
بسم الله الرحمن الرحيم

FINAL YEAR PROJECT REPORT

Intelligent Solar Panel Tracking System
with
Sinewave Inverter

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DEDICATION

To our respected parents whose utmost love, care and struggle against all odds brought us to this height of knowledge with the blessings and help of the
ALLAH ALMIGHTY.

STATEMENT OF SUBMISSION

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Abstract

Solar energy is rapidly gaining notoriety as an important means of expanding renewable energy resources. Our project includes the design and construction of a microcontroller-based solar panel tracking system and Pure Sinusoidal Inverter. The tracking system computes the position of the sun from available data input by user i.e. (date, month, year and time) and controls the movement of a solar panel so that radiation of the sun comes normally to the surface of the solar panel. The main advantage of the system is that it is programmed, so that it could rotate solar panel at a pre-determined angle and at predetermined periods by using short pulses without using sensors. The developed-tracking system tracks the sun both in the azimuth as well as in the elevation plane. The operation of the experimental model of the device is based on a DC motor intelligently controlled by a dedicated drive unit that moves a PV panel according to the yearly calendar stored in microcontroller.

This report also focuses on DC to AC power inverter, which aim to efficiently transform a DC source to a high voltage AC source. An inverter circuit by using sinusoidal Pulse Width Modulation (SPWM) switching schemes is developed to run AC utilities. DC is one type of energy that is found in solar panels and can be stored in batteries for usage in future. Semiconductor device, Metal Oxide Field Effect Transistor (MOSFET) is used as switch in full bridge (H-Bridge) inverter configuration using Unipolar voltage switching. Driver circuit for MOSFET is also very important as it is used to interface between control circuits (Low voltage part) and inverter (High voltage part). PIC microcontroller chip is used to generate modulating signals. At the end of this project, the SPWM output signal is developed from the Microcontroller and applied to the MOSFET driver and the inverter. The method to complete the desires outcome would be to first convert the low voltage DC to AC by using pulse width modulation, and then use a transformer to boost the voltage to 220 volts to drive the AC load.

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CHAPTER 1

INTRODUCTION

With the alarming rate of depletion of the major energy resources worldwide, it has become an urgent necessity to seek for renewable energy resources that will power the future. According to the worldwide market economy, the increasing demand for energy had forced to put a huge price tag on natural combustible sources of energies. In fact, it has been predicted that in the near future the demand of energy will grow in such a rate that it will be completely impossible to find out or meet the demand with the resources that we had been using for so long, such as – oil, gas, coal, etc. This issue throws a positive challenge to the scientific community as more and more funds are being allocated for the research and development of new alternatives.

In this context, we have concentrated our focus on the research of renewable energy. Among these renewable energy resources, solar energy is one of a kind. In today's world, there is a growing demand to find greener ways to power the world and minimize greenhouse gas emission. The sun is a natural power source that will keep on shining for an estimated 4 billion years. Solar power (photovoltaic) systems are a sustainable way to convert the energy of the sun into electricity. The expected lifetime of a system is 25-30 years the energy potential of the sun is immense, and it is one of the emerging energy sources, which is subsidized in order to secure the distribution of the technology worldwide. By tracking the sun, the efficiency can be increased by 30-40%. The photovoltaic technology allows the conversion of sunlight directly to electricity with a conversion ratio of about 15-20%.

1.1 Motivation

With all the above information, the rapid depletion of the natural resources of the world, we would soon meet a great demand for alternative source of energy. In the very near future, experts are predicting that we will be bound to move to renewable sources of energy, solar being one of them. As long as our earth exists, the sun is there to give us unlimited solar energy. It is completely up to us how we are going to utilize this abandoned energy.

Not only the world but also our country is in a severe crisis of electricity. There are many rural areas, which are still deprived from the wonder of electricity. Due to the geographical location of our country, we get sun almost 300 days a year. Compared to many other countries like Canada and Norway, we are in a much better location for utilizing solar energy. It can be used in areas where there is no grid connection also. Considering all the above things, the environmental friendliness, economically sound, and the ease of implementation, we thought of working on it, as we believe that in the near future, our country along with the whole world will be benefited from this source of renewable energy.

1.2 Aim of Project

The aim of the project is to keep the solar photovoltaic panel perpendicular to the sun throughout the year in order to make it more efficient. The dual axis solar photovoltaic panel takes astronomical data as reference and the tracking system has the capability to always point the solar array toward the sun and can be installed in various regions with minor modifications. The vertical and horizontal motion of the panel is obtained by taking altitude angle and azimuth angle as reference. The microcontroller has been used to control the position of DC motors. The mathematical simulation control of dual axis solar tracking system ensures the point-to-point motion of the DC motors while tracking the sun.