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SOLAR PV ARRAY BASED HYBRID WATER PUMPING SYSTEM USING INDUCTION MOTOR DRIVE

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ABSTRACT

IN this project AN Induction motor (AC) driven pump with a star electrical phenomenon (SPV) array and 3 part inverters. The SPV- array primarily based hybrid generation is employed as an influence supply so as to realize an eternal full volume water flow in spite of the climate condition. The SPV array is employed as a primary supply whereas the battery as a backup. Therefore, the battery is discharged solely beneath unhealthy climate condition or at nighttime once the PV array is skimpy to feed the pump. in addition, it's charged by the SPV array once the water flow isn't needed. Thus, no external offer is employed for the battery charging. A duplex charging management permits to change the mode of operation of the battery mechanically through a buck-boost DC-AC convertor. The Induction motor is systematically operated at its rated speed and cargo. No current sensing is needed for the speed management and also the power devices of voltage supply electrical converter (VSI) are switched at fundamental.

Keywords: Induction Motor, Solar Photovoltaic Array, Boost Converter, Three Phase Inverter, PID Controller, Water Pump, Battery.

I. INTRODUCTION

The proposes of a bidirectional power flow management of a grid interactive star electrical phenomenon (PV) fed water pumping system, associate Induction motor- drive while not part current sensors is employed to run a pump. this method allows a shopper to work the water at its full capability for 24-hours no matter the environmental condition condition and to feed a single-phase utility grid once the water pumping isn't needed. the complete utilization of a PV array associated motor-pump is created attainable additionally to an increased dependability of the pumping system. In a grid isolated or standalone system, the prevailing Induction motor driven pump feed by a PV array swear solely on star PV energy. within the course of unhealthy environmental condition condition water pumping is severely interrupted and system is underutilized because the pump isn't operated at its full capability. Moreover, associate inaccessibility of daylight ends up in conclusion of the water pumping system. In case of remote-control square measures are unfortunate from installation offer typically diesel generator is employed as a backup. The PV installation et al supply remains used just in case the pump isn't needed. The Induction motor is consistently operated at its rated speed and cargo. No current sensing is needed for the speed management and power device of voltage supply electrical converter (VSI) square measure switched at first harmonic.

1.1 Concept of Solar Water Pumping System:

A star pump system is usually seen in residential and industrial uses, in addition as for irrigation of agricultural land. Through star panels, the pump will eliminate the value of energy and supply a lot of possible choice that uses energy from the sun (and not fuel-burning mechanisms) for pumping water.

Advantages of a solar water pumping system:

- No fuel cost - as it uses available free sun light
- No electricity required
- Long operating life
- Highly reliable and durable
- Easy to operate and maintain
- Eco-friendly

Disadvantages of a solar water pumping system:

- It is expensive.
- The output of the panel will depend on the weather.

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- It requires a water storage tank as well as a battery.

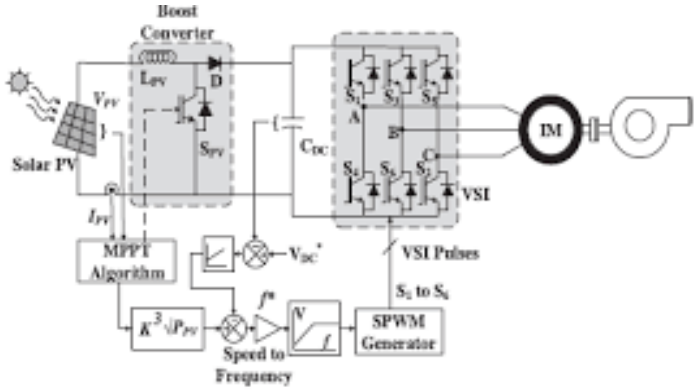


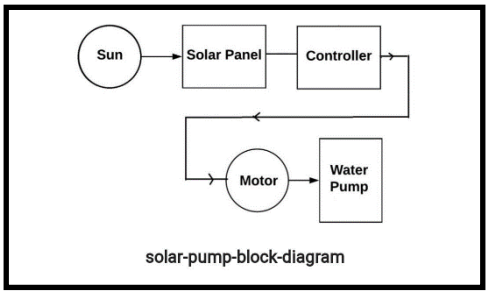
Figure 1: Circuit Diagram of Water Pumping System

1.2 System Configuration:

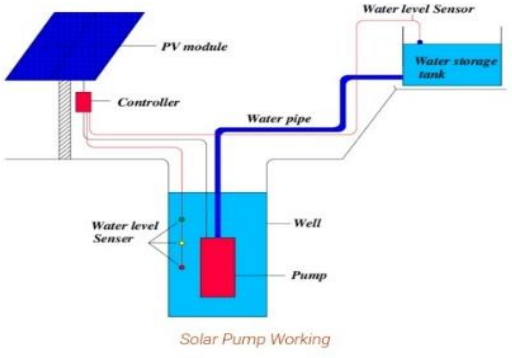
The configuration of proposed hybrid water pumping system is sketched in Fig. 1. An SPV array via a boost converter and a battery storage via a bidirectional buck-boost converter create a common DC bus. An Induction motor-pump is supplied by this common DC bus via a VSI. The DC-DC boost converter is engaged to perform MPPT of SPV array through an InC technique; while a buck-boost converter plays a role of charge controller for the battery. When the battery is discharged; this converter acts as a boost converter and the battery feeds the common DC bus. Conversely, it acts as a buck converter; when the battery is charged and fed by the common DC bus. A VSI performs an electronic commutation of Induction motor. A centrifugal water pump is coupled to the shaft of Induction Motor which has three inbuilt Hall Effect sensors to generate Hall signals for commutation.

1.3 Working Principle of Solar Water Pumping System:

The star pump primarily includes a solar array, water pump, motor, and controller. This pump is essentially associate electrical pump, and this pump uses the electricity that is received from the star panels to figure. These panels store the energy from the star. the electrical motor manages the electricity or electrical energy. The controller employed in this technique adjusts the output power likewise as speed.



A star pump system is often seen in residential and industrial uses, additionally as for irrigation of agricultural land. Through star panels, the pump will eliminate the price of energy and supply a additional possible possibility that uses energy from the sun (and not fuel-burning mechanisms) for pumping water.



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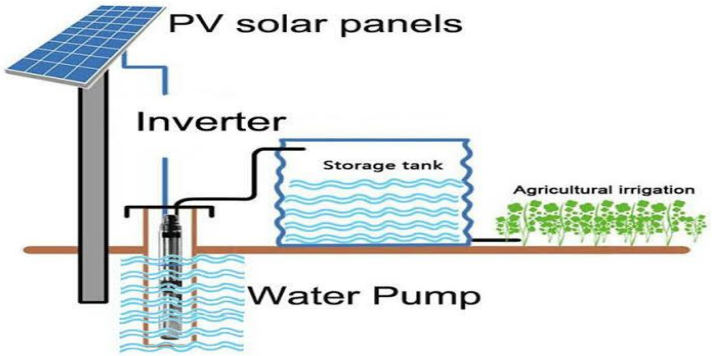
1.4 Implementation of INDUCTION motor in Water Pumping System:

- An Induction motor emerges as a better substitute for DC motors in water pumping applications due to high efficiency, high reliability and least maintenance requirement.
- **Soft Starting of INDUCTION Motor:**
- At standstill, a high inrush current is drawn due to the absence of back-EMF which may harm the stator windings and switching devices. This current surge is required to be prevented by controlling the stator starting current. This current is controlled by modulating the pulse width of switching devices for a predefined duration.
- **Electronic Communication in INDUCTION Motor:**
- Electronic commutation refers to commutating the currents tlowing through windings of INDUCTION motor such that a symmetrical direct current is drawn from the DC bus of VSI for 1200 and placed at the centre of back-EMF. The three inbuilt Hall Effect sensors generate a particular combination of Hall signals (H)-H3) in accordance with the rotor position at an interval of 60°.

1.5 Solar PV array in Water Pumping System:

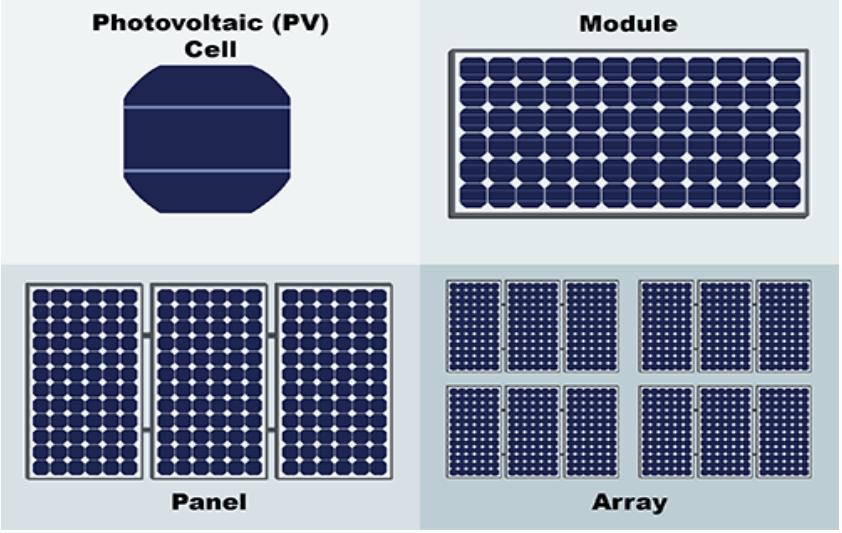
1.6 Introduction

A star pump system is associate degree electrical pump system during which the electricity is provided by one or many electrical phenomenon (PV) panels. A star steam-powered pumping system consists of a solar battery array that powers an electrical motor, that successively powers a bore or surface pump.



- **The Solar Photovoltaic Array**

If photovoltaic solar panels are made up of individual photovoltaic cells connected together, then the Solar Photovoltaic Array, also known as a Solar Array. It is a system which is made by a group of solar panels connected together. A photovoltaic array is actually multiple solar panels electrically wired together to form a much larger PV system called an array, and in general the total surface area of the array, will products more solar electricity.



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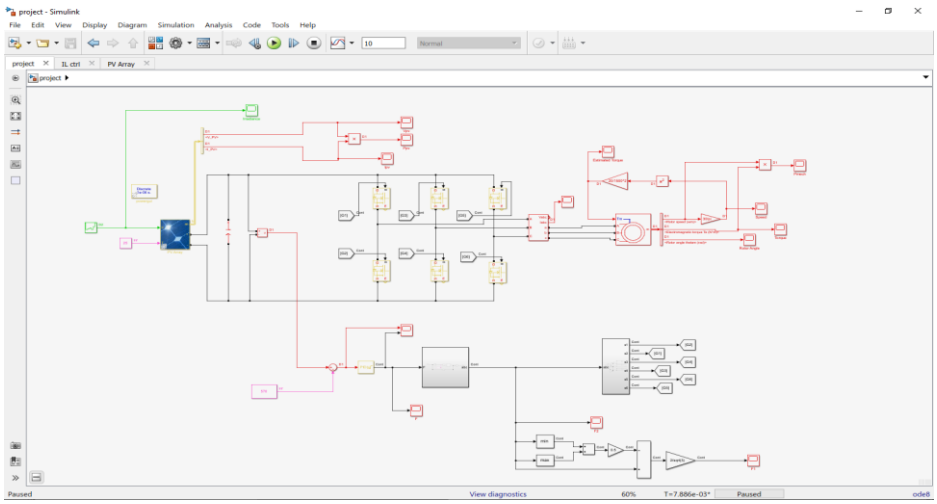
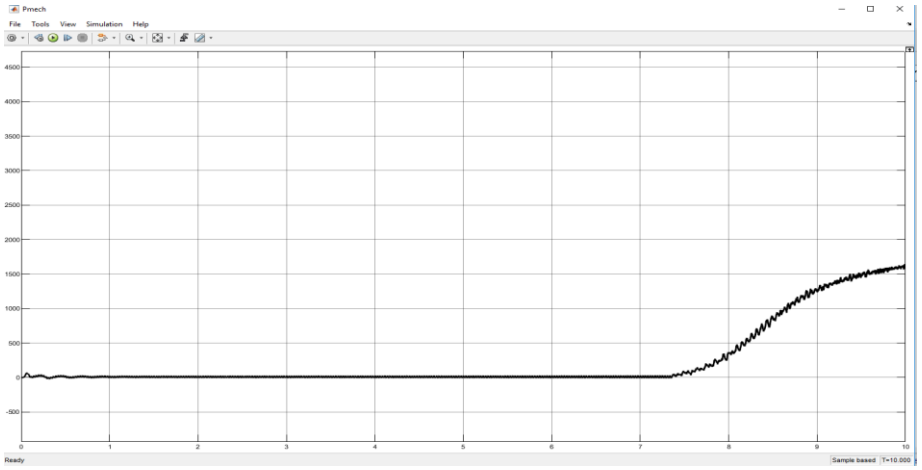
II. CIRCUIT DIAGRAM IN MATLAB SIMULINK AND RESULTS



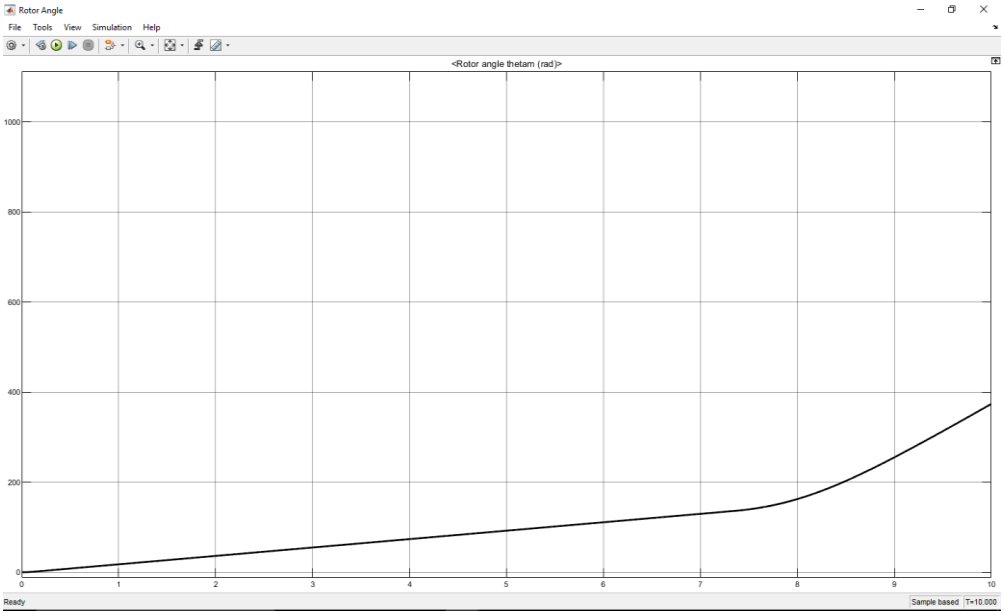
Circuit Diagram of Water Pumping System in MATLAB

2.2.1 Pmech



In figure 2.2.1 we have the mechanical power graph of the motor.

2.2.2 Rotor Angle



In figure 2.2.2 we have the rotor angle graph in 30 degrees at a certain time then it increasing.

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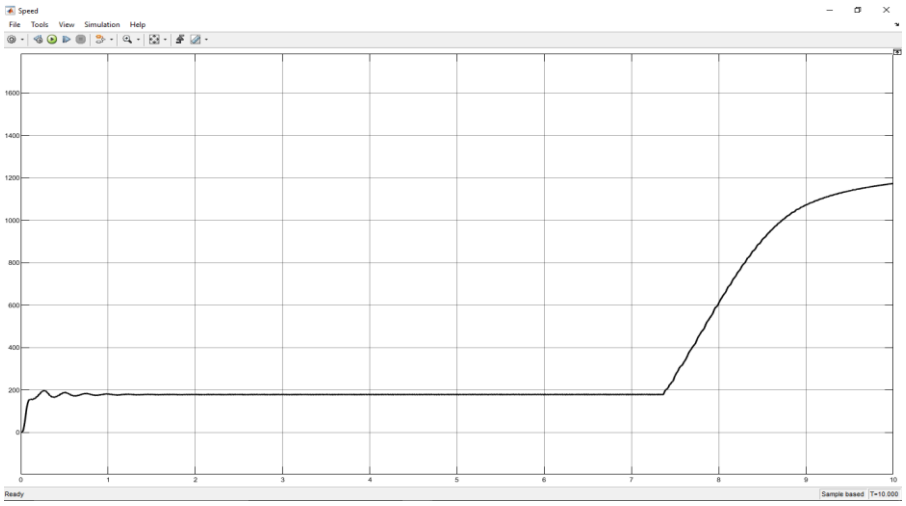
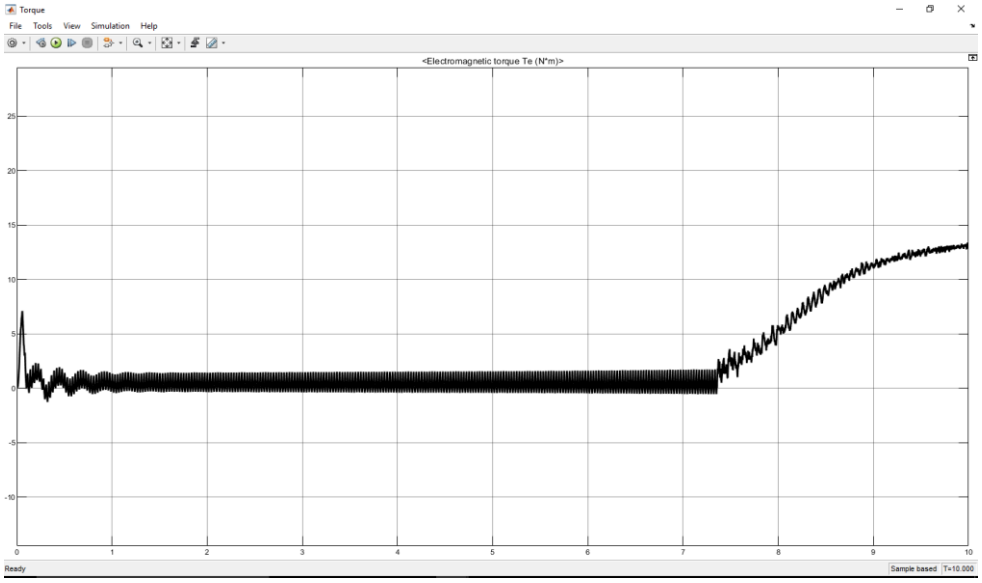
2.2.3 Speed



In figure 2.2.3 we have the speed of the motor graph

2.2.4 Torque



In figure 2.2.4 we have the electromagnetic torque graph of the motor

III. INDUSTRIAL, ENVIRONMENTAL APPLICATION INDUSTRIAL

3.1.1 Industrial:

- Drinking Water Extraction
- Daily water needs application
- Tank Storage
- Deep borehole extraction and remote storage pumping
- Land and Farm Irrigations
- Round About and Garden irrigation

3.1.2 Environmental:

- The solar PV array-based hybrid water pumping system are widely used in the socio-economic benefits as well as climate related benefits.
- The water pumping system supplies water to irrigate crops, livestock activities, and provide portable drinking water.

IV. CONCLUSION

Here, in this project we designed SOLAR PV ARRAY BASED HYBRID WATER PUMPING SYSTEM. In proposed effort the difficulty of detecting the fault in the hole circuit is done. We project a MATLAB model for healthier recognition by using MATLAB simulation. It is widely used in environmental aspects and provides the portable water supply different areas.

FUTURE OBJECTIVES

The model leaves a scope of further development using advanced technologies to give more accurate resolves of various critical problems. So mainly we are trying to improve in the photovoltaic array structure, the interconnection of the solar module, the interaction of the photovoltaic array with the electric motor, and that of the electric with the pump. According to the academics, should focus on the further cost reduction, extending the life cycle of the device and improving their components.

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