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Sorghum (Hurda) Making machine using Electronic automation

[1]Prof.Geeta.B.Kalkhambkar, [2]Shivani.S.Chandekar,[3]Aarti.A.Nulkar, [4]Poonam.P.Upalkar

[1]Assistant Professor, [2] Engineering Student, [3]Engineering Student, [4]Engineering Student
[1]Department Of Electronics And Telecommunication Engineering Mahagaon,
[1]Sant Gajanan Maharaj College Of Engineering , Mahagaon, India

Abstract : **The Sorghum Hurda Making Machine is an innovative device designed to automate the process of producing hurda, a popular snack made from sorghum grains. This machine utilizes electronic automation to streamline the traditionally labor-intensive and time-consuming steps involved in hurda production.The sorghum hurda making machine offers numerous advantages over traditional manual methods. It enhances productivity by reducing the need for manual labor, increasing processing speed, and improving overall efficiency. The use of electronic automation ensures greater accuracy, precision, and repeatability in each step of the process, leading to a consistent and high-quality end product.**

IndexTerms **- Optimization, Raw, Automatic, Hurda.**

1. Introduction

Hurda, a common Indian snack made from roasted sorghum (also called jowar) kernels, is often produced using labor-intensive manual techniques. These procedures take a lot of time, are ineffective, and demand a lot of labour. This research intends to develop an automatic way for producing hurda without relying on conventional manual approaches in order to overcome these difficulties and increase the effectiveness of hurda production. By doing away with manual labour, an autonomous hurda-making machine can cut down on expenses and manufacturing time while increasing consistency and quality. This novel method not only makes the production process more effective, but it also creates possibilities for expanding production to satisfy the rising demand for hurda.

The study likely involved conducting experiments and analyzing data to understand how the growth characteristics of sweet sorghum plants relate to their carbohydrate content[1].Sweet sorghum varieties are typically cultivated for their high sugar content, which can be used for syrup, biofuel, or other industrial applications[2].The findings of this research would be beneficial for sorghum farmers, food processors, and consumers interested in sorghum-based snacks like hurda. It provides insights into which sorghum genotypes are most suitable for hurda production and outlines the technology and processes needed to produce high-quality hurda[5].Starch is a significant component of sorghum grain and serves as a source of energy in human diets.The starch content and amylase activities in different sorghum varieties or samples. Amylases are enzymes responsible for breaking down starch into simple sugars.

which are then absorbed by the body for energy[6].It provide information on post-harvest processing techniques, storage, and value addition strategies for sorghum and millet, aiming to enhance their nutritional quality, extend shelf life, and promote marketability[7].It may include information on the total cultivated area, production quantities, and yield per hectare for these crops[9].It can contribute to enhancing yield, sugar content, and overall quality of sweet sorghum biomass in Western Kenya, thus supporting its potential as a valuable crop for food, fuel, or industrial purposes[10].

2. BLOCK DIAGRAM

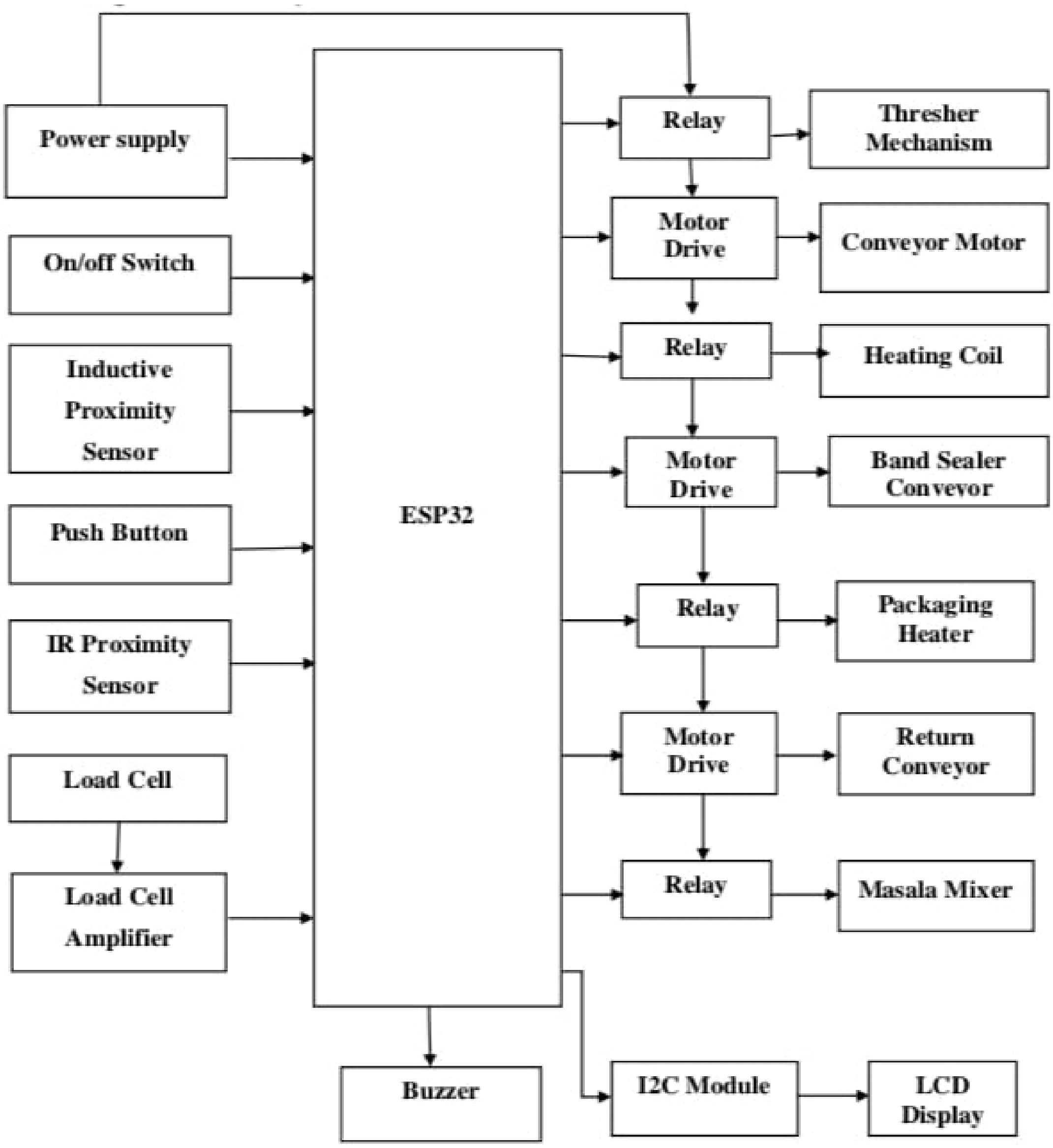

fig 1 . block diagram of Proposed Project

The figure 1 shows the block diagram of the project. The block diagram gives the insight of the connection of the system to be developed. As shown in the block diagram, the entire system is powered using the power supply. The blocks on the left are used as inputs and the controller ESP32 is responsible for reading the inputs from different sensors and process the outputs using the python program running on the ESP32 controller board. The Relay modules are interfaced to the right hand side of the block diagram is responsible for driving the different motors and actuators of the hurda making machine. The push buttons are interfaced to the ESP32 controller as shown in the block diagram are used for driving the different components and automating the hurda making machine. Wherever direction control of the motors is required we have used motor drives which can be used for controlling the motors from the controller as well as providing the directional control to the motor.

When the system is started using the push button the relay drives the thresher motor. The product after threshing comes over to the conveyor. The Motor driver interfaced drives the conveyor which will carry the product to the heating station. The relay is then used to drive the heater coil which will heat the product for predetermined amount of time and the same will be then passed to the quality checking system. The quality checking system consists of the load cell interfaced to the ESP32 which monitors the density of the final product to check if it is properly roasted. If not the motor driver drives the return conveyor to roast it once more. If the quality check succeeds it will be carried forward to the masala addition section where the masala will be added and then moved to the packaging station where it will be packed in pouches.

3. FLOWCHART

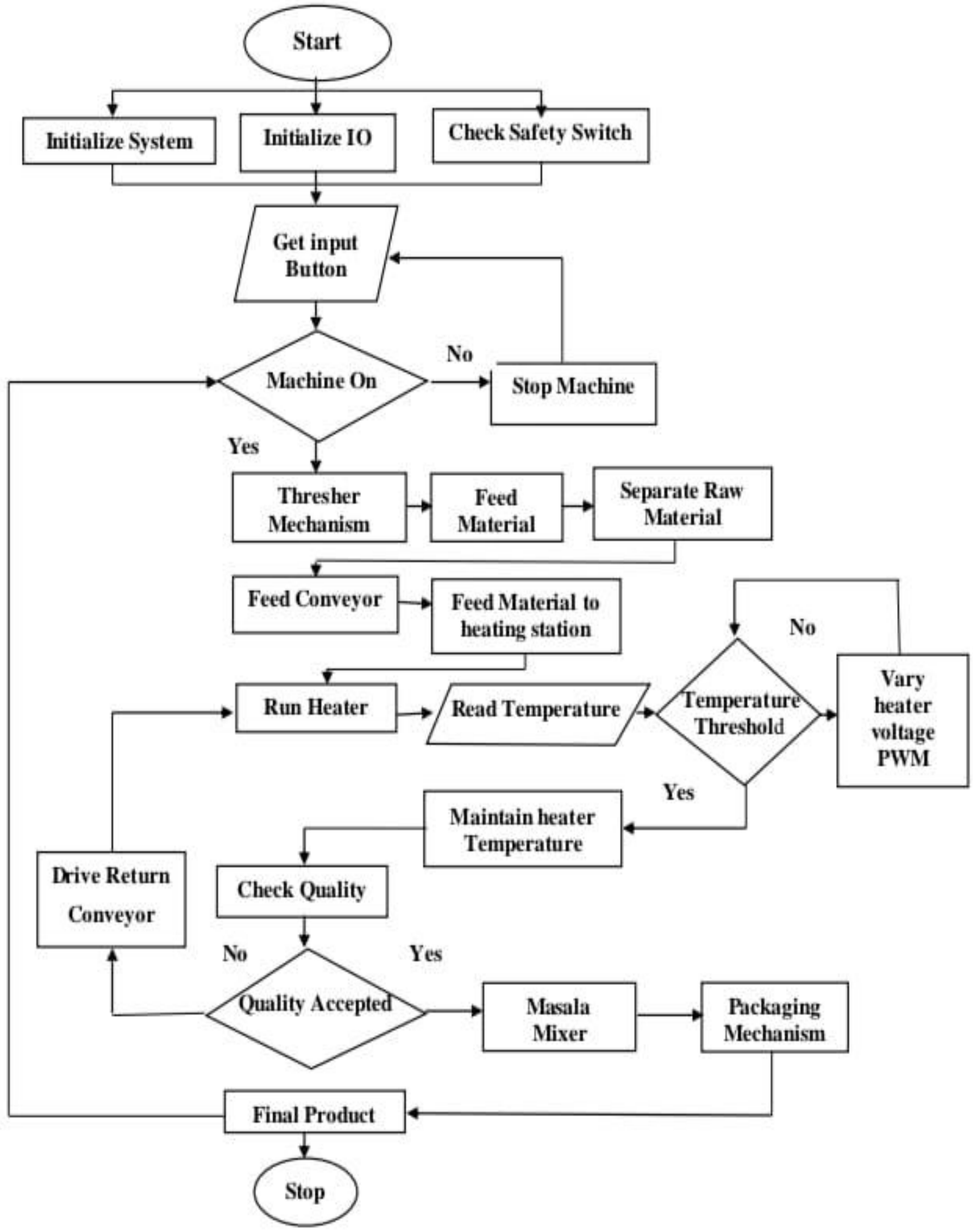

Fig.2 Flowchart of Proposed Project

The Fig 2 is shows that the flowchart of proposed work. Flowchart explains the diagrammatic work flow of a machine.

Start: This represents the starting point of the process, indicating the initiation of the hurda-making procedure.

Thresher Mechanism:The thresher mechanism is responsible for separating the raw material (sorghum) from impurities or unwanted particles. It may involve the use of rotating blades or other mechanical means to separate the grain from the stalks.

Separate Raw Material:The thresher mechanism separates the raw material into its components, separating the sorghum kernels from the stalks or other unwanted parts.

Feed Conveyor: Once the raw material is separated, it is conveyed or transported using a feed conveyor to the next stage of the process.

Feed Material to Heating Station: The separated sorghum kernels are then fed into the heating station or apparatus for further processing.

Maintain Heater Temperature: The heater voltage or PWM may be adjusted to maintain the desired temperature throughout the roasting process. This ensures consistent and uniform roasting of the sorghum kernels.

Quality Accepted: Once the sorghum kernels are roasted to the desired level, they are inspected for quality. This step determines whether the roasted sorghum meets the required standards and is accepted for further processing.

Drive Return Conveyor: After the roasting process, if there is a need to return any leftover or unprocessed material from the heating station, a return conveyor is used to drive the material back to the appropriate location for further processing or disposal.

Masala Mixer: If additional flavoring or seasoning is desired, the roasted sorghum may be transferred to a masala mixer where spices, salt, or other ingredients are added to enhance the taste.

Packaging Mechanism:The seasoned and roasted sorghum, also known as hurda, is then packaged using appropriate packaging mechanisms, such as bags, containers, or boxes, to ensure proper storage and transportation.

Final Product: The packaged hurda is the final product of the process, ready for distribution or consumption.
Stop: This represents the end of the flowchart and the completion of the hurda-making process.

4. PROPOSED WORK

1.SOFTWARE IMPLEMENTATION

The software part of our project involves the Thonny IDE for programming in Python.

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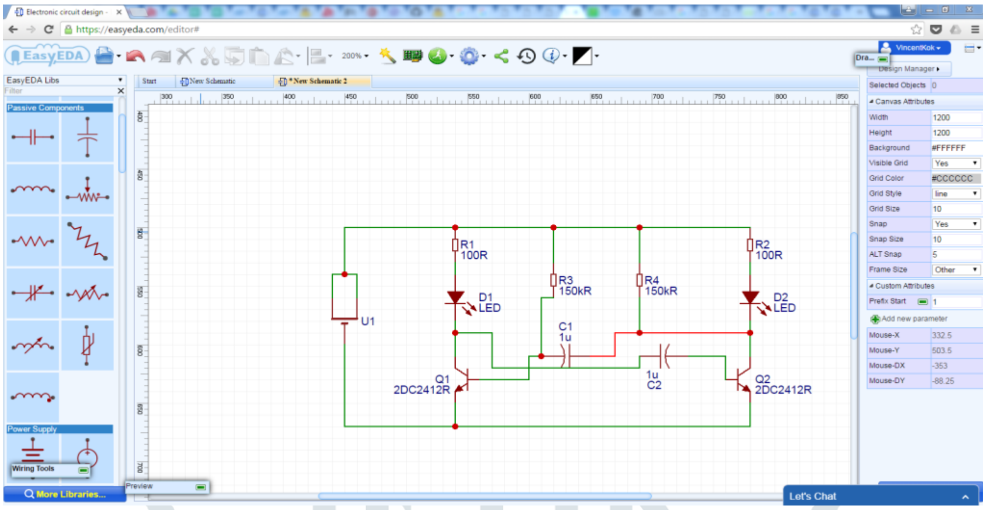

Fig.3.Easy EDA of proposed Project.

The Fig.3 shows that the Easy EDA of proposed Project. A great web based EDA (Electronic Design Automation) tool for electronics engineers, educators, students, market and enthusiasts. Easy EDA is free online software for creating circuit schematics, designing PCBs as well as simulating electronics circuits.

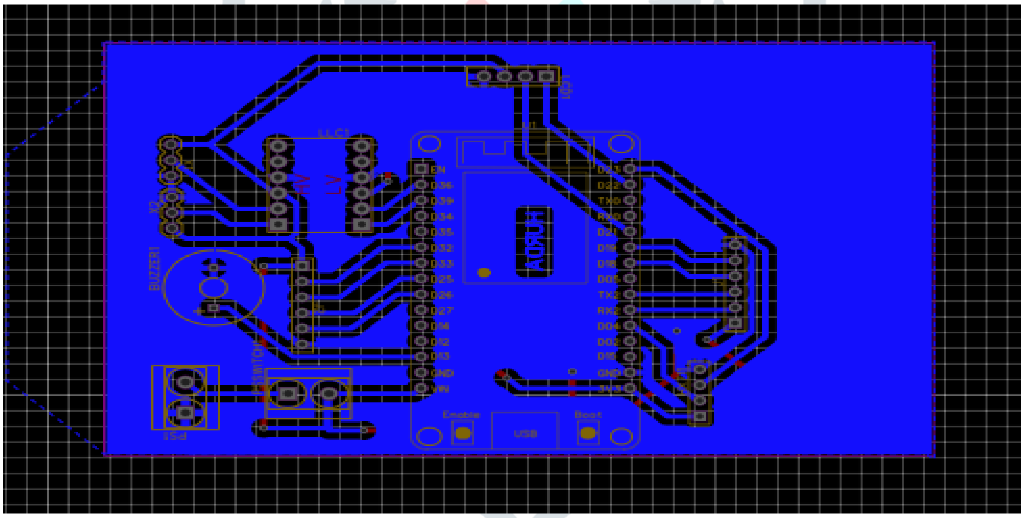

Fig.4 PCB Layout of Proposed Project

. The fig.4 shows that the PCB(Printed Circuit Board) Layout of proposed Project.It representation of the electronic circuit design of proposed Project.

5. FINAL RESULT :

Fig.5 Sorghum (Hurda)Making Machine

Crushing Unit

Sieve unit

Conveyor Unit

Heating Unit

Masala Mixer

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Packaging Unit

Crushing Unit:

It is the first step of hurda making, In Crushing Unit, corn of sorghum is crushed in crushing unit and give the output in the form of seeds in 5 sec and seeds are passing through the next Sieve Unit.

Sieve Unit : Sieve unit is second step of the hurda making. Wherever crushing unit is stopped then sieve unit is separates sorghum seeds and waste materials. Only seeds are proceed to the conveyor within 5 seconds.

Conveyor Unit: In Conveyor Unit, seeds of sorghum passes through the heating unit within 5 seconds**.** 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. Many kinds of conveying systems are available, and are used according to the various needs of different industries. In this project the belt conveyor system is used to transport the hurda from one place to another for further processing.

Heating Unit: in the heating unit, in 30 seconds the seeds are roasted. If seeds are properly roasted then they proceed to the mixing unit. If seeds are not properly roasted, then they proceed to the return conveyor**.**

Masala Mixing Unit: In Masala Mixer, the upper hopper drops the masala into lower hopper which contains the roasted seeds and stirrer mixes it. After 5 seconds of properly masala mixing it proceed to the packaging unit. The masala mixer consits of a simple stirrer with DC Motor mounted to the stirrer and servo hopper arrangement.The hopper drops the masala into the hurda and stir mix it.

Packaging Unit:.The packaging mechanism consist of a simple press based packing system with heating coil to melt the plastic bags and pack the material. The insulation coating is provided on the packaging heating coil to avoid sticking of the plastic bags to the packaging mechanism used is 12 inch band packaging machine.

6.CONCLUSION

The project deals with the development of hurda making machine. From the project it can be concluded that the project can help commercialize the process of making hurda and the same can be used to sell the hurda in the commercial markets. The process of hurda making is simplified by production of the machine which can be used to prepare hurda right from the initial harvesting stage to packaging stage in single machine. Thus the machine can be used for commercial production of hurda.The project has wide scope for further modifications. At present we have just implemented the prototype for hurda production. In future the commerzial scale machine can be prepared.

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