NFC Based Student Control Application

Fatih Başçiftçi, Hamza Yaraş, and İbrahim Ertekin

***Abstract*—In recent years, the studies have been going on for faster and more secure data transfer. With these studies, the world has turned to this area with multitude of mobile devices and a new technology which makes life easier has been developed. This technology is called Near Field Communication (NFC). NFC is the communication technology between electronic devices using radio frequencies. Owing to the secure elements on the NFC, it has provided the opportunity to develop the applications such as banking, entry/exit where a high level of security. In this study, it was investigated how Android platform, Android NFC support and the Java platform can be used for example control systems. It is aimed to be used NFC applications in places where using cards to enter and exit (schools, stadiums, office buildings, etc.). By making various improvements in this control mechanism, a different perspective is provided. The aim of the study is to prepare an interactive structure with the user, which provides easy transition with NFC Control Application. In this study, a system was carried out for entrance and exit of schools which are managed and kept under the control by a phone that allows NFC support. With this system, a faster and more reliable structure is presented.**

***Index Terms*—Android, java, near field communication, mobile, radio frequencies.**

I. Introduction

Near Field Communication (NFC) is the wireless communication standard. NFC technology was developed by Sony and Philips in 2002. The emerging technology was soon acknowledged and in 2003 it was accepted as the standard by the International Electrotechnical Commission (ISO) and the International Electrotechnical Commission (IEC). In 2004, Sony, Nokia and NXP came together to form the NFC Forum. The purpose of the established platform is to identify development standards and protocols for NFC technology, as well as to inform users about NFC [1].

NFC technology does data transmission with a bi-directional logic. It can send and receive data in short distance (2-4 cm) between two devices supporting NFC technology. Doing it in a short distance prevents any device from connecting and seeing the connection. In this way, the security problem has been minimized. It operates at a radio frequency of 13.56 MHz. The speed is 424 Kbit /s at most. NFC technology is divided into 3 as working principle [1].

a) Reader/writer mode: This mode provides communication with 2 devices supporting NFC. One of the devices is active while the other is in a passive position. The active device allows data to be written and read on the passive device. It is based on the data being written to the NFC cards and the other devices to be prompt by reading the data written on this card. Smart labels and smart posters have been developed by this way of use. It is also used in the field of health and education. Fig. 1 shows the communication between the phone and the NFC card [2]. It is compatible with ISO14443 and FeliCa work schemes.

b) End-to-end mode: This mode allows two devices with NFC support to send and receive data to each other. There is bi-directional communication. It allows you to share data such as virtual business cards or digital photos. It supports the ISO/IEC 18092 standard. Fig. 2 shows the mode of operation [2].

c) Card emulation mode: This mode is a device with NFC support on one side and the other is a service provider system with NFC support and service. The data that comes with the service provider system can be used for various jobs. Payment systems and control systems are built on this mode. Fig. 3 shows the mode of operation [2].

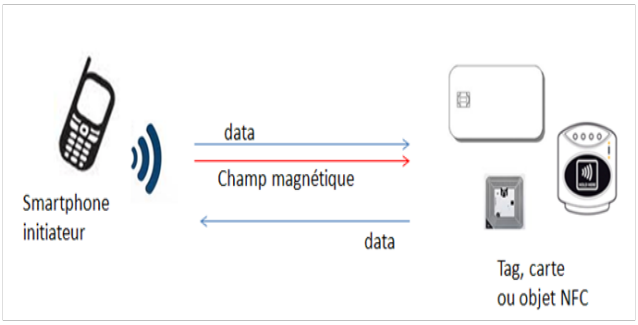

Fig. 1. Reader / writer mode.

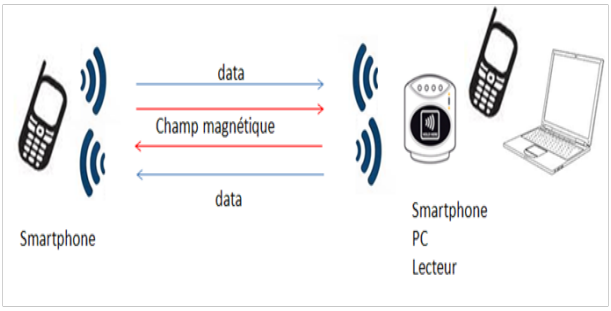

Fig. 2. End-to-end mode.

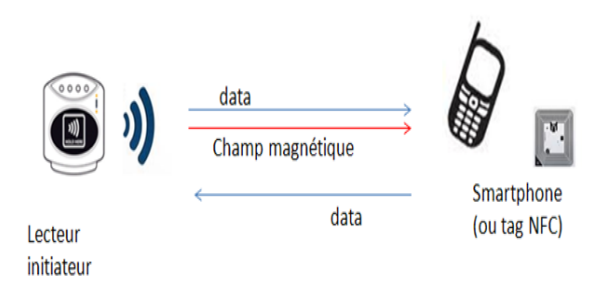

Fig. 3. Card emulation mode.

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With NFC technology starting to be used on mobile devices, tablets and other electronic devices, it becomes usable in our lives. In parallel, studies on NFC technology have also increased. Some of them are as follows.

In Yilmaz and his colleagues' study in 2014, NFC tags were placed on products. It is an internet based system which ensures that information is kept up to date. As a result, NFC tags have made shopping fast and efficient [3].

In Sungur and his colleagues' study in 2016, attendance taking was conducted with mobile devices supporting NFC for university, high school and secondary school students. With the NFC technology, a more useful and reliable attendance taking system has been aimed [4].

In the study done by Türk in 2016, the reasons for the use of NFC in payment systems, the properties of NFC and the modes of use of NFC technology have been mentioned [5].

In a study conducted by Işık and his colleagues' in 2015, a structure was developed by using NFC to address all of the visual, auditory and tactile sensations that an individual with mental disabilities could use alone or with an instructor. It is emphasized that the features of NFC technology can also facilitate the lives of mentally handicapped individuals [6].

These studies emphasize that NFC is the technology of the future. It shows that it is faster and safer compared to similar technologies. In line with these considerations, a study called "NFC Based Student Control Application" has been carried out. Study is aimed to use in places where it can be accessed by card (school, stadium, work places, etc.).

An identity card loads the phone. Other systems provide a more manageable system by moving the control structure to a single device. It facilitates tracking. This technology can also be used in many different areas. Education can be adapted to many systems in the banking, transport and entertainment sectors. These systems can be customized to their needs and become more effective and efficient for end users.

II. Application

This study consists of; an application to be installed on a mobile device which has an Android operating system and NFC support, a desktop application to record students and track student entries, and a Windows Communication Foundation (WCF) service that enables data exchange between the databases in which student information is stored and the desktop application.

A. Database

Microsoft Structured Query Language (SQL) Azure is a database service located on the Windows Azure platform of the SQL Server product which is relational database engine used on regular physical servers. SQL Azure provides ease of use, cost-effective scalability, high availability and reduced administrative costs thanks to it is cloud-based system; hence it is preferred in this study.

B. WCF Service

Windows Communication Foundation (WCF) is a Web service developed by Microsoft to develop applications for Service Oriented Architecture (SOA), which enables applications on stand-alone machines to communicate with each other. Today, WCF services are the most used method for communicating between systems. Microsoft Azure is preferred because it is faster, easier to set up, and more practicable when coding WCF services. The WCF service was designed to manage the desktop application's database and was implemented in Microsoft Visual Studio 2015 in C#. Fig. 4 shows the service installed on Microsoft Azure.

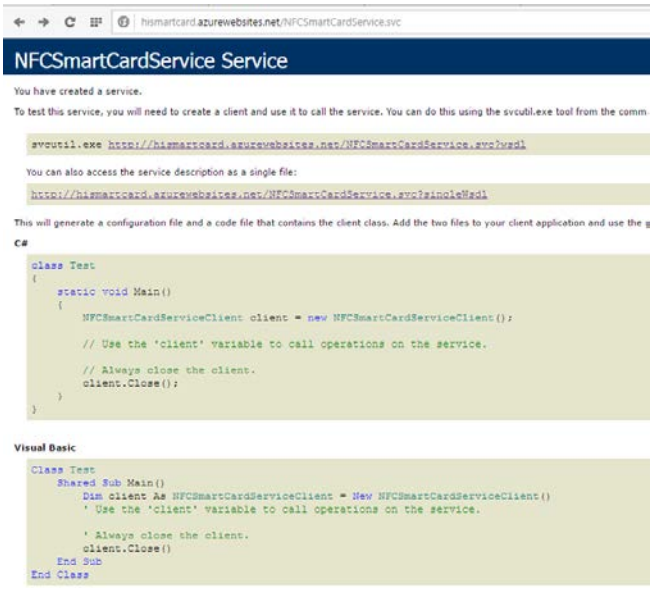

Fig. 4. WCF service.

Fig. 5. Mobile application.

C. Mobile Application

The mobile application part of the project has been developed in the Android Studio editor for the android operating system, which is open source. The purpose of the mobile application is to send the necessary information to the desktop application with the NFC device. In this part, "International Mobile Equipment Identity (IMEI)" and "Subscriber Identity Module (SIM) Serial Number" of the phone are obtained through the telephone and SIM card information provided by the Android operating system and transmitted to the desktop application it is transferred. The mobile screen designed in Fig. 5 is shown.

D. Desktop Application

Programs developed with Java are independent of operating systems. The reason for this is that all operating systems support Java. Because it is mobile and WCF service support, Java programming language is preferred and NETBeans is used as editor.

The desktop application handles data received from mobile using WCF service to control the database. These; If the student is not registered in the school database, registeration of the student, and if the student is registered, the entry process'are recorded with the dates.

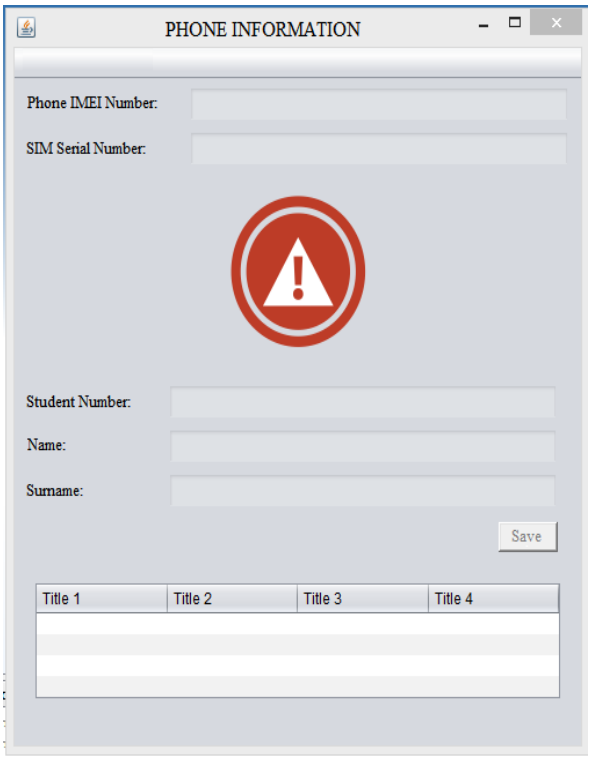

Fig. 6. Desktop application.

Fig. 6 shows the information from the "Phone IMEI Number" and "SIM Serial Number" in the application. If the student is registered in the database, "Student Number", "Name", "Surname" and "Entry Table" will be displayed. If the student is not registered, the student can be registered to database by filling the active fields. Fig. 7 shows the flow diagram used in the desktop application.

III. Result

The application has been developed on NFC technology because of the NFC-enabled devices that are becoming widespread today. The cards will leave the functionality to the mobile devices. NFC-enabled mobile devices will be able to use it as an identity. It is aimed to have a faster and more secure system in the control structure in fields like the university entrance, dining hall, sports hall etc. by mobile access with the NFC system; it is aimed to make the mobile devices which are a part of our life more functional by getting rid of the extra cards. NFC, which is called a future technology, will be in our lives.

The results obtained in Table I show the success rate. The success rate indicates that the data communication between the NFC device and the mobile device is correct and accurate.

TABLE I: Success Rate

Model	Number Of Users	Rate
Sony	94	%91
LG	72	%87
Samsung	53	%83

TABLE II: Average Reading Time

Model	Number Of Users	Time(sec.)
Sony	94	2.4
LG	72	2.8
Samsung	53	3.7

The results obtained in Table II indicate the average reading time. The average reading time indicates the communication time between the NFC device and the mobile device. From this result, Sony model mobile devices have been found to be more suitable for the application.

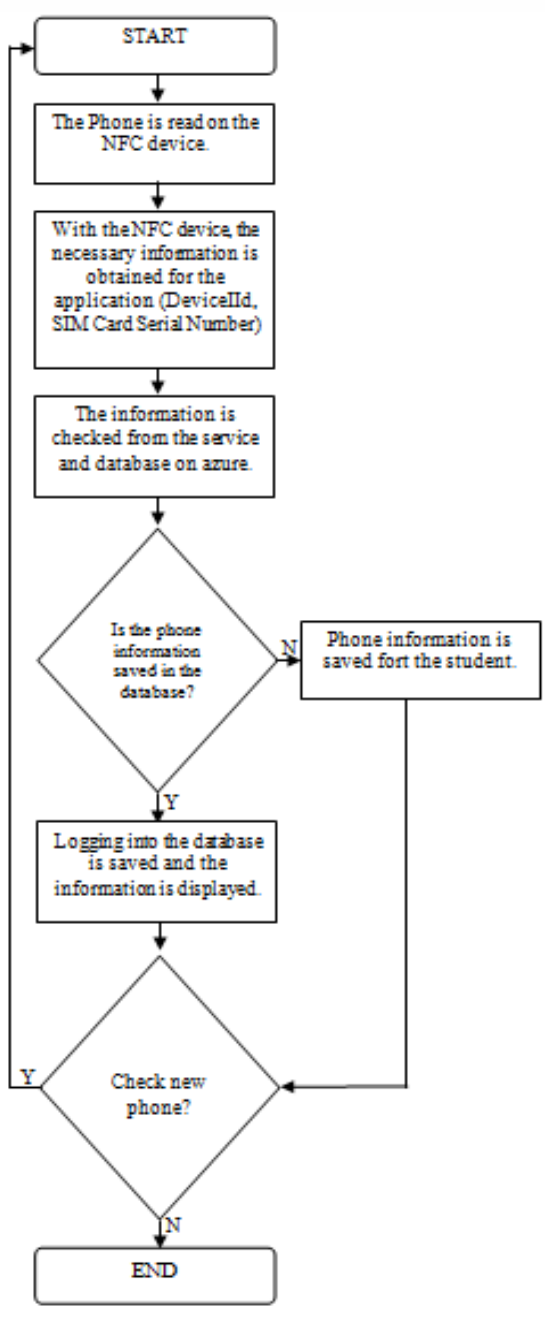

Fig. 7. Flow diagram.

IV. Discussion

System is used by the phone to ensure that security vulnerabilities that may occur during card entry and exit are avoided.

The management and execution of platforms with a large number of users will become easier and faster with this tracking system. Due to its ease of use, this system becomes open to many innovations and developments. With this technology, the solutions those cards and other materials present will carry a single platform to facilitate transport and use by the user.

Acknowledgment

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