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Automatic Fire Rescue System in Railway by using LabVIEW with myRIO

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ABSTRACT: Even when an accident occurs due to human error or an unexpected situation occurs in the fastpaced automation world, more technologies are developed. As a result, we developed an improved fire rescue system to reduce the number of fatalities in the event of a train fire. Smart sensors and myRIO technology were used to build and implement this system. It will automatically detect a fire and transmit the information to the loco pilot through wireless signal transmission. The fire will be put out first, and information about the accident will be sent to the crossed and approaching stations via Short Message Service (SMS). This SMS accurately conveys the status of a fire accident by transmitting physical parameters such as compartment number and fire intensity. This also shows the specific area code for that GSM Mobile network. The full location where the train is stopped, as well as train details, could be obtained from the control room

KEYWORDS: GSM, Zigbee, myRIO, LabVIEW, Flame sensor, Fire alarm system, Wireless sensor network, Servo engine, Automatic sprinklers

I. INTRODUCTION

Railways are one of the world's best modes of transportation because they are more convenient and comfortable for passengers. In India, around 20 million people travel by train each year. The development of railways in our country has been rapid; however, there are numerous unsolved issues in the way of steady growth, such as train fires, train collisions, and so on. The only precautionary warnings about the fire in each compartment are the notices that say "Do not smoke" and "Do not carry inflammable material." Fire accidents in trains, on the other hand, are common due to failures in the routine maintenance system or the activities of illegal social elements. As a result of these issues, the human death rate has risen. Everyone is responsible for fire safety. Every employee should be aware of how to avoid and respond to a fire.

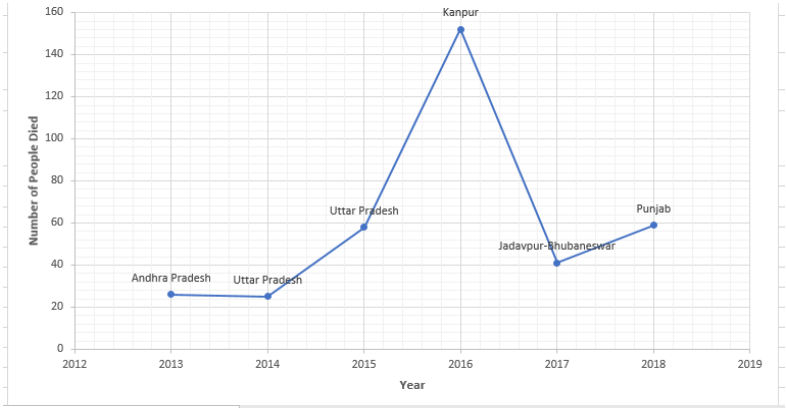

Figure 1. Major fire accident in train

Our project's primary goal is to use automatic water sprinklers, CO2 fire extinguishers, and compartment separation to prevent fire from spreading. Thereby we will scale back the decease rate and make sure the safe journey of passengers.

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II.LITERATURE REVIEW

[1]IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT) FIRE SAFETY AND ALERTING SYSTEM IN RAILWAYS This paper is about detecting fires between temperature ranges and sending an alerting signal to the loco pilot via GSM.

[2]International Conference on Green Computing Communication and Electrical Engineering FIRE RESCUE SYSTEM IN RAILWAYS USING LABVIEW In this project, if a fire breaks out for any reason, the fire sensor installed in each compartment will detect it. To detect a fire, fire detectors are installed in each compartment of the train. For each compartment, a total of 9 sensors will be used. The fire sensors can be addressed, and the sensor's signal can be obtained by LabVIEW. The loco pilot should use the monitor to check the status of each compartment.

III. METHODOLOGY

The flame sensor, which is placed in each compartment of the train to sense the fire, will detect the fire in this project. The fire sensors are addressable, and the signal data from these sensors is read using the LabVIEW software via myRIO. myRIO is the heart of the proposed system and the hardware used; it can easily connect to a wireless network, which aids in quick response, and it also has a wider range of connectivity, so it was chosen for this purpose. Through the monitor, the loco pilot can see the status of each compartment. The project focuses on the integration of Zigbee-based sensor technology with other technologies. The project involves combining Zigbee-based sensor technology with GSM to produce seamless serial communication between the computer and the loco pilot.

IV. COMPONENT DESCRIPTION

a) Flame Sensor: A flame detector is a sensor that detects the presence of a flame or fire, making it possible to detect flames. When the flame sensor detects a change in temperature, the output is sent to myRIO. When used in industrial furnaces, their role is to check that the furnace is operating properly; they can also be used to turn off the ignition system, though in many cases they do nothing more than alert the operator or control system. Because of the mechanisms it uses to detect the flame, a flame detector can often respond faster and more accurately than a smoke or heat detector.

Figure 2. Flame Sensor

b) Servo motor: A servomotor is a linear or rotary actuator. It is made up of a suitable motor and a position feedback sensor. It also necessitates a sophisticated controller, which is often a dedicated module designed specifically for servomotors. Although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system, it is not a particular type of motor. Servomotors are used in robotics, CNC machines, and automated manufacturing, among other applications. In this project, a servomotor rotates a fire that has occurred, along with a water sprinkler, in order to extinguish the fire. To provide position and speed feedback, the motor is connected to a position encoder. Only the position is measured in the most basic case. The measured output position is compared to the command position, which is the controller's external input. If the output position does not match the necessary position, an error signal is produced, causing the motor to rotate in either direction to bring the output shaft to the correct position. The error signal decreases as the positions reach zero, and the engine stops.

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Figure 3. Servo motor

c) myRIO: myRIO is a portable device that can be used to design and control robots and a variety of other systems with ease. It's a National Instruments real-time embedded assessment board. It's used to create apps that take advantage of the onboard FPGA and microprocessor. The acronym RIO stands for Reconfigurable Input/Output. myRIO has a programmable dual-core ARM cortex A9 processor. A Xilinx Field Programmable Gate Array is included (FPGA). myRIO's requested terminal is a power supply, which we connect to our computer using a USB cable. The data from these sensors is read using the LabVIEW Software and myRIO. The proposed system's heart, as well as the hardware used, is myRIO. It can easily connect to a wireless network, allowing for quick responses and a wider range of connectivity, so it has been used for this purpose.

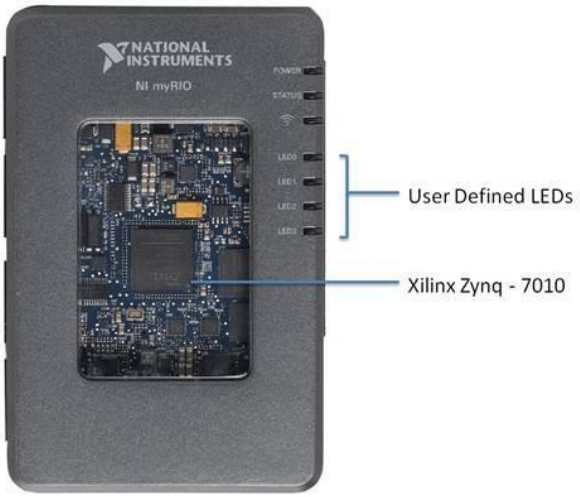

Figure 4. myRIO

d) Zigbee: ZigBee is a high-level communication protocol that is used to connect devices. Wireless communication technology is the common name for it. The IEEE 802.15 standard underpins ZigBee. ZigBee devices, despite their low power, often transmit data over longer distances by passing data through intermediate devices to reach more distant ones, forming a mesh network. ZigBee is a high-level communication protocol that is used to connect devices. Wireless communication technology is the common name for it. The IEEE 802.15 standard underpins ZigBee. ZigBee devices, despite their low power, often transmit data over longer distances by passing data through intermediate devices to reach more distant ones, forming a mesh network. The loco pilot then comes to a complete halt. When the train is going into the wind, the main reason for stopping the engine is to prevent fire from spreading to other compartments. Simultaneously, the loco pilot requests assistance from the concerned authority.

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The following are some of the features of the Zigbee protocol:

- Multiple network topologies are supported, including point-to-point, point-to-multipoint, and mesh networks.
- Low duty cycle – extends the life of the battery.
- Spread Spectrum in Direct Sequence (DSSS)
- Each network can have up to 65,000 nodes.
- Secure data connections with 128-bit AES encryption
- Avoiding collisions, retries, and acknowledgments

Figure 5. ZIGBEE.

V. SOFTWARE IMPLEMENTATION

a) Introduction to LabVIEW National Instruments' (www.ni.com) LabVIEW (Laboratory Virtual Instrument Engineering Workbench) could be a graphical programing language for making applications that uses icons rather than lines of text. Virtual Instruments, or VIs for short, are LabVIEW programs/codes. A typical instrument setup based on LabVIEW includes data acquisition, signal processing (analysis), and hardware control. Engineers and scientists should use LabVIEW to create test, control, and measurement applications. On a variety of platforms, including Microsoft Windows, LabVIEW is widely used for data acquisition, instrument control, and industrial automation. LabVIEW 2019, which was announced in May 2013, is the most recent version.

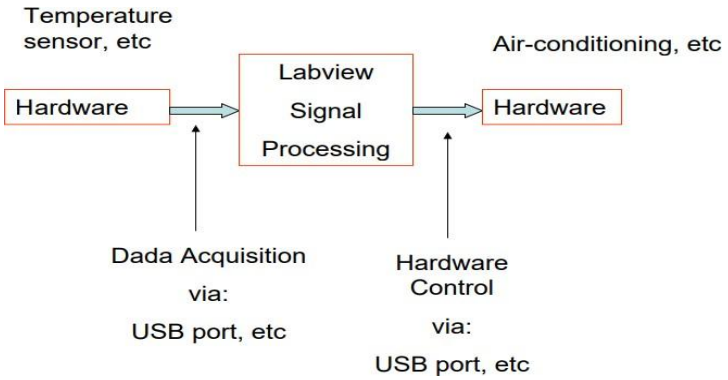

Figure 6. Schematic diagram of an instrument system based on LabVIEW

b)Front panel and block diagram Controls and indicators (input and output/display, respectively) are located on the front panel. Using a set of tools and objects in LabVIEW, we can create a user interface. The front panel is the name given to the user interface. Block Diagram window: Terminals (/Icons) resembling front panel controls and indicators, in addition as constants, function, SubVIs, structure, and wires that connect knowledge from one object to a different. We can add code using graphical representations of functions to control the front panel objects. The block diagram contains this code. To control the front panel objects, we can add code using graphical representations of functions. This code can be found in the block diagram.

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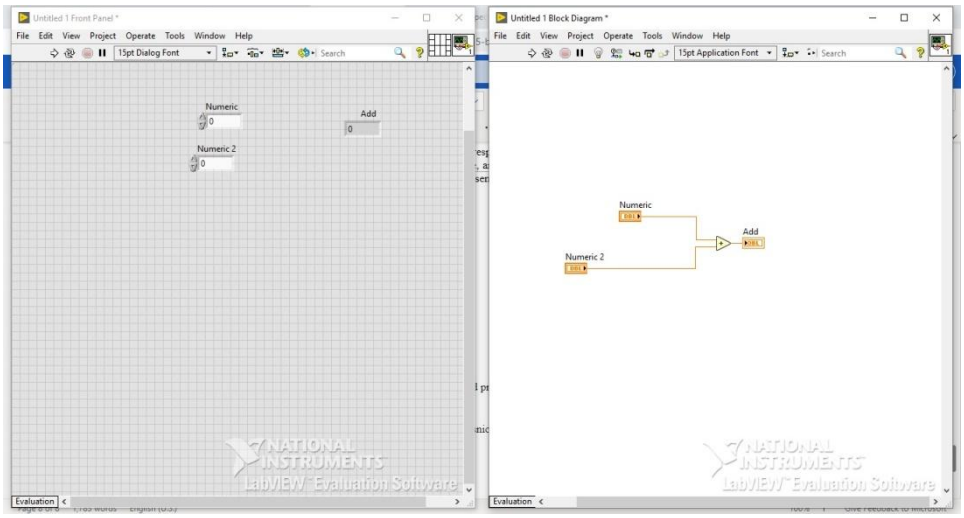

Figure 7. Front panel and block diagram

b) Advantages of using LabVIEW

- The ease with which a DAQ can be acquired for the first time
- Processing in parallel
- FPGA-based programming now has a lower entry hurdle.
- Visualization of measurement data
- Interfacing with instrumentation is easy.
- Interfacing over various communication links is easy

VI. BLOCKDIAGRAM

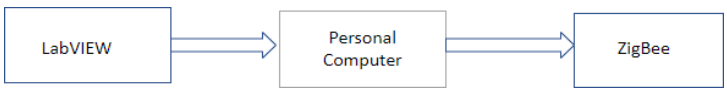

Figure 8. Transmitter Block

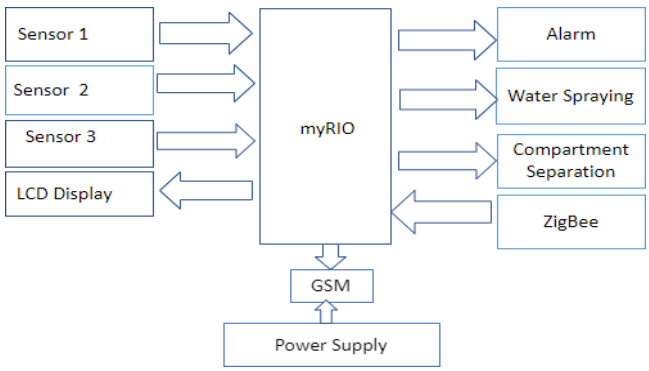

Figure 9. Receiver Block

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VII. PROPOSED WORK

Here we are showing automatic fire alarm and water spraying system which is interface with myRIO by using LabVIEW.

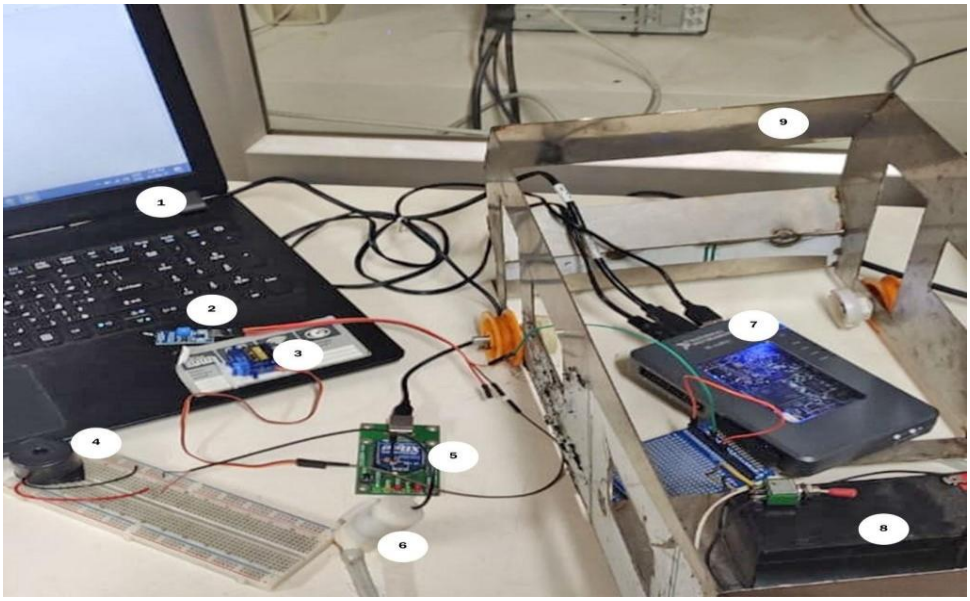

Figure 10. Hardware setup

From figure 10,

1. Programming and Monitoring
2. Flame Sensor
3. Servomotor
4. Alarm
5. Zigbee
6. WaterPumpingmotor
7. myRIO
8. Battery
9. TrainCompartment

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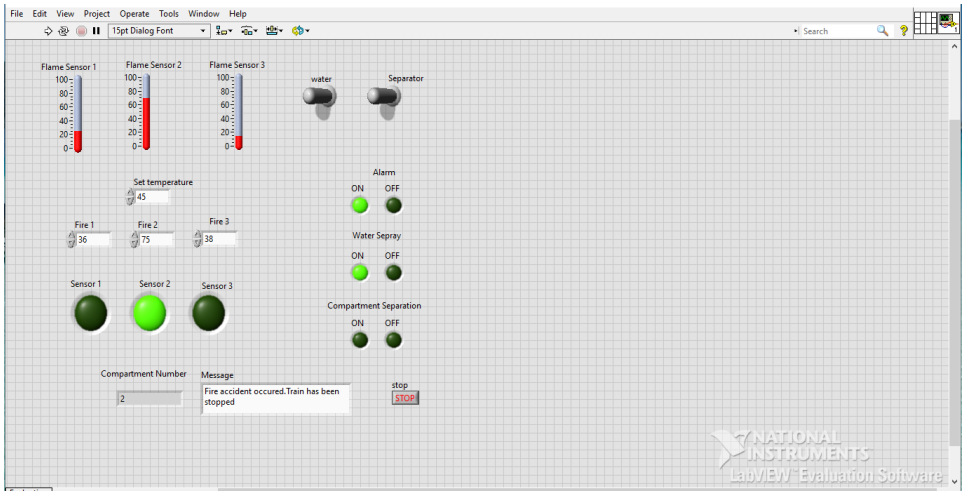

Figure 11. LabVIEW frontpanel

From this front panel we know the fire is detected at compartment 2. So that flame sensor 2 is in ON condition. At the same time the warning alarm and water spray are turned ON automatically.

ADVANTAGES OF PROPOSED SYSTEM

• An automatic fire extinguisher has been installed on the engine side.
• Using LabVIEW and myRIO, the loco pilot monitors the entire compartment through the front panel.
• An automatic water sprinkler and a CO2 fire extinguisher are used to keep the fire from spreading.
• Separation of compartments is fully automated. • The rate of human death has decreased.

VIII. CONCLUSION

myRIO is used to implement this working system. This system will be extremely helpful in preventing accidents by detecting fire at an early stage, alerting passengers, relaying the message to the loco pilot, and taking immediate action to prevent the fire from spreading. As a result, the system is extremely secure. Fire is both a good servant and a bad slave, so we must treat it with caution and caution. We will be able to achieve better results in the future if we use this approach.

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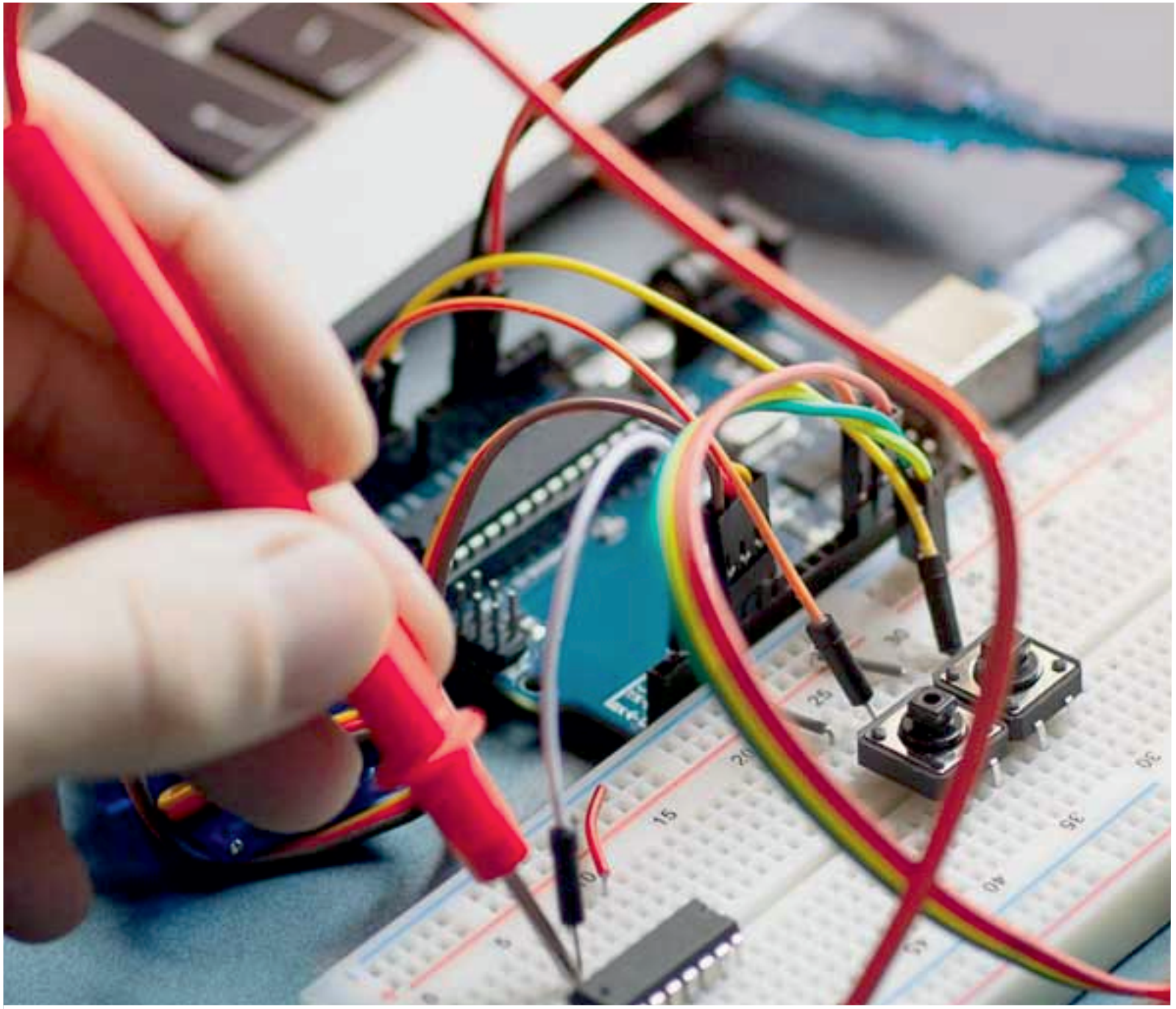

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