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Power-Efficient Gathering in Sensor Information Systems Protocol Using LEACH & GA

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ABSTRACT: A growing numorous research work are carried out. Several routing protocols have been developed to provide better performance for optimizing the network's energy consumption in WSN; most are based on clustering and hierarchical topology. The improved algorithm is simulated in MATLAB R2016b simulation tool. Simulation results in this paper indicate that the introduced protocol works better than LEACH through extending the lifetime of the WSN. Contention-free protocols like DEMAC, PACT, and LMAC, provide collision-free communication. Each node has pre-assigned time slots to transmit the data, but each node has to listen to its neighbors' time slots to synchronize. This may increase energy consumption. Contention-free protocols suffer from clock drift problems and require tight synchronization. Most of the protocols show better and efficient features for an application like surveillance. However, there are still many more challenges that need to be solved in the sensor networks like in MAC protocols; there is still need to find out a suitable solution for real-time support and energy efficiency because contention-based protocols are energy efficient.

KEYWORDS: CH, Leach, WSN, GA, Dead node,BCE-LEACH,Clustering.

I. INTRODUCTION

There are mainly two reasons responsible for the dynamic infrastructure. The first reason is the energy; the sensor nodes have limited power in the form of batteries. If the protocol is unable to balance the load among the nodes, the sensor node could die. It leads to a dynamic network structure. The second reason is mobility; in many scenarios after the deployment, sensor nodes are static, but sink can move within the network. It makes the network dynamics and the protocol that works for static sink may not be applicable for mobile sink [7]. In many applications, sensor nodes are required to know their location information. It is not feasible to enable all nodes with Global Positioning System (GPS) [5]. So the protocol should have to take the help of the techniques like triangulation-based positioning [6], GPS-free solutions [7], etc., to get the approximate location information. In the routing protocol with a static sink, the sensor nodes close the sink always forward a large amount of data; as a result, they die. Finally, the network is partitioned, and the sink can not receive any data. This phenomenon is known as the crowded center effect [8] or energy hole problem [6]. A mobile sink is used in the network to overcome this problem. The portable sink makes the network dynamics and routing becomes difficult. In this section, a study on the existing routing protocols with mobile sink is done. They are categorized and explained. The routing protocol with portable sink can be classified into hierarchical-based, tree-based, and virtual-structure-based

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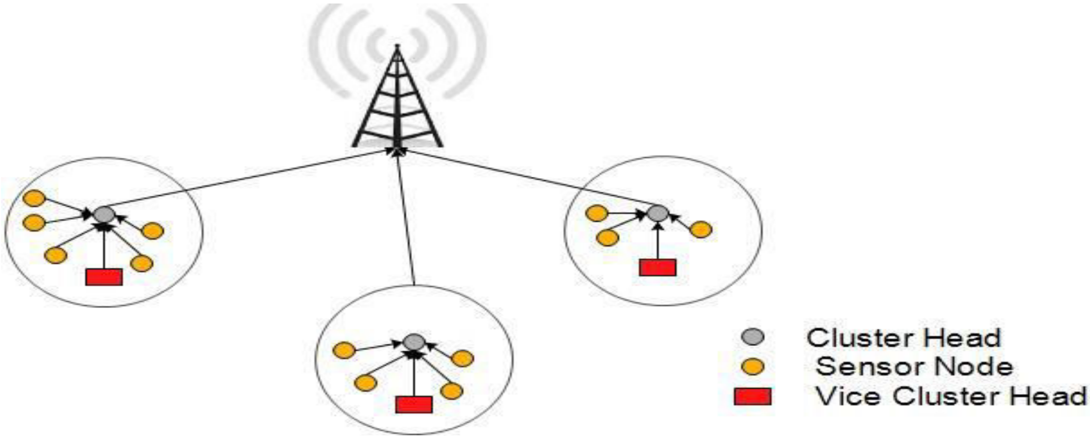

Fig. 1: Pegasis protocol model

II. BACKGROUND WORK

PEGASIS (Power-Efficient Gathering in Sensor Information Systems)

PEGASIS is an enhancement form also called prolongation of the LEACH algorithm. It serves to avoid the formation of several clusters. In the PEGASIS algorithm, every sensor node has overall news about its entire detection network and perfect knowing of the emplacement of neighboring sensor nodes. Every sensor node can deliver and take data since a neighbor and just one sensor node are elected in one channel at around to communicate with the receiver [5].

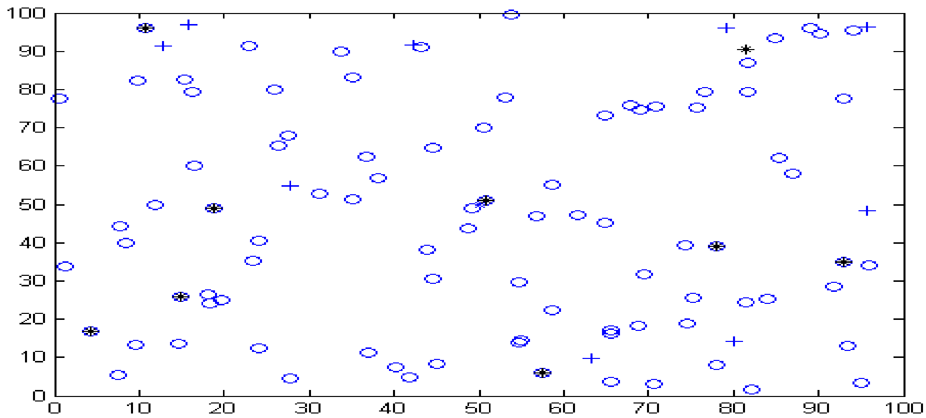

Fig. 2: Node placement of proposed WSN scenario

III. METHODOLOGY AND METHODS

The construction of an original PEGASIS protocol based on three steps: 1. Chain formation, 2. Leader selection, and 3. Data transmission. But the structure of the proposed EE-PEGASIS protocol is designed by the following step. Firstly all PEGASIS sensor network fields are divided into four parts. In the first part, node distributes in the network field, example; out of 100 nodes, 25 nodes are distributed in one part of XY coordinate, then provide energy and apply the greedy algorithm for chain formation, then select the leader node that is nearest to all nodes and sink node. Apply energy and distance formula for communication between the node and select sink node from energy and distance to complete PEGASIS sensor network formation. The remaining sensor node follows all processes and forms (100 100) PEGASIS sensor networks.

Energy Consumption Model

In the radio model, to send a b bit packet to remote receiver di meters, the channel of emission depletes $E_{Tx}(b, d)$ described in (4). Otherwise, to take a b bit packet, the reception chain depletes $E_{Rx}(b)$as defined in (6).

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$$E_{Tx}(b,d) = \begin{cases} b.E_{elec} + b.E_{fs}.d^2, d_i < d_0 \\ b.E_{elec} + b.E_{mp}.d^4, d_i \geq d_0 \end{cases}$$

$$d_o = \sqrt{\frac{E_{fs}}{E_{mp}}}$$

$$E_{Rx}(b) = b.E_{elec}$$

The signification of every indication in previous formulas is as pursue:

E_{Tx} : Energy depleted by sensor node for delivering b bit data from di distance between the emission chain and the receiver.

E_{Rx} : Energy consumed by sensor node when receiving b bit from the transmitter.

E_{elec}: Energy consumed in the electronics system.

E_{fs}: Energy depleted by the amplifier circuit for dispatching 1-bit data to the zone in the free space.

E_{mp}: Energy exhausted by the amplifier circuit for dispatching 1-bit data to the zone in the multipath propagation.

The energy consumption design is shown in Fig. 3.

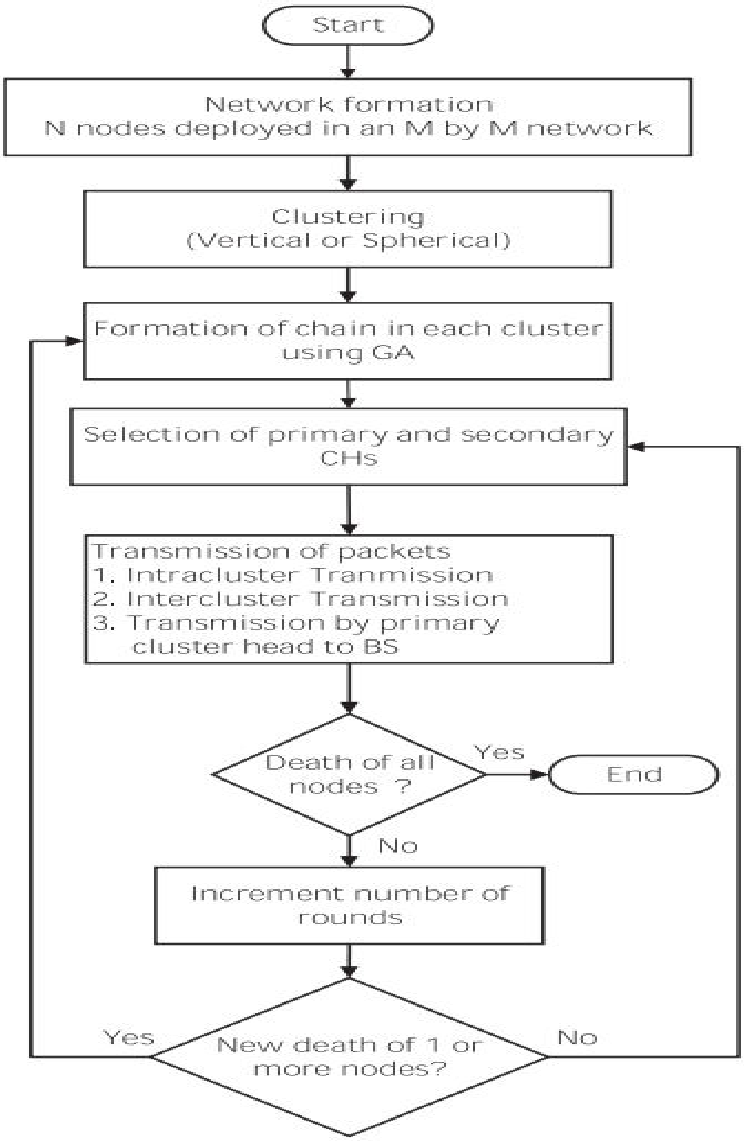

Fig. 3: Flow diagram of proposed energy-efficient Pegasis Scheme

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IV. SOFTWARE SIMULATION

Matlab 2014a has been used for the simulation of PEGASIS code. The performance of pegasis is evaluated by simulating pegasis code using random 100 nodes in a network. Fig. 4 shows a random 100 nodes network. The base station (BS) is located at (50,200) in a 200m x 100m field.

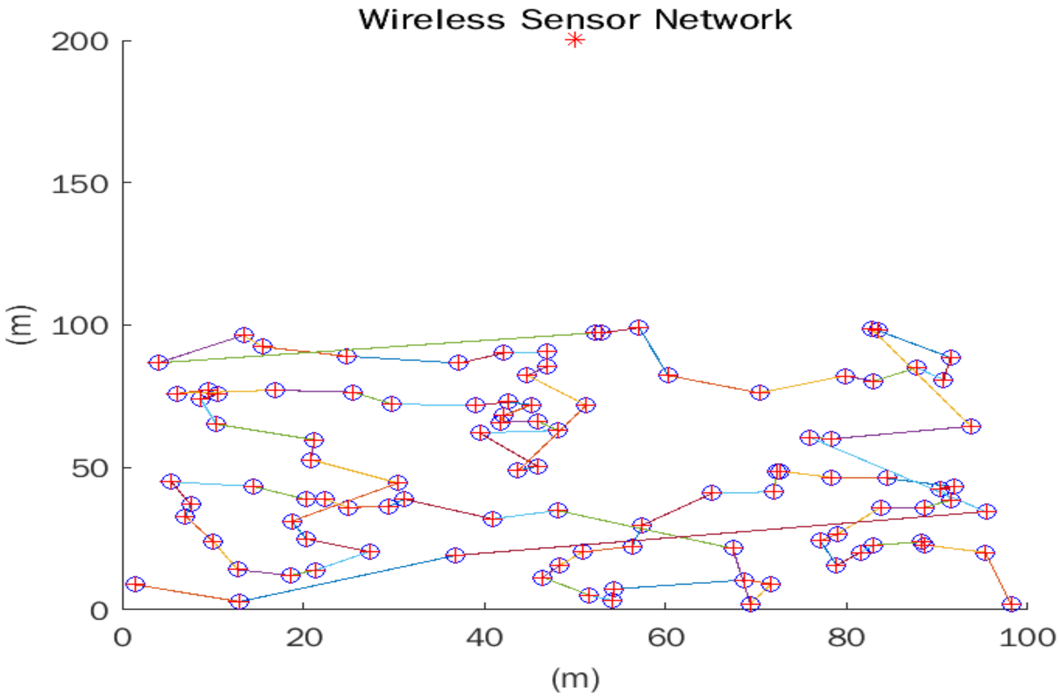

Fig. 4: Proposed scenario of Sensor Network

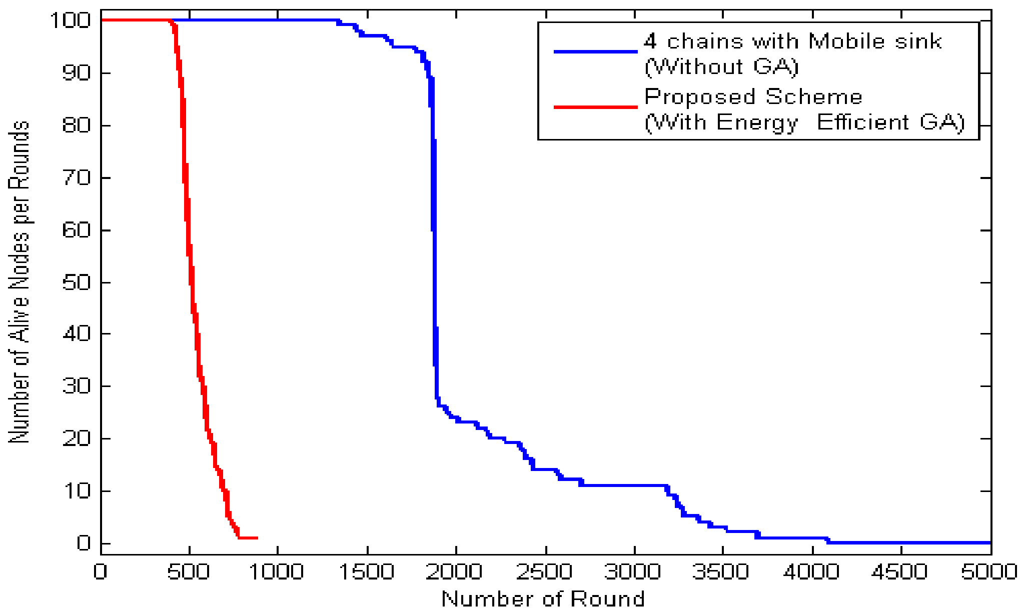

Fig. 5: Number of alive nodes per rounds vs number of rounds.

Figure 5 represents Number of alive nodes per rounds vs number of rounds for 4 chains with mobile sink without Genetic Algorithm and the proposed scheme with Genetic Algorithm. From this figure, we infer that the proposed scheme performs much better than without Genetic Algorithm based approach.

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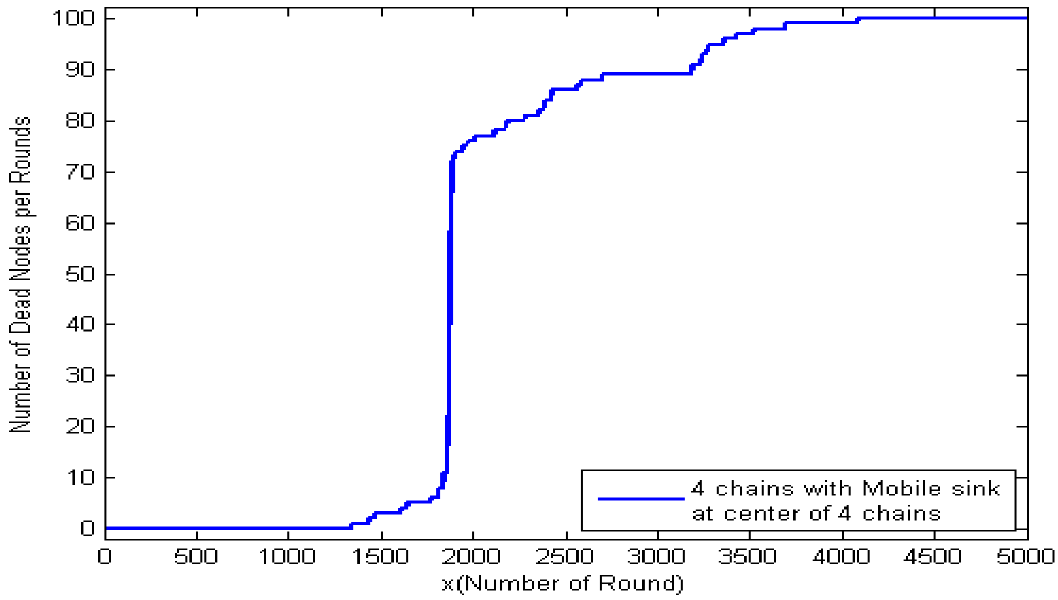

Fig. 6: Number of Dead nodes per round vs x(Number of rounds.)

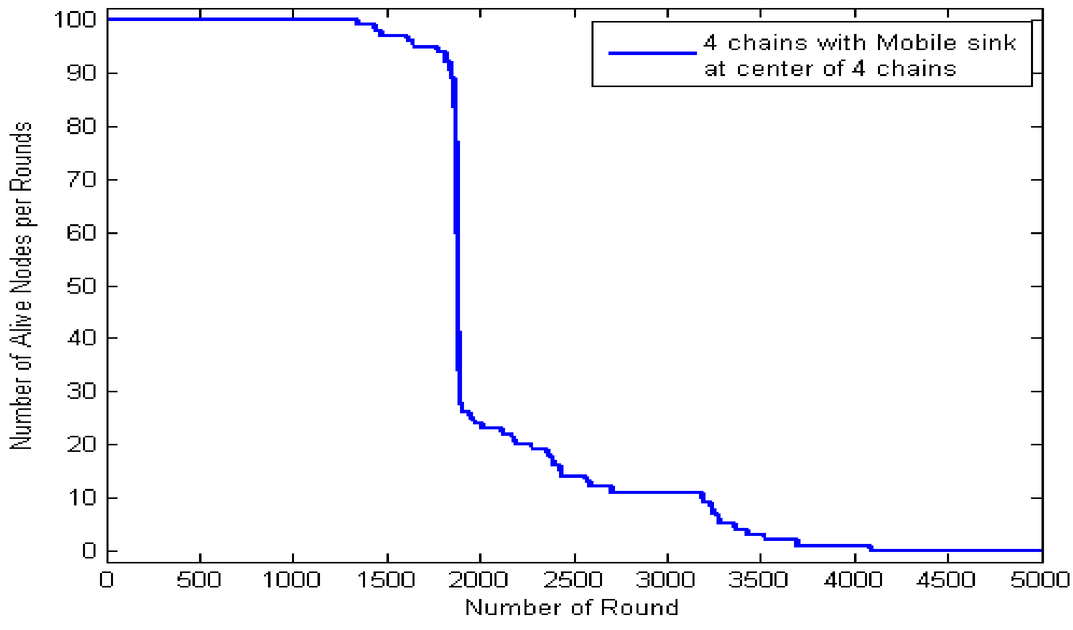

Fig. 7: Number of Alive nodes per round vs Number of rounds.

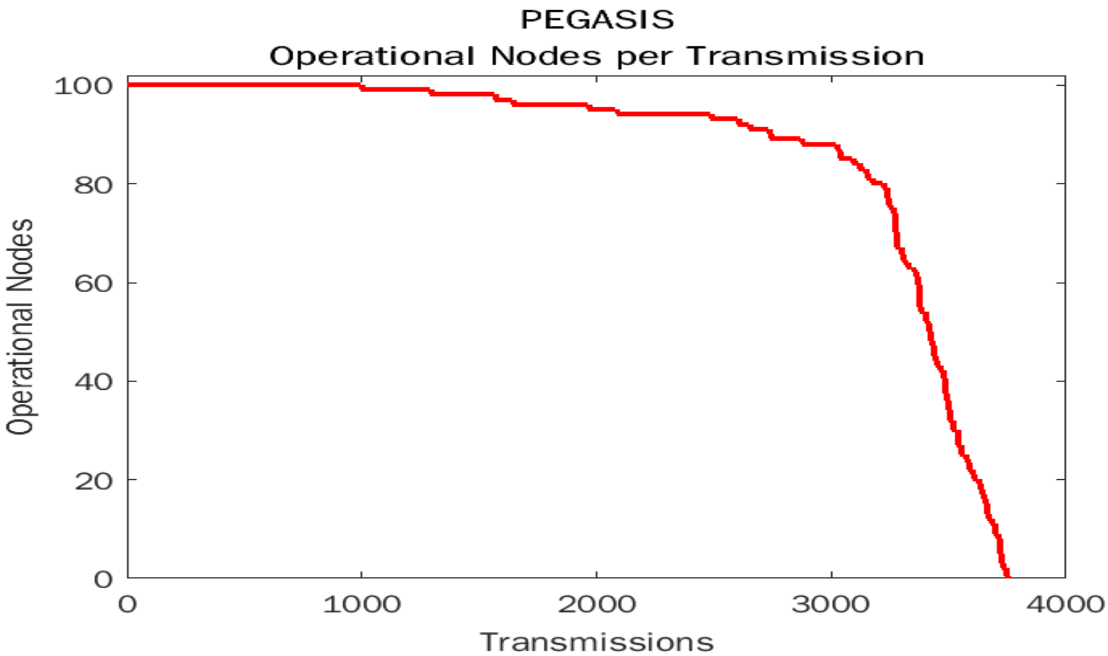

Fig. 8: Operational nodes per transmission vs number of transmission for PEGASIS protocol

V. CONCLUSION

Most of these routing protocols cannot consider all critical and essential metrics to increase the network's lifespan. The proposed protocol is based on the residual energy of sensor nodes to pick out cluster heads (CHs) which means only nodes with sufficient current energy can participate in CH selection. This work introduces an enhanced algorithm of the Low Energy Adaptive Clustering Hierarchy (LEACH) protocol called Balanced Current Energy-LEACH (BCE-LEACH), aiming to equity the power consumption of sensor nodes of the network due to extend the lifetime of the network. Then it focuses on both current energy and the distance toward the base station (BS) to select a parent CH with present energy greater than the mean energy of CHs and the distance to the BS is fewer than the average. These protocols have proved efficiently that they are more helpful in routing the essential data and conserving energy resources of a sensor (the batter) using different operation approaches. A detailed study of routing and MAC protocols is carried out in this thesis, which focuses on the energy conserving schemes used by protocols and their real-time support towards applications like surveillance. We have discussed the design tradeoff between energy preserving and quality of service support, results when protocols are tested on the assumption factors like latency, scalability, energy awareness, synchronization, etc., necessary for a wireless sensor network. Contention-based protocols like SMAC, TMAC, and TEEM use a single radio and change the radio state periodically to make the nodes energy efficient. STEM is also a contention-based protocol but uses two radios (data and wake-up radio) to make the nodes energy efficient. It allows the nodes to wake up the data radio when there is a need to process data. Otherwise, it stays in a sleep state. In contention-based protocols, transmission suffers from collision and delay because each node can access the shared medium.

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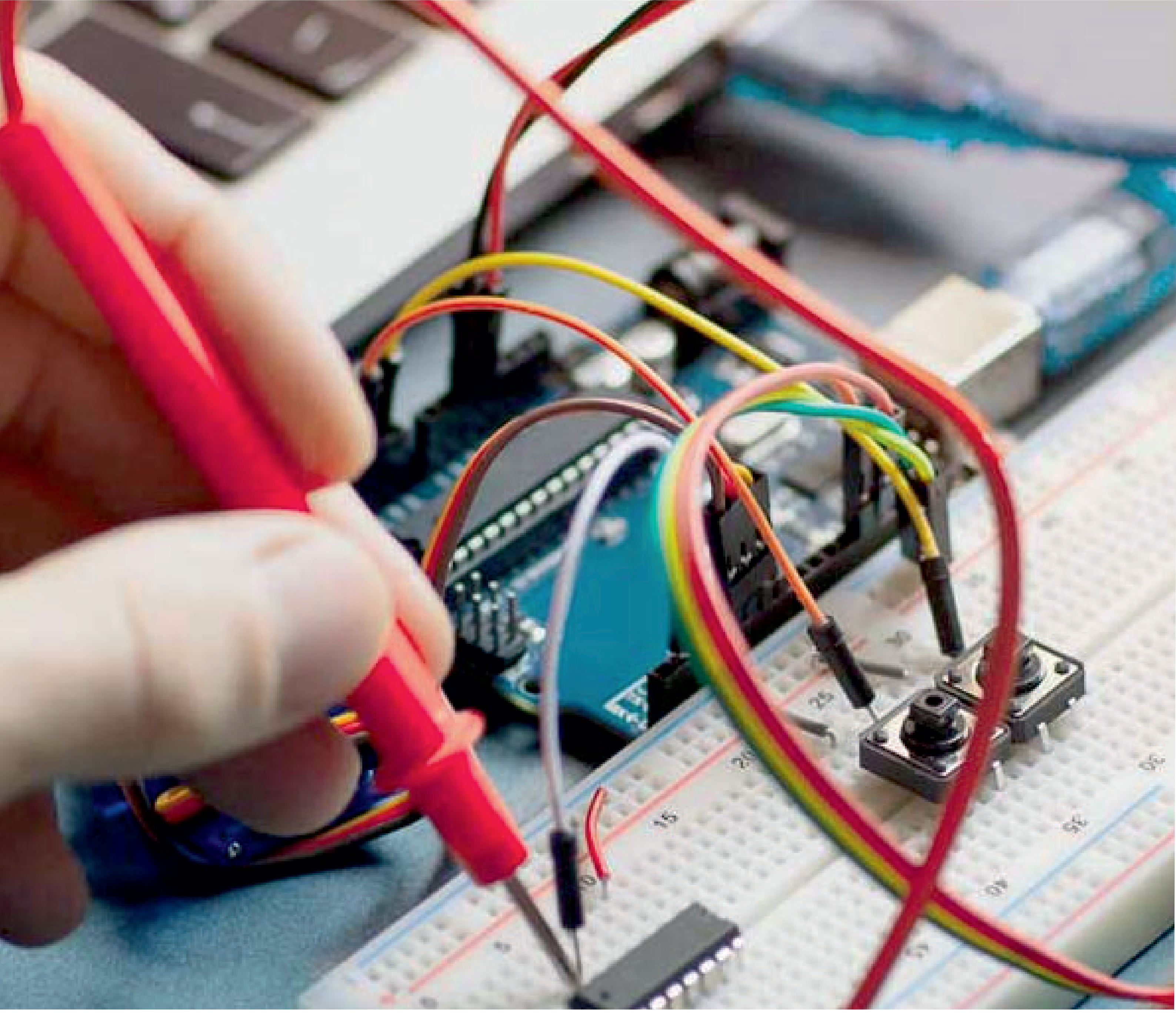

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