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A 20/20 vision of Internet of things

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Abstract: *One of the trending terms Internet of things as been around since the concept of wireless devices have been conceived. A dais where every device is connected with internet and are synchronized, IoT allows devices communicate in intelligent way. This smart way of communication by linking machine to machine has created abundance of new opportunities leading to business innovation. Its application is found in various areas namely- Manufacturing, education, healthcare facility, smart home, transportation etc. Even though wealth of opportunities is produced, this has led increasing security risks. Enabling intelligent and robust cyber security will make way for secured IoT.*

Keywords: *Internet of things, control, automation,*

I. Introduction

Internet of things is one of the most speculative topics in IT industry but its groundwork was laid a long way back. Internet of the things has been around since the concept of wireless devices was visualized. Its origin is debatable matter. Some say its inception is with the ATM (Automated Teller Machine) Machines in 1930's, others believe its inception is with barcode in late 1940's. The timeline for wireless devices and concepts goes this way-wearable computer, ARPANET, TCP/IP, Domain Name server (DNS), emergence of Worldwide Web (www). The term 'Internet of Things' was coined by Kevin Ashton of MIT's AutoID Lab in 1999 while he was working on RFID (Radio Frequency ID) for Proctor and Gamble. The idea was conceived when attempt to link RFID information to internet. If all the objects used in our day to day life could be given unique identity through identifiers and wireless connectivity, then these objects could communicate with each other and also could be managed by computers [1].

In an article published in RFID journal in 1999 Ashton wrote: *"If we had computers that knew everything there was to know about things—using data they gathered without any help from us -- we would be able to track and count everything, and greatly reduce waste, loss and cost. We would know when things needed replacing, repairing or recalling, and whether they were fresh or past their best. We need to empower computers with their own means of gathering information, so they can see, hear and smell the world for themselves, in all its random glory. RFID and sensor technology enable computers to observe, identify and understand the world—without the limitations of human-entered data."* [2]

There are various definitions of IoT available on public domain. The International Telecommunication Union's Global Standards Initiative have defined IOT in following manner: The Internet of Things (IoT) is the network of physical objects or "things" embedded with electronics, software, sensors, and connectivity to enable objects to exchange data with the production, operator and/or other connected devices based on. The another definition (Morgan J., 2014) given is : IoT is a giant network of connected "things" (which also includes people). The relationship will be between people-people, people-things, and things-things.[3]

It is a simple idea where network devices can sense and from various objects around, data is collected. Internet of things is a simple concept where network devices could sense and collect data from various objects around us and then share this data through internet where it could be processed and analyzed for any business or personal purpose. In simple words IOT can be described as all the physical things or objects in this world translated to a computer which is connected to internet. According to Gartner, they expect a 30 percent rise in the number of devices allied with the Internet of Things (IoT) this year. This growth will result in more than 6 billion devices joining the IoT, with an addition of 20 billion devices expected to be a part of the IoT by 2020.

II. Applications Areas Of Internet Of Things

Application of IoT can be found in all fields like manufacturing, education, health, environment, building smart cities & home automation, transportation, agriculture, infrastructure, manufacturing etc. IoT has its applications spread across vast spectrums which will help make life and work easy, its beneficiaries being individuals, enterprise and society.

1.1. Smart Manufacturing

IOT applications create an environment where information can be made available from shop floor – to logistics – till the customers on real time basis. Manufacturing operations can be improved by the use of IOT by effective factory management. IOT helps in proper asset utilization and its management. Asset utilization helps in improving the efficiency and cost savings. IOT increase the decision making capability of the workers as they can compare the old and new data. Also IOT implementation can aid in remote controlling of machine. Preventive alerts for maintenance can reduce breakdown of machines, reducing the failure rate ultimately leading to optimization of manufacturing processes.

1.2. Education and IOT

Learning environment can be changed totally by internet of things. This technology can change the way of learning as well as teaching. IOT applications will help the spread of education in remote areas where teachers are unable to reach personally. IOT applications will aid students with time management as they can learn n study at their own pace. Also teachers could assess the work done by students online also. Faculties can improve their teaching skills and also can cover large number of students at same time by taking advantage of connectivity through usage of internet of things.

1.3. Health and IOT

Advancement in the field of health and wellness can be brought in by IoT. Assistance to patients' treatment, in case of their presence in distant location or otherwise, can be accommodated with the help of remote monitoring, communication and tracking as they move through medical care. Using IoT will be an advantage, as it helps in compilation of patient data over a period enabling preventive care and quick diagnosis which will help in on time treatment. This can also facilitate in understanding what all parameters that can speed up a patient's recovery. There are sometimes critical patients requiring care and needs to be kept in constant observation. This can be carried out using IoT driven monitoring.

1.4. Smart & Safe Environment

IOT applications can be used in making environment smart as well as safe. IOT based data can provide alerts for Forest fire, Air pollution, Snow level monitoring, earthquake, landslide and avalanche. These alerts can prevent damage to life as well as infra. Monitoring levels of various gases, humidity, temperature etc in the environment can predict the day to day environmental changes. Preventing pollution by detecting the chemical leakage in the rivers and sea is also possible by analyzing the data received from various IOT devices.

1.5. Smart Cities & smart home

Smart cities and smart homes can be built up using internet of things. The concept smart lighting for street lights can save the energy consumption. The IOT sensors can detect the available natural lights and based on the data received from the sensors the lighting devices will adjust the brightness. People can get live updates about traffic conditions during peak hours or warning messages if any accidents occur in their driving routes. This will help them to plan their travel in the cities. Similarly IOT can also make living better by use of simple devices and sensors in our day to day life. Any home appliances can be operated by sitting in the living room by use of internet of things. Examples: Switch off the microwave or washing machine, watering the plants, light turns on automatically when the sun sets etc. This automation through the use of IOT applications can make home a better place to live.

1.6. Transportation & IOT

An internet enabled commercial vehicle will be able to provide both owners as well as drivers with real time data about traffic as well as safety conditions. Sensors in the vehicles will provide indication about the health of engine as well as the entire vehicle. This data can be shared with the owner as well as the maintenance team for further analysis. Also this build up devices and sensors can detect preventive maintenance to save abrupt breakdown of the vehicle at the time of delivery. IOT applications can also send warning as well as alerts for scheduled maintenance and service of the vehicles.

1.7. Agriculture & IOT

Agriculture is another sector where IOT can help to minimize the efforts of farmers. Farmers can plan their entire agriculture cycle based on environmental analysis done by IOT devices and applications. Weather and environmental predictions through IOT can make traditional agriculture smarter. Farmers can set alerts for seeding, watering, replanting etc. Sensors and monitoring devices in the fields can give preventative notifications to farmers about spraying of pesticides, any growth of pests & germs, soil fertility and climate

forecasting. IOT can guide farmers in supply chain management for selling the harvest at appropriate price, location and time.

1.8. Infrastructure and IOT

Big infrastructure like bridges, dams, flyovers can be monitored with help of small sensors to keep a check on their structural stability. The usage of IOT in monitoring and operating the infrastructure will help to improve the incident management and emergency response for any incident. It can be used for scheduled repairs and maintenance activities. This can reduce the cost of operation in all infrastructure related areas.

III. Why Go For Iot

The concept has its inherent merits. Also its applications, as listed above, can be found in every field, the following reasons can provide an insight on why to go ahead with this technology.

1.9. Communication:

Communication is imperative for any business to thrive. The same can be applied for creation of an IoT setup since its basis is on interdependent contact with the devices. Also main function of IOT is to establish communication between people and systems. Since devices are connected with each other, a proper communication channel should be established between these devices. Also the information and data collected will be shared with the end user. So there will be two types of communications: between devices and between devices & people.

1.10.Control & Automation:

IOT allows connection between the devices and various objects. This will be of assistance to any business or consumer for controlling the devices remotely. For example adjusting the temperature, switch on or off a device etc. Hence a performance baseline needs to be set, so that the process sends alerts for anomalies and deliver automated responses.

1.11. Cost Savings:

Companies adopt IOT to save money. Business may lose money when equipment fails. IOT helps to detect the failure in advance by sending alerts. This will facilitate planned maintenance and save money by minimizing equipment failures. Smart devices provide data to understand energy consumption and help identify opportunities for saving money.

IV. Impacts Of IOT

Major impact of IOT applications is on use of resources, optimization, Preventive or predictive maintenance.

4.1. Resource Optimization

Use of Smart devices will assist resource optimization since we can have better control over the resource available to us. Organization can manage their assets, supply and raw materials by receiving real time information. Also this will help in best utilization of resource by managing priorities. Use of IOT devices will guide in making tradeoffs between urgency against importance which will lead in better resource allocation.

4.2. Data

IOT basically means all the objects & devices have unique identity and are connected to each other in a network. These IOT devices generate data in continuous streams. Therefore the total amount of data generated will be massive. This will impact the big data landscape on large scale. Organizations need to handle this high volume of data streams and perform actions on it. This will also influence the data collection mechanism used in an organization.

4.3. Analytics

IOT can be valuable only if we are able to extract the exact required, useful and important data from the large volumes. This is because it is not necessary that all the data generated is important and useful. Hence to manage and distinguish between the useful and redundant data is also one of the major challenges. Therefore organizations need to improve the analytical capabilities. The analytics will be taken to next level because of the tremendous amount of data and the interconnections between the devices. Hence there is a need that organization should set up a proper analytics platform in order to analyze the data.

4.4. Infrastructure

Taking consideration IOT, the very first thing comes in minds is the large, continuous data streams collected in data storage. Hence organizations must prepare themselves to manage this large additional load. The data centre equipments must be capable to store the heterogeneous data generated. Organizations are inclined towards PaaS ie Platform as a Service model for data storage. It is cloud based solution which provides flexibility, scalability, compliance and architecture which provides storage for valuable IOT data.

4.5. Business Processes

IOT will lead to rethink and redesign the business processes. It is seen that the performance of operational activities is improved due to implementation of IOT. There will be a change in controls and accountability. Certain processes which used to be done manually can be replaced totally by IOT devices.

V. Opportunities

Any business or industry either local or global can be potentially transformed by IOT. To gain value from the networked connection among people, data and processes, IOT is creating unparalleled opportunities for both individuals as well as organizations. The ability of devices to gather data on their own removes the limitations of human-entered data—automatically obtaining the data need, at the time and in the way they need it. The automation reduces the risk of error. Fewer errors can mean increased efficiency, lower costs and improvements in quality in just about any industry. As IOT can provide real time information, this will help organizations to respond rapidly and efficiently. This will help organizations to increase revenue by increasing customer satisfaction. IOT will increase the global visibility of business, since the borders of locations can be cut through by remote monitoring and control feature of IOT.

VI. Challenges In IOT

The rapidly transforming technology can bring in many risks and added complexities. Following are the key issues areas related to IOT

1.12. Absence of Governance

One of the major challenges for widespread adoption of IOT globally is absence of governance. Regulatory and legal governance is absence since this is an emerging concept. There should be proper policies specifying the regulatory, legal rules for data protection that will be generated through IOT applications. The data gathered from IOT could be used for beneficial as well as discriminatory purposes. Hence there should be governance to manage these data usage issues. The devices used for IOT should also have some standard which can help in collaborating around cross borders.

1.13. Security issues

Since IoT uses internet, there should be a high degree of trust on the information & data collected from the IoT devices. Every device and sensor connected to internet (cloud and network) possesses a risk. Competitive cost & technical constraints of IOT devices challenges the manufacturers to design as secured device with long term sustainability.

A technically sound solution should be designed to address the security issues related to IOT. Public acceptance of IOT will happen only if there is a strong security solution in place.

A trillion points of vulnerability –Poorly secured IOT devices could open doors for cyber attacks which may lead device to malfunction. Malfunctioning of IOT devices may cause vulnerabilities. Hence proper controls should be developed to preserve the confidentiality of data collected and integrity of data sent. As the no of devices increase the risk will keep on going high.

It should be noted that security of all devices isn't absolute. For different devices the level of security will be based on the usage & function of devices. Hence a security spectrum should be designed from devices fully unprotected to highly secured devices.

1.14. Privacy and data sharing

The main objective of IOT is to make life easier by improving the productivity and efficiency of business and employees. This will be done by making decisions after analyzing the data. IOT helps to make smarter decisions based on the data collected. But this will impact the privacy of the data collected. IOT applications should take care that the data received is protected and shared only with required level of personnel.

1.15. Data Integrity

Organizations will receive data from all the connected sensors of IOT. So organizations will have to be sure about the data received from any device and also needs to check on the integrity of data. Hence the devices should be designed & build in to address the security to create trust about the hardware and integrity of data.

1.16. Massive amount of data

The data generated from IOT devices will be massive and it will be a great challenge for organizations to manage this large volume of data. Organization need to modify their data management systems to adapt with huge volumes of continuous data flows. Organizations need to manage the infrastructure where the data can be store safely. The analytical tools may vary because of this large massive database.

VII. Conclusion

IOT can create a paradigm shift the way computer network works. IOT will promote a different approach of working as it will impact people, process as well as organizations. This will connect the dots with various devices. And this connectivity, in turn, will ease the remote controlling functions which will lead to increased productivity. IOT applications will ease the way of living and working. But also there are certain areas where more maturity is required for smooth functioning of IOT applications. Security of data remains one of the major concerns with respect to IOT applications. Also the data collection done should be from trust worthy source, so that its authenticity isn't questioned. The privacy and sharing of data are the two areas requiring to be worked on for IOT implementation. As IT companies predicted, the data that will be generated from IoT based applications will grow exponentially. So the organizations need to work on the data management. The storage back up, tracking and analysis of such huge volumes of data will be another major challenge for IT organizations. A revolutionary change is bound to happen in the future of organizations since it will be Internet of everything.

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