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Electricity Generation Using Flywheel

Akhilesh Barwahe[1], Amrendra Kumar[2], Ankit Domde[3], Deepak Dhakad[4], Manish Kumar Dhadse[5], Vishal Wankhade[6]

[1,2,3,4,5] Student, [6]Assistant Professor , Bachelor of Engineering in Mechanical Engineering

Swami Vivekanand College of Engineering, Indore

Abstract— Flywheels have been under consideration to be used for energy storage purposes. In developing countries like India, with rapid growth in the economy, the demand for electricity is also increasing. With the rising demand for reliable, cost-effective, and environmentally friendly energy storage, the Flywheel Energy Storage System (FESS) is quickly coming into its own. This study presents an analysis which shows that using an FESS is a promising alternative in mitigating energy storage problems in decentralized electricity generation projects where an uninterrupted power supply (UPS) is required. An electrical machine is used as a motor to store kinetic energy when the solar energy is available, and then the stored energy is converted back to electrical energy by running the machine as a generator when the solar energy is no longer available. Flywheel Energy Storage systems (FESS) using advanced technology have come up as a promising alternative to the traditional electrochemical battery. The amount of energy storage depends on the mass, flywheel shape, and rotational speed of the rotor. A FESS can have energy fed into the rotational mass of a flywheel, store it as kinetic energy, and release it upon demand.

Keywords: Uninterrupted power supply, Flywheel Energy Storage System, kinetic energy, spinning mass, environmentally safe.

I. INTRODUCTION

This is a mechanical device which uses the flywheel to store energy in the form of inertia. Let us explain all the system. In this system we apply extra energy source to start the main motor like electricity or by applying the mechanical energy. In this system a main motor is used to drive a series of pulley and belt arrangement which forms a gear train arrangement which produce a twice/ thrice speed at the shaft of generator. The intriguing thing about this system is that grater electrical can be drawn from the output generator than appears to be drawn from the input drive to the motor. The inertia of flywheel can be increase by increasing the radius of flywheel, weight of flywheel. It also increase if the flywheel weight is concentrated as far out toward the rim of the flywheel as is possible. Firstly the requirement for an effective system needs to be a suitable flywheel with as large a diameter as is practical, and vast majority of the weight needs to be close to rim. The construction needs to be robust and secure as ideally, the rate of rotation will be high as possible, and of course, the wheel needs to be exactly at right angles to the axle on which it rotates and exactly centred on the axle. The main motor is low speed and low voltage input motor and the generator is high speed and high voltage output generator. So when we apply an extra energy to the main motor it start running, which causes to rotate the flywheel. When the motor is reaches the highest speed (constant speed) we switch the power by applying the electrical energy generated by the generator. We add the extra thing in the system like transformers, inverter, any extra needed circuits etc. to run the system and take the efficienciable output.

II. LITERATURE SURVEY

K. Ghedamsi- “The flywheel energy storage systems (FESSs) are suitable for improving the quality of the electric power delivered by electric motor.

Jamie Patterson, 2004, “The broad goal of this project was the development and demonstration of a complete prototype Flywheel Power System (FPS) and successful proof of the feasibility of this energy storage technology. The next step in development will be final system modifications for the transition from laboratory to field testing, and interface engineering for a field experiment.”

Michael Mathew, 2009, “Flywheels serve as kinetic energy storage and retrieval devices with the ability to deliver high output power at high rotational speeds as being one of the emerging energy storage technologies available today in various stages of development, especially in advanced technological areas, i.e., spacecraft’s. Today, most of the research efforts are being spent on improving energy storage capability of flywheels to deliver high power at transfer times, lasting longer than conventional battery powered technologies. Mainly, the performance of a flywheel can be attributed to three factors, i.e., material Strength, geometry (cross-section) and rotational speed. While material Strength directly determines kinetic energy level that could be produced safely Combined (coupled) with rotor speed, this study solely focuses on exploring the effects of flywheel geometry on its energy storage/deliver capability per unit mass, further defined as Specific Energy”.

Federal energy management program, “Flywheels have been around for thousands of years. The earliest application is likely the potter’s wheel. Perhaps the most common application in more recent times has been in internal combustion engines. A flywheel is a simple form of mechanical (kinetic) energy storage. Energy is stored by causing a disk or rotor to spin on its axis. Stored energy is proportional to the flywheel's mass and the square of its rotational speed. Advances in power electronics, magnetic bearings, and flywheel materials coupled with innovative integration of components have resulted in direct current (DC) flywheel energy storage systems that can be used as a substitute or supplement to batteries in uninterruptible power supply (UPS) systems. Although generally more expensive than batteries in terms of first cost, the longer life, simpler maintenance, and smaller footprint of the flywheel systems makes them attractive battery alternatives".

Rickard Östergård, "The main conclusion of the literature review was that FESS is a promising energy storage solution; up to multiple megawatt scale. However, few large-scale installations have so far been built and FESS is not a mature technology. Therefore further research and development is needed in multiple areas, including high strength composite materials, magnetic bearings and electrical machines. The model was implemented with the necessary control system and tested in a simulation case showing the operational characteristics".

R. Hebner, 2014," A FESS stores energy in the form of kinetic energy of a spinning mass. Energy transformations from electrical into mechanical and back are carried out by an electrical motor/generator. Potentially, a FESS can offer an Essentially unlimited number of charge/discharge cycles. Furthermore, if magnetic bearings and a brushless motors/generator are used, the rotor can be suspended without any mechanical contact. This allows very high rotational speeds and energy densities without affecting the system life."

Seong-yeol Yoo,2009," Flywheel energy storage systems (FESS) store electric energy in terms of the kinetic energy of a rotating flywheel, and convert this kinetic energy into electric energy when necessary. A FESS is a viable technology for energy storage because it is environmentally safe, can sustain infinite charge/discharge cycles, and has higher power-to-weight ratio than chemical batteries"

III. METHODOLOGY

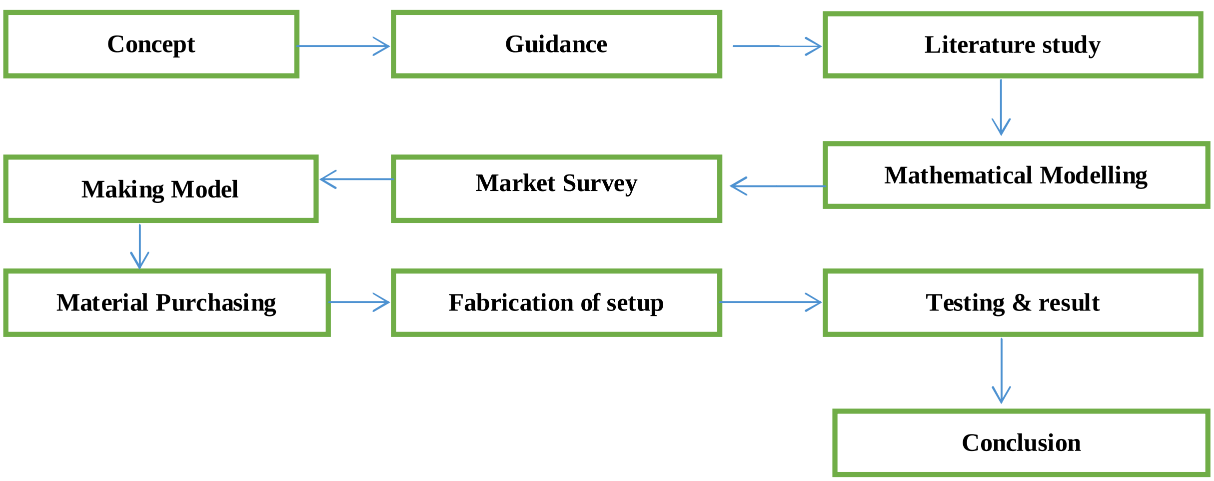

Fig. 1 Process Chart

TABLE 1
FRAME WORK

Activity	**Operation**				
	Operation	Inspection	Storage	Delay	Transport
Transport of material					
Cutting of ply-board					
Taking positions for motors					
Inspection for motor position					

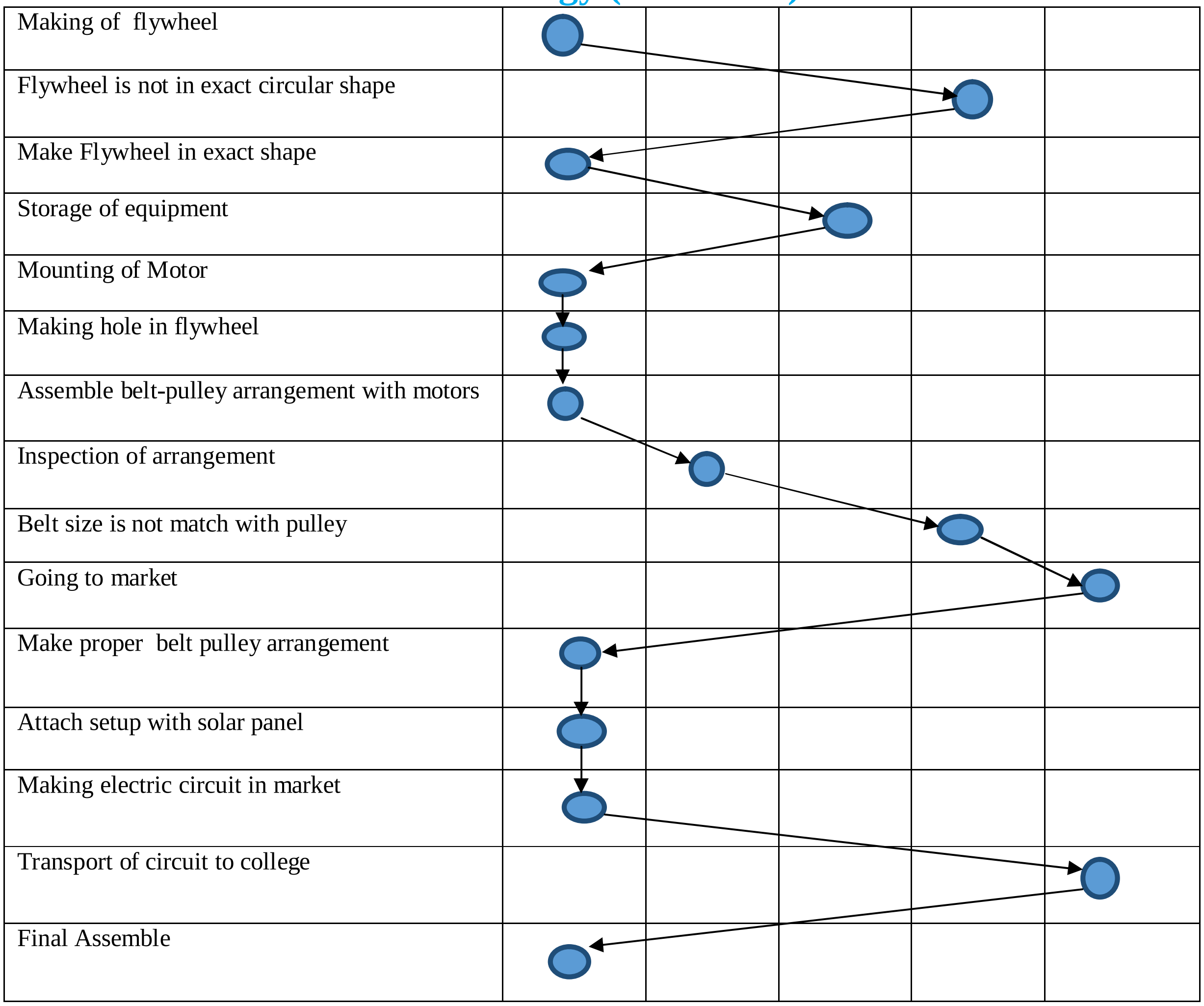

TABLE 2

SPECIFICATIONS

Materials	Specifications
Motor	1200 r.p.m. , 12 Volt
Motor (Ideal)	1000 r.p.m.
Main Flywheel	Diameter = 9.4 c.m. Thickness = 0.3 c.m. Mass = 163 gram
Second Flywheel	Diameter = 5.5 c.m. Thickness = 0.3 c.m. Mass = 38 gram
Small Pulley	Diameter = 13 mm
Larger Pulley	Diameter = 40 mm
Solar Panel	6 W , 6V, 0.55 A Size- 185*250*17.5 mm
Adaptor	12 V , 1A
Capacitor	1000 µF

IV. CONCLUSIONS

We realize that with the help of our setup when flywheel is not attached in setup then series of L.E.D. light is switch off after switch off of A.C. supply while when the flywheel is attached with setup then series of L.E.D. lights is not off after the 5 seconds of A.C. supply off . We supply 12 V AC current to the setup and we got 10 V DC current. So we can say that if we increase the weight of flywheel then it stores more energy in the form of inertia and when we cutoff main supply it will continue give electricity but it increase time period in the comparison of first one. Flywheels appear poised to replace or supplement batteries as a backup power supply in UPS systems. Six companies currently offer DC flywheel energy storage products. Another half dozen or so are developing products they expect to bring to market within the next few years. Still others offer products where the flywheel is an integral part of the UPS system rather than being a direct substitute for batteries. Although currently developed DC fly-wheel energy storage systems offer significant advantages over batteries, the number of companies currently offering products, and an equal or greater number developing products, suggests that further product development and enhancement is likely to occur. Coupled with seemingly ever increasing needs for more reliable, higher quality power, the long-run prospects for flywheel energy storage in UPS applications looks good. Flywheels will be a strong alternative to batteries in UPS systems with generators that can reliably come on line in 10 seconds or less. Otherwise, fly-wheels could be used to supplement batteries, thereby significantly extending battery life and increasing UPS system reliability. Although the initial cost of a flywheel is typically greater than batteries it would be replacing or supplementing, its longer life and simpler maintenance will often result in lower life-cycle costs.

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