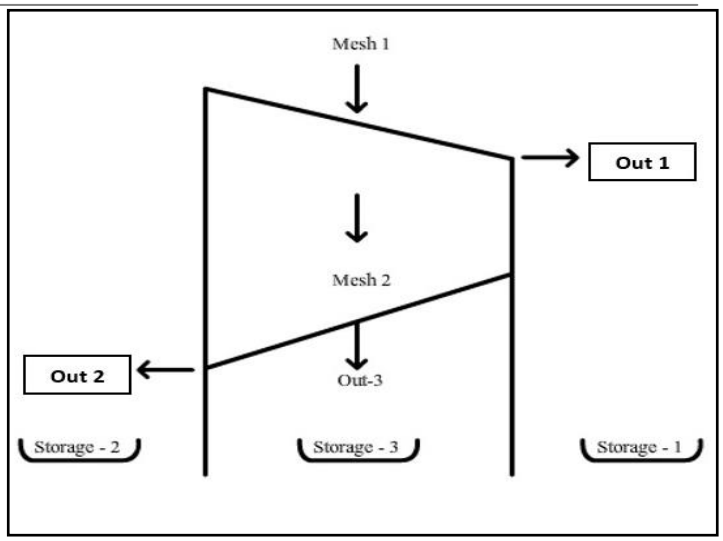


Figure.3.2. Entire structural assembly.

Table.3.1. Preferred dimension

Components	Desired dimension in cm
4 bars	60cm
Mesh 1	75×47
Mesh 2	75×47
Slope preferred	30 degree

3.2. Modus operandi

To understand the working procedure of system, use the flowchart given.

Grading of products like fruit and fruit vegetables is the post-harvest process so when we pour the bulk quantities of fruits or fruit vegetable for grading on the stage 1.it goes through the process assign. At very first mesh 1 then mesh 2 respectively. In mesh 1 due to spoke arrangement (as ideal dimensions) grade 1 product don't process to next stage 2.so grade 1 by pass it through gate out1 and then this grade 1 product collected in storage1.similarly process at stage 2 takes place it only allows to go grade 3 product obstructing grade 2 product at mesh 2. And it gets stored from gate out2 at storage 2. In this stage also grade 3 products collected at storage 3 from gate out3 successfully.

This whole process can be accompanied with circular motion at crank handle. This will provide required to and frow motion therefore no fruit obstruct at of any stage, stage 1 and stage 2 respectively. This crank runs on the channel which is fitted at the ground of the assembly.it can very well visualized in provided 3D diagrams.

Henceforth the process become easy and can be undertaken with only two men, without any skilled force itself.

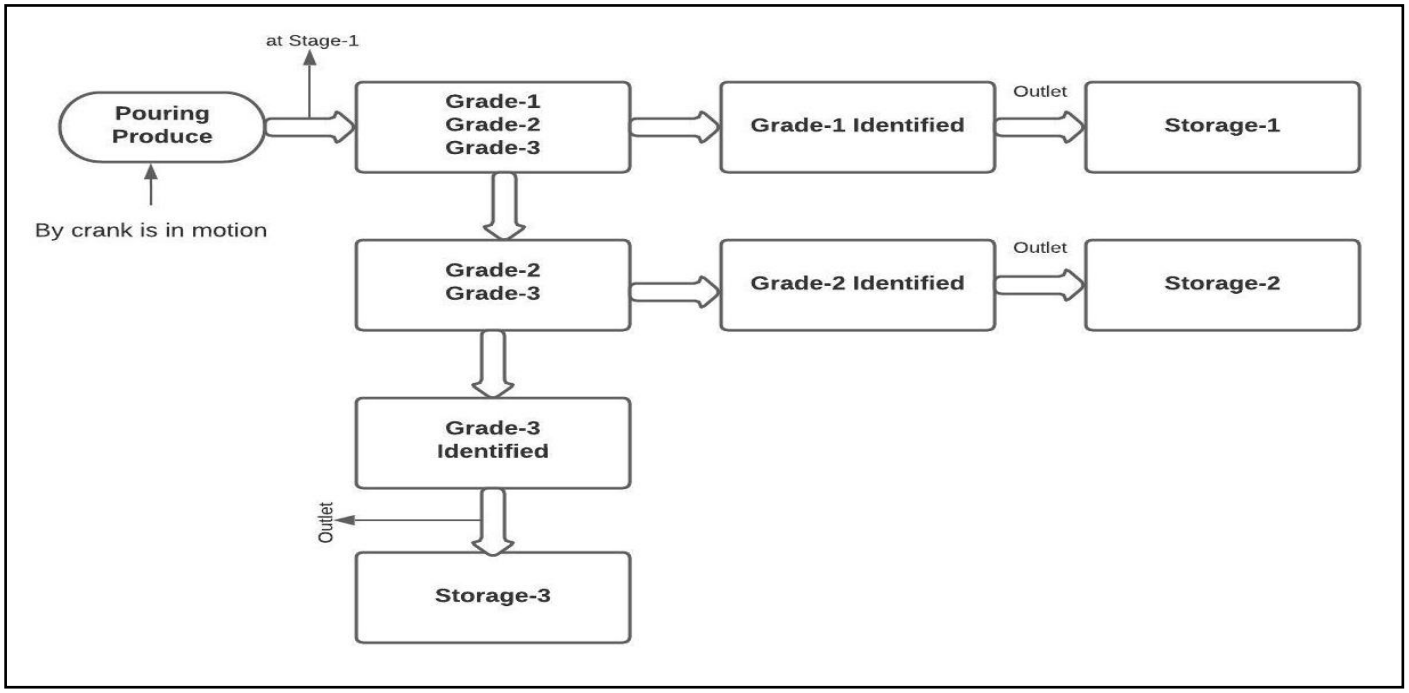


Figure3.2.1working process of mechanized system for grading of fruits and fruit vegetables

4. EXECUTION

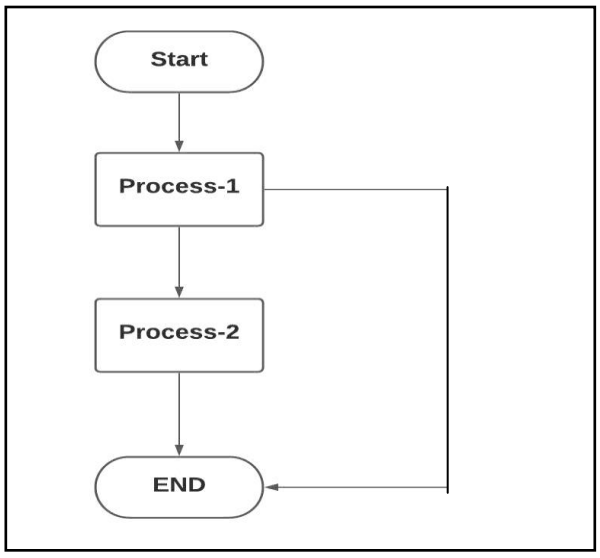


Figure.3.3.1. Execution Flowchart

5. APPLICATION

Any farm produce which generally round in shape. also beneficial to MSMES

6. ADVANTAGES

Some pros of the proposed mechanisms can be reflected in the following heads, and are the key driver for the future productivity.

I. No need of electricity.
II. Less time-consuming process.
III. Required less manpower
IV. Less costly assembly.
V. Portable system

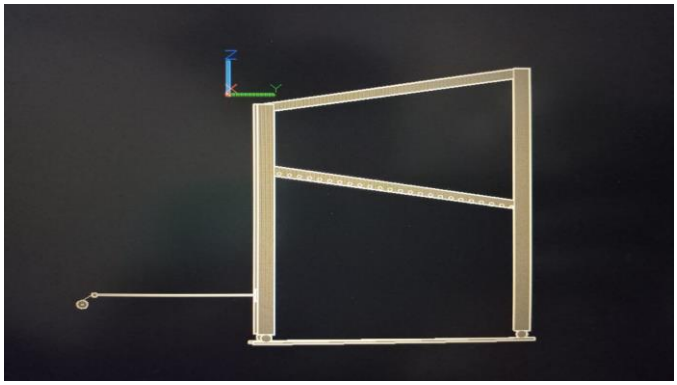
7. DISADVANTAGES

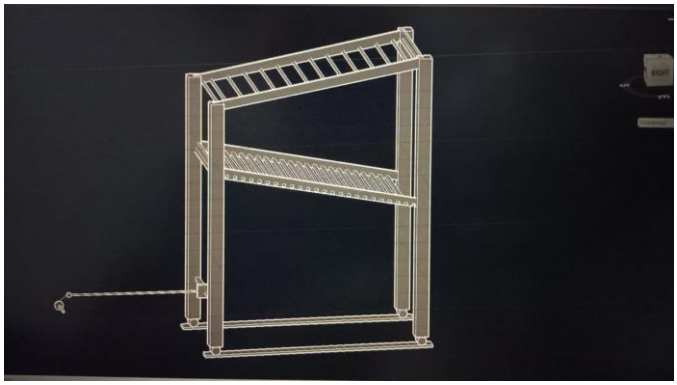
This mechanism has very few disadvantages as compare to other, this can be cited as

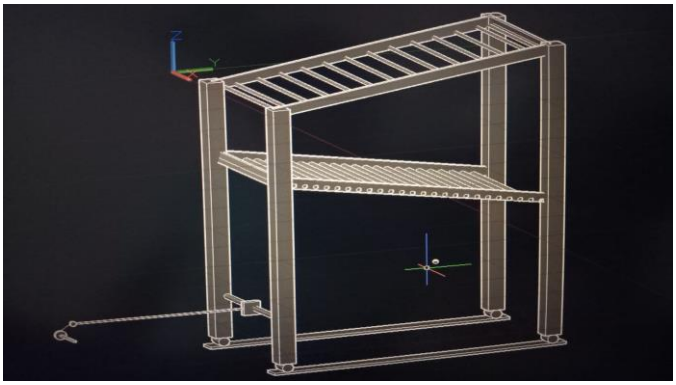
I. Shelf life can be hampered in small extinct.
II. Only round shape fruits and fruit vegetable can be handled.

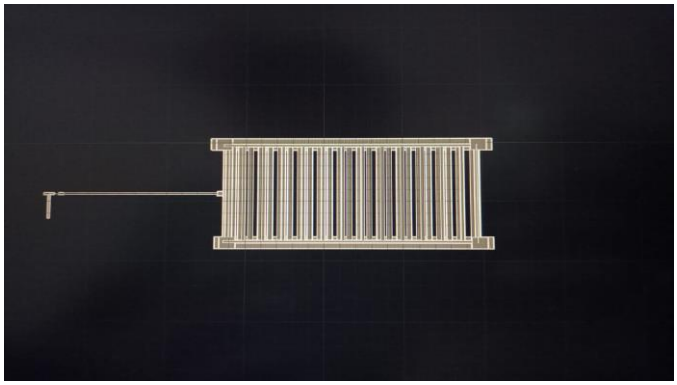
8. 3-D LAYOUT

3-Dimensional layout of model as shown above consisting views from every possible side.









9. CONCLUSION

Grading is last mile process post harvesting which is very hectic, time consuming and having less accuracy. This issue can be ace through proposed model. Model is portable in nature and less costly. Thence it is immensely helpful for downtrodden and marginalize, low-income farmer. Provided that this model takes no electricity hence is a need of 21st century on priority basis.

10. REFERENCES

[1] https://ishrae.in/newsdetails/India-nd-Largest-Fruit-Vegetable-Producer-In-World-/471

[2] http://mospi.nic.in/agriculture-statistics

[3] Kamble Apeksha B, Pandav Pornima T, Patil Sudarshan, Prof. Salunkhe.Grading and sorting of apple by using image processing. Volume: 06 Issue: 03 | Mar 2019

[4] Machine vision technique based smart fruit grading system. S. Sivachandran, C. Pavithra, T. Preetha, V. Silpa, S. Sriranjani; Volume: 08 Issue: 03 | Mar 2021

[5] Identification, classification & grading of fruits using machine learning& computer intelligence: a review. (Mar 2020) Santi Kumari Behera, Amiya Kumar Rath, Abhijeet Mahapatra, Prabira Kumar Sethy.

Journal of Ambient Intelligence and Humanized Computing · March 2020

[6] https://dogr.icar.gov.in/index.php?option=com_content&view=article&id=122&Itemid=194&lang=en#:~:text=The%20onion%20bulbs%20are%20classified,before%20storage%20or%20before%20marketing