

Internet of Things: A Revolution

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Abstract: This paper focuses on the Internet of Things. Key enabling factor for this model is the combination of numerous technologies and communication solutions. Identifying and tracking technology, wireless sensors, actuator networks and dispersed intellect for smart objects are just the most relevant ones. Basically the deployment of NFC and RFID currently has conceived the idea of 'Internet of Things'. However, it can be speculated that if the current internet can hold so many objects together. The answer to the question can be IPv6 which is the latest communications protocol and can accommodate billions of objects or devices by providing each of them a unique IP address. The paper also discusses the issues related to IoT which could be social or privacy concern.

Keywords: RFID, NFC, Automation of systems, IPv6, Smart objects

I. Introduction

The Internet of Things (IoT) is a concept in which Internet will be incorporated into everyday objects by tagging chips thus forming an intelligent network of the physical objects. The objects tagged with unique identifying chips will allow them to be remotely controlled and communicate with each other. The given idea is based on the fact that there has been constant progress in the field of microelectronics and technology which will persist in the future. Moreover, the decreasing size and falling prices of chips will promote their usage in day-to-day life. It is expected that there would be 50 billion smart objects by 2020^[1]. While the perception is very futuristic the beginning of the IoT has already appeared in the form of RFID and NFC. The radio waves emitted or detected by the RFID or NFC tags help the object to be identified from a distance. Although RFID is in use today IoT is yet to evolve in a large network of things. The scenario where Internet of Things is pictured contains everyday life objects connected to each other such as cars, toaster, roads and even our pets. Since these objects will become aware of their surroundings, they can send out responses as and when required and also respond to the requests without human intervention.

II. Technologies supporting Internet of Things

A. Identification Technology

The purpose of identification is to record a unique identifier (UID) to any entity so as yield a non-ambiguous

identifiable object. UIDs may be created as a solitary quantity or out of a set of characteristics such that their resulting value is unique. In the visualization of IoT, objects have digital identity (UID) and are identified with a particular set of traits which are specified in a digital domain. The UID for the object can turn into a single permanent allotted name for the existence of that object. However, IoT would be challenged with a need to accommodate several identifiers per entity as well as variations to the identifiers. For instance, items will have permanent UIDs assigned by their makers while may also need network addresses such as IP addresses which may change with place and time. In fact the thought of presenting the internet to everyday life objects seems likely due to the establishment of Internet protocol (IPv6)^[3]. IPv6 is the latest Internet communications protocol which offers unique IP address to each device present on the Internet. Due to a large number of devices which have to be accommodated in IoT, IPv6 is very essential. It's very feature of supporting so many IP addresses while being secure and flexible makes it a viable solution to be used in IoT. The main aim of fusing IPv6 with IoT is that all the devices of the world can be united on a common platform. IPv6 is scalable, ubiquitous, flexible and tested for end to end connectivity.

B. Network Technology

The IoT is not a tangible reality but an upcoming vision of a number of technologies of which RFID is the base^[2]. RFID and sensors are the support pillars of IoT. In fact, the indication towards such a notion was created only after

RFID came to be used in businesses. RFID refers to automatic detection of tagged objects within the proximity of its reader using radio waves. The tags fixed to the object store the information and respond to the request of the reader. The data saved in the tag can be used to recognize, manage and track the items automatically using the unique code present in the tag. The data collected from the tags is sent to a server. The chip attached is a passive one so that longer life time can be attained in the whole process. The shortcoming related to passive tag is that it has a very short range. Other option is to use active tags which would considerably increase the range but reduce the life of tag since the batteries would have to be constantly replaced after every few years.

III. NFC supporting the idea of IoT

A fascinating technology which has materialized in the last few years and which seems as a valuable candidate to assist on providing a better way of interaction between a user and its surroundings is Near-Field-Communication (NFC). This technology is a blend of contactless discovery and interconnection technologies which enables wireless short range interaction between two NFC devices. It offers an easy, 'Tap and go' solution to transfer information and access data and other services in a spontaneous manner.

Therefore, the emergence of NFC would simplify human to environment communication, where people have to just wave their NFC phones in front of everyday objects tagged with RFID or NFC chips in order to spark the intelligent services offered by them. In fact, the amalgamation of RFID and NFC tags will promote the Internet of Things where each and every object and the corresponding services would be available through some kind of networking and programming setup.

The kinds of services which are offered by NFC are:

A. *Launching any service and configuration*-The user taps the NFC enabled phone to a specifically located tag on everyday items such as street signs, food items, bus stop, posters etc. providing info about the particular item. Information could be text, URL or phone number depending on the type of service the item can offer. If we are talking about an advertisement poster the information could be a URL directing us to the webpage which provides further information regarding the commercial. In the same manner NFC can be used to interact with entities surrounding us.

B. *Peer to Peer communication*-NFC facilitates data exchange between two devices if the devices are equipped with appropriate tags and chips. NFC is likely to be useful if the information is up to a few KBs however if data is large NFC can be used to initiate another wireless interaction method using Bluetooth or Wi-Fi. This type of setup is best suited for ubiquitous computing scenarios.

C. *Ticketing and Payment*-NFC enables smart ticketing and payment settings by establishing the device as an 'electronic wallet' and offering services like debit and credit. The transactions are secure and protect the credentials of the user. Several commercial deployments have been praised regarding payment through NFC such as Payment of public transport in Germany.

The services mentioned above when unified can be viewed as a scenario where various objects interact with each other thus developing an 'Internet of Things'.

IV. Applications

The two broad classifications in which the applications of IoT can be categorized are: Analysis of collected information and automation of systems.^[4]

A. Automation of systems

The real time detection of unexpected conditions and immediate reaction by the automated machines or objects is very illusionary but soon would be turned into a reality. For automating the machines it is necessary the data collected be analyzed and converted into a command and fed back to the controller or actuator which can turn it into a process. Machines imitating humans by making decisions in various circumstances improve the performance levels of any process or organization. For instance the auto industry is manufacturing vehicles which can detect a probable collision if something comes too close to it and take actions to avoid the same.

B. Collection of data and analysis

When an object is embedded with sensor, organizations can follow the progress or movement of that particular object and also supervise its communication with other objects. Companies can maximize profit by analyzing this kind of data. Data collected from large number of such sensors organized in a structure can help the experts take a wise decision based on the interpretation of data. In real time environmental conditions can also be monitored and assessed. In hospitals, the sensors can be attached to the patients to monitor their conditions and help them in better treatment. It can be seen that Internet of things will take over every business and field.

V. Social and political issues

The Internet has been modified from being absolutely an intelligent system to one that is socio-technological. However the relevance of its non-technological attributes are becoming even more clear in the growth of an Internet of Things, as it adds completely different quality to the non-technological aspects. Therefore a few critical queries need to be answered as well in addition to the positive

expectations. A lot of speculation has been done on whether IoT is acceptable or not due to its contrasting nature. At one point it makes our lives secure and comfortable whereas on the other hand it invades our freedom and privacy. The discussion can be very similar as in the case of electronic passports and video surveillance. With RFID, the discomfort focuses on the personal data which is routinely collected and used by third parties without the user's consent and the personal privacy is disturbed.

Intelligent objects can gather huge data about a particular user in order to perform in the best possible manner obviously without the knowledge of the user in the backdrop. That is why one cannot be sure whether he is being observed during a particular frame of time. A particular transaction may seem harmless but it can prove to be disastrous if the content is redirected elsewhere resulting in breach of confidentiality. Regardless of the data security concerns, there is also uncertainty about who will own the data collected and who would be able to use it within the rightful frame. Another serious matter is that of our dependence on technology. If in future every little object functioned with the help of internet then we will be rendered at the mercy of internet and electricity. If the technological structure flunks for some reason then it would be dreadful for even ordinary people let alone the businesses and the economy.

VI. Privacy and Security Issues

IoT remains highly vulnerable to adversaries as its devices are exposed most of the time. Furthermore, the communication between the objects is wireless making it easy for snoopers to intrude the privacy. It is perhaps one of the major concerns for the customer. For instance, an NFC enabled phone is a multi-purpose device which may act as credit card, a smart car key or key to our homes, if the phone is lost or stolen the user is left helpless also the credentials are at risk. The trouble can be avoided if the phone is password protected so that the hacker has a good time unlocking it. Other important issue relates to Data integration and authentication. Authentication of the devices is a pre-requisite before exchanging the data to prevent theft of information. To achieve authentication, an infrastructure which confirms key management and cryptography is required however the system still remains prone to man-in-the-middle attack^[5].

Data Integrity verifies that the data has not been altered by the middle man and can be attained by various Hash algorithms. Further, the devices throughout the world would be of different standards, a standard which may be followed by all the devices has to be established so that communication between all the devices becomes achievable.

VII. Conclusion

The Internet has transformed our lives in every imaginable way. It is likely that it is going to be more advanced and

ease our lives still more by integrating Internet in everyday objects. IoT is an outlook where every object in and out of our homes will be inter connected thus reducing human intervention at every point. Nevertheless there are a lot of issues which need to be addressed while carrying out research in this particular field such as our dependence on technology for carrying out little chores. Also if the whole system is hacked into then confidentiality can be broken very easily. In this paper, we have presented a brief idea of what an Internet of Things is and how it is going to be implemented with the privacy and security issues.

VIII. References

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