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IoT Based Agriculture Water Pumping System

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ABSTRACT: The technology used in horticulture sector is fetching surplus everyday. The main goal concerning this paper is the farmer will be able to monitor and control irrigation by using a smart phone or pc from anywhere at any time, to monitor the water parameter and reduce his efforts also to optimize the use of water. the measured value of sensor driven to cultivator wound up the WiFi router and the yield setup contrived through android application. The peculiar sensors are worn in this ideology. The sensors furnish and communicate towards Arduino. The scrutinizer transmit the information directed towards cloud server. This project used Arduino software to program the NodeMCU board to link the board with the cloud system. Then ThingSpeak Cloud is used for data collection and monitoring. This project used MIT Apps Inventor to create the Android application. Besides, this system also control 'ON' and 'OFF' water pumping system via smartphone using android interface at a certain range. The performance of the system is analyzed based on specificity, sensitivity and accuracy. The value for specificity is 95%, value for sensitivity is 100% and value for accuracy is 96.67%

KEYWORDS: Agriculture, Internet of Things, Cloud, MIT, Android.

INTRODUCTION

Agriculture is the major source of income for the largest population in India and is major contributor to Indian economy. However, technological involvement and its usability have to be grown still and cultivated for agro sector in India. Although few initiatives have also been taken by the Indian Government for providing online and mobile messaging services to farmers related to agricultural queries and agro vendor's information to farmers. Based on the survey it is observed that agriculture contributes 27% to GDP, and Provides employment to 70% of Indian population. IoT is changing the agriculture domain and empowering farmers to fight with the huge difficulties they face. The agriculture must overcome expanding water deficiencies, restricted availability of lands, while meeting the expanding consumption needs of a world population. New innovative IoT applications are addressing these issues and increasing the quality, quantity, sustainability and cost effectiveness of agricultural production. Agriculture is the backbone of Indian Economy. In today's world, as we see rapid growth in global population, agriculture becomes more important to meet the needs of the human race. However, agriculture requires irrigation and with every year we have more water consumption than rainfall, it becomes critical for growers to find ways to conserve water while still achieving the highest yield. But in the present era, the farmers have been using irrigation technique through the manual control in which they irrigate the land at the regular interval. According to statistics, agriculture uses 85% of available freshwater resources worldwide, and this percentage will continue to be dominant in water consumption because of population growth and increased food demand. There is an urgent need to create strategies based on science and technology for sustainable use of water, including technical, agronomic, managerial and institutional improvements. Agricultural irrigation based on Internet technology is based on crop water requirement rules. By using Internet technology and sensor network technology we can control water wastage and to maximize the scientific technologies in irrigation methods. Hence it can greatly improve the utilization of water and can increase water productivity.

The Internet of Things (IoT) is a technology where in a mobile device can be used to monitor the function of a device. The Internet of Things (IoT) is concerned with interconnecting communicating objects that are installed at different locations that are possibly distant from each other. Internet of Things (IoT) is a type of network technology, which senses the information from different sensors and makes anything to join the Internet to exchange information. It can also be used to modify the status of the device. The central processing unit will also include communication device to receive data from the sensors and to be relayed to the user's device. This will be done using a higher communication device such as a Wi-Fi module. The data processed by the central module is converted to meaningful data and relayed to the user. The user can view the data with the help of a handheld device such as a mobile phone or a tablet. Nowadays water scarcity is a big concern for farming. This project helps the

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farmers to irrigate the farmland in an efficient manner with automated irrigation system based on soil moisture.

This project was focusing on design an agriculture system by using NodeMCU as a controller while smart phones as a switch which it can be control loads from an assured range. The sensors were connected to the controller through relay and smart phone will send the signal to the controller via Wi-Fi module connectivity to "ON" and "OFF" the water pump. An android application and coding for sensors and water pump were developed to automate thissystem. This system can be applied for any kind of agriculture purpose not only limited for small farm.

Two different types of evaluation measures have been used to evaluate the performance of the proposed methods where it is used to assess the classification. The main reason for choosing these measures is that they are standardized, and they will enable the data taken to compare the proposed algorithms with other state of the systems. The classificationis implemented on the time taken for water pump to ON and OFF.

This project therefore proposes a system which is useful in monitoring the field data as well as controlling the field operations which provides the flexibility. The project aims at making agriculture smart using automation and IoT technologies. The highlighting features of this project includes Wi-Fi-module based remote controlled robot system. Secondly, it includes smart irrigation with smart control based on real time field data. Controlling of all these operations will be through any remote smart device connected to Internet and the operations will be performed by interfacing sensors, Wi-Fi modules and actuators with micro-controller.

The main aim of this project is to provide automated application in crop field. As the world is trending towards new technologies and implementations it is a necessary goal to trend up in agriculture too. Many researches are done in the field of agriculture and most of them signify the use of

wireless sensor network that collect data from different sensors deployed at various nodes and send it through the wireless protocol. The collected data provide the informationabout the various environmental factors.

II.RELATED WORK

In this paper, the wireless detector system used in horticulture will trail to agriculture farming society to exchange a standard methods. The agriculture increases the crop production and the saves labour cost and protect the environment from pesticide and fertilizers. The parameters includes temperature, humidity, soil moisture, leaf wetness and atmospheric pressure sensors to be integrated in all nodes[1]. The main purpose of this paper is to find moisture level and switch relay manipulation the solenoid valve allowing to the fundamentals. This system uses python programming for controlling the entire system. It users soil moisture sensor to measure the amount of moisture in soil. The Raspberry Pi is supplied with 5V to control the system[2].

This ideology was signified new knowledge and communication technology (ICT) advancements. Automatic management options with the latest electronic technology mistreatment microcontroller that turns the pumping motor ON and OFF on detective work the moistness content of the world and GSM telephone circuit is planned when activity the temperature, humidity, and soil wetness[3]. In this proposed system, the sensor node provides low-power communication. It helps to estimate the network. The energy and worth were used for interpretation of networks. In this network it consist of sink nodes and gateway depending on network topology. The sink receive data from sensor nodes and send the data to server. In wireless network the sink is in active state and thus saves more power[4]. In this paper, they used MLP and RBF to find soil moisture, ELM to find soil temperature, SVM to find condition of soil KNN to find dryness of the soil. Using think speak channel , we built the IOT application and also representing the data in the form ofchart. The plugins and apps are creator for proving web services and other API[5].

In this paper, they used sensors like temperature, soil moisture, humidity sensors. This sensor will sense a different parameter of the soil. By using the value of soil moisture the motor will ON/OFF automatically. The central processing unit includes communication device forcollecting data from sensors It can be done using a Wi-Fi module. The user can see the data using mobile phone or tablet. The mobile application of the user receives the data from an IP address[6].

"Irrigation Control System Using Android and GSM for Efficient Use of Water and Power" this system made use of GSM to control the system which may cost more so to overcome that proposed system used arduino yun board which already consist of in build wifi module [7]. "Microcontroller based Controlled Irrigation System for Plantation" In this paper old generation with lesser memory microcontroller is used to control the system but proposed system made use of arduino yun board which is user friendly and it helps to dump the programs easily.[8] "A wireless application of drip irrigation automation supported by soil moisture sensors" in this paper irrigation is carried out using soil moisture values but extend to this proposed system displays temperature and humidity values.[9]

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Rajalakshmi and Mahalakshmi [10] proposed an automated irrigation system which monitors cropfield using soil moisture, temperature, humidity, light sensors. The data from sensors are forwarded to webserver through wireless links. The data is encoded in JSON format in web-server database. The irrigation is automated if the moisture and temperature of the field fall below certain level. The farmerscan monitor their field ubiquitously as the notifications are sent to their registered mobile numbers periodically. Sharma and Borse [11] suggested the use of wireless sensors for real-time monitoring of various farming parameters such as environmental temperature, soil moisture content and humidity remotely. The authors have used the methods of image processing for automatic disease detection on plant leaves based on vision. The authors have given a portable, compact and a well-founded platform that can monitor the agricultural area automatically and examine the growth of the plant, identify plant disease and accordingly spray pesticide, water, and fertilizer to the plant. Kokkonis et al.
[12] proposed a fuzzy-based framework for smart irrigation systems which employs sensors (air temperature, humidity and ground moisture), actuators and microcontrollers. All the sensor data collected from microcontroller are forwardedto cloud database for further processing. The fuzzy computational algorithm is used to decide opening of servo valve or not. Salvi et al. [13] proposed a smart multi-level irrigation system using IoT for reduced water consumption. A local node (customized to selected crop) for each level is provided having its own local decision making system. These local nodes communicate with centralized cloud server which stores and process the data.

III.BLOCK DIAGRAM

Most of the existing works focus only on switching on the pump either manually or automatically. There is no full-fledged system which considers factors like water level and rainfall prediction. Using moisture sensor data only sometimes leads to overwatering of farms if rainfall occurs simultaneously. To counter that, the proposed system uses two ranges for time when there is no rain which lower than the range when it is raining. E-Krishi aims at maximizing the agriculture yield by using sensing technology to stop the wastage of water in the irrigation fields. This can be done by plotting some moisture sensors on the field with the help of microcontrollers like ESP8266, Arduino Uno and ESP8266 micro-controllers send the moisture level data onto the cloud. This data is being used by the user (field owner) to know the current water need in the fields using an Android interface as shown in Figure 1. An Application programming interface is used to predict the possibility of rainfall. This mobile application is used by the user (field owner) to turn the water pump for irrigation on and off. Irrigation is stopped automatically by the system when moisture level reaches a particular value and is started if the level is much lower for the crops to survive. The android application for smart phone is developed by using MIT Apps Inventor is an open source web application that originally provided by Google. This application is divided into two parts which are designer editor and block editor.

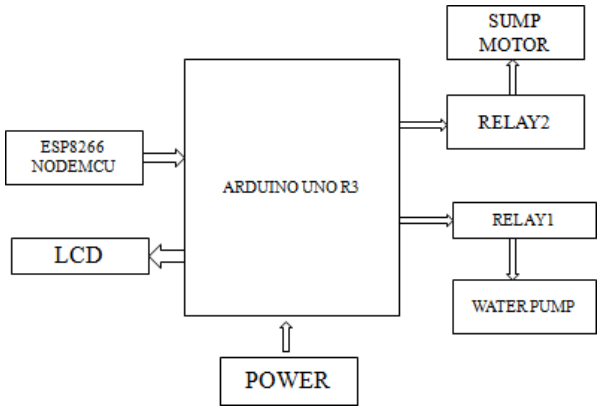

Fig 1:Block Diagram

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A. Hardware Requirements

- Arduino Uno R3
- Relay
- Water Pump
- Sump Motor
- Power Supply Unit
- 16*2 Lcd

B. Software Requirement

- ARDUINO IDE
- Embedded C

I. HARDWARE IMPLEMENTATION

A. Arduino UNO

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by arduino. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under Common Creative Attribution Share-Alike 2.5 license and is available on the arduino website. Layout and production files for some versions of the hardware are also available. "UNO" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0.The UNO board and version 1.0 of arduino Software (IDE) were the reference versions of arduino, now evolved to newer releases. The UNO board is the first in a series of USB arduino boards, and the referencemodel for the arduino platform. The ATmega328P on the arduino UNO comes pre programmed with a boot loader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol. The UNO also differs from all preceding boards in that it does not use the FTDI USB- toserial driver chip. Instead, it uses the Atmega16U(Atmega8U2 up to version R2) programmed asa USB-to-serial converter.

Fig -2: Arduino Board

B.LCD:

Liquid Crystal Display (LCD) is used to display the output to the user in the form of GUI (Graphic User Interface) and a mono chromatic display. LCD used in this project is JHD162A series. There are 16 pins in all. They are numbered from left to right 1 to 16 (if you are reading from the backside). Generating custom charcters on LCD is not very hard. It requires the knowledge about custom generatedrandom access memory (CG-RAM) of LCD and the LCD chip controller. Most LCDs contain Hitachi HD4478 controller. CG-RAM is the main component in making custom characters. It stores the custom characters once declared in the code. CG-RAM size is 64 byte providing the option of creating eight characters at a time. Each character is eight byte in size.

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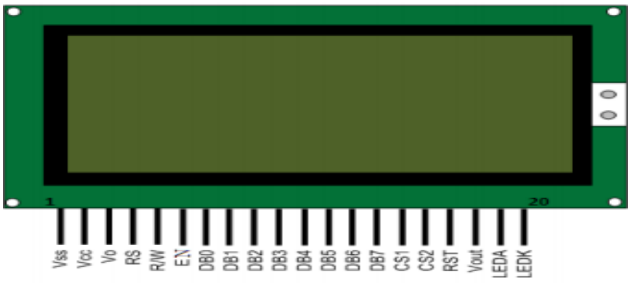

Fig 3: LCD

C. NodeMCU

NodeMCU is an IOT platform which bound on the ESP8266 Wi-Fi. It refers to firmware and prototyping board. In this operation lua scripiting language is used. NodeMCU possess features such as Wi-Fi capability, analog pins, digital pins and the serial communication protocol. ESP8266 Wi-Fi module gives access to Wi-Fi or internet. It can communicate with any microcontroller. We can directly program it by using a desktop. It is Wi-Fi enabled (systemon chip). It is flexible in terms of programming, has inbuilt USB and is easily connected.

Figure 4: NodeMCU

D. RELAY

A relay is an electromechanical switch, which perform ON and OFF operations without any human interaction. General representation of double contact relay is shown in fig. Relays are used where it is necessary to control a circuit by a low- power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal.

Fig 5:Relay

E. SUBMERSIBLE PUMP

Micro DC 3-6V Micro Submersible Pump Mini water pump for Fountain Garden Mini water circulation System DIY project. This is a low cost, small size Submersible Pump Motor which can be operated from a 3 ~ 6V power supply. It can take up to 120 liters per hour with very low current consumption of 220mA. Just connect tube pipe to the motor outlet, submerge it in water and power it. Make sure that the water level is always higher than the motor. Dry run may damage the motor due to heating and it will also produce noise.

Fig-6: Submersible Pump

elements such as buttons, labels, list pickers, images and many more and it is coupling with the mobile device features such as NFC, Bluetooth, GPS and others for developer to design the apps. Figure 1 shows the designer

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editor part in MIT Apps Inventor. Figure 2 shows the block editor part for MIT application start up page.

Fig. 6. Designer Editor Part in MIT Apps Inventor

F. Arduino IDE

Arduino IDE is used to write the program in C and C++ programming language. This helps to convert the executable code into a text file and also loaded into Arduino board. It accommodate a text editor for writing code, message area. Itchecks the error and also we can make changes wherever possible. Using USB port we can able to dump the code in Arduino UNO. It consist of toolbar button that allowing to create , save, open and upload the program.

G. Developing android application

MIT App Inventor is a mobile developer app for Android that using drag and drop visual programming tool for building and designing an app. This app provided a new method for developers to design, create, and use personally meaningful mobile technology solutions in endlessly unique situations. This app focused on the logic programming to develop an Android application rather than using the syntax C# for the coding language. Thus, it is easy to understand and troubleshooting for developer since it used a logic blockdiagram connection for its coding language. The android application for smart phone is developed by using MIT Apps Inventor is an open source web application that originally provided by Google. This application is divided into two parts which are designer editor and block editor.

IV.RESULTS AND DISCUSSION

Figure 7 shows the prototype of automatic irrigation system. The microcontroller arduino is connected to temperature sensor, soil moisture sensor, humidity sensor, relay and motor. These sensors sense the various parameter of the soil, motor is used to provide water to the land. And relay is used control the motor. When the system is off process shutdown otherwise it will goes beyond the certain limit buzzer will on according to the humidity, temperature and other sensing elements.Likewise it will displayed it on the LCD display to check and controll the process. This analysis done without manpower by automatically buzzer will on and it will improve the efficient use of energy saving.

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Fig 4.Experimental Setup

V.CONCLUSION

This paper develop a system controlling water pumping system using Maasachusetts Institute of Technology (MIT) Apps Inventor. An application is created by using MIT for monitoring and controlling water pumping system. The sensor reading of each sensor will be displayed inside the Apps. Then, the performance of water pumping system using IoT for agriculture purpose is analyzed based on specificity, sensitivity and accuracy. The Wi-Fi module able to receive and transmit signal between NodeMCU and smartphone to switch on and off the load within 50 meters range. The application is named as Smart Agriculture System. All the objectives achieved. The ideology affords high-quality option to the issues faced inside the existing guide process of irrigation with the aid of enabling green usage of water resources. The proposed systems explore how the horticulture sector is used in IoT. the effective use of water pump is done. It includes low value, low strength consumption of devices, a higher selection making system. WiFi enabled paperwork collecting statistics to carry out ina manner to be able to reduce the quantity of water wastedin irrigation and also reduces monetary price for farmers.

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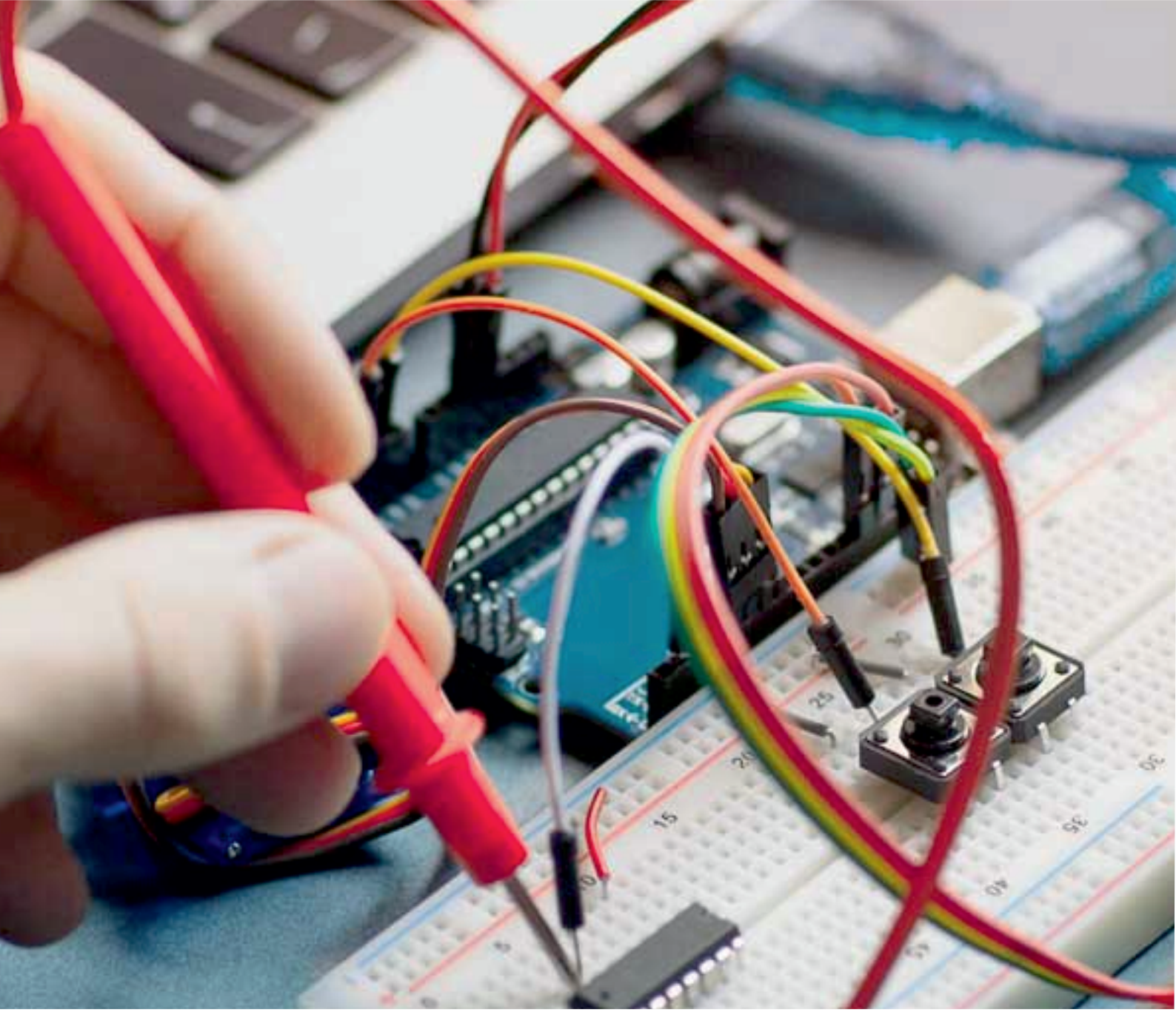

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