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A BRIEF STUDY ON IOT CONCEPTS

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Abstract: The Internet of Things (IoT) describes the network of physical objects that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. These devices range from ordinary household objects to sophisticated industrial tools. With more than 7 billion connected IoT devices today, experts are expecting this number to grow to 10 billion by 2020 and 22 billion by 2025.the major applications of iot are: home applications , smart cities ,energy and environmental resources, health and fitness etc .The scope of iot device is not only connected to the internet and also exchange the information between devices. IoT empowers users to communicate and control physical devices to salvage vital information. Large amounts of data will be generated and exchanged which in turn will help in decision making. As the network grows the size of the communicating and processed data also increases. The large data can be stored in cloud and can be retrieved from cloud data bases. But dynamic reading and storage is a biggest challenge for embedded systems used in IoT. For storing real time data entity high speed data RAMs and internal storage devices are embedded in IoT modules. This paper describes the architecture, protocols used in IoT, applications like home, smart cities, health, emerging technologies used in Iot.

Keywords: IOT, protocols , emerging technologies , home , city, health-applications.

1. INTRODUCTION

IoT comprises things that have unique identities and are connected to internet. By 2020 there will be a total of 50 billion devices connected to internet. IoT is not limited to just connecting things to the internet but also allow things to communicate and exchange data. The main characterstics of iot are: Iot devices and systems may have the capability to dynamically adapt with the changing contexts and take actions based on their operating conditions, user‘s context or sensed environment. the surveillance system is adapting itself based on context and changing conditions. Iot Allows a large number of devices to work together to provide certain functionality called self-configuration. It supports a number of interoperable communication protocols and can communicate with other devices and also with infrastructure. Each IoT device has a unique identity and a unique identifier(IP address).Integrated into Information Network allow them to

communicate and exchange data with other devices and systems. . These devices range from ordinary household objects to sophisticated industrial tools. With more than 7 billion connected IoT devices today, experts are expecting this number to grow to 10 billion by 2020 and 22 billion by 2025.

2. RELATED WORK:

Dhanalaxmi. B., & Naidu, presented A survey paper on design and analysis of robust IoT architecture.They proposed to access the data parameters without intervention of main processor. In this method a Direct Memory controller (DMA) is used to fetch the real parameters.

Datta, P., & Sharma, presented A survey on IoT architectures, protocols, security and smart city based applications This survey paper describes the architecture of IoT, protocols used in IoT, its security issues and smart city based IoT application .

R.want, proposed RFID technology and its limitations and advantages discussed in his paper.

Hameed, A., & Alomary, presented Security issues in IoT. In this paper he proposed different applications of internet of things and proposed different enabling technologies used in iot, and security issues provided by the iot.

Tan, L., & Wang, N. presented Future internet: The internet of things. In this paper he proposed future trends and technologies used in internet of things .In Greeks for Greeks author proposed different application of internet of things. home automation applications taken from the mobinus blog spot.

Zhu, Q., Wang, R.,proposed Iot gateway: Bridging wireless sensor networks into internet of things.in this paper he proposed about wireless sensor networks,and its applications ,and limitations of wireless sensor networks.

2. IOT ARCHITECTURE:

Iot has been significant advancement in this field in a relatively short amount of time, both from a hardware and a software standpoint. Iot has allowed for a wide variety of new experiences to be created for us in domestic as well as business environments. The architecture of iot is a framework that defines the physical components, the functional organization and configuration of the network, operational procedures and the data formats to be used. However, there's no single standard reference architecture for IoT as it encompasses a variety of technologies .IoT architecture can actually vary significantly depending on the implementation; it needs to be open enough with open protocols so that it can support multiple network applications .The three layers of iot architecture Can be shown below figure(1):

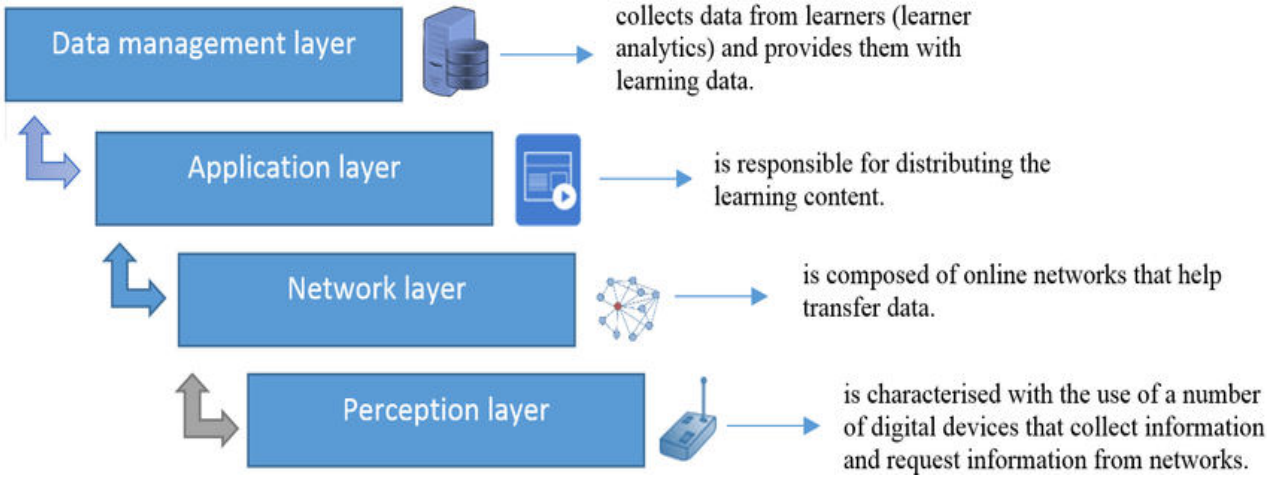

Fig-1:Architecture of IOT

Three layers are: Perception, Network, and Application. Perception layer is the physical layer of the architecture. This is where the sensors and connected devices come into play as they gather various amounts of data as per the need of the project. These can be the edge devices, sensors, and actuators that interact with their environment .Network layer collects data by all devices needs to be transmitted and processed. It connects these devices to other smart objects, servers, and network devices. It also handles the transmission of all of the data. Application layer: The application layer is responsible for delivering application to specific services to the user. This can be a smart home implementation, for example, where users tap a button in the app to turn on a coffee maker.

4.PROTOCOLS IN IOT:

This section discusses briefly protocols of IoT. In a telecommunication connection, end points use a special set of rules and regulations to communicate with one end point to other end points in a network. In this section, some of the IoT data protocols are discussed briefly and how they interact with the IoT gateway is shown in below fig:2. Link Layer determine how data is physically sent over the network‘s physical layer or medium. This layer determines how packets are coded and signaled by the hardware device over the medium to which the host Is attached. The protocols which are used in link layer are: Ethernet,Wifi,Wimax,6lowspan,Lr-wpan .IEEE802.3 is collection of wired Ethernet standards for the link layer. ethernet uses co-axial cable,copper twisted pair connection, fiberoptics. IEEE802.11 (wifi) is a collection of wireless LAN(WLAN) communication standards including extensive description of link layer.

IEEE802.16(wimax) is a collection of wireless broadband standards including exclusive description of link layer. WiMax provide data rates from 1.5 Mb/s to 1Gb/s. IEEE802.15.4(LR-WPAN) is a collection of standards for low rate wireless personal area network. Basis for high level communication protocols such as ZigBee. Provides data rate from 40kb/s to250kb/s. 2G/3G/4G-Mobile Communication Data rates from 9.6kb/s(2G) to up to100Mb/s(4G).Network/Internet Layer is Responsible for sending IP datagrams from source n/w to destination n/w. Performs the host addressing and packet routing. Datagrams contains source and destination address.IPv4: Internet Protocol version4 is used to identify the devices on a n/w using a hierarchical addressing scheme. 32 bit address. Allows total of 2**32addresses.IPv6: Internet Protocol version6 uses 128 bit address scheme and allows 2**128 addresses. 6LOWPAN:(IPv6overLowpowerWirelessPersonalAreaNetwork)operates in2.4 GHz frequency range and data transfer 250 kb/s. Transport Layer Provides end-to-end message transfer capability independent of the underlying network. Set up on connection with ACK as in TCP protocol and without ACK as in UDP protocol. It Provides functions such as error control, segmentation, flow control and congestion control. Protocols used here are: Transmission Control Protocol used by web browsers(along with HTTP and HTTPS), email(along with SMTP, FTP). Connection oriented and stateless protocol. User Datagram Protocol is connectionless protocol. Useful in time sensitive applications, very small data units to exchange. Transaction oriented and stateless protocol. Application Layer Defines how the applications interface with lower layer protocols to send data over the network. Enables process-to-process communication using ports. some of the application protocols are: Hyper Text Transfer Protocol is the foundation of WWW. It Follow request- response model . Constrained Application Protocol for machine-to-machine(M2M) applications with constrained devices, constrained environment and constrained network. Uses client- server architecture. WebSocket allows full duplex communication over a single socket connection. Message Queue Telemetry Transport is light weight messaging protocol based on publish-subscribe model. Uses client server architecture. Extensible Message and Presence Protocol for real time communication and streaming XML data between network entities. Data Distribution Service is data centric middleware standards for device-to-device or machine-to-machine communication. It Uses publish- subscribe model. Advanced Message Queuing Protocol is open application layer protocol for business messaging. Supports both point-to-point and publish-subscribemodel.

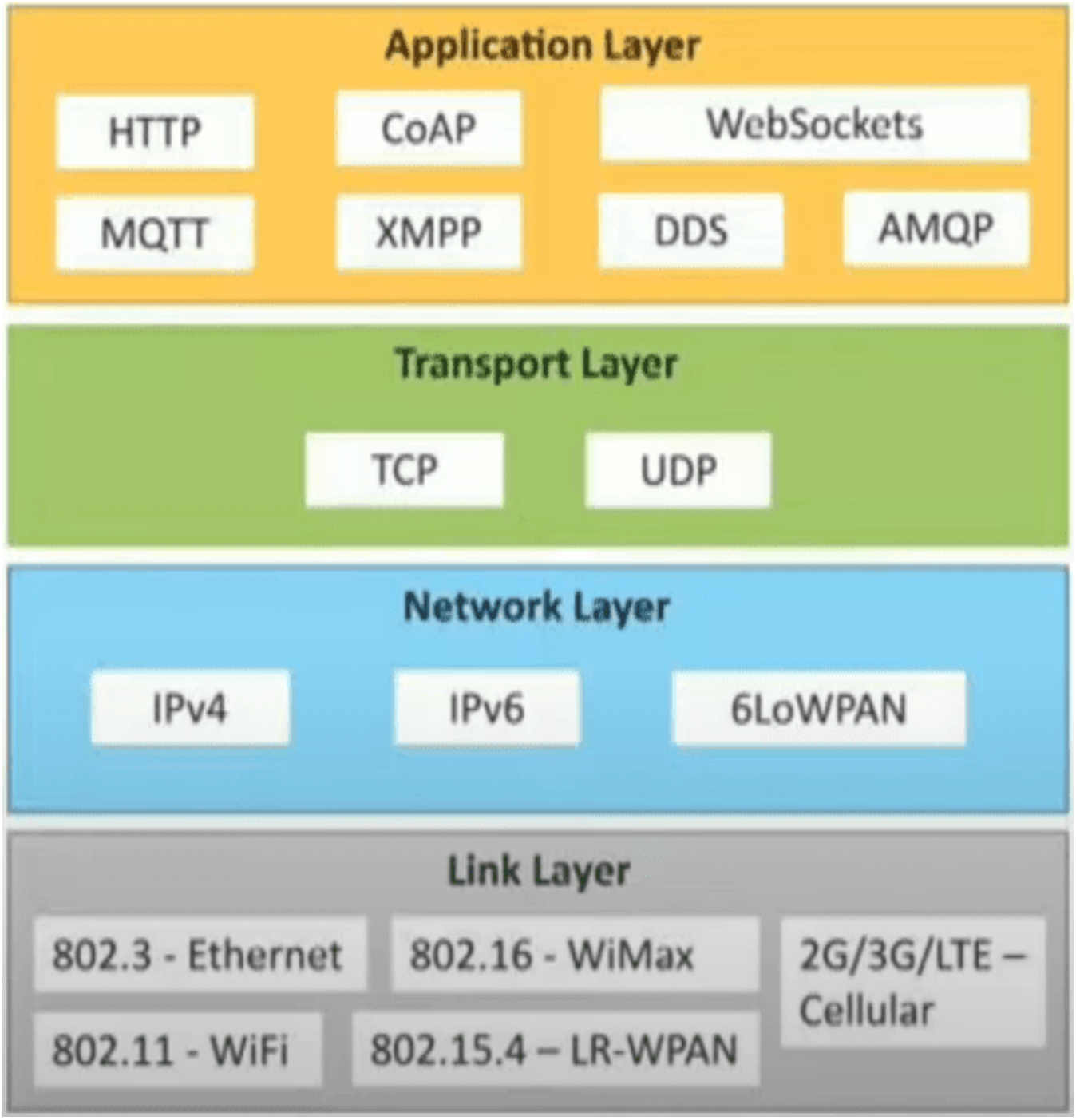

Fig 2:Layered architecture of IOT

5. APPLICATIONS OF IOT:

The major applications of iot are : home appliances, smart city, environment applications ,energy applications, agriculture applications ,health and fitness, industry applications etc.. Wearable technology is the hallmark of IoT applications and one of the earliest industries to deploy IoT. We have fit bits, heart rate monitors and smart watches these days. glucose monitoring device has been developed to help people with diabetes. It detects glucose levels in our body, uses a small electrode called the glucose sensor under the skin, and relates it to a radiofrequency monitoring device.In this paper we will discuss majorly about home and smart city and health applications.

A.Smart Home Applications :The smart home is probably the first thing when we talk about the IoT application. The major devices used in home automations using iot are: smart lighting ,intrusion detection , temperature control ,security etc. we will discuss each application in briefly . Lighting: With the help of IoT technologies,[6] smart lighting that turns off/on themselves without any human intervention. It will not only save your time but will also help you save the electricity that is a non-renewable resource for our planet. You can control the intensity of the bulb with the help of your smartphones and even the amount of natural light entering your room.

Fig 3:Application of home

A.1:Temperature Control: When we are away on our home, and we want the AC to be turned on ,before we reach home so that we can enjoy a good resting time, then this IoT device is apt for you. Once we install a smart thermostat

in our house, then we need not worry about the temperature control of our house because it automatically adjusts the house temperature according to the outside temperature[6].

A.2:Security Systems : Whenever we went outside, one thought always protrudes in our mind that did we check the locks, did we close the windows, haven't we forget anything? The answer to all these questions lies with the smart security system that IoT companies provides as per our choice. With this system, our door automatically locks when we step outside our house. If someone tries to make a forced entry, then alarms start ringing, and we can even have doorbells with video surveillance to know who is outside. And we can manage all this just by sitting beside our smartphone. We can install various safety sensors to help us to get notifications about gas leakage, fires, water leakage, filling tank etc.[6].

B. Smart city: cities needed better planning and infrastructure if they have to be energy efficient and environmentally friendly to provide a good quality of life. In other words, cities need to become **smart cities**! This is possible using a combination of the **I**nternet of Things with **sensors** collecting data and machine learning implementing the insights obtained from the data. IoT can be used in many ways to make cities more efficient ranging from managing the traffic, controlling air pollution, handling waste management, creating smart buildings, planning for natural disasters, etc. Here we will discuss some of the applications of smart cities.

B.1Traffic Management: It is important to control the traffic in cities otherwise there are huge traffic jams in popular places and totally empty streets otherwise. This is also depends on the design and layout of the roads but it can be managed by having smart traffic lights. For example, the traffic lights should automatically adjust according to the volume of the traffic so that green lights should have a longer duration where there more traffic and shorter duration when the streets are empty. Sensors can also be embedded in roads and bridges to monitor their conditions so that they can be repaired when there is much wear and tear. After all, roads with patholes are also a major cause of traffic pollution!

B.2Air pollution : It is a major problem in many metropolitan cities where the particulate matter in the air is so high it is damaging to the lungs in the long run. But IoT along with machine learning can be used to reduce air pollution. This is possible by collecting data related to city pollution like emissions from vehicles, pollen levels, airflow direction, weather, traffic levels, etc using IoT from various sources and then calculating pollution forecasts to see the trends in pollution so they can be controlled.

B.3 Health: Healthcare is an extremely important aspect of life, especially in current times when non-communicable diseases like heart problems and cancer are increasing in big cities . In such a situation, IoT technology can surely help in enhancing the healthcare system so that the best healthcare is received by everybody. One example of this is micro bots that can directly enter the bloodstream and reach any place inside the body to deliver medicines.

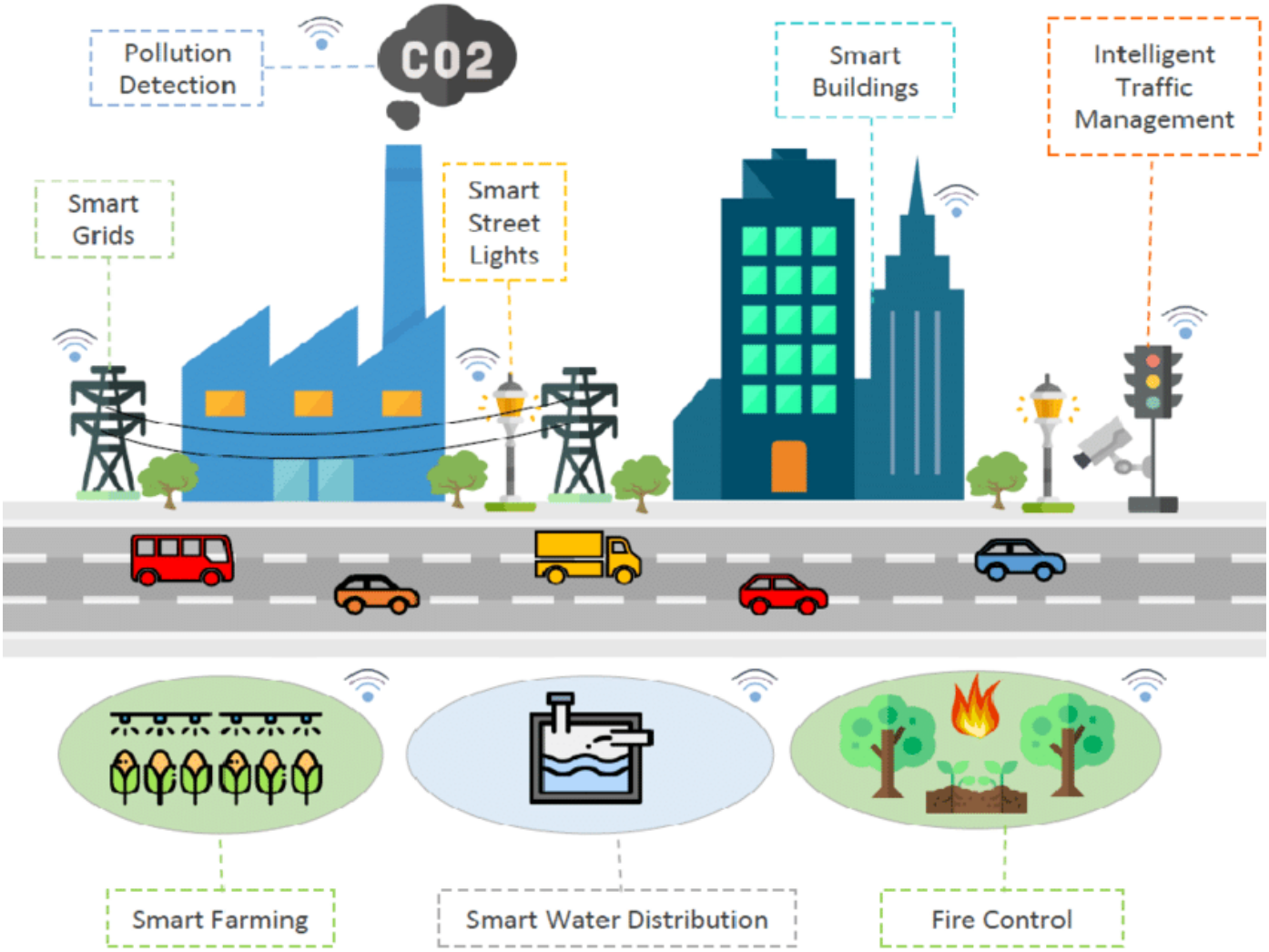

Fig 4:applications of smart cities

Another application of IoT and sensors in healthcare is remote patient monitoring where patients can be monitored 24/7 and emergency responders called if there are any problems.[7]

B.4Public Transport: smart public transport can streamline traffic and also make commuters' life much easier. It is very convenient when the trains and buses are connected with a single app and you know exactly when the next service will arrive and how long you need to wait.[7]

B5. Parking: It doesn't sound like parking is a problem but it is actually a big headache, especially in large cities. Less available space means that drivers have to waste their time finding parking spaces and increase road traffic in this process. This issue can be solved by using IoT connected sensors around the city that point out the empty parking spaces around wherever your destination is. This data will also allow city officials to see where there is congestion due to less parking space and where there is lots of empty space available. This can then be used to optimize parking and prevent traffic jams as well as driver irritation![7]

B6.Natural Disaster Management: It is not possible to prevent natural disasters like hurricanes, earthquakes, tsunamis, etc. but it is entirely possible to anticipate these disasters before they occur and then manage them effectively. For example, sensors in combination with IoT can be used to anticipate when earthquakes are going to occur by analyzing the makeup of the ground, seismic plate interaction, energy propagation in the ground, etc. Similarly, sensors can be used to obtain flood detection data like river level readings, rainfall records, terrain and elevation of an area, etc. to predict when and where a flood might occur and the severity of the flood as well[7].

6. TECHNOLOGIES

The main motive of Internet Of things is to make the things or objects in the world to be connected through internet, wireless sensor networks (WSN) and smart phones. so that they can share information automatically [10] just like people sharing information. To implement this motive, there are many technologies that come into picture. Radio Frequency Identification (RFID) tags mobile phones, sensors, actuators, embedded systems and nanotechnology helps the things to communicate among themselves.

6.A.Radio Frequency Identification Radio Frequency identification (RFID): It is a wireless technology that is used for identification of objects [10]. Due to its reduced cost and increased abilities like tracking the location, status of objects and remote reading [9], it is more preferred than the usual bar code technology. It is the root cause factor for an object to be identified so that it can be connected to the internet. RFID uses radio waves to identify things and transfer its information to the RFID reader without physical contact. The RFID system has two main components: RFID tags (transponders) and RFID Readers (transceivers) [10]. The tags have a microchip, memory to record information using Electronic Product Code (EPC) or Universal Identification (UID) and an embedded antenna. The working of an RFID application is as

follows: The RFID tags are attached to the items which have to be monitored and whose information is to be shared. The readers are flashed on the tag and due to the radio signals received by the in-built antenna, the tag responses by transferring their EPC to the reader. The reader then transmits this information from EPC to the computer to be shared across the internet. In cases where smart phones are used, the sensors present in the mobile devices capture the information and are uploaded online using GPRS or Wi-Fi[12].

6.B . Wireless Sensor Networks Wireless Sensor Networks (WSN) : It play a vital role in connecting the physical world to the information world [9].These networks monitor the changes happening in the environment; report them so that corresponding responses can be taken. WSN help in short distance communication among the objects by building wireless networks in an ad-hoc way [11].WSN contain many independent nodes that communicate among themselves with the help of wireless radio. The nodes contain a sensor(collecting data) , microcontroller (computing data and controlling) ,memory (storing program and data) , radio transceiver (for communication with other nodes) and battery (power supply) [10]. These sensors work together to collect data and send it to the sink node. The sink node redirects the data to the destination. Hence many nodes have to coordinate together to send the signal to the sink node.

6.C. Embedded Systems and Nanotechnology : Embedded systems are intelligent and things with embedded intelligence become smart things. For e.g. A smart washing machine can wash and dry clothes automatically without human intervention. Nano- 6 technology can imbibe intelligence in things which are called smart devices. They are able to process information, self-configure and take independent decisions [9]. These smart devices are connected with the help of LAN, GPRS, WSN, Wi-Fi, 3G, etc.

7.CONCLUSION

In this paper, we have presented the detailed survey on IoT architectures, protocols, security and smart city based applications. Firstly, we have presented a common IoT architecture. Secondly, we have presented the essential application layer protocols that have attained focus for IoT as well as providing a comparison among each other. Thirdly, we explained different iot applications used in our dialy life like,home applications,smart cities, health applications etc. Finally we are presented various security measures by using many technologies like RFID and Wireless sensor networks, embedded systems, nanotechnology.

Internet of things is a new internet application which leads to an era of smart technology where there exists thing-thing communication rather than human-human communication. Through IOT, each and every object in this world can be identified, connected and take decisions independently. It has taken its birth from mobile computing and

ubiquitous computing. Technologies such as RFID, wireless sensor networks and embedded systems play a vital role in forming an IOT application. It is used in many applications in healthcare, agriculture, smart buildings, transportations etc.

8.REFERENCES

1. Hameed, A., & Alomary, A. (2019, September). Security issues in IoT: A survey. In *2019 International Conference on Innovation and Intelligence for Informatics, Computing, and Technologies (3ICT)* (pp. 1-5). IEEE.
2. Datta, P., & Sharma, B. (2017, July). A survey on IoT architectures, protocols, security and smart city based applications. In *2017 8th International Conference on Computing, Communication and Networking Technologies (ICCCNT)* (pp. 1-5). IEEE.
3. Dhanalaxmi, B., & Naidu, G. A. (2017, February). A survey on design and analysis of robust IoT architecture. In *2017 International Conference on Innovative Mechanisms for Industry Applications (ICIMIA)* (pp. 375-378). IEEE.
4. Overcoming Challenges of Connecting Intelligent Nodes to the Internet of Things, Silicon Labs, Inc, rev 1
5. Katole, B., Sivapala, M., & Suresh, V. (2013). Principle elements and framework of internet of things. *Int. J. Eng. Sci*, *3*(5), 24-29.
6. https://www.mobinius.com/blogs/iot-in-home-automation/?sfw=pass163
7. https://www.geeksforgeeks.org/10-applications-of-iot-in-creating-smart-cities
8. Jain, D., Krishna, P. V., & Saritha, V. (2012). A study on Internet of Things based applications. *arXiv preprint arXiv:1206.3891*.
9. Tan, L., & Wang, N. (2010, August). Future internet: The internet of things. In *2010 3rd international conference on advanced computer theory and engineering (ICACTE)* (Vol. 5, pp. V5-376). IEEE.
10. Shen, G., & Liu, B. (2011, May). The visions, technologies, applications and security issues of Internet of Things. In *2011 International conference on E-Business and E-Government (ICEE)* (pp. 1-4). IEEE.
11. Zhu, Q., Wang, R., Chen, Q., Liu, Y., & Qin, W. (2010, December). Iot gateway: Bridging wireless sensor networks into internet of things. In *2010 IEEE/IFIP International Conference on Embedded and Ubiquitous Computing* (pp. 347-352). Ieee.
12. Want, R. (2006). An introduction to RFID technology. *IEEE pervasive computing*, *5*(1), 25-33.