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IOT Based Power System Fault Monitoring and Theft Detection System

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ABSTRACT: The main aim of the thesis is to acquire real-time fault monitoring of transmission lines remotely over the internet falling under the category of Internet of Things (IOT). For this Realtime aspect, we take one temperature sensor, one potential transformer, earth fault, oil level and one current transformer for monitoring Earth, V, I, over voltage, under voltage, short circuit, open circuit data of the transformer and then send them to a remote location. These five analog values are taken in multiplexing mode and connected to a programmable microcontroller of atmega 328p-pu families through an ADC inbuilt. They are then sent directly to a Wi-Fi module under TCP IP protocol to a dedicated IP that displays the data in real-time chart form in any web connected PC / Laptop for display in 3 different charts.

KEYWORDS: Transmission Line, Three-Phase, Fault Detection, IOT

I. INTRODUCTION

The IoT-based Power System Fault Monitoring and Theft Detection System revolutionizes electrical network management by leveraging IoT technology. It provides real-time monitoring of electrical parameters, enabling swift detection and localization of faults for rapid response and maintenance. Moreover, advanced analytics algorithms are employed to identify irregularities indicative of theft or unauthorized usage, promoting efficient resource utilization. Through seamless integration with existing infrastructure, the system ensures reliable operation and minimizes downtime. Automated alerts and remote access enhance responsiveness, facilitating timely intervention to mitigate potential disruptions and losses. Ultimately, this system optimizes power grid performance, enhancing reliability, security, and sustainability in energy distribution. In power system, fault is defined as the defect in power system due to which current is distracted from the intended path. Then, the fault creates the abnormal in power system which reduces the insulation strength between the conductor and this will cause excessive damage to the system. ESP8266 Node MCU is used in this project to improve the protection system since user can detect the fault easily by getting notification from server to mobile phone. ESP8266 is a microcontroller and also a self- contained Wi-Fi networking solution offering as a bridge from existing microcontroller to Wi-Fi.

The ESP8266 Node MCU module also has built in USB connectorand a rich assortment of pin-outs. The Node MCU can connect to the laptop and flash it without any trouble by using the micro-USB cable. One of the advantages of Node MCU is very user-friendly Detecting and locating fault in power line is very necessary for healthy operation of power system. In electrical powerline fault often happen many times making the power system unreliable. In this idea using wireless sensor for detecting fault which includes phase to phase, shortcircuit and mainly line to ground fault in power line for better reliable and best operationof the system is presented.

This project can be applied at power system including in generation, transmission or distribution system because in this system, there are many apparatuses that need to be protect and users can get the supply without having disturbance. Hence, from this project, we can know and control fault occurred from the control room. The system consists of four main parts which is Arduino, Wi-Fi module circuit and cloudserver. This project used Arduino, Node MCU ESP8266 (V3) Wi-Fi module, Thingspeak cloud server and using Arduino software for the programming. The purpose of this project is to advance to “Three Phase Transmission Line Fault Detection Analysis”. This project utilized Arduino software for programming

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II. LITERATURE SURVEY

Chandra Shekar. P, "Transmission Line Fault Detection & Indication through GSM" This paper explains detection of multiple faults in three phase transmission line by using GSM. Generally, when a fault occurs in transmission line, unless it is severe it is unseen. But gradually these minor faults can lead to damage of transformer and can turn havoc to human life. Present day in India, we do not have a system in hand that would let us know in real time once a fault occurs. Matter of concern is that since we do not have a real time system, this leads to damage of the underlying equipment connected and turns out to be a threat to human around. In order to avoid such incidents to the maximum extent, maintenance or checking of the transmission lines are generally carried out on a frequent basis.

S. R. a. T. Madakam, "Internet of Things (IoT): A literature review," *Journal of Computer And Communications,* vol. 3, no. 05, p. 164, 2015.An overview of IoT and its uses which can be implemented in real world have been discussed in literature. Many technologies like.Wi-Fi, Bluetooth etc. were discussed, these technologies find a big application in building IoT environment The IoT aims to unify everything in our world under a common infrastructure, giving us not only control of things around us, but also keeping us informed of the state of the things

III. NECESSITY

An IoT-based power system fault monitoring and theft detection system can provide several important benefits, making it necessary in various contexts, especially in the field of electrical power distribution. Here are some of the key reasons for the necessity of such a system:

Improved Reliability and Efficiency: An IoT-based power system monitoring system can help improve the overall reliability and efficiency of the power distribution network. By continuously monitoring the system, it can detect faults and irregularities in real-time, allowing for rapid response and reducing downtime.

Early Fault Detection: The system can identify faults such as short circuits, overloads, voltage sags, and other issues as soon as they occur. Early detection helps prevent larger outages and can save time and resources in diagnosing and repairing problems.

Reduced Downtime and Maintenance Costs: With timely fault detection, maintenance teams can respond quickly to rectify issues, reducing downtime and the associated costs. Predictive maintenance can also be implemented, which means that maintenance is performed when needed, rather than on a fixed schedule, saving resources.

Theft Detection: Power theft is a significant problem in many regions. An IoT-based system can monitor power consumption patterns and identify abnormal usage or attempts at theft. This helps utilities and authorities combat power theft and revenue losses.

Data Analytics and Optimization: The collected data can be used for advanced analytics to optimize power distribution, load balancing, and demand forecasting, leading to more efficient use of resources.

Environmental Impact: Improved efficiency and reduced downtime result in a smaller carbon footprint. Efficient power distribution leads to energy savings and, in turn, reduced greenhouse gas emissions.

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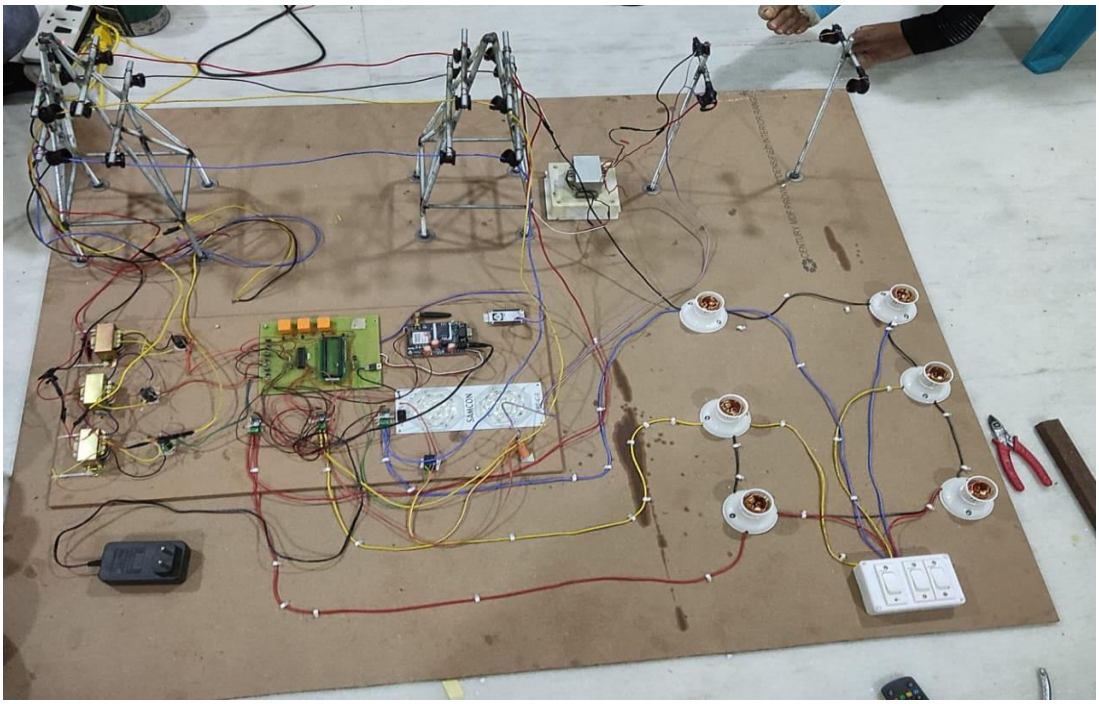
SYSTEM MODEL:



Hardware

IV. SYSTEM MODEL AND ASSUMPTIONS

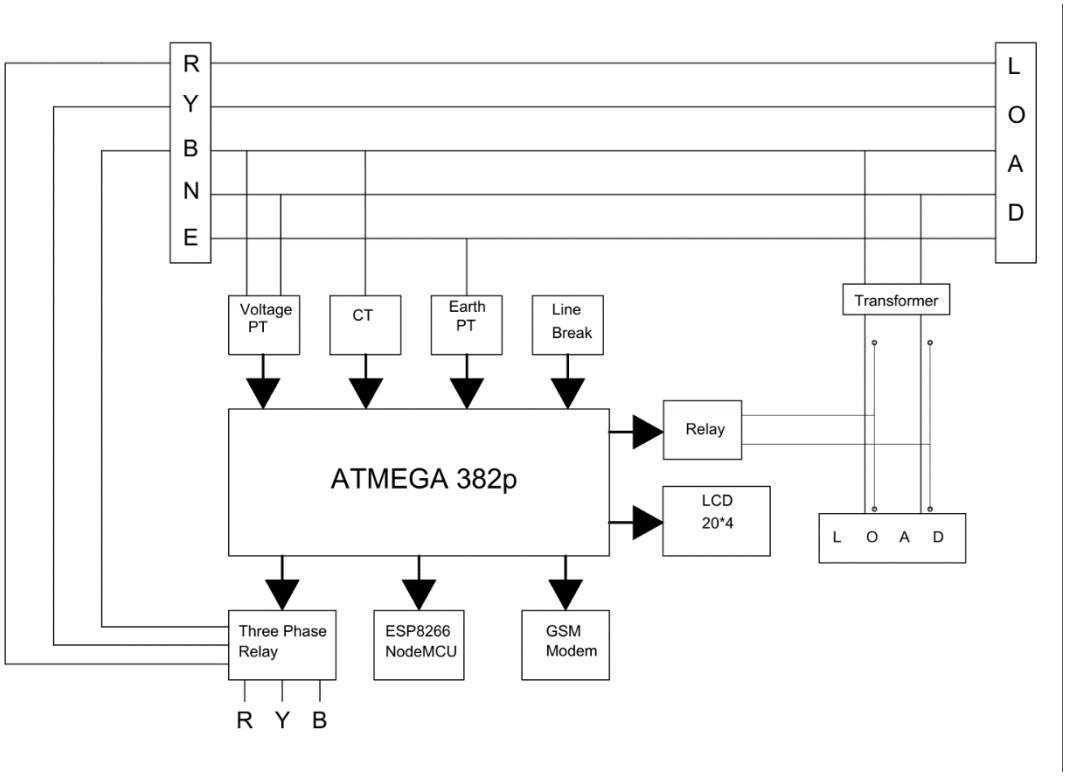


Fig. Block Diagram

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There is transmission line in which is three phases system.in that there is CT and PT are connected to measure the current and voltage of transmission line. The at mega 382p microprocessor fed by the CT and PT then that values signal is given to the microprocessor. The microprocessor processes the values. Then the earth PT is connected. It connected to the neutral of transformer. The values of these three parameters are shown on the LCD. According to that the relay will work.

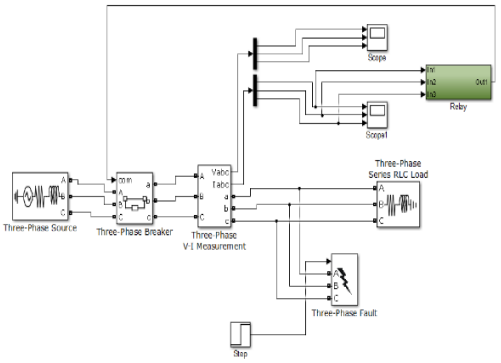


Fig. Simulation Main Block

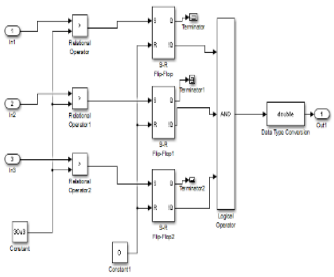
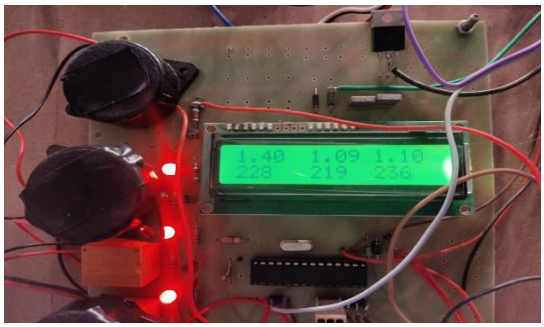


Fig. Relay block

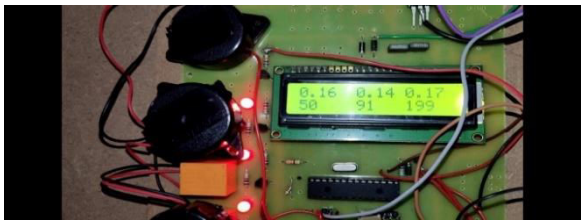
V.RESULT AND DISCUSSION

1. Normal Condition

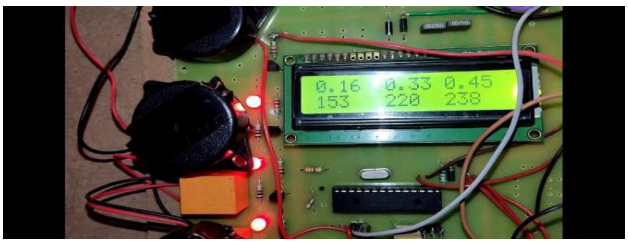
3. Overcurrent Fault

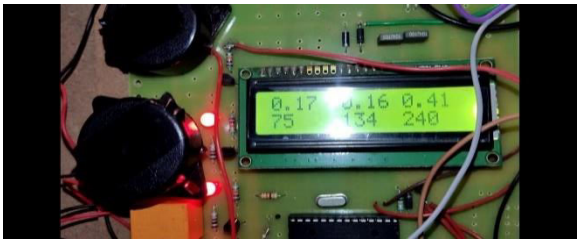


2. Triple Line Fault



4. Single Line Fault





Double Line Fault

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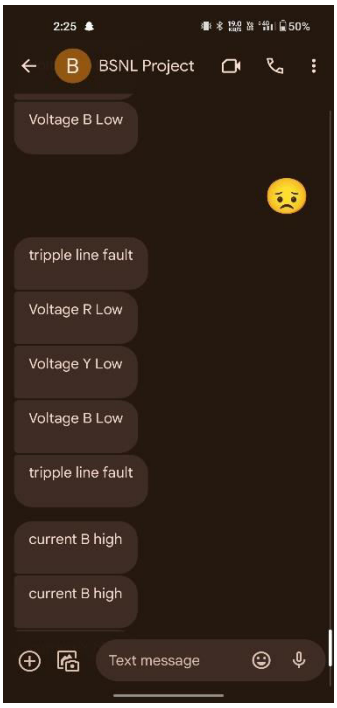
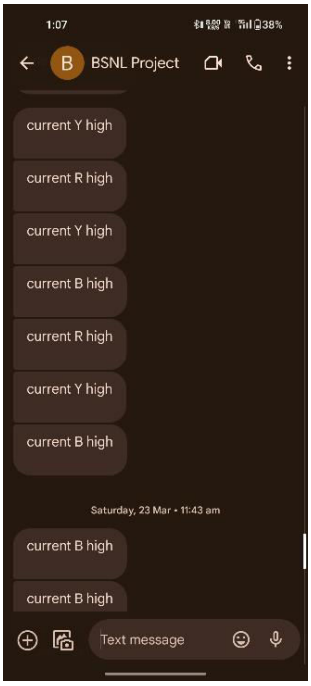
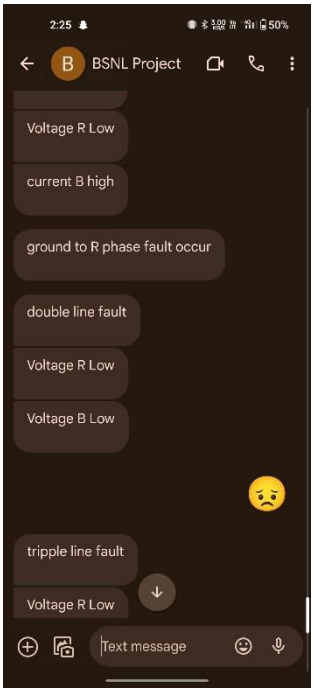


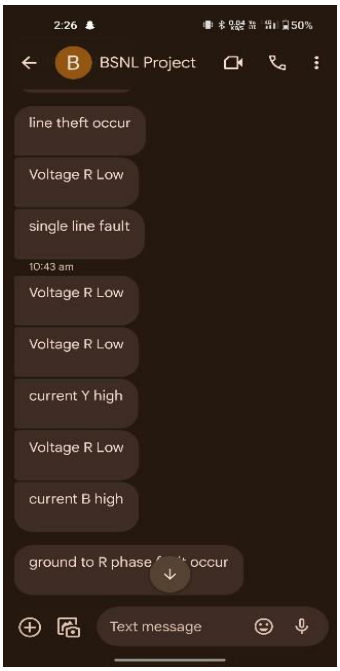
6. Triple Line Fault Message



7. Overcurrent Fault Message



8. Ground Fault and Double Line Fault Message



9. Theft Detected Message

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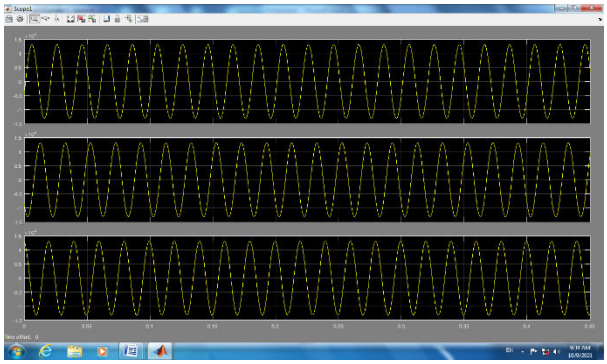
VI. SIMULATION RESULTS

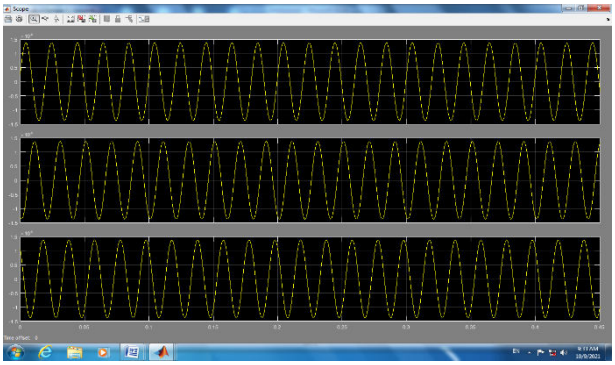
FUNDAMENTAL CONDITION:

When relay will not trip at that time current and voltage waveform are fully sinusoidal means in which the current and voltage are not going to zero .it is normal fundamental voltage and they travel with fundamental frequency.

Voltage without Fault

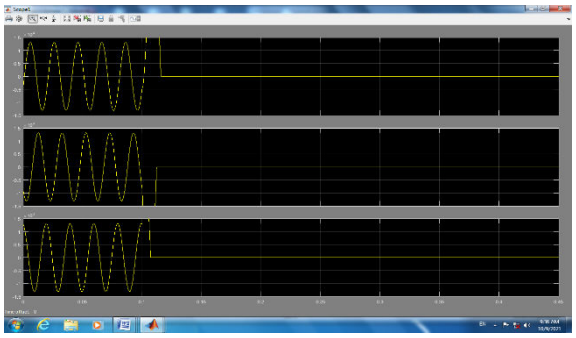


Current Without Fault

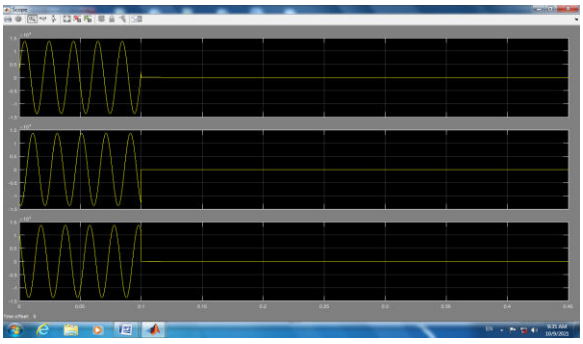


Voltage waveform and current waveform when relay trip:

First current and voltage waveform are in sinusoidal condition. when relay will be trip that is fault occurring in the system the voltage and current are going to zero condition means in which current and voltage will not flow.



Voltage waveform with fault condition relay trip



Current waveform with fault condition relay trip

VII.CONCLUSION

In conclusion, the IoT-based power system fault monitoring and theft detection system offers a robust solution for enhancing power grid reliability and security. By leveraging IoT sensors and communication technology, real-time monitoring of power system parameters is achieved, facilitating prompt fault detection and localization. Additionally, the system's theft detection feature provides an effective mechanism for preventing energy theft, ensuring revenue protection for utility companies. Overall, this project demonstrates the potential of IoT in revolutionizing power system management, contributing to a more efficient and secure electricity infrastructure. , the IoT-based Power System Fault Monitoring and Theft Detection System marks a significant milestone in the evolution of power grid management. Its ability to enhance reliability, mitigate theft, and contribute to sustainable energy practices positions it as a pivotal technology in the future of electrical power systems.

VIII. FUTURE SCOPE

In the future, the IoT-based power system fault monitoring and theft detection system can evolve by incorporating advanced analytics for predictive maintenance, optimizing renewable energy integration, and enhancing cybersecurity

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measures. Predictive maintenance algorithms can anticipate faults, reducing downtime and maintenance costs. Integration with renewable energy sources and smart grid technologies can optimize energy distribution and utilization. Strengthening cybersecurity with advanced encryption and authentication protocols is crucial for protecting against cyber threats. Additionally, exploring blockchain technology for transparent energy transactions could revolutionize revenue protection strategies. These advancements will further enhance grid efficiency, reliability, and security, ensuring a sustainable and resilient energy infrastructure for the future

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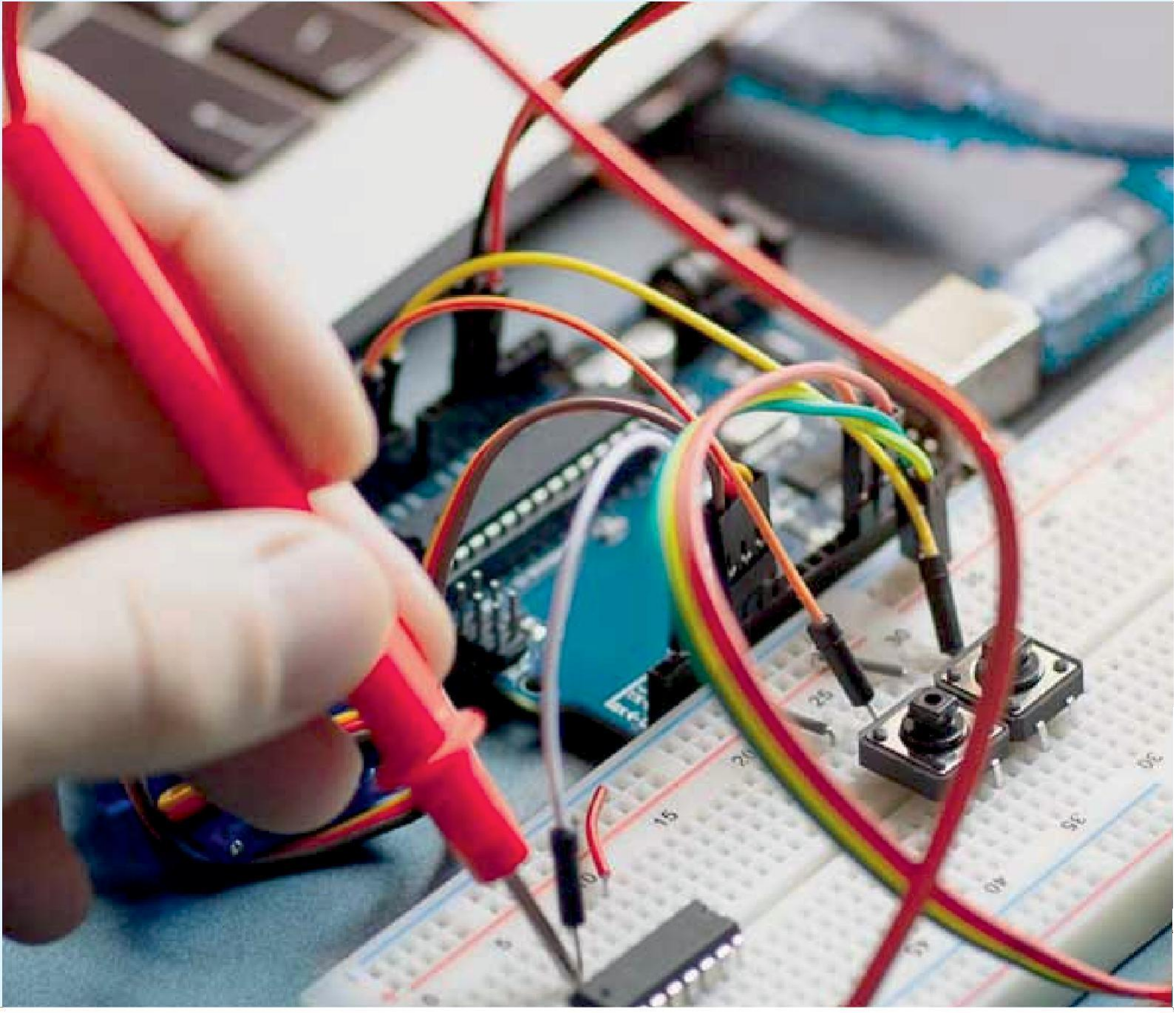

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