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# Development of a Radio Frequency Identification Based Attendance Management Application With A Pictorial Database Framework

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## Abstract

Radio Frequency Identification (RFID) is a technology that incorporates the use of electromagnetic coupling in the radio frequency portion of the electromagnetic spectrum to uniquely identify a person, animal, or object. The main benefit of using RFID is that it does not require direct contact scanning. This paper presents an RFID attendance system, with a pictorial database framework. In this RFID system, each individual is given an RFID tag, 125 kHz in this case, which is generated by the antenna embedded in the RFID reader. The tag contains an integrated in-built circuit that stores and processes information through modulating and demodulating of the radio frequency signal that is being transmitted, and the data stored in this card is referred to as the identification/attendance of the person.

**Keywords:** *Attendance, Identification, Database, RFID.*

## 1. Introduction

Radio Frequency Identification (RFID) is an automatic identification system that stores data and information on devices like RFID tags and RFID readers. The RFID tags are usually electronically programmed with data or information of the personnel or object for the purpose of identification. RFID tags can be read from just a few meters away or can be read from a distance far from the line of sight, depending on its frequency. The RFID reader has an antenna that transmits the radio frequency waves which the tags receive [1], [2], [3], [4].

Most educational institutions are concerned about student attendance. Lateness can affect the performance of students in their academic pursuit. The old methods of taking attendance, such as signing of paper attendance (which is stressful, time wasting and not always accurate), calling of students names (which can take a long time to complete, and will not show what time the student came to class) have proved to be time consuming and ineffective. This has led to institutions resorting to better ways to effectively monitor attendance. Technologies have arisen to help such cases, such as biometric methods, radio frequency identification (RFID) methods and the combined RFID and biometrics systems. The need for an efficient and consistent attendance system in any organization is of definite importance as this will ensure accurate attendance in such an organization and reduce the extra time taken to manually sort out attendance issues. This work which includes an RFID Attendance system with a pictorial database framework is used as the means to tackle the attendance issue using Covenant University as a case study.

In Covenant University, attendance is still taken manually mainly at the class level which can be a challenge most times as it is tedious and inconsistent. This inadequacy has led to this project on how the Radio Frequency Identification (RFID) technology can be used as a solution to the attendance issues in Covenant University. As a means of accomplishing this, the design is made up of an RFID System and an Application for Storing and retrieving the attendance of the students. The RFID system includes an RFID tag with data that is read by the Reader and connected to the application for proper collation of the Student's attendance at the classroom, Chapel, Hall attendance, and any other place needing attendance.

## 2. Materials and Methods

The Attendance system is based on the working principles of an RFID System, using Visual Studio 2012, as an IDE (Integrated Development Environment) to develop and run the system. The Attendance system works in such a format that RFID Tags which have unique numbers (identities) are matched to a student. This means that each student is given an RFID card that is unique to him/her. Passive RFID Tags were chosen because they don't need a power source to operate, as they are stimulated when they get close to the electromagnetic field created by the RFID reader [5], [6], [7], [8], [9].

This Attendance system operates in such a way that when a student passes the RFID Tag close to the RFID reader, the number associated with the tag is captured by the Reader, and sent to the Attendance Application, which records the student's attendance in the database, also displaying the student's picture for verification. The student's attendance register is also collated by the attendance system, which returns the student's attendance percentage. The block diagram of the system is shown in Figure 1.
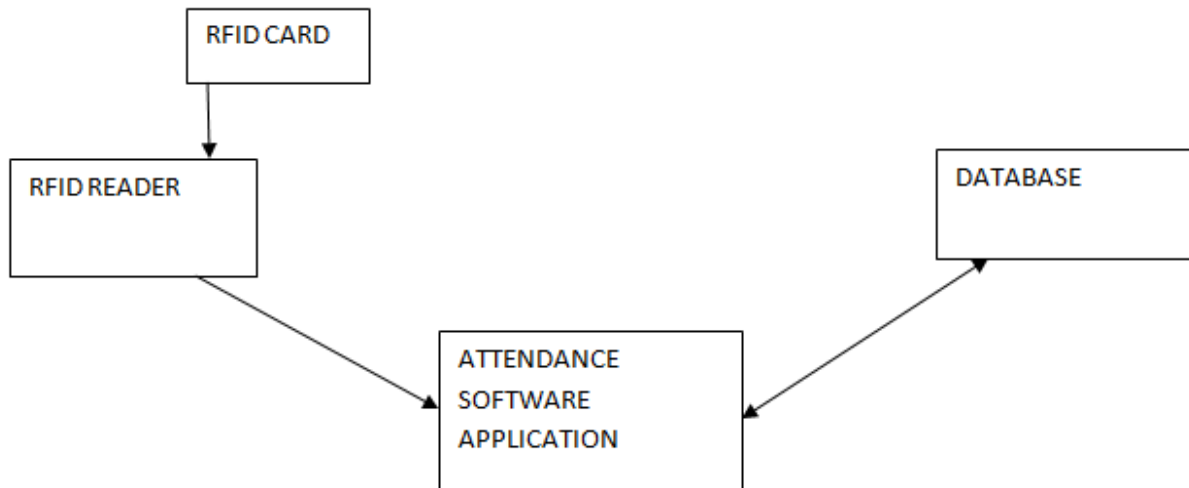


Fig. 1: Block diagram of the RFID Attendance Based system

This system makes use of the RFIDREAD-µRW-USB (125KHZ), which is designed to read and write Hitags, EM4100, EM4205, EM305 and T55xx/67/xx transponders/tags. The RFIDREAD-µRW-USB RFID module at its core, generates a magnetic field through its integrated antenna at 125 kHz, or 134 kHz. The Passive tags also have an in-built antenna that tunes to the same frequency. When the tag comes near the range of the reader module, it draws power form the electromagnetic field to power itself. Once powered, they modulate the magnetic field which is detected by the RFID reader. This way, the Tags transmit their data to the Reader module. The EM4100 Transponder is a type of RFID Tag that can be read from the RFID reader. However, data can't be written to the EM4100 Transponder, which is one of the disadvantages. It comes with its company assigned number, which is a simple string of 10 ASCII coded Hexadecimal character. The Microsoft visual Studio is an IDE (Integrated Development Environment), where the attendance system was built and designed. It offers several programming languages such as: Visual Basic, Visual C#, Visual C++, Visual F#. The Version used was the Visual Studio 2012, and the programming language used for the project was Visual C#. The Virtual Serial Driver software creates virtual ports, as the number of physical ports or physical connections may not be available for communication between ports. Datasnip is a communication port to keyboard redirection program. Characters arriving from the port of the Computer would be transferred to the application needing it. In our attendance system, the RFID numbers arriving from the RFID reader was redirected to the visual studio attendance application, which is on another port [10], [11], [12], [13].

**2.1 Student Data Entry Interface**
This is the interface where the details and personal information of the student are imputed, and sent to store in the database. This interface was designed using visual studio, and programmed in visual c#. The student data entry interface for our system is shown in Figure 2.
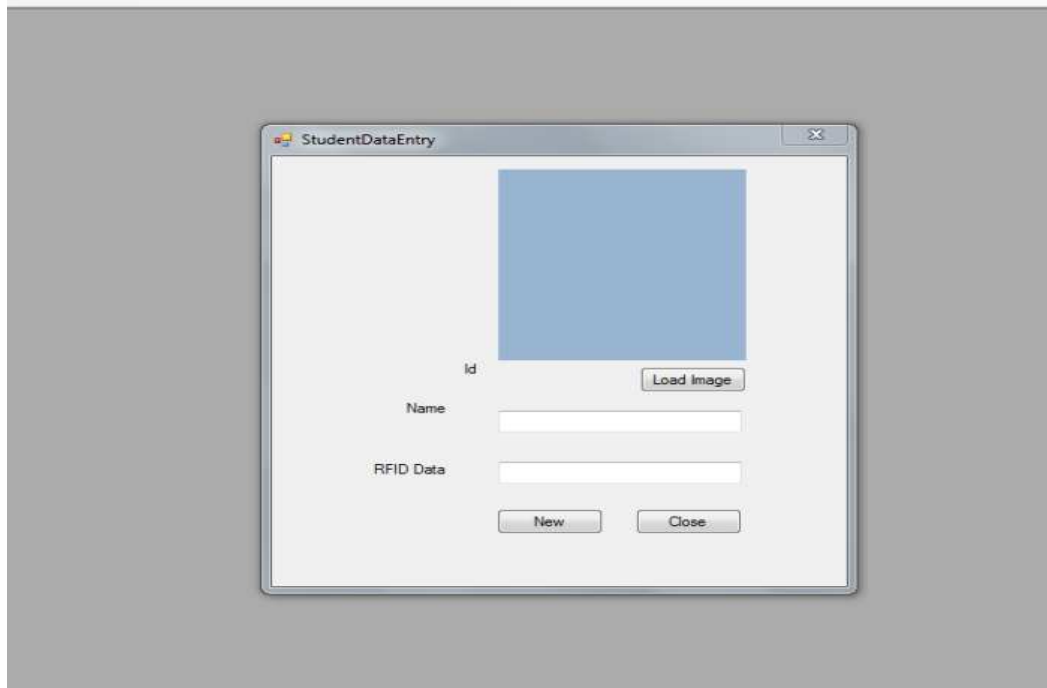


Fig. 2: The Student Data Entry Interface

**2.2 Attendance System View Interface**

This is the interface where the student's attendance will be taken; it also displays the image of the student for verification and can show the percentage of the student's attendance. It is shown in Figure 3.
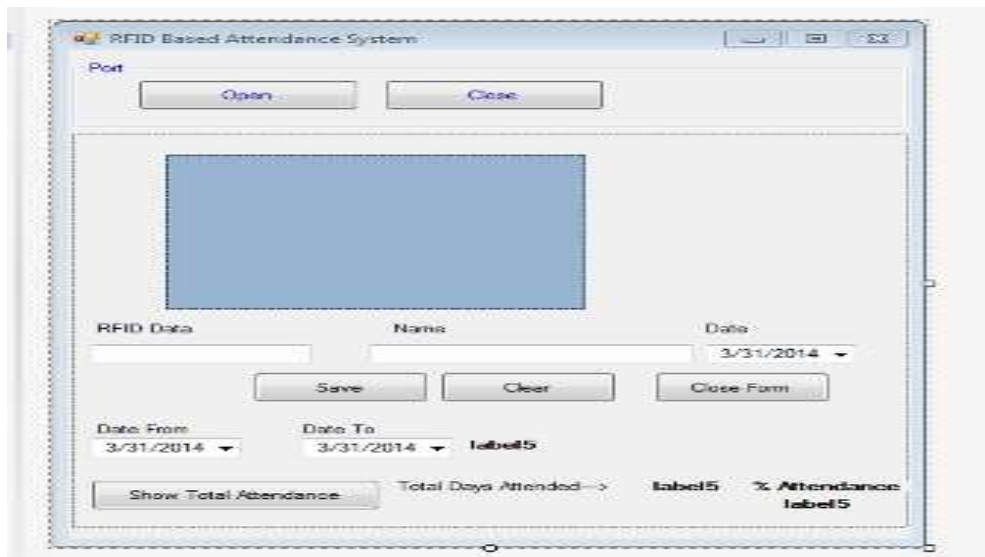


Fig. 3: The Attendance System Interface

**2.3 Menu Interface**

This is the interface which brings a drop down list where you can select the Student Data Interface, and the Attendance View Interface. It is shown in Figure 4.
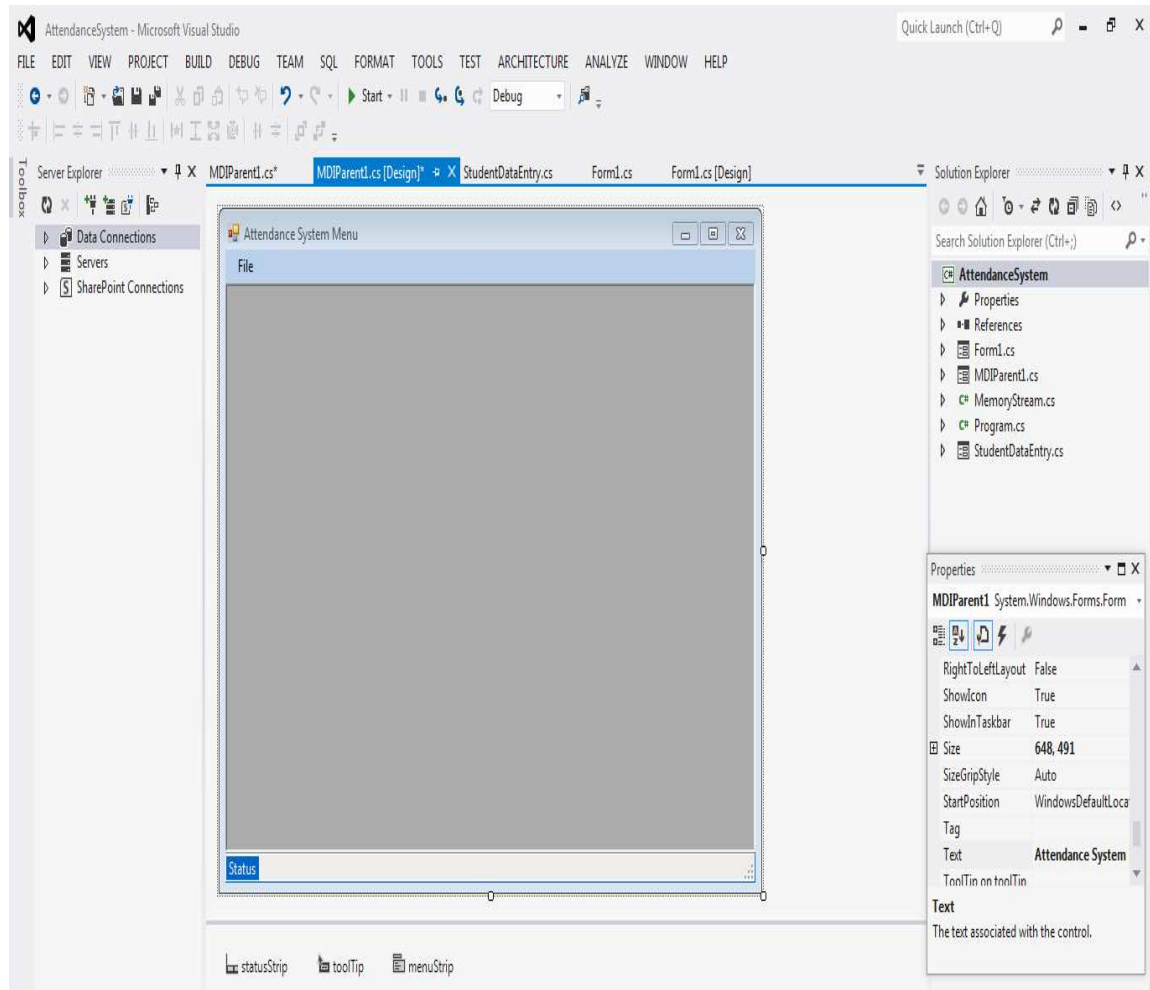


Fig. 4: The Menu Interface

**2.4 SYSTEM DATABASE**

A database is needed to store the information retrieved from an RFID reader. The database used was the Microsoft Access database. The Microsoft Access database was chosen because it was easier and simpler to understand and interact with, than other databases. Two tables were created to store the data; the first table is the "Student Data" table that is linked to the Student Data Entry Interface of the visual studio application, where the input of the User is stored. The second Table is the Attendance table that stores the attendance of the student, and is linked to the Attendance Interface of the Visual studio application. These tables are shown in table 1 and 2 respectively.

Table 1: Student Data Table

| Field Name | Data Type | Description |
|---|---|---|
| StId | Number | Identification Number |
| RFID | Text | RFID Number |
| SName | Text | Name of Student |
| Image | Text | Location of the Student's Image |

Table 2: Attendance Table

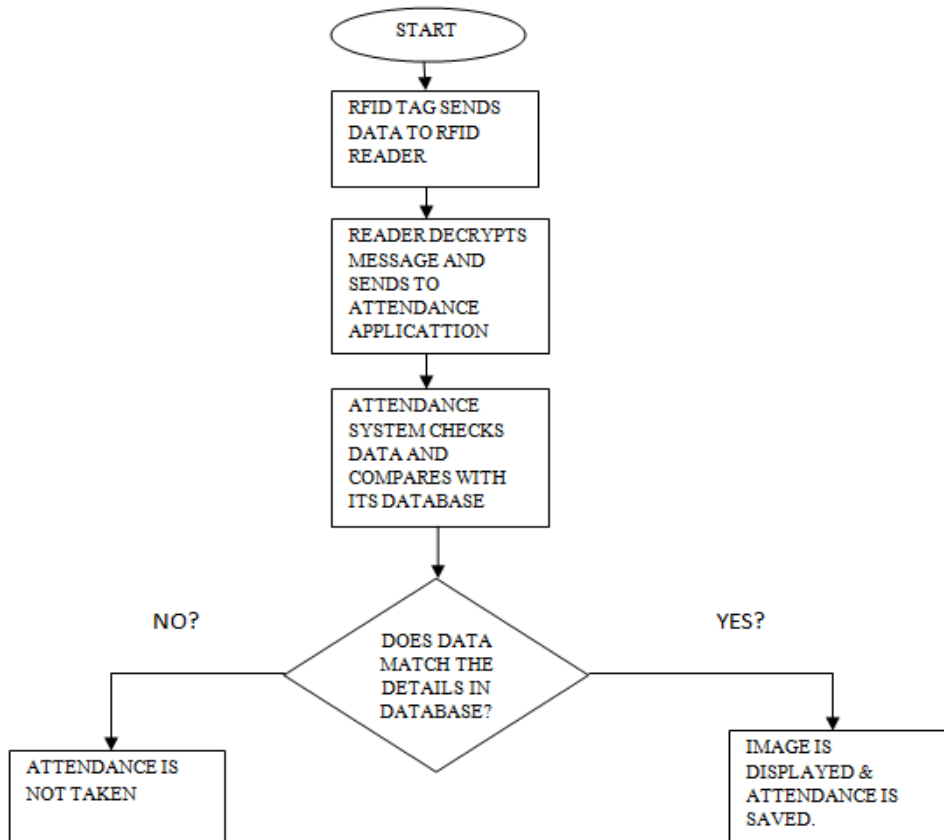| Field Name | Data Type | Description |
|---|---|---|
| SNAME | Text | Name of Registered Student |
| ADate | Date/Time | Attendance Date |

The flow chart of the RFID system is shown in Figure 5.



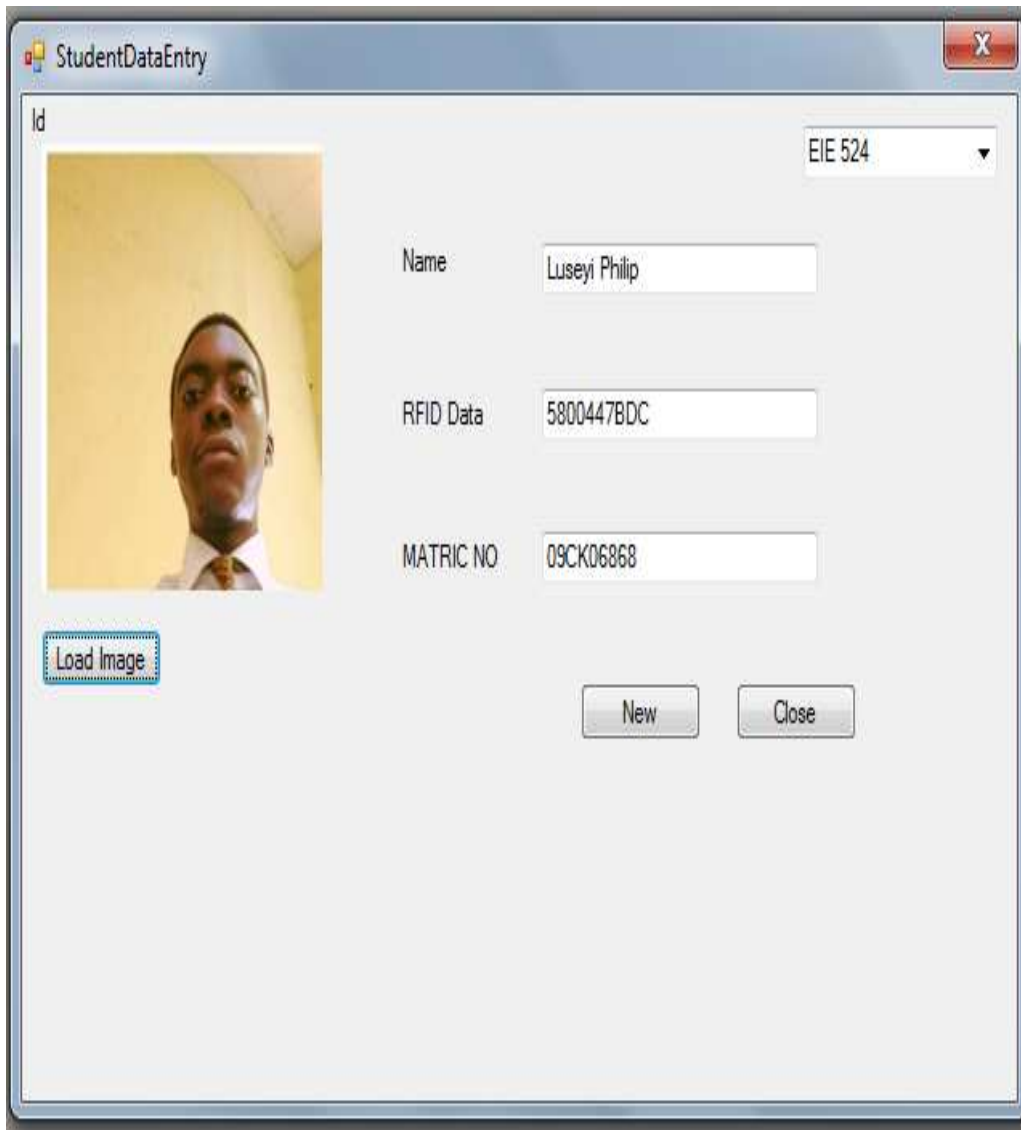Fig. 5: Flow Chart of the RFID Attendance Monitoring System

## 3. Results and Discussions

For the application to Record Attendance the following actions are taken:
1.  Connect the RFID reader to the Computer.
2.  Open the Attendance application
3.  Open the "DATASNIP serial to keyboard redirection", set the port in which the RFID reader is connected and click start redirection.
4.  When the Attendance application opens, Select the Attendance register, click open port, and then place the RFID cards on the RFID reader, to begin saving the attendance.

Figures 6, 7, 8 give a pictorial view of the results derived from the RFID attendance system.
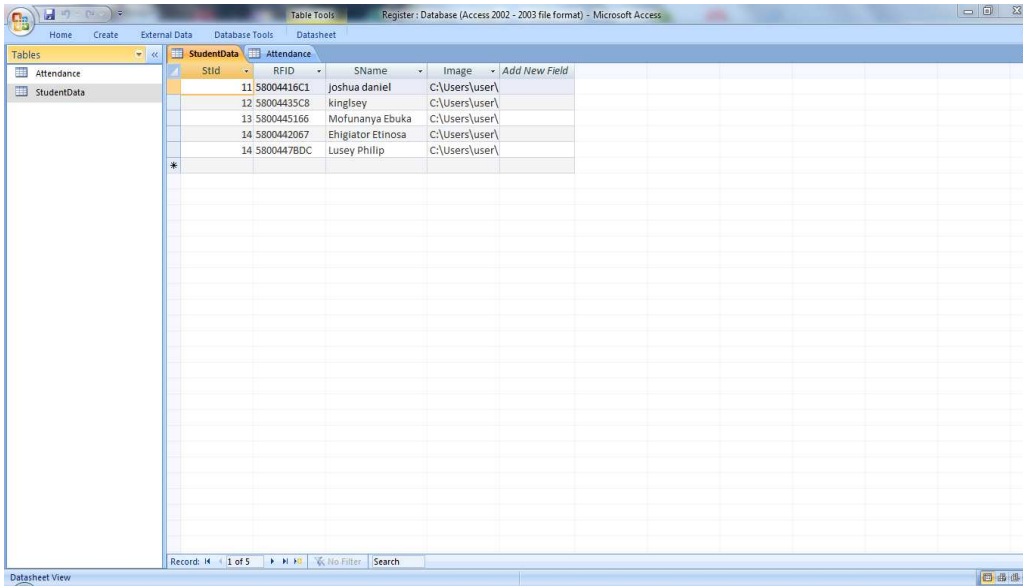


Fig. 6: Student Data Entry Stored in the Database.
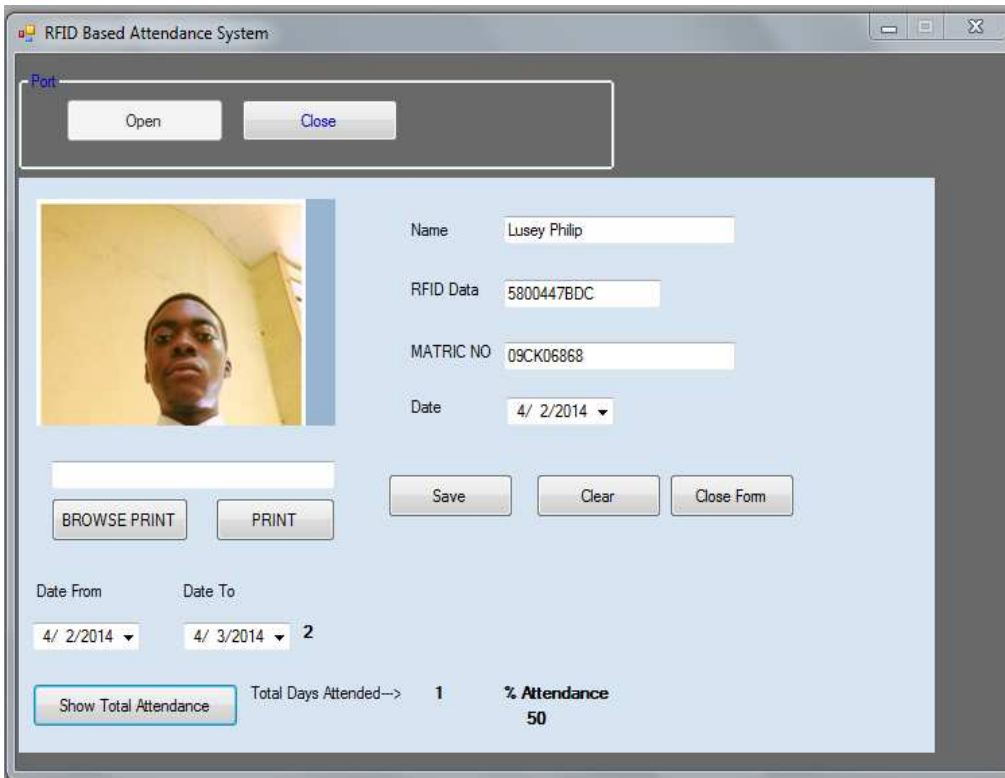
Fig. 7: Students Data Input into the Database.



Fig. 8: Attendance Capture of the Student.

## 4. Conclusion

The development of the technology in the world has enhanced human activities and made life easier in certain areas. Manual attendance also has to give way to the technological advancement of the world. Therefore the attendance solution of the System implemented, has helped to deal with the issue of taking and compiling attendance manually, as this eliminates a student taking attendance for another student, and

the application calculating the percentage attendance of the students. This system is simple and easy to operate, and it is also cost effective, as the application is computer based, and only requires the RFID reader and card externally. Through the implementation of this system, accurate attendance capture has been guaranteed, reducing tedious manual capture and eliminates human errors in attendance taking.

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