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Modernization of Solar Power Analyzer by Implementing IOT

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ABSTRACT: Power crisis is a major up coming issue in the society. Some of the non-renewable energy sources like thermal, nuclear energy are expensive and hazardous to the mankind. The conventional energy sources are limited and causes pollution to the environment.

To overcome these problems, eco-friendly system will be a better solution. Our project deals with monitoring and controlling the voltage output of a solar panel kept at distant location and observing the output in the server using Internet of Things (IOT). Each server page consists of a unique IP address that allows the user to access the output page.

Further controlling of solar panel outputs are enabled using relay boards and circuits.

KEYWORDS: Generation of Electricity, Photovoltaic Cell, Solar Power Analyzer, Power Using Regulators.

I. INTRODUCTION

This chapter begins with a brief introduction to the Sun. Our solar system's primary star is the Sun. It is primarily made up of hydrogen and helium. The Sun's mass is so great that it accounts for 99.68 percent of the solar system's total mass. Nuclear fusion can occur in the Sun's core because of the pressure and temperature conditions.

Solar energy is the radiant light and heat from the Sun that can be captured using a variety of ever-evolving technologies like solar heating, photovoltaic, solar thermal energy, solar architecture, molten salt power plants, and artificial photosynthesis.

II. GENERATION OF ELECTRICITY

Solar power is the conversion of sun radiation into electricity through the use of solar photovoltaic cells. This conversion takes place in the solar cell by photo voltaic effect. As said by many experts that the amount of solar energy reaching the earth ismorethan10000timesthecurrentenergyconsumptionbyman. Also, the power created by solar is sufficient for one year for the entire planet, if we could convert the100percent of the solar energy into electricity in one hour.

There are several applications that use solar power, here is the information on the generation of electricity through PV cells. The solar power generation is the most efficient route for power generation because it takes a minimum number of steps (for producing electricity) than that of other generation methods.

There are two ways of converting sunlight into electricity. In one method, solar energy is used simply as a source of heat. This heat is further used to produce the steam, which drives the steam turbine. This method of power generation is called solar thermal power generation.

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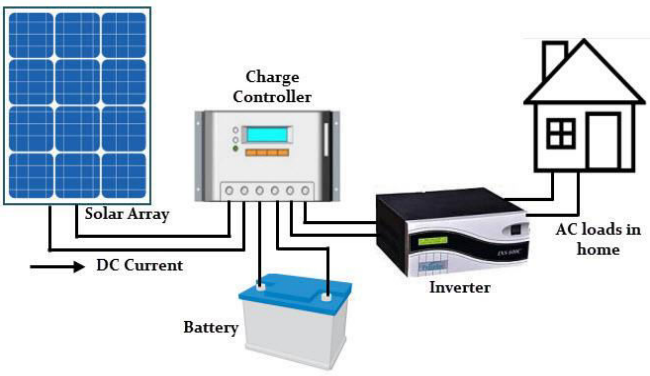
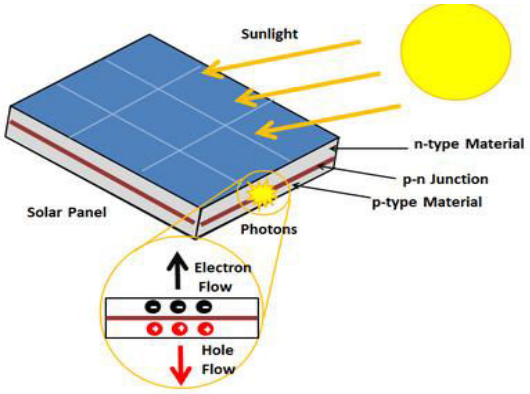


III. PHOTOVOLTAIC CELL

A solar cell, or photovoltaic cell, is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon. A photovoltaic (PV) cell is an energy harvesting device that uses the photovoltaic effect to transform solar energy into useable power. PV cells come in a variety of shapes and sizes, but they always rely on semiconductors to interact with photons from the Sun to create an electric current.



IV. CONSTRUCTION OF PHOTOVOLTAIC CELL

The solar cells are made with silicon semiconductor material and is treated with phosphorous and boron to make a thin silicon wafer.The wafer layers are the aligned together to make the solar cells, once they are doped. Irrespective of the technology and material used, every solar cell has two terminals (positive and negative terminals) so as to take the electric current from it. Typically, a solar cell consists of front contact at the top, PN junction in the middle and back contact at the bottom.In order to generate high potential difference or voltage and more electric power, these individual cells are connected together that means some cells are connected in series and some are in parallel.

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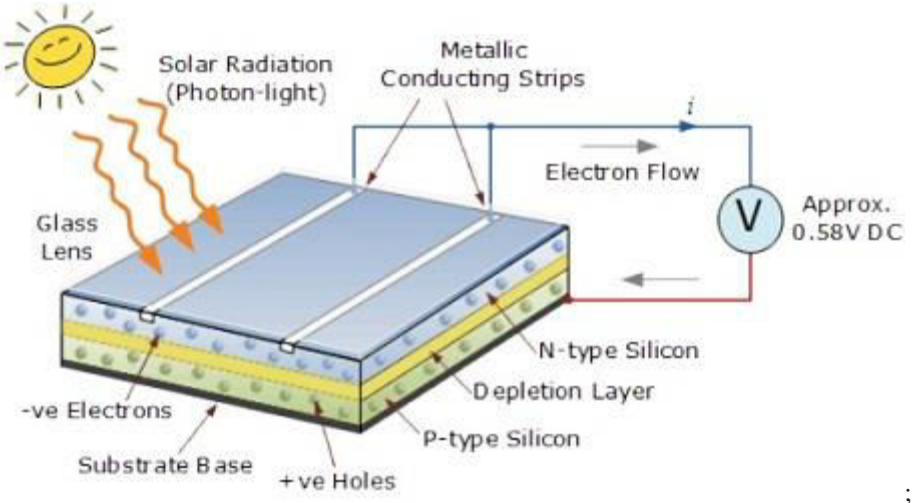

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V. SOLAR POWER ANALYZER USING IOT

Solar Analyzers are very useful for the planning and maintenance of photovoltaic parks. Solar analyzers are used to search for the best location and also to check photo voltaic modules are working correctly. Due to the fact that solar energy is nowadays one of the most important and exciting of all alternative energies, it would be worthwhile to invest in this sector for long term benefits. Photo voltaic installations use solar radiation to produce energy from solar light. Prior preparation is in dispensable before installing a photo voltaic array so that you can maximize the return on solar cells. Our solar analyzers allow the user to record direct sun light over a extended period of time. Radiation values are stored in the internal memory of the meter for further analysis. To ensure photo voltaic cells optimum efficiency were commend a regular maintenance as with any product. Solar analyzers you can record the photovoltaic cells characteristic voltage curve.

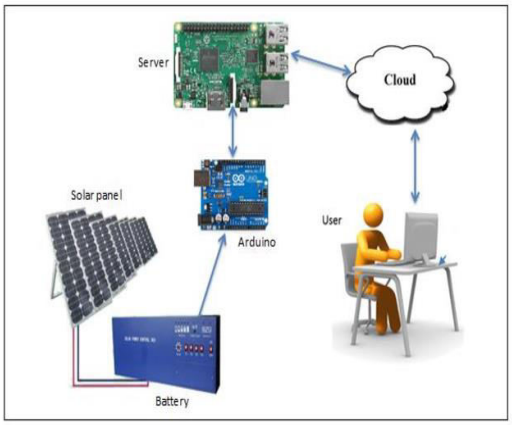

Fig 1. *System Design*

VI. BASIC PRINCIPLE OF SOLAR POWER ANALYZER

Solar Power analyzers can make a variety of measurements dependent upon the manufacturer and the model. Some solar power analyzers are intended for high power measurements and may even have special high power sensors, whereas others may be intended for measuring the standby current parameters for various items of equipment.

As solar power energy analyzers can often be used to monitor equipment over a long period of time, possible under a host of different conditions, the data communication capabilities are of great use. Also it is often possible for the solar power analyzer to be controlled remotely. This can be very useful when an item is undergoing temperature or vibration testing.

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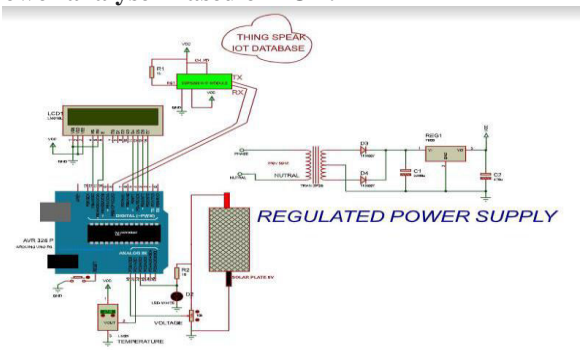
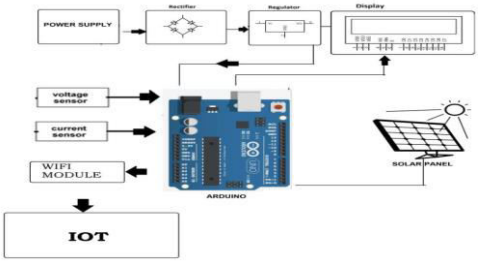
A) Circuit diagram of solar Power analyser Based on IOT:



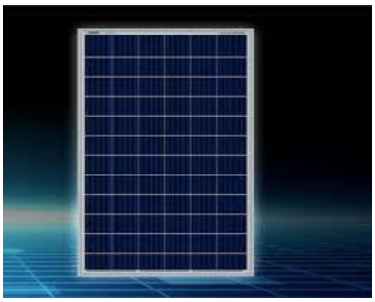
B)Block Diagram of Solar power Analyzer:



VII. COMPONENTS AND THEIR DESCRIPTION

Solar Panels:

Solar panels work by absorbing sunlight with photovoltaic cells, generating direct current (DC) energy and then converting it to usable alternating current (AC) energy with the help of inverter technology. AC energy then flows through the home's electrical panel and is distributed accordingly.



Here are the main steps for how solar panels work for your home:

1. Photovoltaic cells absorb the sun's energy and convert it to DC electricity.
2. The solar inverter converts DC electricity from your solar modules to AC electricity, which is used by most home appliances.
3. Electricity flows through your home, powering electronic devices.
4. Excess electricity produced by solar panels is fed to the electric grid.

VOLTAGE CONTROLLER:

A voltage controller, also called an AC voltage controller or AC regulator is an electronic module based on either thyristors, TRIACs, SCRs or IGBTs, which converts a fixed voltage, fixed frequency alternating current (AC) electrical input supply to obtain variable voltage in output delivered to resistive load. This varied voltage output is used for dimming street lights, varying heating temperatures in homes or industry, speed control of fans and winding machines and many other Applications, in a similar fashion to an autotransformer. Voltage controller modules come under the purview of power electronics. Because they are low-maintenance and very efficient, voltage controllers have largely replaced such modules as magnetic amplifiers and saturable reactors in industrial use.

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Types of Voltage Controller:

There are essentially two types of voltage controllers:

1.Single-phase voltage controllers which control voltage of 230 rms, 50–60 Hz power supply.

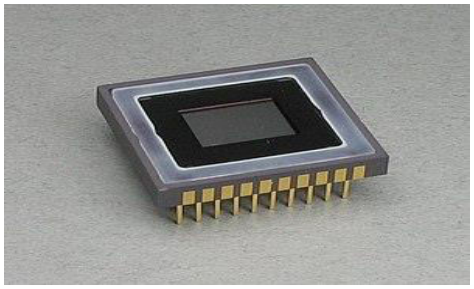
2. Three-phase voltage controllers which control 400 rms voltage, 50–60 Hz Power supply.

SENSORS:

- A sensor is a device that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument.

A sensor is a device which receives and responds to a signal and stimulus.

For example, mercury in glass thermometer converts the measured temperature into expansion and contraction of a liquid which can be read on a calibrated glass tube**.**



WIFI Module:

ESP8266 offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor.

* When ESP8266 hosts the application, and when it is the only application processor in the device, it is able to boot up directly from an external flash.

* It has integrated cache to improve the performance of the system in such applications, and to minimize the memory requirements.

VIII. SUPPLY OF POWER USING REGULATORS

Power supply:

Power Supply is a Primary requirement for the project work. The required DC power supply for the base u nit as well as for the recharging unit is derived from the mains line. For this purpose center tapped secondary of 12V-012V transformer is used. From this transformer we getting 5V power supply. In this +5V output is a regulated output and it is designed using 7805 positive voltage regulator. This is a 3 Pin voltageregulator, can deliver current up to 800 milliamps. Rectification is a process of renderingan alternating current or voltage into a unidirectional one. The component used for rectification is called Rectifier. A rectifier allows it's current to flow only during positive half cycles of the applied AC voltage. Thus, pulsating DC is obtained to obtain smooth DC power additional filter circuits required.

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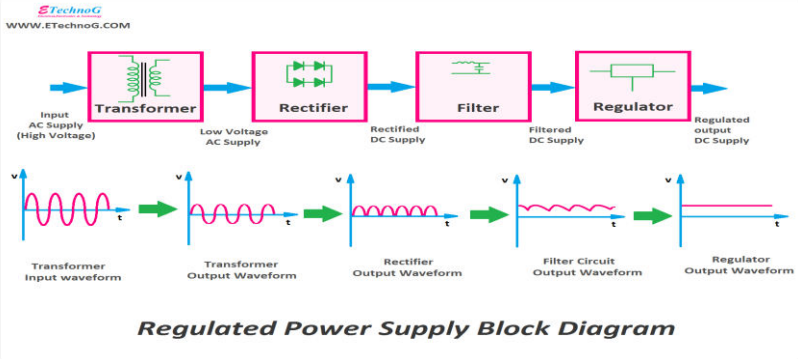
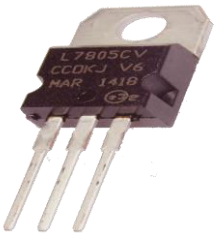


Regulated Power Supply Block Diagram

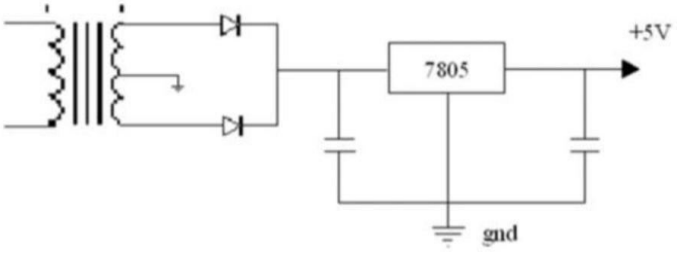
Components:
a) Capacitors
(i) 100µF/25v for +12v
(ii) 2200µF/25v
(b) Step down transformer
(i) 230v / 12v- 0 -12v/ 500mA Transformer
(c) Diodes: 1N4007

Regulators (LM7805):
A variable regulated power supply, also known as a variable bench power supply, has an output voltage that may be adjusted continually to meet your needs. After double-checking components placement against circuit schematics and the parts placement guidance, the suggested method of testing a project is to vary the output of the power supply. This form of control is excellent for a straightforward variable bench power supply. This is crucial since building a variable regulated power supply is one of the first tasks a hobbyist should tackle.



Features:
- Output Current up to 1A
- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection

Full Wave Regulator:
A diode can be used as rectifier. There are various types of diodes. However, semiconductor diodes are very popularly used as rectifiers. A semiconductor diode is a solid state device consisting of two elements is being an electron emitter or cathode, the other an electron collector or anode.Since electrons in a semiconductor diode can flow in one direction only-form emitter to collector-the diode provides the unilateral conduction necessary for rectification.



Full Wave Rectifier Circuit Diagram

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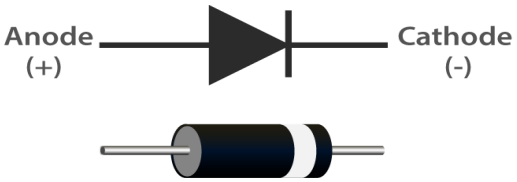
VIII. DIODES, CAPACITORS, RESISTORS, TRANSISTORS

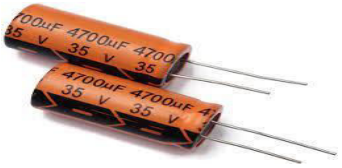
DIODES:

The contact surface is known as a P-N junction when p-type semiconductor material components are linked together. The P-N junction, commonly known as a semi-conductor diode, is a very important device.



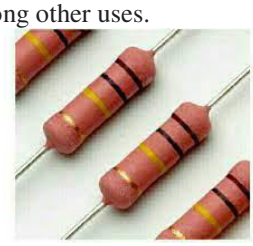
CAPACITORS:

A capacitor is a passive two-terminal electrical components that stores electrical energy in an electrical field. The effect of a capacitor is known as capacitance.



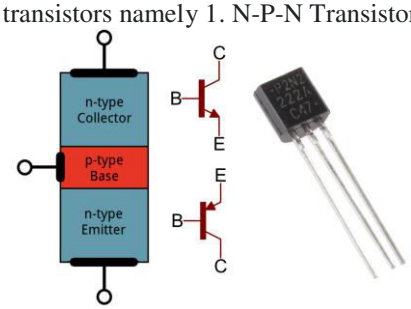
RESISTORS:

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate, transmission lines among other uses.



TRANSISTORS:

A transistor consists of P-N junctions formed by sandwiching either P- type or N –type. Semiconductor between a pair of opposite type. There are two types of transistors namely 1. N-P-N Transistor 2. P-N-P Transistor.



IX. FUTURE SCOPE

Solar is the fastest-growing renewable energy source in the world, increasing in worldwide capacity by an average of 40percenteveryyear. Many companies are expanding to offer solar, which is among the most energy-efficient and lucrative sources of renewable electricity on the market.

X. CONCLUSION

In this paper, IoT based system is designed to get an optimum power output from the solar panels during dust is accumulated on it. And, a monitoring system is designed for there is any malfunctioning of the solar panels will be

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displayed on and we can also get information about whether the solar or battery connected for the loads. It now displays these parameters. A solar panel is used that keeps monitoring the sunlight. Here different parameters like voltage, current and temperature are displayed on the LCD by using IOT technology. Now we are getting only information we can see it in cloud but in future we can control whole system through IoT which Distant is a way.

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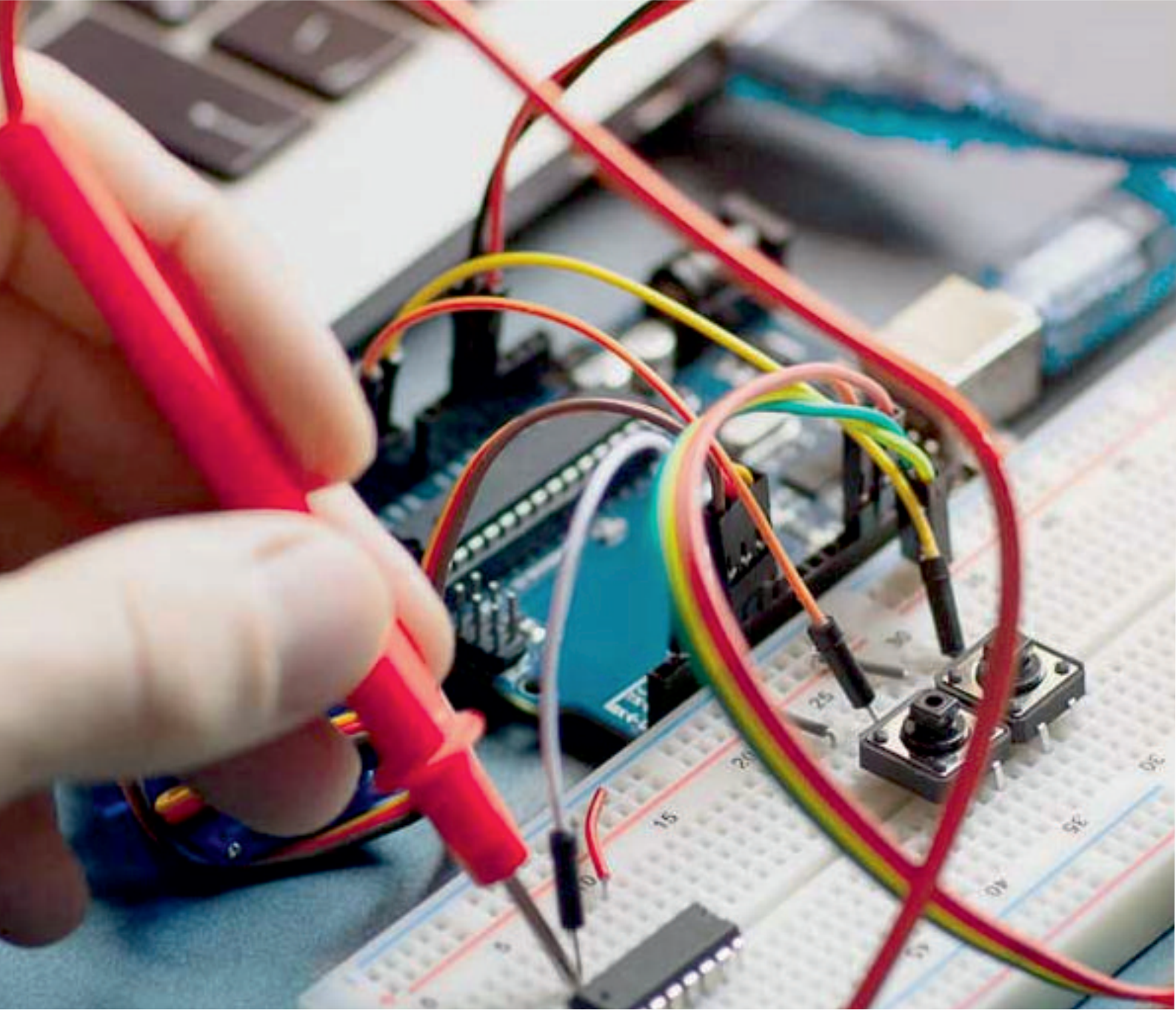

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