

Chapter 9

MPPT–Based Solar Powered Water Pumping With RMS: Augmentation of IoE Technology

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ABSTRACT

In the present era of technology drift, the Internet of Things (IoT) is a promising technology that shows the considerable transition from enterprises to businesses. In this context, renewable energy has played critical roles in developing the agricultural sector with its functionality to generate power over distant areas and different terrain. There has been a transformation in the way we consume electricity and the way it is operated by the utilities. The smart monitoring features are an efficient way to utilize energy and minimize losses. These losses might be the transmission and distribution losses or losses by the inefficient household wiring or appliances. These losses can be minimized if they are monitored well with relevant data and analytics. This book chapter presents an application of the Internet of Energy (IoE) technology in the renewable sector. The study was carried applying Maximum Power Point Tracking (MPPT) functions and corresponding Remote Monitoring System (RMS) functions. The undertaken site

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for Solar Water Pump (SWP) installation for irrigation is Bihar Sharif (Nalanda, Bihar). The proposed IoE based technology served maximum power output with high efficiency during operating hours. Here, the farmers may do automatic start/shut, remote start/shut from SMS/web with a health check, and self-diagnostic mechanisms for easy maintenance. Thus, the SWP system emerged as a cost-effective and environment-friendly irrigation solution for remote farmers throughout the year. The solar potential assessment of the site and circuit development were done using PVsyst 7.0 and KiCad software tools, respectively. The successful working of the developed product has been observed at the site.

INTRODUCTION

Renewable energy has driven the resource gathering process for power generation into more dynamical supply chain operation, since the sources of the renewable energy are diversified throughout the earth in the form of solar, wind, biogas, geothermal and few more. These resources build the confidence to generate and distribute the energy more efficiently with its deep penetration into the micro-industries such as farming, cattle rearing and the types of industries among the rural population directly affecting the livelihood. No matter how tremendous the energy consumption pattern is among the urban population but the basic necessities are fulfilled by the micro-industries, which provide us food and shelter. On the other hand, millions of people living in remote areas are not having sufficient access to the electricity due to unavailability of central grid. Furthermore, the expansion of power grid to such places with low power demand and having dispersed population is not economically feasible. Hence, for such places solar energy is emerged as one of the most inexhaustible source of energy with boundless potential. Solar powered pump is a cost effective solution to the farmers by which they can manage harvesting upfront cost and even becoming an optional revenue stream for them (as presented in Table 1). Most of the farmers are dependent on conventional sources based pumping system like electric and diesel/ kerosene water pumps for irrigation in India. Due to its continuous increase, approximately 8-12% of total greenhouse gases (*i.e.*, 45 million tonnes of CO₂) emitted to the atmosphere (Rathore et al., 2018).

Table 1. Competitive features of SWP system

Parameters	Features
Cost	<ul style="list-style-type: none">• No fuel cost compared with diesel price• Savings on high cost of providing last mile electricity connections• Savings on current diesel and agricultural power subsidy
Power	<ul style="list-style-type: none">• Peak load management between urban and rural areas• Zero distribution losses due to decentralized power generation
Operations and Maintenance	<ul style="list-style-type: none">• Long operating life of pumps• Highly reliable, durable/negligible maintenance over time• Easy to operate and maintain
Environmental	<ul style="list-style-type: none">• Reduction in greenhouse gas emissions• Reduction in pollution due to diesel combustion
Societal	<ul style="list-style-type: none">• Generation of local employment in villages• Prevention of mass migration of villagers to urban areas• Enabling economic development of rural farmer

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