Design And Fabrication Of Sprig Cassava Chopping Machine For Farmers

R. Kiruba Shankar, M. G. Ramjee, M. Saran, S. Sasivengat

Abstract: In India, the cultivation of cassava is mainly done in Kerala, Tamil Nadu, Andhra Pradesh, Nagaland, Meghalaya, Assam, etc. Tamil Nadu stands first both in area and production followed by Kerala and Andhra Pradesh. The mixed cropping system practiced in these states provides the much needed additional income to the small and marginal farmers. As per the second advanced estimates for the period 2012- 13, the total area under tapioca in India is 216.66 thousand hectares and the production is about 7319.13 thousand metric tons. The cultivation of cassava can be done by using planted sprigs of cassava's. This re-cultivation process is a cyclic process which requires manual power. Farmers used to chop the planted cassava sprigs of around 10cm for the re-cultivation of cassava and this requires manual power and time consuming. So the needed project that can chop the cassava sprigs as per the requirement for the further cultivation s to be designed and fabricated.

Index Terms: Agri-Automation, Design, Control, Farmers

1. INTRODUCTION

The Cassava (Manihot esculenta Crantz), also known as tapioca or manioc, is one of the major tuber crops grown in more than 80 countries of the humid tropics. It is a high energy food obtained with low inputs and little effort. To the people in the tropics it is either a main or a secondary staple food. The annual production of cassava in the world is 129.02 million t from a net cropped area of 14.150 million ha distributed in over 80 countries.' Most of the world production of cassava is used for human consumption in tropical countries, the other main uses are for animal feed and the starch industry. In view of the acute shortage of cattle feed, formulations based on cassava have to be developed [2]. In some communities, the leaves are consumed as a vegetable, or cooked as a soup ingredient or dried and fed to livestock as a protein feed supplement. The roots are the main product of the plant and are typically processed for human consumption and industrial utilization [3]. India has a greater love towards plastic, plastic has become a most ubiquitous product nowadays. It makes our life a easy going one. Plastic production is the pillar of India's economy. Large plastic production is found mostly in the developing countries (India, China, Albania, Afghanistan, Argentina and Bangladesh) than the developed countries (Japan, Germany, Singapore, South Korea). India, China etc., are the largest plastic producing countries. In India there are about 22000 plastic processing units and 150 machinery manufacturers. Different types and methods are used in plastic production [5]. The agriculture and land mass is more than just being a feeding source in today's world. Indian economy is highly dependent of agricultural productivity. hence it is vital to use advanced techniques to increase the productivity of the agricultural products and thereby increase financial income of farmers. Despite of variations in crop cultivations, crop yield in India were generally low compared to international standards [4]

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2 REVIEW OF EXISTING SYSTEM

The continuous-process mechanical peeler is described in this paper. The peeler consists basically of a cylindrical knife assembly and a solid cylinder, both mounted parallel and 20 mm apart on an inclined frame [7] The machine was demonstrated publicly at six different exhibitions. Various varieties of cassava, which thrive well on Nigerian soils, were identified and used for the performance evaluation of the machine. The tuber was easily maneuvered round the peeling brush by the operator. The latter being a major advantage and thus make the machine able to peel varying shapes and sizes of cassava. The results of the project were intended to serve as a basis for the commercial production and utilization of cassava peeling machines [8].

3 PROBLEM DEFINITION

3.1 Existing System

The figure 2 shows the manual chopping of cassava's sprigs.

Figure 2 *Manual chopping of cassava's sprig*

The existing system which is already available in the market will be using conventional tools for chopping cassava plant operations only. The existing system cost starts from 50000 to 60000 which cannot be afforded by innkeepers and farmers. So the cost of the machine and the time consumption became the important parameter for them while purchasing the machine.

3.2 Draw backs

- This process is time consuming
- It increases the manual work
- Improper chopping of sprigs may occur

4 WORKING PRINCIPLE

The sprigs that stocked after the harvesting is placed in the stock section of the sprig cassava machine. The missing pieces in front of ultrasonic sensor make the input to the Arduino controller. Arduino takes the signal from the sensor as the input and provide the output to the servo motor to actuate at that time and it allows the stoked cassava sprigs to feed to the chopper. The chopper which connected with the bane motor by gear drives that makes the shaft to rotate at the required rpm. Predefined mode program helps operator in chopping the sprigs one by one. Based on the parameters entered by the operator servo and bane motor speed will be set. Customized mode program helps operator in setting their own servo and bane speed, sprig plant selection and cutting blade selection can be done initially. This mode also has summary screen as previous one. Manual mode is used for any servo speed, any process, any sprig plant. If operator want any other cutting blade instead he can go with this mode. After operator verifies

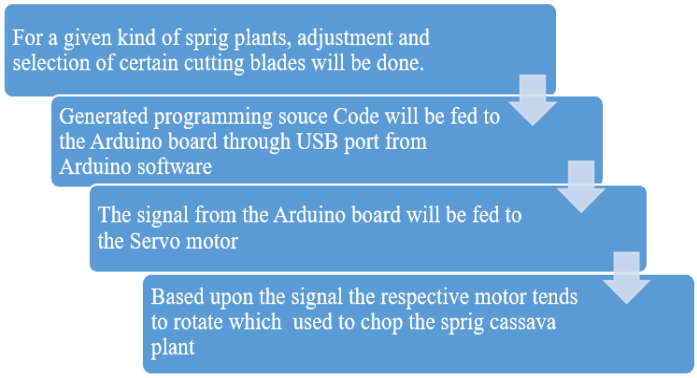

Figure 4 *Functional diagram of sprig cassava chopper*

All the parameters then the sprig cassava chopping machine started and drives will be powered up so that Arduino board depends on the C command.

4.1 Advantages

- It helps to reduces manual power.
- The output of the machine is at higher rate than the manual process
- It can be adapted for the mass production

5 FEASIBILITY STUDY

5.1 Economic Feasibility

The cost of the production of the machine in parallel with the cost is being achieved during the manual process is reduced and hence the machine has a payback period of once after a year. The various component that is used in the project are of lower cost hence the overall cost of the product is been reduced.

5.2 Operation Feasibility

The cost of the operation of the machine in parallel with the cost is being achieved during the manual process is somehow reduced and hence the machine has a payback period of once after a year. The various component that is used in the project are of lower cost hence the overall cost of the product is been reduced

6 DESIGN CALCULATION

6.1 Electrical Design

6.1.1 Servo Motor Torque Calculation

Screw weight = 1000gms =1kg
Acceleration = 9.81m/s2
Force = Mass*Acceleration
Force = 1*9.81 = 9.81 N
Torque = Force*distance
Torque = 9.81*0.016 = 1.56 Nm (or) 15 kg.cm

6.1.1 Servo Motor Speed Calculation

In order to find the speed of the stepper motor the Equation (1) can be used

$$Max\ Speed = \frac{V}{2LImax}.spr$$

Voltage V = 3.08V
Current I = 3A
Inductance L = 3.6mH
Steps per revolution = 200
Speed = 3.08/ (2*3.6*3*200)
= 0.713 revolution/sec
Minimum time per step = 2LI/V
= 2*3.6*3/3.08= 7.01ms
Power = V*I
= 3.08*3 = 9.24 watts

6.2 Mechanical Design

The model was developed by using solid works. It is solid modeler, and utilizes a parametric feature-based approach to create models and assemblies. Building a model in Solid works usually starts with a 2D sketch (although 3D sketched are available for power users .Relations are used to define attributes such as tangency, parallelism, perpendicularity, and concentricity. The dimensions in the sketch can be controlled independently or by relationships to other parameters inside or outside of the sketch. In an assembly, the analog to sketch relations are mates. Just as sketch relations define conditions such as tangency, parallelism and concentricity with respect to sketch geometry, assembly mates define equivalent relations with respect to the individual parts or components, allowing the easy construction of assemblies.

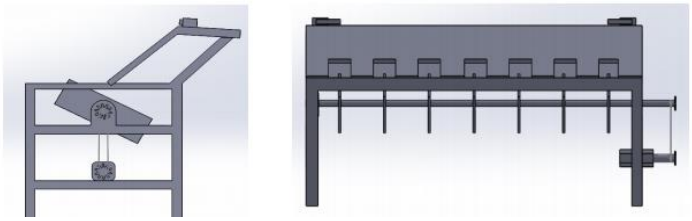

Figure 6.2 *Mechanical design of the sccm*

7 SOLIDWORKS MODEL

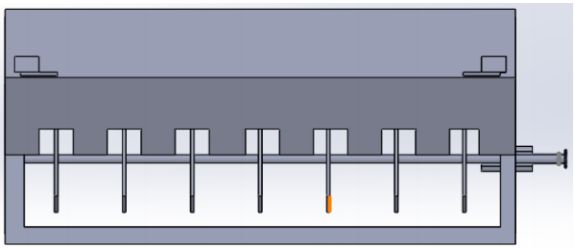

Figure 7 *(a) Solid Works model*

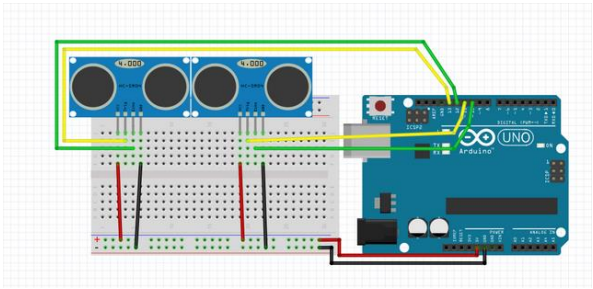

Figure 7*(b) 3D model of sccm.*

8 ELECTRICAL CIRCUIT DIAGRAM

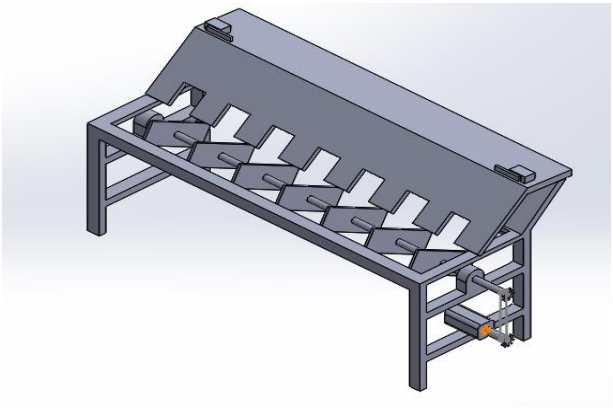

Figure 8 *Electrical circuit connections to sensor*

8.1 Overview of an electrical setup

The Figure 8.1 shows the Electrical Setup of the machine. It shows the overall control of the Arduino board. It includes Arduino board, ultrasonic sensor and servo motor and bane motor

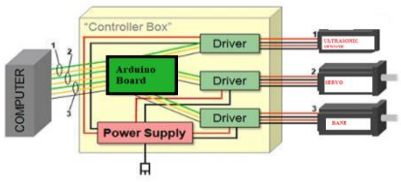

Figure 8.1 *overview of an electrical setup*

9 CONCLUSION

The economically affordable, robust sprig cassava chopping machine was designed, developed. The electro mechanical system that chops the cassava sprigs thereby eliminating the problem in manpower and time consumption in the chopping process. The Servo motors that placed in the storage portion make the automatic feed to the steel cutters (chopping portion) so that cassava sprigs are chopped uniformly.

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