Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 8, No. 1, August : 2023

A COMPREHENSIVE STUDY OF IOT TECHNOLOGY AND ITS SIGNIFICANCE IN 21ST CENTURY

Dr. Jayshri Patil, Assistant Professor, Dr. D Y Patil School of MCA, Lohegaon, Pune, India
pjayshri14@gmail.com

Abstract
Digital technology with Enabled devices connected with the internet. The various applications of IOT technology move towards the advancement in 21st century. This research paper presents the comprehensive study on the occupied process of sensors and actuators. The paper describes the Importance of IOT in the 21 St Century which changed the world. The potential of IOT technology and inspiration of future research and innovation describes growth in future enhancement.

Keywords: IOT, Internet of Everything, Embedded Technology, Sensors, Actuators

INTRODUCTION

In the current era various innovative Technologies are functional in information technology. The term Internet of Things IOT, connecting devices to be performed in an automated, digitized process. The IOT implies the objects which are connected to the tools, software platform and internet. This denoted the start of the cutting edge innovation, the "internet of things (IOT)". What's more, Cisco considered this the "Internet of Everything (IOE)".

Internet of Things (IOT)

“Sensors and actuators embedded with physical objects are through networks facility, which connects the Internet”

The internet contracted the world by giving effective communication among gadgets situated at remote terminals. Along these lines, trade of valuable data over the globe (with the assistance of human intercession) was made conceivable. Inquires about needing to dispense with human intercession or downplay it, bringing forth an inventive idea of associating each and every gadget independent with size.

Essentially, IOT is a development for portable, home and inserted applications that are associated with the internet, to coordinate correspondence. By utilizing information examination, these gadgets determine important data. These gadgets share the information on the cloud and break it down in a safe way and thus our organizations are getting splendidly changed from numerous points of view. Numerous businesses are receiving Internet of Things arrangements innovation to improve their current frameworks.

The network connectivity of IOT is multiple communication protocols network is used like IEEE802.15.4, Zigbee, 6LOWPAN, Wireless HART, Z-Wave, Bluetooth, NFC, LOADng Routing, RPL Routing, RFID, IOT Protocols, MQTT etc. Radio frequency identification (RFID), is tags containing integrated circuits which may have passive and active RFID tags. Which is used for tracking systems and Automatic Identification of Data (AIDC) wired Communication which reads information or data and transfers to the database through radio waves.

Literature Review

Paper discussed to make attractive classroom 21st century use of IOT technology increasing efficiency of education. IOT facilitates beneficial "smart lesson plans". The educational members use IOT technology in the learning process. E-learning elements of IOT are essential in use in the classroom. The G-IOT concepts involve an educational environment of greener behavior. Sheryl Nussbaum-Beach says as “Teachers will not be replaced by technology but teachers who don’t use technology will be replaced by those who do“.

The paper discussed multiple reasons to love IOT technology in teaching and learning. Digital way has no limit of time & space in education with virtual study. Paper introduced an automatic Computational thinking Model for better communication between students & teachers using mobile phone applications. Paper concluded the intellectual learning of transparency and skill of computer scientists [1].
This research paper describes implementation & efficient design of Wireless sensor networks for long range environmental observing both indoor and outdoor IOT applications, which deployments with different nodes generated by customary nodes. This paper contains information about IOT requirements for environment monitoring & introduction of proposed systems and key components of the system. Paper explained that a wide wireless sensor network application field can be divided into three main categories: Monitoring space, monitoring objects and monitoring interactions between objects and space & also detailed information of the proposed system of WSN with its components [5].
Paper discussed questions on IOT & Machine to machine learning beneficial to cloud computing & IT business sectors. The questionnaire explained edge cloud computing in today having characterize this revolution of Programmable network, cloud computing applications have mini clouds & the IaaS that carriers can make available for distributed locations, IOT business with industrial IOT manufacturing, smart grid, connected vehicles, cities, homes, real time analytics of Microsoft Azure with cloud platform. , AR in industry, IOT as a Service (IOTaaS), IT infrastructure in IOT etc [2].
The paper discussed a brief idea of new technology of IOT that arises currently in the digital time. There are a number of different tools used in developing IOT technology like RFID, Wireless Sensor Networks (WSN), uniform resource network (URN) and Data Storage and Analytics etc. As per paper discussed presently we are faced with a number of challenges in use of IOT technology.
Focus of the paper is categorization of different applications of IOT technology as Personal, Home, Enterprise and mobile. Paper also discussed two main studies, first on Robotic Systems with proposed design of robots and second on Emergency situations in Hospitals [3].

History of IOT

IOT is older technology having real thoughts of associated gadgets that have been used together since the 70s. In those days, the thought was frequently called "Installed web technology". In 80s the first connected device was situated at Carnegie Mellon University. They invented a coca- cola vending machine integrated by micro-switches with the internet for keeping it cold. In 1991 the University of Cambridge used the technology and developed a webcam to send the image to local computers. The genuine term established in the world as "Internet of Things" was instituted by Kevin Ashton who is introduced as the father of IOT Technology. He was working in production network improvement, needed to draw in senior administration's consideration regarding another energizing innovation called RFID.
In 1994, portrayed a new idea in IEEE Spectrum that is used to manage and computerize home gadgets for processing plants". The field picked up force when Bill Joy imagined Device to Device (D2D) communication in 1999. In 1999, BILL JOY developed a device to device communication. In 2000, the technology was used by L. G. Electronics in the refrigerator. In 2002, KERY PRAMLING and his group made major reforms in the technology at HELSINKI UNIVERSITY OF TECHNOLOGY. In 2005 NABAZTAG used the technology to predict weather forecasts, stock marketing and to provide latest news to all concerned.
Characterizing the Internet of things as "basically the point in time when more 'things were associated with the Internet than individuals", Cisco Systems assessed that IOT was "conceived" somewhere in the range of 2008 and 2009 to 2010. In 2011, Gartner, the statistical surveying organization that concocted the renowned "publicity cycle for rising innovations" remembered another rising wonder for their rundown: "The Internet of Things". Cisco has established a new term as Internet of Everything

(IoE) which is also called as “embedded internet”. After this technology is introduced by different other terms.
In this rapid evaluation of development, IOT is one of the most dominant technologies in the world. In 2019, Gartner predicted that IOT technology will emerge very fast in the field of enterprise and automotive in 2020. Currently all devices can be connected to each other performing digital systems. These devices link with each other. In 2020 the IOT technology expanded as data collection with cloud. Which decreases the cost of sensors and mostly use of IOT with smart phones and tablets. So, IOT is a great revolution in the world structure of life and gives new opportunities for people.

Applications of IOT
Smart Home: Smart homes in the 21st century are self-controlled using sensors and controllers coordinated together with different IOT devices inside their home. In the home the diverse security frameworks have been developed in the homes using IOT tools and framework facilities. Using sensor information is stored and the produced in the framework is accessible for PIR sensors, PIC controller is used in homes.
Smart City: A Smart city which includes digitization over all areas of the city such as Smart buildings, Smart roads, Smart education, Smart banking, Smart hospitals, Smart Industries, Smart transportation facility, Smart environment and pollution maintenance facility, Smart parking, Smart agriculture, Smart governing etc.
Smart Education: The Smart teaching and learning applications to become a smart campus, in smart classrooms uses fully smart objects of IOT in the classroom. The main feature of IOT applications is digital learning. The smart classroom of IOT uses smart objects having examined the need of Internet of things in part of education grounds Campus the opposite advancements are going hit advertise very soon, has likewise been portray as a pertinent case of use of the IOT worldview to keen urban areas and how new advances and IOT applications can be upgrade education.
Smart vehicle: Interconnected vehicles are currently used in travel business. User’s vehicles have smart IOT devices in their cars which makes it easy to analyze route and also avoid traffic routes etc. Google map is one example of this.
Smart Health Management: Associated wellbeing remains the dormant beast of the applications of IOT. This contains related medicinal services and clinical tools.
Smart Retail: Nearness based publicizing as a subset of brilliant retail is beginning to take off. However, the notoriety positioning shows that it is as yet a specialty section. One LinkedIn post for each month is nothing contrasted with 430 for a keen home.
Smart Cultivating: Brilliant cultivating is a regularly disregarded business-case for the web of Things since it doesn't generally fit into the notable classes, for example, wellbeing, versatility, or modernity. Notwithstanding, because of the remoteness of cultivating activities and the enormous number of domesticated animals that could be observed, the Internet of Things could reform the manner in which ranchers work.
Transportation Industry: In the transportation business, there is a great requirement for a brilliant framework to oversee assets in the right manners. How about we think about a keen traffic camera, it can screen street traffic and keep track of mishaps, clogs, climate conditions, and speak with other shrewd cameras to impart this information to them. The general recorded information is consolidated and assembled to the city traffic framework.
Presently if this information will be imparted to another city's traffic framework which is sharing their own information too with the assistance of their knowledge framework, envision how enormous will be the arrangement of the framework with a mind blowing measure of information.
Clinical Industries: Clinical businesses should be further developed and thus they are as of now utilizing IOT based devices. With the assistance of IOT devices, the specialists can screen the patient remotely and give sedates based on the following data. For example, there is a patient at home, he is

in consistent life backing and all his medical problems are as a rule totally recorded in a cloud framework.
In a crisis circumstance, specialists could be set up for the activity as they as of now have a total record. Likewise, the emergency clinic can dispatch the rescue vehicle to the patient's area. Specialists don't require investing a lot of energy to comprehend ailment of the patient since they are now mindful of the necessary activities which can spare a great deal of time and endeavors.
Smart Hospitality: To improve voyaging experience of clients with IOT cordiality industry is likewise enhancing IOT encounters to make their administrations increasingly agreeable for visitors. In lodgings, face recognition id is given to the clients with the goal that inn staff can perceive the client before their appearance.
Soon after IOT, there are chances that inns may outfit their rooms with sensors and feeling acknowledgment cameras to catch feelings of supporters for example on the off chance that the client is eager, it can suggest suppers. On the off chance that the visitor is feeling cool, the room will get hotter on personalization.

Tools Used to Develop IOT Applications
The IOT Tools: The Sensors and actuators are used in development of IOT Applications
Sensors: The Internet of Things has given sensors an input signal in analog form, which is something to do for ground-breaking, cloud-based diagnostic programming to create insightful answers for machines, individuals and conditions. The Internet of Things needs progressively more effective sensor arrangement. It means the sensors are the components or modules which convert one form of energy into another form. This means it controls some intensities that are not possible to find in the 0's and 1's format; it converts in display output format. It means the sensors are the components or modules which convert one form of energy into another form.
Actuators: Little as they seem to be, they are infrequently obvious during activity, however the impacts of their work can be felt in vehicles, mechanical machines or some other electronic gear including mechanization innovations. They can be isolated into four fundamental classes dependent on their development design and the job they play in a particular IOT conditions. As the name itself proposes which is a mechanism of converting energy into motion, and follow up on their prompt condition to empower the right activity of the machines or gadgets which they are inserted into.

Types of Sensors
- Sound Sensor: A sound sensor is used to detect sound waves having vibration into signals which in the analog format and then it converts into digital signals 1's to 0's. The sound waves pass through air modules. If the presence of a surrounding sound is found, it shows digital logic 1's otherwise its digital logic 0's.
- Fire Sensor: The fire sensor works to detect the presence of fire or not. It’s working as both an analog sensor and digital sensor. If fire is present the analog sensor works as a fine intensity of fire, it detects by wavelength of fire. If fire is present the digital sensor works to find voltage, it is detected by logic 1's and logic 0's. The example fire in building the alarm system starts automatically or a call is done to fire bridged automatically or messages sent etc.
- Temperature Sensor: The temperature sensor used to sensing or detect temperature of the surrounding environment and changes in temperature. If temperature goes high, its resistance goes down and if temperature goes low, its resistance goes up. The changes in resistances take particular action on it. It gives temperature in the format of co-efficiency and second is the capacitor.
- If changes in temperature occur then capacitors also change in digital values. An example of a temperature sensor is to find the level of temperature in a room or surrounding, manufacturing companies, agriculture to find temperature of soil helps for production of plants and maximum output, in education to maintain temperature of classrooms, Labs, Laboratories etc.

- Motion detection Sensor: This detects the physical human movement which transfers it in digital signals. It is mostly used for security purposes. This sensor used to sense the presence and absences of a person. This sensor is connected to a device, where the sensor is connected and in the part of the sensor the presence of humans around it. If sensors detect the living thing or human being around presence then it gives the result as logic 1, in other hand its logic 0.
- From time to time the logic changes as 1's to 0's and 0's to 1's. This change in status can give action on that time. Example: start alarm, send messages via internet, switch ON light etc. There are different types of motion sensor Passive Infrared (PIR) which are mostly used in home security systems, Ultrasonic is tracking sound waves, Microwave having radio wave pulses.
- Light Sensor: The light sensor works to find the presence of light in the surrounding or not. In this we use LDR (Light dependent Resistor) as if light is present in surrounding the resistance is low which detect as logic 0's or 1's and if light is absent in surrounding the resistance is high which detect as logic 1's or 0's.
- The example of light sensor is street light on road and parking, if it is morning, resistance of light is low sensors, it returns digital logic is 0's then automatically all light OFF on roads, other hand if it is night, the resistance of light is high, it returns digital logic is 1's then automatically all lights stars on roads. The examples of light sensors used are Night lamp, Burlager Alarm etc.
- Soil Moisture Sensor: It is used to detect wetness of soil. It's working both analog sensor and digital sensor as analog sensor work to find particular wetness level and digital sensor work to find whether moisture is present or not in the soil, it shows in the format of 0's and 1's.
- The soil moisture sensor measures the volume of water in the soil, using the electric current to pass through the soil and finds its resistance, measuring the moisture level of the soil. If soil has more water and is detected, the soil conducts more electricity, it means that the resistance will be less. And if soil has less water it generates less electricity, it means the resistance will be high.
- Rain Drop Sensor: It finds the existence of water. It works as a digital sensor, if water is detected then it shows digital logic 1's and if water is not detected it shows digital logic 0's. For example in a water tank, it feels like water, if the tank is full then the pump needs to stop automatically and if the tank is empty then the pump needs to start automatically.
- Ultrasonic Sensor: The ultrasonic pulses are used for reflection pluses. There are two points, one is transmitter and other is receiver. This sensor transmits pulses in waveforms, if these waveforms are transmitted for travel, and it comes back to the receiver.
- It is used to find distance between substances or particular objects, as far as the wave's forms are transmitted and received from it. It also used to find the time duration required for a travel transmitter to receiver. An example of these sensors are electric motors, Robots, Obstacles are moving from one direction to another etc.
- Proximity Sensor: It is used to detect the existence or not existence of an object, it forms signals in a simple electronic way for contact with that person. These sensors are used to notify the person to send messages or emails of discounts and special offers of nearby products. Some examples of proximity sensors are to find space for parking in malls, crowded places, education areas etc.
- Touch sensor: The touch sensor works on the static energy of our body. It used to detect someone touching sensing or not touching sense. It gives only digital values, if someone touches an object sensing value is high, it shows digital logic 1's and if no touch then sensing value is low as shows digital 0's. Some examples of touch sensors are presence or absence of a person, door handles, safe handles, punch machines etc.
- Pressure Sensor: The pressure sensor used to sense pressure applied in objects to find standard pressure range and it converts it into an electrical means digital signals to do action on it.
- Water quality Sensor: This sensor finds the quality of water means presence of iron, impurities, chlorine, organic elements, solids parts, dissolved compounds, acids etc. This sensor plays an important role in monitoring the water quality. They are used in a variety of industries. This works as different sub categorized sensors.

- Chemical Sensor: These are used to find chemical changes present in the air environment. It is used in different industries for Industrial environmental monitoring use to track changes in environment and to find released harmful chemicals from industries. There are different sub categories in various types.
- Gas Sensor: The Gas sensor is used for analysis of change in the air quality and finds presence of different gases in air. It is the same as a chemical sensor. This sensor has four outputs, analog and digital types. In this the purpose of digital output is to give presence and absence of gas, and analog output display intensity or PPS of gas presence also finds quality level of purity or any types of gas in air. Some examples of gas sensors are air quality monitoring, gas industries, chemical laboratories, manufacturing companies of paints, plastics, rubber, pharmaceutical & petrochemical etc.
- Smoke Sensor: It is used to identify the level of smoking. It is used by the manufacturing industry, to find information of fire and gas incidents.
- Gyroscope Sensor: The Gyroscope sensor used for finding angular rate, it having angular velocity is a found rotation speed in 3 axis directions. Examples of these sensors are vehicle direction finding systems, game managers, robot management and many more.
- Humidity Sensor: It detects vapors or different types of gases present in the environment. It works the same as a temperature sensor.
- Optical Sensor: The optical sensors detect light rays quantity. It is in the form of analog output, it converts into digital logic to easily understand this sensor used to track environmental changes in the manufacturing industry. There are many types of optical sensors like Photo detector, Fiber Optics, Pyrometer Proximity & Infrared etc.

Types of Actuators

- Pneumatic Actuators: It is a type of actuator used for compression of air generated for motion.
- Hydrolic Actuators: It is used for liquid to generate motion. The example is a water pump or liquid pump used in malls as if you give your hand below the water tap then automatically dispensing water to make water flow.
- Electric Actuators: It uses an external power source form like a battery which is used to generate motion form energy.
- Thermal actuators: It is used to a heat source of energy is converted in to motion form of energy
- Linear Actuators: These actuators used to motion any object or device in a straight line.
- Motors Actuators: It is used for rotational movements of devices. The example is a DC motor in which we want to rotate a device connected by ultrasonic sensors, it rotates the objects as like wheels of a tier.
- Relays: This is used for electromagnet-based actuators in which power energy is converted into power switches in lamps, heaters or even smart vehicles etc.
- Solenoids: It is mostly used for home appliances as locking or triggering mechanisms.

Trends of IOT

- IOT Stages: The stage is the way to progress. "Things" become progressively economical applications. IOT stages group a large number of the foundation segments of an IOT framework into a solitary item. Gadget tasks for example specialized, gadget checking and the executives, security and firmware refreshes.
- IOT information securing, change and the executives. IOT application improvement, including occasion driven rationale, application programming, representation, investigation and connectors to associate with big business frameworks.
- Norms and Ecosystems: IOT things multiply, new biological systems will rise and there will be "business and specialized fights between these environments" that "will command territories, for example the brilliant home, the savvy city and human services. Associations making items may need

to create variations to help numerous principles or biological systems and be set up to refresh items during their life expectancy as the norms develop and new benchmarks and related APIs.

- Event Stream Processing: IOT applications can produce amazing information rates and break down progressively. Frameworks making a huge number of occasions every second are normal, and a huge number of occasions. It necessitates, appropriated stream registering stages developed. It normally utilizes equal designs to process high-rate information streams to perform undertakings, for example continuous examination.
- Operating system: There is a very huge scope of frameworks intended for explicit resolutions.
- Wide Area Networks: Recent arrangements are restrictive, yet models come overwhelm. As per Gartner : "Conventional cell systems do not convey decent blend specialized highlights, wide territory inclusion joined generally low data transmission, battery life, low equipment
- and working expense and high association thickness. The haul objectives are a wide region. IOT organizations convey rates of information from several bits for every second to many kilobits every second across the country.
- Processors and Architecture: Structuring gadgets is a comprehension of gadgets' need for "profound specialized abilities."
- Device Management: Communications of devices across in IOT are three types of network seen as things to the internet, things to gateway and things to things. The connectivity to these networks are wired and wireless, and these network connectivity are maintained by IOT.
- Low Power and Short Range IOT Networks: Short extent systems interfacing IT things will be tangled. These won't be solitary basic foundations associating things.
- Analytics: As indicated by Gartner, IOT will require another way to deal with examinations. "New explanatory instruments and calculations are required. The money will be "information." however new cash possibly has esteem, the majority of information can be converted into bits of knowledge and data can be changed into solid activities will change organizations, people transform, and impact change in society.
- Security: As per Gartner, dangers broaden well past refusal of rest assaults: Those are assaults utilizing pernicious code, engendered through the IOT, planned for depleting the batteries of gadgets by keeping alert. As indicated by Gartner, IOT presents a wide-ranging scope of security dangers and difficulties to IOT things, their foundation and working frameworks, correspondences, and the frameworks to which they are associated.
- Security advancements will be required to shield IOT things and stages from both data assaults and physical altering, to encode their correspondences, and the address to new difficulties, for example mimicking 'things' or refusal of-rest assaults that channel batteries.

IMPORTANCE'S OF IOT IN 21ST CENTURY

Recently, the IOT is a digital technology having a technique of things one of those things that are utilized related to actuators, hardware, sensors, programming and network to upgrade connection, assortment and information trade.

The IOT gives a feature that makes open doors for individuals to interface with different devices and control them with huge information innovation, which consequently will advance proficiency in execution, main advantages and limit the requirement for human inclusion. It's the most significant improvement of the 21st century.

Internet of Things in short IOT is an innovative field that changes over any electronic gadget into a more brilliant one. A great deal of businesses are starting to embrace this innovation in their activities to expand their profitability and improve proficiency.

This valuable innovation connected the gadget with the internet, gathered information by sensor and stored it in the cloud and gave a reflected trigger of an activity from an activated application. As per survey, it expresses that in excess of billions of gadgets linked with the web by 2020 changing into a world with multiple innovative ideas.

IOT and IOE both have conceptually the same meaning in the digital era. From associated home center points, savvy indoor regulators, remote entryway locks, and all the different application controlled apparatuses, odds are, and you definitely know how supportive IOT is in your regular day to day existence. In all actuality, IOT is developing in significance, both for technological use and regular use. It is improving our lives from numerous points of view, and it will probably keep on doing as such.

IOT Changes the World

In a world of advanced innovation of IOT, It has made different frameworks to give many exhibitions in each errand. The multiplication of the IOT has made other innovations like phones, home and other applications that are completely associated with the internet. These gadgets can infer important data utilizing orders dependent on information gathered, share the information on the cloud, and examine it securely to give the necessary action. Some organizations are quickly changing from multiple points of view, by using this technology.

In the next year of IOT, Everybody needs things to be done exceptionally quickly and programmed. Presently a day's every one contemplates controlling things remotely with the web for example Web of things (IOT). It is used for improved execution of applications, reduced cost of work, and innovative management. New revenue stream etc. An IOT rapidly changes basic across businesses and keeps on quickening, organizations will progressively maintain administrations that create new economical income. A large number of organizations get multiple benefits from IOT.

This is the most important technology used for improving the profitability of organizations and people alike. IOT is Improving Productivity of organization. The best approach to assume responsibility for the gadget will be through cell phones, Spare time and get progressively out of your day and Need to work more earnestly by IOT makes innovative industry.

There are using different ways IOT change of methods of work like Significantly more information by gathering data from device, Realize where everything is, constantly by making IOT can possibly make the working environment life and business forms considerably more beneficial and effective, Reach anyplace faster by using interconnectivity of cell phones, vehicles and the street you drive on help save travel time, Less expensive by the Internet of Things is definitely bring down expenses in the assembling industry by diminishing wastage, utilization of fuel and the disposing of monetarily unviable resources, Totally remote cell phone the executives (MDM) using it offices may have remote access to PCs and cell phones, however IOT will likewise empower remote control of other Internet-connected gadgets, Expanded gadget the executives multifaceted nature uses as a significant number of things to come IOT-associated gadgets won't have a screen.

CONCLUSION

The potential use of IOT technology is the best approach to make an innovative industry. The enhancement of technology implies the growth in applications. The tools and techniques used for development in applications. IOT is changing the manner in which we work by sparing time and assets and opening new open doors for development and advancement.

REFERENCES

[1] Dr. Shahbaz Pervez, Shafiq ur Rehman, Dr Gasim Alandjani, (2018), “Role Of Internet Of Things (IOT) In Higher Education”, 4th International Conference on Advances in Education and Social Sciences, Istanbul, Turkey, ISBN: 978-605-82433-4-7, pg no 792 – 800.

[2] Guenter I. Klas, (2016), “Edge Cloud to Cloud Integration for IOT”, first published on www.yucianga.info pg no 1-10.

[3] Kalavathy Perumal and Murali Manohar, (2017), “A Survey on Internet of Things: Case Studies, Applications, and Future Directions”, from book Internet of Things: Novel Advances and Envisioned Applications in Big Data 25, pp.281-297

[4] Jayavardhana Gubbi, Rajkumar Buyya, Slaven Marusic, Marimuthu Palaniswami, (2013) "Internet of Things (IOT): A vision, architectural elements, and future directions", Elsevier, Future Generation Computer Systems, 1645–1660.
[5] Ms. Padwal S. C., Prof. Manoj Kumar, (2016), "Application of WSN for environment monitoring in IOT applications", International Confernce on emerging trends in engineering and management research NGSPM's Bramha vally of college of engineering & research Institute, ICETEMR – 16 , ISBN: 978-81-932074-7-5, Pg no 415-424.
[6] Ms. Prachi Sharma, Mr. Shubham Zawar, Dr. Suryakant B Patil, (2016), "Ransomware analysis: Internet of Things (IOT) security issues, challenges and open problems in the context of worldwide scenario of security of systems and malware attacks", International conference on recent innovations in Engineering & Management, ICRIEM-16, ISBN: 978-81-932074-5-1, page no 521-528
[7] M.Suruthi, D. Nivetha, (2016), "A Survey on Challenges, Technologies and Applications of IOT", International Journal of Advanced Research in Computer and Communication Engineering, ISSN (Online) 2278-1021 ISSN (Print) 2319 5940, Vol. 5, Issue 3
[8] M. Shona, B. N. Arathi, (2016), "A Survey on the Data Management in IOT", International Journal of Scientific and Technical Advancements, ISSN: 2454-1532, Volume 2, Issue 1, pp. 261-264.
[9] Ms. Padwal S. C., Prof. Manoj Kumar, (2016), "Application of WSN for environment monitoring in IOT applications", International Confernce on emerging trends in engineering and management research NGSPM's Bramha vally of college of engineering & research Institute, ICETEMR – 16 , ISBN: 978-81-932074-7-5, Pg no 415-424.