

Utilization of Secure Wireless Networks as Environment for Learning and Teaching in Higher Education

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Abstract

This paper investigate the utilization of wire and wireless networks to be platform for distributed educational monitoring system. Universities in developing countries suffer from a lot of shortages(staff, equipments and finical budget) and optimal utilization of the wire and wireless network, so universities can mitigate some of the mentioned problems and avoid the problems that maybe humble the education processes in many universities by using our implementation of the examinations system as a test-bed to utilize the network as a solution to the shortages for academic staff in Taiz University. This paper selects a two areas first one quizzes activities is only a test bed application for wireless network learning environment system to be distributed among students. Second area is the features and the security of wireless, our tested application implemented in a promising area which is the use of WLAN in higher education for leering environment.

Keywords

Networking Wire and Wireless Technology; Wireless Network security; Distributed computing; Algorithm; Encryption and Decryption.

1. Introduction

Rapid advances in information technology and telecommunications, wireless network and mobile communications offer a large environment for exchange data and information without limited connectivity. Technology is curricula tool for increasing the use of applications in different areas the consideration of this paper is fully utilize the wireless network for educational applications. A huge number of researches in wireless networks studied many applications base in wireless network as new learning environments [1]. In addition the

rapidly developments in the wireless networks field courage the researchers not only applied huge number of educational applications but also commercial applications based on this technology, various network learning environments that attract many individuals' attention and expectations can be find in [2]. Also, huge number of researchers has predicted that wireless learning environments have the potential to create the new platform which will significantly impact education [3]. Wireless learning environments offer many educational possibilities that are not easily achieved in normal learning environments.

The actual problems in a normal learning environment in many universities especially those in developing countries are the shortage in academic staff, equipments, classes space, budgets and Taiz University is suffer from all of the mentioned problems at once, in addition to the lack of real-time feedback which should come from students also, number of students especially the female students are too shy to participate actively on learning by commenting the presentation, proposing their ideas or asking questions. In [4] presented an exploratory review of several categories of wireless technologies, their successful applications in higher education institutions and challenges from the educator's perspective such as mobile learning. A hot topic among researcher from early days and is still ongoing in many projects are the exploration of the extension of e-learning into wireless/handheld (W/H) computing devices with the help of a mobile learning framework. Also, a similar work to the work in this paper can be find in [5] the researchers replaced the traditional quizzes with an automated approach. Another application called "Student Response System (SRS)", a server-side web application, which requires only a web browser on client side. Quizzes can be answered with handheld computers via wireless networks. The results can be seen as charts and can be projected to students. Work in [6] is very similar to our work; students can send questions during the lecture, and also the teacher can receive the question and retain the answer, teacher can also do tests online and system return the test or quiz's marks to student, we presented in this paper the quizzes activities as an

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item to the ongoing developing wireless network environments.

Recently most university in the world consider the network learning environments an important learning environments. At present wireless technology in education is used principally in research studies, although many practitioners envisage wireless to become an integral part of learning and teaching processes. Security of exchanging data is very important because there are many threats which can interpose this data and make many problems. The lack of security of the information transferred through WLAN can affects the use of many applications. So the security of exchanging data is very important because there are many threats that can interpose this data and make many problems. A huge number of security researches have been proposed to protect the wireless resources. An overview of wireless network security can be find in [7,8,9,10].

Security for wireless network as platform for learning environment is a great challenge, this paper contributed to the solution of this problem we proposed the following techniques: User Authentication, User Identification, Messages Digesting, Encryption, Digital Signature, and MAC monitoring. Applying those techniques surly we are going to gain or increase the security level of information used by any types of applications our test-bed application in this paper is examination system for individual course uses the WLAN. The paper has presented the background of the technology that we work through and some knowledge about tools that we used to develop the work, paper has also described the proposed two modules of security which are integrated in each other to create the solid security. The first module is associated with the application security which makes the examination process executing in safety environment. The second module is the wireless network security which is the main subject tackle by this paper, and all mechanisms for network security have been built as middleware. The implementation mechanism will insure the security of information applied and also provide a programming package that can be used by programmers immediately when they intend to write their application by applying functionality of the mechanisms implemented at the package without need to rebuild methods for enhancement security or starting from scratch.

2. Organization of the Paper

The rest of the paper is organized as follows. Section 3 covers the A wireless ocal area network (WLAN). & its components also, the description of Accesses point is formulated. WLAN architecture has been given in section 4. Applications, hardware, programming environment, algorithms and security model used in this paper for WLAN have been given in sections 5,6,7 sequentially. We closed the paper with result and future research directions in Section 8.

3. Wireless Local Area Network (WLAN)

WLAN is a flexible data communications system that can use radio frequency technology to transmit and receive information over the air, WLAN has been widely used in many areas such as education, healthcare, and warehousing etc. According to some surveys for using the WLAN approximately 99 percent of companies, organizations, schools, universities laptops around the world are equipped for WLAN, this technology becoming an important to satisfy the needs for installation flexibility, mobility, reduced cost-of-ownership, and scalability.

A. WLAN Components

Basic components of a WLAN are access points (APs) and Network Interface Cards. One of the advantages of Wireless LAN is the simplicity of its installation system is easy and can eliminate the need to pull cable from machine to others and pull cable through wall and ceiling which one can seen in the installing of physical architecture of LAN.

B. Access Points(APS)

An AP is basically the wireless equivalent of a LAN hub. It is links wireless clients to the traditional wired LAN through a standard Ethernet Cable, a single AP may handle up to several hundred wireless clients. An AP and a wireless client can talk to each other only if they use the same SSID (System Set Identifier) SSID is often referred to as Network Name, figures 1,2,3 can be found in many Commercial website and is illustrate the wireless client which may be a desktop, laptop, or handheld device with a wireless network card (NIC) able to communicate with an AP. Each client has its own NIC which scans the available frequency spectrum for connectivity and associates it to an access point or another wireless client. The NIC enables new user to

be connected instantly to the network and enable Internet access.

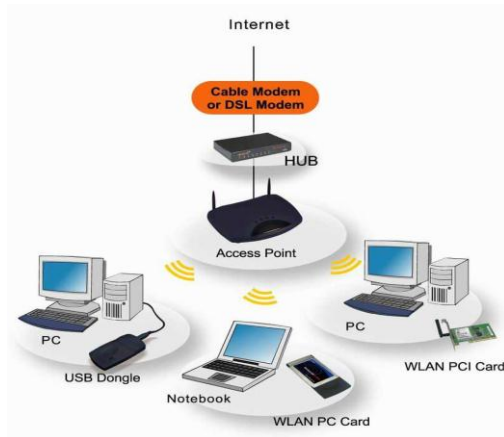


Figure 1: The Wireless Client

4. WLAN Architecture

In previous section we have presented the WLAN components that are connected in several configurations. WLAN architecture has three main types, Independent, Infrastructure, and Microcells and Roaming .

A. Independent WLAN

Independent WLAN is simplest configuration and is peer-to-peer that connects a set of PCs with wireless adapters. Any time two or more wireless adapters are within range of each other, they can set up an independent network which can be seen in figure 2



Figure 2: The Independent WLAN

B. Infrastructure WLAN

Infrastructure WLAN consists of wireless stations and access points, access Points combined with a distribution system (such as Ethernet) support the creation of multiple radio cells that enable roaming throughout a facility, access points not only provide communications with the wired network but also mediate wireless network traffic in the immediate

neighbourhood and this type of WLAN architecture shown in figure 3.



Figure 3: The Infrastructure WLAN

C. Roaming

In this type of infrastructure WLAN at any point in time, a mobile PC equipped with a WLAN adapter is associated with a single access point and its area of coverage. Individual areas overlap to allow continuous communication within wired network, they handle low-power signals and hand off users as they roam through a given geographic area. The area of coverage for an access point is called a "microcell" those microcells are similar to the cellular telephone system to extend the range of wireless connectivity more detail and figure 4 can be find in [11] which is illustrate this type of Infrastructure.

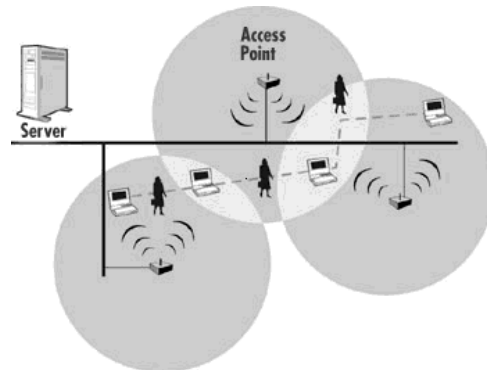


Figure 4: The Microcells and Roaming.

5. Applications for WLANS

Wireless LANs used in wide rang applications for example in Education Industry The infrastructure for most wireless LANs in the education sector is the utilization of access points, of which a wired network connection is necessary. Radio frequency is used to connect terminals in classrooms, lab computers, or other buildings via access points. The reduction of

and cabling costs have allowed the education sector to justify the cost of implementing the new system. Providing wired connections in universities has been very costly due to wiring works need in the new or old buildings. The wireless applications are not limit to educations applications only but also cover a wide range of applications in different areas such as healthcare Industry ,Warehouse Industry ,Retail Industry and so on.

6. Hardware and Programming Environment tools:

To construct the security modules and build prototype of the distributed educational monitoring system for investigate the utilization of wireless networks to be a platform for a the proposed security modules and the prototype of the distributed educational monitoring system. We have used the Java programming language which has many features and consist of many tools that helped us to build the proposed security modules. Verity of using java in many purposes, Java programming and java database connectivity have been used to create the connectivity to SQL and Oracle Database related to the work in this paper, we did not stop using java in this level but we also, used java security package to build the security model for securing wireless network learning environment which has proposed in this paper, wireless network learning environment and web technologies are the platform for proposed work in this paper. Java Servlets , java Applets, Graphic user Interface and Java Beans have been used to make the communication between server and clients effectively and efficiently.

A. Clients and Server:

- We have tested the educational applications and Wireless security model in four laptop computers and desktop computers distributed in one laboratory consist 24 Samsung PCs and one server which we have considered the tested environment for executing the middleware which implement the security mechanisms and test-bed application is examination system for our university using the WLAN.
- SQL Server 2005 has also, many features that we have used to develop the relational data base of the examination process .
- Microsoft Office Visio 2003 provides templates, shapes, and drawing tools we also has been used to create effective and

interactive web side to help students to learner and teacher to teach.

- Hardware equipments are four access points have been installed to serve number of laptop and desktop computers distributed in one lab consist 24 Samsung PCs.
- Hi-speed Internet Access
- Wireless Device: Computer, Ipad, Game system,
- Cable/DSL Modem : D-link, Linksys
- Wireless Router: Linksys, D-link, Belkin, Netgear

B. Wireless Standards

- 802.11a : 5ghz, 54Mbps, 50ft Range
- 802.11b : 2.4ghz, 11Mbps, 90-100ft Range
- 802.11g : 2.4ghz, 54Mbps, 90-100ft. Range
- 802.11n : 2.4 or 5ghz, 144Mbps, 150ft Rang

7. Algorithms Used for Security

The Data Encryption Standard (DES) was developed in the 1970s, uses a 56-bit key to encrypt data using various algorithms 56 bits provide for 256 possible key combinations, was a widely implemented in U.S. As known that DES is being phased out, but it is still widely used and the first priority in this paper is to set up the availability of the wireless network as learning environment to mitigate the shortages of Academic staff ,budget and space in our future work we will apply the security model we have proposed in [10]. We have also adopted the asymmetric encryption algorithm (RSA) detail of this algorithm which can be find in [12,13] due to its popularity in research area, most popular public-key encryption using the different keys to encrypt and decrypt a message many of these algorithms full under of asymmetric algorithm such as symmetric, single-key, secret-key and asymmetric encryption algorithm using the different keys to encrypt and decrypt a message the implementation of encryption and decryption algorithm have been developed and tested in this paper and we have practically used the most techniques related to those algorithms such as Plaintext, Cipher text to achieve a practically result to the Confidentiality, Error detection, User authentication, Message authentication.

A. The security Model

The security model for the proposed wireless learning environment has been built in client side and

also in the server side figures 5 and 5.1 Illustrates a security model ware or model ware security.

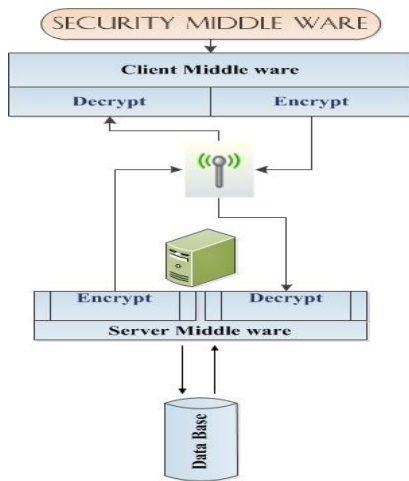


Figure 5: Client and Server Security Model

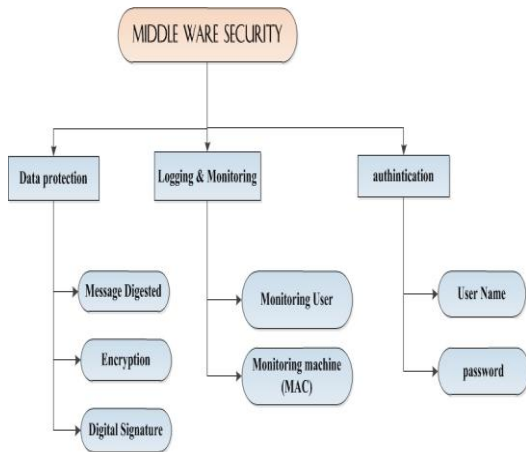


Figure 5.1: The Security Model Ware

Security middle ware consists a two levels of security the first one is the security of the wireless as environment and the second is the security of the application test bed which has been instituted during the time of the java and oracle programming for developing the Quiz system as test bead application based on wireless network leaning environment, in each level of security has several steps those steps can be shown in figure 6.

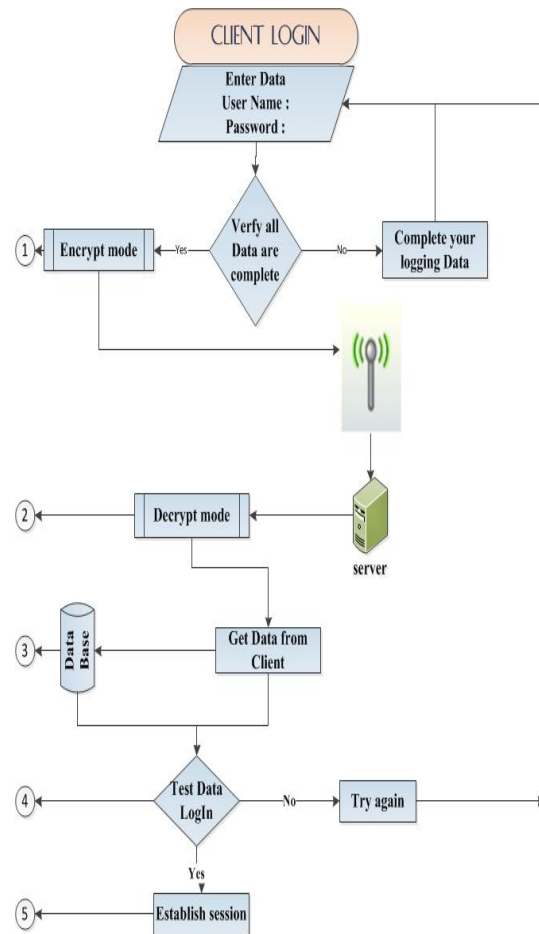


Figure 6: Security Model

1. Client's user request the permeation from the AP to the Quiz system that led in the database server.
2. Authenticator(reside in the AP) is work as detector to detect any client association with it and enables the client's port.
3. Port is forced into an unauthorized state to forward only IEEE standard traffic any other traffic from any wireless device is blocked.
4. User should submit his/her user name and password and authenticator verify them in case are wrong system gives user two more attempts after that system drop the connection, in case the verification result is true the message will be enter to the encryption mode which is responsible for encrypt any data will send the server and the detail can be seen in figure 7.

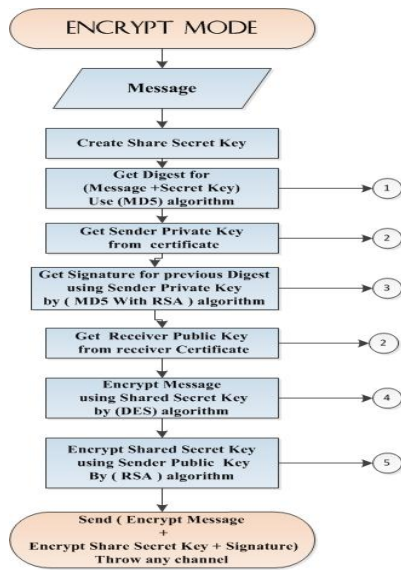


Figure 7: Encryption Algorithm

5. Authenticator Server and client exchange authentication messages if the server verify client's identity and mutual authentication also possible in case Authenticator Server result is true the message or data entered in a decryption mode and message or data will be decrypted and students or learners can be take the automatic quiz or any other courses martial figure 8 shown the decryption mode.

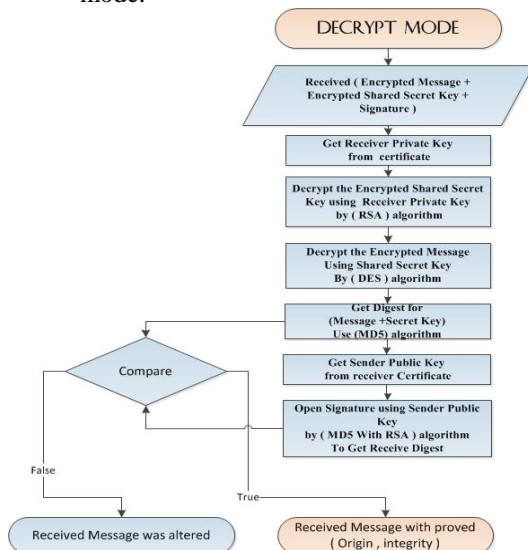


Figure 8: Decryption Algorithm

6. In educational application test bed which we called quiz system we have applied the oracle security associate with the fields and tables also we have applied the java data base connectivity and java security model, so students or learner have to checked automatically by the system for their authentication.

This type of security we called security at the application level and figure 9. describe the quiz system.

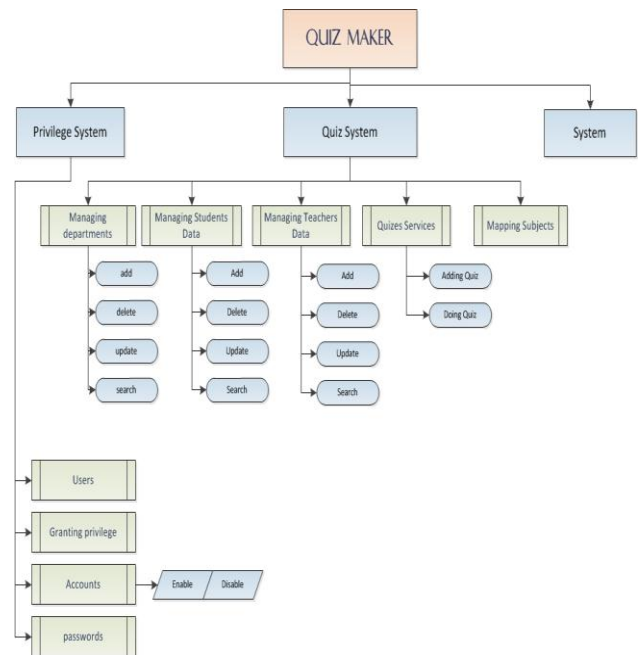


Figure 9: The Quiz System

8. Conclusion and Future Work

This paper presents the prototype for wireless network learning environment represented by the flowchart which describe the feature and security model the test bed educational application based in wireless network for mitigate the problems in higher education Institutions, we have applied the test-bed application (quiz Activities) to the proposed environment to secure not only the communications between the server where the quiz application for any course is reside but also the communication sending by the student's client. The security model mentioned in this paper consist two levels are application level which created at programming phase and our programming environments are java database connectivity and java security, those make the security in this level more powerful. Second level of

security is securing the wireless network, in this level the server and client have forced to do their communication under the principle concept of the security, this phase has achieved the main security concept such as Authentication, User Identification, Messages Digesting, Encryption, Digital Signature, and MAC monitoring. Applying these techniques we have increased the security level of information used by any types of applications and this what we consider an effective and efficient security solution which is enhance the utilization of computing for all kinds of applications.

The developed environment became capable for acting number of functions like lecture evaluation, student evaluation through quizzes and questions most of these functions has been implemented and some other under-construction. According to the feedback from teachers and students used our work we found that teacher not only gain a better understanding of students situation, but also can flow up student's study and became able to improve the way of teaching in addition students get a better understanding on their study. Finally according to the results gained from testing the test-bed application we can be sure that the work for developing the wireless network learning environment is promising and the problems for higher education can be mitigate by our ongoing wireless network learning environment if only if the powerful education teaching and learning wireless network environment is secure.

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