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Solar Power based AC Water pumping System for Crop Application

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ABSTRACT: This paper deals with the innovative technology in considering the various ways to irrigate the agricultural land using solar power. Agricultural technology is changing rapidly, farm, machinery, farm building and production facilities are constantly being improved. agricultural application suitable for photovoltaic (PV) solution and main components are used in this project that is solar PV array and solar pump and most important thing is AC motor because DC motor are already used in many project for crop application but now we have using AC motor to using water pumping system.VFD is totally used to changing the variable speed of motor for applying water irrigation.

KEYWORDS: solar pannel, AC motor ,AC Water pump, Storage tank ,LCD display and VFD .

I. INTRODUCTION

One of the hurdles in the growth of rural India is lack of electricity. in Indian condition, solar system are becoming a very variable solution due to many sunny days are existing during the year.solar energy is the richest source of energy in the earth. solar power is not only an answer to today's energy crisis but also an environmental socialable form of energy. Farmer are using solar photovoltaic system in agricultural field.during past few years in rural areas farmers uses DC pump based on SPV even through they suffer with many problems with DC pumps.

To solve this issue, the system of AC Water pumping Inverter is designed.the designing inverter is capacity 1.5kv A which is very small when compared with inverters used in large scale .To overcome these problems, design of inverter and experimentation carried out.The main aim of this project was to provide water to the plant through the AC motor with VFD.water speed is totally depend on the light and dark condition because temperature is high or low according the day or night.so water is ON in day and automatically OFF in night.

Photovoltaic (PV) power for irrigation is cost - competitive in comparison to traditional energy source for small scale water pumping requirements. photovoltaic power is to become further economical in further [12]. PV powers water pumping system have become alternative for livestock and agricultural application in remote location with limited access to conventional electricity [13]. A number of studies have been carried out on performance evaluation, optimization, sizing technique, economical and environmental aspect of PV pumping system.The highlights of the research investigation are presented in this section.

II. OBJECTIVE

The main purpose of this project is past few years in rural areas farmers uses DC pump based on SPV even through they suffer with many problems with DC pumps .To solve this issue, the system of AC Water pumping Inverter is designed. Now we have to use AC motor for agriculture application for growth of plant and solar power used is rescue the electricity.



III. METHODOLOGY

The proposed work is taken in two major parts design of 1.5KVA .Inverter and testing of 1HP AC Water pumping system.

The solar AC Water pumping system block diagram is shown in fig (1). The main concept is designed to work Inverter of 1.5K VA for 1HP AC Water pumping system.it includes SPV array , Inverter and AC motor .At discharge side the pressure guage is connected to hydraulic pressure.the solar data are collected from automatic weather station inverter will result in 230v AC voltage from 24-32V variable DC output from SPV panel.

Block Diagram

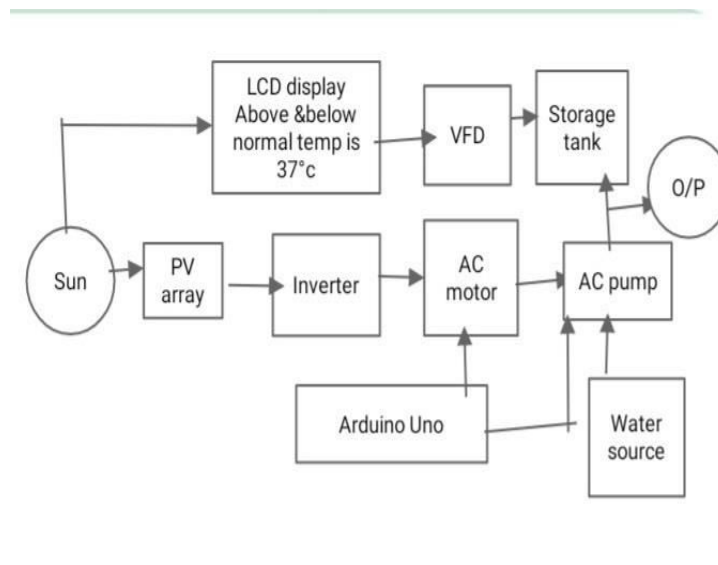


Fig (1): Block diagram of Solar power based AC Water pumping system

WORKING

The working of this project three main part is solar panel, inverter, AC motor .Sun is emits the light energy towards the solar panel.solarpanel is photovoltaic array i.e group of solar is collect the light energy and is fed to the inverter.inverter is act as a convertor it converts the light energy into electrical energy .electric supply to the AC motor .AC motor is an electrical motor drive by alternating current and motor is driven by AC to supply a rotating flux .other side of input from VFD i.e variable frequency driver it controls the speed of an AC motor by varying the frequency supplied to the motor.electric supply to AC motor with a corresponding frequency and voltage change in the motor speed and torque .AC Pump use basic forces of nature to move a liquid i.e water .

As the moving pump being to move air is pushed out of the way with water tank .source of water is the lacked riversand underground aquires that one source of our water supply .we have to used water well source ..the water tank is a container for storing water for used to provide storage of water for use in many application in this project using agricultur.the storage tank that is water tank is stored a water and we have to used crop appliances .water is applied from tank to crop water is supplied continuesly in day and continuesly monitoring in LCD display is show the temperature above and below the normal temperature is 37°C and automatically ON in day and OFF in night condition.

Software Component

- Microcontroller
- C.programing
- temperature controlling sensor



Hardware Component

- Water pump
- Inverter
- Arduionano
- water tank
- AC motor
 - Solar pannel
- Water pump
- Inverter
- Arduionano
- water tank
- AC motor

Circuit Diagram

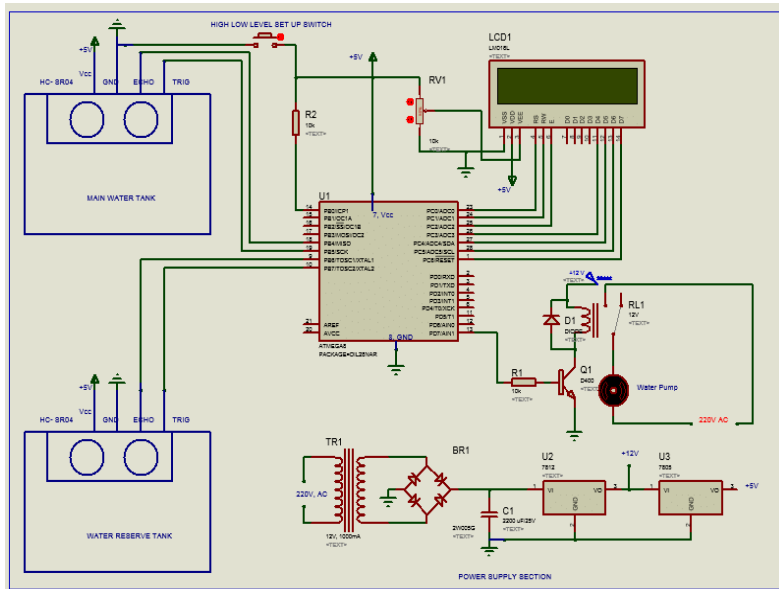


Fig 2): Circuit Diagram of Solar powers based AC Water pumping system

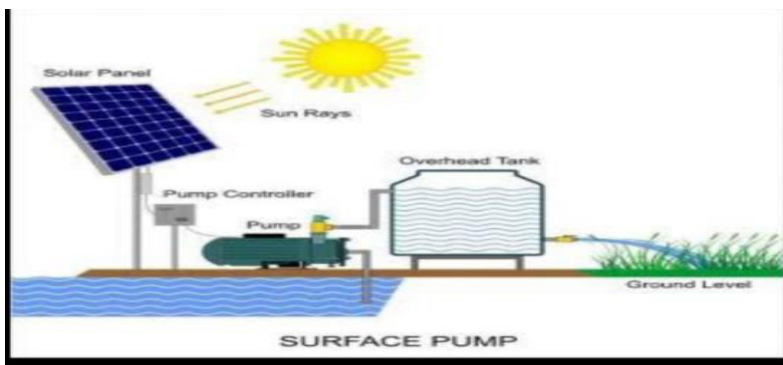


Fig : 3)solar power AC Water pumping system for Agriculture.

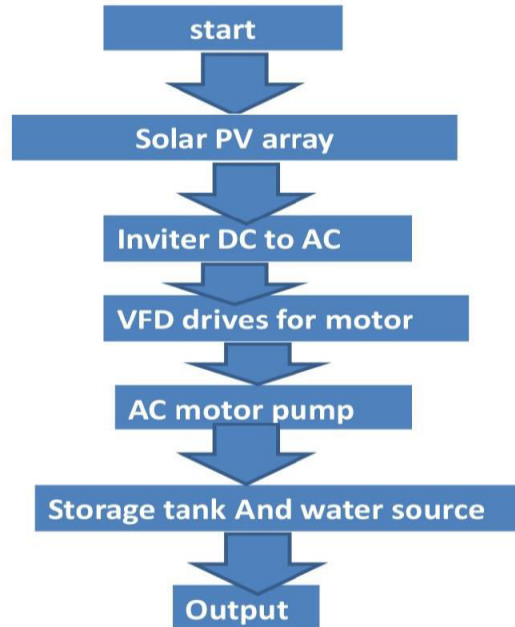


Fig :4) flow chart of AC Water pumping system



Fig : 5) Solar Panel (monocrystalline)

Solar panel or photovoltaic module is an assembly of photo voltaic cells mounted in a framework for installation .solar panels use sunlight as a source of energy and generate direct current electricity .A collection of PV modules is called PV panels system of panels is an array .most solar panels generate direct current (DC) electricity.monocrystalline cells dark blue in colour and almost square missing corners due to the method of production .they are produced from a single cylindrical crystal of silicon cut into thin circular wafers to increase the cell density in a module ,four edge are then cut from each of the round cells ,allowing them to packed closely monocrystalline module are typically more efficient than other type of solar modules with commercial efficiency level of around 18to 21 percent.They also tends to have cost to power ratio then solar modules.



Fig: 6) water pipe

Here it is used as a water channel and pile has been used for watering plant. A pump is a device that moves fluid or sometimes slurries by mechanical action typically converted from electrical energy into hydraulic energy.

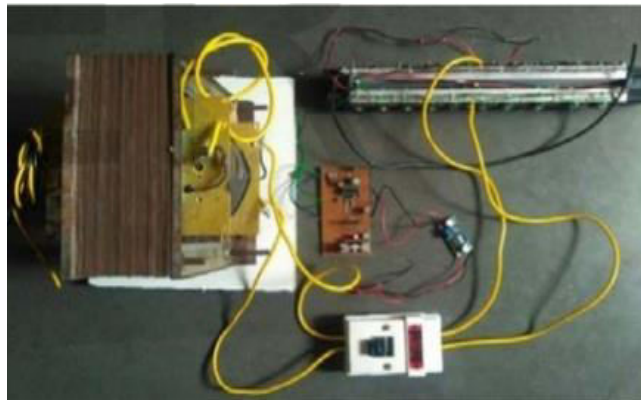


Fig : 7) solar inverter set- up

A polyester capacitor of 1 micro F ,400V is used , As it is necessary to get 240v output ,it is preferred to used set up voltage depending upon the requirement .In the present work 24v /240V central tapped set up transformer is employment of experiments.

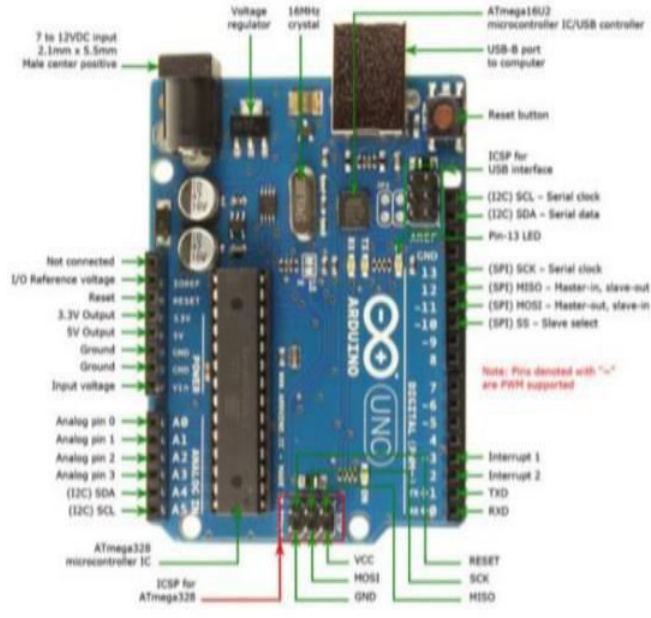


Fig :8) Arduino Uno

Arduino Uno is an open source electronic platform with a microcontroller board based on ATmega328 and integrated development environment is provided by Arduino project based on a programming language called processing. It supports low power consumption, huge documentation, large libraries and is highly portable.

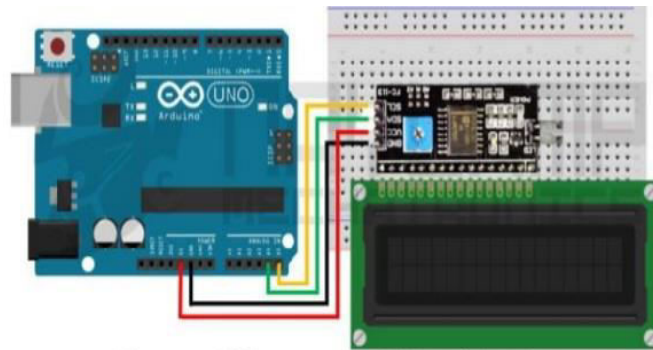


Fig 9) Arduino with LCD display

It is a serial computer hub. It is small pieces used to connect lower speed peripheral ICs to processors and microcontroller. In this project it has been used to connect LCD to Arduino.



Fig :10) AC motor for water pump

An AC motor is an electrical motor driven by associated in alternating current AC. The AC motor normally consists of two basic components, an outdoor stationary stator coil having coils furnished with AC to supply a rotating flux, and an indoor rotor connected to the output shaft manufacturing a second rotating flux. The rotor flux could also be made by permanent magnet, reluctance striking, or DC or AC electrical winding.

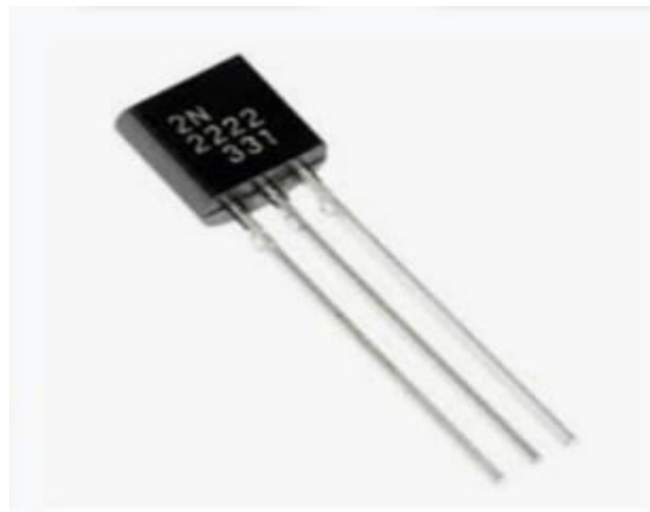


Fig :11) Transistor

The NPN may be a common NPN bipolar semiconductor devices, bipolar junction transistors (BJT) used for general purpose low power amplifying or switch application. It is designed for low to medium current, low amplifying current, low power, medium voltage and might operate at moderately high speed. It had been originally created within the TO - 18 metal.



Fig:12) Resistor

Here it is an electrical device may be a passive two terminal electrical part that impedances resistance as a circuit component. In electronics circuits, resistors unit of measurement accustomed reduce current flow,alter signal levels to divide voltage ,bias active component and terminate transmission line among completely different uses.



Fig : 13) Variable frequency driver (VFD)

Variable frequency driver are used for adjusting flow or pressure to the actual demand .they control frequency of the electrical power supplied to pumps or fans.power savings can be achieved when using a VFD pump.

Variable flow water system has employed has played an important role in field of energy saving with the VFD widely used in practical projects.how to control the VFD to work properly is an essential issue which we must first emphatically solve.the control technology of VFD is closely related to characteristics of pump and it is used to water speed is changing according to soil moisture and temperature.



Fig :14) Relay

Relay it is an electrically operated device, used in this project to control the operation Of the water pump.



Fig : 15) storage tank

Depending on climate and usage ,storage tank capacity should equal 3 to 10 days of water use.for domestic use , agriculture use in cloudy climate , 10 days may necessity while sunny climate such as new Mexico ,3 days of storage tank size is calcu by multiplying the days of storage requirements by the daily water requirement and is provide as a reference only.

Water pumping

Water pumping is one of the simplest and most appropriate uses for photovoltaic .from crop irrigation.photovoltaic powers pumping system meet a board range of water needs.most of the system have the added advantage of storing water for use when the sun is not shining eliminating the need for batteries,enhancing simplicity and reducing overall system costs.manypeople considering installing a solar water pumping system are put off by the expense.viewing the expense over a period of 10 years ,however gives a better idea of the actual cost by comparing installation cost (including labour) ,fuel cost and maintenance cost over 10years ,so you may find that solar is an economical choice .A solar powered pumping system is generally in all the same prices range as a new windmill but tends to be more reliable and require less maintenance.



IV. FUTURE SCOPE

- 1) India plans to generate 100 gigawatt (GW) of power saving using solar panels by 2022 according to the council on energy.
- 2) Environment and water and the natural resources defense council India this growth will create an estimate 330,000 jobs in the field of solar .
- 3) With the provision of initial investment it can be carried out forward.
- 4) Increased energy requirement in future can only be met with renewable resources of energy, such as that obtained from solar energy.
- 5) To reduce the consumption of fossil fuel and to eliminate global warming the innovative idea of solar panel road is inevitable.
- 6) It agriculture livestock watering /crop application ,home applications and drip irrigation system.
- 7) Domestic portable water for remote homes.
- 8) Pond water management and water transfer.
- 9) Water supply for villages in developing world .
- 10) This project is implemented with GSM for mobile communication facility.
- 11) This is also used in industry, and small to big application .because it is all time electricity is saved .
- 12) It can be used where the shortage of power electricity is a major issue.
- 13) From experimentation it can be concluded that the system is practically feasible.
- 14) Implementing a pendulum pump setup use gravitational force only. leads to large amount of energy conservation.
- 15) This system is more efficient, considering the minimum efforts required.

V. CONCLUSIONS

Solar powered water pumping system for 1HP AC motor is developed successfully. solar based AC Water pumping Inverter worked efficiently. and it is proved to be cost effective in comparison to DC pump. 1.5KV A inverter is designed and installed successfully. detailed performance of the system with varying solar radiations is monitored and tabulated. It was observed that pumping system operated effectively .when solar radiation is above 750W / . Further ,it is concluded that SPV powers AC Water pumping system is much suitable for small scale agriculture.

Solar pumping system offers an alternate means to meet electricity demand for irrigation and livestock watering .an advantage of this system is that the system needs no maintenance and uses solar energy which is a renewable form of energy. the project indicates that the solar water pumping system can be integrated to irrigation system in Bangladesh as it is feasible solution for longer periods. for 25 years of life cycle, solar PV system will cost half of the diesel engine operated system. combination of battery storage and water tank economically feasible solution to meet the irrigation challenge faced during dry season.

ACKNOWLEDGMENTS

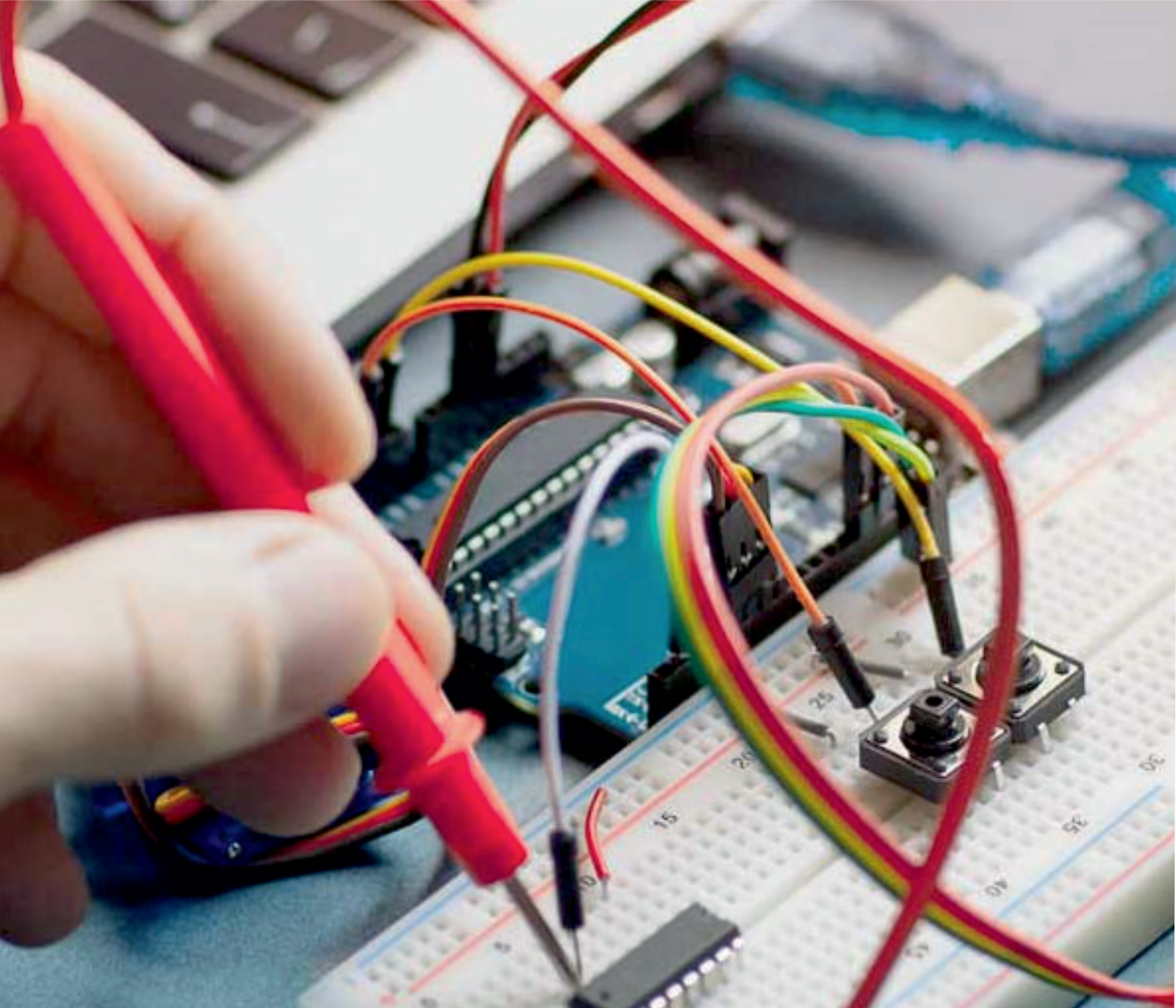
The acknowledgement of the idea for my project is to create solar panel system that would be used on farms in . The idea of project and important role is AC motor because the last few years rural areas are used DC motor with courses many problems and this problems is overcome by using AC motor and AC Water system. First and for most I would like to give thank to Nagpur university and college of a supportive working environment in which I was able to produce my project entitled "pumping water using solar energy for irrigation".

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