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A Digital Water Metering and Control System for All Types of Water Usage

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ABSTRACT: Water is one of our most important natural resources. We drink it, use it for cooking and cleaning, and depend on it in many aspects of our lives. For this motive she must be protected and managed economically. It should not be surprising, then, that we have a need to measure the amount of water we use. In this paper we present a short history of mechanical residential water meters with moving parts such as displacement and velocity water meters. Due to this traditional water meters we cannot able to get the actual consumption of water. And also for multispecialty flats utility and toilets will be located in different places so we cannot able to get the cumulative value of consumption of each and every flat. For solving these problems we are going to introduce a digital water meter. So that we can able to get the flow consumption of each and every inlets of the flat though the digital flow meter and also we can able to generate the accurate water consumption bill for each flats. And also, it has a special advantage of leakage detection, open tap detection and no flow detection alarm. So that we can able avoid the complete leakage of water. We can also be able to monitor the data wirelessly. When no bill paid we can automatically stop the water connection also. Thus, this project will help us to do effective water conservation.

I.INTRODUCTION

GENERAL

Accurate flow measurement is an essential step both in the terms of qualitative and economic points of view. Previously a technique known as ultrasonic flow measurement a non-invasive type of measurement is widely used to calculate flow, because of its capability to avoid noise interferences in its output. Water metering is particularly important for municipalities since it forms the basis for much of their income through the sale of water to their consumers. Many countries currently lack proper water meter management, with many municipalities and bulk water suppliers not having the capacity to undertake and manage optimal and integrated meter calibration, replacement, reading and information management systems. Often the divided responsibility between billing and meter man agreement (typical of the institutional arrangements within most municipalities) results in poor billing, incorrect information capture, and poor maintenance. This is further compounded by the fact that where initiatives of water demand management and conservation are required, the data is not easily accessible to the departments responsible for this task, leading to the frequent lack of integration between domestic and bulk water metering. Conserving water is becoming increasingly important in the world as it faces a widening gap between ever reducing water supplies due to climate change, inefficiencies in agriculture, poor water governance, industrialization, urbanization and increased demand from population growth. It results in many environmental, political, economic, and social forces. There are number of major predictions that III world war might happen because of water. They say: “if you can’t measure, you can’t manage”. So, what exactly happening to the customer is where the associated water bill is managed to linked to the volume consumed, rather than a flat rate or a fee based on the size of property serviced. So, the one who is not using the water most of time have to pay the same amount that of the person using the water at max. This project solves the existing problem economically and efficiently

II.EMBEDDED SYSTEM

An **embedded system** is a controller with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today.Ninety-eight percent of all microprocessors manufactured are used in embedded systems.

Modern embedded systems are often based on microcontrollers (i.e. microprocessors with integrated memory and peripheral interfaces), but ordinary microprocessors (using external chips for memory and peripheral interface circuits) are also common, especially in more complex systems. In either case, the processor(s) used may be types ranging from general purpose to those specialized in certain class of computations, or even custom designed for the application at hand. A common standard class of dedicated processors is the digital signal processor (DSP). Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale.

Embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic light controllers, programmable logic controllers, and large complex systems like hybrid vehicles, medical imaging systems, and avionics. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large equipment rack.

The origins of the microprocessor and the microcontroller can be traced back to the MOS integrated circuit, which is an integrated circuit chip fabricated from MOSFETs (metal-oxide-semiconductor field-effect transistors) and was developed in the early 1960s. By 1964, MOS chips had reached higher transistor density and lower manufacturing costs than bipolar chips. MOS chips further increased in complexity at a rate predicted by Moore's law, leading to large-scale integration (LSI) with hundreds of transistors on a single MOS chip by the late 1960s. The application of MOS LSI chips to computing was the basis for the first microprocessors, as engineers began recognizing that a complete computer processor system could be contained on several MOS LSI chips. The first multi-chip microprocessors, the Four-Phase Systems AL1 in 1969 and the Garrett AiResearch MP944 in 1970, were developed with multiple MOS LSI chips. The first single-chip microprocessor was the Intel 4004, released on a single MOS LSI chip in 1971. It was developed by Federico Faggin,using his silicon-gate MOS technology, along with Intel engineers Marcian Hoff and Stan Mazor, and Busicom engineer Masatoshi Shima.

One of the very first recognizably modern embedded systems was the Apollo Guidance Computer, developed ca. 1965 by Charles Stark Draper at the MIT Instrumentation Laboratory. At the project's inception, the Apollo guidance computer was considered the riskiest item in the Apollo project as it employed the then newly developed monolithic integrated circuits to reduce the size and weight. An early mass-produced embedded system was the Autonetics D-17 guidance computer for the Minuteman missile, released in 1961. When the Minuteman II went into production in 1966, the D-17 was replaced with a new computer that was the first high-volume use of integrated circuits.

Since these early applications in the 1960s, embedded systems have come down in price and there has been a dramatic rise in processing power and functionality. An early microprocessor for example, the Intel 4004 (released in 1971), was designed for calculators and other small systems but still required external memory and support chips. In 1978 National Engineering Manufacturers Association released a "standard" for programmable microcontrollers, including almost any computer-based controllers, such as single board computers, numerical, and event-based controllers.

As the cost of microprocessors and microcontrollers fell it became feasible to replace expensive knob-based analog components such as potentiometers and variable capacitors with up/down buttons or knobs read out by a microprocessor even in consumer products. By the early 1980s, memory, input and output system components had been integrated into the same chip as the processor forming a microcontroller. Microcontrollers find applications where a general-purpose computer would be too costly.

A comparatively low-cost microcontroller may be programmed to fulfill the same role as a large number of separate components. Although in this context an embedded system is usually more complex than a traditional solution, most of the complexity is contained within the microcontroller itself. Very few additional components may be needed and most of the design effort is in the software. Software prototype and test can be quicker compared with the design and construction of a new circuit not using an embedded processor.

IOT

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects,

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animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

The definition of the Internet of Things has evolved due to the convergence ofmultiple technologies, real-time analytics, machine learning, commodity sensors, and embedded systems.[5] Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of Things. In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the "smart home", covering devices and appliances (such as lighting fixtures, thermostats, home security systems and cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smartphones and smart speakers.

There are a number of serious concerns about dangers in the growth of IoT, especially in the areas of privacy and security; and consequently industry and governmental moves to begin to address these.

III.PROPOSED SYSTEM

We are going to introduce a digital water meter. So that we can able to get the flow rate of each inlet through the digital flow meter and, we can able to generate the accurate water consumption bill. And, it has a special advantage of leakage detection, open tap detection, and no flow detection together with a message to the phone as an alert mechanism. **Node Js**

Node.js is an open-source, cross-platform JavaScript run-time environment for executing JavaScript code server-side. Historically, JavaScript was used primarily for client-side scripting, in which scripts written in JavaScript are embedded in a webpage's HTML, to be run client-side by a JavaScript engine in the user's web browser. Node.js enables JavaScript to be used for server-side scripting, and runs scripts server-side to produce dynamic web page content before the page is sent to the user's web browser. Consequently, Node.js has become one of the foundational elements of the "JavaScript everywhere" paradigm, allowing web application development to unify around a single programming language, rather than rely on a different language for writing server side scripts.

INTRODUCTION TO NODE

Node.js allows the creation of Web servers and networking tools using JavaScript and a collection of "modules" that handle various core functionality Modules are provided for file system I/O, networking (DNS, HTTP, TCP, TLS/SSL,or UDP), binary data(buffers), cryptography functions, data streams, and other core functions Node.js's modules use an API designed to reduce the complexity of writing server applications.

Node.js applications can run on Linux, macOS, Microsoft Windows, NonStop, and Unix servers. Alternatively, they can be written with CoffeeScript (a JavaScript alternative), Dart or TypeScript (strongly typed forms of JavaScript), or any other language that can compile to JavaScript.

Node.js is primarily used to build network programs such as Web servers. The biggest difference between Node.js and PHP is that most functions in PHP block until completion (commands execute only after previous commands have completed), while functions in Node.js are designed to be non-blocking (commands execute concurrently or even in parallel, and use callbacks to signal completion or failure).

Platform architecture

Node.js brings event-driven programming to web servers, enabling development of fast web servers in JavaScript. Developers can create highly scalable servers without using threading, by using a simplified model of event-driven programming that uses callbacks to signal the completion of a task.Node.js connects the ease of a scripting language (JavaScript) with the power of UNIX network programming.

Node.js was built on the Google V8 JavaScript engine since it was open-sourced under the BSD license, extremely fast, and proficient with internet fundamentals such as HTTP, DNS, TCP. Also, JavaScript was a well-known language, making Node.js immediately accessible to the entire web development community.

Industry support

There are thousands of open-source libraries for Node.js, most of them hosted on the npm website. The Node.js developer community has two main mailing lists and the IRCchannel #node.js on freenode. There are multiple developer conferences and events that support the Node.js community including NodeConf, Node Interactive and Node Summit as well as a number of regional events.

The open-source community has developed web frameworks to accelerate the development *of applications. Such*

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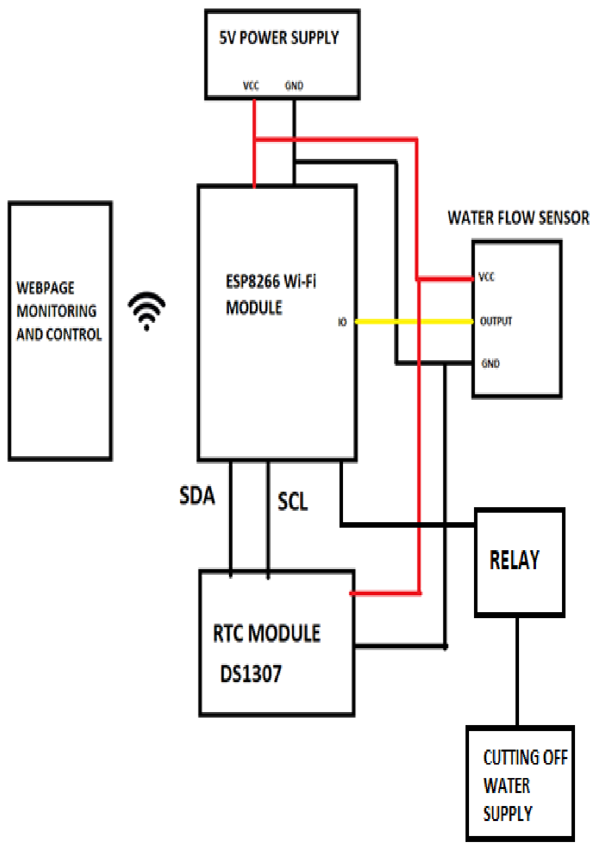
frameworks include Connect, Express.js, Socket.IO, Koa.js, Hapi.js, Sails.js, Meteor, Derby, and many others.
Modern desktop IDEs provide editing and debugging features specifically for Node.js applications. Such IDEs include Atom, Brackets, JetBrains WebStorm, Microsoft Visual Studio (with Node.js Tools for Visual Studio, or TypeScript with Node definitions,) NetBeans,Nodeclipse Enide Studio (Eclipse-based), and Visual Studio Code. Certain online web-based IDEs also support Node.js, such as Codeanywhere, Codenvy, Cloud9 IDE, Koding, and the visual flow editor in Node-RED.

IV. PROPOSED SYSTEM CIRCUIT DIAGRAM



Circuit Diagram

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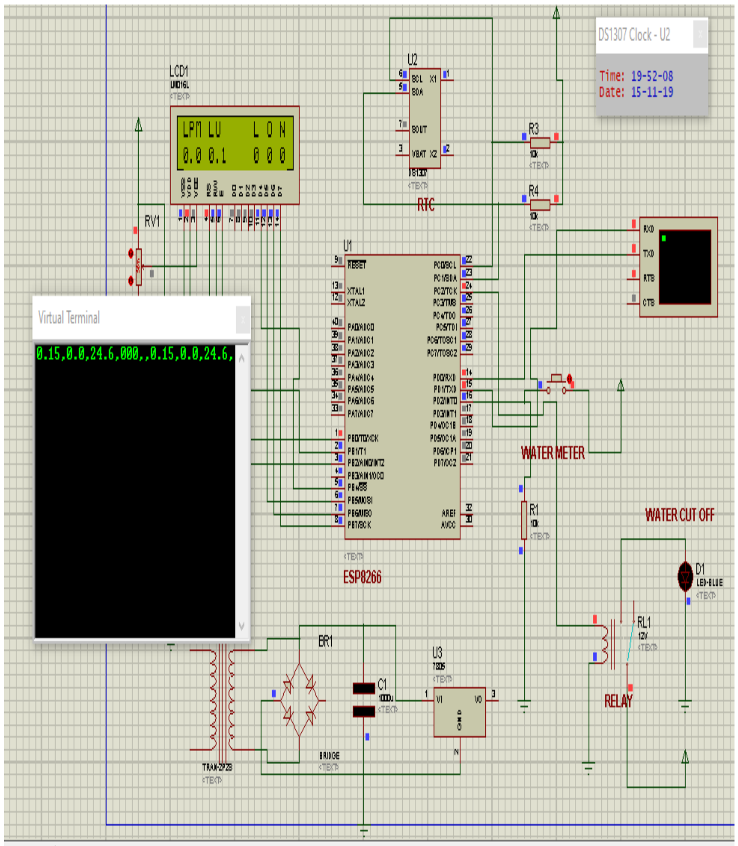
V.SIMULATION RESULTS & CIRCUIT DIAGRAM OF THE PROPOSED SYSTEM

The simulation of the project that is been done in proteus simulation tool which shows our actual setup is shown in fig 5.1



Proposed Simulation Circuit Diagram

HARDWARE SETUP

The hardware setup of the project can be seen in the figure below

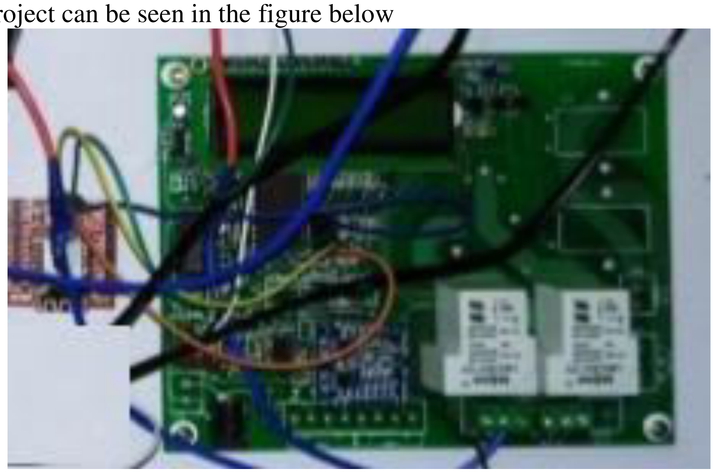


Figure 6.1Hardware Setup

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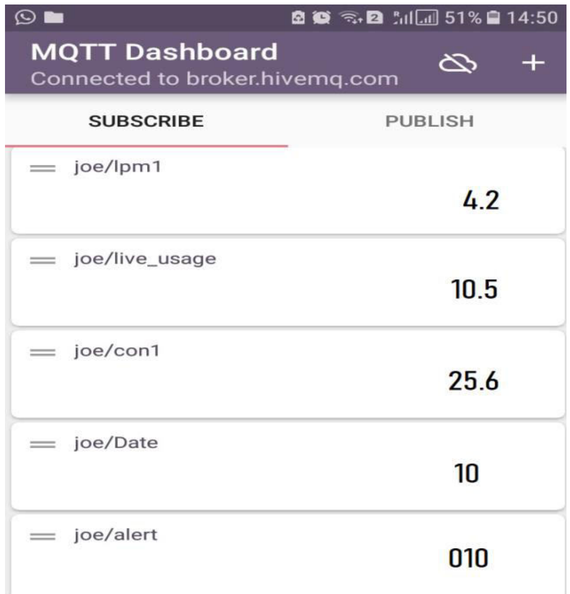
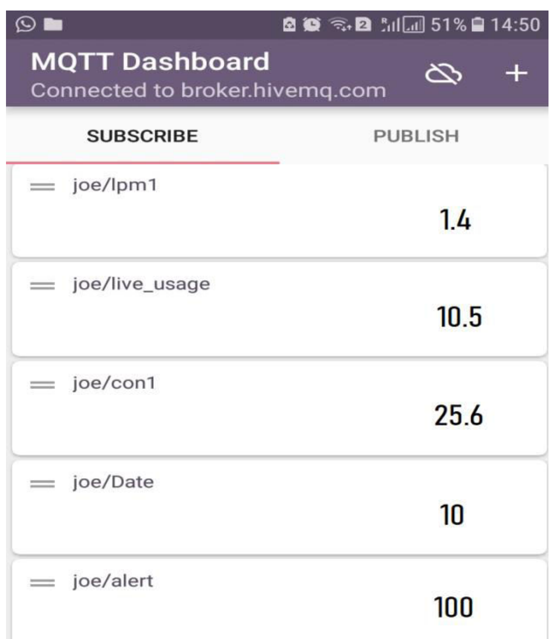
Whenever an open tap is detected the Alert gets generated in the mobile app as 010 and it can be seen as shown in the figure below



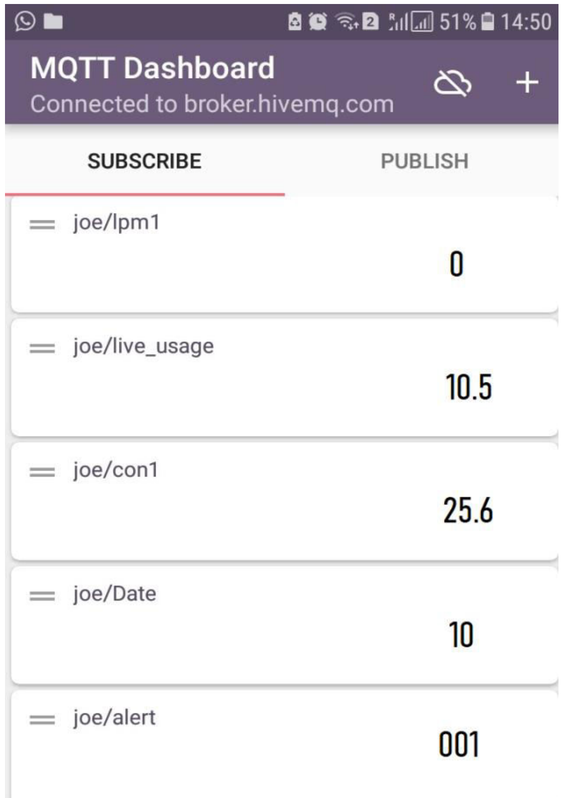
Open Tap Alert

Whenever leakage is detected the Alert gets generated in the mobile app 100 and it can be seen as shown in the figure below



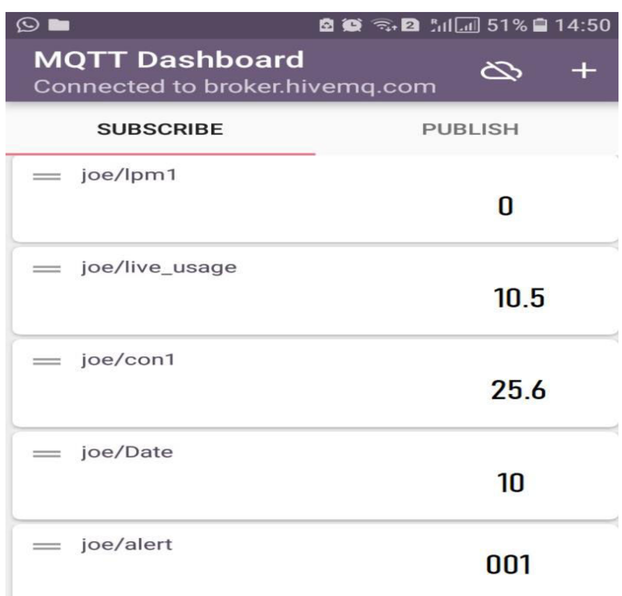
Leakage Alert

Whenever a no flow is detected the Alert gets generated in the mobile app as 001 and it can be seen as shown in the figure below



No Flow Alert

All the other parameters such as lpm, consumption and live usage are monitored through mobile app which can be seen as given in the figure below



Mobile App Monitoring

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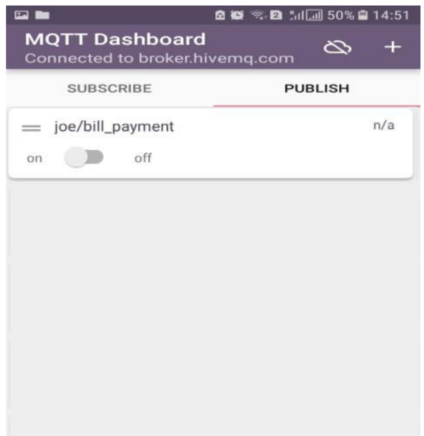
We can also control the water flow wirelessly which can be seen as given in the figure below

Wireless Control of Water



Thus, this project helps in effective conservation of water in terms of predicting leakage, opentap and no flow. Along with we can also view the real time water usage through mobile app from anywhere.

VI. CONCLUSION

Thus, by using this delineated idea, we can able to reduce the unnecessary use of water along with a reduction of leakage cause. Henceforth water metering is effective and efficient thus can prevent India from scarcity of water. So, in the final analysis, we will be able to save freshwater for future generation. We conclude that we can hope that we have a long way to end in DAY ZERO. Hence this system proves to be more affordable and economical to all citizens of India.

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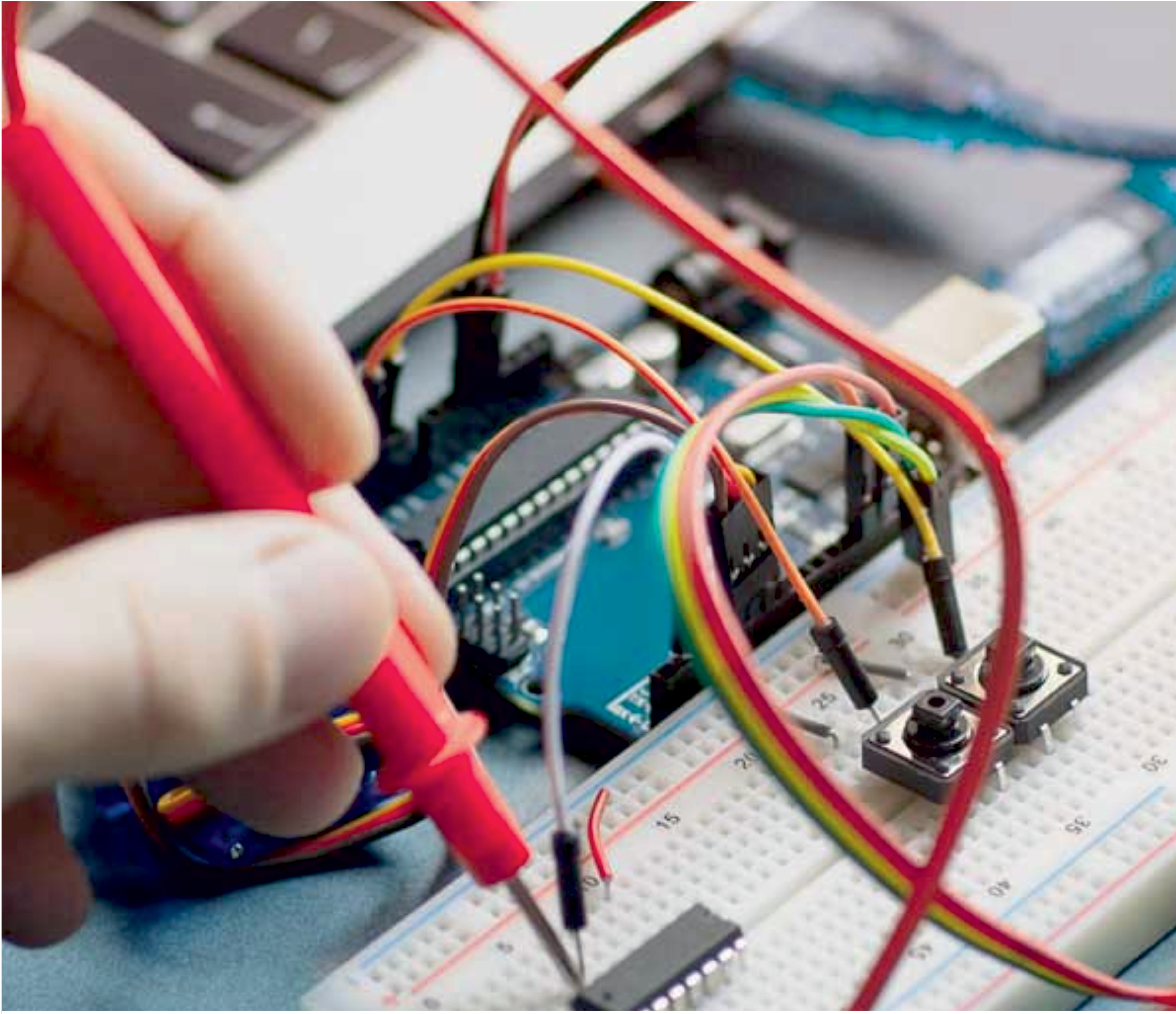

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