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Highlights

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WLAN and WiMAX

Discovering Thoughts, Inventing Future

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Information & Communication Technology and 'Individual': Prospects & Concerns

By Muhammad Zubair Khan, Dr. Amanullah Khan Miankhel
& Dr. Allah Nawaz
Gomal University, Pakistan

Abstract - Technologies have always played a significant role in the development of human civilization. The contemporary information and communication technologies are also expected to play a similar role. These technologies facilitate of connectivity and cost-effectiveness are such characteristics of ICTs that help individual raise its political, economic and social capabilities. However, ICTs also pose certain threats to the socio-economic life of individuals. The individual seems threatened by loss of privacy, become prey to tech-addiction, and suffer from piracy issues. The very nature of ICTs makes these issues global in character, demanding fresh legislation equally global in nature. This article explicates this issue at length by juxtaposing the research findings from the existing research and comes up with a theoretical model for better understanding.

Keywords : *individual; information & communication technologies; privacy; net addiction; globalization.*

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Information & Communication Technology and 'Individual': Prospects & Concerns

Muhammad Zubair Khan [α], Dr. Amanullah Khan Miankhel [σ] & Dr. Allah Nawaz [ρ]

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I. Introduction

Historically speaking technology has played a significant role in the evolution of human civilization. From hunting gathering societies to agrarian, and from industrial to information, technologies have served as one of the major determinant of socio-political and economic system of a society (Hoyle, 1953). The invention of wheel and printing press are significant examples of how technologies can set off cascades of revolutions within societies (Mc Chesney, 1995). Technology refers to the hardware and software i.e. instruments and techniques to resolve human issues or achieve certain objectives (Tehranian, 2004).

Political organizations and businesses of each epoch in history seem to be the major benefactor of technologies; however a profound look suggests that technologies have always been the invention of the individuals and for the individuals. It is the novel use of technology that gives birth to newer political, economic and social values and institutions of the society. Technologies, not only facilitate the social life but also the economic and political life of individuals. The blessings of technology for social life of individuals need no praises; however the political and need no praises; however the political and economic aspects of technology for individual have remained a vital concern for scholars for years. Technologies have always enabled individual to participate in political, economic and social life of the society (Tehranian, 2004). New technologies in every age raised discussions about their mobilizing power. In order to become a participant of any political process, the individual requires information. The emergence of newspapers in Europe helped change the role of individuals from spectator to participant in the political process (Gordon, 2004). The 18th century bourgeoisie were facilitated by printing press, along with other gradual developments that reduced the cost of production. The invention of electric telegraph by Samuel F.B. Morse in 1837 and the telephone by A.G. Bell in 1876 facilitated people to communicate at long distance, again supported by additional developments like automatic switch boards to reduce costs and ameliorate quality. The radio- the invention of Marconi in 1895, probably carried with it high expectations of its democratizing power followed by the Baird's invention of television in 1923 (Gordon, 2004). However, owing to state and market interference, along with the rise of the cultural industries, individual lost many of its political, economic and even social benefits and got 'refeudalized' (Habermas, 1989).

Nevertheless, with the emergence of information and communication technologies (ICTs), several new prospects ushered in for individual and a possibility to achieve its lost status of participant in the political and economic affairs of the society (Khan et al, 2012). The role of the internet and other digital technologies is paramount in this respect. ICT influences the lives of a rising number of individuals in different ways all over the globe. ICTs have not only been an essential element at the macro-level as in process of globalization, but equally at the micro-level where the enhanced use of mobile phones, for example, transformed daily communication methods universally (Weigel & Waldburger, 2004: 16).

Ever since the inception of the internet in the last decade of the 20th century, the number of the internet users has been on the rise across the world. It is being used by common citizens, activists, nongovernmental organizations, telecommunications firms, software providers, and governments across the world (Shirky, 2011).

This first section of this paper explores the significant digital technologies that directly influence the life of individual. The next section highlights the prospects generated by ICTs for individual. ICTs have

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also created some challenges for individual which would be discussed next. Finally, the whole debate would be capsuled in a schematic model for the sake of clarity.

II. Information Technology Revolution

ICTs refer to the entire range of technologies devised to retrieve process and communicate information in the shape of text, sound, data and images. ICT cover the full range from conventional widely used appliances such as radio, telephone or television to more stylish devices like computers, the Internet, networks, hardware and software, satellite systems, and podcasting Internet. The blend of technologies used might be determined chiefly by the particular local perspective and demand (Weigel & Waldburger, 2004).

ICTs as high-tech tool are rather well-known; however their significance lies as stimulators of novel associations and spaces. ICTs are actually generating a new global arena attracting a fresh competition regarding the distribution of power, information, and resources (Van Dijk, 2006).

Industrial societies played significant role in the rise of informatics revolution. Different labels have been used to describe it like 'Post-Industrial', 'Knowledge', 'Information', 'Postmodern' and 'Network Society'. The different labels actually describe the various aspect of the same phenomenon. The most remarkable changes can be observed in communications systems at both global and national levels. Information revolution has (1) facilitated merger of telecommunication and computers, (2) offered smart personal communication devices, (3) swiftly expanded the wireless networks and devices (4) facilitated the storage, processing and retrieval of information in all sectors of the economy (Tehranian, 2004).

The invention of press (1450) is a typical illustration of how novelty can set off cascades of revolutions within societies. ICTs are expected to play similar role. Due to their service potentials and prevailing nature ICTs have social, political and economic implications (Mc Chesney, 1995). They offer a variety of tools to businesses, states, civil society and individuals to achieve their goals.

In order to estimate the impacts of ICTs on individual, it would be useful to have a broader review of those information technologies that facilitate individual in various ways.

a) Digital Technologies

Digital technologies fundamentally are the extensions of the ways individual communicate. The human desire to communicate effectively and easily motivated the efforts for development of these technologies. Digital technologies involve creation, sharing and usage of information in digital form. Digital information is in the form of 'data' that can be structured, manipulated, stored and exchanged through digital equipments.

There is a huge variety in the available digital technologies that perform varieties of functions. Moreover their speed, efficacy and cost-effectiveness are rapidly increasing.

i. *Internet*

The Internet is 'an interconnected system of networks that connects computers around the world via the TCP/IP protocol' (Online American Heritage Dictionary). It is a network of networks which enable users at any one computer, if they have authorization, to obtain information from any other computer and sometimes talk directly to users at other end (Gordon, 2004).

The Internet is a public, accommodating, and self-sustaining service accessible to hundreds of thousands of people across the world (ACARM, 2005). It is a unique matrix of networks which is established on a "many-to-many" model of information distribution, contrary to the "one-to-many" structure of mass media (Crack, 2007).

Electronic mail (e-mail) is probably the most frequently used service on the Net. It has provided a substitute, to almost all the Internet users, for the conventional postal service in order to send short written messages. World Wide Web (WWW) is the most extensively used element of the Internet. Through the Web, one can get access to millions of websites containing bulk of information (Rouse, 2008).

ii. *Networking*

A digital network connects two or more computers through wires, telephone lines, radio waves, satellites, or infrared light rays and enables them to share resources, exchange data, and facilitate electronic communications (Winkelman, 1998). The Internet is the largest digital network in the world. Networked computers can expand the scale of the world to unprecedented levels (Bell, 2008).

There is substantial evidence that virtual networks facilitate diasporic public spheres; support ethnicity by e-mail and uphold the functions of INGOs and social movements. They also offer information, support and facilitate possibilities for companionship for a multitude of people poorly served by the available facilities in the civic spaces where they actually live. In sum, most suitable to the global context, networks can construct social associations without limitations of physical space or presence (Axford, 2004).

Moreover, it is expected that with the passage of time the networked population will not only increase in number, rather they will also acquire better access to information, enjoy more opportunities for debates and collective action (Shirky, 2011).

iii. *Social Software*

A social-software facilitates socializing processes and social activities by brining individual or groups of individuals together in regular contact. It enables them to communicate with each other beyond temporal and spatial confines (Oblak, 2002). The different types of social media are similar in that they all posses' dense fundamental network structures that supply metadata and environment that can be useful while retrieving information from their content (Finin et al., 2008).

The Internet-based social media systems including blogs, wikis, message forums and media-sharing sites, have turned out to be significant modern ways to pass on information, hold discussions, and shape social communities on the Internet. Their coverage and ramifications are important, with hundreds of millions of people supplying content consistently from around the world. Recent researchers suggest that social media systems are shaping about one third of new web content (Finin et al., 2008).

Social networking sites may be defined as web-based facilities through which individuals can (1) create a profile, public or semi-public, within a circumscribed system, (2) generate a list of other users with whom they share a link, and (3) observe and navigate their list of associations and those made by others within single system.

Social network sites (SNSs) are unique, not because they help individuals connect with strangers, but because they facilitate users to articulate and make observable their social networks. This result in links between individuals that would not otherwise be possible, but that is seldom the objective and these interactions are often between 'latent ties' who share some offline association (Haythornthwaite, 2005).

Though community based websites still exist and flourish, SNSs are essentially woven around individuals, not interests. Initial public online communities like Usenet and public interaction forums were arranged by topics, however, SNSs are designed as personal networks, with the people at the core of their own community. Facebook is a good example in this perspective (Boyd, 2008).

iv. *Mobile Phone*

A mobile phone, sometimes also called as a cellular phone, or cell phone, is a communication invention that can make and receive telephone calls over a wireless link within a wide geographic area. It operates by linking to a cellular network offered by a mobile phone operator, permitting access to the public telephone network (Tanenbaum, 2002).

Contemporary developments in the mobile phones technologies include the improved features of phones to generate and pass on contents other than SMS. High standard image and video facilities in the latest generation of mobile phones has paved the way to several new software that enable individuals to publish images, audio, and videos from mobile phones directly to related websites. Similarly, bulk SMS can also be sent through mobiles (Yadav & Rani, 2011).

By the end of 2011, there were around 6 billion mobile subscriptions around the world (ITU, 2012). That translates in to 87 percent of the entire world population. It is an enormous rise from 5.4 billion in 2010 and 4.7 billion mobile ownership in 2009. This shows that individual access to modern technologies is on the rise.

III. Prospects for Individual

Like any dominant technology of each epoch, ICTs are the characterizing technology of information age. Just as it has facilitated state and businesses in variety of ways, similarly it has opened new avenues for individual as well. It is creating an environment in which individual's political, economic and social capabilities get ameliorated due to various factors. However, the same technologies have also raised some of the newer concerns for a citizen.

a) Access to Information

In the modern age, due to ICTs greater number of citizens can access unlimited information. The Internet plays a significant role in this perspective. It supplies millions of pages of information on almost every subject (Khan et al., 2011). Owing to advancement in the Internet technologies both the quantity of available information and quality of access is ameliorating. Today, any one with some fundamental computer literacy and access to the Internet can easily retrieve information of his/her need from the Internet (Khan et al., 2012).

Access to information is a step forward in empowering individual. Obtaining and diffusing political communication through the Internet is swift, convenient, and cost-effective. New technologies supply information and apparatus that may raise the position of the public in the socio-political domain (Papacharissi, 2002). Certainly, the swift diffusion of the ICTs into various aspects of public life was chiefly raised by its historically matchless capabilities for "interactive, unmediated and synchronous communication" (Oblak, 2002). Moreover, ICTs supply strategic devices that serve as stimulant for transformation by raising efficiency and effectiveness (Kalas & Finlay, 2009).

b) Connectivity

ICTs help connect people together. An individual as a student, worker, or as a businessman may be extremely busy but if he/she can remain in touch with his/her network of relations simply by a cell phone. Higher levels of literacy or computer skill are no more required. The various social technologies not only link people within a state, rather these also facilitate

individual's social connections across the world. Importantly, an ordinary individual with a limited knowledge and skills to use modern technologies can also establish links far away in other continents.

ICTs capabilities to produce networks of knowledgeable citizens reflect their political powers. Cyber enthusiasts contend that the Internet can strengthen democracy by connecting people, with utter disregard to territory, and by fostering public spheres and fresh social movements (Min, 2010).

c) Innovative Platforms for Expression

The potentials of the Internet for facilitating public debates cannot be overlooked. Today, individuals have numerous opportunities for expressing their views. There are hundreds of thousands of political web sites with local, national, and global scope; some of them are partisan, but most are not. It is easy to find chat rooms, discussion forums, new types of journalism, civic associations' platforms, advocacy sites, and sites for promoting citizens' awareness (Dahlgren, 2005). Individuals can easily find spaces for expressing their views to influence political decisions. Increasingly a consensus is emerging among researchers that ICTs are facilitating a virtual public sphere which can help bring the state in touch with the needs of the public (Khan et al., 2012).

One might contend that the net-based virtual sphere has a great potential as a political medium, particularly in redesigning political processes and revitalizing political practices. Moreover, the internet and associated technologies encourage political discussion and provide spaces for it (Papacharissi, 2002).

The Internet acquires a pivotal position in the arena of new politics, particularly its potential for the "horizontal communication" of civic engagement is highly significant. There is little doubt that access to the internet and other technologies like cell phones, has assisted the rise of large-scale cyber networks of activists (Dahlgren, 2005).

d) Economic Opportunities

ICTs potentials to exchange information in run time and facilitate networks reflect the economic prospects for individual. Like technological changes of the past, information technology is also likely to boost productivity, raise the standard of life, decrease prices, and generate new economic activities leading to new employment openings and generation of wealth. The world is experiencing a transformation not due to the fact that computer operators have substituted the secretaries and the typists across the world, leading to reasonable hike in efficiency, rather the information technologies have restructured the economy on essentially different basis, commonly called as information based economy (Tezcan, 2006).

The changes in economy are opening new prospects for individuals. Temporal and spatial transformations brought about by ICTs are facilitating individuals in performing their jobs in relaxed environment at their convenient timings. Similarly, the enhanced 'connectivity' is also giving birth to new economic prospects for individual.

e) Educational Opportunities

Significance of education for individual needs no explanation. ICTs facilitate education processes in variety of ways right from the elementary level to the higher education. The use of audio-visual aids in educational activities is not a new concept; however, computer and later the Internet brought a revolution in the field of education at all levels (Nawaz & Khan, 2012a).

From concept building to simulations, from collecting information to getting in touch with other students of same level and expertise, ICTs are facilitating each and every step in the educational process. The use of ICTs in higher education has particularly been emphasized by the educationists and social scientists for over a decade. Moreover education for all (E4A) in developing countries seem to be a realizable goal because of the proliferation of ICTs in education sector (Nawaz & Khan, 2012b).

IV. Concerns for Individual

Though ICTs are facilitating individual in many ways and have raised individual's socio-political and economic capabilities however, these have also given birth to numerous novel challenges for the individual. These concerns range from privacy issues to tech addiction which influences the individual and collective lives of modern citizens.

a) Privacy

Privacy is an individual's condition of life. Its major quality is exclusion from publicity (Neethling et al., 1996: 36). ICTs influence the various areas of individual's privacy. For example, the interception and reading of E-mails, the electronic screening of individuals in the workplace, and the integration of different databases which contains individuals profile information. Another significant challenge to privacy is the emergence of 'hackers' and 'crackers' who break into others computer systems (Ashoor & Gore, 2011). The hackers and crackers are novel thieves of the information era. They not only steal data rather they can also steal someone's identity by pretending to be who they are not.

ICTs impacts on the individual's privacy can lead to loss of dignity and spontaneity. Moreover it also poses threats to individual's freedom. So ICTs to a certain extent threatens privacy of individual (Rosenberg, 1993).

b) Addiction

The Internet addiction is a kind of psychological disorder which refers to socio-psychological state of those individuals that spend excessive amounts of time over the Internet at the cost of several other social aspects of individuals' lives (Young, 1998). The Internet addiction can take several forms; 1) spending huge amounts of time in establishing online relationships in different chat rooms at the expense of real friends and family members, 2) spontaneously gambling or trading online, 3) compulsive information searching on websites and database, 3) Gaming: compulsive computer games that can be multi-user games as well and 4) addiction to cyber sex or pornography on the Internet (Childnet International, 2006).

The Internet addiction leads to loss of time eventually in the loss of variety of social activities. This in turn creates a range of psychological and sociological anomalies in the life of an individual (Akin & Iskender, 2011).

c) Propaganda

Propaganda is traditionally defined as dissemination of particular information by words of mouth or printed pamphlets distributed by a certain group within a limited community. However, the ICTs make information easily accessible to a wide and diverse audience utterly irrespective of their location (Crilley, 2001). ICTs can easily facilitate groups, cults, political parties in their propaganda campaigns. On the one hand, it drastically hampers the formation of real public opinion and on the other it can also facilitate extremists and terrorist groups in achieving their goals.

The prominent features of the Internet like easy access to information, swift broadcast of multimedia information to large and widely dispersed audiences, low levels of censorship, and cost-effectiveness are all such qualities of the modern technologies that different groups can use to propagate their agendas (Weimann, 2004). An individual can easily become a victim of such propaganda during its search for objective information. Different groups use the websites for disseminating speeches, images, training manuals, audios, videos, slides, blogs, and Web casts for the sake of achieving their goals (Porth, 2006).

d) Piracy Issues

Piracy refers to act of unlawfully reproducing copyrighted material like books, music, movies, and computer programs etc. Before the advent of ICTs, it was uncommon and difficult to print books or burn movies and then circulate on a large scale; however ICTs have made this task quite easy and have given birth to what is commonly called as digital piracy (Al-Rafee & Cronan, 2006).

Piracy on the Internet is not simply a concern of the individual rather organizations of all types also face similar threat. Piracy and copyright issues include intellectual property theft and infringement - the unlawful copying and distribution or sale of books, music, films, software, games, and other intellectual properties (CSIS, 2008).

e) Financial Concerns

In the information era, money has become digital and payment systems has also taken digital form. According to the Federal Deposit Insurance Corporation (FDIC) reports online bill payment systems and softwares have become the most frequent target of digital thieves. Such crimes include the data theft particularly stealing of credit-card information, account details, social-security number and other profile information (CSIS, 2008). Corporations generally have better guard-systems against such cyber thieves however individuals always remain at higher risks in this perspective.

V. Discussion

The Internet integrates various stages of the communication process, for example storage and sharing of information, interaction, and transformation of the communication channels in an unprecedented manner. Internet is a catalog of unlimited information and a medium for its communication, and is particularly significant for its capacity to link different agents efficiently, swiftly and reciprocally. It has really opened several new opportunities for the amelioration of individual's political, economic and social life (Oblak, 2002).

A glimpse at the mobile phone sector suggests that mobile phone ownership in the developed world has touched saturation level with minimum one mobile subscription per person. This shows that recent market expansion is being driven by demands in the developing world, spearheaded by China and India. These two states jointly increased 300 million new cell phone subscriptions in 2010 that is more than the entire mobile users in the US. By the end of 2011 there were around 4.5 billion mobile phone subscriptions in the developing world that is 76 percent of worldwide subscriptions. Mobile penetration stands at 79 percent in the developing world (ITU, 2012). This suggests that the most emphasized ailment of the information era i.e. digital divide, is gradually ebbing away and individual in the developing world are also now enjoying or beginning to enjoy the miracles of 'connectivity' and 'access' to information (Khan et al., 2012). The internet, cell phone and social media played the central role in perspective of political protests in 2011 particularly in Arab world, both as a planner of physical dissent and as a civic realm in its own right. London riots are yet another case in this respect.

Moreover, as ICTs operates beyond territorial boundaries so these facilitate civic interactions beyond nation-state territorial confines. Moreover, speedy and

efficacious access to information raises transparency and assists individuals in making their governments accountable. Similarly by providing citizens information regarding rights, facilities and services, citizens can be empowered and opportunities for public debates can be augmented (Weigel & Waldburger, 2004). Drache optimistically contends that contemporary era through the ICTs and information flows provide the common citizen limitless social opportunities to innovate and shape discursive communities on a range of issues (Drache, 2008).

However, it is a fact that the ICTs on the one hand has raised the accessibility to information but on the other hand, because of low/no mechanisms for controlling the dissemination of information, ICTs are also creating problems for individuals, state and markets in the shape of hiking information security concerns (Papacharissi, 2002; Kapitonenko, 2009).

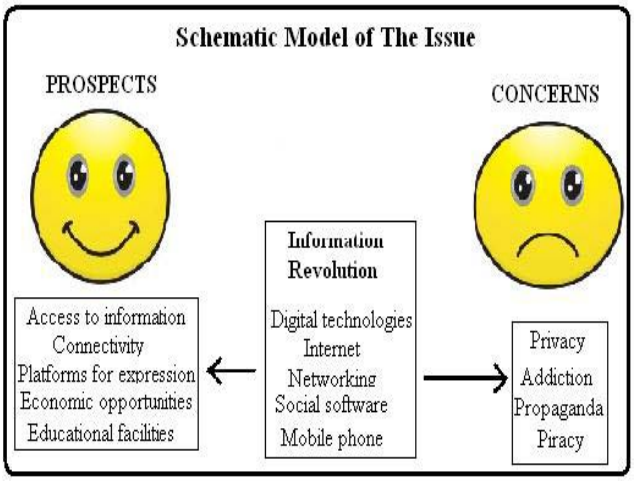
Similarly, there can be no disagreement that a number of such issues have surfaced due to ICTs which require fresh legislations. For example, credit card thefts, illegal fund transfers, profile thefts, copyright issues, and intellectual property rights etc. The severity of these concerns for individual is certain. Furthermore, ICTs make these issues global in nature; therefore a global set of digital laws has become a dire need of the day (Segura-Serrano, 2006).

Moreover, despite numerous positive qualities of ICTs, individual's personal character, aptitude, motivation and Internet skills play significant role in determining the impacts of ICTs on individual and society (Bargh & McKenna, 2004). It is the individual personal character and motivation which leads to problems of 'net addiction'. The off-line crimes can shift to online realm owing to motivation and character of certain individuals. Citizens in any society face risks of theft, violation of intellectual property rights etc., ICTs seem to have augmented these challenges in the face of low/no regulation of the flow of information over the Internet (Min, 2010).

Individual is experiencing a kind of ambivalence with respect to ICTs potentials. There is desire for free flow of information but the hazards of this phenomenon are also recognized at all levels (Otnes et al., 1997; Mick & Fournier, 1998). The human civilization is passing through a transition from industrial to information era. The realms of 'private' and 'public' are getting refined. Individual's private rights need to be redefined (Khan et al., 2012). The situation direly demands novel set of legislations with implications beyond nation-state territorial boundaries (Segura-Serrano, 2006).

Figure 5.1 is a schematic presentation of the issue discussed, showing the significant factors regarding ICTs that on the one hand offer a list of opportunities but on the other pose variety of threats for an individual.

Figure 5.1



VI. Conclusions

Information revolution is fostering numerous opportunities and concerns for individual. ICTs are supplying technological infrastructure for a new globalized world. These have in various ways strengthened the status of individual in society and have offered novel social, political and economic opportunities. However, certain socio-economic and psychological concern cannot be undermined. The unchecked flow of information, often celebrated as a great blessing of the information era, at times seems to be curse for individual.

The need for fresh legislation for monitoring the flow of information seems imperative. However, such legislation can also threaten the newly won freedom of information for individual. Human civilization is passing through a transition, and like transitions of the past, the emerging newer global civilization can be optimistically expected to be more sophisticated, paying more respect to individual's social, political and economic rights.

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Enhancement in DSR Protocol for Load Balancing and Congestion Control

By Shivali Katoch & Reena Aggarwal
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Abstract - The routing protocols are classified as reactive and proactive routing protocol. The reactive protocols are the protocols which establish route from source to destination when required on the other hand proactive routing protocols are protocols in which nodes store routing tables and on the basis of these routing tables route is established between source and destination. The simulation results show that reactive routing protocols are efficient than proactive routing protocols. DSR is the reactive type of routing protocols. DSR protocol establish route from source to destination on the basis of hop counts and sequence number. There is possibility that the route which is established between source and destination will be in congestion. In this paper, we are proposing new technique for congestion control in DSR protocol. The new technique is implemented in NS2 and results show that proposed technique is better than the previous techniques.

Indexterms : *DSR, congestion, NS2, load balancing, reactive and proactive routing protocols.*

GJCST-E Classification : *C.2.4*

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Enhancement in DSR Protocol for Load Balancing and Congestion Control

Shivali Katoch [α] & Reena Aggarwal [σ]

Abstract - The routing protocols are classified as reactive and proactive routing protocol. The reactive protocols are the protocols which establish route from source to destination when required on the other hand proactive routing protocols are protocols in which nodes store routing tables and on the basis of these routing tables route is established between source and destination. The simulation results show that reactive routing protocols are efficient than proactive routing protocols. DSR is the reactive type of routing protocols. DSR protocol establish route from source to destination on the basis of hop counts and sequence number. There is possibility that the route which is established between source and destination will be in congestion. In this paper, we are proposing new technique for congestion control in DSR protocol. The new technique is implemented in NS2 and results show that proposed technique is better than the previous techniques.

Indexterms : DSR, congestion, NS_2, load balancing, reactive and proactive routing protocols.

I. Introduction

Wireless systems, both mobile and fixed, have become an indispensable part of communication infrastructure. There applications are ranging from simple wireless, low data rate transmitting sensors to high data rate real-time systems, those used for monitoring large retail outlets or real-time broadcasting of sport events. The existing wireless technology is based on point-to-point technology. An example is GSM system with an architecture that is based on mobile nodes communicating directly with central access points. Sometimes there are networks that can't rely on the centralized connectivity such as Mobile Ad-Hoc Networks (MANET). MANET is a wireless network having mobile nodes with no fixed infrastructure. These kinds of networks are used in areas such as environmental monitoring or in rescue operations. The main limitation of Ad-hoc systems are the availability of power. In addition to running the onboard electronics, power consumption is governed by the number of processes and overheads required to maintain connectivity. The most important performance criterion for mobile users is the battery life of device. The battery life can be extended by reducing energy consumption over devices. The energy efficiency of wireless networks can be improved by designing of energy conservative protocols over radio interface. There are two main components that consume energy such as the host CPU and Wireless network interface. The progress on battery technology is steady but slow, so spending as little energy as possible on different operations is likely to remain an important design constraint for mobile solutions [1]. The use of laptops, PDAs and mobile devices has changed the business sector to improve the market of wireless networks in an ad hoc mode. MANETs have gained much importance because of the features such as they are decentralized, self organizing, adaptive and dynamic in nature. The delay, power consumption and traffic are main concerns in ad hoc networks due to its non confined nature. The MANET station acts like a router to route the information from one node to the other node as there is no access point available in ad hoc networks. Mobile ad hoc networks are dynamic in nature as the nodes are dynamically allocated without the central administration and the nodes will behave as the hosts for the file transfer protocol, email, HTTP and other applications to transmit and receive the information [2]. The DSR protocol in which the source node sends route request message and the nodes which is having route to the destination node. MANETs have the limited energy budget [7] for communication among mobile nodes, thus usage of the energy resources of a small set of nodes at the cost of others can have an adverse impact on the node lifetime as well as network lifetime.

II. Literature Review

K. Arulanandam and B. Parthasarathy (2009) [5] gave an approach to minimize power consumption in idle mode of mobile nodes. They gave an idea to change mode of the mobile nodes from Idle to Sleep, because when nodes were neither transmitting nor receiving data packets but in Idle mode consume power as been consumed in receiving mode. They have taken two ad hoc on-demands routing protocols and performed this approach and illustrated that power consumed by these protocols, with this mechanism is less than power consumed by any other mechanism. It saved power up to 60%.

Canan Aydogdu and Ezhan Karasan (2010)[6] proposed an analytical model for the IEEE 802.11 DCF in multi-hop wireless networks that considered hidden terminals and accurately worked for a large range of traffic load that are used to analyze the energy

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consumption of various relaying strategies. The results shown that energy consumption not only depends upon processing power but also on traffic load that is the number of nodes presented in network.

Xavior pallot and Leonard E. Miller (1998) [10] proposed a design to evaluate the effectiveness of a MANET in delivering priority message service using a standard routing algorithm such as DSR but altering the protocols used at Medium access (MAC) and Physical (PHY) layers according to the IEEE 802.11 specification. in Yu (2004) [6] proposed mechanisms to make routing protocols aware of the packet lost data packets and ACKs and help reduce TCP timeouts for mobility-induced losses. He presented two mechanisms: Early packet loss notification (EPLN) and Best effort ACK delivery (BEAD). Shweta Jain and Samir R. Das (2010) [3] proposed an any cast mechanism at link layer that forwards packets to the best suitable next hop link to enable efficient packet forwarding on a multichip route. They proposed a mechanism that depends on the availability of multiple next hops, which could be computed by a multipath routing protocol. The any cast protocol provides significantly better packet delivery relative to 802.11 in variety of ad-hoc networks.

Kaixin Yu, MArioa Gerla, Sang Bae (2008) [4] shown the effectiveness of RTS/CTS in wireless ad-hoc networks. First, they analyzed the interference range for open space environment. Second, verify the data packet corruptions due to large interference range. Third, a simple MAC layer scheme proposed to combat the large interference range. They have done only trivial modification to 802.11

III. DSR Protocol

The DSR is the reactive type of protocol .The route from the source to destination is established when required. This approach will enhance the efficiency of the network as compared to proactive routing protocols. The other reactive routing protocols are AODV and OLSA. The DSR protocol is based on the traditional Proactive DSDV protocol. In DSR protocol the source node broadcast the route request packets in the network and the intermediate nodes which is having path to the destination will reply with the route reply packets. In DSR protocol the intermediate node which further broadcast the route request packets which add its own identity in header of route request packet. When the source node start broadcasting the route request packets the header of the route request packets is empty and header will be fill by the intermediate node. The destination node will select the best path on the basis of will select best path on the basis of header value count [8]. The destination wills uncast the route establishment message to the source through the intermediate nodes. The header value update approach is inefficient approach because the header value will be over flooded. The other problem in DSR protocol selects the best path on the basis of minimum hop count and highest sequence number. But in the route which is established there should be congestion. In figure 1 the route request packets are broadcasting and in figure 2 route reply packets are unicasted by the destination node.

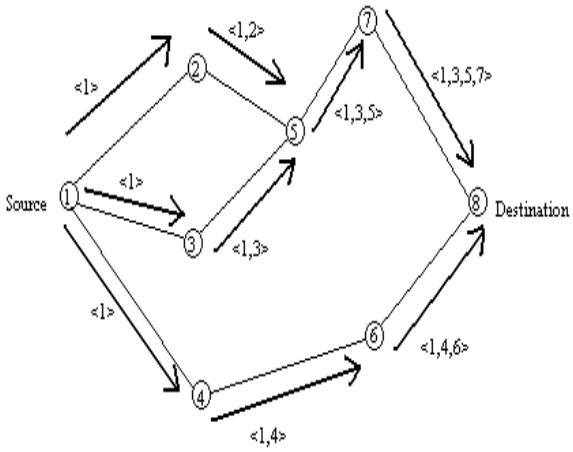

Figure 1 : Route request packets broadcasting

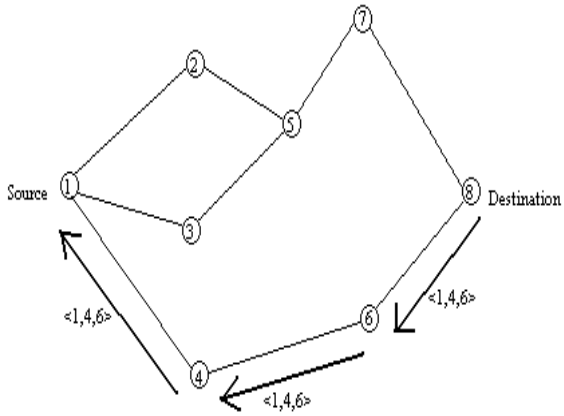

Figure 2 : Route reply packets unicast by destination

IV. Congestion Problem

Wireless ad-hoc network is usually defined as a set of wireless mobile nodes dynamically self organizing a temporary network without any central administration or existing network infrastructure. The node in the wireless ad-hoc network can serve as routers and hosts. So, they can forward packets for other nodes if they are on route from source to destination. Routing is important problem in wireless ad-hoc network. Traditional working protocols cannot work well in wireless ad-hoc network because of the characteristics of the wireless ad-hoc networks. Since, mobile nodes have limited transmission capacity they mostly intercommunicate by multichip relay. Multichip routing is challenged by limited wireless bandwidth, low device power, dynamically changing

network topology, high vulnerability to failure. To answer these challenges, many routing algorithms in MANETs were proposed. There are different dimensions to categorize them: proactive routing Vs reactive routing or single path routing Vs multipath routing. In proactive Protocols, route between every two nodes are established in Advance even though no transmission is in demand. In reactive protocols, route is discovered when needed transmission and released when transmission no longer takes place. Congestion is one of the most important restrictions of wireless ad-hoc network. It may deteriorate the performance of whole network. In the current design routing is not congestion-adaptive. Routing may let the congestion happen which is detected by congestion control. But dealing with congestion in reactive manner results in longer delay and an unnecessary packet loss and requires significant overhead if the new route is needed.

V. Congestion Problem in DSR

In this it is shown when there are more than source nodes which is sending data packets to the same destination. Than at some point the node which is common in both the route resulting in the congestion due to the queue overflow. IT will result in delay do data packet and the loss of the data.

VI. New Proposed Technique

The route established between the sources to destination is based on hop counts and sequence numbers. The best path is that which is having minimum hop counts and higher sequence number. The sequence number tells the freshness of the route. The route which is established between the source and destination there will be congestion [9]. The route should be selected which is having minimum congestion. Before route establishment every node has to present its queue size and current number of packets in their queue. The nodes which is having higher queue size and less number of packets in their queue is selected as best node for data transfer. The Simulation results shows that proposed technique will remove congestion and applicable for load balancing in figure 1 and figure 2 the comparison graphs between previous and new proposed technique is shown.

VII. Simulation Results & Observation

In this section, we present our simulation efforts to evaluate our observations that compare the performance of the DSR routing protocol and new improved DSR protocol and we find out that the new improved DSR has much better throughput and less delay as compare to earlier DSR. The simulation parameters are as follows:

Table 1

Parameter	Value
Channel Type	Wireless Channel
Radio Propagation	Two Ray Ground
Antenna Type	Omni antenna
Interface Queue Type	Queue/Drop tail/ Pri Queue
Maximum Packet	50
MAC Type	802_11
Mobile Nodes	11
Routing Protocol	DSR
Network Interface Type	Wireless Physical
Link Layer Type	LL

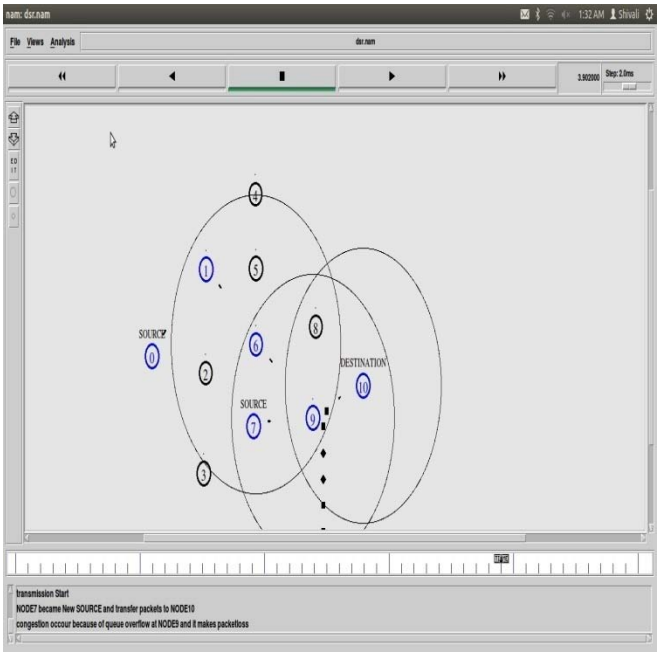

Figure 3 : Packet loss due to congestion

The figure 3 shows the congestion that occurs in the network due to flow of data packets from the two source node at the same destination. Resulting in the loss of data packets on the route in the network.

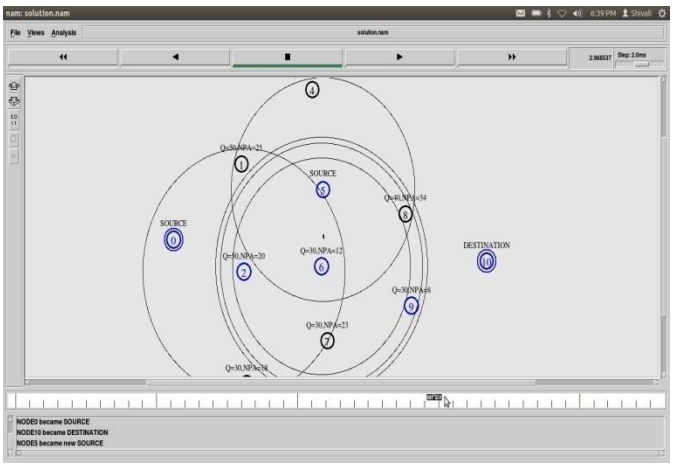

Figure 4 : No packet loss

In the figure 4 it is shown that the problem of congestion has been removed . Thus two sources are sending data too the same destination without much loss of data packets.

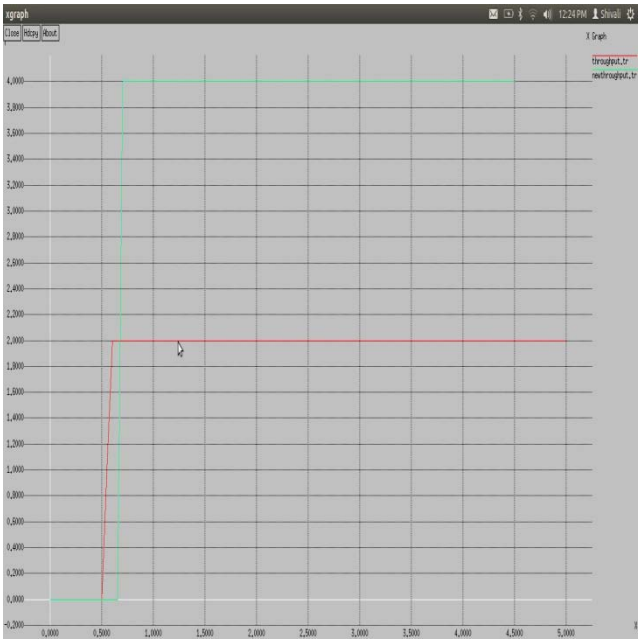

Figure 5 : Throughput Graph

In figure 5 the throughput graph has been plotted between the DSR and the new improves DSR and it is found the throughput of the new improved DSR is much better as compare to the earlier DSR. The red line shows the old DSR whereas green line shows the new improved DSR.

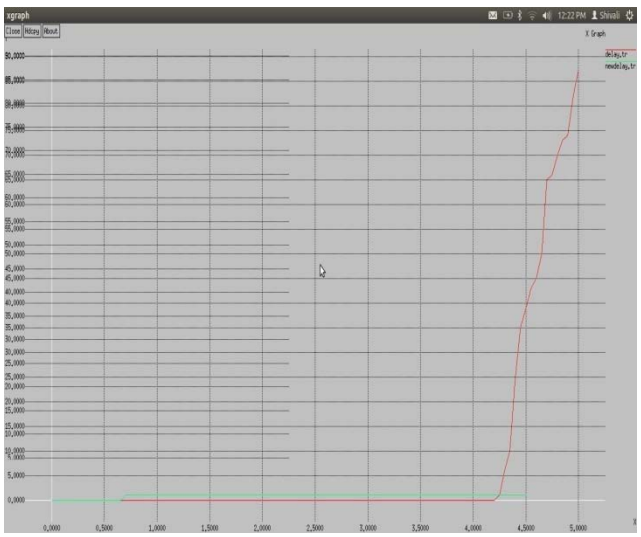

Figure 6 : Delay Graph

The delay graph has been plotted between the new improved DSR and the DSR and it is found that DSR has more delay than new improved DSR.

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Intrusion Detection in Homogeneous and Heterogeneous Wireless Sensor Networks (WSN)

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GJCST-E Classification : *C.2.1*

Strictly as per the compliance and regulations of:

Intrusion Detection in Homogeneous and Heterogeneous Wireless Sensor Networks (WSN)

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Keywords : intrusion detection, node density, node heterogeneity, sensing range, wireless sensor network (WSN).

I. Introduction

An Intrusion detection system (IDS) is designed to detect unwanted attempts at accessing, disabling of computer mainly through a network, such as the Internet. Intrusion detection plays a key role in the vicinity of network security, so an attempt to apply the idea in WSNs makes a lot of sense. Intrusion, i.e. unconstitutional access or login (to the system, or the network or other resources); intrusion is a set of actions from internal or external of the network, which violate security aspects (including integrity, confidentiality, availability and authenticity) of a network's resource.

There are two approaches: misuse detection and anomaly detection. Misuse detection identifies an unauthorized use from signatures while anomaly detection identifies from analysis of an event. When both Techniques detect violation; they raise an alarm signal to warn the system. Wang divides intrusion detection techniques into single - sensing detection and Multi - sensing detection. In single-sensing detection, the intruder can be successfully detected by one sensor. While in multi-sensing detection, multiple collaborating sensors are used to detect the intrusion.

A wireless sensor network (WSN) is a type of wireless network consist of small nodes with capabilities of sensing physical or environmental conditions, processing related data and send information wirelessly. WSN is a wireless network consisting of spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants, at different locations. The development of wireless sensor networks was originally motivated by military applications such as battlefield surveillance. However, wireless sensor networks are now used in many industrial and civilian application areas, including industrial process monitoring and control, machine health monitoring, environment and habitat monitoring, healthcare applications, home automation and traffic control. The sensor nodes are tiny and limited in power. Sensor types vary according to the application of WSN. Whatever be the application, the resources such as power, memory and bandwidth are limited. Moreover, most of the sensors nodes are throw away in nature.

Early study on wireless sensor networks mainly focused on technologies based on the homogeneous wireless sensor network in which all nodes have same system resource. However, heterogeneous wireless sensor network is becoming more and more popular recently. And the results of researches show that heterogeneous nodes can prolong network lifetime and improve network reliability without significantly increasing the cost. A typical heterogeneous wireless sensor networks consists of a large number of normal nodes and a few heterogeneous nodes. The normal node, whose main tasks are to sense and issue data report, is inexpensive and source-constrained.

II. Related Work

With respect to security, there are many tools that are used to ensure security in ID systems. The IDSs are very important tools since they can detect intrusions in networks. Many techniques that are result of research

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are pertaining to network security in general. They are developed for the nodes that have lot of resources in place. For this reason they can't be directly applied to WSN. That led to further research in the area of WSN for modifying techniques or inventing new ones that are best suited for WSN where nodes are energy constrained. Among the researchers on WSN Zhang and Lee [1] are first in researching on security issues of Ad hoc networks. Their IDS which is distributed in nature works based on the detection techniques of statistical anomaly. This technique assumes much traffic and the time taken for detection of intrusion is high and thus not efficient. The cost of this model can't be afforded by any WSN.

At times intruders might be moving and detecting such intruder is also important in WSN. This has attracted research in this domain. When nodes are in transit, the mechanisms and techniques are to be altered. The moving objects, their direction and probability of intrusion, detection etc. are to be considered. The intrusion detection in this environment also has to be considering energy efficient approaches. Most of the research that has been done in this area focuses on detection of intrusions under assumptions and criteria. The sensor coverage and sensing capabilities for detection of intrusions has effect are impacted by mobility according to Liu et al. [9]. His work demonstrated with the mobility of sensor increases the coverage of network and provides fast detection of intrusions and targeted events. Sensing models are of two types. They are single sensing model and multi sensing model. Intrusion detection process in these two models is explored by Wang et al. [13].

In his work, the combination of detection probability and network Parameters such as transmission range, sensing range, and node density are considered for experiments under single sensing models. A security management model is proposed by [15] where intrusion detection in WSN assumes that the nodes in the network are self organizing and the model is based on the layers in network. The cryptography used by WSN can only prevent external attacks while it can't do it with already compromised nodes.

Heterogeneous WSN

A heterogeneous wireless sensor network (WSN) consists of several different types of sensor nodes (SNs). Various applications supporting different tasks, e.g., event detection, localization, and monitoring may run on these specialized sensor nodes. In addition, new applications have to be deployed as well as new configurations and bug fixes have to be applied during the lifetime. In a network with thousands of nodes, this is a very complex task. A heterogeneous node has more complex processor and memory so that they can perform sophisticated tasks compared to a normal node. A heterogeneous node possesses high bandwidth and long distant transceiver than a normal node proving reliable transmission.

a) Types of Heterogeneous Resources

There are three common types of resource heterogeneity in sensor node:

i. *Computational Heterogeneity*

Computational heterogeneity means that the heterogeneous node has a more powerful micro-processor and more memory than the normal node. With the powerful computational resources, the heterogeneous nodes can provide complex data processing and longer term storage.

ii. *Heterogeneity*

Link heterogeneity means that the hetero-geneous node has high bandwidth and long-distance network transceiver than the normal node. It can provide more reliable data transmission.

iii. *Energy Heterogeneity*

Energy heterogeneity means that the heterogeneous node is line powered, or its battery is replaceable.

Among above three types of resource heterogeneity, the most important heterogeneity is the energy heterogeneity because both computational heterogeneity and link heterogeneity will consume more energy resource. If there is no energy heterogeneity, computational heterogeneity and link heterogeneity will bring negative impact to the whole sensor network, i.e., decreasing the network lifetime.

A heterogeneous node is line powered (its battery is replaceable).The heterogeneous WSN consists of different types of sensors with different sensing and transmission range. So while selecting the sensor nodes for intrusion detection, we need to consider these inequality of sensing and transmission range. For example, if two nodes have different transmission range it is better to select the one whose transmission range is higher. In this paper, we are considering N types of sensors. Here the sensing range and transmission range is high for Type 1 compared to Type2 and so on. The sensors are uniformly and independently deployed in an area A = LxL.

III. Contribution

Here we have developed an algorithm which helps the WSN in detecting the intruder with energy efficiency and thereby increasing the life time of the network .Moreover, we have carried out the probability analysis for intrusion detection. Two things are considered in this work.

- Energy consumed for the intrusion detection process.
- Whether this technique can be used for both external and internal intrusion detection.

The algorithm is developed by keeping these two things in our mind. We cannot separate internal and external intrusion detection as separate fields because most of the applications need both in the network. The internal intrusion detection includes the analysis of data send by each node. The algorithm proposed by us can be used for internal data analysis. This algorithm selects a set of nodes among the entire nodes and activates its IDS module.

IV. Problem Definition

The life span of wireless sensor network directly depends on the power. The power required to transfer a data from sensor is more compared to its internal processing. All sensors are performing the intrusion detection and passing this information to base station may cause unnecessary usage of power. It is better to activate only few sensors within a region of WSN at a time for intrusion detection. So in the case of intrusion detection, if we are able to save battery power of each sensor, then it is very easy to increase the WSN life span. In this paper, we are proposing a new technique of energy efficient Intrusion detection, which will maximize the network life time, and its probability analysis.

V. Assumptions

The sensors we are considering here are static sensors. The intruder is considered as a moving object. Each node has Omni antenna properties for sensing. The sink node knows each nodes location and its neighbour list. The algorithm is executed at the sink node and it sends packet to the selected nodes to activate its IDS module. Such a random deployment results in a 2D Poisson point distribution of sensors. A sensor can only sense the intruder within its sensing coverage area that is a disk with radius as centred at the sensor.

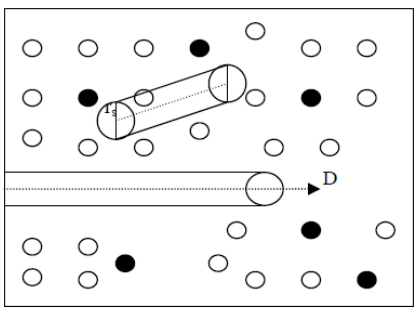

Figure 1 : Area moved by intruder

Consider figure 1, here the intruder is coming from the boundary and the distance moved by the intruder is D, the intruder is detected only when there is any sensor in the area moved by the intruder. In this paper we are considering only straight path. Figure 1 show the case when the intruder enters from the boundary. Here the area moved by the intruder

$$S=2*D*r_s+ \Pi r_s^2/2 \quad (1)$$

If the intruder is entering the WSN area from a random point, i.e. , the intruder is dropped from the air, then the area moved by the intruder is also shown in figure 1. This area is given by

$$S=2*D*rs+\Pi r_s^2 \quad (2)$$

a) Algorithm

The algorithm for node selection trying to select the high capacity nodes compared to other one. High capacity means large sensing range and transmission range.

Si- set of type i sensors in the WSN area.
S- Set of all sensors
N (a) - Set of neighbours of node a
Repeat
For i=1 to N
Select node a with min N (a) in set Si
If N (a) ≠Ø
Select a
SN = {j/ the distance between a and N (a) < (r_{si} /2)}
If |SN| >1

S=S-(SN U a)

Else
S=S-a
Until S is null se

The algorithm select a certain set of nodes that cover the entire area based on type of node, its transmission range and sensing range.

b) Single sensing detection model

As we explained before, the intruder is detected only when it enters the sensing range of any one sensor nodes. When the intruder enters the area through the boundary and the boundary is covered by the sensors, then the intruder will be detected as soon as it enters the WSN area. Otherwise it has to move a certain distance D before detected by any of the sensors.

Theorem 1

The probability P (D) that an intruder can be immediately detected once it enters a heterogeneous WSN can be given by

$$p(D=0)=1-\prod_{i=1}^{N} e^{-n_i}$$

Where n_i is the number of type i nodes activated in the area $\Pi r_{si}^2/2$.

Proof:

Here the area we need to consider when the intruder enters from the boundary is $A_1= (\pi\ r_{s1}^2)/2$, $A_2= (\pi r_{s2}^2)/2$, $AN=\pi r_s N^2/2$ as shown in figure 2. So P (0, A1),

P (0, A_2)….P (0, AN) gives the probability that there is no Type 1, Type 2 type N sensors in that area. The probability that neither type 1 nor type 2….nor type N are given P (0, A1) P (0, A2)…..P (0.A_N) $=1-e^{-n1}e^{-n2}\ldots e^{-nN}$ where n1, n2, nun are the number of selected nodes from each type. So the probability of detecting the intruder when it enters the boundary is given by complement of P (0, A1) P (0, A_2)….P (0, AN) $=1-e^{-n1}e^{-n2}\ldots e^{-nN}$.

Theorem 2

Suppose η is the maximal intrusion distance allowable for a given application, the probability P(D) that the intruder can be detected within η in the given heterogeneous WSN can be derived as

$$p(D <= \eta) = 1 - \prod_{i=0}^{N} e^{-n_i} ,$$

Where n_i is the number of sensors participating in intrusion detection area $A_i = 2\eta r_{si + (1/2)} \pi rsi2$.

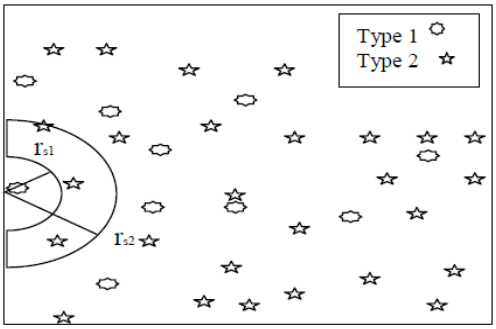

Figure 2 : The area covered by sensors at the boundary

Proof: This can be proved just like above theorem

(c) Multi sensing detection model

Multi sensing in a heterogeneous WSN is explained in figure 3. Here multiple sensors have to detect a intruder at the same time. Three sensors are considered. The intruder is within sensing range of three sensors. In the k-sensing detection model of a heterogeneous WSN with types of sensors, at least k sensors are required to detect an intruder. These k sensors can be any combination of any type of sensors.

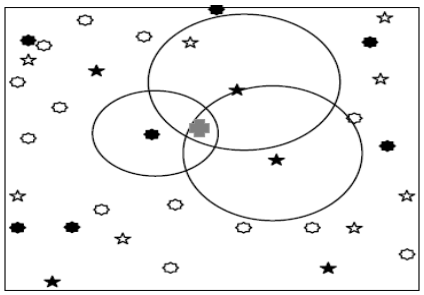

Figure 3 : Multi Sensing

Let P_m (D=0) be the probability that an intruder is detected immediately once it enters a WSN in multi sensing detection model.

$$Pm\ (D=0) = 1 - \prod_{j=1}^{N} \sum_{i=0}^{m-1} P(i, Aj)$$

Where A_j is the area covered by type j sensor and we are assuming that n_j of type j sensors are activated in the area A_j.

Proof:

This theorem can be proved just like above theorems. Here the area is only one half circles with radius r_s...P (i,A) gives the probability of detecting the intruder with i sensors.

$\sum_{i=0}^{m-1} P(i, A)$ gives the sum of the probabilities of detecting the intruder with less than m sensors. So the complement will give the multi sensing probability.

VI. Simulation and Verification

The simulation considers two types of nodes. Here in order to get the result we are varying the parameters such as sensing range, transmission range, number of sensors etc. The sensors are uniformly distributed in a two dimensional space of 1000*1000 meters. The sensing range is varied from 0 to 50 meters and maximal allowable intrusion distance is 50 meters. The graph shows the detection probability. It is found that the detection probability remains same as in the case of analytical results, thus proving the correctness of the analytical model. The fig 4 shows Single-Sensing detection. It is evident that the single sensing detection probability is higher than that of multi sensing detection probability.

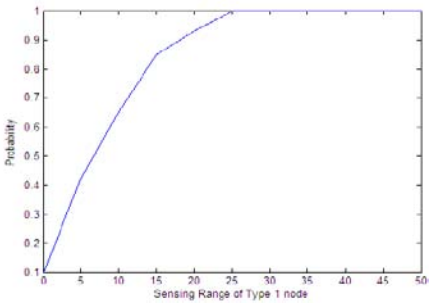

Figure 4 : Probability Analysis

This is because the multi-sensing detection imposes a stricter requirement on detecting the intruder (e.g., at least 3 sensors are required).

Type 1 node: Here the graph is obtained by changing the sensing range from 0 to 40. The each point in the graph is a result of 100 simulations. That is to get each point we need to execute our simulation and find out the probability from the result of this 100 executions. Here we can see that single sensing is possible at lower ranges also. But for multi sensing it will take a little time to get the result. Because needs the more than one sensor (here, in this simulation 3 sensor information) information to detect the intruder. Fig. 5 demonstrates the average number of nodes selected by

using this algorithm specified above. The density of type 1 nodes is varied to check how many nodes are activating its IDS module. Here the simulation is done by fixing the number of Type 2 sensors to 300. The sensing range and transmission range are set to 30. The sensing and transmission range of Type 1 is set to 45. The numbers of type 1 nodes are varied in each execution and find out how it will affect the selection process.

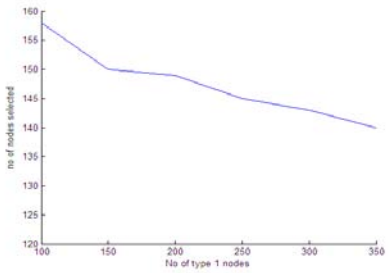

Figure 5 : Number of Nodes Selected

The energy used by this algorithm is analyzed in the figure 6 given below. Here we compared our paper with the base paper. We assumed that the energy used by one node for a unit time is one unit. The graph clearly shows the energy efficiency.

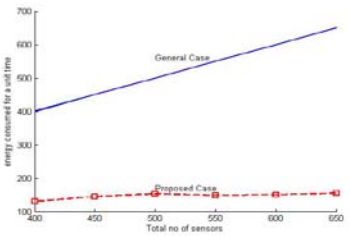

Figure 6 : Energy Used

a) Verification for Network Connectivity and Broadcast Reach Ability

In this part, we verify our analysis on the network connectivity and broadcast Reach ability. The analytical results shown in Figs.7 and 8 are calculated by using Theorems1 &2.In the simulation, an adjacency matrix is constructed to represent the digraph of the network topology.

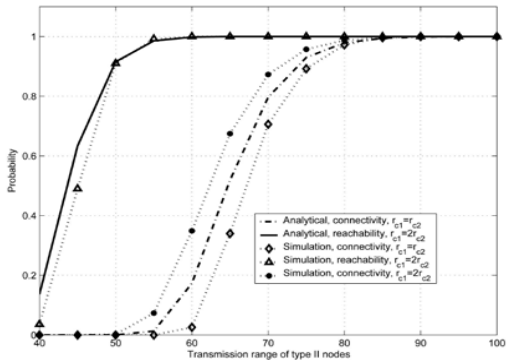

Figure 7 : Effects of transmission range on the broadcast reach ability in heterogeneous WSN

The depth-first-search algorithm is employed to check the network connectivity by selecting a random sensor as the starting node and the broadcast Reach ability by choosing a random Type I sensor as the broadcast initiator. The simulation considers 200 Type I sensors and 300 Type II sensors. In the homogeneous WSN, the transmission range of Type I sensors is set equally to that of Type II sensor (i.e., rx1 ¼ rx2). The transmission range of Type II sensor rx2 is varied from 40 meters to 100 meters in both homogeneous and heterogeneous case.

Broadcast reach ability is equivalent to the network connectivity since there are no asymmetric links. Next, the simulation is carried out to see the effect of Type I sensors on the network connectivity and broadcast reach ability. We fix the number of Type II sensors as n2¼300 and vary the number of Type I sensors from 10 to 300. The transmission ranges are set as rx1 ¼ 140 meters and rx2 ¼ 70 meters for Type I and Type II sensors, respectively.

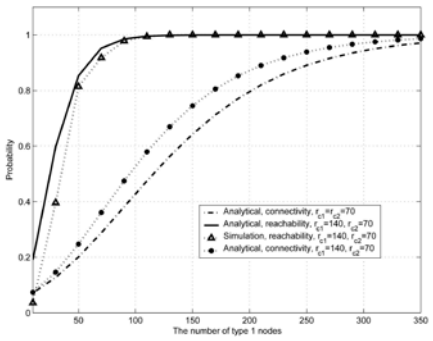

Figure 8 : Effects of Type I sensors on the broadcast Reach ability in heterogeneous WSN

We compare the results in homogeneous WSN with that in heterogeneous WSN by reducing Type I sensors to Type II sensors. Fig. 8 shows the analytical and simulation results, and they match with each other closely. From the figure, network connectivity and broadcast reach ability are improved while increasing Type I sensors. This is because some sensors that are originally isolated or unreachable from the rest of the network are now connected or reachable in the network after the introduction of Type I sensors. In addition, the results indicate that even a small increase of Type I sensor significantly improves the broadcast reach ability, while network connectivity only improves gradually. This also implies that the node heterogeneity does affect the broadcast reach ability much more dramatically than it does to the network connectivity.

VII. Conclusion

This paper analyzes the intrusion detection problem in both homogeneous and heterogeneous WSNs by characterizing intrusion detection probability

with respect to the intrusion distance and the network parameters (i.e., node density, sensing range, and transmission range). Two detection models are considered: single-sensing detection and multiple-sensing detection models. The analytical model for intrusion detection allows us to analytically formulate intrusion detection probability within a certain intrusion distance under various application scenarios. Moreover, we consider the network connectivity and the broadcast reach ability in a heterogeneous WSN.

Our simulation results verify the correctness of the proposed analytical model. This work provides insights in designing homogeneous and heterogeneous WSNs and helps in selecting critical network parameters so as to meet the application requirements.

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WAVE: The Web Audio Visual Education in India

By U. V. S. Seshavatharam
I-SERVE, India

Abstract - To promote advanced low fees high quality education among the people of India within their reach and to promote continuous research program in all areas of Science & Technology.

GJCST-E Classification : J.1

Strictly as per the compliance and regulations of:

WAVE: The Web Audio Visual Education in India

U. V. S. Seshavatharam

Abstract - To promote advanced low fees high quality education among the people of India within their reach and to promote continuous research program in all areas of Science & Technology.

I. Introduction

a) Year by year, educational course fees are being increased by the central and state governments of India due to so many issues.
b) Please note that, many of the talented students are not in a position get seats in IIT's due to many reasons.
c) Even though Indian government is putting lot of money and effort, most of the IIT students are going to abroad.
d) Teaching standards seems to be common for both talented students and backward students and there is no separate teaching methodology for the backward students.
e) In India, in educational seats allocation, forward and backward community problems very high.
f) Research oriented philosophy is very poor in the present education system.
g) Practical knowledge gaining methodology is weak in the present education system.
h) Instead of concentrating on education, many students are showing lot of interest in internet browsing, internet shopping, internet games, internet movies, internet chatting etc. By any means if we are able to guide them in using the internet in a proper way, their future can glow like a lamp and country can grow like a star.
i) In view of getting good marks and ranks, students are forced to by-heart the subject and in due course they are losing their creative and reasoning skills.
j) In villages and towns, every day student is making a long journey to reach their colleges from their homes by means of buses, autos and trains. This is very risky and causing money loss and valuable time loss.
k) Students are paying lot of money for staying in rooms and hostels. By staying in rooms and hostels, they are losing their parents care and guidance.

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II. Wave: the Web Audio Visual Education

1. In each and every subject of any branch of science and engineering, high quality teaching lessons (like IIT Professor's lessons) are recorded and mixed/edited through software with appropriate figures, movies, documentaries, graphs, tables etc.
2. These edited audio-video lessons are kept in a web site to form into a web library.
3. With a suitable fees package students will be given a membership in this web library.
4. With flexible rules and regulations, this web site acts like a Web University.
5. This web university can be linked with various colleges and universities in the country.
6. Parallel to this web education, some of the teaching staff can be grouped into Research & Development wing and a continuous Research can be carried out in all areas of Science & Technology.

III. Advantages of Wave

a) Teaching and Education Part

1. Throughout the country, starting from remote villages to major towns & cities, students will get same IIT standard education.
2. Please note that, in any existing institute, one professor will teach one lesson only for one time in one year. With WAVE, like a song, same topic can be browsed and listened for several times so that a poor student can easily understand the subject thoroughly.
3. Regular students, physically handicapped students, job holders, poor students (Male & female), sitting in their homes can get the quality education compared with the existing Open and Distance scheme educations. Thus college 'travelling expenses' and 'time loss' can be minimized.
4. As WAVE is able to provide theory part as well as virtual laboratory, student is exposed to (virtual) practical knowledge; his/her creative and reasoning skills can be improved a greater extent.
5. As WAVE is able to provide the theory part as well as virtual laboratory, all other institutions can work as laboratories so that new ideas and innovations can be generated at a faster rate.
6. Research net work can be initiated among the students having same ideology.
7. Web conferences among students and WAVE members can be put into operation.

8. Junior teachers and students can improve their teaching skills through the recorded and edited audio-video lessons.
9. With this WAVE all universities can be linked well and a standard syllabus and a standard education can be maintained.
10. Existing schemes of Professional, Open and Distance educations can be inter-liked with this WAVE.
11. As time passes, with this WAVE quality of education will be improved and cost of education fee will be reduced to a minimum or free.
12. Students can take any branch of engineering/science/arts with reference to their personal interest at any time.
13. Due to struggle for existence, existing money oriented institutes will reduce course fees and gradually transforms into a good institutes.
14. Forward and backward community problems can be resolved in seats allotment.
15. New and creative ideas, papers, documentaries, short movies proposed by students can be published online from the web university and can be made available to public.
16. Due to competition so many web universities may evolve and can serve better education in the country.
17. Usage of Internet, computers, audio-video devices and printers will be increased to a great extent and there by their cost will be reduced.
18. From time to time syllabus can be modified and maintained easily.
19. Gradually with WAVE, Indian Vedic science concepts can be recorded and edited and can be made available for the future India.
20. In future, Audio-Video lessons can be aided by international professors and thereby we can have One World - One University.

b) Research-Development Part

1. With the R & D wing, research projects can be carried out continuously and creative & innovative things can develop and can be patented in the international market of science & technology.
2. The R & D equipment can be used as a special laboratory for the young students so that they can be exposed to the latest science and technology that develops creative and innovates skills in the their mind.
3. Since R & D is continuously put into operation, youth can be turned towards Science & technology (other than politics & bad issues) with rewards and cash prizes.
4. Since R & D is continuously put into operation, 'Abroad going' will be reduced and Knowledge can be confined to our country only.

IV. Mechanism of Wave

To maintain and develop this WAVE and to promote continuous Research program, with the willing of the existing teaching staff,

a) Some of the existing teaching staff can be grouped into teaching wing.
b) Some of the existing teaching staff can be grouped into Audio-Video Recording & Editing wing.
c) Some of the existing teaching staff can be grouped into Web Designing and Maintaining wing.
d) Some of the existing teaching staff can be grouped into call center maintenance wing.
e) Finally remaining teaching staff can be grouped into Research and Development wing.
f) Through call centers, exams can be conducted round the year after completing 10 months of any course.

V. How to Implement Wave

a) Even though initial investments are very high, they can be collected and maintained by big software companies or industries or Govt. Of India and loans from banks.
b) Just like Money saving policies, suitable educational policies can be initiated and money can be collected from the parents well before admissions.
c) Starting from 8th class to inter second year, parents can be made convinced to pay a prefixed amount as educational policy for a prefixed time span.
d) 'High internet speeds' and 'large data bases' are required and are very common and essential for the present and future super-tech world.

VI. Conclusion

Advantages of WAVE are plenty. Its 'effectiveness' and 'influence' only depends on its implementation. Not only for India, can WAVE be implemented in any developing country. Even though the proposal under consideration is interlinked with many issues, with reference to 'Vision2020' program, this proposal can be given a chance in Indian higher education system.

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Monitoring for Precision Agriculture using Wireless Sensor Network-A Review

By Anjum Awasthi & S.R.N Reddy
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Abstract - This paper explores the potential of WSN in the area of agriculture in India. Aiming at the sugarcane crop, a multi-parameter monitoring system is designed based on low-power ZigBee wireless communication technology for system automation and monitoring. Real time data is collected by wireless sensor nodes and transmitted to base station using zigbee. Data is received, saved and displayed at base station to achieve soil temperature, soil moisture and humidity monitoring. The data is continuously monitored at base station and if it exceeds the desired limit, a message is sent to farmer on mobile through GSM network for controlling actions. The implementation of system software and hardware are given, including the design of wireless node and the implementation principle of data transmission and communication modules. This system overcomes the limitations of wired sensor networks and has the advantage of flexible networking for monitoring equipment, convenient installation and removing of equipment, low cost and reliable nodes and high capacity.

Keywords : *WSN, soil moisture, soil temperature, humidity etc.*

GJCST-E Classification : *C.2.1*

Strictly as per the compliance and regulations of:

Monitoring for Precision Agriculture using Wireless Sensor Network-A Review

Anjum Awasthi [α] & S.R.N Reddy [σ]

Abstract - This paper explores the potential of WSN in the area of agriculture in India. Aiming at the sugarcane crop, a multi-parameter monitoring system is designed based on low-power ZigBee wireless communication technology for system automation and monitoring. Real time data is collected by wireless sensor nodes and transmitted to base station using zigbee. Data is received, saved and displayed at base station to achieve soil temperature, soil moisture and humidity monitoring. The data is continuously monitored at base station and if it exceeds the desired limit, a message is sent to farmer on mobile through GSM network for controlling actions. The implementation of system software and hardware are given, including the design of wireless node and the implementation principle of data transmission and communication modules. This system overcomes the limitations of wired sensor networks and has the advantage of flexible networking for monitoring equipment, convenient installation and removing of equipment, low cost and reliable nodes and high capacity.

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I. Introduction

Nowadays, agriculture needs tools and technology to improve the efficiency and quality of production and reduce the envirnomental impact on the crop. The wireless sensor network in agriculture may bring out the fundamental contribution to precision agriculture. The precision agriculture is defined as the technique of applying the right amount of input (water, fertilizer, pesticides etc.) at the right location and at the right time to enhance production and improve quality, while protecting the envirnoment [1].

A wireless sensor network is a collection of nodes organized into a cooperative network. Each node consists of processing capability. It consists of one or more microcontrollers, CPUs or DSP chips, may contain multiple types of memory (program, data and flash memories), have a RF transceiver (usually with a single omni-directional antenna), have a power source (e.g., batteries and solar cells), and accommodate various sensors and actuators. The nodes communicate wirelessly and often self-organize after being deployed in an ad hoc fashion.

II. Problem Definition

It is observed that farmer bear huge financial loss because of wrong prediction of weather and incorrect irrigation method to crops. With the evolution of WSN now it is possible to use them for automatic envirnoment monitoring and controlling the parameter of field for precision agriculture application.One of the major problems present today is the less knowledge of the soil content & types, less knowledge of the type of fertilizers to be added, the irrigation amount and pattern depending on the soil porosity and its water retention capacity. In the current Indian scenario analysis of soil to increase crop yields is not being used to a large extent primarily due to the cost involved and the inaccessibility of labs offering such testing facilities. Moreover due to large size of land the procedure of sending soil samples to a lab would not represent the whole land.

In Wireless Sensor Network (WSN) the sensor nodes are very much sensitive to the energy consumption. The success of the wireless sensor network applications highly depends on the reliable communication among the sensor nodes. One of the major problems in WSN environments is the limitation of the physical resource that is energy resources. More energy is consumed in transmission of data from sensor nodes to the destination that is the base node. Due to change in environmental conditions and energy available with nodes there may be change in network structure; therefore dynamic clustering is essential. Apart from existing protocol, improved protocols are needed so that energy consumption can be reduced and overall performance can be improved.

III. Literature Review

The proposed irrigation management system in [1] using intelligent humidity sensor and low power wireless Trans receiver to collect the data and record SWT for facilitating irrigation management. The monitoring device used in this paper is laptop/computer or PDA. The processed SWT data make it possible to determine soil moisture trends and to predict or modify irrigation schedule for better crop yield.

The proposed system in [2] i.e. automatic irrigation controller is open loop, automatic and adaptive. This system determines the soil moisture and necessity of water to crop in order to supply just the right amount of water just enough to maintain moisture level. A microcontroller is used to control the operation along with relay switch and pump.

The proposed system in [3] uses the sensor node that include JN5121 module, an IEEE

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802.15.4/zigbee wireless microcontroller. The sink node for data aggregating was based on ARM9. GPRS gateway was used for long distance data transmission. The mobile unit was used as monitoring device.

The proposed system in [4], a study of zigbee based wireless sensor network in agriculture was carried out. This paper has reviewed few issues regarding zigbee in agriculture. That how the factors like node spacing, antenna height, crop canopy and density of leaves affects the signal strength.

The energy efficient WSN for agriculture proposed in [5] uses the sensor node equipment with CC1110 system on chip with low power RF Tran's receiver and 8051 MCU from texas. A CC 1110 evaluation module plugged into smart RF04 evaluation board who's LCD and LED buttons are readily available for monitoring and control. The hardware allows radio transmission in multiple power levels and also allow user to change receiver sensitivity. To compare the performance of PDMAC with SMAC, the behaviour of two nodes, a sender and a receiver was simulated using TOSSIM.

The proposed design of node system in [6] [7] uses the CC2420 zigbee/RF module as RF Tran receiver core unit of wireless communication system and MSP430 as microcontroller unit. The RF module is connected to SPI through MCU. The system also includes the communication web server, the centre of monitor based on web, expert system of agriculture. So the real time data connected through the sensor node is transferred to the sink node and then the information can be uploaded to the real time data base on the internet by GPRS.

The proposed system in [8] also includes the camera nodes and cattle sensor network along with the soil moisture sensor. To attach the sensor nodes to cattle, custom collars were created.

The paper [9] has proposed and analysed the use of programmable system on chip technology as a part of WSN to monitor and control various parameters of green house. In this CC3271 PSOC is used which is the first touch starter kit with low power RF with low cost USB thumb derive kit including related IDE software for sense and control of the data collection. It consists of PC dongle with RF and multifunction board with power amplifier and two battery boards. It can be used as touch sensing, temperature sensing, light sensing and proximity sensing requirement of green house.

The instrument in [10] [12] [13] is designed to monitor the soil temperature and humidity of agriculture environment. The tests were done to verify the reliability and accuracy of the temperature and humidity monitoring system. Two different sets of test were conducted i.e. in close room and open room environment [10].

The position estimation of sensor nodes in WSN for precision agriculture generally include errors and it is concluded that the average value of localization error decreases with the signal propagation coefficient and proved that the robustness of NMDS (non metric multi-dimensional scaling) algorithm for bad environment [11].

This paper [14] proposed a field signals monitoring system with wireless sensor network (WSN) which integrates a System on a Chip (SoC) platform and Zigbee wireless network technologies in precision agriculture. The wireless-network acquiring system is the MCU in which the Sunplus SPCE061A and signee module 3160 is used along with web server.

In this study [15], a fringing electric field (FEF) – capacitance based wireless soil moisture sensor has been designed, fabricated and tested to measure the volumetric water content (VWC) of soil for application in precision agriculture. Typically, the performance of the sensor is evaluated based on parameters such as penetration depth, signal strength, sensitivity and linear response.

To satisfy the needs of modern precision agriculture, a Precision Agriculture Sensing System (PASS) is designed in [16], which is based on wireless multimedia sensor network. The system is designed for sensing in wide farmland without human supervision. A dedicated single-chip sensor node platform is designed especially for wireless multi-media sensor network. To guarantee the bulky data transmission, a bitmap index reliable data transmission mechanism is proposed. And a battery-array switching system is design to power the sensor node. The effectiveness and performance of PASS have been evaluated through comprehensive experiments and large-scale real-life deployment.

The aim of the [17] is to review the technical and scientific state of the art of wireless sensor technologies and standards for wireless communications in the Agri-Food sector and it focuses on WSN (Wireless Sensor Networks) and RFID (Radio Frequency Identification), presenting the different systems available, recent developments and examples of applications. These technologies are very promising in several fields such as environmental monitoring, precision agriculture, cold chain control or traceability.

The results of real deployment of A2S [19], which consists of WSN(Wireless Sensor Network) to monitor and control the environments in green house with melon and cabbage in Dongbu Handong Seed Research Centre and a management sub-system to manage the WSN and provide various and convenient services to consumers with hand-held devices such as a PDA. A2S was used to monitor the growing process of them and control the environment of the green houses.

The paper [20] also describes a real-deployment of WSN based greenhouse management which is designed and implemented to realize modern precision agriculture. The proposed system can monitor the greenhouse environments, control greenhouse

equipment, and provide various and convenient services to consumers with handheld devices such as a PDA living a farming village.

Cluster based routing algorithm is proposed in [21] [22] to reduce energy consumption of node transmitting data. The application of wireless sensor networks (WSN) to precision irrigation system is explored based on the acoustic emission principle for crop water stress [21]. The paper [22] proposes a new type of routing protocol for WSN called PECRP (Power-efficient Clustering Routing Protocol), which is suitable to long-distance and complex data transmission (e.g. patient-surveillance or chemical detection in agriculture), and for fixed sensor nodes of WSN. PECRP combines the advantages of some excellent cluster-based routing protocols together, such as HEED (Hybrid Energy-efficient Distributed Clustering Approach), PEGASIS (Power-Efficient Gathering in Sensor Information Systems) and so on.

The work in paper [23], focuses its research on the integration of existing computer tools in order to establish an application development environment for WSN, uniting the robustness of programming languages with the usability of a friendly interface.

The paper [24] presents two applications of WSN supported by the IEEE 802.15.4 protocol; the first one is oriented to monitoring a mushroom crop and the other one to e-health. Both applications are monitoring-oriented, results obtained show how WSN can be used to support requirements of applications for data acquisition in distributed and collaborative way.

The paper [25], proposed a system where hybrid hexagonal positioning for sensor node has achieved better link utilization compare to other topology saving energy and increasing life lime of sensor node and network. A village centric model is presented to define applicability of proposed solution.

In paper [26], in order to study how current irrigation practices affect the environment, the researchers build and deploy a WSN in a sugar farm. The system acquires data from the sensor network in the field and transmits the data through microwave link to back-end server.

In paper [27], a self-organizing ad-hoc sensor network is deployed in vineyard, which collects the temperature data throughout the vineyard. Based on the temperature data, the back-end application calculates and shows a map of powdery mildew risk to help the vineyard management.

IV. Classification of Existing Systems

The existing system studied so far may be classified in two categories. These are a) simulator based and b) implementation based.

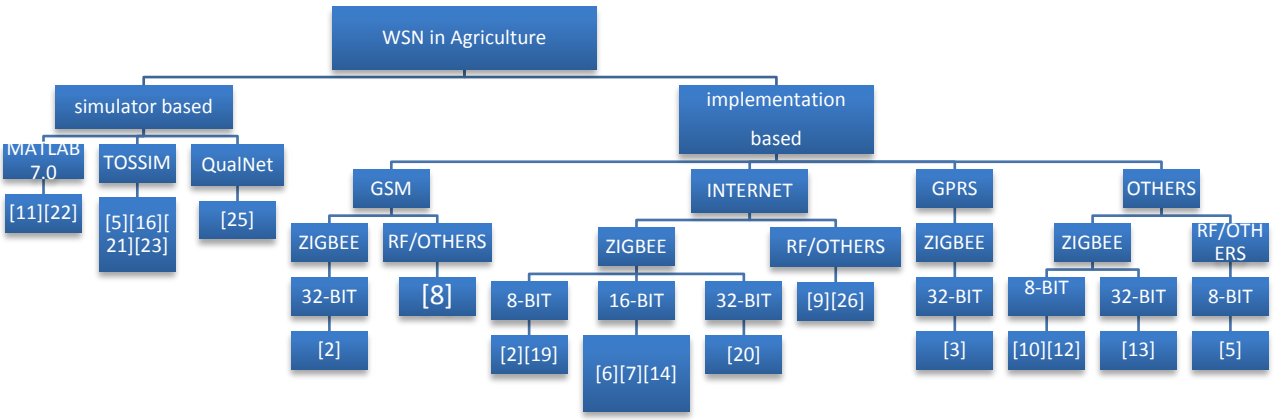


Figure 1 : Classification of Existing Systems

The proposed system in [5] [11] [15][16] [21] [22] [23] [25] are simulator based. The simulator used to conduct an experiment in [11] [22] is Matlab 7.0 and in [5][16][21][23] TOSSIM is used, whereas in [25] Qual Net simulator is used.

The energy efficient WSN for agriculture proposed in [5] compares the performance of PDMAC with SMAC, the behaviour of two nodes, a sender and a receiver was simulated using TOSSIM.

In [11], Xihai Zhang, Yachun Wu and Xiaoli Wei evaluated the performance of NMDS-RSSI localization algorithm, using data from the farm and concluded that the average value of localization error decreased with the increase of signal propagation coefficient and the simulation results shows that the NMDS-RSSI localization algorithm yield better performance than the MDS-MAP in same simulation conditions.

In [21] XIONG Shu-ming, WANG Liang-min, QU Xiao-qian, ZHAN Yong-zhao proposed a cluster based multi-hop routing to reduce energy consumption of node transmitting data. Simulation results show that the application is correct and reasonable and enables user to precisely acquire the crop water requirement information.

In [22] Tao Liu, Feng Li also proposed a new type of routing protocol for WSN called PECRP (Power-

efficient Clustering Routing Protocol), and simulation results show that PECRP has better performances than LEACH in prolonging lifetime and transmitting data in the symmetrical distribution of nodes in WSN.

In [23] Gracon H. E. L. de Lima, Lenardo C. e Silva, Pedro F. R. Neto M proposed the integration of existing computer tools in order to establish an application development environment for WSN, uniting the robustness of programming languages with the Usability of a friendly interface.

In [25] milind pande, N.K. choudhari, shantanu pathak and debajyoti mukho padhyay shows that the hybrid hexagonal positioning(HHP) for sensor nodes has achieved better link utilization compared to other technology saving energy and increasing the lifetime of sensor node and network.

The system proposed in [2][3][5][6][7]-[8][9][10][12][13][14][15][16][19][20] are designed, implemented and real-deployed. Now these systems can further classified on the factors like technology used, processor used, sensor used, monitoring devices and crops monitored. This classification is shown in the given table:

Table 1 : Classification of Existing Remote Monitoring and Control Systems

References	Technology	Monitoring System	Module Interfaced	Processor used	Sensor Interfaced
[2]	Zigbee, internet	Laptop	-	89c52	Moisture sensor
[3]	Zigbee, GPRS	Mobile	JN5121	ARM9	Soil moisture/ temperature
[5]	RF	LCD	CC1110	8051	-
[6],[7]	Zigbee, internet	Laptop, pda	CC2420	MSP430	Temperature/ humidity/ illumination
[8]	GSM, RFID	-	-	-	Camera nodes, cattle sensor network, soil moisture.
[9]	RF, internet	Laptop, PDA	C43271	C43271 Psoc	TOUCH, TEMPERATURE, moisture, LIGHT
[10]	Single sensor node	-	-	89C52	Temperature/ humidity / ph
[12]	zigbee	PC	nRF905	89C51	Temperature/ humidity
[13]	Zigbee	TFT-LCD	nRF905	MCF52235	Temperature/ humidity
[14]	Zigbee, Internet	PC	Zigbee module 3160	SPCE061A	Temperature/ humidity/soil temperature/ soil moisture/co2/ illumination
[16]	Zigbee, internet	Laptop, pda	MSENS SoC		Air Temperature/ humidity/soil temperature/ soil moisture/ anemometer /radiometer /rain gauge/ CMOS image
[19]	Zigbee, internet	PDA	Zigbee transreceiver	8-Bit MCU	Light/ temperature / humidity
[20]	Zigbee, internet	PDA	JN5121 with On chip 32 bit core		Light/ temperature / humidity/ wind speed
[26]	wired ADSL, internet	NRF905	PC	Atmega-128	-

The above research papers studied so far, demonstrate the effective use of WSN in agriculture. However, most of the papers have proposed various schemes to make this system effective and efficient but those schemes are not deployed in real field and the papers where real field deployment is done, that is not suitable for all the crops. As we know that every crop has different requirement, so it is necessary to design and implement a system by taking the requirement of particular crop into account. In [26] the system is designed and deployed for sugarcane field but that may not be suitable in the Indian environmental conditions for sugarcane.

V. Proposed Work

India is the world's largest producer of sugarcane. Of the several agricultural crops, sugarcane is most remunerative crop and has a very high economy biomass to total biomass ratio. Its requirement for water and fertilizer are equally high. Sugarcane roots may extends to 90cm depth and grows extremely well in medium to heavy, well drained, soil of pH 7.5 to 8.5 and high organic matter content.

Heat, humidity and sunlight plays important role in sugarcane germination, tillering, vegetative growth and maturity. Sugarcane grows well in humid and hot weather it require humidity of 70% for more vegetative growth.

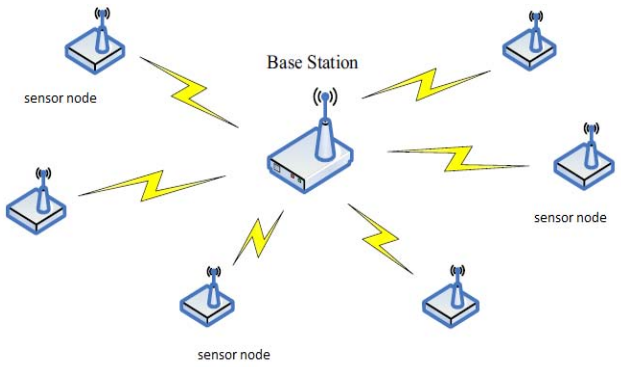
Table 2 : Effect of climatic factors on sugarcane [28]

	Air temperature	Soil temperature	Soil moisture	Humidity
Sprouting	Optimum 26-33deg .C. Minimum-18degC	Optimum 23-28deg .C. Minimum-19degC	Initiated by water	-
Tillering	Assisted by cool nights	Less if soil is warm	Helped by sufficient moisture in soil	-
Growth	Optimum at 30-33degC, poor<20degC	Optimum 23-29deg .C. Poor<21degC	Adequate moisture essential	Better in humid air
Flowering	Warm nights helps, halted by few nights at 18degC	Maximum in warm soil	Optimum in moist soil, halted by drought	Some humidity is required
Ripening	Prompted by cold nights, optimum<15degC	Best at low temperature	Prompted by lack of moisture	Better in very dry climate
Over ripening	Prompted by return of hot season	Helped by increase in temperature	Prompted by water being available after a dry period.	-

According to the above information, it is clear that growth of sugar cane crop is highly dependent on few climatic factors like air temperature, humidity, and soil temperature and soil moisture. So it is essential to monitor few climatic conditions for the better yield of sugarcane.

This paper would take the opportunity to design an instrument that is able to monitor the ait temperature, humidity, and soil temperature and air moisture of an agricultural field and transmit it to a remote receiver outside the field. The system represented in this paper is composed of the microcontroller, WSN base station with GSM module, Data collecting nodes, device control node and mobile phone. The WSN data collecting node is connected with temperature, soil moisture and humidity sensor. When these sensor nodes find an abnormal or unsuitable environment condition of the soil the nodes will send encoded alarm signal to base station. Once the base station receives an alarm signal, it will send a SMS to farmer through the GSM module and GSM network immediately.

Figure 2 : Structure of Wireless Sensor Network



a) Sensor node design

The sensor node is the basic unit of the environmental information monitoring system; its task is to achieve the perception, collection, processing and wireless communication of environmental data.

The general architecture of a wireless sensor node is presented in Fig. 2. As seen from the figure, a wireless sensor node is composed of four major components which are namely, the sensing unit, the processing unit, the power unit and finally the wireless transceiver unit. The sensing unit converts such measured physical quantities as temperature, moisture etc. into a voltage signal and digitizes it to produce digital output for processing. The processing unit with a microcontroller controls all of the functions of the sensor node and manages the communication protocols to carry out specific tasks. Communication between the WSN node and the base station is provided by the transceiver unit. And finally the power unit, which is the most crucial component of a sensor node, supplies mandatory power to all of these units.

b) Base station unit

This unit is responsible for collection of the data from all the sensor nodes and critically evaluate the data, if it finds an abnormal or unsuitable environment condition of the soil, the base station send a SMS to farmer through the GSM module and GSM network immediately.

VI. Conclusion

The proposed system in this paper is designed by considering the requirement of a sugarcane crop for Indian climatic conditions. The WSN in agriculture is new technology for information acquisition and processing in sugarcane field. It is more advantageous than the traditional agriculture techniques. This work structured the precision agriculture monitoring system by wireless sensor nodes and base station to record the data of sensor nodes. This is low cost system where the recorded information is transmitted to remote location using a GSM network via a SMS. The farmer may use the received information to control the parameters. This kind of wireless detection and control improves the effectiveness and efficiency of resources used, which leads to the improved production. The drawback of system is its dependency on the GSM network.

VII. Future Work

The other problem farmers are facing is the crop destruction by the wild animals. So the future work include the design of the system that may monitor the farm by installing sensors at the boundary of farm and a camera module which may take a snapshot once the sensor detects the entrance and transmit the real time pictures by integrating it with other information.

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Intervention of Bluetooth with WLAN and WiMAX

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Abstract - Bluetooth technology unplugs the digital peripherals and comes as cable replacement technology. IEEE 802.11 and Bluetooth are two operating in the unlicensed 2.4 GHz frequency. WiMAX is operating both licensed and unlicensed frequencies (2-11GHz). The devices equipped with IEEE 802.11 and Bluetooth are mobiles, laptops, watches and many more and in future with WiMAX. Result is the number of co-located devices may cause interference issues in the 2.4 GHz radio frequency spectrum. Bluetooth supports both voice (SCO) and data (ACL) packets. In ACL, there is retransmission of packet if it is lost while transmitting but in SCO there is no retransmission of packet. So, retransmission is big issue in Bluetooth. In this thesis, these interference issues are investigated and implement a new Bluetooth voice packet named synchronous connection-oriented with Repeated Transmission (SCORT) with WLAN interference and WiMAX interference to study the improvement in performance by using MATLAB Simulink. SCORT technique also helps in reducing co-existing interference by using HV3 type of packet in voice signal. By this technique BER does not effect at all and very minimal delay comes due to retransmission.

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GJCST-E Classification : *C.2.5*

Strictly as per the compliance and regulations of:

Intervention of Bluetooth with WLAN and WiMAX

Pankaj Garg [α] & Ruby Verma [σ]

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I. Introduction

Wireless technology allows us to connect with people around the world and delivers life-changing services to global communities that heal, educate, empower, and delight. Wireless communication enables anywhere, anytime, mobilizing the rapid transfer of information and services over immense distances, unbound by geographic barriers. Wireless technology has been at the forefront of a technological revolution that has materially improved the lives of many people. A wireless device continues to expand and the development of mobile technology continues to improve the society beyond what we can currently imagine. We switch to wireless from wired communication because cost of wired link will be much higher compared to the Antenna cost of wireless link. With the help of wireless technology like Bluetooth, WI-Fi, WiMAX, device can communicate directly with the mobile phones without having wires plugged in. In short these are Cable-replacement technologies. Bluetooth has less data rate and WiMAX has maximum data rate and high bandwidth is used. Bluetooth is an application that allows mobile devices to transmit data over short distances and creating PANs (Personal Area Networks) with high levels of security. Bluetooth technology has enabled people to free their hands. For example, Bluetooth headsets with cell phones make enable that people can talk without having to hold the phone up to their ear. Bluetooth is widely available to most people because of the relatively low cost of the technology and ease in implementation. Bluetooth technology is also important because of its mobility.

a) Bluetooth

Bluetooth technology is a short-range communications technology that is simple, secure. It is replacing the cables connecting devices, while maintaining high levels of security. The key features of Bluetooth technology are robustness, low power, and low cost. When two Bluetooth enabled devices connect to each other, this is called pairing. It is operation on unlicensed industrial, scientific and medical (ISM)band at 2.4 to 2.48GHz, using a spread spectrum, frequency hopping, full-duplex signal at up to 1600 hops/sec [1]. The signal hops among 79 frequencies at 1MHz. The Bluetooth Specification defines a short (10 meter) or optionally a medium range(100 meter) radio link capable of voice or data transmission to a maximum capacity of720 kbps per channel (with a gross throughput of 1Mbit/sec) [2]. This is table of different versions of Bluetooth.

Table1 : Bluetooth Versions

Version	Data rate
Version 1.2	1Mbps
Version 2.1+EDR	3Mbps
Version 3.0+HS	24Mbps
Version 4.0 EDR+HS+LE	24Mbps

II. Bluetooth Specification

a) Synchronous Connection Oriented (Sco) Link [3, 4]

SCO is used for voice transmission of Bluetooth. The SCO link is a symmetric point to point voice link for sending and receiving voice packets at regular intervals of time. Bluetooth can support a maximum of up to three voice calls at the same time. It is generally only used for audio connections. Due to the isochronous (time dependant) nature of audio-data, and the unpleasant sound of delays in conversations, this method is generally to be preferred in duplex (two-way) audio communication. A Bluetooth audio connection transfers data at 64 kb/s and supports audio frequencies of up to 4 kHz; this is sufficient for speech, but not for music or other signals requiring higher frequencies. The SCO is circuit-switched connection between the master and the slave. The packets are

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used a CRC and are never retransmitted [5]. It uses different types of packet which are given below-

HV1 packet: HV stands for high-quality voice. The HV1 packet carries 10 information bytes, which are protected with a rate 1/3 FEC. This packet has to be sent every two time slots and can support 1.25ms of speech at a 64Kb/s rate.

HV2 packet: This packet carries 20 information bytes, which are protected with a rate 2/3 FEC. This packet has to be sent every four time slots.

HV3 packet: This packet carries 30 information bytes, which are not protected. This packet has to be sent every six time slots.

DV packet: The DV packet is a combined data-voice packet. The payload is divided into a voice field of 80 bits and a data field of up to 150 bits.

b) Asynchronous Connection Less (Acl) Link [3, 4]

Bluetooth data transmission is called ACL. If an error occurs, those packets must be transmitted again. In the case of ACL transmission, the system will wait for acknowledgement from the receiver. It will send the packets repeatedly till an acknowledgement is received. The receiver will check the packet and verify the cyclic redundancy code (CRC) to make sure that the packet is received correctly. The ACL link provides a packet-switched connection between the master and all active slaves in the piconet. The specifications define 7 kinds of ACL packets, three DM (data-medium rate) packets, three DH (data-high rate) packets and one AUX Pocket[6].

DM: These packets are coded with a rate 2/3 FEC. They contain a 16-bit CRC code and are retransmitted if no acknowledgement is received. Three DM packets have been defined, DM1, DM3 and DM5, which cover 1, 3 and 5 time-slots respectively.

DH: These packets are similar to the DM packets, except that the information in the payload is not FEC encoded. Similar to the DM packets, three DH packets (DH1, DH3 and DH5) have also been defined.

AUX: This packet is like a DH1 packet, but has no CRC code and is not retransmitted.

c) Scort

Synchronous connection oriented with retransmission (SCORT) is proposed technique used in retransmission of voice signal in Bluetooth. In SCO connection there is no retransmission process if data is failed. SCO is used to send the voice signal to other terminals. In SCORT we can send three packets at a time, if one packet fails due to bad hop then second packet will transmit in SCO interval. In SCORT technique, it is synchronized the transmitter and receiver through ARQN. The 1-bit acknowledgment indications ARQN is used to inform the source of a successful transfer of payload data with CRC, and can be positive acknowledge ACK or negative acknowledge NAK. If the reception was successful, an ACK (ARQN=1) is returned, otherwise a NAK (ARQN=0) is returned. This provides an improvement for frame-error rate (FER) in an interference scenario. It does not affect the BER of the payload [7].

III. Bluetooth Simulation

This section deals with Bluetooth's transmitter, receiver and channel interference which is created by WLAN and WiMAX at 2.4 GHz of frequency bandwidth because Bluetooth works at 2.4 GHz band. It is unlicensed band of frequency so, that's why lots of interference is there. Transmitter has CVSD encoder, up-sampler, GFSK modulator, Frequency hopping, FEC, and HEC with CRC generator. Channel consists of AWGN noise with WLAN and WIMAX interference Receiver consists of GFSK demodulator, frequency hopping, access code checker, header information detector, switch, FEC, CVSD decoder and down-sampler.

a) Transmitter

Bluetooth has one transmitter which is called master transmitter which may master of a piconet or scatter net. It consists of CVSD encoder which encodes the voice signal [8]. CVSD is linear delta modulation with the addition of an adaptive step-size. By adjusting or adapting the step-size to the changes in slope of the input signal, the encoder is able to represent low-frequency signals with greater accuracy without sacrificing as much performance due to slope overload at higher frequencies. Each input sample is compared to the reference sample. If the input sample is larger, the encoder emits a 1 bit and adds the step size to the reference sample. If the input sample is smaller, the encoder emits a 0 bit and subtracts the step size from the reference sample. The GFSK modulation used in the Bluetooth system is a type of binary partial response continuous phase modulation. It is a slight generalization of the GMSK modulation [9] used in the GSM cellular system. In Bluetooth every data bit is transmitted over two symbol intervals, causing inter symbol interference but reducing the required bandwidth. The 366 data bits are transmitted at 1 Mbps. Frequency hopping devices have an inherent level of robustness due to the fact that they do not continually transmit at the same frequency. Bluetooth technology's adaptive frequency hopping (AFH) capability was designed to reduce interference between wireless technologies sharing the 2.4 GHz spectrum. AFH works within the spectrum to take advantage of the available frequency [10]. This adaptive hopping among 79 frequencies at 1 MHz intervals gives a high degree of interference immunity and also allows for more efficient transmission within the spectrum.

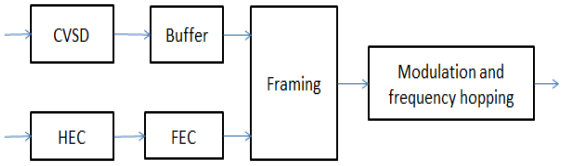

Figure 1 : Transmitter of Bluetooth

b) Channel Interference

Bluetooth uses 22 MHz frequency bandwidth for channel where lots of interferences added.

i. *Awgn Channel*

Additive white Gaussian noise (AWGN) is a channel model in which the only impairment to communication is a linear addition of wideband or white noise with a constant spectral density and a Gaussian distribution of amplitude. The model does not account for fading, frequency selectivity, interference, nonlinearity or dispersion. In AWGN channel signal to noise ratio (Es/No) =18 with power of 1 watt. The Initial seed parameter in this block initializes the noise generator. Initial seed can be either a scalar or a vector with a length that matches the number of channels in the input signal.

ii. *Wi-Fi Interference*

Wi-Fi and Bluetooth both occupy a section of the 2.4 GHz ISM band. Bluetooth uses Frequency Hopping Spread Spectrum (FHSS) and is allowed to hop between 79 different 1 MHz-wide channels in this band. Wi-Fi uses Direct Sequence Spread Spectrum (DSSS) instead of FHSS. Its carrier does not hop or change frequency and remains cantered on one channel that is 22 MHz-wide. While there is room for 11 overlapping channels in this 83 MHz-wide band, there is only room for three non-overlapping channels. Thus there can be no more than three different Wi-Fi networks operating in close proximity to one another. When a Bluetooth radio and a Wi-Fi radio are operating in the same area, the single 22 MHz-wide Wi-Fi channel occupies the same frequency space as 22 of the 79 Bluetooth channels which are 1 MHz wide. When a Bluetooth transmission occurs on a frequency that lies within the frequency space occupied by a simultaneous Wi-Fi transmission, some level of interference can occur, depending on the strength of each signal [11].

iii. *Wimax Interference*

Wireless network technology hasan impact in communications: 802.16, better known as Wi-MAX. This technology supports speeds as high as 70Mbps and a range of up to 48 kilometres. WiMAX can be used for Wireless networking like the popular Wi-Fi. WiMAX allows higher data rates over longer distances, efficient use of bandwidth, and avoids interference almost to a minimum. WiMAX can be termed partially a successor to the Wi-Fi protocol. WiMAX operates in a mixture oflicensed and unlicensed bands. The unlicensed bands are typically the 2.4 GHz and 5.8 GHz bands. Licensed spectrum provides operators control over the usage of the band, allowing them to build a high-quality network. The unlicensed band, on the other hand, allows independents to provide backhaul services for hotspots. When frequency bands of 22 MHz of WiMAX is present with channel of Bluetooth then it also causes interference. Being a packet-based system, WiMAX transmission can be characterized as bursts of activity at a Poisson rate [12].

c) Receiver

Master slave who receives RF signal and demodulate through GFSK demodulator after de-spreader signal through frequency hopping. After demodulating signal exact 366 bits are coming out in which 72 bits are access code, 54 bits of header information and 240 bits of payload are de-frame. An access code checker checks whether the bits are correct or not. For checking these bits, total 57 bits are checked of access code starting from 5 to 62. For header information, checks whether information is coming is equal as transmitted signal and after that de-repeat the header information then only 18 bits are left in which 8 bits of CRC and 10 bits of header information is extracted. After that a switch is connected which selects whether payload will pass or not. Then un-buffer is used and CVSD decoder is used which decodes the signal and down-sampler is used to down-sample the signals.

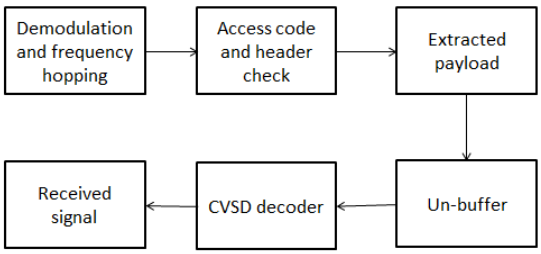

Figure 2 : Receiver of Bluetooth

From header information, check whether ARQ is received is 1 or 0. If received ARQ is 1, then it passes payload to receiver. If ARQ is 0 then it goes to transmitter where state flow is there and it enables the audio packet for resending the voice signal through SCO link.

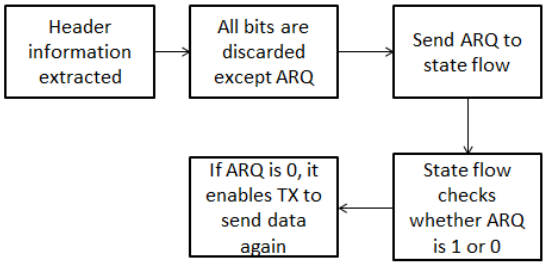

Figure 3 : Retransmission Block

Through SCORT, retransmission as well co-existence interference is reduced because it does not effect on BER.

IV. Result and Conclusion

Bluetooth model is working on Matlab Simulink where voice signal is send through SCO link and for data signal is send through ACL link.

These are following graph of spectrum of signal which shows the power spectrum density of signal of Bluetooth. Figure 4 shows that spectrum of signal before modulation. It contains access code, header information and payload data. The graph contains a frame of data with frequency in x axis is auto and in y axis maximum magnitude is -52.6 db.

Figure 5 shows spectrum of signal after modulation. When data is going to modulate and adding of frequency hopping spread spectrum then data spreads a little due to frequency hopping. Figure 6 shows the spectrum in which AWGN noise is added. Figure 7 shows that signal after demodulator block. This spectrum shows that signal after demodulation and frequency hopping block. In this graph noisy signal is demodulated and extraction of frequency hopping is done. Only 366 bits are coming out per frame after demodulation block and figure 8 shows the BER of signal from the value of SNR 0 to 20.

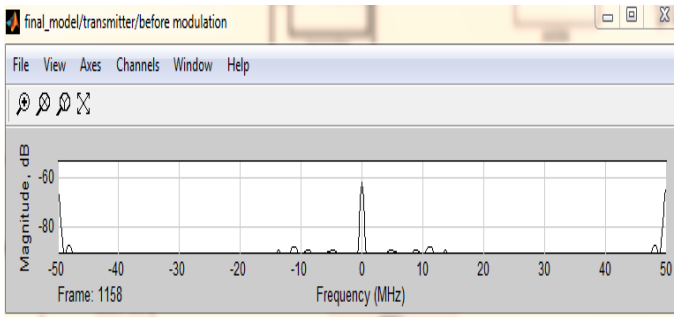

Figure 4 : Signal before the modulation

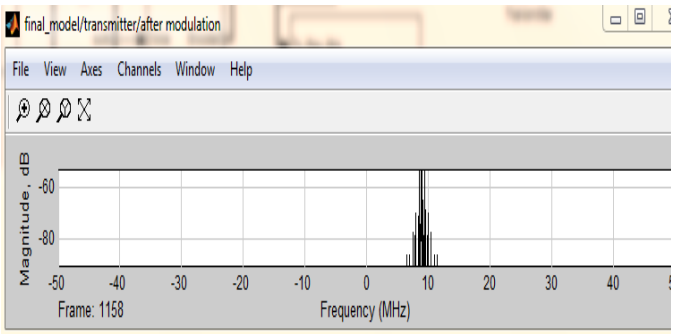

Figure 5 : Signal after modulation block

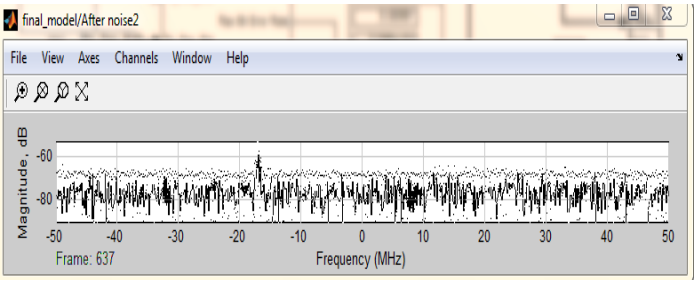

Figure 6 : Addition of AWGN noise with transmitted signal

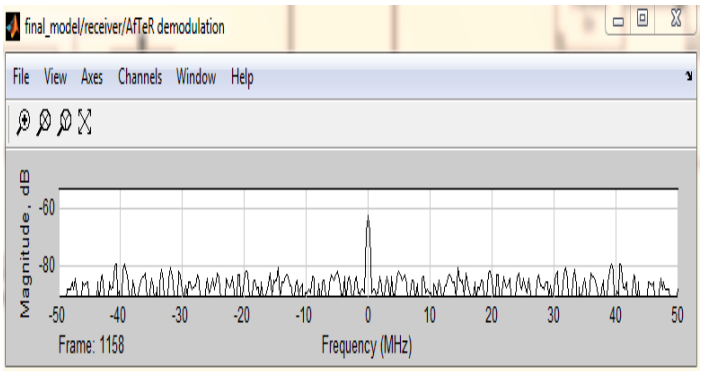

Figure 7 : Spectrum after demodulation block

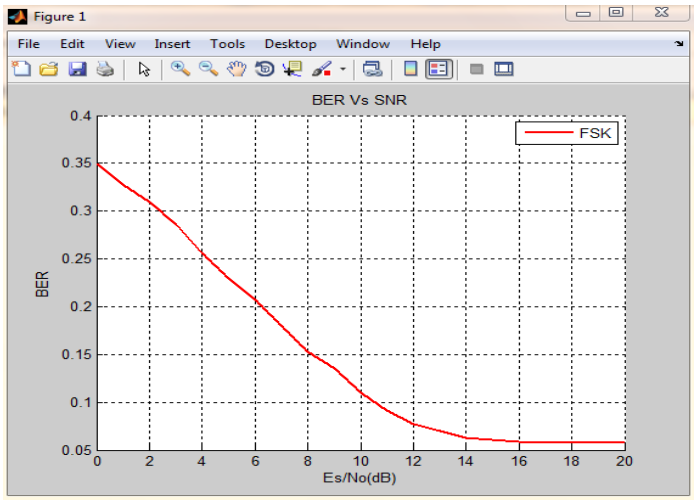

Figure 8 : BER Plot

a) Conclusion

Transceiver of Bluetooth with interferences of WLAN and Wi-MAX is implemented with AWGN channel. For unlicensed frequency bandwidth of 2.4GHz, Bluetooth works on it and WLAN and also Wi-MAX cause interference. After demodulation exactly 366 bits are coming out which consists of 72 bits of access code, 54 bits of header information and 240 bits of payload. After de-framing the header, access code and payload, header and access code is checked whether the data received is correct or not. If data which is received at receiver side does not contain ARQ then it enables a technique SCORT. With the help of SCORT technique receiver automatically tells the transmitter

about the bits of voice signal. With the help of SCORT, it also reduces the interferences issues and better bit error rate which is depend upon transmitted power and channel.

b) Future Work

With the help of SCORT techniques, interference issues will reduce but it also causes the power issue and very little delay of receiving a data. If power is used in Bluetooth is more, then interference issues and noise will less. So, in future if power management scheme is implemented with SCORT technique it will benefit in future. For delay in received signals, time computation algorithm is also added.

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Mobility Management in 4G Networks

By Ruby Verma & Pankaj Garg
Lovely Professional University, India

Abstract - Over the past 25 years, the evolution of the internet and the advances of wireless technologies have made a tremendous impact on lifestyle of people around the world. Together, these two factors have changed the way people communicate, work, and get their entertainment. In order to be always best connected for various applications, the network selection procedure in heterogeneous multi-access environment during vertical handover decision is intended to choose the most suitable network for mobile user. In this paper, a performance study using the fuzzy logic concept is done and the integration of UMTS and WiMAX network is taken as an example to show that the proposed vertical handoff decision algorithm is able to determine when a hand off is required, and selects the best access network that is optimized to network conditions, quality of service requirements, received signal strength, bandwidth requirements and user preferences.

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Mobility Management in 4G Networks

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I. Introduction

IP based mobile telecommunication networks are the next big jump in the mobile telecommunication industry. 4G networks will allow users to roam over a variety of radio access networks such as WLAN, W-CDMA and CDMA2000 by integrating mobility management mechanisms and vertical handoff schemes at the network layer. WiMAX technology brought revolution in both fixed and mobile wireless communication. In present communication world, wireless communication does not mean only data and voice transmission. It also supports high data rate transmission which supports various types of service like voice, data, and multimedia [1].WiMAX embedded devices support the Wi-Fi standards. So the people who are using Wi-Fi can easily switch to WiMAX technology. Moreover, in the developing countries the high data rate wireless communication infrastructure is not strong enough. WiMAX can be a good solution for these countries which is more secured, reliable and cheap. For these reasons the users of this technology are increasing day by day. As WiMAX is the latest technology and better solution in the wireless communication world, so this technology is used and work is done on the mobility management between UMTS and WiMAX networks by using fuzzy toolbox.

A handoff decision scheme using fuzzy logic is proposed in [10] that chooses the correct network with the imprecise information of some criteria and user preference. This algorithm will help to reduce the call Dropping probability in vertical handoff with the help of redetection of signal. In this vertical handoff algorithm, the Predictive Received Signal Strength (PRSS) is used to decide when to start a vertical handoff for WWAN to WLAN. Based upon input parameters like predicted RSS, bandwidth and users preference the value of handoff decision is calculated by the handoff decision algorithm. Taking idea from this algorithm, the proposed algorithm in this paper is more optimized as it also takes into account the network conditions and network coverage area and it is used to carry out handoff between 3G networks (UMTS) and 4G networks (WiMAX).

A handoff algorithm using fuzzy concepts must be capable of making a decision based on incomplete information and in a region of uncertainty. An adaptive multi-criteria handoff decision algorithm that incorporates fuzzy logic is used because of the inherent strength of fuzzy logic in solving problems exhibiting imprecision and the fact that many of the terms used for describing radio signals are fuzzy in nature. In conventional handoff decision only Received Signal strength (RSS) power level received from candidate base stations is compared. However, to optimize a handoff decision, other factors like bandwidth, network coverage and user preference should also be considered. Fuzzy logic can be exploited to develop approximate solutions that are both cost-effective and highly useful. In this paper, two handoff scenarios are considered, one is handoff from UMTS to WiMAX, and other is handoff from WiMAX to UMTS.

II. Proposed Handoff Algorithm

In this algorithm, if the mobile terminal is connected to the UMTS and the velocity of the mobile terminal (V) is higher than a velocity threshold (V_T) handover to the WiMAX is directly initiated to prevent a connection breakdown. Otherwise, the pre-decision unit checks whether the predicted RSS satisfies its requirements. If the predicted RSS from the UMTS (PR_w) is larger than its threshold (P_{rW}), or the predicted RSS from the WiMAX (PR_U) is smaller than its threshold (P_{rU}), no handover is triggered. After the pre-decision, the fuzzy logic based normalized quantitative decision (FNQD) is applied. The FNQD has three procedures: fuzzification, normalization and quantitative decision. The four inputs, received signal strength (RSSI), bandwidth/ data rate available, network coverage area and perceived Qos, are fuzzified and normalized to

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generate performance evaluation values (PEV), and the vertical handoff decision (VHD) is made by comparing PEVs of the network candidates. If the mobile terminal is connected to the WiMAX and the UMTS connectivity is available, the pre-decision unit is used to eliminate unnecessary handovers when the velocity of the mobile terminal is larger than the threshold (V_T). The process of this algorithmic illustrated in Figure 1.

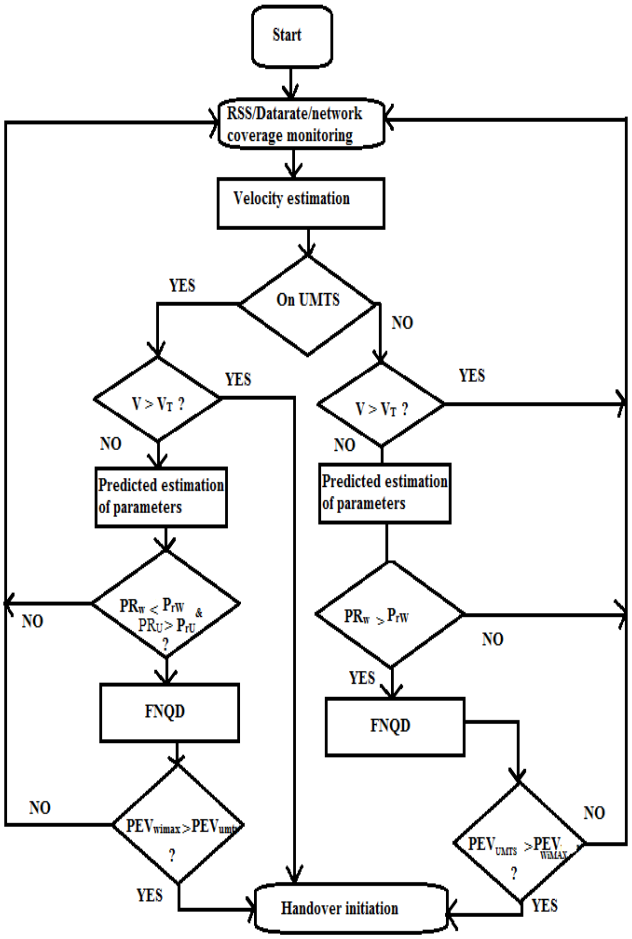

Figure 1 : Vertical handoff decision heuristic (VHD)

III. Fuzzy Inference System for Handoff

Inference is the process that draws conclusions from a set of facts using a collection of rules. The fuzzy inference system is a computing framework based on the concepts of fuzzy set theory, fuzzy if-then rules, and fuzzy reasoning. Mamdani and the Sugeno are the two types of fuzzy inference systems that can be implemented. The differences between these fuzzy inference systems lie in the consequents of their fuzzy rules, and therefore their aggregation and defuzzification processes differ accordingly. The fuzzy inference engine is based on the Mamdani fuzzy inference system whose computational performance is more efficient than the Sugeno system and it consists of following functional blocks:

a) Fuzzifier which transforms the crisp inputs into degrees of match with linguistic values.
b) Fuzzy rule base which contains a number of fuzzy IF-THEN rules.
c) Database which defines the membership functions of the fuzzy sets used in the fuzzy rules.
d) Fuzzy inference engine which performs the inference operations on the fuzzy rule.
e) Defuzzifier which transforms the fuzzy results of the inference into a crisp output.

The handoff decision is shown in Figure 2. Vertical handoff decision in a heterogeneous wireless environment depends on several factors. A handoff decision in a next generation wireless network environment (including WWAN, WLAN, WiMAX and Digital Video Broadcasting) must solve the following problem: given a mobile device connected to an access network, determine whether a vertical handoff should be initiated and dynamically select the optimum network connection from the available access network technologies to continue with an existing service or begin another service.

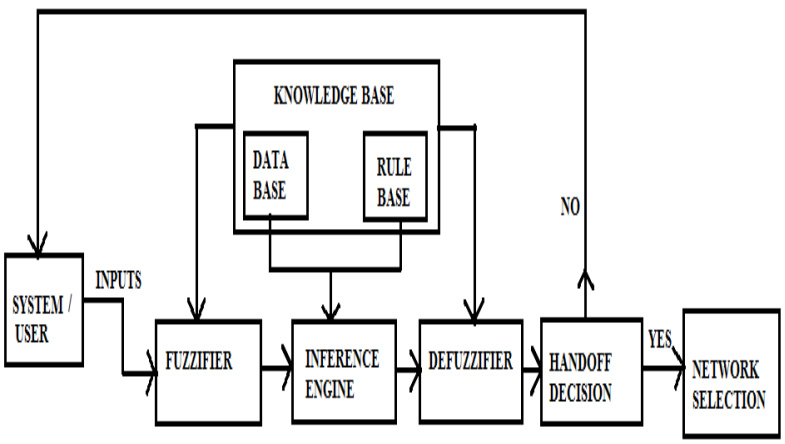

Figure 2 : Block Diagram for Vertical Handoff Decision

a) Handoff from UMTS to Wimax

Suppose that a mobile terminal (MT) is connected to a UMTS network and detects a new WiMAX network. Since the UMTS could be always on and the WiMAX is optional, the objective of the handoff from the UMTS to WiMAX is to improve the QoS. A user connected to a UMTS system would like to move into a WiMAX area and change the connection to WiMAX to obtain a higher bandwidth service at a lesser cost. The multimode mobile node associated with the UMTS monitors at repeated intervals and measures the RSSI of nearby WiMAX to see whether or not a better high data rate service is available. Input data from both the user and the system are required for the handoff decision algorithm, whose main purpose is to select an optimum wireless network for a particular service that can satisfy the following objectives: preferred user wireless network, good signal strength, good network coverage, optimum bandwidth, low cost, high reliability, and low network latency.

Input parameters like RSSI, data rate, network coverage area and perceived Qos of the target WiMAX network are fed into a fusilier in a Mamdani FIS, which transforms them into fuzzy sets by determining the degree to which they belong to each of the appropriate fuzzy sets via membership functions (MFs).

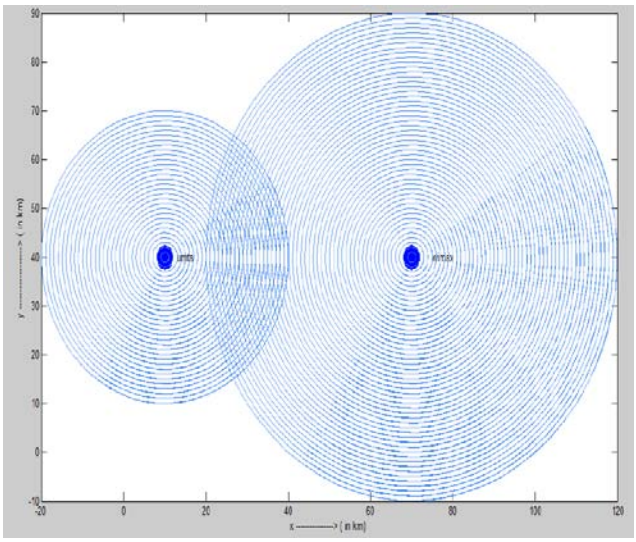

Figure 3 : Range of UMTS and WiMAX simulated in MATLAB

Next, the fuzzy sets are fed into a fuzzy inference engine where a set of fuzzy IF-THEN rules is applied to obtain fuzzy decision sets. The output fuzzy decision sets are aggregated into a single fuzzy set and passed to the defuzzifier to be converted into a precise quantity, the handoff factor, which determines whether a handoff is necessary. The range for WiMAX and UMTS is shown in Figure 3.

Each of the input parameters is assigned to one of three fuzzy sets; for example, the fuzzy set values for the RSSI consist of the linguistic terms: Strong, Medium, and Weak. These sets are mapped to corresponding Gaussian MFs. The universe of discourse for the fuzzy variable RSSI is defined from -78 dBm to -66 dBm. The universe of discourse for the variable Data Rate is defined from 0 Mbps to 60 Mbps, the universe of discourse for the variable Network Coverage is defined from 0 m to 50 Km [6], and the universe of discourse for the variable Perceived Quos is defined from 0 to 10. The fuzzy set values for the output decision variable Handoff are {Yes (Y), Probably Yes (PY), Uncertain (U), Probably No (PN), and No (N)}. The universe of discourse for the variable Handoff is defined from 0 to 4, with the maximum membership of the sets "No" and "Yes" at 0 and 4, respectively. Since there are four fuzzy input variables and three fuzzy sets for each fuzzy variable, the maximum possible number of rules in our rule base is $3^4 = 81$. The fuzzy rule base contains IF-THEN rules such as:

a) IF RSSI is weak, and available data rate is low and network coverage area is bad, and perceived Qos is undesirable, THEN handoff is N.
b) IF RSSI is weak, and available data rate is low, and network coverage area is medium and perceived Qos is acceptable, THEN handoff is PN.
c) IF RSSI is strong, and available data rate is high, and network coverage area is good and perceived Qos is desirable, THEN handoff is Y.
d) IF RSSI is strong and available data rate is medium and network coverage area is medium, perceived Qos is acceptable, AND THEN handoff is PY.
e) IF RSSI is medium and available data rate is high and network coverage area is good, and perceived Qos is desirable, THEN handoff is Y.
f) IF RSSI is medium and available data rate is low and network coverage area is medium and perceived Quos is undesirable, THEN handoff is U.

Figure 4 (a) shows a MATLAB-based Mamdani fuzzy logic inference display of the combined six IF-THEN rules indicated above and (b), (c), (d), (e) shows the Surface Viewer for the system composed of these six rules in three specific cases with other two parameters taken as constant.

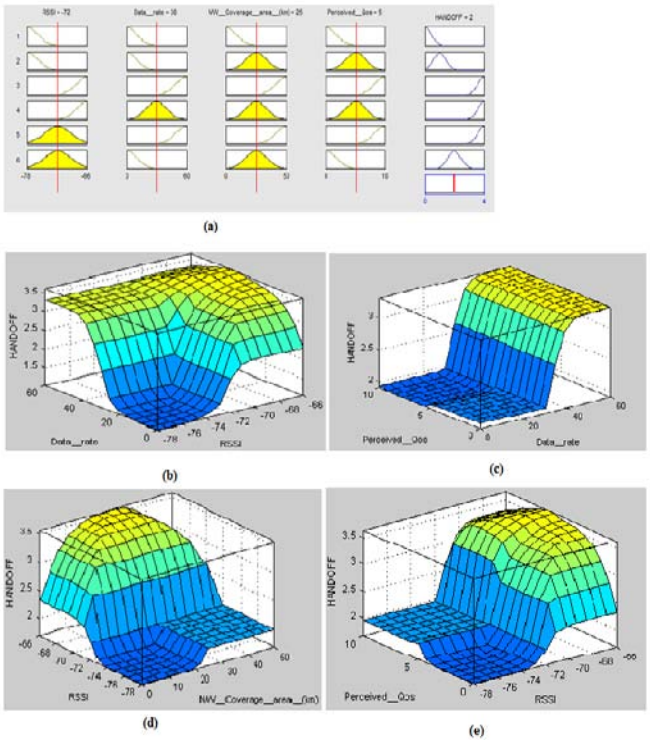

Figure 4 : (a) IF- THEN rules used in fuzzy block for UMTS to WiMAX; (b) Surface Viewer in case of constant network coverage and QoS; (c) Surface Viewer in the case of constant network coverage and RSSI; (d) Surface Viewer in the case of constant data rate and Qos; (e) Surface Viewer in the case of constant network coverage and data rate.

The crisp handoff factor computed after defuzzification is used to determine when a handoff is required. If handoff factor > 2, then initiate handoff, otherwise do nothing.

b) Handoff from WiMAX to UMTS

The parameters that are used in this directional handoff include the RSSI, data rate, network coverage area, and perceived Quos of the current WiMAX network. The design of the fuzzy inference system for this handoff scenario is similar to the design of the fuzzy inference system for the UMTS-to-WiMAX handoff. The fuzzy rule base contains IF-THEN rules such as:

a) IF RSSI is weak, and data rate is low, and network coverage area is bad, and perceived Quos is undesirable, THEN handoff factor is Y.
b) IF RSSI is weak, and data rate is low, and network coverage area is medium, and perceived QoS is undesirable, THEN handoff factor is PY.
c) IF RSSI is strong, and data rate is high, and network coverage area is good, and perceived QoS is desirable, THEN handoff is N.
d) IF RSSI is strong, and data rate is medium, and network coverage area is medium, and perceived QoS is undesirable, THEN handoff is PN.

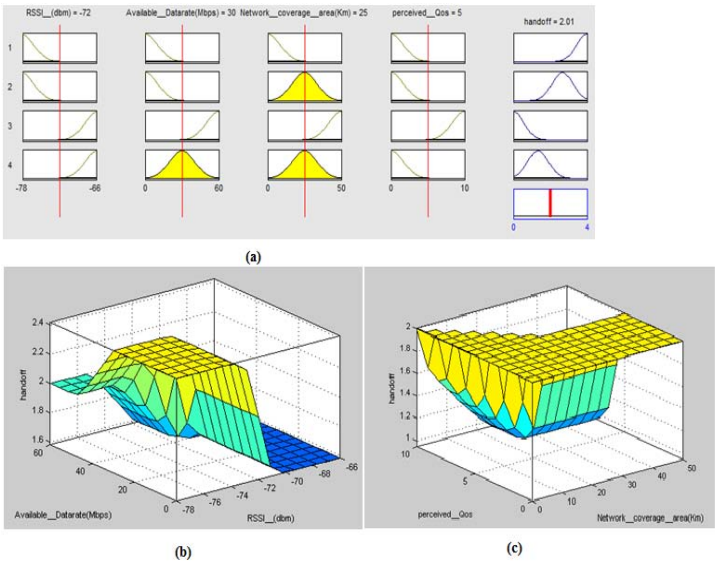

Figure 5 : (a) IF- THEN rules used in fuzzy block for WiMAX to UMTS; (b) Surface Viewer in the case of constant network coverage and Qos; (c) Surface Viewer for the fuzzy handoff in the case of constant RSSI and data rate

A MATLAB based fuzzy logic inference displays of the combined four IF-THEN rules indicated above are shown in Figure 5 (a) and (b), (c) shows the Surface Viewer for the system composed of these four rules in three specific cases where any two parameters are constant.

IV. Conclusion and Future Work

As foreseen by many researchers, the next generation wireless mobile communications (4G) will be based on the heterogeneous underlying infrastructure integrating different wireless access technologies in a complementary manner. This paper has presented the

use of fuzzy logic concepts to design an adaptive multi-criteria vertical handoff decision algorithm that is both cost-effective and highly useful. For the handoffs initiated by mobile nodes, fuzzy logic based vertical handoff decision algorithm (VHDA) is employed to select the most appropriate network for the mobile nodes. Afterward, the selected mobile nodes are handed over to other nearby base stations. The simulation results show that the VHDA can make accurate handoff decisions, help to balance the network resources and improve the performance of the networks. This research will facilitate the evolution of seamless mobility of the next generation networks.

Since the RSS was used in this algorithm, it is predicted that this algorithm decreases the probability of occurring handoff. However, the proof and the simulation of the algorithm for both application types (data and voice) and also the proof of the probability of handoff occurring formula for a different time are considered for future work. Comparison with other Cellular handoff mechanisms can also be considered for future work.

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FM and Web Based Solution: A Novel Approach to Monitor and Control Home Appliances using Mobile

By Md. Hafizur Rahman & Jinia Afrin
International University of Business Agriculture and Technology, Bangladesh

Abstract - The capacity of controlling various electrical and electronics devices in a wireless and remote fashion has provided a great convenience to many people in life. Through a wireless distant control system, people can do remote operation without directly accessing the host of home appliances like fan, lamp, TV, washing machines and others. Pocket switch is one of these types of system which we can use to control home appliances smartly from anywhere. The main objective of this work is to make such a system which controls the home appliances remotely using Web service and FM technology from a mobile phone. This paper discusses two methods of controlling home appliances. The first one is web service based where server will generate a command to the controller computer and the second one is FM network based where server will synthesize the SMS in to speech.

Keywords : *web service, FM system, SMS, device controller, client.*

GJCST-E Classification : *C.2.m*

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Keywords : web service, FM system, SMS, device controller, client.

I. Introduction

Use of long range wireless control system is not a new concept in today's world; it is used to provide expediency for user to remotely control the home appliances with a better use of electricity. Sometimes it is not feasible to be physically near to the home whereas it is very important to control the appliances for many purposes such as electrical short circuit, fire burning, electrical explosion etc. These types of situation may cause loss of wealth and life. By controlling the system from distant place, we can save the unexpected waste of wealth and loss of life.

There exists a number of available media for remote communication. Internet is a good example of this type of remote communication. Internet places virtually no bounds on geographical placement and is thus considered "enough" remote by our definition. But the Internet is a place crowded with various types of traffics, often hostile to each other. Security vulnerability is the most striking alert point of the Internet. Whenever a web based application goes live, a lot of efforts have to take place before it can be said to be secured, if at all. When we say remote control, we want to make sure no malicious party ever gains control and abolishes everything. Also to use web, it requires resources like flawless internet connections and hosting servers, which may not always fit to the concept of remote control -ling [1].

Mobile Phone is another example of remote communication which has become one of the most popular communication devices amongst the people all over the world with wide range of communication services like voice and data transfer through SMS and other enhanced data transfer protocols like GPRS, EDGE etc. Research shows that, at the present with the world population of around 6.7 billion peoples, 60% of the world population uses mobile phones which are about 4.1 billion mobile phone users. Since the GSM network started its operation in 1991, the SMS became popular as it provides cheap and convenient method of communication. SMS users are able to message over 160 (7 bit) word characters including the space using cellular network to almost anywhere in the world within seconds [2]. Unlike the Internet, the SMS is safe from network security threats and can be operational from anywhere in the world where there is a mobile network.

Numerous techniques have been proposed to address the challenging issues associated with the control of home appliances remotely. Wireless technologies are very attractive where infrared, or radio link technologies (e.g. IEEE802.11b) are most frequently utilized. For example Sachin Sharma et al [1] has proposed a system that control home appliances through infra-red remote controller and power line communication by developing a JAVA (Android platform) based module in cell phone at the Transmitting end that gives instructions and commands to Receiving Unit via GPRS network that will control the Infrared control devices. Nevertheless, with the availability of complex controllers and processors at lower costs, technologies that are well established for common PCs are being revisited for numerous embedded devices. It is not unusual therefore, that simple computer systems are being used to bridge devices interconnection gap, having the cheap PC act as a home/ambient controller. On top of PC-based architectures, user interfacing is often provided by a simple web server, when PC is exposed to the global network and can be accessed from any internet hot spot [3, 4, 7].

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Also, GSM or GPRS networks can be used with a standard mobile provider, to allow control of the system via short message service (SMS) or a phone call. PC based software packages that provide management of supported devices with the goal of home automation are scarce, at least when it comes to providing ambient intelligence and awareness. Dedicated home automation controllers are also deprived of high level ambient functions [5, 6, 8].

In this paper we present a novel method to control the electronic devices using a mobile phone through FM system. In case of absence of internet service mobile user will send the SMS to the server computer. The server computer will work as a service provider. The server computer will receive the SMS and synthesize it to the speech. The speech will be transmitted through the FM system. The remote controller computer will receive the signal by recognizing the command and act on that. Clients can also control the electronic devices over internet. Mobile and controller computer will be connected with the internet. The mobile will send service request to the server. The server will generate a command to the controller computer. The controller computer will control the device on the basis of service request.

II. System Architecture

a) Method 1

The block diagram of this method is shown in Fig. 1.

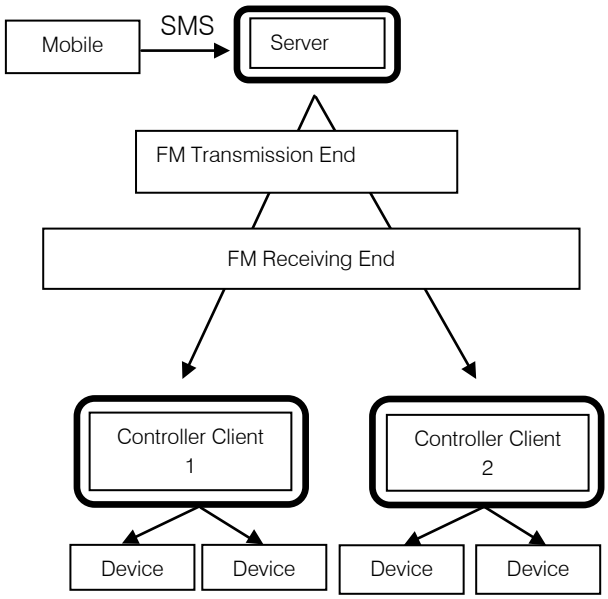

Figure 1 : Block Diagram of the Web Service based Method

i. *Server*

There exists one server listening to the COM port with a GSM receiver for command SMS to come from GSM network. This server is also connected with an FM transmitter, which is used for transmitting command signal with a specific frequency (MHz) E.g: 95.6 MHz.

ii. *Controller Client*

It is device controller that is connected with an FM receiver listening to the frequency that server will transmit. Multiple devices e.g: "Generator", "Automatic door lock" etc. are connected with this client.

iii. *User Client*

It is any kind of cell phone that has SMS sending capability.

The mobile client will send the command SMS to the server. The server will work as a service provider.

Valid SMS format: "*Controller Client ID: Command*"
Valid SMS example: "*Industry client: turn off generator*"

Server will receive the SMS and verify the valid client from database using the cell phone number. If the client is valid, it reads and passes the SMS and find if there is any controller client with this ID number under SMS sender client. Then, existing command will be synthesized into speech and will be transmitted through FM network with a specific frequency for specific client to receive.

Valid transmission format: *"client name followed by the command".*
Valid transmission example: *"Industry client turn off generator".*

All controller clients connected with FM network and listening to the frequency of that server used for transmitting the command signal will receive the signal and try to recognize the command. Only valid controller client will recognize the command. For example: if valid transmission is "Industry client turn off generator" only client that has name "Industry client" will be able to recognize the command. If received command is, "turn off generator", it will turn off the generator.

iv. *Security*

While sending an SMS to the server, server will analyze the mobile number. Any unauthorized SIM number will not be able to control the server. Thus there is no chance of misuse of control.

b) Method 2

In this method, there exists one server with one web service and multiple device controller clients connected with it over TCP. The block diagram of this method is shown in Fig. 2.

i. *Server*

When TCP server first starts, it listens on two ports, one for web service and another for multiple device controller clients.

ii. *Controller Client*

Device controller client is a computer which is equipped with an application which is built using C-Sharp programming language. Device controller client has the servers IP address and Listening port. When it

first starts, it sends a formatted request to the server containing its unique identification, that is; its device identification number and electronic/electrical devices that are connected with it or it can control.

a. *Format of Request*

"*Device unique identification: name of electrical/electronic devices separated by comma: Owners ID".*

Format of request example: "Controller client 78941256: generator, door, main power switch: 12345".

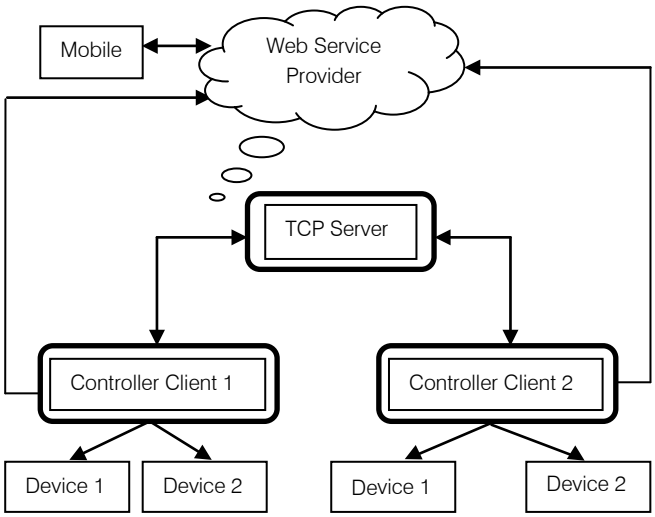

Figure 2 : Block Diagram of the Web Service based Method

SQLite database is provided with the TCP server. When server receives this message, it will first check if the client is in database, if so it will update the information and its active status to up. If client is not in the database, it will insert it to the database with a unique ID and send the ID back to the client with same socket.

Format of the database:

Unique ID	Own ID	Device to be controlled	Owners ID

By this time, server saves this socket information to an active client list for further use. When client gets this ID, it will start its functionality with that ID.

iii. *Mobile Client*

A J2ME based application is equipped with the client mobile phone. Mobile client sends a request to the web service to control his electrical or electronic device using mobile application. Web service will add it to the queue if another request is in process. Web service will then send the client request to the TCP server using servers IP and listening port over socket and wait for a specific time to get acknowledgement form distant client.

Message format (Mobile Client to web service): *"Encrypted command [Device unique identification]: encrypted command [on off status/operation status]: encrypted command [name of electrical/electronic devices]: session ID".*

When server gets the web client request from web service it will first decrypt the Device Unique Identification and check to the active socket client list. If it exists, then it will send the encrypted command to the matching distant client over existing socket as shown below.

"*Encrypted command [on off status/operation status]: Encrypted command [name of electrical/electronic devices]: session ID*".

After getting the message, device controller client will decrypt it and perform the desired operation and send the ACK with the session ID to the web service. After getting the ACK from distant client with appropriate session ID web service returns the status message to the calling Mobile client.

c) PC Interfacing System

In controller client end, computer is used as controller client. In this paper, the PC parallel port is used for the purpose of interfacing with the real time control applications. The parallel port pins are TTL levels output. This means that they put output 0 to 0.8 dc volts to logically 0 and 2.4 to 5 dc volt to logically 1. An optocoupler is connected with parallel port which controls the relay. External devices are connected with that relay. When command signal reaches the device controller, it triggers the optocoupler, which operates the relay. Fig. 3 shows the Block diagram of PC interfacing system.

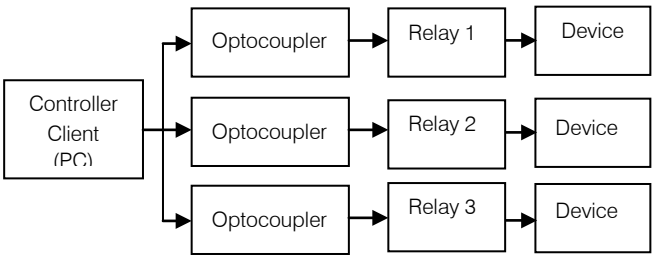

Figure 3 : Block diagram of PC interfacing system

III. Advantage of the System

The system offers some attractive features like:

1. SMS technology is easy to use and learn and can be accessed easily when needed.
2. In case there is any suspension of internet connectivity this system provides backup control and monitoring using FM technology.
3. This system saves time as the user does not require making a dedicated connection to the computer to be controlled.
4. SMS services are very cheap and most service providers do not charge users for receiving SMS.
5. It is very cost effective and very easy to implement.
6. The industrial management could minimize the loss of life and wealth in accidental circumstances.

IV. Conclusion

Now a day, human beings are so much busy in their daily life. Accidents may occur anytime due to their unconsciousness about various sort of life e.g. electricity mismanagement. Solution is required in a simple way. This paper presents the novel design of a remotely controlled electrical apparatus via FM and web service. Both the proposed models are very effective and efficient in appropriate circumstances to control electric or electronic devices in a less complex manner that is highly required for the busy people. Again, mobile phone and computers are very common and less costly. So we think this project will be successfully deployed in real life situation to change the world.

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A Review of NTLM Rainbow Table Generation Techniques

By Meetika Malhotra & Bhushan Dua
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Abstract - Rainbow tables reduce the difficulty in brute force cracking a single password by creating a large pre-generated data set of hashes from nearly every possible password Rainbow Tables. This method, known as the Faster Time- Memory Trade-off Technique, is based on research by Martin Hellman & Ronald Rivest done in the early 1980's on the performance trade-offs between processing time and the memory needed for cryptanalysis. In this paper we review some of the most important works in rainbow table generation and using rainbow tables in window NT environment, i.e. against NTLM. We will discuss how NTLM is weak against rainbow table attacks.

Keywords : *brute force attack, LM, NTLM, rainbow tables and cryptanalysis.*

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Keywords : brute force attack, LM, NTLM, rainbow tables and cryptanalysis.

I. Introduction

LAN Manager [1], or LM, is an authentication protocol designed (at its time) to maximize password security in a Windows-based environment. The LM protocol was first used in Microsoft's LAN Manager Product a very long time ago and is still the authentication protocol of choice for older operating systems, such as Windows 95 and Windows NT 3.51 and earlier. Later, when Windows NT was introduced, LM was enhanced and renamed the NTLM[2] authentication protocol. Although NTLM has been around for a long time, it's still a basically good authentication protocol, and it is the native network authentication protocol of Windows NT 4.0 and earlier operating systems.

a) NTLM Major Weaknesses [3]

- SAM has several vulnerabilities, which allowed attackers to access the hashed passwords.
- NTLM can use a maximum of 14 characters to create its stored hash. These 14 characters are split into two seven-character strings. Crypto-graphically, it is reasonably easy to brute force attack [8] two seven-character strings with modern computers.
- NTLM cannot use lowercase letters. It converts all lowercase letters to uppercase before creating the hash. This reduces the character set for the password, making brute force attacks far more likely to succeed.
- The hash algorithm used to store passwords became well known. That allowed attackers to guess users' passwords by running password guesses through the hash until the result matched the result stored in the SAM. Because the algorithm remained constant, large libraries of hashed passwords could be stored and used to quickly attack a SAM.
- NTLM used a mechanism known as pass-through authentication to distribute the authentication task. The way pass-through authentication was designed created a bottleneck at the primary domain controller (PDC) of each domain. Some of the tasks done by the PDC, such as password changes, could not be offloaded to any other server.
- Attackers began accessing passwords by pretending to be trusted servers. Users' client computers would transmit logon information to the attackers, thinking that they were domain controllers or file servers. NTLM provided no way for users to verify that the server they were connecting to be the one they intended to connect to.
- NTLM was largely limited to interoperability with Microsoft products. As computer networks became more heterogeneous, NTLM didn't provide a way to interoperate with non-Microsoft operating systems.
- NTLM provided no way for a middle-tier application to access resources on a user's behalf. When a user's client application accessed a middle-tier application, the middle-tier application usually used a generic administrator credential to access backend resources. This technique works, but presents a security threat, because the middle-tier application is running under powerful security credentials.

II. Rainbow Tables

A rainbow table [5] is a way of doing cryptanalysis very quickly and efficiently. Suppose that you are a hacker and you have acquired a database of usernames and encrypted passwords. The System encodes the password using a hash function, which is basically a way of condensing a given set of data into a condensed string. For example, the MD5 algorithm encrypts password "MyPassword" as **48503dfd58-720bd5f-f35c102065a52d7** if one, as a hacker, have the password described above, one wouldn't know what the password is just by looking. Instead, one would refer to the rainbow table for the password. Rainbow tables are a pre-computation based approach to reversing hashes.

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They require a large amount of pre-computation, but can store the results of this in a reasonable amount of space. When searching for a hash, additional computation is required, but the computation required for searching is significantly less than the amount required for the pre-computation, and significantly less than the amount required to brute force [3] a password.

By generating long chains of passwords and hashes, tied together by the hash function and a reduction function, rainbow tables store a compressed representation of a password search space. By performing similar computations on a provided hash, they are able to dramatically reduce the amount of computation required to find the original password. As with many algorithms, there are limitations with rainbow tables. Unlike a brute force algorithm, they are not guaranteed to find a password within the search space, as the algorithm is probabilistic in the coverage of the password space, and a password will only be found if it is represented in the generated tables. However, very high success probabilities can be achieved, and the search time is significantly less than with a brute force algorithm.

The crack time/storage space tradeoff of rainbow tables is adjusted by changing the chain length. Longer chains require less storage space, but require more computation (and more time) to crack passwords.

a) Related Works

MARTIN E. HELLMAN, [4], in "A Cryptanalytic Time - Memory Trade-Off", describes that A probabilistic method is presented which crypt analyzes any N key cryptosystem in $N^{2/3}$ operations with $N^{2/3}$ words of memory (average values) after a precomputation which requires N operations. If the precomputation can be performed in a reasonable time period (e.g. several years), the additional computation required recovering each key compares very favorably with the N operations required by an exhaustive search and the N words of memory required by table lookup. When applied to the Data Encryption Standard (DES) used in block mode. It Indicate that solutions should cost between $1 and $100 each. The method Works in a chosen plain text attack and, if cipher block chaining is not used, can also be used in a cipher text-only attack.

The time-memory trade-off was described for use with a block cipher, but the same approach works with a synchronous stream cipher. The first ***k bits*** of key stream are taken as the ***f (K)*** function, where ***k*** is the number of bits of key. This can be done under a known plaintext attack. The method works on all systems in a chosen plaintext attack but does not work with a known plaintext attack on a cipher feedback system if the initial load of the shift register is random and varies between conversations.

Proposed Federal standards suggest this precaution. Even a block cipher can foil the time-memory trade-off in a known plaintext attack through cipher block chaining or other techniques which introduce memory into the encipherment. Then, even when eight blanks occur in the plaintext, their encipherment depends on the preceding text. Even if the first block of text is fairly standard (e.g., "Login: "), this technique can be foiled by the transmission of a random "indicator" which is used to affect the encipherment (e.g., it is taken as the 0th plaintext block). Again, proposed standards include provision for cipher block chaining with a random indicator. While this time-memory trade-off cryptanalytic technique can be easily foiled, it does work on the DES in basic block mode, more importantly; it indicates that even when cipher block chaining or other techniques are added, a larger key size is needed to have a reasonable assurance of security.

While table lookup and exhaustive search are currently infeasible on systems with 64-bit or larger key sizes, an $N^{1/2}$ time-memory trade-off would push the minimum usable key size up to 128 bits. The $N^{2/3}$ technique described here, coupled with the large number of $N^{1/2}$ time-memory tradeoffs known for other searching problems, indicates that valuable data should not be entrusted to a device with smaller key size.

Philippe Oechslin, [5], in "Making a Faster Cryptanalytic Time-Memory Trade Off", describes that In 1980 Martin Hellman described a cryptanalytic time-memory trade-off which reduces the time of cryptanalysis by using precalculated data stored in memory. This technique was improved by Rivest before 1982 with the introduction of distinguished points which drastically reduces the number of memory lookups during cryptanalysis. This improved technique has been studied extensively but no new optimizations have been published ever since. The Authors proposed a new way of precalculating the data which reduces by two the number of calculations needed during cryptanalysis. Moreover, since the method does not make use of distinguished points, it reduces the overhead due to the variable chain length, which again significantly reduces the number of calculations. As an example, the authors have implemented an attack on MS-Windows password hashes. Using 1.4GB of data Attacker can crack 99.9% of all alphanumerical passwords hashes (237) in 13.6 seconds whereas it takes 101 seconds with the current approach using distinguished points. The Authors showed that the gain could be even much higher depending on the parameters used and they have introduced a new way of generating precomputed data in Hellman's original cryptanalytic time-memory trade-off. Our optimization has the same property as the use of distinguished points, namely that it reduces the number of table look-ups by a factor which is equal to the length of the chains. For an equivalent success rate

our method reduces the number of calculations needed for cryptanalysis by a factor of two against the original method and by an even more important factor (12 in our experiment) against distinguished points.

The Authors showed that the reason for this extra gain is the variable length of chains that are delimited by distinguished points which results in more false alarms and more overhead per false alarm.

They conjecture that with different parameters the gain could be even much larger than the factor of 12 found in our experiment. These facts make our method a very attractive replacement for the original method improved with distinguished points.

The fact that their method yields chains that have a constant length also greatly simplifies the analysis of the method as compared to variable length chains using distinguished points. It also avoids the extra precalculation effort which occurs when variable length chains have to be discarded because they have an inappropriate length or contain a loop. Constant length could even prove to be advantageous for hardware implementations. Finally their experiment has demonstrated that the time-memory trade-off allows anybody owning a modern personal computer to break cryptographic systems which were believed to be secure when implemented years ago and which are still in use today. This goes to demonstrate the importance of phasing out old cryptographic systems when better systems exist to replace them. In particular, since memory has the same importance as processing speed for this type of attack, typical workstations benefit doubly from the progress of technology.

Hans Hedbom, et al [6], in "A Comparison of the Security of Windows NT and UNIX", describes that this paper presents a brief comparison of two operating systems, Windows NT and UNIX. The comparison covers two different aspects. First, we compare the main security features of the two operating systems and then we make a comparison of a selection of vulnerabilities most of which we know have been used for making real intrusions.

The Authors found that Windows NT has slightly more rigorous security features than "standard" UNIX but the two systems display similar vulnerabilities. The conclusion is that there are no significant differences in the "real" level of security between these systems.

This paper demonstrates that the security mechanisms of Windows NT are slightly better than those of UNIX. Despite this fact the two systems display a similar set of vulnerabilities. This implies that Windows NT has the theoretical capacity of being more secure than "standard" UNIX. However, with the present way of installing and using the system there seems to be no significant difference between their security levels. It is true that there are presently more intrusions in UNIX systems, but the authors believed that this is due to the *aging* factor, i.e. the statement above should hold when comparing the systems at the same state of development and market penetration.

Thus, the only reason for more UNIX penetrations is that the system is older and more well-known and we should anticipate an increasing number of intrusions into Windows NT, a tendency that has already started. It is clear that the Achilles heel of both systems is networking. Since both systems utilize the same low level protocols, i.e. IP, TCP and UDP, and comparable high level protocols. This could to some extent explain that the security behavior of both systems is similar, but it does not provide the full explanation. However, as long as the networking is such a weak point, the usefulness of other security mechanisms is diminished.

Jorgen Blakstad, et al [7], in "All in a day's work: Password cracking for the rest of us", Describes that the majority of computer systems are still protected primarily with a Username and password, and many users employ the same password on multiple systems. Additionally, some of the most popular operating systems such as Windows XP, Windows Vista and the upcoming Windows 8, still use ad-hoc constructed hash functions such as LM, while many Linux variants use the hash function MD5.

This paper describes an experiment where we have tested the strength of a selection of passwords when converted to LM, NT and MD5 hashes, respectively, using commonly available tools. Our conclusion is that a large number of passwords can be cracked within a normal working day, and that all LM hash passwords can be recovered easily. The use of such weak hash functions in the process of user authentication in these operating systems poses a significant threat to an organization's security.

III. Conclusion

The main benefit of Rainbow Tables is that while the actual creation of the rainbow tables takes much more time than cracking a single hash, after they are generated you can use the tables over and over again. Once you have generated the Rainbow Tables, Attacks using is faster than brute force attacks and needs less memory than full dictionary attacks.

In this paper we have reviewed some of the most important works in rainbow table generation and using rainbow tables in window NT environment, i.e. against NTLM. We have discussed how NTLM is weak against rainbow table attacks.

IV. Future Scope

Rainbow Tables are popular with particularly weak password algorithms such as Microsoft LM and NTLM hash, these password algorithms was used in earlier days of Windows and still lives on only for compatibility reasons.

In the future we want to devise an experiment where we will test the strength of a selection of passwords using commonly available tools. This is to show that a large number of passwords can be cracked within working days and Majority of passwords used commonly have very skewed frequency distributions. We want to device methodologies based upon calculation of frequency distribution algorithm.

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References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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