NORTH TECHNICAL UNIVERSITY

FACULTY OF ENGINEERING IN SCIENCES APPLIED

CAREER OF ENGINEERING IN ELECTRONICS And NETWORKS OF COMMUNICATION

SCIENTIFIC ARTICLE

DESIGN And IMPLEMENTATION OF An ELECTRONIC SYSTEM FOR THE REGISTER OF ACCESS And SENDING OF INFORMATION BY MEANS OF TECHNOLOGY NFC To THE ADMINISTRATIVE PERSONNEL And OF TECHNICAL SUPPORT OF THE COMPANY WISP AIRMAXTELECOM TECHNOLOGICAL SOLUTIONS S.A.

PREVIOUS PROJECT To THE OBTAINING OF THE TITLE OF ENGINEER IN ELECTRONICS And NETWORKS OF COMMUNICATION

VÁSQUEZ AIZAGA SANTIAGO ISRAEL

DIRECTOR: ING. CARLOS VÁSQUEZ

IBARRA, ECUADOR 2016

Diseño and implementation of an electronic system for the register of access and sending of información by means of technology NFC to the administrative personnel and of technical support of the company WISP AIRMAXTELECOM TECHNOLOGICAL SOLUTIONS S.A.

Author-Santiago VÁSQUEZ[1]
savasqueza@utn.edu.ec
santymana2011@hotmail.com
North Technical university

Summary. *This project has like purpose the design of a system of register of electronic access for the administrative personnel and technician of the company AIRMAXTELECOM S.A., by means of the employment of the technology NFC technology that will allow to send and receive information in the mobile device, for which will make a review of the characteristics of the technologies by vicinity to define his operation.*

It will design the electronic system of register of access that will comprise the interconnection between the reader NFC and the server where will be lodged the database the one who register the access, said connection will make it to him by means of the protocol Ethernet to make possible in sending and reception of the information

Finally it will make the transmission and reception of information between the reader NFC and the mobile device.

Key words

Electronic system, NFC, Control of Access

1. Introduction

The attention to the customers in a determinate company is definitely the best letter of presentation of this, since when it offers an efficient attention to the users the company purchases recognition in the competitive market.

Many of the companies treat to boost the order and mainly the punctuality of his workers, is for this reason that opt for carrying registers of control of access for his employees. From it does several years the public and private entities carry the control of assistance by means of signatures of entrance and exit of his personnel, the advance of the technology aims to that this methodology of register carry out by means of electronic systems, as for example the systems biométricos, which store the hour of entrance and of exit of his personnel of work.

The different types of technology comport to that electronic systems cover these needs. In this case, the technology NFC is the most optimum solution since it is present in several electronic devices like example the Smartphone, what makes possible the sending and reception of important information for all the personnel of the company.

2. Materials and Methods

The wireless technologies of short scope have a big acceptance in the actuality and are so immersed in our society that almost happen unobserved although they are so useful. The importance that have have won it to him by the help and by the way in that they facilitate the daily life of the people that is almost impossible to imagine us, for example, a mobile telephone without Bluetooth with which can transfer and conceal archives included to the PCs or other devices like digital cameras doing that we forget us of the molestosos wires.

Like this it is as it presents the stage of the wireless technologies of short scope, an environment that every time presents more applications in which they can fit, with striking innovations that differentiate them and that do them compete between them to win more popularity but also offering compatibility with the already existent.

2.1 Technology NFC

The wireless technology NFC, by his acronyms in English Near Field Communication, appears like a progress

in the convergence of applications inside the mobile telephone when offering the services of the intelligent cards and the advantages of the wireless technologies of short scope by means of his use.

NFC Was approved like a standard ISO/IEC on 08 December of the 2003 and stickriormente like a standard ECMA. To the equal that the ISO/IEC 14443 (international Standard related with cards of electronic identification), communicates via induction of magnetic field, where two bows of antenna are located inside each near field of the another, forming sure enough a transformative core of air.

NFC Operates inside the band of radius frequency of the 13.56 MHz in ISM that is available in bands no graduates that is to say that it does not require pay for his utilisation, besides possesses a bandwidth of 2MHz.

The communication NFC consists of five phases which are important since have a specific function and always are presents in the establishment of this.

So that it make successfully the establishment of the connection is necessary to establish parameters of authentication, speeds of transmission, type of data to be sent.

In the following figure makes the graphic process of the establishment of the communication.
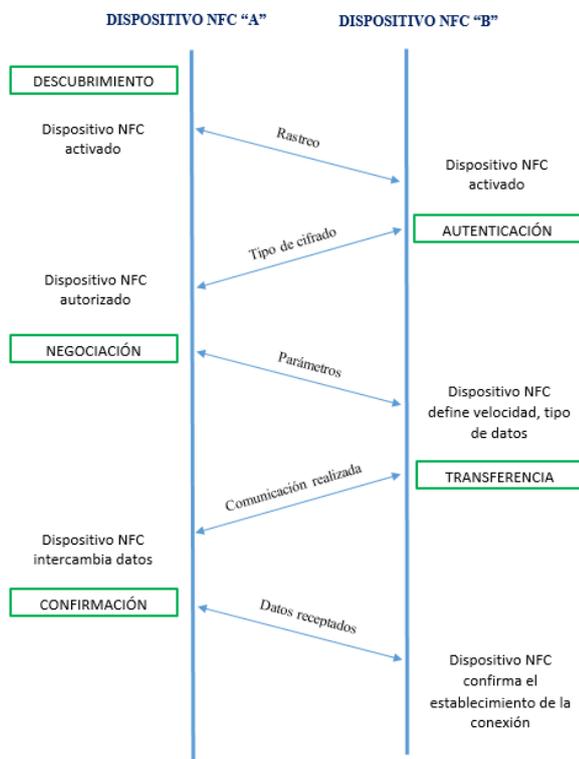
Figura. 1. Establishment of communication NFC.

To continuation describes each one of the stages of establishment of the communication.

•Discovery: In this phase the devices initiate the stage to track the one to the another and later his recognition.

•Authentication: In this part the devices verify if the another device is authorised or if they have to establish some type of enciphered for the communication.

•Negotiation: In this part of the establishment, the devices define parameters like the speed of transmission, the identification of the device, the type of application, his size, and if it is the case also define the action to be requested.

•Transfer: Once negotiated the parameters for the communication, can say that it already is made successfully the communication and already can make the exchange of data.

•Confirmation: The device receptor confirms the establishment of the communication and the transfer of data.

2.2 Characteristics of operation

The operation of NFC bases in the one of the technologies without contact and Identification by Radius frequency. His maximum scope is of roughly 10 cm, by what turns it into a technology inherentemente safe.

Since the foundation of his communication is the identification by radius frequency, obviously require two types of devices for his establishment The device that initiates the conversation is the attendant to monitor the same and this role is interchangeable between the two parts involved.

In the standardisation of the communication NFC essentially have defined two protocols, NFCIP-1 (Near Field Communication Interface and Protocol-1) standardised in ISO/IEC 18092 / ECMA – 340 and NFCIP-2 (Near Field Communication and Protocol-2) standardised in ISO/IEC 21481 / ECMA – 352.

Inside the protocol NFCIP-1 defines the link of Radius Frequency with which NFC works that it is of 13,56 MHz and the ways of active and passive operation with his ranks of speed from 106 kbits/s until 424 kbits/s. Also it defines the characteristics that have these ways of operation, for example the initiation and selection of the aim in the passive way and the avoid collisions of radius frequency in his active way.

To his time, the protocol NFCIP-2 specifies mechanisms of selection of the ways of communication so that it do not interfere other communications in course in the frequency of 13,56 MHz. The ways of communication that specify in this protocol are:

Way NFC.

Way PCD (Proximity Coupling Devices), specified in the ISO/IEC 14443.

Way VCD (Vicinity Coupling Devices), specified in the ISO/IEC 15693.

2.3 Ways of operation

They exist two ways of operation of NFC:

Way of Passive communication: In this way only the device that initiates the connection is the attendant to generate the electromagnetic field and the device of destination takes advantage of of the modulation of the load to be able to transfer the data. The device of destination could draw his power of operation from the electromagnetic field that caters the device that initiates the communication, converting like this to the device of destination in a transponder.

Way of Active communication: So much the device initiator of the communication like the one of destination, communicate alternately generating his own fields, that is to say, a device desactiva his field of RF while it is expecting by an answer. In this way, both devices need to have a source of energy for his operation.

2.4 Electronic plate Arduino

Arduino Is a platform of hardware of open source, based in a simple plate of circuit form that contains a micro controller of the mark "ATMEL" that has entrances and exits, analog and digital, in some surroundings of development that is based in the programming language processing. The device connects the physical world with the virtual world, or the analog world with the digital controlling, sensors, alarms, systems of lights, engines, systems communications and physical actuators.

The software of Arduino works in the operating systems Windows, Macintosh OSX and Linux. The majority of the surroundings for micro controllers are limited to Windows.

The software Arduino is published under a free licence and prepared to be expanded by programmers and developers experienced. The language can expand through bookshops of C++ and modify it through the programming language AVR C in which it is designed.

The Arduino Yun is an electronic plate based in the ATmega32or4 and the Atheros AR9331. The processor Atheros is compatible with a distribution Linux based in OpenWrt called OpenWrt -Yun. The board has incorporated in Ethernet and support Wi-Fi, a port USB-To, slot for card micro-SD, 20 digital entrances / pines of exit (of which 7 can use like exits PWM and 12 like analog entrances), a glass of 16 MHz oscillator, a connection micro USB, a cabecera ICSP, and a 3 buttons of replacement.

The Yun distinguishes of other plates Arduino in that it can communicate with the distribution of Linux on board, that offers a team in network of big scope with the ease of Arduino. In addition to the commandos of Linux like cURL, can write his own scripts shell and Python for the strong interactions.
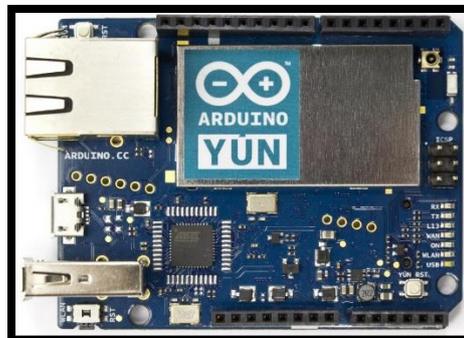
Figura. 2. Plate Arduino Yun.

2.5 Module NFC

The plate NFC uses the PN532 chip set (the chip NFC more popular in the market), this chipset is very powerful, and can do almost everything, like reading and write in the labels and cards, communicate with the telephones, and act like a label NFC.

The plate NFC is designed to use protocols I2C or SPI communication. I2C is the value by defect, since it uses less pines: analog of 4 and 5 use for I2C.
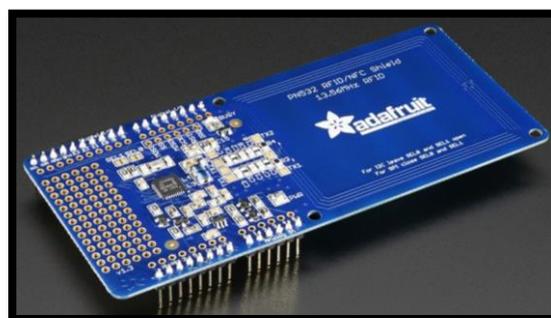

Figura. 3. Module NFC.

2.6 Software of Administration

XAMPP Is an independent server of platform, free software, that consists mainly in the system of management of databases MySQL, the server web Apache and the interpreters for languages of script: PHP.

It allows to install of simple form Apache in an own computer, without mattering your operating system (Linux, Windows, MAC or Solaris). And the best of everything is that his use is free.

XAMPP Includes besides servers of databases like MySQL and SQLite with his respective agents

phpMyAdmin and phpSQLiteAdmin. It incorporates also the interpreter of PHP, the interpreter of Perl, servers of FTP like ProFTPD or FileZilla FTP Serve, etc. between a lot of things more.

One of the advantages to use XAMPP is that his installation is of the simplest, suffices to download it, extract it and begin to use it.

MySQL is a system of administration of databases (Database Management System, DBMS) for relational databases. Like this, MySQL is not more than an application that allows to manage archives called of databases.

They exist a lot of types of databases, from a simple archive until relational systems oriented to objects. MySQL, like relational database, uses multiple tables to store and organise the information. MySQL was written in C and C++ and stands out by his big adaptation to different surroundings of development, allowing his interactuación with the most used programming languages as PHP, Perl and Java and his integration in distinct operating systems.

A database is a collection structured of data. The information that can store a database can be so simple like the one of a diary, a counter, or a book of visits, or so vast like the one of a shop on line, a system of news, a portal, or the information generated in a corporate network. To add, and process the data stored in a database, needs a system of administration of databases, such as MySQL.

A relational database stores the data in separate tables in place to put all the data in a single place. This adds speed and flexibility. The tables are linked when defining relations that make possible to combine data of several tables when they need consult data.

The server Apache HTTP, also called Apache, is a server web HTTP of open source for the creation of pages and web services. It is a server multiplataforma, free, very robust and that stands out by his security and performance.

Apache is used mainly, to make service to web pages, already are static or dynamic. This stupendous server integrates to perfection with other applications, creating the famous package XAMP with Perl, Python, MySQL and PHP, beside any operating system, that generally is Linux, Windows or Mac YOU.

•Installation/Configuration. Software of open source.

•Cost. The server web Apache is entirely free.

•Functional and Support. High acceptance in the network and very popular, this does that a lot of programmers of all the world contribute constantly with improvements, that are available

•Multi-Platform. Can install in a lot of operating systems, is compatible with Windows, Linux and MacOS.

•Performance. Capacity to handle more than one million visit/day.

•Support of security SSL and TLS.

PHP is a programming language of general use of code of the side of the originally designed server for the development web of dynamic content. It was one of the first programming languages of the side of the server that could incorporate directly in the document HTML in place to call to an external archive that process the data. The code is interpreted by a server web with a module of processor of PHP that generates the resultant web page. PHP has evolved by what now includes also an interface of line of commandos that can be used in independent graphic applications. It can be used in the majority of the servers web to the equal that in almost all the operating systems and platforms without any cost.

Python Is a programming language interpreted whose philosophy does upsetting in a syntax that favour a readable code.

It treats of a programming language multiparadigma, since it bears orientation to objects, imperative programming and, in lower measure, functional programming. It is a language interpreted, uses tipado dynamic and is multiplataforma.

It is administered by the Python Software Foundation. It possesses a licence of open source, designated Python Software Foundation License, that is compatible with the public Licence general of GNU from the version 2.1.1, and incompatible in some previous versions.

Characteristics of the language

•General purpose

Can create all type of programs. It is not a language created specifically for the web, although between his possibilities yes finds the development of pages.

•Interpreted

It wants to say that it does not have to compile the code before his execution. In reality yes that it makes a compilation, but this makes of transparent way for the programmer. In some cases, when it executes for the first time a code, produce some bytecodes that save in the system and that serve to accelerate the implicit compilation that makes the interpreter every time that it executes the same code.

•Interactive

Python Has of an interpreter by line of commandos in which they can enter sentences. Each sentence executes and produces a visible result, that can help us to understand better the language and test the results of the execution of portions of code quickly.

•Oriented to Objects

The programming oriented to objects is borne in Python and offers in a lot of cases a simple way to create programs with reusable components.

•Functions and bookshops

It has of a lot of functions incorporated in the own language, for the treatment of strings, numbers, archives, etc. Besides, exist a lot of bookshops that can matter in the programs to treat specific subjects like the programming of windows or systems in network or things so interesting like creating archives compressed in .zip.

2.7 Design of the Electronic System NFC

Andl design of the electronic part, consists of the plate Arduino Yun and the module NFC with his respective elements that conform an electronic circuit.

These elements that conform the electronic circuit are used to to be encapsulados generally of ceramic material, metallic or plastic and are designed to be connected between them usually by welding.

Once chosen the main component for the development of the electronic system NFC, proceeds to make the interconnection between the plate Arduino Yun and the module NFC where makes the following:

Establish the communication SPI between the two electronic modules

The SPI is a synchronous protocol that works in way full dúplex to receive and transmit information, allowing that two devices can communicate between himself at the same time using different channels or different lines in the same wire. ()

Inside this protocol defines a teacher that will be that device commissioned to transmit information to his slaves. The slaves will be those devices that commission to receive and send information to the teacher.
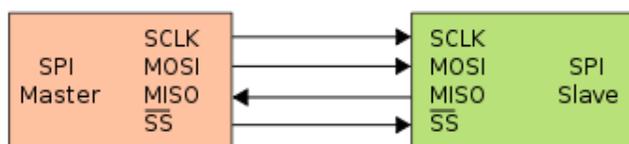
Figura. 4. Protocol SPI.

•MOSI (Master Out Slave In): Line used to carry the bits that come from of the teacher to the slave.

•MISO (Master In Slave Out): Line used to carry the bits that come from of the slave to the teacher.

•CLK (Clock): Line from the teacher commissions to send the signal of clock to synchronise the devices.

•SS (Slave Select): Line commissioned to select and to his time, enable a slave.
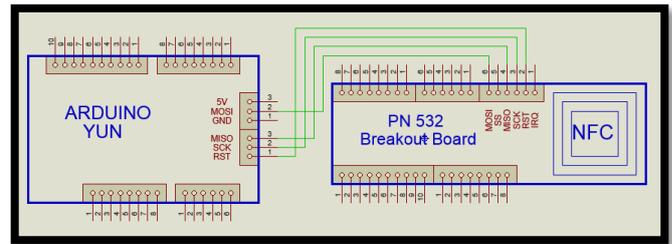
Figura. 5. Connection Plate Arduino Yun and NFC.

2.8 Politics of the Company

The company AIRMAXTELECOM S.A., founded on 07 July 2010 and situated in the city of Ibarra, offers services of Internet to his six hundred customers, in different coverages. In the actuality the company AIRMAXTELECOM S. To., it puts to disposal the service of transmission of data (Internet) to the inhabitants of the Canton Ibarra (Alpachaca, Caranqui, The Sagrario, The painful of Priorate, San Francisco, The Hope, Saint Antonio), Otavalo (Peguche, González Suarez, San Juan of Ilumán, Saint Pablo, Saint Rafael), Cotacachi (The Sagrario, San Francisco, Apuela, García Moreno, Quiroga), Antonio Ante (Andrade Marín, Atuntaqui, Imbaya, Natabuela), Pablo Sands, Saint Blas.

This service offers by means of the network of wireless access. According to statistics obtained of the company AIRMAXTELECOM S.A. shows that the access to the service of Internet in the course of the years has increased , by what also increases the quantity of report of telephone calls so that it offer the technical support by some falencia in the service of the network of telecommunications. By the exposed, has considered the need to propose an electronic system for the register and sending of information to the employees of the company for like this can solve the big demand of users that report incidences in the service.

Process of acquisition of the service of internet: The service of internet can it to him purchase in the offices of AIRMAXTECOM S.A., the customer has to present his cédula of citizenship and provide all his data to the personnel of attention to the customer.

When it have signed the agreement of provision of the service of internet, proceeds to register the day and the hour of installation of the service.

Process of installation of the service of internet: The technical personnel of the company reviews in the register of installations and proceeds to recolectar the materials and to have of the technicians that went necessary for the installation, in said moment go out of the company to make the installation to the domicile of the user.

Process of attention to the customer: The user of AIRMAXTELECOM S.A. makes a call to the company reporting a damage in his service, the personnel of attention to the customer takes the call and proceeds to report the

damage with a member of the available technical department, the user awaits in the telephone line while the technician reviews the state of the service of said customer. If the damage can it to him resolve in the course of the telephone call the technician will have finished an incidence without problems. If the problem no can it to him solve in the course of the call ingresará like an incidence which will have to be attended in the domicile of the customer in a lapse of 48 hours. If in the moment in that it registered   the incidence does not exist the personnel to assist to cover said damage then will have to expect to that they arrive the technicians so that they are designated to repair the damage in the domicile of the customer.

Process of attention to the customer in the domicile: When it exist the available technician to move   to the domicile of the user will have to review the direction of the incidence and the damage that is arising in the user. When finishing the review of the service in the domicile of the user the technician has to return to the office and give of drop this incidence since it was fulfilled successfully.

2.9 Final design of the Plate NFC

One of the considerations to take in account in the design of the electronic system is to replace the connections of the protoboard by the design of a small plate done in bakelite, with the end to reduce the space of connection of electronic components.
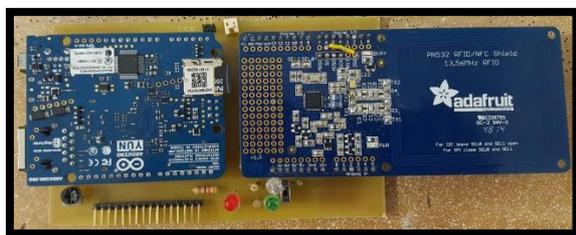
Figura. 6.   Plate NFC finished.

A bakelite of copper, allows to adapt the electronic components of better way regarding posture and fixation of the same, besides allows to interconnect them by means of the design of a track of copper and helped of the tin to fix each terminal of the electronic components used.

2.10 Software of management of the System NFC

The software of management of the system of control of access NFC contains a web page, by means of which the administrator will be able to add new employees, register activities for each one of them, verify the schedules of entrance and exit of the personnel and make a management in general of each employee.

Figura. 7.   Main page of the System NFC.

Each one of the links that contains the main page of the system of control of access NFC, help to the administrator to carry a register of management of user in the company.

2.11 Application Android

To make the register of access in the system is necessary to have installed the application electronic diary.apk, which this encoded in code QR in the main page of the system.

Figura. 8.   Application electronic diary in QR.

This application finds lodged in the server web, which can be downloaded by means of the reader of codes QR.

To make the register of access in the system, is necessary to validate the direction MAC of the Smartphone, that is to say by means of the application of Android will be able to make the validation of an only user in the system NFC.

3. Results

By means of the electronic system of control of access NFC already implemented in the company AIRMAXTELECOM, obtain the following results after a week of operation.

In the figure 100 indicates all the employees of the company AIRMAXTELECOM that have been assigned in the system of control of access NFC.

Figura. 9. List of employees Registered.

With the system of control of access NFC in the company AIRMAXTELECOM arrives to determine the following.

•The employees of the company AIRMAXTELECOM if they fulfil with the schedule established in the new politics of the company described previously. The hour of entrance to the company in to the 08h00 of the morning.

This verifies in the report weekly that finds in database by means of the web page of the system of control of access.

It proceeds to verify the report of schedules of entrance and exit of each one of the employees of the company AIRMAXTELECOM.

The schedules to verify are of the week of 18 April to 22 April as it indicates in the following figures.

Figura. 10. Employee Santiago Vásquez.

Figura. 11. Employee Geovanny Almeida.

Figura. 12 . Employee Renán Arias.

By means of the results obtained after a week of use of the system of control of access NFC, determines that the company AIRMAXTELECOM S.A. carries registers of each one of his employees, as well as the registers of the electronic diaries envoys to each user.

4. Conclusions

It designed the electronic system NFC that allows to carry a control of assistance of entrance to the workers of the company AIRMAXTELECOM S.A. which helps to identify the hour of arrival and exit of the technicians those who also through the electronic diary reenviadas to his Smartphone, know his daily activities what facilitates the attention to the customer.

It made a new alternative of control of assistance and sending of information for the company, which allows to save the data of the hour of entrance of the workers to the institution, presenting an advantage regarding the times that needs each employee to make his work out of the company by means of the use of the electronic diary.

It effected the theoretical and technical investigation of the characteristics of the plate Arduino Yun and of the module NFC, where each module was adapted of correct way by means of the protocol SPI which allows that it exist a communication Full Duplex doing that the plate Arduino Yun actue like Teacher and the module NFC like slave.

It made the communication between the database and the web page so that the data received by the reader NFC, hours of entrance and exit, are stored in each user for like this can carry a register of control of access.

It designed the software of the system of control of access NFC, which allows that there is a management of each one of the employees that work in the company, by means of the register of hours of entrance and exit of the personnel, generating like this report of weekly or monthly schedules of the workers.

It carried out the proofs of operation of the system NFC concluding, that the employees of the company respect the schedules of entrance and exit by means of the monitory of control of access that carries out to each user, giving like this scope to the attention of incidences and report of all the customers that the company possesses.

It has verified that the technology NFC finds in big growth, this can extend and consolidate in the market,

since to theprinc ipio was alone for mobile devices Smartphone and has extended in the market to other devices like Smart Tv, communication between mobile terminals and parlantes and other diversities of products more.

The greater obstacle in the realisation of this project was the development of the applications since it requires at least a basic knowledge of the programming languages to understand the commandos and the instructions that use to attain the communication and the back reception.

The cost of the implementation of the project if it is accessible for any company since the profits that this system offers, allows to generate management in the users, which carries to have a greater performance in the hours of work of the personnel, for like this improve the quality of attention to the customer in the company by means of the use of the electronic diary.

Bibliographic references

[1] SANNA PASANEN (2013). Bluetooth Security Attacks: Comparative Analysis, Attacks, and Countermeasures. EE.UU: Editions Springer. First Edition.

[2] DARÍO BUGLE (2010). Introduction to the identification by radius frequency. Madrid: Electronic Editions. Third Edition.

[3] LUIS GODÍNEZ (2010). RFID, NFC Opportunities and risks, his practical application. Spain: Editions CRC. First Edition.

[4] SYED To. AHSON (2008). RFID, NFC Handbook: Applications, Technology, Security, and Privacy. EE.UU: Editions CRC. First Edition.

[5] HENRY DUNAT (2013). White book on the application of the technology NFC in the Public Transport. Madrid: Editions ITS. First Edition.

[6] JUAN MORENO (2013). Practical applications of NFC. Spain: Editions TIC. Third Edition.

[7] MAGAZINES And ARTICLES

[8] JUAN ARMENDARIS (2009). Comparative analysis of the technologies RFID, HID and AWID. Scientific article.

[9] INTERMEC (2007). The ABC of the systems RFID and NFC. Technical documentation.

[10] SILVIA GÓMEZ (2012). Influence of the technology NFC in the society. Scientific article.

[11] LAURA CAVALIER (2012). Report Near Field Comunication (NFC). Technical documentation.

[12] THESIS

[13] ESTEFANÍA TORRES (2012). Electronic system for control of access of people by recognition of footprint dactilar, with remote authentication in database through a WLAN . (Unpublished thesis of Engineering). North Technical university, Ibarra, ECU.

[14] CLAVIJO ZHINDÓN CHRISTIAN ANDRÉS (2014). Design and implementation of a system prototype of residential security through the networks of stage And.P. (Unpublished thesis of Engineering). University of Cuenca, Cuenca, ECU.

[15] NATALIA SÁNCHEZ MORENO (2010). Application of evaluation based in NFC (Near Field Communication). (Unpublished thesis of Engineering). University of Madrid, Madrid, ESP.

[16] BYRON R. VALENZUELA M. (2015). Plate of training for electronic applications with mobile terminals based in operating system Android. (Unpublished thesis of Engineering). North Technical university, Ibarra, ECU.

[17] JAIRO BRYAN NAVARRETE ENRÍQUEZ (2015). Prototype g.t.s.b-1 (glove translator of basic signals), for people with auditory disability and of language. (Unpublished thesis of Engineering). North Technical university, Ibarra, ECU.

[18] DIEGO FERNANDO SWIFT CHÉRREZ (2010). Design and implementation of a prototype for control of access of people applying the technology NFC by means of the use of compatible mobile phones with this technology. (Unpublished thesis of Engineering). National Polytechnical school. I remove, ECU.

[19] Elena Vicente García (2011). Development of an application of control of access and systems of identification by means of the technology NFC. (Unpublished thesis of Engineering). University of Madrid. Madrid, ESP.

[20] GUSTAVO OF JESÚS LÓPEZ COLD (2013). Design and implementation of software and hardware of a recorder of electrical variables with communications Ethernet based in technology Arduino and system of supervision HMI. (Unpublished thesis of Engineering). Polytechnical school of the Army. I remove, ECU.

[21] URLS

[22] JAVIER PENALVA (2013). NFC What is and for what serves? Recovered of: http://www.xataka.com/moviles/nfc-que-es-y-para-que-sirve

[23] CAMERON FAULKNER (2015). What is NFC? Everything you need to know. Recovered of: http://www.techradar.com/news/phone-and-communications/what-is-nfc-and-why-is-it-in-your-phone-948410

[24] JAIME RGP. (2013). The labels NFC What are and How use them? Recovered of: http://computerhoy.com/paso-a-paso/apps/etiquetas-nfc-como-usarlas-que-sirven-4351

[25] ISABEL VALENCIA (2015). Android for beginners. How happen archives NFC. Recovered of: http://www.androidpit.es/como-pasar-archivos-con-nfc

[26] JESÚS GONZALES (2012). NFC (Near Field Communication). Recovered of: http://es.slideshare.net/eventoscreativos/nfc-en-mviles

[27] STEPHAN SCHOLZ (2018). Architecture and solutions of NFC. Recovered of: http://www.uco.es/users/jcheca/cong/pages/pon/soluciones.pdf

[28] SANTIAGO VICENTE (2011). Webseminar NFC. Operation, use and implications of security. Recovered of: http://es.slideshare.net/larsete/nfc-funcionamiento-usos-e-implicaciones-en-seguridad?related=2

[29] IES BORGA (2013). NFC Remote connections in Databases. Recovered of: http://es.slideshare.net/gdgmallorca/nfcconexiones-remotas-a-bases-de-datos?related=3

AUTHOR

SANTIAGO VÁSQUEZ; nation in Ibarra on 28 June 1989, sand graduated of bachiller in the speciality of Mathematical Physicist in the Experimental Educational Unit Teodoro Gómez of the Tower, in Ibarra. At present it is graduate of the north Technical University in the Career of Engineering in Electronics and Networks of Communication.