Current Emerging Trends in IOT: A Survey and Future Prospects

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Abstract

Exponentially increasing use of internet and its network motivates technical communities to pursue research in the field called Internet of Things (IoT). IoT provides a different nature of communication between all the physical objects, people and other items implanted with sensors and network infrastructures. A pioneering effort has already been done by various companies and government agencies for implementing IOT in various domains but still academic circle and cities need to be explored more .In this paper, all the concepts, methods and technologies are listed in brief. The potential idea contribution in making smart university, smart city and smart hospital has been done. After reviewing the literature, we would be able to comment upon the current practical service models with IOT to make the everyday life easier, faster and efficient.

Keywords: *IoT, Smart City, Smart University, Smart Home, Smart Classroom*

1. Introduction

Internet of Things (IOT) is a theory that visualizes items around us as an element of internet. It includes a variety of things like Smartphone, sensors, PC, etc. It helps in connecting those devices with each other that perform services and looks after our needs, surroundings, safety and health. Experts estimate that the IOT will consist of about 30 billion objects by 2020. The term "The Internet of things" was coined by Kevin Ashton in 1999. It is a framework for the implementation of ally services which are independent and characterized by high degree of autonomous data capture event transfer and connectivity between different networks [1].

The main feature of this technology is the integration of heterogeneous sensing and action elements(actuators) in the distributed system that performs different actions based on the information gathered by the sensors, combined with the requirement of the particular application [2]. Intelligent information system available in IOT enables the processing of multi-model data collected by the sensors so that it can combine heterogeneous information and provide conclusions on the gathered information, giving rise to the activation of the necessary actions to address the consequences of those events. There are various aspects of IOT has been shown Figure1, in which progress or further researches can be done.

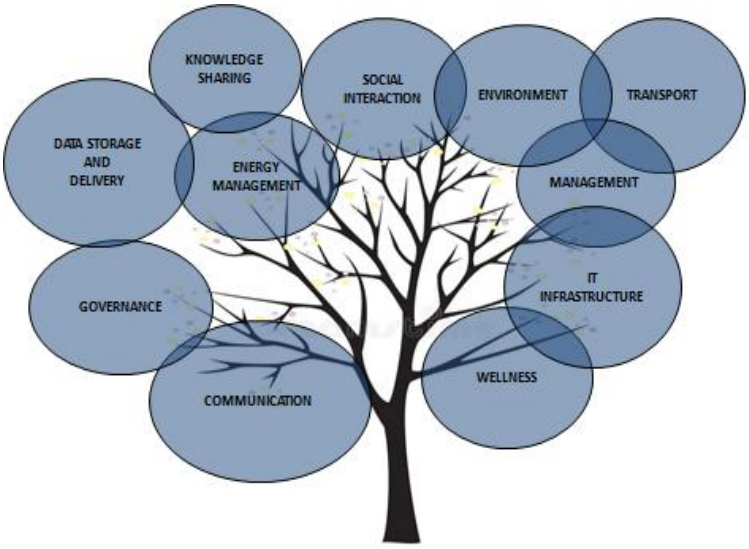

Figure1. Research Direction in IOT

The branches we see are research directions in Figure1 and those branches are communication, social interaction, transport, management, wellness, governance, energy management, data storage and delivery, knowledge sharing, IT infrastructure and environment. Till date emerging fields of research opted in IoT are shown in the next figure(Figure2).

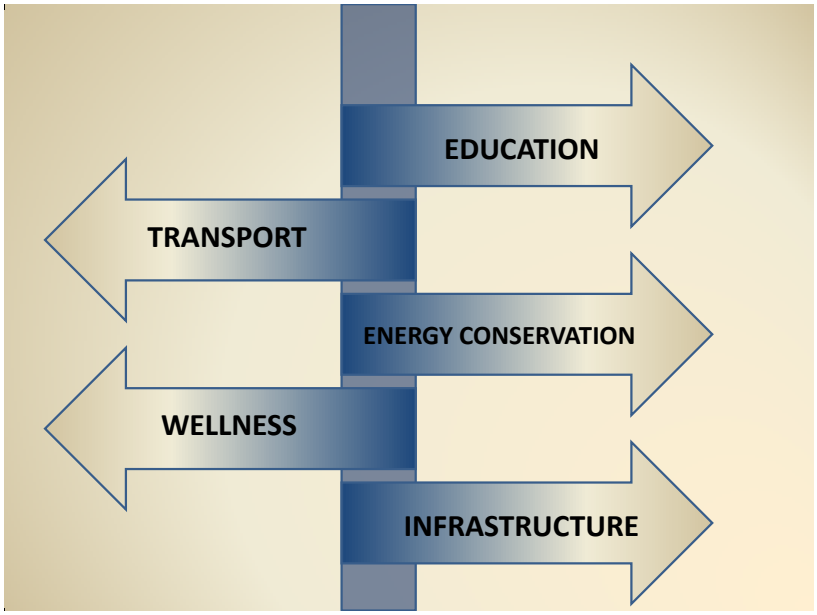

Figure2. Current Research directions discussed

A smart city is a gestate blueprint rather than the actual services that have been implemented and put in use in people's everyday life. This concept is developing rapidly and by 2020 more than 50% of the world population is expected to live in urban cities. By 2020, there will be 25-30 high-tech cities with 50-55% in developing countries [3]. The main purpose of this paper is to discuss the ideas which can be implemented in the cities to make them smart in homes, colonies, traffic systems, transportation systems, classrooms, universities, hospitals and in structural health of architecture so that life can be advanced, easier, faster and safer for the citizens.

2. IOT Technologies for Smart Cities

IOT is a network that uses the standard protocols for communication [4] on the internet platform. The concept of IOT is the presence of objects that will help in changing the environment. It consists of devices like smart phones, appliances, landmarks, monuments that can cooperate together to provide a common target [4].For achieving the aim we would need some kinds of technologies for setting communications between the devices. For setting short range of communication, there are various wireless technologies available with less power consumption and can be easily implemented owing to the cheaper rates.

One of the short range wireless technologies is Light-Fidelity (Li-Fi). Li-Fi is a wireless technology used for communication which is equivalent to Wi-Fi with the benefit of high bandwidth. The communication will take place with the help of light Li-Fi system. It can be implemented in smart hospitals. QR codes and barcodes – bar codes are the optical tags that contain various information about the entities with which they are attached. It could also be used in libraries. Radio-frequency identification (RFID) –it is a technology that is used in setting a unique identification tag between the objects. The process of giving unique identification to objects is automatic. It uses electromagnetic fields. It could be used in vehicular inter-communication. Z-Wave-it is a protocol that is an alternative of Wi-Fi because of its low power consumption and the nature of this technology is that it is short range and so it could be used in smart homes. ZigBee – it is also a cost efficient communication protocol that is used for short range of communication with less power consumption and high output. For medium range communication, we can use HaLow , a variant of Wi-Fi which consumes less power in data transmission and this technology could be used for transferring data in concept of smart colony. For long range of communication, the usage of Low-power wide-area networking (LPWAN) could be preferred. Its less power consumption and cost efficiency makes it even more versatile.

3. Related Works

In recent years, IOT is burgeoning industry but it is not a new concept and now it has been applied in many application domains including education, energy conservation, hospital, governance and social interaction. Patil.et.al. [3] proposed an energy efficient system which provided quality data with good performance. However, most wireless devices are resource constraint and operate on battery. So, the power consumption is an important issue in wireless sensor network design. To counteract, they proposed the system that controls the sleep schedule and number of links to deal with the power consumption with an acceptable delay constraint by implementing IOT.

IOT has been implemented in education for student safety and attendance monitoring after analysing the data gathered from questionnaire which was conducted in primary school staff in Iraq. It helped in improving safety of students and monitors student attendance accurately in real time [5]. Kanase.et.al. [6] proposed a project which could be implemented in hospitals to uproot the problems like excessive use of the electricity by the medical equipment installed in the hospital. They found that energy causes increase in amount of carbon footprint and also results in increase in amount of greenhouse gases entering the atmosphere. The use of Arduino board with microcontroller (ATmega Atmel 328PU) they designed the project of smart hospital using IOT which is highly energy efficient.

An innovative idea that enables teachers to use a real classroom type teaching approach to teach classroom-based distant students has been proposed by Jeffery.et. al [7]. Smart classroom integrates a tele-education experience to a traditional classroom experience [7]. Smart education, smart classroom, smart university and related topics are booming in various pioneering national events as well as in international events and projects. Some researchers discussed ways of adaptation of smart solution in university environment to enhance the quality of life, to improve performance of both teachers and students and to make university a place where knowledge is shared between employees, teachers and students [8].
After analyzing the opportunities and problems available in this field, diverse new ideas have been proposed in the next section.

4. Diverse Ideas and Concepts for Smart Cities

4.1 Smart Homes

Implementation of IOT in homes can change the basic concept of living. It will make our lives much easier, simpler and efficient, Its purpose is all about creating connectivity between the devices so that we can make our homes smart by implementing smart electronic system like a sensor that will sense the amount of water and gas supply in our house and it will notify us to our Smartphone and tell us that how can we use it efficiently according to our usage and will conserve energy. By implementation of a smart surveillance system, we will be notified about the presence of a visitor in our house and alerted with a message [4]. By the use of sensors, we can detect short circuits, gas leakages and other risk factors that are equipped with the alerting system and then we would be able to take appropriate actions. Some monitoring devices could be devised that will look after babies and pets equipped with some decision making modules for taking smart decision as and when required [2].

4.2 Smart Colony

The concept of smart colony can be a reality by implementing IOT in different ways like the concept of smart lightning system, smart waste management system and many more. A smart device will be available in every colony that will check for air, noise and environmental pollution along with the UV radiation and weather condition. The information gathered from the above sensors will be displayed on the display monitor with an alarming system. In case, any of the catastrophic failure occurs in a particular situation then the alerting and alarming system will get automatically activated with the warning messages [9].

4.3 Smart Vehicle, Transportation, Traffic and Parking System

One way of making the vehicles smart is by creating an inter-communication between the vehicles by DSRC [1]. By using sensors we can detect drunk drivers and the monitoring devices will detect traffic signals and change the driving mode accordingly. A smart public transport system will be implemented. Suppose a person wants to travel through a bus or a metro then he/she needs to know about its arrival and departure time along with the frequency in its intended source and destination and instead of visiting the respective station, all the required information can be gathered and saved by the smart transportation system in order to help them instantly. All the details will be handy with the online booking facility and helpful for the people.

Roads equipped with sensors and monitoring devices for identifying presence of the unwanted objects, monitoring violation of traffic rules like speed limit, wrong lane driving and accidents. If happens, A warning signals with a message could be displayed at a distance of every 300 m which alerts other drivers to take precautions in foggy days/night or in case of heavy rain when visibility is less. Traffic signals equipped with monitoring devices and sensors to detect accidents and then providing mobile medical support and contacting the emergency medical support station providing accident location could be established.

Smart parking procedure can be used efficiently for utilizing the space provided for parking, avoiding unnecessary traffic [4].Major smart services in the cities include parking scheme for prevention of illegal parking and for setting a proper parking procedure. Proper parking means construction of a platform that enables real time checking of available space and parking prices in the area that require parking facilitation of reservation/payment through mobile or web connection[10].

4.4 Smart Classroom

Classrooms will become smarter by conserving energy using smart lightning devices, by installing smart notebooks in the desks that can be accessed with unique ID of every student. It would be

beneficial for the disables too as those smart notebooks will work as a smart device for pattern making and help them to notify their teachers and better communicate with others. These all could also be accessed through PCs or laptops , reducing much of the class work in order to make a smart and advanced education system. A smart gesture recognising and monitoring system for the disable student would help in making their work easier.

4.5 Smart Universities

The concept of smart university is an integral part of the smart city concept. This could be achieved by putting into practice the use of a new attendance system coupled with biometric sensors. This would keep updating the database and report to the parents in case the student leaves early from the class or if not present. In addition, a portal facility can be added for the individual student, that can be accessed through PCs and Smartphones with the IDs assigned to them. This may work as a notice board, a platform for other works like assignments, declaration of test results, query submission, lost and found notices or any important emergency announcements. Along with this an app for students can be made which will help them to issue books from the library by scanning barcodes on the books, connected to the library system database, update automatically and notify the date of submission of the book and penalty can be collected in case of late submission.

4.6 Smart Hospital

Smart hospital system can be implemented in the city by using modern equipments equipped with sensors for energy conservation, a smart lightning system, also providing a smart mobile medical system. During unavailability of hospital staffs and nurses, monitoring and care taking of patients suffers and can't be done timely causing serious harm to patient and sometimes leads to death of patient. These situations can be handled by implanting the sensors and monitoring devices equipped with some alerting system for regular monitoring on the patient and notify the hospital staff in case of emergency[6]. In hospitals, a proper guiding system which helps people who are not familiar with the place, to reach directly and quickly to their destination once they enter to the hospital. This can be resolved by just connecting with the hospital domain, and submit the issue, all the details about who to contact, where to go, ward routes or compartments will be in their phones. This would be very much effective in emergency cases and will make the procedures faster and more lives could be saved.

4.7 Structural Health

The old monuments, building or historical structures require maintenance on regular basis so that they do not get damaged by the external disastrous agents. Structural health is one of the major concerns in the society as if not taken care properly it could lead to misfortunes and a lot of casualties. In the present scenario a proper sensing and monitoring system is not there to check vibrations, any kind of deformations in structure and environmental pollution so that preventive actions can be taken in order to preserve our buildings. This would lead to provide a better safety to our citizens[9].

5. Conclusion

IOT is one of the biggest reasons for the evolvement of the smart technologies. The main purpose of any idea, project or experiment is to make life simpler and easier keeping in mind about the availability of natural resources which are limited by utilizing them efficiently. The idea discussed in this paper can be implemented with the help of IOT for making the city smarter in every aspect. All these discussed concepts like smart homes, smart colony, smart traffic, smart hospital, structural health, smart classroom and smart university can be implemented but are limited to infrastructure provided, security and privacy issues and availability of network coverage in a city. We hope that all the ideas discussed would be tried to be implemented in future.

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