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Solar Mini Flour Mill Machine

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Abstract : This This study addresses the growing demand for electricity in India,particularly in remote villages. With biomass and other non-commercial fuels constituting a significant portion of energyrequirements, the need for alternative energy sources is evident. Theaim of this research is to explore the use of solar power as asustainable energy solution for remote villages in India, specificallyfor powering grain milling activities. The methodology involves thedesign and implementation of solar panel systems to capture solarenergy and convert it into electricity for use in grain milling. The study includes participants from remote Indian villages whocurrently rely on traditional, time-consuming milling techniques.The results indicate that solar power can significantly improve theefficiency of grain milling, reducing the time and effort required.The implications of this research are far-reaching, as it highlightsthe potential for solar power to address energy needs in remote areasand improve the livelihoods of the residents.

Index Terms–
India, Electricity demand, Remote villages, Biomass, Non-commercial fuels, Alternative energy sources, Solar power, Sustainable energy solution, Grain milling, Solar panel systems, Energy conversion, Efficiency, Livelihoods, Socioeconomic conditions, Research implications

INTRODUCTION

India is the second most populous country in the world. With a growing population the needs of people is alsogrowing, in such cases demand for electricity is very high here. Biomass and other non-commercial fuels constitutearound 40% of energy requirements in India. Around 85.49% of the Indian villages are electrified, but many of the remote villages are still without electricity. People in villages mainly use bicycles as their means of transport for small distances, in such places our system is of great use. Solar cells are devices which convert solar energy directly into electricity, either directly via the photovoltaic effect, or indirectly by first converting the solar energy to heat or chemical energy. Assemblies of cells used to make solar modules which are
used to capture energy from sunlight, are known as solar panels. The energy generated from these solar modules, referred to as solar power. Cells are described as photovoltaic cells when the light source is not necessarily sunlight (lamplight, artificial light etc). The amount of power available from a PV device is determined by the type and area ofthe material, the intensity of the sunlight, the wavelength of the sunlight. In particular, grain milling using saddle stone,
pestle or mortar is arduous and time consuming, carried out exclusively by women and children. These milling techniques are more than 3000 years old (Pomeranze, 1986) and allow only low grinding rates of less than 1 kg per hour (Carruthers and Rodriguez, 1992). Therefore, milling 2.5 kg of grain which is the average daily consumption of a family takes about three hours (Chinsman, 1985).

Literature Review

1. E. Beshadal, M. Bux2 and T. Waldenmaier2: Are the researcher, which conducted research in rural areas of Africa many people still rely on time consuming and physically demanding hand milling methods for their daily food prep. This mainly falls on women andchildren. Introducing motorized mills can significantly improve their quality of life.
   However, typical diesel-driven mills have a high capacity that may not be suitable for scattered rural settlements, where the average daily grain consumption per family is only 2.5 kg. To tackle this, a new PV-driven stone mill was developed with a smaller capacity of 3 kg per hour. It produced flour that met local preferences and had a maximum power requirement of less than 100 W. With solar panels and a battery, it can process 15-60 kg per day, depending on sunlight availability.
   The researcher explores factors such as grain type, moisture content, rotational speed, millstone gap, and feed rate that affect torque and power requirements.

2. Mr. Prasad A Hatwalne, Mr. Mahesh Gorde, Mr. Swapnil B. Patond, Mr. Parvezalam I. Shaikh: The researcher found. That developing countries like India, people living in rural areas facesocio-economic challenges, energy crisis, and a growing desire for physical fitness. Pedal-operatedmechanisms have gained popularity as they provide a Solution to these issues. They are used to generate power and Operate flour mills, among other activities. However, a Common concern is the level of comfort during operation. To address this, an ergonomically viable pedal-operated flour Mill has been

developed, taking into account the anthropometric data. This ensures a comfortable posture During operation, meeting the needs of the majority of people in India who rely on wheat and wheat flouras their staple Food.

3. M.S.Giripunje -Human powered food grain crusher. To develop such a food grain crusher which will be cheap and Independent of conventional energy.

4. Rahilpatel, Meet shah, Dhavalparekh, Zenith patel, Partheshpatel -pedal powered grinding machine is used only For grinding purpose. Also, it requires lots of efforts and limited for single application use. Another Problem in existing model is that it consumed more time and also has lower efficiency. Our aim is to design a human powered grinding machine which can also be used for many purposes like pumping, grinding, washing, cutting, etc.

Problem Defination

The concern about the high electricity costs associated with flour mill machines. Our project aims to address this issue by incorporating solar panels, which will significantly reduce the electricity expenses. Additionally, we are taking a modern approach by making the machines more portable and compact through the use of wheels. This enhanced mobility will make it easier to operate and transport the machines. Moreover, by incorporating adjustable blades, we are ensuring that the machine meets the diverse needs and preferences of the market. This combination of energy efficiency, portability, and adaptability is truly remarkable.

METHODOLOGY

Working Principle

A flour mill machine primarily utilizes mechanical force, including impact, compression, and friction, to grind grains into flour, with centrifugal force aiding in propelling grains towards grinding surfaces for efficient milling.

Major components

Solar Panel

A solar panel is a device that converts sunlight into electricity by using photovoltaic (PV) cells. PV cells are made of materials that produce excited electrons when exposed to light. The electrons flow through a circuit and produce direct current (DC) electricity, which can be used to power various devices or be stored in batteries. Solar panels are also known as solar cell panels, solar electric panels, or PV modules.

DC Motors

A DC motor is an electrical motor that uses direct current (DC) to produce mechanical force. The most common types
rely on magnetic forces produced by currents in the coils. nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor. DC motors were the first form of motors widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field Windings. Small DC motors are used in tools, toys, and appliances.

Battery

A sealed lead acid battery or gel cell is a lead acid battery that has the sulfuric acid electrolyte coagulated (thickened) so it cannot spill out. They are partially sealed, but have vents in case gases are accidentally released for example by Overcharging. They can be used for smaller applications where they are turned up side down. They are more expensive than normal lead acid batteries, but they are also safer.

Hopper

A hopper is a large, inverted pyramidal or conical container used in industrial processes to hold particulate matter or flowable material of any sort (e.g. dust, gravel, nuts, or seeds) and dispense these from the bottom when needed. In some specialized applications even small metal or plastic assembly components can be loaded and dispensed by small hopper systems. In the case of dust collection hoppers the dust can be collected from expelled air. Hoppers for dust collection are often installed in groups to allow for a greater collection quantity. Hoppers are used in many industries to hold material until It is needed, such as flour, sugar or nuts for food manufacturing, food pellets for livestock, crushed ores for refining, etc. Most hoppers are made of steel.

Chamber

A mill is a device, often a structure, machine or kitchen appliance, that breaks solid materials into smaller pieces by grinding, crushing, or cutting. Such comminution is an important unit operation in many processes. There are many different types of mills and many types of materials processed in them. Historically mills were powered by hand or by animals (e.g., via a hand crank), working animal (e.g., horse mill), wind (windmill) or water (watermill). In modern era, they are usually powered by electricity. The grinding of solid materials occurs through mechanical forces that break up the structure by overcoming the interior bonding forces. After the grinding the state of the solid is changed: the grain size, the
Grain size disposition and the grain shape.

Controller
A solar controller is an electronic device that controls the circulating pump in a solar hot water system to harvest as much heat as possible from the solar panels and protect the system from overheating. The basic job of the controller is to turn the circulating pump on when there is heat available in the panels, moving the working fluid through the panels to the heat exchanger at the thermal store. Heat is available
Whenever the temperature of the solar panel is greater than the temperature of the water in the heat exchanger. Overheat protection is achieved by turning the pump off when the store reaches its maximum temperature and sometimes cooling the store by turning the pump on when the store is hotter than the
Panels.

Blades
The grinding of solid materials occurs through mechanical forces that break up the structure by overcoming the interior bonding forces. After the grinding the state of the solid is changed: the grain size, the grain size disposition and the grain shape.
Milling also refers to the process of breaking down, separating, sizing, or classifying aggregate material (e.g. mining ore).

Frame
The frame of a flour mill machine is a crucial component that provides structural support and stability to the entire system. The design and construction of the frame play a significant role in the performance, durability, and efficiency of the flour mill. Here is some general information about flour mill machine frames.

Working
Basically the hopper, is like a container that can hold up to 1kg of grains. You pour the grains into the hopper, and they stay inside until they're ready to be crushed. Now, there's this pathway that leads from the hopper to the crushing chamber. The grains slowly make their way along this pathway, kind of like a conveyor belt, until they reach the chamber. Inside the crushing chamber. There are these blades that start rotating, with the help of a primary mover. As the blades spin, they create a powerful force called centrifugal force. This force is what actually crushes the grains into tiny particles or even a powdery form. It's like crushing happening inside that chamber. After the grains are crushed, all those small particles need to go get collected. It's like a big container that collects all the crushed grains. To make sure only the small particles get collected, there's a handy strainer that filters out any larger pieces. So, all the crushed grain particles go through the strainer and end up in The storage tank and the storage tank It's conveniently placed on the base, so it's easy to access and manage. That way, you can collect all the crushed grains and use them however you like.

RESULTS AND DISCUSSION

Results of Descriptive Statics of Study Variables

The results of the solar mini flour mill machine are: the solar mini flour mill has the capacity to process 1.5 kg of wheat at a time.1 kilogram of wheat takes 15 to 20 minutes to grind. One kilogram of rice takes about fifteen minutes to mill. Our tiny flour mill machine took 15–20 minutes, whereas the pedal flour mill machine required 25–30 minutes. Our machine requires 12 volts to operate and takes approximately 15 minutes, comparing to the machineavailable in the market that runs on 230 volts and takes nearly 10 minutes for 1 kg.

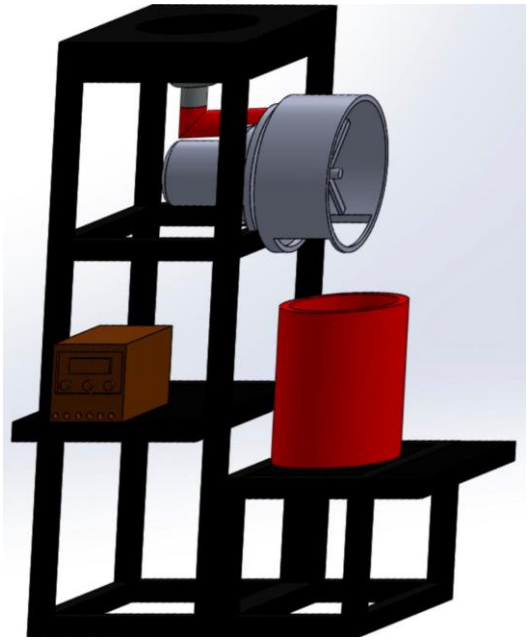

Fig 1: 3D Model

Fig 2: Actual Model

Conclusion

The main aim in developing the small flour mill machine was to develop an inexpensive, simple-to-use system that could be assembled with minimal electricity using easily accessible materials. As a result, we proposed a simple structure that could produce a trustworthy, productive, and efficient flour mill that would be useful in a rural as well as an urban environment. Additionally, this equipment can be placed in areas with inadequate power supplies with convenience.

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