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Energy Management System for AC and DC Grid

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ABSTRACT: This project focused on design cost-effective hybrid power generation system with renewable source such as solar combined AC Source based storage system. The proposed system uses solar for producing power which will meet out the demand. Hybrid power generation system using the solar and Peltier plate.

So, when there is no sun then we can be got generate energy using the Peltier plate. The solar and Peltier energy obtained is stored to a battery. The battery is connected to the inverter through converter with load. Hybrid power generation is achieved by PSO algorithm. The PSO algorithm is used to optimization search algorithm due to its advantages over the other techniques for reducing the levelized cost of energy. The Simulation is carried out by MATLAB/ Simulink software. The major application of the stand-alone power system is in remote areas where utility lines are uneconomical to install due to terrain, the right-of-way difficulties or the environmental concerns. The wind power output can fluctuate on an hourly or daily basis.

The stand-alone system must, therefore, have some means of storing energy, which can be used later to supply the load during the periods of low or no power output. Alternatively, the wind can also be used in a hybrid configuration with fuel cell in urban areas. In this project a novel intelligent method is applied to the problem of sizing in a hybrid power system such that demand of residential area is provided. The system consists of fuel cells, some wind units, an electrolier, a reformer, a compressor, an anaerobic reactor and a hydrogen tank. The system is assumed to be stand-alone and uses the municipal.

KEYWORDS: Hybrid power generation, Peltier plate, Inverter, Converter, PSO algorithm, Fuel cells, Electrolier, Are former, Compressor, Anaerobic reactor, hydrogen tank.

I. INTRODUCTION

This project focused on design cost-effective hybrid power generation system with renewable source such as solar combined AC Source based storage system. The proposed system uses solar for producing power which will meet out the demand. Hybrid power generation system using the solar and Peltier plate. So, when there is no sun then we can be getting generate energy using the Peltier plate. The solar and Peltier energy obtained is stored to a battery. The battery is connected to the inverter through converter with load. Hybrid power generation is achieved by PSO algorithm. The PSO algorithm is used to optimization search algorithm due to its advantages over the other techniques for reducing the levelized cost of energy.

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II. RELATED WORK

INTRODUCTION OF SOLAR SYSTEM

There are few other sources for charging the battery. The charging of inverter battery is mostly done by taking power supply from the mains. Where the alternating current from the supply is rectified and given to the battery for charging. Also, solar panel are used for charging the same inverter battery, in this the light energy is converted to electrical energy and stored in battery.

INVERTER BATTERY CHARGER

A power inverter, or inverter, is an electronic device or circuitry that changes current (DC) to alternating current (AC). The input voltage, output voltage and frequency, and overall power handling depend on the design of the specific device or circuitry. The inverter does not produce any power; the power is provided by the DC source. A power inverter can be entirely electronic or may be a combination of mechanical effects (such as a rotary apparatus) and electronic circuitry. Static inverters do not use moving parts in the conversion process.

SOLAR MODULE

The solar energy is one of the most important renewable energy due to its easy availability, cleanness and cheap energy resources. Now days, a number of solar energy approaches are in progress and solar cells have paid more attention due to rapidly developing technology and potential applications to cater the energy demands of the developing world and the society. The solar cell is a device which directly converts electrical energy from the solar radiation which is based on the photovoltaic effect. Mono-crystalline silicon (mc-Si) solar cell is a part of silicon solar cell family and it has a number of advantages like low maintenance cost, high reliability, noiseless and eco-friendly. The overall performance of solar cell strongly depends on the environmental parameters such as light intensity or irradiance, tracking angle and cell temperature. Some Advantages are, low maintenance cost, reliability, commonly available, solar energy is free of pollution, no fuel cost, easy to replace.

The Solar cells which as the name implies of (photo meaning "light" and voltaic meaning "electricity"), it directly converts sunlight into electricity. A module is nothing but a group of cells which are connected both electrically and packaged into a frame (commonly known as a solar panel), and then can be grouped into a larger solar array. Photovoltaic cell converts Photons to Electrons. These Photovoltaic cells are made with special materials called as semiconductors such as silicon, which is currently used. Basically, when the sun light strikes any cell a small certain portion of it is absorbed within the semiconductor material. This means that the energy which is absorbed from the light is transferred to the semiconductor. This energy knocks all the electrons to lose allowing them to flow freely.

SOLAR INVERTER

A solar inverter, or converter or PV inverter, converts the variable **direct current** (DC) output of a **photovoltaic** (PV) **solar panel** in to a **utility frequency** alternating current (AC) that can be fed into a commercial electrical **grid** or used by a local, **off-grid** electrical network. It is a critical **balance of system** (BOS)–component in a **photovoltaic system**, allowing the use of ordinary AC-powered equipment. **Solar power inverters** have special functions adapted for use with photovoltaic arrays, including **maximum power point tracking** and **anti-islanding** protection.

III. PROPOSED ALGORITHM

INTRODUCTION OF PELTIER MODULE

By highlighting the disadvantages of the usual existing system, a new module working on See beck effect is introduced. The Peltier is made of series of p and n type metals. As See beck effect states, the temperature difference given to the Peltier module will cause the electrons to flow. This flow of electron will intern produces electricity.



ADVANTAGES

1. The big advantage of this system is eco-friendly.
2. It is cost efficient and compact module.
3. It can be installed anywhere in the home.
4. The source of the Peltier is a renewable energy.

TESTING PROCESS

The testing of Peltier module has been done with various hot and cold surface.

- | | |
|--------|--|
| Test 1 | : Hot surface-candle heat
Cold surface-ice cubes |
| Test 2 | : Hot surface-heat absorbed by the Kadapa stone
Cold surface-ice cubes |
| Test 3 | : The module was attached with simple kid made of glass
Hot surface-hot water
Cold water-ice cubes |
| Test 4 | : The module was then attached with another kit made of thermocol.
Hot surface-converged sun rays
Cold surface-Ammonium chloride with ice bars |

Thus, testing processes concluded that, the Peltier must get a constant source for generating electricity.

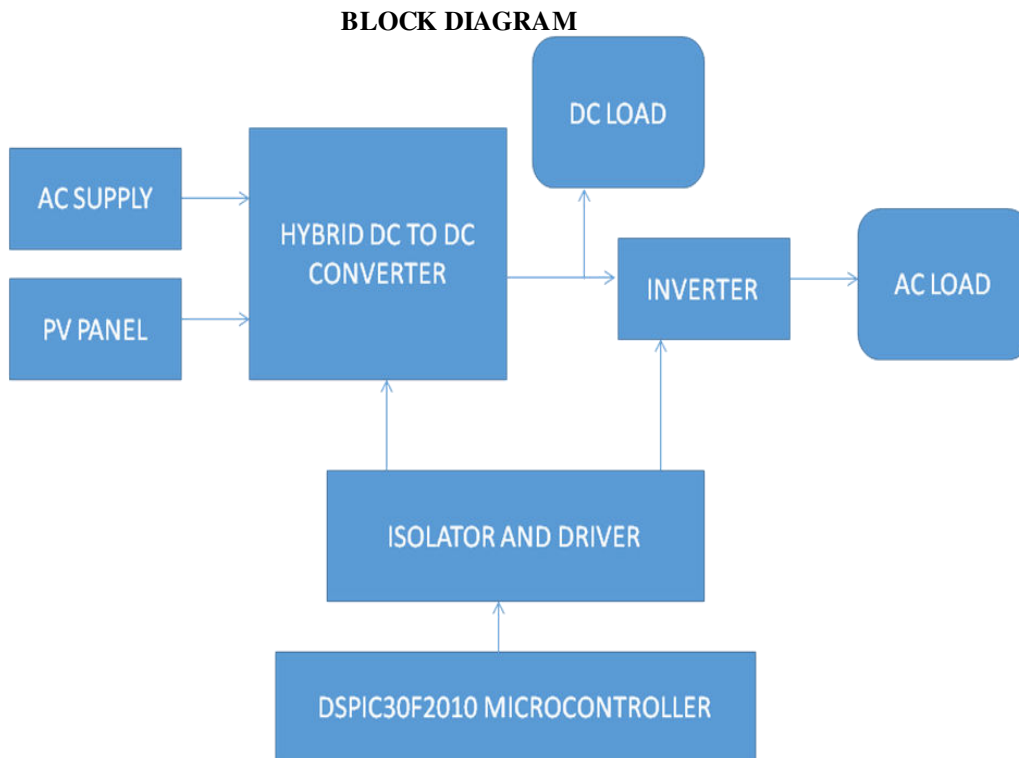


Fig.1 Block diagram of power generation system using Peltier module

BLOCK DIAGRAM DESCRIPTION

The rays from the sun are converged by convex lens over the Peltier sensor. The cooling system provides the temperature difference in the Peltier. By see beck effect the voltage is generated and it is buck or boosted by buck boost converter. The battery stores this voltage. Though the inverter the appliances take the supply voltage.

WORKING

Place the solar panel at any place where daylight is available. This solar panel contains photocells. In daytime these photocells convert the energy of 3Tlight3T directly into 3Telectricity3T by the 3Tphotovoltaic effect3T. The solar cell



works as, 3TPhotons 3T in 3Tsunlight 3T hit the solar panel and are absorbed by semi conducting materials, such as silicon. 3TElectrons3T (negatively charged) are knocked loose from their atoms, causing an electric potential difference. Current starts flowing through the material to cancel the potential and this electricity is captured. Due to the special composition of solar cells, the electrons are only allowed to move in a single direction. An array of solar cells converts. Solar energy into a usable amount of 3T direct current 3T (DC) electricity. The Peltier plate converts heat energy into electrical energy using See beck effect. When provide heat to the Peltier plate at one side of the plate gets hot and at other side of the plate gets cold means that the temperature of each end is different is called the See beck effect. The output of the both solar and Peltier plate is connected to the battery through the charging circuit.

The charging circuit functions as a voltage regulator, i.e., the process of converting variable voltage to constant regulated voltage. The main function of a controller is to prevent the battery from being overcharged by the hybrid system. When a battery is fully charged, the controller will either stop or slow down the amount of current flowing into the battery from the generating systems. Battery can be used for storage purpose. Hence this hybrid system will work at day time as well as at night time.

The output of the battery is DC, that can be directly connects to any DC load. Move the slide switch that is present on the charging circuit board to run the DC motor. The output of the battery is DC only, for required AC powers have to convert from DC to AC form. The inverter is used for converting DC to AC and the battery is connected to an inverter board to convert generated DC into AC voltage. The pulse generator generates pulses and it's given to the MOSFET. Which are be done in voltage source inverter circuit. This inverter board takes DC input from battery and converts it to. A LED which is placed at the top right-hand corner of the inverter board will glow to indicate that the power supply is working properly. A step-up transformer is installed to receive low voltage from two MOSFET's and the transformer will step up the voltage the transformer high voltage i.e., secondary side is connected to the AC appliances i.e., AC motor.

IV. SIMULATION RESULTS

SOFTWARE DESCRIPTION

If you are new to MATLAB, you should start by reading Manipulating Matrices. The most important things to learn are how to enter matrices, how to use the: (colon) operator, and how to invoke functions. After you master the basics, you should read the rest of the sections below and run the demos.

At the heart of MATLAB is a new language you must learn before you can fully exploit its power. You can learn the basics of MATLAB quickly, and mastery comes shortly after. You will be rewarded with high productivity, high-creativity computing power that will change the way you work.

Introduction - describes the components of the MATLAB system.

Development Environment - introduces the MATLAB development environment, including information about tools and the MATLAB desktop.

Manipulating Matrices - introduces how to use MATLAB to generate matrices and perform mathematical operations on matrices.

Graphics - introduces MATLAB graphic capabilities, including information about plotting data, annotating graphs, and working with images.

Programming with MATLAB - describes how to use the MATLAB language to create scripts and functions, and manipulate data structures, such as cell arrays and multidimensional arrays.

INTRODUCTION

What Is MATLAB?

MATLAB® is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include:

- Math and computation.
- Algorithm development.
- Modelling, simulation, and prototyping.
- Data analysis, exploration, and visualization.



- Scientific and engineering graphics.
- Application development, including graphical user interface building.

MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. This allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar non interactive language such as C or FORTRAN.

The name MATLAB stands for matrix laboratory. MATLAB was originally written to provide easy access to matrix software developed by the LINPACK and EISPACK projects. Today, MATLAB uses software developed by the LAPACK and ARPACK projects, which together represent the state-of-the-art in software for matrix computation.

MATLAB has evolved over a period of years with input from many users. In university environments, it is the standard instructional tool for introductory and advanced courses in mathematics, engineering, and science. In industry, MATLAB is the tool of choice for high-productivity research, development, and analysis.

MATLAB features a family of application-specific solutions called toolboxes. Very important to most users of MATLAB, toolboxes allow you to learn and apply specialized technology. Toolboxes are comprehensive collections of MATLAB functions (M-files) that extend the MATLAB environment to solve particular classes of problems. Areas in which toolboxes are available include signal processing, control systems, neural networks, fuzzy logic, wavelets, simulation, and many others.

The MATLAB System

The MATLAB system consists of five main parts:

Development Environment. This is the set of tools and facilities that help you use MATLAB functions and files. Many of these tools are graphical user interfaces. It includes the MATLAB desktop and Command Window, a command history, and browsers for viewing help, the workspace, files, and the search path.

The MATLAB Mathematical Function Library. This is a vast collection of computational algorithms ranging from elementary functions like sum, sine, cosine, and complex arithmetic, to more sophisticated functions like matrix inverse, matrix Eigen values, Bessel functions, and fast Fourier transforms.

The MATLAB Language. This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented programming features. It allows both "programming in the small" to rapidly create quick and dirty throw-away programs, and "programming in the large" to create complete large and complex application programs.

Handle Graphics®. This is the MATLAB graphics system. It includes high-level commands for two-dimensional and three-dimensional data visualization, image processing, animation, and presentation graphics. It also includes low-level commands that allow you to fully customize the appearance of graphics as well as to build complete graphical user interfaces on your MATLAB applications.

The MATLAB Application Program Interface (API). This is a library that allows you to write C and FORTRAN programs that interact with MATLAB. It includes facilities for calling routines from MATLAB (dynamic linking), calling MATLAB as a computational engine, and for reading and writing MAT-files.



Fig.2 Hardware Model

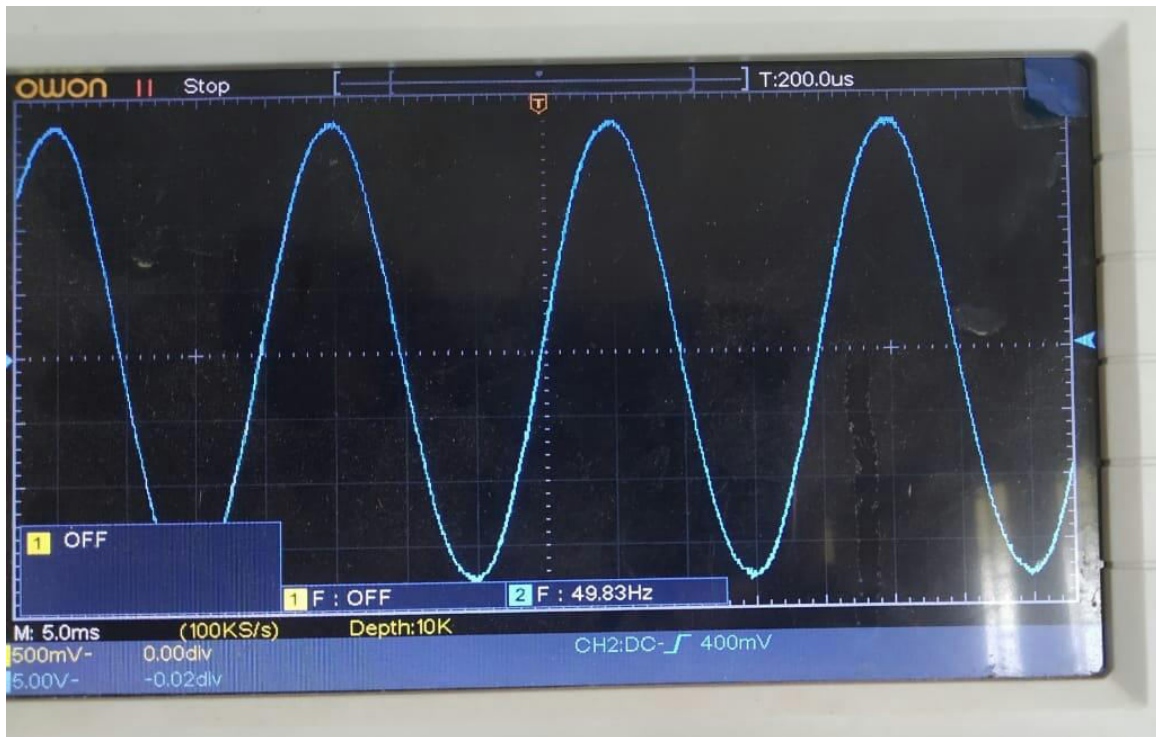


Fig.3 Hardware Output

SOFTWARE DESCRIPTION:

MATLAB® is a high-level technical computing language and interactive environment for algorithm development, data visualization, data analysis, and numerical computation. Using MATLAB, you can solve technical computing problems faster than with traditional programming languages, such as C, C++, and Fortran.

MATLAB is a data analysis and visualization tool which has been designed with powerful support for matrices and matrix operations. As well as this, MATLAB has excellent graphics capabilities, and its own powerful programming language. One of the reasons that MATLAB has become such an important tool is through the use of sets of Matlab programs designed to support a particular task. These sets of programs are called toolboxes, and the particular toolbox



of interest to us is the image processing toolbox. Rather than give a description of all of MATLAB's capabilities, we shall restrict ourselves to just those aspects concerned with handling of images. We shall introduce functions, commands and techniques as required. A MATLAB function is a keyword which accepts various parameters, and produces some sort of output: for example, a matrix, a string, a graph. Examples of such functions are `sin`, `imread`, `imclose`. There are many functions in MATLAB, and as we shall see, it is very easy (and sometimes necessary) to write our own.

MATLAB's standard data type is the matrix all data are considered to be matrices of some sort. Images, of course, are matrices whose elements are the grey values (or possibly the RGB values) of its pixels. Single values are considered by MATLAB to be matrices, while a string is merely a matrix of characters; being the string's length. In this chapter we will look at the more generic MATLAB commands, and discuss images in further chapters.

When you start up MATLAB, you have a blank window called the Command Window_ in which you enter commands. Given the vast number of MATLAB's functions, and the different parameters they can take, a command line style interface is in fact much more efficient than a complex sequence of pull-down menus.

You can use MATLAB in a wide range of applications, including signal and image processing, communications, control design, test and measurement financial modelling and analysis. Add-on toolboxes (collections of special-purpose MATLAB functions) extend the MATLAB environment to solve particular classes of problems in these application areas.

MATLAB provides a number of features for documenting and sharing your work. You can integrate your MATLAB code with other languages and applications, and distribute your MATLAB algorithms and applications.

When working with images in MATLAB, there are many things to keep in mind such as loading an image, using the right format, saving the data as different data types, how to display an image, conversion between different image formats.

Image Processing Toolbox provides a comprehensive set of reference-standard algorithms and graphical tools for image processing, analysis, visualization, and algorithm development. You can perform image enhancement, image deblurring, feature detection, noise reduction, image segmentation, spatial transformations, and image registration. Many functions in the toolbox are multithreaded to take advantage of multi core and multiprocessor computers.

V. CONCLUSION

Since the global warming has been increased, the installation of the Peltier module will be very effective. In comparison with solar panel the Peltier module is eco-friendly and it is affordable by all people. Thus, the temperature difference given to Peltier module is converted into electricity. The voltage generated can drive the load connected. The same concept can be applied for portable mobile charger by using any other heat source. This setup can be kept at the heat exchangers at power plant and even in hotels. A model to generate electric energy from solar energy and heat energy has been successfully implemented. A SIMULATION is developed that the power is generated from two different sources (solar and heat energy) are combined and utilised to run the AC LOAD. The outputs of software are found quite satisfactory. The generated electrical energy is in the form of DC voltage. The DC voltage obtained from solar and from the Peltier module are combined and used to run DC motor. The DC voltage of 12volts converted into AC voltage to run AC motor. This type of model can be used where only solar energy is not sufficient to meet the requirements there a energy is boosted by using hybrid power generation with the help of Peltier.

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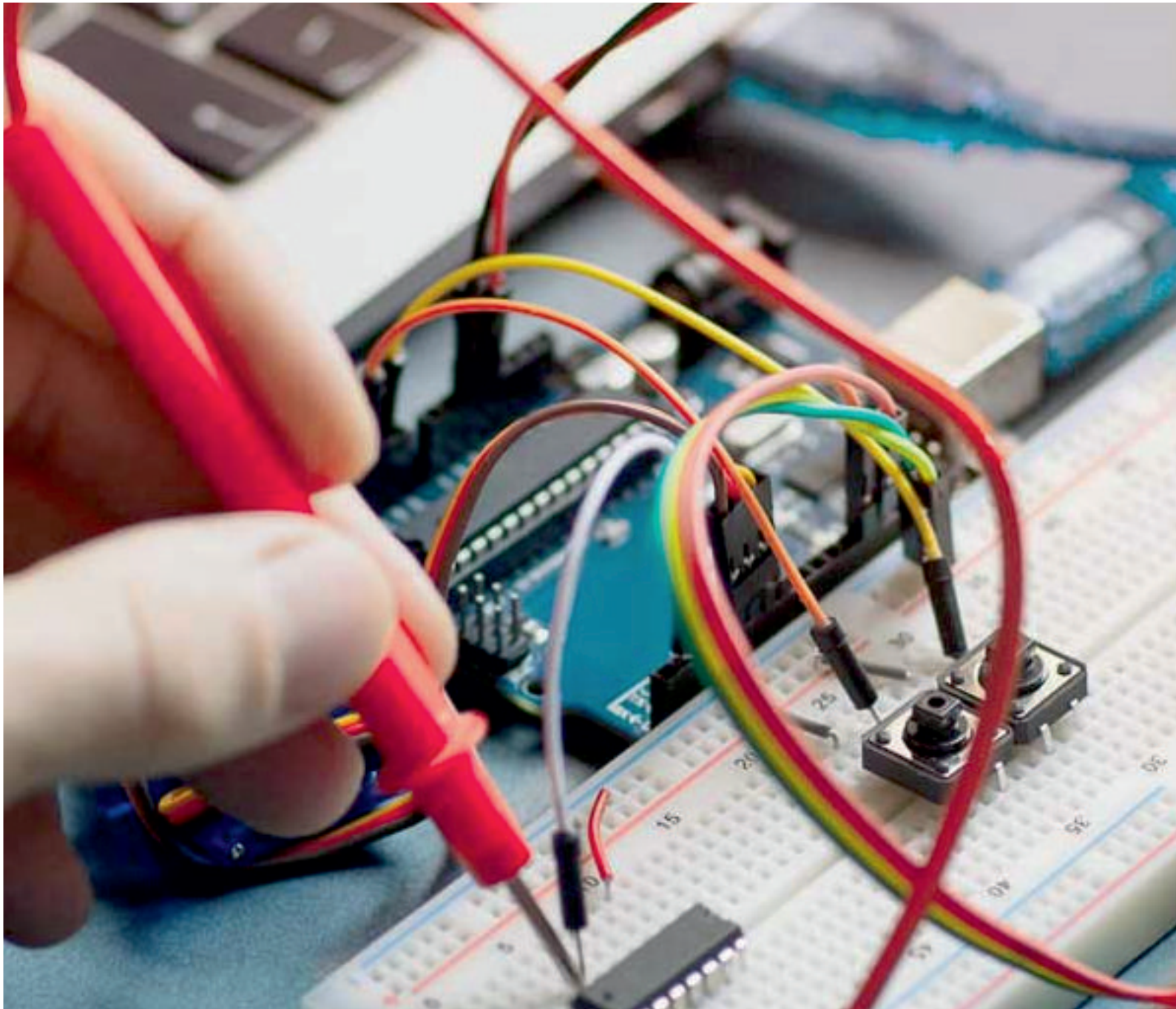
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BIOGRAPHY

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