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IoT-Future Smart Systems

Simple Batra

Dept. of IT, Delhi School of Professional Studies and Research (Affiliated to Guru Gobind Singh Indraprastha University), Dwarka, New Delhi

**Corresponding Author: simpletondon@gmail.com, Tel-9315080761, 7290988620*

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Abstract— IoT (Internet of Things) is the advanced concept of ICT (Information Communication Technology), connected network of physical objects-devices, vehicles, buildings, machines and sensors. Controlling of remote objects across the distributed network infrastructure and sensing them is done by Internet of Things in which all devices and services in collaboration reduce human involvement for better human life. The Internet of Things (IoT) is the result of integration of fragmented complex technologies to meet the social, economic and business challenges. The Internet revolution has given new approach to business to-consumer (B2C) industries such as media, retail and financial services. In the coming 10 years, the Internet of Things revolution will facilitate and change manufacturing, energy, agriculture, transportation and other industrial sectors to transform how people will work through new interactions between humans and machines. This technological change will bring exceptional opportunities, along with new risks, to business and society.

Keywords- IoT Sensors, Actuators, Smart systems, Intelligent Systems, Hyper connected society.

I. INTRODUCTION

The term "Web of Things" has come to assemble a number of technologies and research disciplines that empower the Internet to reach out into the real world of physical objects. Today the Internet has become ubiquitous, has touched almost every corner of the world, and is affecting human life in every way. Smart devices, Smart phones, Smart cars, Smart homes, Smart cities, Smart Systems -A smart world is the goal of many diverse and often disjoint research communities. Internet of Things (IoT), Mobile Computing (MC), Pervasive Computing (PC), Wireless Sensor Networks (WSN), and most recently, Cyber Physical Systems (CPS) are the major research communities which relies on underlying technologies such as real-time computing, machine learning, security, privacy, signal processing, big data, and others. The smart vision of the world involves much of computer science, computer engineering, and electrical engineering and interactions among them will enable the development of smart systems for the hyper connected society. Hyper connected society is IoT, Machine to Machine (M2M) communication or Internet of Everything (IoE) is the long term goal in the 21st century, we want to be connected with anything anytime and anywhere. Machine to machine (M2M) processing means the sharing of data and processing that takes place between these devices. The Internet of Everything also includes people as participants in the global network. Ubiquitous computing emphasizes that network and computing resources are available almost everywhere, but pervasive computing highlights the fact that processors are embedded in objects all around us where a very wide variety of appliances will be connected to the web. Things are expected to become dynamic participants where they are able to interact and communicate among themselves by exchanging data and information sensed about the particular environment. For that they must sense, react autonomously to the real world events and provide services with or without direct human intervention. Connections such as RFID, Wi-Fi, Bluetooth, and ZigBee, can be used by sensors and for wide area connectivity can use many technologies such as GSM, GPRS, 3G, and LTE. IoT-enabled things will sense and share information about the things and the surrounding environment with people, software systems and other machines. Through this technology the world will not only become smart in every aspect by providing a means of smart cities, smart healthcare, smart homes and building, but also give many important applications such as smart energy, grid, transportation, waste management and monitoring. In this paper Impact of digitization can be seen in many IoT applications and future systems that how they are bridging the gap between the cyber space and the physical world of real things.

II. RELATED WORK

ROLE OF SENSORS AND ACTUATORS-

Internet of Things refers to a new kind of era where almost all the devices and appliances that we use are working collaboratively to achieve complex tasks that require a high degree of intelligence. IoT is not a single technology-it is an integration of various technologies that work together. For this intelligence and interconnection, IoT devices are equipped with embedded sensors, actuators, processors, and transceivers. For interacting with the physical world sensors and actuators are required**.** Sensor is a sophisticated device that is used to detect and respond to electrical or optical signals. From the physical environment a sensor is able to detect and respond to some type of input from the environment. A **Sensor** converts the physical parameter (for example: temperature, blood pressure, humidity, speed, etc.) into a signal which can be measured electrically. The light, heat, motion, moisture, pressure, or any one of the number of other environmental phenomena can be the input to it. The output is a signal that is converted to human-readable display at the sensor location or transmitted electronically over a network for further processing. An input device senses the environment or surrounding passes it to signal processing block which processes the signal from input device and an output device which presents the signal in a readable and usable form.

Figure 1-Basic working model

The storage and processing of data can be done on the edge of the network it or in a remote server. The processed data is then typically sent to a remote server for display. The storage and processing capabilities of an IoT object depends on size, energy, power, and computational capability. It is important to ensure that we get the right kind of data must be accurate also. Along with the challenges of data collection, and handling, the communication between IoT devices is mainly wireless because they are generally installed at geographically dispersed locations. These channels often have high rates of distortion and are unreliable. Too many retransmissions must be avoided and thus communication technologies are integral to the study of IoT devices. Sensors collect the data, stores and process it intelligently for deriving useful interferences from it. On the basis of the derived inferences diverse actions can be taken on processed i.e. modification of the physical world through actuators. An actuator is a device that is used to effect a change in the environment such that converts energy into motion or to apply a force. At a particular point of time state of object defines the change in physical world. An application will behave differently in different contexts, so actions are context dependent also.

The core architecture of an IoT framework is formed by sensors, actuators, compute servers, and the communication network. All the heterogeneous components are required to be connected through some middleware. Protocols and standards must be taken in to account for connecting several devices. Health care, fitness, education, entertainment, social life, energy conservation, environment monitoring, home automation, and transport system are the application areas, IoT technologies have considerably been able to reduce human effort and improve the quality of life.

III. APPLICATIONS OF IOT –FUTURE SMART SYSTEMS

There are numerous and diverse potential applications of IoT, which includes all areas of everyday life of individuals, enterprises and society as a whole. It includes smart energy, smart health, smart buildings, smart transport, smart industry, smart agriculture and smart city.

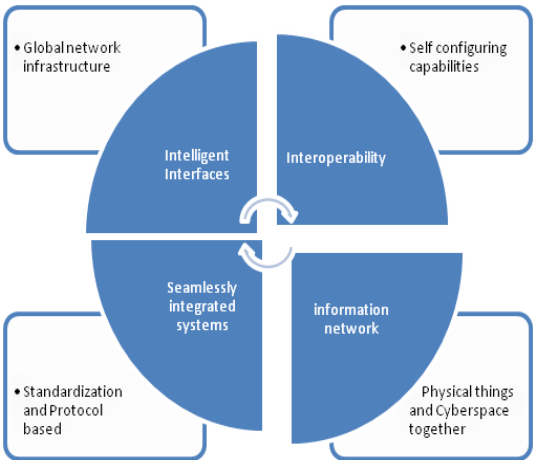

Figure 2-Internet of Things (Integration of interoperable systems)

Smart Homes-

Home Automation refers to automation of the home, housework or all activities of home. Home automation may incorporate unified control of lighting, HVAC (warming, ventilation and cooling), appliances, and security locks of entry gates. These systems are aimed to provide human beings convenience, comfort, energy efficiency and security. Elderly persons who might generally require caretakers or institutional care can be given better quality of life through such systems. A home automation system integrates electrical devices like smart phone, tablet and information technologies with the home environment, systems and appliances are able to communicate effectively which results in convenience, Advanced technologies that enable remote data transfer, sensing environment and control, for example, Bluetooth, Wi-Fi, RFID, and cell systems have been used to insert different levels of knowledge in the home to create intelligent homes. Many of the home automation systems frameworks can be isolated into two classes privately controlled frameworks and remotely controlled frameworks. Privately controlled frameworks use an in-home controller to

accomplish home automation. This permits clients to completely use their automation system from inside their home by within their home via a stationary or wireless interface. Remotely controlled frameworks connect the Internet with a current home security framework to allow the users to control the system from their cell phone, PC, or by means of phone from their home security provider. There are various issues included when planning a home automation system like a graphical and user friendly interface on the host side, with the goal that the devices can be managed, observed, and controlled.

Smart Health-

IoT (Internet of Things) is a presently propelled idea of ICT (Information Communication Innovation), in which all gadgets and administrations are working together while reducing human intercession for better human life. Furthermore, social insurance benefit is making the application and improvement of the at present most dynamic IoT advances. For example, Google Fit is centered on the open IoT stage and its inserted gadget includes sensors. In any case, basic achievement factor of IoT is an explosion of demand for services. Therefore it is critical to build up a wellbeing system that gives customized services to users on the open IoT platform. Also, Medical sensor devices, for example, glucose meter, blood pressure monitors and virtual medicinal sensor, for example, diabetes meter ought to be given to clients as self health care devices. Few of such platforms are namely Google fit, Apple health kit, and Samsung SAM. Notwithstanding, they are putting forth benefits distinctively each other, on the grounds that there is no any standard particular for the IoT, and focus of each platform is distinct. It requires having a common open IoT platform as a health management model for ceaseless ailment, for example, hypertension, stoutness, diabetes. Primary component required is a therapeutic sensor gadget to quantify medical data and send the restorative information for being processed. The second component is a virtual medicinal sensor which is a product sensor having an intelligent determination calculation and mash up information from different physical restorative sensors and server. Most Important needed is versatile application that is processing information about patient or client from medicinal IoT device and in addition utilizing it for self-management. The last part is the administrator and common platform that empowers all segments to be networked with each other through one API. Portable application provides a medium of communication between the patient and the doctor though UI of the medical sensor device to give information about the health of the patient also.

Smart Transport-

Developed transportation system is one of major factor responsible for the wellbeing of the country. Application of computer technology to the transport sector enables Intelligent Transport Systems (ITS) systems to gather data about the transport system, process it, and then use the results of processing to improve the management of the transport system, and provide the transport user precise information on which to take their transport decisions. ITS can be used to detect any incident on any transport system, and the same is communicated to control centre. Traffic management strategies can be implemented in response to certain types of incidents, to take corrective actions like changing route. For example, an accident may occur on any route; Variable message signing (VMS) automatically gets activated to manage the traffic that is too close to the accident to advice traffic to remain away from the accident by taking another route. Parking management will prove to be boon to drivers by informing them about parking opportunities, including their pricing and assist in the enforcement of parking. IoT used in transportation can bring into picture electric vehicles which can reduce both the fuel cost and global warming. Many of the technology, data and integration advancements underway with IoT have to come together in to make network of connected and cognizant cars. By 2020, there has to be totally connected vehicles on the road, enabling new in-vehicle services and automated driving systems.

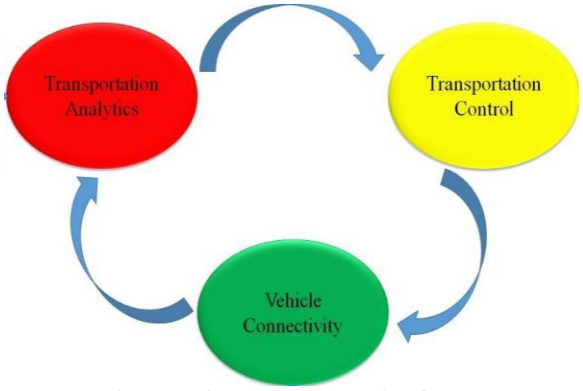

Figure 3. Smart Transportation System

Smart agriculture

In a developing country like India agriculture is one of the most important areas on which human life is very much dependent and majority of human population was engaged in the sector of agriculture. Smart Agriculture system needs to Sense local agricultural parameters, identify location through sensors, gather data, transfer data from crop field to control station for decision making by AI algorithms based on local data, domain knowledge and history to take control of situation. This would help farmers to reduce waste and improve productivity. Combining data from crop field with weather forecasts will help to take crucial decisions like to hold off irrigation if rain is imminent. Smart farms can also benefit from 'Smart' bins and silos which can report on the levels of grain and other feedstuffs to avoid risky physical

checks. These intelligent devices can also send alerts when temperatures in the containers rise to levels that might cause damage to the contents Sensor Network technology, Grid Computing technology and Context-aware Computing Technology all need to integrate for having smart agriculture. Satellite navigation technology is also supports the sensor network collected data to acquire the location of sensors as well as actuators. To know the exact area under effect location related data plays a crucial role in decision making. Grid computing technology supports to provide the low cost high power computing and distributed data storage facility. As sensor network generates huge amount of sensed data so heavy amount of storage space as well as the high computing power for processing and decision making is needed which is provided by these technologies. The use of grid computing is important to keep look for low cost solution development. Context-aware computing is an aid to model the exact situation based on the sensed data and help in decision making process to find its solution based on the current and history data. The agricultural-research community needs to work on different aspects of agriculture to improve the quality of farming and increase the productivity of agriculture land as it will have a huge impact on economy of developing country like India.

Smart Energy- Smart energy management systems are required to relate the information and communications technologies (ICTs) to have a dynamic electricity network which enables a real time communication between suppliers and consumers to help deliver electricity more efficiently and sustainably. Sensing and monitoring technologies for power flows, digital communications infrastructure to transmit digital data across the grid; in homes smart meter display to check energy usage; highly coordinated, controlled and fully automated systems are essential to aggregate and process various types of data, and to create a highly efficient electricity management system to save energy. Internet of things can handle multiple applications together to create an electrical grid, which includes a variety of operational and energy measures, including smart meters, smart appliances, renewable energy resources and energy-efficiency resources. Developing micro grids for more efficient energy distribution; integration of renewable energy sources and green technologies; implementing projects for electric vehicle charging stations and improving energy supply to the consumers will take a step further towards using a low carbon energy system. Major research needs to be conducted in efficient storage, enable two way communication, remote controlled operations, extensive power flow control and integration of energy from next-generation batteries, thermal technologies and other sources. The smart grid will be an enabling engine for

- Allowing the seamless integration of renewable energy sources like wind…
- Enabling nationwide use of plug-in hybrid electric vehicles…
- Ushering in a new era of consumer choice…
- Making large-scale energy storage a reality
- Exploiting the use of green building standards to help "lighten the load..."
- Making use of solar energy – 24 hours a day

Smart city-
Many major cities are supported by smart projects like New York, Tokyo, Shanghai, Singapore Amsterdam, and Dubai. Cities of the future and smart life may still be viewed by the innovations rate of any city; it will become feasible only when the IoT technology works for development of cities. It requires careful planning at every stage, constant support and approvals from governing bodies, citizens to be trained to use the internet of things technology in practical aspect. Improvement in infrastructure, enhancement in public transportation, reduction in traffic congestion, implementation of energy management systems, provision of better security and healthcare systems, weather monitoring systems etc. and specifying protocols for them are must for any smart city. Moreover interconnection of all these systems in the cities and to support people by the internet in every place to access the database of airports, railways, transportation will become smarter by means of the internet of things.

IV. CONCLUSION AND FUTURE SCOPE

Smart Systems that will be able to sense and respond to the real time objects need to be composed of sensors that provide data to the command-and-control units that process data and provide commands. Further actuators then process data as per the commands. Examples Home automation, climate, lighting and security control, smart-grids, electric grid with renewable energies etc. It is concluded that the major challenges include integrating heterogeneous components and technologies, merging interdisciplinary approaches and solutions and improving system energy consumption and efficiency. Integration of multiple systems in smart environments and smart ecosystems cross the specific application domains along with the assimilation of ICT concepts is again a challenge. Utilization of advanced technologies and networks will take us towards the smarter world with the use of smart systems around the globe giving ease and comfort to all. Cloud computing, ubiquitous connectivity, embedded Sensors, Real-time analytics, maturing software industry Investments by big IT firms are the key enablers of IoT. Research institutes play a vital role by working on following technologies to build a smart city which can reflect the new information paradigm of IoT as part of the future vision of local governments and will contribute a lot in economic growth equally.

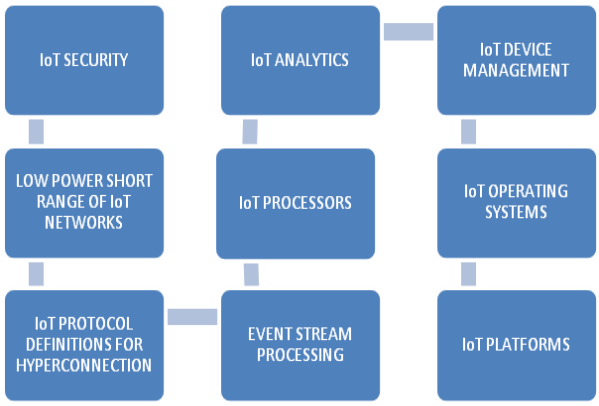

Figure 4. Technologies for Smart Future

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