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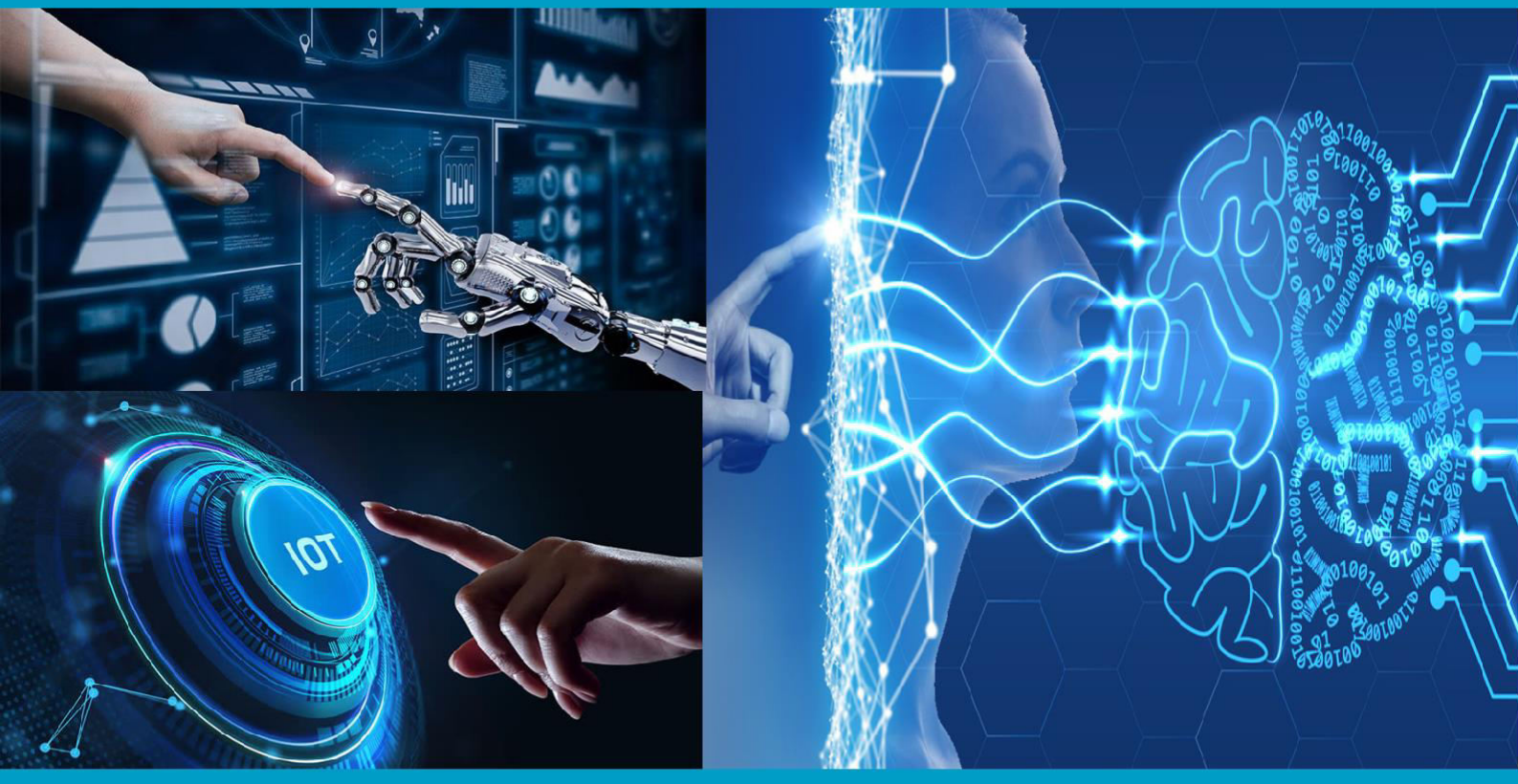

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Development of Battery operated Centrifugal Pump

Dr. Kaushal K. Prasad, Mr. Abhijit M. Date, Naeem mogal, Miran Bhatkar, Mihir Miragal, Amey Keer

Professor, Dept. of Mechanical Engineering, Finolex Academy of Management and Technology, Ratnagiri, Maharashtra, India

Assistant Professor, Dept. of Mechanical Engineering, Finolex Academy of Management and Technology, Ratnagiri, Maharashtra, India

UG Students, Dept. of Mechanical Engineering, Finolex Academy of Management and Technology, Ratnagiri, Maharastra, India

Abstract: A centrifugal pump is a roto-dynamic pump using a rotating impeller to maximize the fluid pressure. A typical company in South Africa using Centrifugal Pumps to supply water is the Rand Water and its pumping stations. They pump about 4.7 billion liters of drinking water from their booster stations per day through centrifugal pumps. The pump-set has two stages connected in series and is designed to deliver 200 mega liters per day (ML/day) at a generated head of 197 meters of water. In the course of the years, the pump's hydraulic output has dropped to a point where more energy is expended to provide the required head and flow rate. The reduction in centrifugal pump output causes increased energy consumption. The high consumption of energy is a direct result of the centrifugal pump not operating as required by the standards. Appropriate calculations were done to obtain the desired dimensions in order to improve the performance of the pump.

I. .INTRODUCTION

Water is daily required for drinking, irrigation and industrial processes. The water required is pumped from ponds, rivers or underground reservoirs. The pumps run on electricity. Thus, pumps are major consumers of electrical energy [1]. Electricity is primarily produced using fossil fuels, which causes pollution. Fossil fuel resources are declining very fast and the cost is rising up too. All these problems have led to the exploration of nonconventional energy resources for electricity generation. Thus, the use of battery is on the rise. Though the system initial cost is high and efficiency is less electricity can be easily generated from battery using charged battery which is pollution free. Research is going on to bring down the cost and improve the efficiency of battery. Thus, battery is a good alternative to fossil fuels for electricity generation. Water pumping is also required in remote places as well where grid electricity is not available or less available. In such cases too using battery is a good option. The pumps mainly used for water pumping are positive displacement pump and centrifugal pump. The centrifugal pump is used for constant head applications. In this paper the centrifugal pump operated by battery is studied.

II. Literature Review

[1].Wei li and all, by investigating the varying locus and pattern of transient radial force of centrifugal pump with time the results shows that the frequencies of pressure pulsations are mainly the blade passing frequency at the monitoring points and also at that point most intense pulsation appears. The magnitude of blade passing frequency which causes the pressure pulsation is 114.333 HZ, indicates the interference between the blades of impeller and collector.

[2] Dr.P. Muthu and Alex George described that among number of blade, Inlet and outlet pressure and characteristics of pump the number of blade has major influence on cavitation in the pump. With increase in the number of blade, the head of centrifugal pump increase all the time, the change regulations of efficiency and Net positive suction head required are complex. By numerical simulation they found that 5to 7 numbers of blades are optimum value for best efficiency and capitation characteristics, with increase in blade number, capitation characteristic increases.

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[3] Deeptesh Singh and all studied the failure analysis of centrifugal pump from the perspective life of its component and frequency of occurrence of the failure.After doing questionnaires in the industry and analysis of data obtained from industry it clear that most critical component in a centrifugal pump are packing and bearing. Hence it is required to increase the reliability of these components.

[4] TilahunNigussie and Edessa Dribssa investigated the effect and distribution of velocity profile and pressure within a pump using 3D Navier stokes equation in ANSYS. From the simulation it is observed that the pressure increases gradually from impeller inlet to outlet and velocity increases from impeller inlet until it enters in the volute casing and drops to zero at outlet. It is found that the design and analysis methods lead to very good flow field and general performance predictions.

III. OBJECTIVES

- The main objective of our project is to reduce human efforts and reduce the cost.
- To make cost effective Water pump.
- Easy to use and easy to carry.
- To reduce the maintainnce cost of pump.

IV. FABRICATION OF PROJECT

Fig. Motor [750 watt and 2800-3500RPM]

In the majority of cases, the driver in a centrifugal pumping system is an **electric motor**. However, that isn't always the case. Pumps can also be driven by other drivers such as natural gas engines or even steam turbines. The most common pumping unit combines a centrifugal pump driven by an electric motor.
So the motor with specification [750 watt and 2800-3500RPM] is selected.

Inside the battery is an electrolyte, often consisting of soluble salts or acids, it serves as a conductive medium, allowing the electric charge to travel through the battery. As the battery is the main component of project. A battery with 48V and 24-23A is selected.

.Preparation of 3D model Design

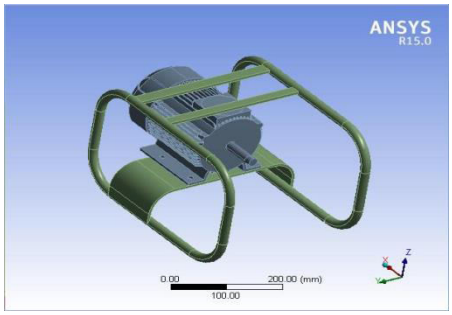

Fig. 3D Centrifugal Pump

A 3D model of the Centrifugal pump is created in the CATIA software. The model consists frame, Motor assembly, and actual centrifugal pump assembly. While fabrication, appropriate changes were made as per the working requirements and model was completed.

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Actual Fabrication of Components :

Fabrication stage includes the fabrication of various components and sub-components. Some components were taken from scrap while some were fabricated and the assembly was created. The material and dimensions of the components are listed in the table 3.1.

Table Components of Battery operated centrifugal pump

Sr No.	Components	Material	Specification
1.	Centrifugal pump	Cast iron	-
2.	Impeller	Cast iron	No of blades:6
3.	Casing	Steel	C frame
4.	Motor	Steel	750 Watt 2800-3500RPM
5.	Piping	PVC	-
6.	Valves	PVC	-
7.	Battery	-	48V and 24-30Amp

Centrifugal pump battery operated:

As discussed earlier, the centrifugal pump consists of two main components, first is the impeller of vortex type with 6 no of blades, then the motor and the casing for the complete model. The adjustable the centrifugal pump with all components arrangement and fabrication is shown below

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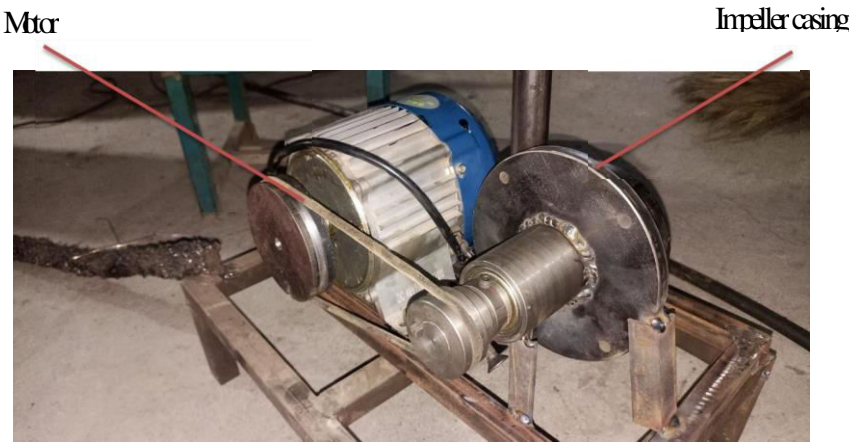

Experimentation

The experimentation includes the testing of centrifugal pump by using a battery to know the actual work output by pump. A battery with 48V and 8amp was used for testing the centrifugal pump. By this we get to know that pump is not giving satisfactorily output with the less ampere so the battery with 48V and 24-30amp was used to get the desirable output.

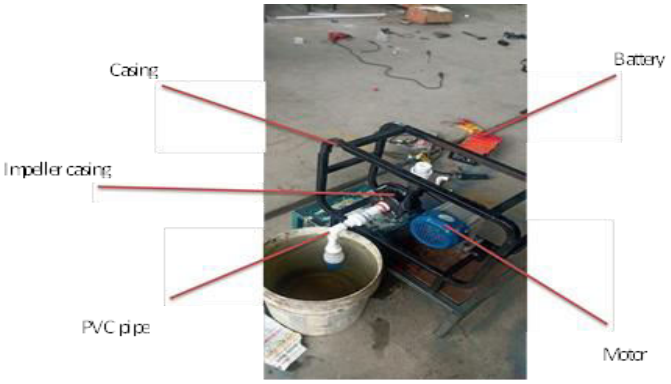

Fig.Complete model Battery operated Centrifugal pump

In this centrifugal pump model system, the battery is use as a power source to operate the battery and avoid the use of petroleum and electricity to reduce the pollution and it cas be portable and easy to operate. It is further connected to the computer system through input vibration module where data is extracted by using LabVIEW software.

V. CONCLUSION

In this centrifugal pump model system, the battery is use as a power source to operate the battery and avoid the use of petroleum and electricity to reduce the pollution and it cas be portable and easy to operate. It is further connected to the computer system through input vibration module where data is extracted by using LabVIEWsoftware.A centrifugal pump was designed through calculations using appropriate equations to develop technical 3D drawings using CATIA Software. A normal and steady pressure distribution results were used to show the pump casing and the impeller are in good condition when the pump is running with the impeller at the given rotational speed. Cavitation will occur if the pressure is too low and this will damage the impeller, thus, reducing its life cycle. However, in this project to avoid cavitation the pump was designed to have a NPSH (Net Positive Suction Head) available that is greater than NPSH (Net Positive Suction Head) required. The results were taken in varying axis and cross sections for pressure distribution of centrifugal pump.

Future scope

The proposed project includes the design and fabrication of Battery operated centrifugal pump which can be operated by the usage of charged battery for the agriculture purpose. As we know in many small towns and urban area farmers

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are facing problems regarding the electricity. This project is designed in the view of without using an electricity a pump can be operated by a battery to reduce the pollution and farmers can easily move the pump because it designed as a portable centrifugal pump. Overall the future looks bright for the battery operated centrifugal pumps as the farmers will able to operate the portable and also a battery operated centrifugal pump to save more electricity and avoid pollution.these pump will play an increasingly important role in the agriculture and farmers area.

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