iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** III **Month of publication:** March 2021

DOI: https://doi.org/10.22214/ijraset.2021.33356

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue III Mar 2021- Available at www.ijraset.com

An Energy-Efficient Ant Routing for the Internet of Things Sensor Networks

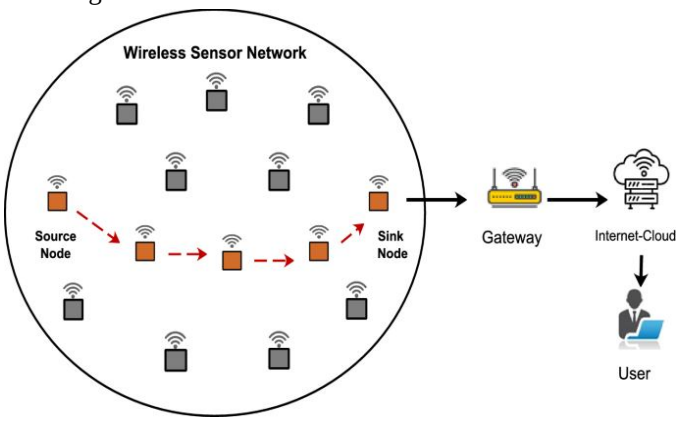
D. Arulanantham[1], P. Anitha[2], E S. Anusoorya[3], A. Arthi[4], B. Jayapriya[5]
[1]*Assistant Professor, Nandha Engineering College, Department of Electronics and Communication Engineering, Erode, Tamil Nadu, India.*
[2, 3, 4, 5]*UG Students ,Nandha Engineering College, Department of Electronics and Communication Engineering, Erode, Tamil Nadu, India.*

Abstract. ***The Internet of Things sensor networks announces the "things" network of physical objects that are fitted out with sensors, software, and other tools to link and interchange data over the Internet with other devices and systems. The Internet of Things is a system with sensors, base station, gateway and network servers. This system also has an independent mechanism by which any machine can control without any human efforts. IoT built automation has become very sensible, and it has been applied in all the areas such as industrial, vehicle, health care, end-user of electronics, etc. The less significant energy consumption sensors are expected to run independently for long periods. By considering this,so much ongoing researches on executing routing protocols for IoT. Energy perception is a vital part of IoT design problems. Reducing Energy consumption is well-organized as one of the key values in the development of routing protocols for the Internet of things. In this paper, we proposed an Ant system-based energy-efficient manner to select the routing path for the Internet of things and its applications. The Ant Colony Optimization algorithm was named the ant system and it was intended to find the shortest round voyage to tie a sequence of nodes. A real-time putting into practice sensor network using Arduino-based IoT architecture with the ESP8266 module was a design and calculated. To end with, analyze the principles of ant system-based energy-efficient routing protocol and their performance.***

Keywords: Internet of Things, Wireless Sensor Network, Multi-Hop Network, Ant Routing, Energy Efficiency

I. INTRODUCTION

The Internet of things sensor networks is the combination of wireless sensor nodes and a sink node. Nodes are wirelessly linked to one node to another node and to the sink. These systems are categorized as Low-power and Lossy Networks (LLNs), as individual nodes have some degree of energy and run in harsh atmospheres. Furthermore, the node wasn't in the traditional communication range with the base station node, the data it locking upto convey in a multi-hop manner. The wireless sensor networks are connected to the internet via gateway and its info is stored in the server's storage area. Figure 1 shows the structure of the Internet of Things sensor networks and users connected through the internet cloud servers.



Figuure1. General Structure of IoT Sensor Networks

In many IoT sensor networks, the sensor node i.e. Source node ahead of the recognized information to the Base Station for other responsibilities. It is accomplished through an active routing technique; routing is a method for identifying the best path among the nodes for data packet transmission which is essential in network communication. To raise the data transferring, trustworthiness, and energy expertise in WSNs, this classes the network more attainable.

The creation of a capable and knowledgeable routing protocol for the IoT sensor network poses numerous challenges including the lack of integrity of the wireless connection and restricted characteristics that usually insufficient in roles of QoS parameters. The network transmission range is also much more comprehensive than the single node radio range, so other nodes can be used as relays to access a particular destination node. This method of communication is known as Wireless Network Multi-hop routing. This need to create a multi-way routing protocol is a prerequisite that will guarantee latency, packet transmission ratio and low energy consumption in many IoT applications. Because of the limited energy associated with the sensor nodes, the data is accelerated to use all the nodes in the network and to change energy usage in the network. The sensor is placed ad-hoc in an unpopulated region without configuration. The constant movement of the base path pushes important for restoring tracks with the sink node. If a massive quantity of sensor nodes are used in certain situations, the neighbouring nodes are very close to one another. Ant-based routing is, therefore, best suited for the Wireless Sensor Network to invest in reusing channels in different areas. The volume of the sensor is usually correlated to an exact position that creates the normal method for WSN. Each node duty, however, recognizes its position and a source node must know the location of the endpoint. The single-hop network and multi-hop networks structure as shown in Fig. 2 & 3,

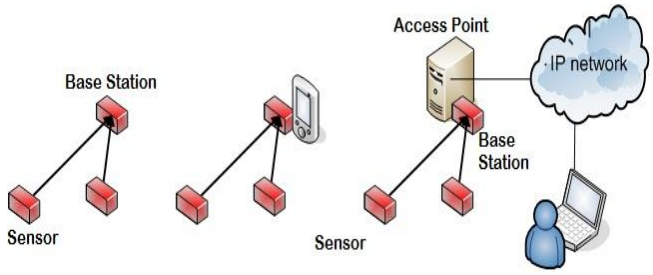


Figure 2. Single-Hop Wireless Sensor Network

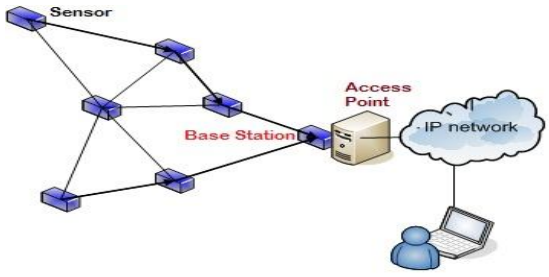


Fig.3 Multi-Hop Wireless Sensor Network

The Sensor networks topology will vary from a simple star network (Single-hop) to an advanced wireless multi-hop mesh network. The transmission method between the hops of the network can be routing or flooding. The Ant colony optimization algorithms were successfully applied to find the routing issues in the network. The rest of this article gives details about in section 2, reviews the existing methods in brief. In the next section 3, IoT-based WSN System Design to built sensor node path selection – Ant system based routing for the multi-hop network as a proposed system. Section 4 is the hardware design of a proposed network system using Arduino Uno. Section5 explains the results and discussion that expresses the performance of the proposed system with real-time implementation work, and the final section concludes the design view and its work.

II. LITERATURE SURVEY

The traditional WSNs is the less specific structure of small, affordable equipment, which can be used in multiple-hop mode to provide life-threatening monitoring and control [14] applications, including industrial, military, domestic, automotive and health care applications [10]. WSNs have few WS nodes across the sensor region and the distance from these two adjacent WS nodes is generally defined by a network design that maintains sensors long alive to satisfy the requirements [1]. Use the clustering technique based on the fuzzy [15] to identify the right cluster head. It aimed to ensure the smallest power during the transmission of information and to validate hub sites with relatively reduced energy consumption. It is also likely to increase the network's lifetime by choosing an appropriate routing system by using this procedure [7]. In order to reduce energy consumption in WSN [6], to Improve the Greedy Accelerating system offers a topographical, effective and confident route.

One of the most difficult areas in wireless network sensor research was the routing of sensor data. A current study into wireless sensor network routing focuses mainly on protocols that strengthen energy and are responsive to network life [8]. The logical addresses cannot be equipped with the sensor nodes, so a logical protocol based on addresses will be used for sensor networks [3]. The sensor node can pick up the light from a minimum of elegance in its inner surface and, by combining heads with obtainable energy, needs to set the sensor acquiring qualities and RF radiation [5]. They carry out a number of ant colonies that motivates this ACO algorithm [2][9]. Because of the low power supply, trying to maximize the ductility of WSN routing is critical [4]. Through the use of Wireless communications technologies is better value for money and less convenient. The above tends to lead to the virtual home idea, which seeks for protection and wellbeing persuasively. This home gateway allows the local Wi-fi module, Wi-Fi as well as Internet interoperability [11]. IoT applications rely heavily on a communications system for transition of information, and it is essential to validate it from the point of view of society decision adherence. Normative leak detection alert are mostly used on-site [12], but Sensing's knowledge was properly evaluated and used for gas recognition [13].

III. IOT SENSOR NETWORK SYSTEM DESIGN

A. Network Establishment

The sensors have recognised the data and directed it to the server via a routing scheme. Some users are then formed to collect data from online servers. The sensors can be placed at the user's home or on the ground remotely in such a situation that a conversation between the sensors and the respective base station needs to initiate the network. The second level network then moves to the next level of communication, which supports Access Point contact between the base station and the cloud Server. After all these connections between the devices have been established, users can retrieve the sensor data from their web servers when required.

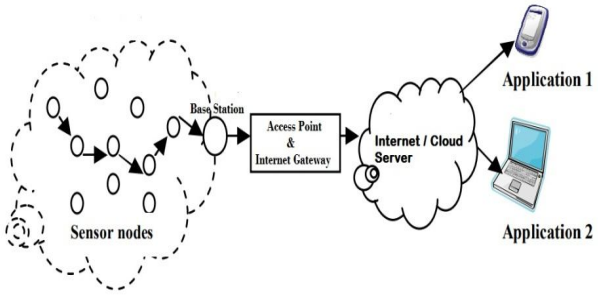


Figure 4. IoT Network Establishment

B. Network Parameter Calculations

A Sensor Node in the network consists of Power Supply, Sensor, Processing Unit, and Communication System, as shown in figure 5. A Sensor Node is accountable for physical world data collection, network investigation, data connection, and data synthesis from another sensor with its data.

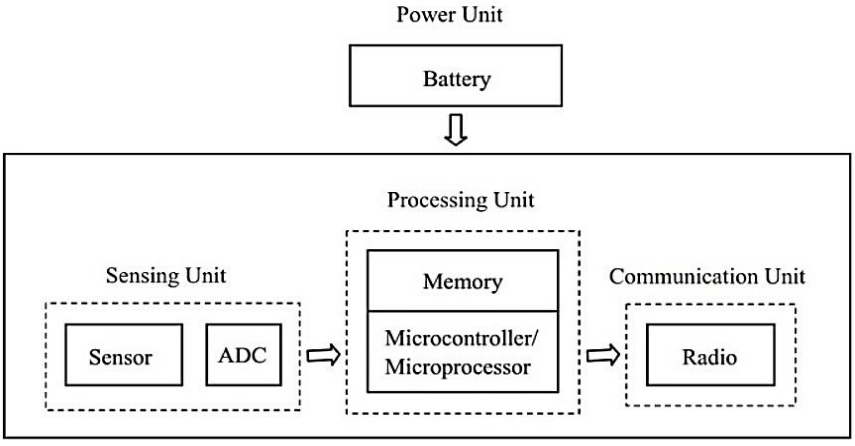


Figure 5. General block of Sensor Node

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue III Mar 2021- Available at www.ijraset.com

In this proposed system, Ant colony optimization based routing established. In the normal world, ants are primarily strolled unsystematically then upon the verdict, food returns to their colony while positioning down pheromone trails. If other ants discovery such a path, they are estimated not to roam at random but instead to monitor the trail, recurring and firming it if they eventually find food as shown in figure 6. Over time, however, the pheromone trail starts to fade away, thus decreasing its striking power. The more time it grosses for an ant to travel downcast the pathway and rear again, the extra time the pheromones have to dissolve.

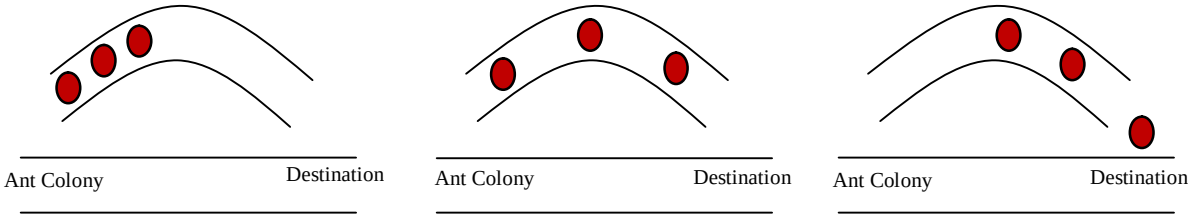


Figure 6 Ant Food Search

A short path, by assessment, acquires streamed above further repeatedly, and consequently, the pheromone concentration becomes greater on shorter paths than lengthier ones. Pheromone loss also has the benefit of escaping the merging to a close by optimum resolution. If there were no evaporation at all, the first ant's paths would incline to be extremely attractive to the following ones. In that case, the exploration of the key planetary would be controlled. Based on this above ant system study, the sensors are arranged in the network area by put on the event distribution establishment technique. Sensor nodes need to reach the base station by considering the shortest distance parameters between the node and the energy consumed to reach the destination. The calculation of these two parameters to achieve effective routing in the network. The Ant IoT routing flow diagram as shown in figure 7 based on this the sensor nodes are start to find the best path among the neighbours. In this network path finding process initially the network nodes are placed evenly distribution manner, the distance between the nodes are calculated by using the formula .Here, the sensor location is detected based on its location points and distance is computed as per the differences between their location points as

$$D = \sqrt{|x_1 - x_2|^2 + |y_1} \quad (1)$$

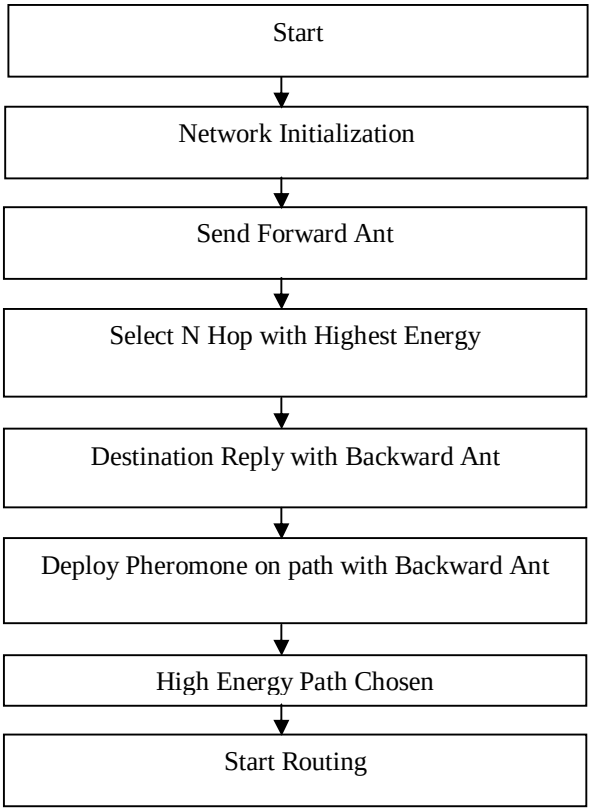


Figure 7 Ant IoT Routing Flow Diagram

Based on hop distance calculation choose the Minimum N-Hop value and update the forwarding table. The nodes Route Failure Checking is also done in the path identification process and then forwarding the node with minimum energy consumed. The energy aggregation calculation is also done and updating the forwarding table. The real-time implementation of multi-hop network architecture for analysis purposes, the network design is impossible due to the complication of circuit complexity, hardware components, cost of equipment, and hardware design making long-term compared to simulation. A simple single-hop network was designed using hardware components in the next section for a home automation application to monitor the LPG cylinder GAS leakage detection and disaster management purpose.

IV. HARDWARE IMPLEMENTATION

The wireless sensor network with IoT is designed for Smart kitchen automation, especially the Liquefied petroleum gas leakage detection and fire monitoring system, using ATmega328 development board with node mcu wifi module. The architecture of the proposed hardware implementation is shown in figure 6.

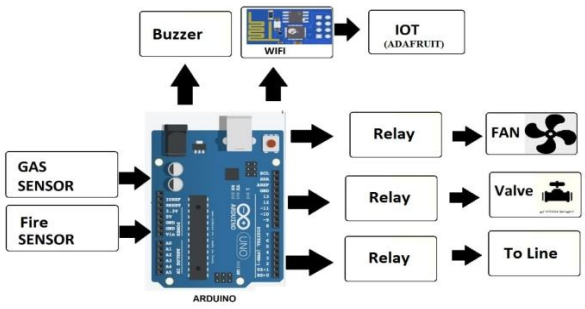


Figure 8. Architecture of Proposed Hardware implementation

The real time hardware designed for a gas leakage detection using mq3 gas sensors as shown in figure 9 and its updated sensing datas over the cloud server using Node mcu. A tany distortion condition happen in kitchen area this hardware unit send notification to the end users via cloud server. Here Ada fruit cloud server is used to send the notification for the end users as shown in figure 10.

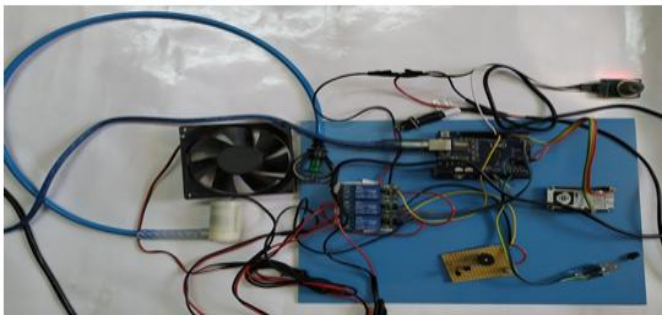


Figure 9.Realtime Hardware design of smart kitchen automation

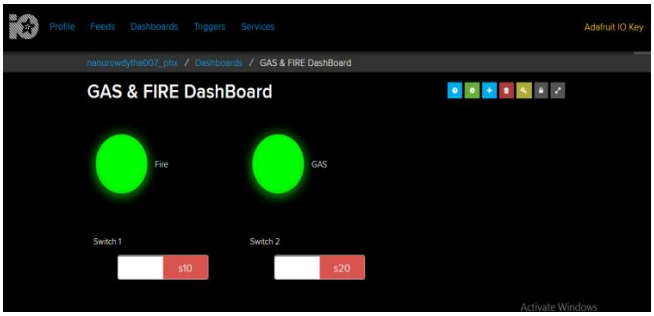


Figure 10.User End Notification form Cloud server

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue III Mar 2021- Available at www.ijraset.com

V. RESULT AND DISCUSSION

A simulation tool network simulator NS 2 was chosen, mainly intended for wired and Wireless networks implementation and performance evaluation of the above discussion.

There are various methods to measure the performance of a deigned network, as each network is different in environment and design. Performance can also be exhibited and simulated instead of measured. Some important parameters like throughput and end to end delay, Number of packets dropped, and average energy consumption are calculated from this above-proposed method.

End-to-end delay represents the time to transmit a packet from origin to destination across a network. It is expressed as,

$$End\ to\ End\ Delay = \frac{\sum \text{Individual Data Packet Network Delay}}{\text{Total no of packkects delivered}} \quad (1)$$

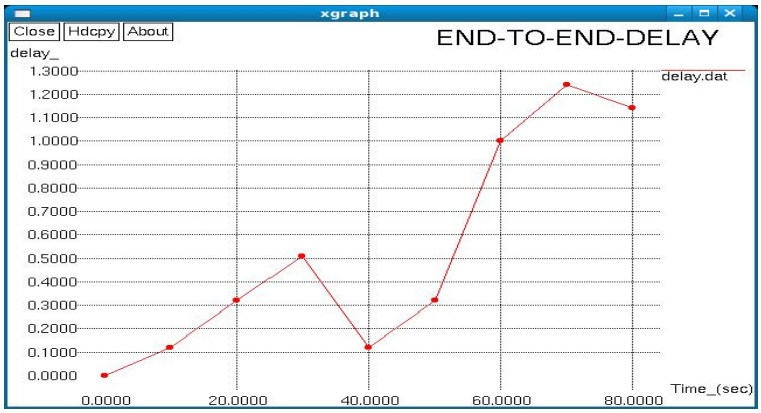


Fig.9 Simulation time Vs End to End Delay

Throughput is rate of accurate data transfer over a medium of communication is the throughput. Throughput is usually measured in bits per second (bit/s or bps).

$$Throughput = \frac{\text{No of Packet at Receiver}}{\text{Time (Sec)}} \quad (2)$$

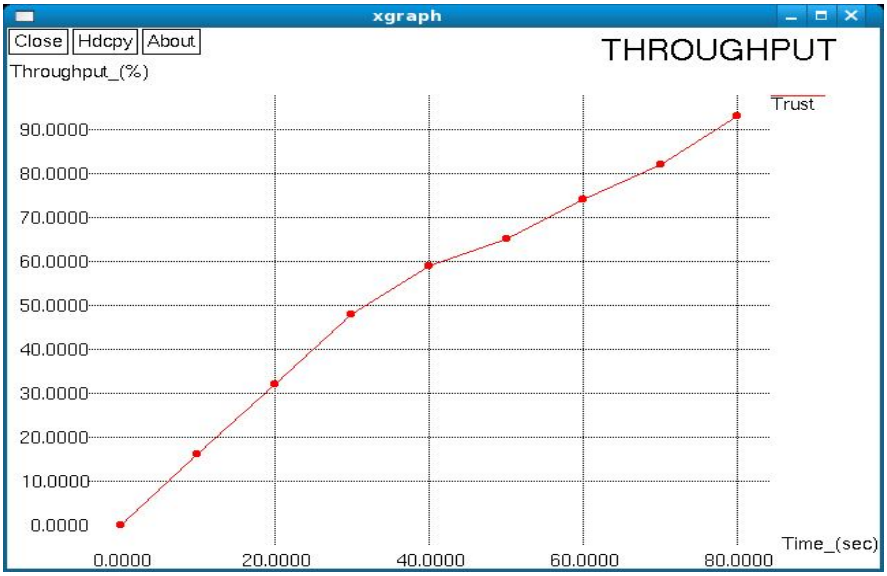


Fig.10 Simulation Time Vs Throughput

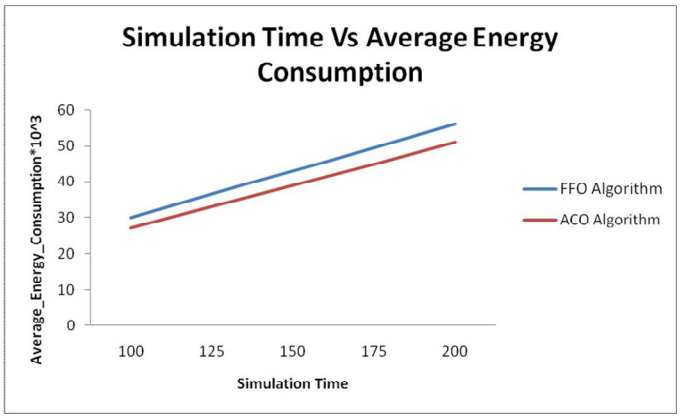


Fig 10. Simulation time vs Average energy consumption

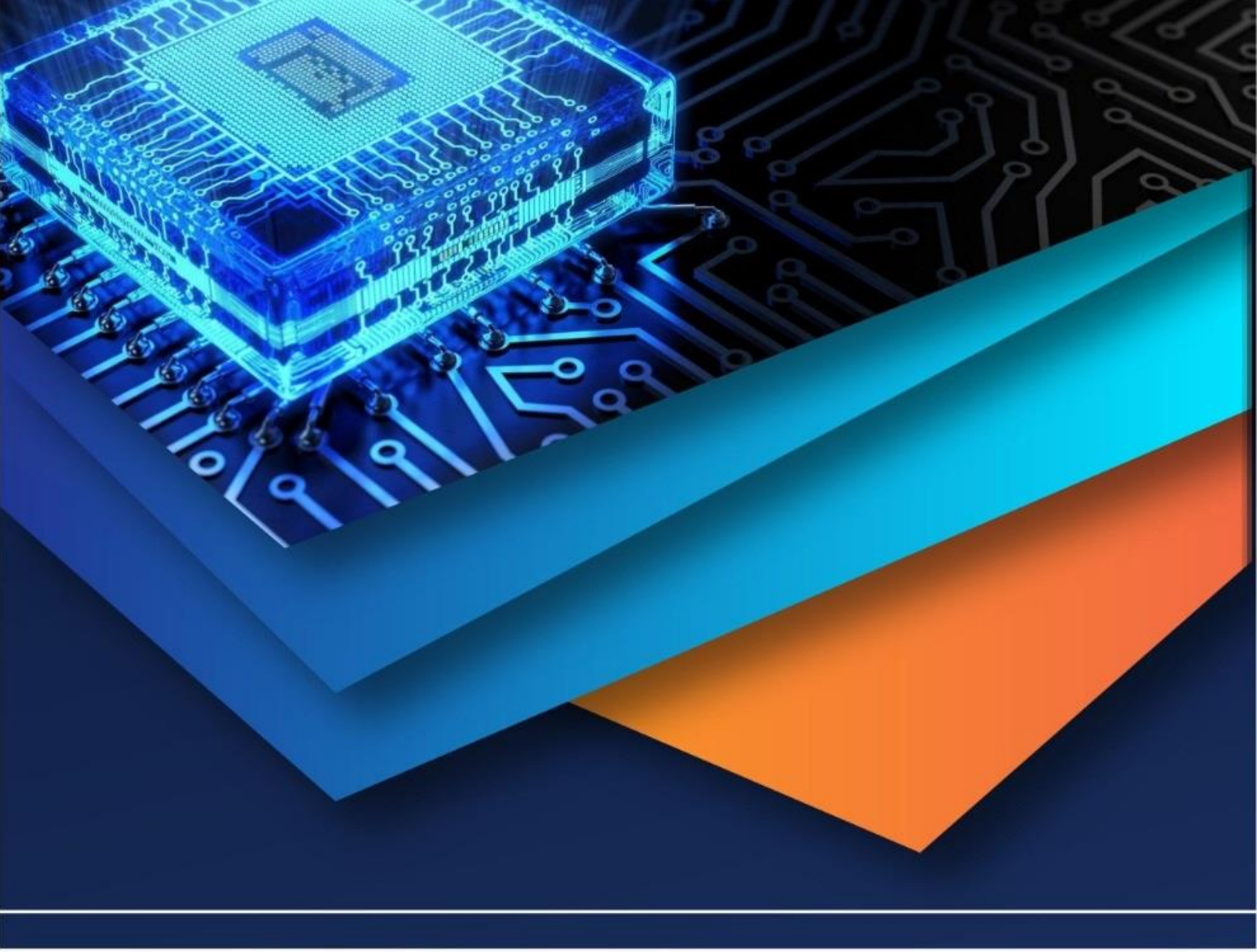
Here, Energy consumption is compared with fruit fly optimization algorithm. From this above study packet sending to the base station through the neighbor node is more efficient in compare to real time implementation. But in case of real-time implementation single-hop sensor network is designed and evaluated for smart home automation system gas leakage detection and management purpose; from this result, need to improve the channel accessing speed and bandwidth of the network also.

VI. CONCLUSION

In this proposed work, the state of IoT based wireless sensor networks was presented. The ANT based routing protocol of the multi-hop IoT network was studied. Implement the Arduino-based IoT single-hop network architecture and analyze home automation applications for the LPG gas leakage detection and management system. The executed results show that our proposed system serves well performance with the smallest energy consumption, delay, and better throughput. This study observes that in the future, to improve energy consumption in the IoT, the routing performance needs to develop a specific sensor node communication channel for effective bandwidth utilization for obtaining the best QoS parameters.

REFERENCES

[1] VidushiVashishth, AnshumanChhabra&Anirudh Khanna 2019, 'Deepak Kumar Sharma, Jyotsna Singh, 'An energy efficient routing protocol for wireless Internet-of-Things sensor networks'.
[2] C. G. M. Vishwas and M. Kiran, "A taxonomy on ant colony based routing algorithms for wireless sensor networks," 2015 International Conference on Applied and Theoretical Computing and Communication Technology (iCATccT), Davangere, India, 2015, pp. 886-891, doi: 10.1109/ICATCCT.2015.7457009.
[3] X. Liu, "Routing Protocols Based on Ant Colony Optimization in Wireless Sensor Networks: A Survey," in IEEE Access, vol. 5, pp. 26303-26317, 2017.
[4] Yi G., Jin M., Zhou Z. (2010) Research on a Novel Ant Colony Optimization Algorithm. In: Zhang L., Lu BL., Kwok J. (eds) Advances in Neural Networks - ISNN 2010. ISNN 2010. Lecture Notes in Computer Science, vol 6063. Springer, Berlin, Heidelberg.
[5] H. Zhang, X. Wang, P. Memarmoshrefi and D. Hogrefe, "A Survey of Ant Colony Optimization Based Routing Protocols for Mobile Ad Hoc Networks," in IEEE Access, vol. 5, pp. 24139-24161, 2017'
[6] RohiniAnandNimbekar 2017 Wireless sensor networking in the internet of things. International Advanced Research Journal in Science, Engineering and Technology, 4(2).
[7] D.Arulanantham, C.Palanisamy, ""DACASN: Dynamic ant routing-based channel accessing cognitive sensor network in Internet of Things", Int. journal of comm sys, Vol.34, iss.1, e4672, 2021.
[8] N.P.R. Kumar, J.B. Gnanadhas "Cluster Centroid-Based Energy Efficient Routing Protocol for WSN-Assisted IoT", Advances in Science, Technology and Engineering Systems Journal, vol. 5, no. 4, pp. 296-313 (2020).
[9] Zannou, A, Boulaaam, A & Nfaoui, EH 2019, 'A Task Allocation In IoT Using Ant Colony Optimization,' International Conference on Intelligent Systems and Advanced Computing Sciences (ISACS), Taza, Morocco, pp. 1-6.
[10] Shafiq, M., Ashraf, H., Ullah, A. et al. Systematic Literature Review on Energy Efficient Routing Schemes in WSN – A Survey. Mobile NetwAppl **25,** 882–895 (2020).
[11] Falguni Jindal, Rishabh Jamar, PrathameshChuri 2018 Future and challenges of internet of things. International Journal of Computer Science & Information Technology (IJCSIT) 10(2).
[12] Shweta Singh, Kishore Kumar Ray 2018 Home automatıon system usıng ınternet of thıngs.International Journal of Computer Engineering and Applications.
[13] Xiao Liu, Sitian Cheng, Hong Liu, Sha Hu, DaqiangZhang andHuanshengNing 2012 A survey on gas sensing technology. Sensor.
[14] Falguni Jindal, Rishabh Jamar, PrathameshChuri 2018 Future and challenges of internet of things. International Journal of Computer Science & Information Technology (IJCSIT) 10(2).
[15] Alkasingh,shubhangirathkanthiwar 2016 LEACH based energy efficient routing protocol for wireless sensor networks. International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT).



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY