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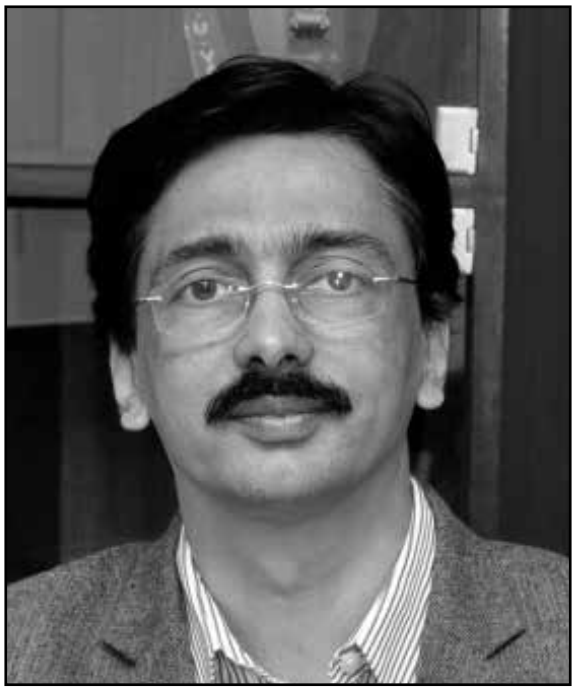

Dr. R.M. Chitnis
Principal
MAEER's MIT-SOM College, Pune.

It is heartening to see that research and writing on varied aspects of information technology embedded in Indian environment is growing. We, at MITSOM College, feel so happy to launch our IT research Journal "Innovation in IT" as a part of this movement.

We are grateful to the many authors and institutes that are contributing to our endeavor to promote research journal on Information Technology. MITSOM College upholds and preserves the quest for academic enrichment and interpersonal development. Research area is the core for the curriculum excellence. With the help of research, there is development of positive thinking and with this, there is motivation to excel in research field which is very important for self esteem and confidence.

This journal aims to support and promote the researches in many fields in IT such as Music with IT, Computer Engineering, Computer Science, Computer Technology, Cyber crime, E-Business, Engineering Management, Engineering Technology, Industrial Technology, Information Systems and many more.

I would like to congratulate the team who strived for the grand success of this IT journal and we look forward to the continued interest and contributions towards the journal.

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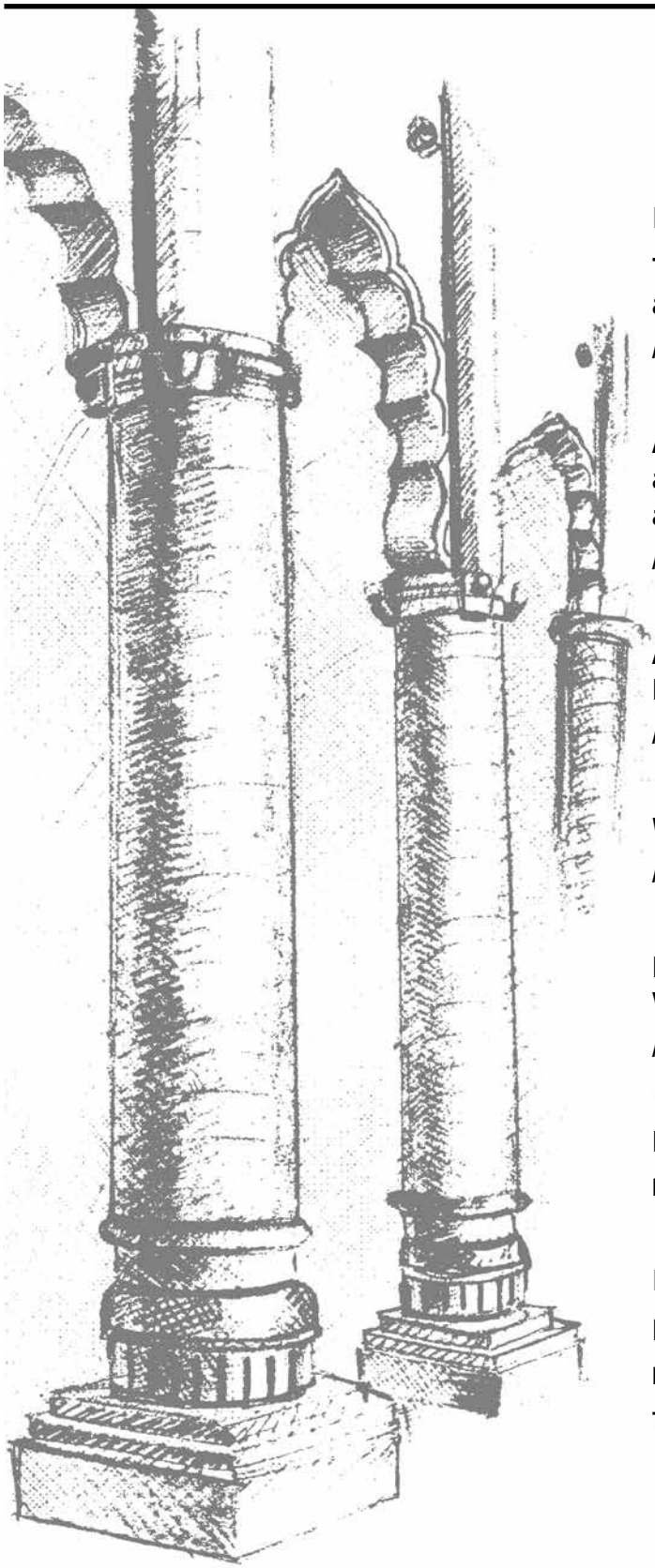

INNOVATION IN IT

The Internet of Things: IoT Applications and Security Challenges

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Abstract:
The Internet of Things (IoT) is aimed at enabling the interconnection and integration of the physical world and the cyber space. It represents the trend of future networking, and leads the third wave of the IT industry revolution.In this article, we first introduce some background and related technologies of IoT and discuss the concepts and objectives of IoT. Then, we present the challenges and key scientific problems involved in IoT development.
Background:

The Internet of Things represents a vision in which the Internet extends into the real world embracing everyday objects. Physical items are no longer disconnected from the virtual world, but can be controlled remotely and can act as physical access points to Internet services. The Internet of Things vision is grounded in the belief that the steady advances in microelectronics, communications and information technology we have witnessed in recent years will continue into the foreseeable future. "Smart" objects play a key role in the Internet of Things vision, since embedded communication and information technology have the potential to revolutionize the utility of these objects. Using sensors, they are able to perceive their context, and via built-in networking capabilities they would be able to communicate with each other, access Internet services and interact with people. One logical development of the Internet of Things is to leverage the World Wide Web and its many technologies as an infrastructure for smart objects. One of the enabling technologies for the Internet of Things is RFID (Radio Frequency Identification). It is primarily used to identify objects from a distance, but can also be used to determine the approximate location of objects provided the position of the reader is known.

What does the future look like?

With the possible exception of the mid-90's as the Internet itself was becoming mainstream and everyone wanted in, the Internet of Things is likely to be THE next big thing. The implications are endless, but it is probably worth exploring the path we will likely travel as the IoT today looks very, very different from what it will look like in the future. In the near future the Internet and wireless technologies will connect different sources of information such as sensors, mobile phones and cars in an ever tighter manner. The number of devices which connect to the Internet is – seemingly exponentially – increasing. These billions of components produce consume and process information in different environments such as logistic applications, factories and airports as well as in the work and everyday lives of people. The society need new, scalable, compatible and secure solutions for both the management of the ever more broad, complexly-networked Internet of Things, and also for the support of various business models.

Examples:

Before we can look at where the IoT is headed, it is important to take stock in where it is today – realistically. There is a ton of buzz about IoT. Everyone gets this. But while many have and will continue to extol the virtues of IoT, realizing these virtues is still a ways off. So where are we today? I think we can best sum up the state of the industry today as largely closed-loop, message response silo applications. I don't say this with disdain or condescension in the least. There are very clever, very productive systems and most enterprises are better off for having put them in place. The motivation here is saving time and saving money. Generally speaking, the business case for the implementation of the IoT is pretty straightforward. Let's look at some examples in today's world:
Smart Parking: Sensors are used to monitor when parking spots are free, then that information gets posted into an application that people use to park faster and easier, saving time and fuel.
Smart Lighting: Ranging from how you set up and control the lighting in your house to the deployment of "smart lighting in buildings, parking lots, and streets and public areas, smart sensors determine when lighting is required and when it is not. The message of the absence or necessity of adequate light creates the response to turn the lights on (or off), saving energy.
Waste Management: Sensors in the city trash receptacles detect when they are near full, informing city services when they need to be picked up (or not picked up, as the case may be). The notification of the status of the bin helps city services coordinate pick-ups, helping save time and utilize their resources wisely.
Vending Machine Servicing: Sensors are deployed to monitor the inventory and the temperature of a soda machines, for example. The machines send messages regarding inventory count or temperature, causing the service person to make a trip only when necessary, and in doing so, ensuring he/she has the right inventory or tools to address the needs of the machine, therefore making the whole process more efficient.
Temperature Monitoring: Most of us are familiar with HoneyWell and their smart thermostats, which generates a message regarding the temperature, and the response is the turning on or off the air conditioning or heat as defined by the configuration, saving energy and increasing comfort.

Applications of IoT:

Potentialities offered by the IoT make possible the development of a huge number of applications, of which only a very small part is currently available to our society. Many are the domains and the environments in which new applications would likely improve the quality of our lives: at home, while travelling, when sick, at work, when jogging and at the gym, just to cite a few. These environments are now equipped with objects with only primitive intelligence, most of times without any communication capabilities. Giving these objects the possibility to communicate with each other and to elaborate the information perceived from the surroundings implies having different environments where a very wide range of applications can be deployed. These can be grouped into the following domains:

Transportation and logistics domain.
Healthcare domain.
Smart environment (home, office, plant) domain.
Personal and social domain.

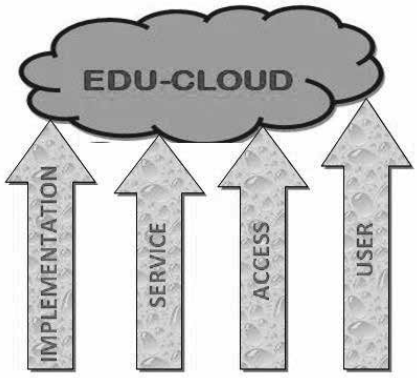
Among the possible applications, we may distinguish between those either directly applicable or closer to our current living habitudes and those futuristic, which we can only fancy of at the moment, since the technologies and/or our societies are not ready for their deployment (see Fig. 3). In the following subsections

we provide a review of the short-medium term applications for each of these categories and a range of futuristic applications.

Transportation and logistics domain

Advanced cars, trains, buses as well as bicycles along with roads and/or rails are becoming more instrumented with sensors, actuators, and processing power. Roads themselves and transported goods are also equipped with tags and sensors that send important information to traffic control sites and transportation vehicles to better route the traffic, help in the management of the depots, provide the tourist with appropriate transportation information, and monitor the status of the transported goods. Below, the main applications in the transportation and logistics domain are described.

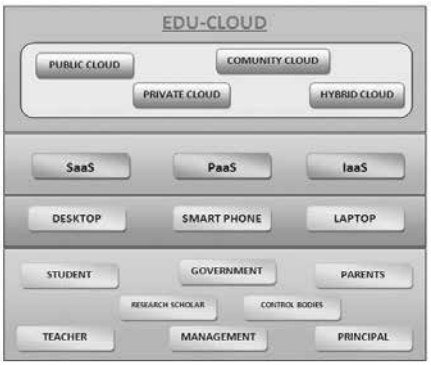
1.1. Logistics



Real-time information processing technology based on RFID and NFC can realize real-time monitoring of almost every link of the supply chain, ranging from commodity design, raw material purchasing, production, transportation, storage, distribution and sale of semi-products and products, returns' processing and after-sales service. It is also possible to obtain products related information, promptly, timely, and accurately so that enterprises or even the whole supply chain can respond to intricate and changeable markets in the shortest time. The application result is that the reaction time of traditional enterprises is 120 days from requirements of customers to the supply of commodity while advanced companies that make use of these technologies (such as Wal-mart and Metro) only needs few days and can basically work with zero safety stock . Additionally, real-time access to the ERP program helps the shop assistants to better inform customers about availability of products and give them more product information in general.

1.2. Assisted driving

Cars, trains, and buses along with the roads and the rails equipped with sensors, actuators and processing power may provide important



information to the driver and/or passengers of a car to allow better navigation and safety. Collision avoidance systems and monitoring of transportation of hazardous materials are two typical example functions. Governmental authorities would also benefit from more accurate information about road traffic patterns for planning purposes. Whereas the private transportation traffic could better find the right path with appropriate information about the jam and incidents. Enterprises, such as freight companies, would be able to perform more effective route optimization which allows energy savings. Information about the movement of the vehicles transporting goods together with information about the type and status of the goods can be integrated to provide important information about the delivery time, delivery delays, and faults. This information can be also combined with the status of the warehouses in order to automate the refilling of the magazines.

1.3. Mobile ticketing

Posters or panels providing information (description, costs, and schedule) about transportation services can be equipped with an NFC tag, a visual marker, and a numeric identifier. The user can then get information about several categories of options from the web by either hovering his mobile phone over the NFC tag, or pointing the mobile phone to the visual markers. The mobile phone automatically gets information from the associated web services (stations, numbers of passengers, costs, available seats and type of services) and allows the user to buy the related tickets.

1.4. Monitoring environmental parameters

Perishable goods such as fruits, fresh-cut produce, meat, and dairy products are vital parts of our nutrition. From the production to the consumption sites thousands of kilometers or even more are covered and during the transportation the conservation status (temperature, humidity, shock) need to be monitored to avoid uncertainty in quality levels for distribution decisions. Pervasive computing and sensor technologies offer great potential for improving the efficiency of the food supply chain.

1.5. Augmented maps

Touristic maps can be equipped with tags that allow NFC-equipped phones to browse it and automatically call web services providing information about hotels, restaurants, monuments and events related to the area of interest for the user. There is a collection of Physical Mobile Interaction (PMI) techniques that can be employed to augment the information of the map:
hovering within read range of a tag so that additional information regarding the marker is displayed on the phone screen;
single selection/de-selection of tags by pressing a specific key when the tag is hovered;
multi-selection/de-selection of different tags;
polygon drawing by selecting the tags in a polygon that delimits an area of interest;
picking-and-dropping, so that selected markers that have been 'picked up' using the phone can be dropped in the itinerary of interest;
context menu displaying when a marker is hovered.

2. Healthcare domain

Many are the benefits provided by the IoT technologies to the healthcare domain and the resulting applications can be grouped mostly into: tracking of objects and people (staff and patients), identification and authentication of people, automatic data collection and sensing.

2.1. Tracking

Tracking is the function aimed at the identification of a person or object in motion. This includes both real-time position tracking, such as the case of patient-flow monitoring to improve workflow in hospitals, and tracking of motion through choke points, such as access to designated areas. In relation to assets, tracking is most frequently applied to continuous inventory location tracking (for example for maintenance, availability when needed and monitoring of use), and materials tracking to prevent left-ins during surgery, such as specimen and blood products.

2.2. Identification and authentication

It includes patient identification to reduce incidents harmful to patients (such as wrong drug/

dose/time/procedure), comprehensive and current electronic medical record maintenance (both in the in- and out-patient settings), and infant identification in hospitals to prevent mismatching. In relation to staff, identification and authentication is most frequently used to grant access and to improve employee morale by addressing patient safety issues. In relation to assets, identification and authentication is predominantly used to meet the requirements of security procedures, to avoid thefts or losses of important instruments and products.

2.3. Data collection

Automatic data collection and transfer is mostly aimed at reducing form processing time, process automation (including data entry and collection errors), automated care and procedure auditing, and medical inventory management. This function also relates to integrating RFID technology with other health information and clinical application technologies within a facility and with potential expansions of such networks across providers and locations.

2.4. Sensing

Sensor devices enable function centered on patients, and in particular on diagnosing patient conditions, providing real-time information on patient health indicators. Application domains include different telemedicine solutions, monitoring patient compliance with medication regiment prescriptions, and alerting for patient well-being. In this capacity, sensors can be applied both in in-patient and out-patient care. Heterogeneous wireless access-based remote patient monitoring systems can be deployed to reach the patient everywhere, with multiple wireless technologies integrated to support continuous bio-signal monitoring in presence of patient mobility.

3. Smart environments domain

A smart environment is that making its "employment" easy and comfortable thanks to the intelligence of contained objects, be it an office, a home, an industrial plant, or a leisure environment.

3.1. Comfortable homes and offices

Sensors and actuators distributed in houses and offices can make our life more comfortable in several aspects: rooms heating can be adapted to our preferences and to the weather; the room lighting can change according to the time of the day; domestic incidents can be avoided with appropriate monitoring and alarm systems; and energy can be saved by automatically switching off the electrical equipments when not needed. For instance, we may think of energy providers that use dynamically changing energy prices to influence the overall energy consumption in a way that smoothes load peaks. Automation logic may optimize the power consumption costs throughout the day by observing when the prices, which are provided by an external web service and are set according to the current energy production and consumption, are cheap and by considering the specific requirements of each appliances at home (battery charger, refrigerator, and ovens).

3.2. Industrial plants

Smart environments also help in improving the automation in industrial plants with a massive deployment of RFID tags associated to the production parts. In a generic scenario, as production parts reach the processing point, the tag is read by the RFID reader. An event is generated by the reader with all the necessary data, such as the RFID number, and stored on the network. The machine/robot gets notified by this event (as it has subscribed to the service) and picks up the production part. By matching data from the enterprise system and the RFID tag, it knows how to further process the part. In parallel, a wireless sensor mounted on the machine monitors the vibration and if it exceeds a specific threshold an event is raised to immediately stop the process (quality control). Once such an emergency event is propagated, devices that consume it react accordingly. The robot receives the emergency shutdown event and immediately stops its operation. The plant manager also immediately sees the status of the so called Enterprise Resource Planning (ERP) orders, the production progress, the device status, as well as a global view on all the elements and the possible side effects of a production line delay due to shop-floor device malfunctions.

3.3. Smart museum and gym

As to smart leisure environments, the museum and the gym are two representative examples where the IoT technologies can help in exploiting their facilities at the best. In the museum, for instance, expositions in the building may evoke various historical periods (Egyptian period or ice age) with widely diverging climate conditions. The building adjusts locally to these conditions while also taking into account outdoor conditions. In the gym, the personal trainer can upload the exercise profile into the training machine for each trainee, who is then automatically recognized by the machine through the RFID tag. Health parameters are monitored during the whole training session and the reported values are checked to see if the trainee is overtraining or if she/he is too relaxed when doing the exercises.

4. Personal and social domain

The applications falling in this domain are those that enable the user to interact with other people to maintain and build social relationships. Indeed, things may automatically trigger the transmission of messages to friends to allow them to know what we are doing or what we have done in the past, such as moving from/to our house/office, travelling, meeting some common mates or playing soccer [36]. The following are the major applications.

4.1. Social networking

This application is related to the automatic update of information about our social activities in social networking web portals, such as Twitter. We may think of RFIDs that generate events about people and places to give users real-time updates in their social networks, which are then gathered and uploaded in social networking websites. Application user interfaces display a feed of events that their friends have preliminarily defined and the users can control their friend lists as well as what events are disclosed to which friends.

4.2. Historical queries

Historical queries about objects and events data let users study trends in their activities over time. This can be extremely useful for applications that support long-term activities such as business projects and collaborations. A digital diary application can be built that records and displays events for example in a Google Calendar for later perusal. This way, users can look back over their diaries to see how and with whom they've spent their time. Historical trends plots can also be automatically generated using the Google Charts API to display where, how, and with whom or what they have spent their time over some arbitrary period.

4.3. Losses

A search engine for things is a tool that helps in finding objects that we don't remember where have been left. The simplest web-based RFID application is a search engine for things that lets users view the last recorded location for their tagged objects or search for a particular object's location. A more proactive extension of this application leverages user-defined events to notify users when the last recorded object location matches some conditions.

4.4. Thefts

An application similar to the previous one may allow the user to know if some objects are moved from a restricted area (the owner house or office), which would indicate that the object is being stolen. In this case, the event has to be notified immediately to the owner and/or to the security guards. For example, the application can send an SMS to the users when the stolen objects leave the building without any authorization (such as a laptop, a wallet or an ornament).

5. Futuristic applications domain

The applications described in the previous sections are realistic as they either have been already deployed or can be implemented in a short/medium period since the required technologies are already available. Apart from

these, we may envision many other applications, which we herein define futuristic since these rely on some (communications, sensing, material and/or industrial processes) technologies that either are still to come or whose implementation is still too complex. These applications are even more interesting in terms of required research and potential impact.

5.1. Robot taxi

In future cities, robot taxis swarm together, moving in flocks, providing service where it is needed in a timely and efficient manner. The robot taxis respond to real-time traffic movements of the city, and are calibrated to reduce congestion at bottlenecks in the city and to service pick-up areas that are most frequently used. With or without a human driver, they weave in and out of traffic at optimum speeds, avoiding accidents through proximity sensors, which repel them magnetically from other objects on the road. They can be hailed from the side of the street by pointing a mobile phone at them or by using hand gestures. The user's location is automatically tracked via GPS and enables users to request a taxi to be at a certain location at a particular time by just pointing it out on a detailed map. On the rare occasions they are not in use, the taxis head for 'pit-stops' where they automatically stack themselves into tight bays which are instrumented with sensors where actuators set off recharging batteries, perform simple maintenance tasks and clean the cars. The pit-stops communicate with each other to ensure no over or under-utilization.

5.2. City information model

The idea of a City Information Model (CIM) is based on the concept that the status and performance of each buildings and urban fabrics – such as pedestrian walkways, cycle paths and heavier infrastructure like sewers, rail lines, and bus corridors – are continuously monitored by the city government operates and made available to third parties via a series of APIs, even though some information is confidential. Accordingly, nothing can be built legally unless it is compatible with CIM. The facilities management services communicate with each other and the CIM, sharing energy in the most cost-effective and resource-efficient fashion. They automatically trade surplus energy with each other and prices are calculated to match supply and demand. In this sense, planning and design is an ongoing social process, in which the performance of each item is being reported in real-time and compared with others. Population changes can be inferred, as can movement patterns, environmental performance, as well as the overall efficiency of products and buildings.

5.3. Enhanced game room

The enhanced game room as well as the players is equipped with a variety of devices to sense location, movement, acceleration, humidity, temperature, noise, voice, visual information, heart rate and blood pressure. The room uses this information to measure excitement and energy levels so that to control the game activity according to status of the player. Various objects are also placed throughout the room and the point of the game is to crawl and jump from one to the other without touching the floor. Points are awarded for long jumps and difficult places to reach. The game also puts a target on the wall-mounted screen. Whoever reaches that target first, wins. As the players work their way around the room, the game keeps track of their achievements. Their controller recognizes RFID tags on objects in the room. To score, they have to touch the object with it. As the game progresses, the system gradually makes it more difficult. At first the objects they have to reach are nearby and easy to reach. At some point it gets too difficult and both players must touch the floor with their feet. Then the game makes a loud noise to indicate that this was wrong. The room now notices that one player is a bit taller and faster than the other so it starts putting the objects a bit closer to him, so that he can keep up. The game then adapts the difficulty level and the target according to the achievements of the players so that to keep high the excitement level perceived by the console through the sensing devices.

Security challenges in IoT:

Security represents a critical component for enabling the widespread adoption of IoT technologies and applications. Without guarantees in terms of system-level confidentiality, authenticity and privacy the relevant stakeholders are unlikely to adopt IoT solutions on a large scale. In early-stage IoT deployments (e.g., based on RFIDs only), security solutions have mostly been devised in an ad hoc way. This comes from the fact that such deployments were usually vertically integrated, with all components under the control of a single administrative entity. In the perspective of an open IoT eco-system, whereby different actors may be involved in a given application scenario (e.g., one stakeholder owing the physical sensors/actuators, one stakeholder handling the data and processing them, various stakeholders providing different services based on such data to the end-users, etc.), a number of security challenges do arise. In this section, we aim at discussing the major security challenges to be addressed to turn Internet-of-Things technology into a mainstream, widely deployed one. In particular, we identified three key issues requiring innovative approaches: data confidentiality, privacy and trust. In the following, we analyze them one by one.

1. Data confidentiality

Data confidentiality represents a fundamental issue in IoT scenarios, indicating the guarantee that only authorized entities can access and modify data. This is particularly relevant in the business context, whereby data may represent an asset to be protected to safeguard competitiveness and market values. In the IoT context not only users, but also authorized objects may access data. This requires addressing two important aspects: first, the definition of an access control mechanism and second, the definition of an object authentication process (with a related identity management system).

As data in IoT applications will be related to the physical realm, ensuring data confidentiality is a primary constraint for many use cases. As a first example, we may consider data provided by bio-sensors on bacterial composition of the product used for guaranteeing the required quality in the food industry. This data is clearly confidential because their uncontrolled spreading could harm company reputation and its competitive advantage over competing companies. As a second example, we may consider an environmental monitoring application, whereby data is used to feed an early warning system against, e.g., the rise of tsunami/earthquakes, etc. In such a setting, data should be accessible only by the relevant civil protection bodies, which can then put in place appropriate risks management strategies. The leakage of such information into the public sphere may give rise to chaotic and panic situations, putting at risk the safety of large groups of people. Customary solutions for ensuring data confidentiality may not be straightforwardly applied to IoT contexts, due to two major limiting factors. The first one concerns the sheer amount of data generated by such systems, and relates hence to scalability issues. The second one relates to the need of controlling the access to data in an on-line and flexible way, with access rights changing at run-time and being applied to dynamic data streams.

First, it is necessary to reach an agreement on a well-defined concept of identity, when referred to a smart object. A well characterized definition of identity should indeed drive the development of an object identity management system (IdM), specifying the main operations that the IdM should perform. Looking at the state-of-the-art, a starting point could be represented by the concept of federation. A federation is defined as a set of organizations that establish trust relationships with respect to the identity information maintained. A federated identity management system provides a group of organizations that collaborate with mechanisms for managing and gaining access to identity information of a given entity in the system and

other resources across organizational boundaries. Traditionally, identity management systems consider users as entities whose identity has to be managed; in our case we are interested in systems whereby the identity attributes relate to smart objects, and not to users.

Although it represents a promising approach, for both its flexible/distributed nature and its capability to couple identity management with trust, its application to IoT scenarios require proper tailoring and further studies.

Summarizing, the main research challenges for ensuring data confidentiality in an IoT scenario relate to:
Definition of suitable mechanisms for controlling access to data streams generated by IoT devices.
Definition of an appropriate query language for enabling applications to retrieve the desired information out of a data stream.
Definition of a suitable smart objects' identity management system.

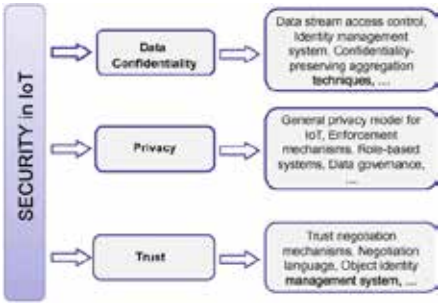


Fig : Security domains in IoT

Privacy
Privacy defines the rules under which data referring to individual users may be accessed. The main reasons that makes privacy a fundamental IoT requirement lies in the envisioned IoT application domains and in the technologies used. Health-care applications represent the most outstanding application field, whereby the lack of appropriate mechanisms for ensuring privacy of personal and/or sensitive information has harnessed the adoption of IoT technologies. In addition, in the IoT vision, a prominent role will be played by wireless communication technologies. The ubiquitous adoption of the wireless medium for exchanging data may pose new issue in term of privacy violation. In fact, wireless channel increases the risk of violation due to the remote access capabilities, which potentially expose the system to eavesdropping and masking attacks. Hence privacy represents a real open issue that may limit the development of the IoT.
At the same time, the development of concrete approaches for building privacy-preserving mechanisms for IoT applications still presents a number of challenging aspects. The development of concrete implementations would benefit from the definition of a general model, able to represent all IoT fundamental entities and their relationships. Moreover the implementations should include enforcement mechanisms able to cope with the scale and with the dynamic nature of IoT scenarios. In order to satisfy such requirements, solutions also able to enforce a dynamic data stream access control should be provided. Summarizing, the open research challenges in terms of privacy-preserving mechanisms for IoT are given by:
Definition of a general model for privacy in IoT.
Development of innovative enforcement techniques, able to support the scale and heterogeneity characterizing IoT scenarios.
Development of solutions that balance the need of anonymity presented by some applications with the localization and tracking requirements of some other ones. This entails the definition of privacy policies, that specify under which conditions it is possible to identify and localize a smart object. Moreover, it needs to specify when it is possible to access sensitive data.
3. Trust
The concept of trust is used in a large number of different contexts and with diverse meanings. Trust is a complex notion about which no consensus exists in the computer and information science literature, although its importance has been widely recognized. Different definitions are possible depending on the adopted perspective. A main problem with many approaches towards trust definition is that they do not lend themselves to the establishment of metrics and evaluation methodologies.
Trust negotiation refers to the process of credential exchanges that allows a party requiring a service or a resource from another party to provide the necessary credentials in order to obtain the service or the resource. This definition of trust is very natural for secure knowledge management as systems may have to exchange credentials before sharing knowledge. For this reason, we base our analysis of trust issues in IoT upon it. Trust negotiation relies on peer-to-peer interactions, and consists of the iterative disclosure of digital credentials, representing statements certified by given entities, for verifying properties of their holders in order to establish mutual trust. In such an approach, access resources (data and/or services) is possible only after a successful trust negotiation has been completed. A trust negotiation system typically exploits digital identity information for the purpose of providing a fine-grained access control to protected resources. The ability to meet the trust requirement is indeed strictly related to the identity management and access control issues, as discussed above.

Anyway, although the complete dynamic and distributed nature of IoT makes to address trustworthiness extremely challenging, we may well consider IoT as an extremely interesting application of trust concepts. In fact in a context in which smart objects themselves take decisions, the first trust relationship has to be established among humans and the objects surrounding them.
The most relevant research challenges in the definition of appropriate trust mechanisms for IoT, can be summarized as:

- Introduction of a simple trust negotiation language supporting the semantic interoperability requirements of IoT.
- Definition of a trust negotiation mechanism based on a fine-grained access control of data streams.
- Development of an adequate object identity management system.
- Design of a general and flexible trust management framework able to leverage the aforementioned items.

Suggestions & Conclusion:

The Internet-of-Things may represent the next big leap ahead in the ICT sector. The possibility of seamlessly merging the real and the virtual world, through the massive deployment of embedded devices, opens up new exciting directions for both research and business.
In this article, we provided an overview of the key issues related to the development of IoT technologies and services. A number of research challenges has been identified, which are expected to become major research trends in the next years. The most relevant application fields have been presented, and a number of use cases identified.
We do hope that this survey will be useful for researchers and practitioners in the field, helping them to understand the huge potential of IoT and what are the major security issues to be tackled, devising innovative technical solutions able to turn IoT from a research vision into reality. However, sound security solutions are not attained easily. There are many challenges that should be defied. A sound solution considers the security from the beginning i.e. from design to implementation, to detect the vulnerabilities from the birth to the death of system.

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A study on Usage, Impact, Consequences and Concerns of Smart phone addiction amongst all age groups.

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Abstract
The advent of Smart phones has squeezed this large world and brought it into the palm of human being. They are now popular as all purpose components of our everyday lives in today's globalizing society. Earlier they were considered as the tool of young generation but now they are famous amongst all age groups regardless of age, gender, ethnicity, career or economic status. The main objective of the study is to investigate the impact, purpose, consequences & concerns of excessively using the smart phones among various age groups. Overall, Literature has provided in-depth evidence and this research would impart insight into the addictive world of technology and the impacts smart phones have on various age groups. In conclusion, the results of this study provide that youth is the most susceptible group among the population to be addicted to the technology. Using structured questionnaire, interviews and observation by the researcher, primary data was collected. Findings of the study showed that most of the young respondents spend a large amount of their time with their smart phones and the purpose of the use in most of the cases is pleasure driven rather than necessity driven.
Keywords: Smart phone usage, addictive behavior, age groups, technology, Necessity

Introduction

Over the past decade, technology has entered our lives in many forms. In recent years, the use of cell phones has played a vital role in communication across the globe. With the advancement of modern technology and in particular mobile technology it is no wonder that cell phones and their popularity are on the rise. It is perhaps because of their ease of use and their ability to facilitate other applications. Overcoming tech addiction doesn't mean ending your use of that technology; it just means doing whatever you need to do so that the technology can improve the quality of your life, rather than taking over your life. Addiction is considered by WHO (WHO Expert Committee - 1964) as dependence, as the continuous use of something for the sake of relief, comfort, or stimulation, which often causes cravings when it is absent.[3] Addiction is the continued repetition of a behavior or an activity independent upon the adverse or negative consequences of the same (Angres & Angres, 2008) or it can be a neurological impairments which leads to such behaviors (American Society for Addiction Medicine, 2012). The two major categories of addiction involve either substance addiction, e.g. "drugs or alcohol addiction" or "behavioral addiction such as mobile phone addiction."

Each and every invention has brought comforts as well as some threatening effects with it. Same is the case with mobile phone technology. This is a medium that allows youngsters to communicate and interact with others without parental and teachers' monitoring. Psychiatrists proclaim that in the 21st century mobile phone addiction has become one of the major non-drug addictions. Mobile phone users suffer from 'nomophobia': severe anxiety and panic due to being without a mobile phone. (www.smh.com.au). According to Yang, many mobile phone users suffer from a new type of mental disease called 'mobile phone dependence' syndrome and it is common especially amongst the youth. When such users observe a drop in phone calls or text messages then symptoms of addiction appear. These symptoms are often observed in eccentric, non-confident and unsociable people (www.timesofindia.indiatimes.com). Long term duress can lead to psychological problems such as insomnia, irritability and depression.

We are surfing the web or interacting in social media searching through other peoples shared experiences instead of creating shared experiences ourselves. Does liking some photos of a party or event you didn't attend make a person feel like they did? Life isn't always a party, there will be dull moments, but engaging in mobile phone use while already in a social setting creates an even duller atmosphere.

Objectives of the study

The objective of the study is to determine:

To explore the usage patterns of smart phones and time spent by different age groups.

To explore whether the use of smart phone is affecting the social relationships.

To explore whether the smart phone usage is affecting the study habits and results of the students.

To explore whether the use of cell phone is affecting the sleeping habits/insomnia, irritability and depression.

To examine the intentions behind use of smart phones.

To study the impacts of the addictive use of the smart phones.

Literature review

There are several studies which show the positive and negative impacts of smart phone usage amongst various age groups and the increasing number of smart phone users and mobile subscriptions in India.

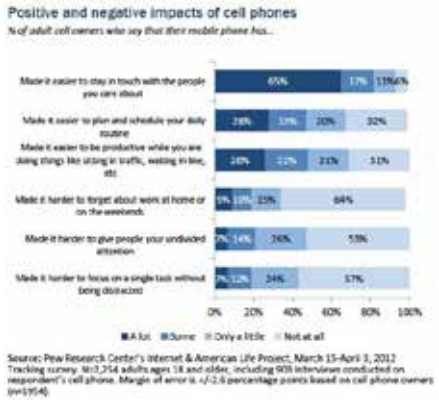
Val Hooper et.al.[1] studied mobile phone usage whether it is addictive, dependent or compulsive. They did survey of 184 students and found out that behavior cannot be conclusively categorized as any specific type, although there was stronger support for mobile phone usage being categorized as dependent, voluntary or mandatory behaviour, rather than being addictive, compulsive or habitual.

Ishfaq Ahmed et, al.[2] in their study regarding Mobile phone to youngsters: Necessity or addiction have given that youngsters use their cell phones under reasonable limits and do not tend towards extreme behaviors leading towards addictive cell phone usage.

Abhas Tandon et. al.[3] in the study "Mobile phone and internet adoption and consumption patterns of college students in India" concluded that the college students in India are highly addicted to the use of mobile phones and internet and excessively use the above technological services. Their life now highly depends on phone and internet.

Louis Leung[4] worked to link Psychological Attributes to Addiction and Improper Use of

the Mobile Phone among Adolescents in Hong Kong. The study found that the larger the social capital one enjoyed (i.e., the more opportunities taken to spend time with classmates, family, and friends face-to-face), the higher the likelihood that one would use the mobile phone in inappropriate places. This may suggest that adolescents see mobile phones as a symbol of individuality that helps social networking and expresses their identity in a ubiquitous way.



Source: Pew Research Center's Internet & American Life Project, March 15-April 3, 2012 Tracking survey. N=2,254 adults ages 18 and older, including 935 interviews conducted on respondent's cell phone. Margin of error is +/-2.6 percentage points based on cell phone owners (n=1954).

Anke Schwittay[5] reviewed New Media Practices in India which bridged Past and Future, Markets and Development.

Jayanti P. Acharya et. al.[6] analyzed the Common Health Effects of Cell-Phones amongst College Students. They concluded that almost all the students' cell phones, and the device is used for a greater part of the day. Headache was found to be the commonest symptom followed by irritability/anger. Other common mental symptoms included lack of concentration and poor academic performance, insomnia, anxiety etc. Among physical symptoms-body aches, eye strain, digital thumb were found to be frequent. Accidents are caused due to cell phone driving.

Predictions for the coming years:

Source: Indo-Asian News Service 'India to overtake US in smartphones by 2016'.

According to the latest report from TRAI mobile phone subscriber base in India recorded 6.71% YoY growth to 980.81 million users in Q2 2015. According to IAMAI-KPMG report "India will have 500 Million Internet users by 2017".

Research methodology

Present study concentrates on smart phone addiction among various age groups and the behavioral aspects of addiction. Study also checks whether mobile addiction really exists. It also reveals whether there is any relationship between age, gender and mobile addiction. This study was conducted with an aim to delineate the aspects of smart phone usage among users of various age groups including usage patterns, behavioral elements and addictive patterns of usage. For this purpose questionnaires were used to elicit the responses. College students, entrepreneur and senior citizens were selected as population and were interviewed and simple random sampling technique was used. Sample was consisting of 50 college students,10 entrepreneurs and 10 senior citizens.

Data analysis, findings & discussions

Questions
Do you have your phone with you continuously, even at home you have it in your pocket or right next to you
Do you always feel anxious about your phone, especially when you are unable to use it (business meetings, class)?
Are you uncomfortable and fidgety when you are not using your phone
Do you feel the need to talk on the phone almost all the time?
Do you take phone breaks while at work?
Do you experience high levels of anxiety, stress, or insecurity whenever you are without your cell phone
Have you had problems at work or school because of your cell phone use?
Do you sometimes believe your phone is ringing, but when you answer it or listen longer you find it wasn't ringing at all (known as 'phantom ringing')?
Has your personal cell phone use increased significantly?
Have you had problems with family or friends because of your cell phone use?

Table (a): Behavioral questions

Positive impact of smart phone

Students and entrepreneur can access Internet on their phones while on the go, and thus can get knowledge of any topic they wish to.

Mobile Phone is what works as boon in any emergency situation.

Can be used for imparting knowledge/ information for education purposes.

Mobile phones have become a source of unlimited entertainment.

Negative impact of smart phone

Bad Impact on Studies - students are more interested in wasting their time on phones, rather than spending it on studying.

The mobile phones have resulted in dangerous driving, whose direct impact can be seen in increasing number of accidents.

Researchers have already proven that activities like checking your phone and discovering a new email from someone, checking Facebook and seeing a new post, or browsing the Internet for interesting information and discovering a fascinating article, all trigger the reward center of your brain, increasing dopamine levels.

People that ignore phone calls, but are constantly texting have a tendency to not speak their minds, or don't want to hear what another person has to say.

Excessive mobile phone use can also lead to depression and chronic stress. Stress can be on fingers as the brain activity increases with every touch on the smart phone. Stress on mind as eye muscles get tired by excessive usage & which also deteriorates energy levels. Stress on the body by continuously looking at it, stress on the neck, shoulder, and cervical spine.

"Statistic analysis indicates that chronic stress, low emotional stability, female gender, young age, depression, and extraversion are associated with Problematic Mobile Phone Use (PU)" (Augner & Hacker, 2012).

Feeling anxious whenever you do not have your phone in your physical possession.

Constantly checking the phone for new texts, coupled with the compulsion to respond immediately.

Limits our use of resources such as encyclopedias and books.

Social networks are accessed in class or lecture and this causes a distraction from the information about what we are learning and limits our knowledge.

When we make use of phones at night, melatonin mistakes the artificial light for daytime. As a result it causes various sleeping disorders including insomnia.

Limitations and future implementations

This study gives good explanation of addictive behavior in itself. Yet there are lots of improvements that can be made. This study can be repeated with different respondents like parents, friends and colleagues. These might be suitable respondents as they are directly affected by one's behavior and habits; and findings of the study would enlighten the findings of existing studies as well as current research.

Suggestions & conclusion

Addiction refers to irrepressible urge which is often accompanied by loss of control. The smart phone has influenced people of all generations. People need their phone to reach out to people instantly. Use of technology has decreased the ability to interact face-to-face, tend to feel much more comfortable behind the screen as it avoids true interaction. Scientific studies and

surveys have shown that there are negative psychological effects, interpersonal, physical, work and behavioral problems, depression, loneliness and social anxiety related to cell phone addiction among various age groups, they have become slaves of smart phones. And this is used by old age people for entertainment when they get bored. This research has addressed the claims made that mobile phone usage is addictive. It has also provided insights into the underlying motivation of the various types of mobile phone usage. Subsequently, academic institution will need to regulate students' use of such kind of wireless devices to reduce the abuse of the smart phone usage. Smart phone addiction can lead to serious problems for the individuals, particularly the young generations who are at the time of growing their mental and physical health. Thus, it is needed that empirical research on various patterns of distressed users and the patterns of behavior and/or disorder for future research to remark advanced phenomenon.

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Awareness and Understanding of Information System Audit

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Abstract
Information System Audit is playing vital role in securing and safeguarding IT .but unfortunately the awareness and understanding about the IT audit is not up to the mark. The word IT Audit is new to many, and this concepts exist is also not known. Following paper explains what Information System Audit is. Why do we need it? And how one can implement IT audit as his/her Profession.

Introduction

An information technology audit, or information systems audit, is an examination of the management controls within an Information technology (IT) infrastructure. The evaluation of obtained evidence determines if the information systems are safeguarding assets, maintaining data integrity, and operating effectively to achieve the organization's goals or objectives. These reviews may be performed in conjunction with a financial statement audit, internal audit, or other form of attestation engagement.

Objective

To make awareness about what is Information System Audit.

To make awareness about importance and need of Information System Audit

To make awareness about ISACA Certifications and Qualification

To make awareness about Professional recognition of Information System Audit

History of IT Auditing

The concept of IT auditing was formed in the mid-1960s. Since that time, IT auditing has gone through numerous changes, largely due to advances in technology and the incorporation of technology into business.

Currently, there are many IT dependent companies that rely on the Information Technology in order to operate their business e.g. Telecommunication or Banking Company. For the other types of business, IT plays the big part of company including the applying of workflow instead of using the paper request form, using the application control instead of manual control which is more reliable, implementing the ERP application to facilitate the organization by using only 1 application. According to these, the importance of IT Audit is constantly increased. One of the most important roles of the IT Audit is to audit over the critical system in order to support the financial audit.

Purpose

IT audit is different from a financial statement audit. While a financial audit's purpose is to evaluate whether an organization is adhering to standard accounting practices, the purposes of an IT audit are to evaluate the system's internal control design and effectiveness. This includes, but is not limited to, efficiency and security protocols, development processes, and IT governance or oversight. Installing controls are necessary but not sufficient to provide adequate security. People responsible for security must consider if the controls are installed as intended, if they are effective if any breach in security has occurred and if so, what actions can be done to prevent future breaches. These inquiries must be answered by independent and unbiased observers. These observers are performing the task of information systems auditing. In an Information Systems (IS) environment, an audit is an examination of information systems, their inputs, outputs, and processing.

The primary functions of an IT audit are to evaluate the systems that are in place to guard an organization's information. Specifically, information technology audits are used to evaluate the organization's ability to protect its information assets and to properly dispense information to authorized parties. The IT audit aims to evaluate the following:

Will the organization's computer systems be available for the business at all times when required? (Known as availability)

Will the information in the systems be disclosed only to authorize users? (Known as security and confidentiality)

Will the information provided by the system always be accurate, reliable, and timely? (Measures the integrity)

In this way, the audit hopes to assess the risk to the company's valuable asset (its information) and establish methods of minimizing those risks.

ISACA (Information Systems Audit and Control Association)

ISACA got its start in 1967, when a small group of individuals with similar jobs (—auditing controls in the computer systems that were becoming increasingly critical to the operations

of their organizations—) sat down to discuss the need for a centralized source of information and guidance in the field. In 1969, the group formalized, incorporating as the EDP Auditors Association.

Previously known as the Information Systems Audit and Control Association, ISACA now goes by its acronym only, to reflect the broad range of IT governance professionals it serves.

Today, ISACA's constituency (—more than 140,000 strong worldwide—) is characterized by its diversity. Constituents live and work in more than 180 countries and cover a variety of professional IT-related positions—to name just a few, IS auditor, consultant, educator, IS security professional, regulator, chief information officer and internal auditor. Some are new to the field, others are at middle management levels and still others are in the most senior ranks. They work in nearly all industry categories, including financial and banking, public accounting, government and the public sector, utilities and manufacturing. This diversity enables members to learn from each other, and exchange widely divergent viewpoints on a variety of professional topics. It has long been considered one of ISACA's strengths.

How one can become Information System Auditor?

Individuals can give exams prescribed by ISACA, (provided they have prescribed qualification)to become a certified System Auditor.

Following are the Certifications provided by ISACA

CISA – Certified Information System Auditor

CISM- Certified Information Security Manager

CGEIT- Certified in the Governance of Enterprise IT

CRISC- Certified in Risk and Information Systems Control

Prerequisites and Registration

Qualification or Eligibility Criteria

5 years in IT audit, control, assurance, security within the past 10 years.

Or within 5 years from passing the exam.

Certain exemptions are available to following criteria

A minimum of 1 year information systems experience. Or 1 year experience in financial or operational auditing can be substituted for 1 year information system auditing, security experience.

60 to 120 completed college semester credit hours can be substituted for 1 or 2 years information system auditing, security experience.

A batchers' or masters degree from a university that enforces the ISACA sponsored model curriculum can be substituted for 1 years information system auditing, security experience.

2 years as a full time university instructor in related field (e.g. computer science, accounting, information system auditing) can be substituted for 1 years information system auditing, security experience.

Experienced must be gained within the 10 year period preceding the application date for certification.

Or within 5 years from initially passing the examination.

Registration Process

Examinations are conducted 3 times a year. In 11 languages and more than 240 locations.

Sign up and download Bulletin of Information

Follow the dates scheduled for registration.

Examination is of 200 marks and time allotted is of 4 hours.

Locations for Examinations

A significant benefit of an ISACA membership is participation in a local chapter which provides professional education, training and networking opportunities. Chapter membership is required of individuals living or working within the chapter's territory

Following are the cities where above given examinations can be given, tuitions and guidance can also be provided to the members.

Bangalore ,Chennai , Cochin ,Coimbatore ,Hyderabad ,Kolkata ,Mumbai ,New Delhi ,Pune Vijayawada

Professional Recognition

ISACA membership and its certification programs are globally accepted and recognized. In fact, independent studies continue to demonstrate that holding an ISACA designation enhances professional recognition, credibility and earning potential.

ISACA members have direct access to research, certifications and products that align systems and strategy. They are connected to a global professional community and have the opportunity to contribute directly to advancing the profession and developing its body of knowledge.

With the complexity of information systems, increased risks, and the need for compliance, it is more important than ever that organizations recruit and retain employees who can take a comprehensive view of information systems and their relationship to enterprise success.

ISACA membership and certification signifies to employers and peers that an individual is:

Dedicated to industry-accepted practices and high professional standards

Serious about enhancing their professional knowledge and skills

Connected with the standards, resources and global network of colleagues that only ISACA can provide

Suggestions & Conclusion

Information Technology plays a major role in facilitating all functions of business in this era, not just in transaction capturing and processing but even in lesser known areas like Corporate Governance and Risk Management. There is no doubt that IT Geeks with ISA qualification will play a major role in Information Systems Audit (ISA) in the coming years.

Individuals should be aware about the need of Securing and safeguarding IT. Programs such as, seminars, workshops and Group discussions should be arranged by which the concept IT Audit can be spread among individuals.

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Introduction to Information System Audit

www.isaca.org

Formation of ISACA

Certifications ISACA Provide

Qualification and Prerequisites for Certifications

Discussion with ISACA Pune Chapter

"Information System Control & Audit By Ron Weber"

Guidance from Mrs.Pratibha Upadhyay . Professor, MITSOM College, Pune

Why VB.NET is better than VB 6.0

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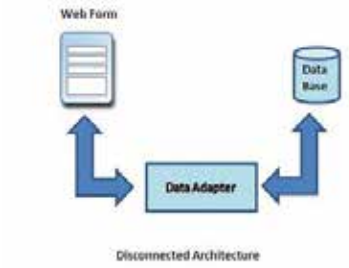
Abstract:-
This paper discusses the concept why VB.net is better than VB6.0.it focuses on dot net framework, Connected and Disconnected Architecture, object oriented concept .
Visual Basic (VB) is a programming environment from Microsoft in which a programmer uses a graphical user interface (GUI) to choose and modify preselected sections of code written in the BASIC programming language.
Visual Basic .NET (VB.NET) is a Microsoft object-oriented programming (OOP) language. It evolved from Visual Basic 6 (VB6) to meet an increasing need for easy web-services and web development.

VB.Net was designed to take advantage of the .NET framework-based classes and run-time environment. It was re-engineered by Microsoft as part of its .NET product group.VB.NET supports abstraction, inheritance, and polymorphism.
Vb.net includes a lot of functionality that has been around in other languages like C++ for ages, and is by some considered way to different from VB6 even to be called VB anymore. But let's set aside the arguing for a moment, what are those new shining thingies? Well, among other you have this:
Elegant structure of Dot Net Framework
Support for Object Oriented Concept .
Connected and Disconnected architecture for data base connectivity
and alot more. Then there are some changes that might be a bit harder to adjust to since they're to close to the old one, like zero-based arrays, returning values from functions using a return statement instead of using the function name, passing of parameters by value instead of by reference, new error handling (using try, catch, finally etc), usage of namespaces etc. The list goes on and on.
When it comes to compiling, VB6 compiled to native code while VB.NET compiles to CIL (Common Intermediate Language) which makes it a lot easier to reverse engineer, however you can obfuscate the code in order to make it less readable.Now lets discuss some of the points in detail.
Elegant structure of Dot Net Framework
.NET Framework (pronounced dot net) is a software framework developed by Microsoft that runs primarily on Microsoft Windows. It includes a large library and provides language interoperability (each language can use code written in other languages) across several programming languages. Programs written for .NET Framework execute in a software environment (as contrasted to hardware environment), known as the Common Language Runtime (CLR), an application virtual machine that provides services such as security, memory management, and exception handling. The class library and the CLR together constitute .NET Framework
Support for Object Oriented Concept
Visual Basic .NET is not Visual Basic 6 with inheritance tacked onto it. Rather, Visual Basic .NET has been entirely rewritten to be fully object-oriented. In fact, everything in Visual Basic .NET can be treated as an object. Yes, even your strings and integers can be accessed as objects in Visual Basic .NET.
For a programming language to be a true OOP language, the language must meet the following criteria:
Abstraction—Abstraction manages the complexities of a business problem by allowing you to identify a set of objects involved with that business problem.
Encapsulation—Encapsulation hides the internal implementation of an abstraction within the particular object.
Polymorphism—Polymorphism provides for multiple implementations of the same method. For example, different objects can have a Save method, each of which perform different processing.
Inheritance—The excitement of Visual Basic .NET lies in inheritance. Visual Basic 5 introduced the concept of interface inheritance, which allows you to reuse the interface of a class, but not its implementation. Visual Basic .NET provides for true implementation inheritance whereby you can reuse the implementation of a class
Connected and disconnected architecture for Database connectivity
Now let us discuss connected and disconnected architecture in detail.
Connected Architecture of ADO.NET
The architecture of ADO.net, in which connection must be opened to access the data retrieved from database is called as connected architecture. Connected architecture was built on the classes connection, command, datareader and transaction.
Connected architecture is when you constantly make trips to the database for any CRUD (Create, Read, Update and Delete) operation you wish to do. This creates more traffic to the database but is normally much faster as you should be doing smaller transactions.

Disconnected Architecture in ADO.NET

The architecture of ADO.net in which data retrieved from database can be accessed even when connection to database was closed is called as disconnected architecture. Disconnected architecture of ADO.net was built on classes connection, dataadapter, commandbuilder and dataset and dataview.
Disconnected architecture is a method of retrieving a record set from the database and storing it giving you the ability to do many CRUD (Create, Read, Update and Delete) operations on the data in memory, then it can be re-synchronized with the database when reconnecting. A method of using disconnected architecture is using a Dataset.



The shear breadth of the .NET Framework which VB.NET makes use of makes it a more versatile platform (IMO). It also runs in the CLR (Common Language Runtime) which is more or

less a virtual machine with a just-in-time compilation engine.
DataReader is Connected Architecture since it keeps the connection open until all rows are fetched one by one

DataSet is DisConnected Architecture since all the records are brought at once and there is no need to keep the connection alive
Difference between Connected and disconnected architecture

Suggestions & Conclusion

vb6.0 is easy to use language, user friendly and used for desktop applications ,but it does not support oop's concepts. So to overcome this limitation Microsoft have designed dot net frame work such a way that it supports oop's concepts ,execution and security as well as it provides connected and disconnected data base connectivity also. so conclusion is vb.net is better than vb6.

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Music Transcription Using Pitch Frequency Values

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Abstract—This paper deals with automatic transcription of a music piece or a piece of composition in Indian classical music. For this purpose, we have compared the standard pitch values for the musical notes that are Swaras in Indian classical music with the observed pitch values for the music piece. This transcription can be helpful for further analysis of the music composition, such as automatic Raga recognition.

Index Terms— Indian classical music, pitch, Saptak, Swara, transcription

INTRODUCTION

In Indian classical music every composition is composed of sequence of musical notes, called Swaras. The process of finding out this sequence of Swaras is called transcription of that composition. Total 12 Swaras are considered in Indian classical music. Out of which 7 are called as Shudhdha Swaras and 5 are called as Vikrut Swaras. They are named as Shadja, Rishabh, Gandhar, Madhyam, Pancham, Dhaivat, Nishad, Komal Rishabh, Komal Gandhar, Komal Dhaivat, Komal Nishad and Teevra Madhyam. Their abbreviations are Sa, Re, Ga, Ma, Pa, Dha and Ni. Every music composition is a combination of some of these Swaras. Three Saptakas are considered for each musical scale. They are Manra Saptak, Madhya Saptak and Taar Saptak. [1]

Every Swar is associated with a particular pitch value i.e. pitch frequency. The fundamental frequency of the voiced component of speech is known as the pitch frequency.[2]

The standard pitch frequencies for the Swaras are given in the following table.[3] Here, for the sake of convenience, we are considering only one musical scale- 'C4#' which is known as Kali-Ek.

Table I
Pitch Frequencies For The Swaras.

Note (Indian Classical Music)	Note (Western Music)	Frequency (Hz)
Sa (Manra)	$C^{\#}_2/D^{b}_2$	69.30
Komal Re	D_2	73.42
Re	$D^{\#}_2/E^{b}_2$	77.78
Komal Ga	E_2	82.41
Ga	F_2	87.31
Ma	$F^{\#}_2/G^{b}_2$	92.50
Teevra Ma	G_2	98.00
Pa	$G^{\#}_2/A^{b}_2$	103.83
Komal Dha	A_2	110.00
Dha	$A^{\#}_2/B^{b}_2$	116.54
Komal Ni	B_2	123.47
Ni	C_3	130.81
Sa (Madhya)	$C^{\#}_3/D^{b}_3$	138.59
Komal Re	D_3	146.83
Re	$D^{\#}_3/E^{b}_3$	155.56
Komal Ga	E_3	164.81
Ga	F_3	174.61
Ma	$F^{\#}_3/G^{b}_3$	185.00
Teevra Ma	G_3	196.00
Pa	$G^{\#}_3/A^{b}_3$	207.65
Komal Dha	A_3	220.00
Dha	$A^{\#}_3/B^{b}_3$	233.08
Komal Ni	B_3	246.94
Ni	C_4	261.63
Sa (Taar)	$C^{\#}_4/D^{b}_4$	277.18
Komal Re	D_4	293.66
Re	$D^{\#}_4/E^{b}_4$	311.13
Komal Ga	E_4	329.63
Ga	F_4	349.23
Ma	$F^{\#}_4/G^{b}_4$	369.99
Teevra Ma	G_4	392.00
Pa	$G^{\#}_4/A^{b}_4$	415.30
Komal Dha	A_4	440.00
Dha	$A^{\#}_4/B^{b}_4$	466.16
Komal Ni	B_4	493.88
Ni	C_5	523.25
Sa (Ati Taar)	$C^{\#}_5/D^{b}_5$	554.37

In the given approach of music transcription, the observed pitch frequency values at particular time

instant are compared with these standard pitch frequency values.

Obtaining Observed pitch frequency values

As a first step of transcription, it is important obtain the observed pitch frequency values at every instance of time. For this purpose we have used an open source software tool called 'Praat'. Using this software some music pieces are recorded. These pieces are then analyzed and pitch listing is obtained at various time instances. This software can provide pitch frequency values as precise as at every 0.01 seconds and even more. Example is shown in Fig. : 1 as given below.

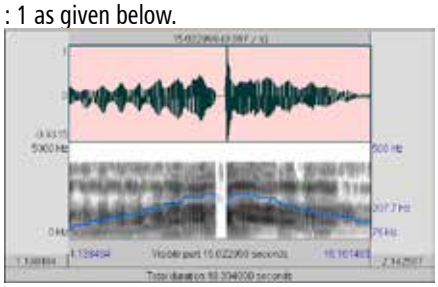


Fig. 1. Analysis of given piece of music using 'Praat' software.

In the above mentioned example, the music piece, that is all the shudhdha swaras sung by a singer in ascending and descending order, i.e. starting from Madhya Sa to Taar Sa and then again from Taar Sa to Madhya Sa is recorded. When this music piece is analyzed using 'Praat' software, we get pitch listing as shown in Fig. : 2 as given below.[4]

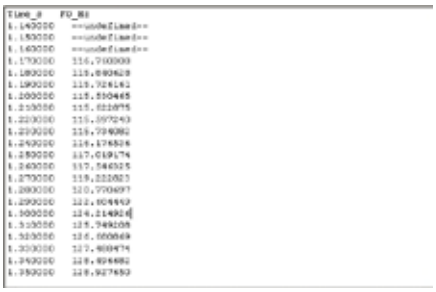


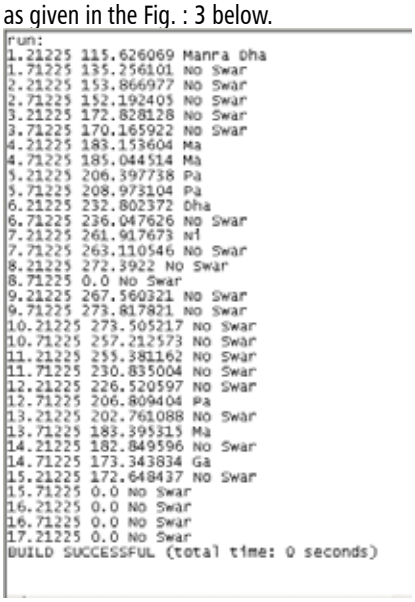
Fig. 2. List of observed pitch frequency values at given time instances.

This pitch listing can be used for further analysis.

Comparing observed pitch frequency values with standard values

In the next step of transcription, we have written a piece of code in java using which the observed pitch frequency values that are obtained in previous step are fetched from the file and they are compared with the standard pitch frequency values associated with each Swar.

For the above given example it gives the results as given in the Fig. : 3 below.



```
run:
1.21225 115.626069 Manra Dha
1.71225 135.256101 No Swar
2.21225 153.866977 No Swar
2.71225 152.192405 No Swar
3.21225 172.828128 No Swar
3.71225 170.165922 No Swar
4.21225 183.153604 Ma
4.71225 185.044514 Ma
5.21225 206.397738 Pa
5.71225 208.973104 Pa
6.21225 232.802372 Dha
6.71225 236.047626 No Swar
7.21225 261.917673 N1
7.71225 263.110546 No Swar
8.21225 272.3922 No Swar
8.71225 0.0 No Swar
9.21225 267.560321 No Swar
9.71225 273.817821 No Swar
10.21225 273.505217 No Swar
10.71225 257.212573 No Swar
11.21225 255.381162 No Swar
11.71225 230.835004 No Swar
12.21225 226.520597 No Swar
12.71225 206.809404 Pa
13.21225 202.761088 No Swar
13.71225 183.395315 Ma
14.21225 182.849596 No Swar
14.71225 173.343834 Ga
15.21225 172.648437 No Swar
15.71225 0.0 No Swar
16.21225 0.0 No Swar
16.71225 0.0 No Swar
17.21225 0.0 No Swar
BUILD SUCCESSFUL (total time: 0 seconds)
```

Fig. 3. List of observed pitch frequency values and the Swaras occurred at given time instances.

Suggestions & Conclusion

The results obtained from this approach of music transcription are quite good. Some extra Swaras appear in the result, which were not intentionally sung by the singer, along with the original Swaras. This error can be considered as human error. This sequence of Swaras obtained can be useful for further analysis of music piece.

References

V.N. Bhatkande. Hindusthani Sangeet Paddhati, Sangeet Karyalaya, 1934.

Siddarth Rai Mahendra, Hemant A. Patil, Narendra Kumar Shukla, "Pitch Estimation of Notes in Indian Classical Music," India Conference (INDICON), Annual IEEE, 2009

http://www.phy.mtu.edu/~suits/notefreqs.html

[4] P. Boersma and D. Weenink: "Praat: doing phonetics by computer": Institute of Phonetic Sciences, University of Amsterdam (www.praat.org)

Need of c Pointers in programming

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Introduction

Most of the time computer students who have learnt c language have question in their mind that why c is having pointers. C pointers are often considered just a confusing topic in c language. Pointers are very easy to use and they have their own importance in software development. Here first I have introduced what are pointers and syntax of pointers to make pointers easy to use and then we will try to understand why they are important in c language.

Objectives

Understanding what are the pointers and how they are used in c?

Understanding why c is having pointers.

Understanding why it is important for programmer to know the pointer concept.

What is a pointer?

Pointer is a variable which holds the address of another variable.

In any programming language variable is a named memory block. Meaning if I want to store addition of 2 numbers in computers I will need one memory block to store the results. So I can do that using programming variables.

Example: int add=30+30;

Above statements says that add is a variable of type integer which stores the value 60. Now I can access value of variable add by name or by memory address. To access a variable by its memory address you need pointers.

Example: int *p;
p=&add;

Above statements says that p is a pointer variable which stores the address of add variable.

Now you can use printf statements to print the values.

```
main()
{
   int *p;
   int add=30+30;
   p=&add;
   printf("\n the value of add: %d",add);
   printf("\n the value of pointer: %u",p);
   printf("\n the value of add: %u",*p);
}
```

Using pointers you can perform some arithmetic operations. Four arithmetic operations can be performed on pointer those are ++,--, + and -. Here I have not explained them because our main objective is to know why pointers are important. You can learn more about pointers from any programming book.

Why pointers?

Pointers are used for many purposes like you can create dynamic data structures using pointers (linked list), in function calls, to make the program more efficient and thus faster. How program can be more efficient with pointers? First I will give a very basic example for beginners. Suppose a program is using array. At the beginning I don't know how much memory I will need so I have to declare the array using maximum memory. Suppose I have declared 20 blocks. First time I only need 10 blocks then 10 blocks are wasted, second time I need 5 then 15 blocks are wasted. Now if this program is using pointer to generate the dynamic memory at the run time every time 15 to 10 blocks of memory can be saved. And if the application is using huge amount of memory it can saved thousand blocks of memory using pointers. Well this is the simplest and easy example of why we need pointers.

C language was developed by Kernighan & Ritchie in 1970. At that time computers was not that advanced and powerful. Middle level Language like c was developed to work closely with hardware and making this language efficient in point of memory uses was a big challenge. Row pointers allow programmers to work with particular memory location and because of these programs can work faster and more memory can be saved or optimized.

In c pointers are used with arrays, stings, functions. Actually it is impossible in c to use array without pointers. I know in general programs we never put a '*' in syntax of array. But indirectly array is just a pointer to particular memory block. For example I want to declare an array with 10 memory blocks to store 10 values.

int arr[10];

Now I want to access the 5th memory block of my array. So I have to use something called array index. Well the array index is a pointer which pointes to 0th block of memory at first and then goes forward. In a same way pointer concept stays hidden behind c strings. Pointers area used to pass parameters to the functions. The programmer knows the difference between pass by value and pass by reference so no need to explain it details.

Pointers are also effective when it comes to structure. C structure is another concept which uses hidden pointers. Structure is a collection of different data types; all this variables are stored somewhere in the memory to access this element from particular block of memory pointers are used.

Accessing computer memory directly from your program can make memory related operations very fast but the one who is using pointer has to be very clear about what he is doing because with little confusion and doubts pointers can make your program much complicated.

Conclusion

Programmer who learn high level languages first like java, .net may think that learning a pointer is waste of time because they are nothing but a confusion and most of the programming languages this days don't have pointers. Well if you are a programmer it means you have to have a good knowledge about computer memory. Because the programs or application you make are going to use memory and pointers are the concepts which works very close with computer memory. No matter which higher level language you are using there is no programming language that don't have concept called pointer. Most of these languages do not provide row pointers to their programmer because many security issues have risen these days and the complicated nature of pointers but all these languages use pointers hidden from programmer.

Suggestions & Reference

The c programming language by Brian W. Kernighan, Dennis M. Ritchie
http://www.thegeekstuff.com
http://duramecho.com
http://www.codingunit.com

Hadoop

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Hadoop was created by Doug Cutting and Mike Cafarella in 2005. Cutting, who was working at Yahoo! at the time named it after his son's toy elephant. It was originally developed to support distribution for the Nutch search engine project.

Apache Hadoop is an open-source software framework written in Java for distributed storage and distributed processing of very large data sets on computer clusters built from commodity hardware

Apache Hadoop's MapReduce and HDFS components were inspired by Google papers on their MapReduce and Google File System

Hadoop consists of the Hadoop Common package, which provides file system and OS level abstractions, a MapReduce engine and the Hadoop Distributed File System (HDFS). The Hadoop Common package contains the necessary Java ARchive (JAR) files and scripts needed to start Hadoop.

As of October 2009, commercial applications of Hadoop included:

Log stream analysis of various kinds
Marketing analytics
Image processing
Processing of XML messages
Web crawling and/or text processing
\\

In 2010, Facebook claimed that they had the largest Hadoop cluster in the world with 21 PB of storage. On June 13, 2012, they announced the data had grown to 100 PB. On November 8, 2012, they announced the data gathered in the warehouse grows by roughly half a PB per day. As of 2013, Hadoop adoption is widespread. For example, more than half of the Fortune 50 use Hadoop.