

# Survey on Application of IoT and its Automation

Anju Markose<sup>1</sup>, Shebin Sharief<sup>2</sup>, J. Ramprasath<sup>3</sup>, Dr. N. Krishnaraj<sup>4</sup>

<sup>1</sup>Assistant Professor, Computer science and engineering, ICET, Muvattupuzha, Ernakulam, India

<sup>2</sup>Assistant Professor, Master Business Administration, ICET, Muvattupuzha, Ernakulam, India

<sup>3,4</sup>Assistant Professor, Information Technology, Dr. Mahalingam College of Engineering and Technology, Pollachi, India

Received: 30 April 2021;

Received in revised form:

25 May 2021;

Accepted: 13 Jun 2021;

Available online: 19 Jun 2021

©2021 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords** – *IoT, Networks, Cloud  
Networking, Wi-Fi Network, RFID, Home  
Automation System*

**Abstract**— *Life is getting more straightforward and easier to utilize as current technologies of automation continue to progress. Automatic systems are favored over manual ones in today's society. The internet has become an integral part of everyday life as its user base has grown tremendously over the past decade, and the Internet of Things (IoT) is the most current and rising internet technology. The Internet of Things is a rapidly expanding network of everyday objects, ranging from industrial robots to consumer gadgets that can exchange data and execute activities while you are away. A smart house, often known as an automated home, is a system that uses computers or mobile devices to monitor your home. Simple house operations and features are automated and accessible from anywhere in the globe through the internet. Its mission is to protect both human and natural resources. The home automation system varies from earlier systems in that it enables users to remotely operate the system from anywhere in the globe through the internet. We propose a Home Automation system (HAS) based on Intel Galileo that combines cloud networking and wireless communication to enable users to remotely control lights, fans, and appliances while also storing data in the cloud. The gadget will modify itself automatically depending on sensor data. This system is inexpensive and versatile, which enables it to operate a large variety of devices.*

## I. INTRODUCTION

The development and application of technologies that enable the production and delivery of products and services with little or no human interaction is known as automation. Thanks to the application of automation technologies, techniques, and procedures, many tasks that were previously performed by humans are now more effective, reliable, and/or rapid. Automation is used in manufacturing, transportation, utilities, security, facilities, processes, and, more recently, information technology.

Automation is typically used to reduce labor costs or to replace humans in the most menial or repetitive activities. Automation can be used in almost all industries and niches, but it is most common in manufacturing, utilities,

transportation, and defense. The IoT is a term that describes the process of linking ordinary physical objects to the internet, ranging from light bulbs to medical devices to wearable, mobile devices, and even smart cities. At many levels, the Internet of Things speeds up engagements and connections. It provides a high level of automation and power [1, 18, 19]. IoT also allows you to gather more data in one location, enabling you to make well-informed choices.

- Real-time tracking is now possible.
- Interactivity and Customization Efficiency Monitoring
- Exceptional perspectives

## II. AUTOMATION AND INTERNET OF THINGS

The IoT plays a significant role in industrial automation as it begins to research and utilize IoT ideas and technologies. IoT aids in the streamlining, collapsing, and development of efficient, cost-effective, and responsive system architectures [10]. To improve versatility and increase manufacturing, the main goal is to establish communication and cooperation in manufacturing field input/output, such as analyzers, actuators, and robotics that is free of conflicting perceptions. Industrial automation has used IoT to optimize commercial technology in big applications, such as PLCs replacing banks of relays.

### 2.1. Internet of Things Nodes

The Internet of Things (IoT) is the next big thing in technology, and it simply refers to internet-connected devices that can collect data. Many Internet of Things (IoT) gadgets blend easily into daily life by making routine chores easier. IoT products come in a range of shapes and sizes, and they can be used in a variety of industries [6].

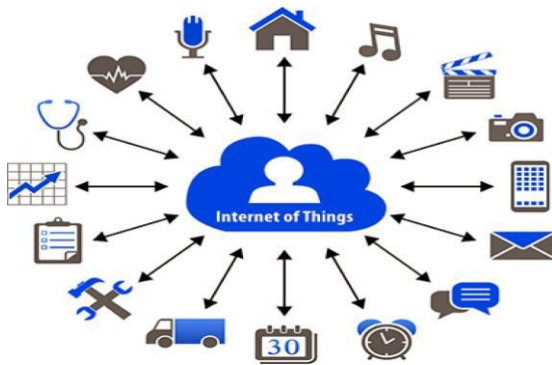


Fig. 1: IoT Application

Company and consumer lives can be smoother than ever before thanks to IoT technologies. Figure 1 shows with a help of IoT we can connect all the business applications [13].

### 2.2. Devices that Link with Internet of Things

Internet of things devices can be used in a diversity of areas, ranging from home automation to home functionality. This category includes smoke alarms, thermostats, smart music systems, and smart light bulbs [7]. IoT gadgets, on the other hand, can be used in the relationship with the human body, such as fitness trackers, smart body scales, and even baby monitors. IoT Gateway Devices connect the IoT Sensor Network to the Cloud Server via a communication link. IoT Gateway Devices are increasingly becoming critical components in the Internet of Things' adoption of next-generation devices (IoT) [2]. They help with networking protocol integration,

data storage and edge analytics management, and data flow security between edge devices and the cloud.

## III. IOT DEVELOPMENT KITS FOR INDUSTRY

Engineers and solution architects can utilize Industrial IoT Development Kits to create a complete, high-quality design environment that will accelerate the development and production of IoT applications. These kits may simply change any development/industrial area into a production-ready unit. The IoT Development Kit provides a choice of hardware platforms to meet a wide range of IoT application needs, ranging from compact, low-power ARM-based designs to powerful multi-core Intel Atom gateways of the newest generation. Advantech Co. LTD, Congatec Asia Ltd., ADLINK Technology, and ICOP technology are just a few of the companies that include IoT-related devices and products [8].

Advantech Co., Ltd offers high-end, cutting-edge products, services, and solutions. This company sells Internet of Things (IoT) products, as well as computers, gateways, and industrial IoT creation kits [9]. Embedded systems, IoT Wireless I/O Modules, automation products, and global logistical assistance are all available from Advantech. This firm specializes in the design and manufacture of high-performance computing platforms.

Congatec Asia Ltd is a leading provider of Internet of Things gateway devices. Industrial automation, telecommunications, transportation, and test and measurement are just a few of the areas and applications where this company's products might be used. The organization's products are made in accordance with current quality standards. Congatec Asia's IoT Gateway Devices are simple to configure and instal in the field. OEMs get a pre-configured, pre-certified IoT gateway that can link a variety of heterogeneous sensors, actors, and systems to cloud-based services fast and easily [3].

ADLINK Technology Inc offers Industrial Internet of Things (IoT) solutions to the automation, medical, transportation, and government/defense industries. ICOP Technology manufactures industrial embedded computers, embedded controllers, IoT Development Kits, industrial panel PCs, and other control system automation components. Industrial IoT Development Kits from this company include with sample code, minimal power usage, and a touch screen LCD, and stackable wireless networking. The Vortex86EX low-power consumption x86400MHz CPU (VEX-SOM) from DMP is combined with DIGI's XBee module in these Industrial IoT Development Kits. The VEX-IOT-DEV kit also offers balanced computing performance with 128MB DDR3

device memory and secure wireless networking for your computers.

Subsequently the tenure "Internet of Things" was devised in 1999, it has generated a lot of discussion about its potential influence on our individual and professional life. The buy and transportable to the way producers control and handle portfolio towards agriculturalists maintain a record of their current stock, the Internet of Things has revolutionized our lives in many ways. It's progressed from a crazed notion to a vital truth. Many of these developments are related to development drivers such as pervasive computing, widespread procedure of the Internet Protocol (IP) / logical layer, and the continual rise of information processing, among others [4, 17]. By 2020, Gartner estimates that 20.4 billion nodes will be associated to the Internet of Things. Notwithstanding the aids it offers, it is still a somewhat perplexing term.

IoT is a vast, digitally linked cosmos comprised of billions of physical devices located around the globe that gather and share information in their use and environment. These products are connected to the internet, outfitted with software, sensors, and other hardware that enables them to interact with other devices through the internet [5]. The internet of things expands the reach of the internet further than computers and mobile devices to everyday objects such as light bulbs, locks, smart microwaves, wearable fitness devices, advanced industrial equipment, and self-driving cars, enabling them to perform more analytical and computational tasks.

#### IV. AUTOMATION AND IOT NODES TOGETHER

While the internet of things has many applications, to link devices to the internet, it relies on key technologies and components, they are:

- Sensors to accumulate information from the atmosphere for processing by the IoT device.
- IP addresses are used to connect and identify devices in the Internet of Things system.
- Actuators allow devices to react to information from their personal devices as well as link input.
- Data from multiple devices is connected to the cloud via an IoT gateway. It also unifies the node protocols into a single customary protocol and eliminates redundant information gathered by the nodes.
- The cloud software will collect and process all data from IoT devices.
- The GUI is where customers acquire information from systems so they may issue commands that

the gadgets require. All of these aspects are linked through automation, which confirms that procedures function efficiently deprived of the need for human intervention.

##### 4.1. The Benefits of Automation in IoT

IoT-enabled automation provides several benefits to the business processes. Uptime has increased. The amount of time your company is open or operational is referred to as uptime. Employees arrive and depart at predetermined intervals, therefore the industry determination individual be exposed for a limited amount of hrs. Per day unless their shifts coincide. There are no time limits while your industry practices are automated, allowing you to operate seven days a week, 24 hours a day. Your employees would be able to focus on higher-level tasks rather than tedious, manual labor.

Automation can save time and money in factories when engineers repair defects in machinery or other equipment due to the fact that automated programming can identify the particular font of the defect and alert professionals consequently they can rapidly repair it and get everything endorsement and organization.

##### 4.2. Sensors and Scanning Technologies

Automation and IoT add intelligence to supply chain and asset management. These aid businesses in supplementing existing technologies such as barcodes with passive radio-frequency identification (RFID) tags for cycle counting or a global positioning system (GPS) for fleet and equipment administration are also viable options.

The efficiency of agency constructions can also be improved by automating eco-friendly necessities are lighting, moisture regulation, and other elements. There is no need to configure the smart devices once the bots have learned the behaviors and interests of the employees in each part of the facility. Lights will only turn on if required, and the appropriate temperature will be determined by the setting, resulting in important electricity charge investments.

##### 4.3. Improve Safety Enforcement

The Internet of Things (IoT) helps workplace safety in a variety of ways. If sensors are installed on several assets in the workplace, they will identify impending component flaws are detected and keep workers are notified, preventing employee harm caused by avoidable conditions. IoT and automation allow better enforcement for companies dealing with perishable goods, whether they are manufacturing or retailing, by ensuring that refrigerated food items do not surpass or fall below FDA temperature thresholds. They will assist in ensuring that consumers receive goods that are suitable for human

consumption, as well as allowing for prompt response to any issues that occur in order to avoid recalls. The Automation and Internet of Things combined solutions can provide manufacturing data to reduce the chances of equipment incidents and enhance efficiency in factories where they have already-automated machine maintenance and diagnostics.

#### 4.4. Enhance Access Management

To power protection systems, IoT and automation will work together. An integrated solution will recognise authorised individuals and doors to high-risk places, such as bank vaults, should be opened and closed on a regular basis. The technologies may also be used to restrict or allow access to specific machinery. IoT and automation can help with enforcement, performance, protection, and other long-standing issues in this way.

#### 4.5. Enhance Customer Insights

Sensors and beacons are ideal for retail businesses because they yield useful information about consumer behaviour and aid consumers in many ways, such as offering directions to locate items and helpful hints for looking things up.

#### 4.6. The public Sector's Activities

Governments and service-related companies will benefit from IoT and automation in a variety of ways. In the public sector, IoT-enabled apps can assist with traffic control, city government, public safety, and resource management.

#### 4.7. Advantages in Health Care

IoT devices could help doctors and emergency responders keep an eye on their patients from afar, particularly if they're in a risky position are showed in Figure 2 [15]. IoT systems can be implemented in medical managers maintain track of assets like hospital bed availability [25, 26].

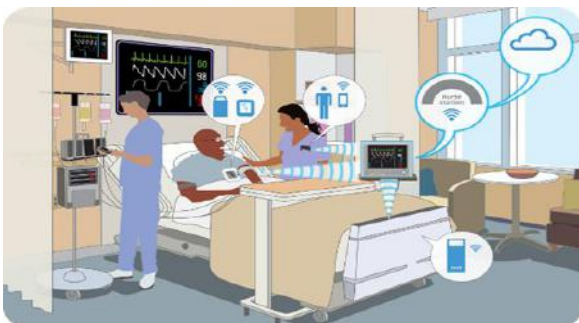


Fig. 2. IoT in Health Care

#### 4.8. Agriculture's Advantages

Smart farming technologies may be used by farmers, particularly those with large-scale operations, to remotely monitor agricultural fields and manage irrigation systems are showed in Figure 3 [16]. Current stock holders may use apps for the Internet of Things that are wireless to get information about their cattle's health and well-being, such as when they're ill, to avoid disease spread, or when they're about to give birth, and where to look for them.



Fig. 3. IoT in Agriculture

#### 4.9. Product Advantages

Automation and the Internet of Things have the potential to dramatically benefit consumers. Wearable are becoming more popular, ranging from smart watches and fitness trackers that help users better understand their health to smart speakers such as Google Home that make information simpler to get, set timers, and even play music. Smart refrigerators deliver low stock notifications, smart light bulbs make it seem when you're not home, smart plugs save energy and money, and smart thermostats keep the house warm till you return. These are simply iceberg tips in terms of possible IoT and automation applications.

Since the phrase "Internet of Things" was created in 1999, there has been much debate about its possible influence on our personal and professional lives. From how we purchase and travel to how companies monitor and manage inventories to how farmers keep track of their animals, the Internet of Things has revolutionized our lives in many ways. It's moved from crazy concept to fundamental fact. The emergence of omnipresent computing, widespread usage of internet protocol (IP), and ongoing expansion in data analytics, among other reasons, all led to this. By 2020, Gartner expects 20.4 billion devices will link to the Internet of Things. Despite the advantages, it's still a rather baffling phrase.

#### 4.10. IoT Effect on Automation

The Internet of Things encompasses anything from consumer electronics to factory-connected machinery to



industrial assets such as computers, robots, and staff in smart factories. It helps automation companies intensify operations and increase efficiency by bringing several improvements. For automation, IoT principles and technologies must be implemented. Its key purpose is to keep manufacturing inputs and outputs linked at all times. At the same time, the situation necessitates the interconnection of several complex and sophisticated devices. This means that supply chain monitoring and management, as well as the management of distributed teams, should be prioritized.

#### 4.11. There is no Human Involvement

Up until recently, the primary goals of automation were to boost efficiency and lower costs. Owing to the decrease in human interaction, both goals have become achievable—machines run 24 hours a day and do not require holidays or benefits. The automation industry's emphasis has changed. It's used to improve product quality and versatility by making manufacturing processes more practical and safe for humans. Human-to-human and human-to-computer experiences can be reduced by IoT technology. This method not only lowers staffing costs, but it also eliminates potential vulnerabilities and errors. Connected devices are self-contained and use two types of hardware. The first is a sensor, and the second is a piece of equipment that converts an electrical impulse into a physical result. It's difficult to predict how the Internet of Things would affect industries and human involvement at various stages of manufacturing. Would artificial intelligence be able to fully replace humans? Now we can see that, in addition to a slew of advantages, IoT also carries with it a slew of problems that have yet to be resolved. Software Defined Networking with IoT will lead better resources management and mischievous node entry in IoT systems can be detected and moderated using SDN [6, 7, 8, 23, 24].

#### 4.12. Prospects for Growth

IoT encompasses a wide range of innovations and services, combining them into a single, well-connected ecosystem. Blockchain, augmented reality, virtual reality, big data, cloud computing, machine learning, and more are all gathered under one roof as part of a larger image. The Internet of Things has evolved from a futuristic phenomenon to a regular part of our lives, infiltrating our cars and homes and even our clothing. By 2017, the demand for connected smart devices had grown to 7 billion people, accounting for the entire world's population. By 2020, there will be approximately 20.4 billion linked devices on the planet. In 13 years, that's more than \$450 billion.

#### 4.13. Smart Products Have a Wide Market

People are now more connected than ever before thanks to devices and data services. Owing to many fair barriers, the diffusion of technology across the world is uneven. Europe, Asia, and the United States are our flagman areas. However, even in communities with advanced technological infrastructure and a strong demand for smart services, risks such as security concerns remain, and many potential consumers are uncertain to fully adopt IoT.

## V. THE FUTURE HOME

While large companies and governments appear to be the primary users of IoT technologies, customers now have access to them as well. Smart watches, self-driving vehicles that are autonomous and smart homes are showed in Figure 4 [14]. A smart home is a grouping of wired devices that follow a set of laws. Some devices are pre-installed, while others can be added later. The most popular sensor types are optical, humidity, water quality, gas, image, noise, temperature, and motion detectors. A smartphone app can be used to connect to the network from a distance. The remote dashboard would connect devices and sensors, allowing all of the house's critical processes to be handled and monitored. For example, lighting can be changed according to the time of day and your preferences, a refrigerator can analyse its contents and submit shopping lists directly to a mobile device app, and a coffee machine can learn your schedule and prepare a latte when you wake up [11, 12].



Fig. 4. IoT in Home Appliances

Smart homes are now a reality in today's world, but they are not commonly used for a range of reasons. High costs and security risks, to name a few. Customers seem to find the expense of smart homes unjustifiable, despite the advantages of smart homes being appealing. Another source of concern among potential customers is security:

hacker attacks are still a possibility, as is the possibility of private information being stolen.

#### 5.1. Industrial Automation and IoT Implementations

Smart innovations are also absorbed by industrial automation. As previously stated, the IoT aids in cost reduction, increased efficiency, and improved protection for both human employees and the company as a whole. However, the cost of IoT technology should not be overlooked. Adding "smartness" to a commodity always raises the price and introduces new layers of maintenance.

The standard linear product life cycle is what we're used to. It covers the stages of product development, design, and manufacturing, marketing, and aftermarket services. The issue is that when a customer buys a product, the manufacturer receives virtually no information about its use, such as whether the customer is satisfied or dissatisfied, and to what extent. Since consumer feedback is often written from extreme polar positions, there isn't much information to be gleaned from it. Furthermore, a favorable evaluation of one function yields no information about the customer's subsequent behavior, such as purchases.

#### 5.2. IoT Five Drivers

The Internet of Things is a global phenomenon that has made its way into our homes. Let's look at the five areas that are propelling smart technology forward.

##### 5.2.1. Safety is paramount.

The number of connected devices on the planet is now outnumbering the human population. As a result, the issue of protection becomes critical, as the potential for breaches is immense and could have disastrous consequences. It's important for IoT tech companies to pay careful attention to security issues during the early stages of product development. Since it is well understood that a chain is only as powerful as its weakest link, end-points of IoT solutions should be highly safe to reduce the risk of being hacked.

##### 5.2.2. Intelligence in Data

A huge quantity of data is produced by billions of interconnected devices. That is why the types and quantities of data collected, as well as the methods for managing and processing it, should be established early in the product development process. Data intelligence differs from business intelligence in that it focuses on interpreting data rather than categorizing and presenting data. Analytical instruments are a critical component of any IoT solution. These are used to identify patterns, detect corrupted data, and introduce machine learning, among other things [20, 21, 22]. Smart innovations become enablers of urban living transformations, increasing quality

of life to new heights. Smart technologies are now commonly used in many cities, but their full benefits are yet to be realized.

##### 5.2.3. Collaborations in Company

IoT technology implementation provides a powerful impetus for new company partnerships. IoT tech companies encounter conventional manufacturing companies at a point of collaboration with promising results for both parties. Smart technology's widespread use and wide variety of applications allow both hardware and software to become increasingly complex and sophisticated. The critical aspect of protection should be considered by application developers; data security is a must. IoT technologies and services have rapidly and fundamentally changed human life, production, business practices, and attitudes toward everyday artefacts around the world. Professionals, officials, and the general public face difficulties in addition to the benefits.

## VI. CONCLUSION AND FUTURE SCOPE

It has been demonstrated that connecting simple appliances to the Internet of Things works adequately, and that the appliances can be controlled remotely via the internet. Not only does the developed gadget track sensor data like temperature, gas, light, and motion sensors, but it also initiates a mechanism based on the necessity. Switch on the light, for example, when it gets dark. It also saves the sensor parameters in real time to the cloud. The user will be able to examine the state of a range of criteria in the home at any time. Weather stations and energy monitoring can be added to the gadget. With the right adjustments, this type of equipment can be utilized in hospitals for disabled people, as well as in industries where human entry is impossible or dangerous, and for environmental monitoring.

## REFERENCES

- [1] Nicholas D., Darrell B., Somsak S., "Home Automation using Cloud Network and Mobile Devices", IEEE Southeastcon, Proceedings of IEEE, 2012.
- [2] DeepaliJavale, Mohd. Mohsin, ShreerangNandanwar "Home Automation and Security System Using Android ADK" in International Journal of Electronics Communication and Computer Technology (IJECCCT) Volume 3 Issue 2 (March 2013).
- [3] Rahul Godha, SnehPrateek, NikhitaKataria "Home Automation: Access Control for IoT Devices" International Journal of Scientific and Research Publications, Volume 4, Issue 10, October 2014.
- [4] E. Sisinni, A. Saifullah, S. Han, U. Jennehag and M. Gidlund, "Industrial Internet of Things: Challenges,

- Opportunities, and Directions," in IEEE Transactions on Industrial Informatics, vol. 14, no. 11, pp. 4724-4734, Nov. 2018.
- [5] Khan, N., Medlock, G., Graves, S., Anwar, S., "GPS Guided Autonomous Navigation of a Small Agricultural Robot with Automated Fertilizing System", SAE Technical Paper, 2018.
  - [6] Ramprasath J, Seethalakshmi V, Secure access of resources in software-defined networks using dynamic access control list, International Journal of Communication Systems, 2020. e4607, <https://doi.org/10.1002/dac.4607>
  - [7] Ramprasath J, Seethalakshmi V, Improved Network Monitoring Using Software-Defined Networking for DDoS Detection and Mitigation Evaluation, Wireless Personal Communications, 116, 2743-2757, 2021, <https://doi.org/10.1007/s11277-020-08042-2>
  - [8] P Ramprakash, M Sakthivadivel, N Krishnaraj, J Ramprasath, Host-based Intrusion Detection System using Sequence of System Calls, International Journal of Engineering and Management Research, Vandana Publications, Volume 4, Issue 2, 241-247, 2014.
  - [9] P Jayasri, A Atchaya, M Sanfeeya Parveen, J Ramprasath, Intrusion Detection System in Software Defined Networks using Machine Learning Approach, International Journal of Advanced Engineering Research and Science, Volume 8 Issue 4, 241-247, 2021.
  - [10] Ponmanikandan V, Ramprasath J, Rakunanthan K S, Santhosh Kumar M, An Ecosystem For Vulnerable Traffic Analysis And Mitigation Services In Software Defined Networking, International Research Journal of Engineering and Technology, Volume 7, Issue 6, 5287- 5295, 2021
  - [11] Shebin Sharief, Dr D Kalpana, 2018, Artificial intelligence: the footstep headed for future supply chain management, International Journal for Research in Engineering Application & Management, Vol-04, Issue-04, July 2018, 562-565, DOI : 10.18231/2454-9150.2018.0543
  - [12] Shebin Sharief, Dr D Kalpana, 2019, Business process innovation through Artificial intelligence, International journal of advance and innovative research, Vol- 6, Issue 2, April-June 2019, 29-32.
  - [13] <https://data-flair.training/blogs/how-iot-works/>
  - [14] <https://delphiansystems.com/home-automation/>
  - [15] <https://datafloq.com/read/8-ways-iot-can-improve-healthcare/3066>
  - [16] <https://iotdesignpro.com/articles/smart-farming-iot-applications-in-agriculture>
  - [17] J Ramprasath, Dr S Ramakrishnan, P Saravana Perumal, M Sivaprakasam, U Manokaran Vishnuraj.: Secure Network Implementation using VLAN and ACL, International Journal of Advanced Engineering Research and Science, Vol-3, Issue-1, 2349-6495, 2016.
  - [18] Balasamy K, Suganyadevi S.: A fuzzy based ROI selection for encryption and watermarking in medical image using DWT and SVD, Multimed Tools Appl 80, 7167-7186, 2021.
  - [19] K. Balasamy, D. Shamia.: Feature Extraction-based Medical Image Watermarking Using Fuzzy-based Median Filter, IETE Journal of Research, 2021.
  - [20] N Krishnaraj, RB Kumar, D Rajeshwar, TS Kumar.: Implementation of Energy Aware Modified Distance Vector Routing Protocol for Energy Efficiency in Wireless Sensor Networks, International Conference on Inventive Computation Technologies, 2020.
  - [21] N Krishnaraj, S Smys.: A multihoming ACO-MDV routing for maximum power efficiency in an IoT environment Wireless Personal Communications 109 (1), 243-256, 2019.
  - [22] J Ramprasath, P Ramya, T Rathnapriya, Malicious Attack Detection in Software Defined Networking Using Machine Learning Approach, International Journal of Advances in Engineering and Emerging Technology, Volume 11, Issue 1, pp. 22-27, 2020.
  - [23] Ramprasath J, Indrajith S, Aswin M, Gokulrajan R, Aswin R, DDoS and DoS Anomaly Detection and Mitigation in Software Defined Networking, International Conference on Recent Advances in Computer, Electrical, Electronics, Civil and Mechanical Engineering 2019, Ranganathan Engineering College, 2019.
  - [24] J Ramprasath, M Aswin Yegappan, Dinesh Ravi, N Balakrishnan and S Kaarthi, Assigning Static Ip Using DHCP In Accordance With MAC, International Journal for Trends in Engineering & Technology, Volume 20, Issue 1, 2017.
  - [25] Vaishnavi P, S Ramkumar, Impact of Employee Engagement on Nurses in Coimbatore District, International Journal for Research in Engineering Application & Management, Volume 4, Issue 05, Pages 7-13, 2018.
  - [26] P Vaishnavi, S Ramkumar, COVID-19: Survey on Awareness Level and Psychological Status during the Outbreak, International Journal of Current Research and Review, Vol 12, Issue 18, 2020.