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Design of Light Contemporaneous Astute Drifter with Cosmic Collector

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ABSTRACT : The Solar energy is widely available and very important renewable energy resource on earth. It is possible to drive electronic systems with solar power as the solar panel can maintain a perpendicular angle of direction to the rays of the sun. This paper discusses the design of Light Contemporaneous Astute Drifter with Cosmic Collector. In this paper LDRs are used for sunlight (Cosmic Power) detection and Astute Drifter is a smart rover can move and track the light by comparing the output from LDRs. The main circuit is based on an ATMEGA microcontroller and it was programmed to detect cosmic power(sunlight) via the LDRs and it will track the sun on day time for charging the rechargeable battery through a solar panel (Cosmic Collector). The rover (Astute Drifter) can move accordingly in the direction of the sun. When charging of the battery is done then it will give indication to the user through web. It also gives a day-to- day information about battery percentage in web application. Once the task has completed the rover can move to its starting position where it was started earlier for the purpose of charging.

KEYWORDS: Cosmic Collector, Tracking, Astute Drifter, LDRs, Web application.

I. INTRODUCTION

Solar Energy is widely available on the earth. The energy source can be utilized in many ways. So many electrical and electronic machineries can work based on this energy. The applications include Home appliances to Mega industries. The concept can be used in space experiments also. In space technology the Satellites are currently using solar energy for their working. They can carry batteries and they will work on it during eclipse period only. The satellite which is not under eclipse will utilize Solar power. So in this connection some space experiments will be conducted on other planets like Mars. Some rovers are also working on it for examining atmosphere and surface materials. For their full functionality they must require power source. They can use batteries but batteries also having lifetime and they will discharge after sometime. So by utilizing solar power it is possible to achieve full functionality without any degradation of the rover functionality. It is difficult to run the rover only with batteries. Design of heavy batteries can affect on weight of the rover and become expensive. The problem can be solved by proper utilization of solar power. It is possible to charge the batteries in the rover with solar power. The rover can identify sun light and its intensity so that rover can move and it can charge its battery through solar power.

II. IMPLEMENTATION OF THE SYSTEM

A. Light Dependent Resistor

LDRs can be used to build solar tracker which includes phototransistors, photodiodes. LDR is a sensor its connections and interfacing are simple and fast which is the most commonly available element in electronics. Based on light the internal resistance of the module will be changed. According to that it will generate some voltage proportion to light intensity on its surface. Its structure is explained below. The photoconductive cell is a light sensitive resistor and it can be available in two materials namely cadmium sulfide and gallium arsenide. In this system two cadmium sulfide photo conductive cells are used for detection of light. Its resistance is also inversely comparative to the light intensity aimed to its surface. A series capacitor is also used in this circuit. The photo conductive cell to be used for the proposed system is based on its R value. So its functionality is based on change of its resistance according to the light falling on it. As explained above the resistance value is inversely proportional to light falling on it. Usually the resistance of an LDR is extremely high but when they are illuminated by the light source then their resistance will drops obviously so that more current will flow through the terminals of the sensor. So as the light increases then current flow increases by decreasing its resistance value or when the light is less then current in the sensor also less by increasing its resistance

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value. In this paper the system uses four light dependent sensors in four corners of the drifter.

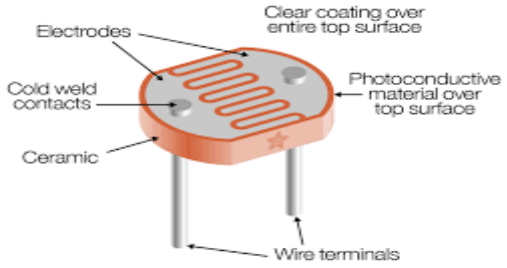

Fig 1: LDR construction

B. The concept of using four LDRs

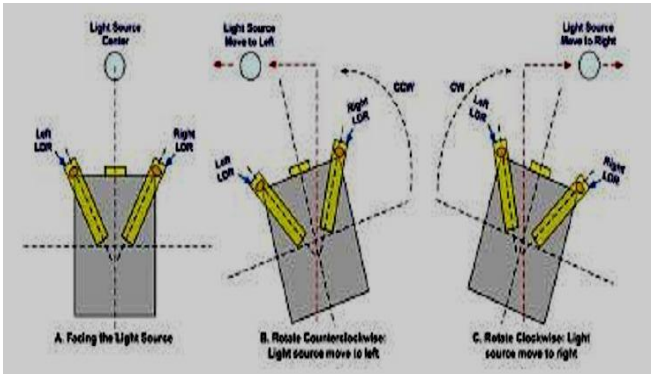

Fig 2: Use of Four LDRs

The usage of four LDRs is, when all LDRs are in steady state then four LDRs having the same light concentration. So there is no voltage difference between them. If the light moves, i.e. if sun moves then its light intensity on the four LDRs also varies and this variation is converted to voltage by using its dividers. The voltage can be monitored and compared by internal comparator of the controller unit and hence the motor can move the cosmic collector in the direction of the way of cosmic light source. There was use of a matching resistor with a value of 10k.

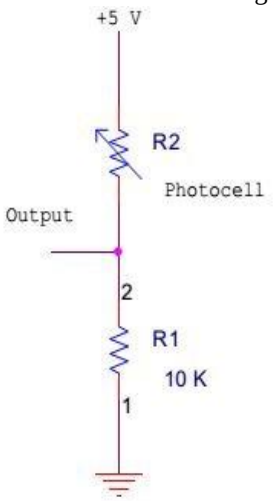

Fig 3: Voltage divider circuit.

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Table 1: Resistance value with light intensity

Measured R value	Comment
50 KΩ	Dark light conditions
4.35 KΩ	Average light conditions
200 Ω	Bright light conditions

III. HARDWARE DESIGN

A. Product features

Ultrasonic sensor works up to from 2cm to 400cm. The accuracy can reached up to 3mm. The sensor includes transmitter, receiver in its circuit. The essential standard of functioning is using I/O prompt for 10us high level signal, then the component will send 40 kHz signal and receives pulse signal back if any. If the signal is reflected back then the sensor recipient can receive it and trial duration/Distance by using the subsequent method.

Fig 4: Ultrasonic Sensor

distance = (high level time x velocity of sound (340M/S)) /2

Table 2: Electric parameters of the Sensor

Operational Voltage	DC 5 V
Operational Current	15mA
Functioning Frequency	40Hz
Max Range	4m
short Range	2cm
Angle	15 degree

B. Timing Determination

A supply of 10uS pulse will be applied to trigger the input. This will works as to start the ranging. The device will transmits an 8 cycle burst of ultrasound waves at 40 kHz frequency by raising its echo. The Echo is nothing but a distance of object and the range will be in proportion. It is possible to calculate the range/distance through the time interval between Tx and Rx echo signal. The most widely used formula for this case is as follows

distance(range) = time * velocity

Hence by dividing the above value with the value 2 then it is possible to find the distance between the sensor module and the object.

C. Software Implementation

The software program for the NodeMCU can be developed with Arduino IDE. It is possible to implement different applications for NodeMCU by using the same integrated development environment. So the developers no need to learn

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new programming languages to implement their application software. This facility makes dev elopers trouble free and it saves lot of developing time. Hence time to prototype attribute of the embedded system development cycle is also solidified. There is no need to learn separate assembly or high level languages like c, c++, Java, Oracle etc. By using simple Arduino instructions it is possible to build suitable software for any application by using its IDE. According to its implementation the developing system contains Arduino software of any version and the target board should connect to any USB port of the developing computer. Hence simply by implementing the code in the editor it possible to check error by clicking verify tab. There by clicking upload option the code will simply dumped into the Node MCU embedded development board. The IDE itself contains software utility programs like editor, debugger, compiler, interpreter, object file converter, absolute object file and hex file converters. Hence the developers can easily integrate both hardware and software without any difficulties. No separate programmers required, no separate dumping kits required and hence implementation is easy and simple by saving more developing time.

D. Motor Driver

The drivers of the motor contain current amplifiers. These drivers act as intermediate stage between motors and microcontroller unit. These drivers can be available in the form of ICs as shown below. The main purpose of the driver is to enhance the input voltage of motors in sufficient way to drive it. The motor can be of any type which is may be a brushless, brushed, stepper or any other DC motors of any kind or any application.

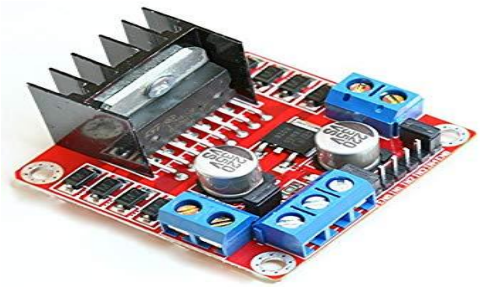

Fig 5: Motor driver module

L293D is a dual H bridge motor driver IC. This is a 16pin motor driver IC and it can drive the motors in both directions depending on the connections are made according to the application. The pin configuration of the driver IC is discussed as follows. 1 and 9 are connected to En Pins. 2, 7, 10, 15 pins are connected input pins. 3,6,11,14 pins are connected to output. 4, 5, 12, 13 pins acts as Gnd pins. 8 and 16 pins are power supply pins. The functioning of the driver enables when En pins must be connected to +5v for the motor driver. If these pins are connected to GND then the motors will not move further. En pins 1, 2 drives the H bridge circuit at left side while the En pins 3, 4 drives the H Bridge at right side by imagining motor fixed at the left to pin 3,6..

IV. ALGORITHM FOR MOTOR DRIVER

1. Take the readings of each LDR Sensor
2. Calculate the average of each LDR by 35
3. Convert output into digital
4. Compare the values of 4 LDRs
5. Depending on the value of sensor drive the motor
   using motor driver where the intensity is high
6. If all LDR values area same then stop the rover and let the battery gets charged.

A. How Rotary Encoder Works

The encoder has a disk with regularly spaced get in touch with zones that are associated to the frequent pin C and two additional disconnect contact pins A and B, as illustrated underneath. At what time the disk will initiate revolving step by step, the pins A and B will initiate making contact with the frequent pin and the two quadrangle wave production signals will be generated consequently. Any of the two outputs can be used for decisive the rotated location if we just add up the pulses of the signal. On the other hand, if we wish for determine the turning round way as well, we need to think about both signals at the same occasion.

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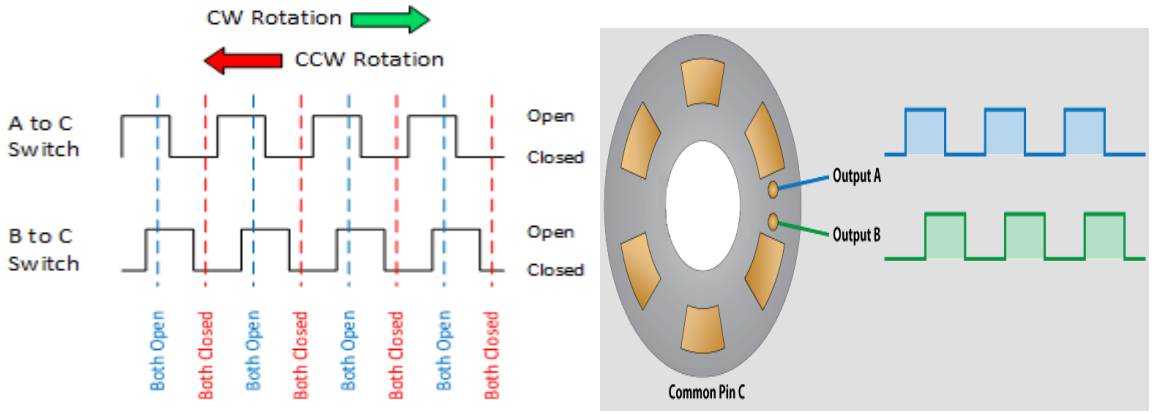

Fig 6: Rotary Encoder Timing Waveform

So if we add up the stepladder each occasion the signal changes, from High to Low or from Low to High, we can become aware of, at that time the two output signals have opposite standards. Vice versa, if the encoder is revolving offset clockwise, the output signals have identical standards.

B. Algorithm to find Shortest Path

1. Note the rotary encoder value when the rover takes a rotation and note the orientation of the bot.
2. When battery percentage reaches 100% the NodeMCU sends trigger to the server to calculate the shortest distance depending on the orientation and rotary encoder value stored in data base.

Assume the rover moved A mtrs in north direction, B Mtrs in east direction, C Mtrs in west direction, D Mtrs in south direction then the coordinates of initial position will be (A-D,B-C). If A-D is negative then the drifter will move towards North. If A-D is positive then it will move to South. If B-C is negative then it will goes to West else towards East directions. The orientation of the rover can be predicted by direction taken by bot.

C. Block Diagram indicates battery charging process

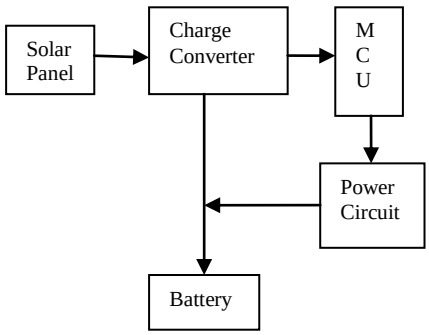

Fig 7: Block Diagram of the charging system.

The solar energy can be stored into battery using charge converter Power circuit is connected between battery and MCU in order to identify battery percentage The power circuit consists of three 10 K ohm resistor as shown in figure The 12V lead oxide battery can be maximum charged up to 14.08V . The power circuit works on voltage divide rule. By this we can calculate the battery percentage buy using the formula (present charge in the battery/5.0)*100. The entire operation of the system is explained in the following section. The entire operation of the system is explained in the following section. When the power is on then system starts its function with light tracking based on sensors used. If the light intensity is the value 30 equivalent in the sensor then he system will start comparing all four values from all four sensors. Hence in this connection the drifter can move where the value exceeds pre determined value. The next task of the drifter is to charge the battery upto full. In this process it is possible to monitor the battery percentage of charging through web page. So the entire battery charging is completed once successfully then the drifter will move to its starting position where it is started earlier. The entire functionality is described in the below diagram.

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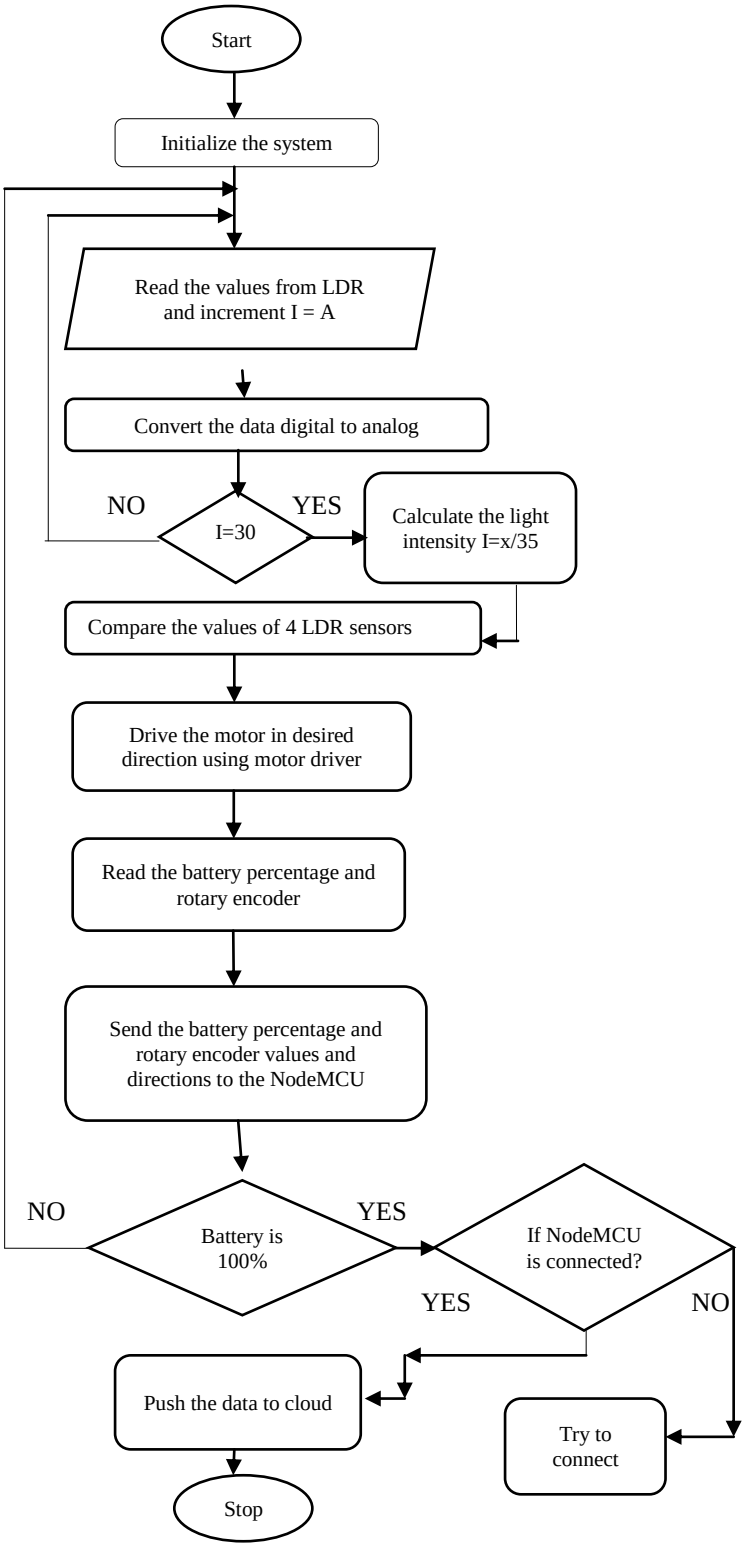

Fig 8: FLOWCHART

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V. RESULT

A. Hardware

Fig 9: Project kit

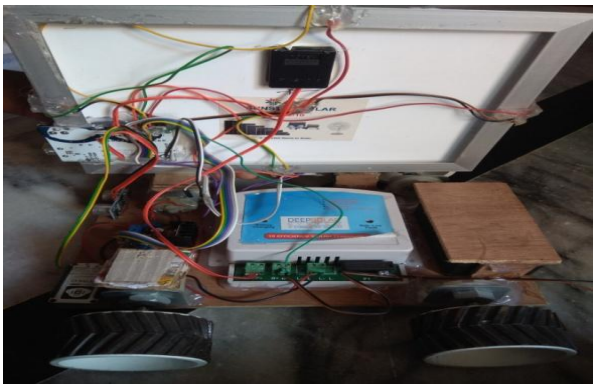

Fig 10: Internal Circuit

B. Front end Software approach

In this project the results can be examined by using web page. The web page contains different options like battery percentage, number of batteries charged, average time to charge, distance traveled to charge the battery. It also contains Detailed analysis regarding the rover movement in all directions along with shortest distance it can travel.

Fig 11: Screen shot of Dashboard view

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Fig 12: Screen shot of Report for distance travelled by Rover

VI. CONCLUSION

A Rover (Astute Drifter) with solar panel (Cosmic Collector) that follows the cosmic sun light (Light Contemporaneous) was designed. The required program was integrated in the rover. The model reached the desired output and the design is based on mono axis tracker with rotary encoder mechanism. So the rover will track the sun light by using LDR and after completion of task it will return back to its starting point of location where it was started earlier. This model is designed with available components and resources and the circuit is also simple and convenient to configure without effecting the functionality and working principle. Hence with the all required things and modules the main aim of the paper is achieved successfully.

VII. FUTURE SCOPE

This project can be implemented to a large extent superior scale. This concept can be useful in satellite technology where the satellite will use Sun light for its functionality. For future extensions, more efficient sensors can be used, but which are at high price tag and power consumption also more. This can be further developed with better efficiency while reducing costs. It is possible to design Robot instead of rover with same functionality for space investigation projects and it will be more reactive to the user by controlling it with mobile application or through web application on need basis.

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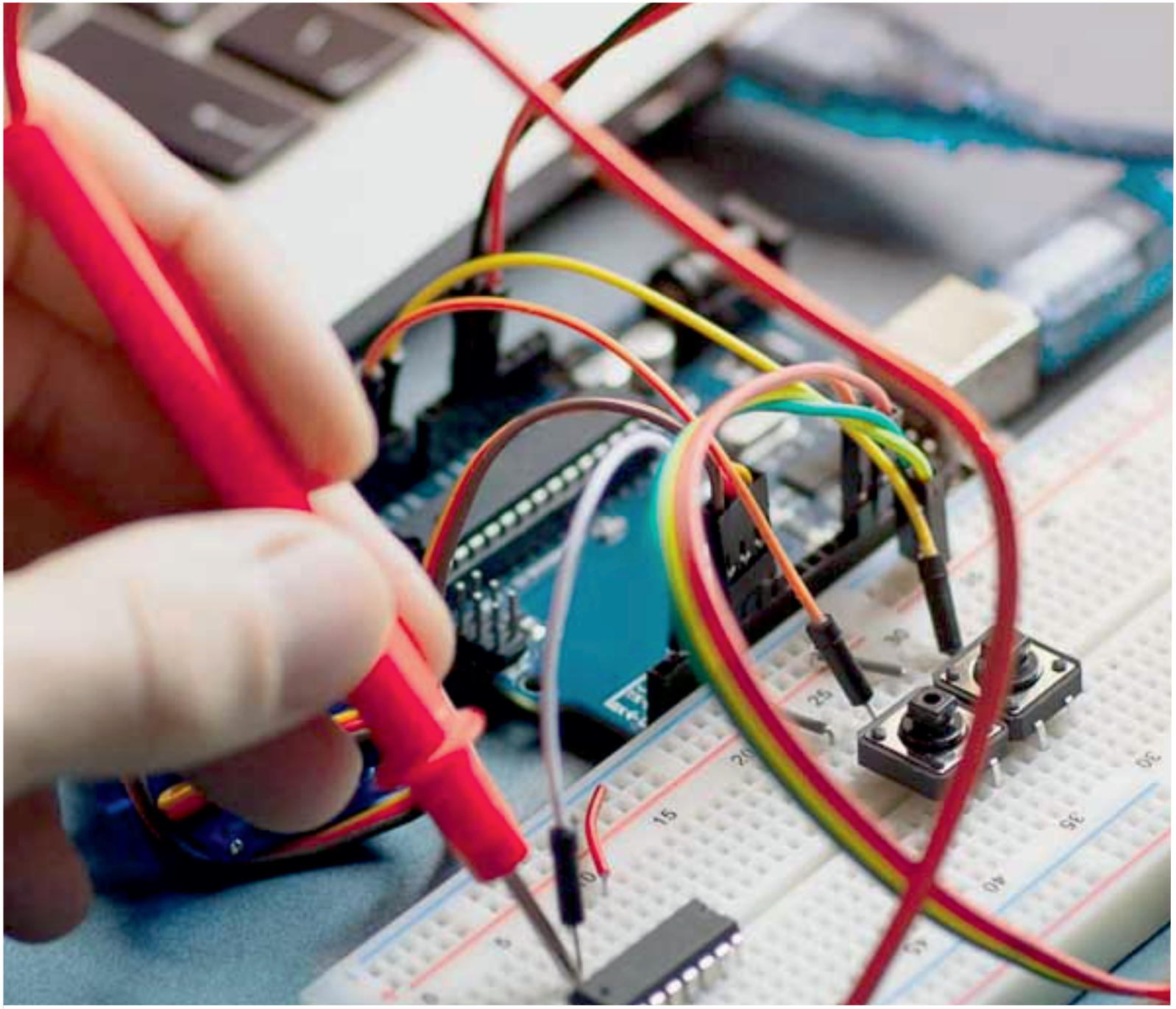

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