

NFC Based Attendance Monitoring System with Facial Authorization

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Abstract- In today's world, speed and efficiency is what needed to reduce the time of work and performance of an individual or a system. There are alternatives available to speed up the process but it's too costly to be purchased by everyone. Hence we are proposing a system called as NFC based attendance monitoring system with facial authentication. This will help in speeding up the attendance monitoring system in schools/colleges/universities and thereby reducing the time for taking attendance by the tutor.

Index Terms- Automated Attendance, Facial Authorization, NFC, Raspberry Pi.

I. INTRODUCTION

NFC [Near Field Communication] as a technology has number of advantages. The technology of NFC is based on a wireless communication interface that has been around for quite a while, based on the technology of Radio Frequency Identification (RFID), which uses "magnetic field induction to enable communication between electronic devices" [1]. Attendance for school, colleges etc is a necessity. Smart system for school & college attendance using NFC Technology is an automated process, financially cheap & a system providing accuracy. The important aspects of this system are: - NFC reader(Raspberry Pi), Student id tag(NFC tag). The Raspberry Pi, features a powerful ARM processor, a 3D graphics processor capable of generating high-definition video, 512 Megabytes of RAM, and a SD memory card connector for our files[2]. Raspberry here will act as a reader device. The Reader device will be placed at every classroom. This attendance system can be used by school, college, university, by using NFC in android/ linux OS based Raspberry Pi device. The student/staff simply tap their android device to the NFC reader device to sign in their attendance. This Application will generate a final report of attendance sheet of an individual student. On the basis of report generated the percentage of attendance can be efficiently calculated. This system detects the entry tag and exit along with facial authorization. This kind of Authorization definitely would avoid illegal attendance marking, skipping of classes by an individual student. For avoiding misuse or an unauthorized attendance this system is embedded with a facial Authorization camera which would recognize face of a particular staff/student etc. The hardware required for a

NFC based Attendance monitoring System is Raspberry PI and a NFC module and a camera module. This makes it low cost system and a user friendly application. Total execution of the system will be done by software as well as hardware; this will make an ease for high authorities to regulate an attendance monitoring throughout the month or a particular period. Research in motion (RIM), creators of the blackberry smart phones started the use of NFC. According to survey in upcoming years NFC will be largely used by most of the population expecting 30% NFC enabled phone in 2014[9].

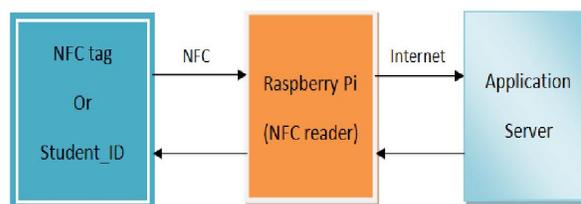


Fig 1: NFC enabled system design

1. The basic scope behind this system is the Attendance monitoring of staff/student. This system comes in focus when Attendance is to be regulated using NFC.
2. The problems related to unauthorized/illegal attendance can be skipped because of its highly secured features.
3. Actual in time of an staff/student/employee can be traced out. With the help of the system overall attendance can be figured out.

II. RELATED WORK

Developments in networked and mobile technologies now provide us with more methods than ever for supporting children in their transition between home and school [3]. For example, locational systems can be used to make sure that children are safe on their way to school [4]. In 2010, "Mari Ervasti", "Marianne Kinnula", "Minna Isomursu" resulted a system which was based on NFC tags of students, NFC reader(Staff Mobile phone). Students need to touch their cards onto the teachers Mobile phone which would be acting as an NFC reader. As soon as the tag is touched that attendance would be marked at the back-end and even delay can be noted. This wastes lot of time of teacher before the lecture and even can waste lecture time[5]. In 2012, "Mohammad Umair Yaqub" proposed a system which stated student would be having an NFC based phone which they would tap on teachers phone before the start of the lecture. The teacher will upload attendance on the server after the lecture. Then it will be saved on the database. Student can achieve a final report after the end of the semester, make payments etc[10]. In June 2013, "Samuel King Opoku Computer Science Department,

Manuscript received September 13, 2014.

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Kumasi Polytechnic, Ghana”, proposed an system which included biometric authentication i.e. Bluetooth & NFC based phone authentication along with fingerprint reading authentication. NFC tag of an student is touched according to entry tag or exit tag on their phone then after their phone’s Bluetooth address will be sent on to the terminal if that was found in database then they will be asked for finger print scanning, if this was matched authentication was successful otherwise it fails !. This provides double authentication but is time wasting and lengthy process involving fingerprint reader device[6]. In december 2013, “Vishal more”, “Surbhi Nayak” proposed a attendance monitoring system where they just modified the existing system which was developed in 2010 by “Mari Ervasti”, “Marianne Kinnula”, “Minna Isomursu”. They made changes in the time stamp i.e. the entry tag and departure tag made it easy to identify the time attended by an student. Everything was stored in database and an final report can be generated[7]. “Jakub Dvorak” have recently worked on “Attendance system using Raspberry Pi and NFC Tag reader”. He has developed system which consists Raspberry Pi as an NFC reader. User initially has to perform some actions regarding incoming or outgoing from class. Then after that he is asked to tap tag on the reader. All this is stored in MySql, which can be retrieved later. But this does not provide an authentication. Misuse or an illegal attendance can be marked of an individual student[8].

III. METHODOLOGY

A. Components

1) NFC

Working of NFC is similar to that of RFID. RFID works on detecting and comparing radio frequency. NFC working is based on magnetic induction. The reader emits an magnetic field which establishes an physical space between the reader and the tag. This magnetic field is received back in the emitter i.e. the tag_id which takes that in the form of electrical impulses. Working of NFC is around 13.56 radio frequency and working can be achieved between the distance of around 10cm. Tags may store data between the range of 96 – 512 bytes transferring of data may occur at a speed of 212Kb/s[11].

2) Raspberry Pi

The Raspberry Pi is a small computer where an SD card can be used for booting purpose. Linux can be installed easily with an advantage that it includes all the drivers



Fig 2: Architecture of Raspberry pi[2]

An NFC module will be interfaced with Raspberry Pi along

with an camera for authorization purpose. The NFC module to be used is ITEAD PN532.

3) Facial Authorization

For facial Authorization many open source software’s are available which can be used to lower the budget of the attendance monitoring system which involves facial authorization.



Fig 3: Recognition of an image stored in database

Working of Facial Authorization would initially store 2D images in the database, Facial authorization system involves accuracy more than 70% because the software is built up considering human face’s distinguishable landmarks. Distance between eye balls. Nose width, Cheek bone size etc are measured by the software. This are unique and distinguishable landmarks and hence can be considered by the software. It is easy if authorization involves 2D image. 3D image claims providing more accuracy then 2D images. 3D images uses distinct features of face such as rigid tissue, nose and chin. This features are unique and never change with time, hence this features make it easy to build software for recognising 3D images. Using of 3D software involves a series of steps. The series of steps combine to form an algorithm for recognising 3D images. This steps include Detection, Alignment, Measurement, Representation, Matching, Verification or identification.

B. Algorithm

Here the student is been registered initially at the Registration department. N number of students can be registered and their details are stored in the database.

1. The student taps his Tag id on NFC reader.
2. The Tag id gets validated.
3. If validation is successful then Face Recognition of that particular student takes place.
4. Else, if validation unsuccessful then that student is not registered in the department or the facial recognition of the student has failed (some other student attempts marking attendance of the individual).
5. If both i.e. Tag id and Facial Authorization are successful then attendance is uploaded on the database.
6. Stop

Admin can produce reports accordingly connecting the database. Admin can even update attendance through his particular account having some restrictions.

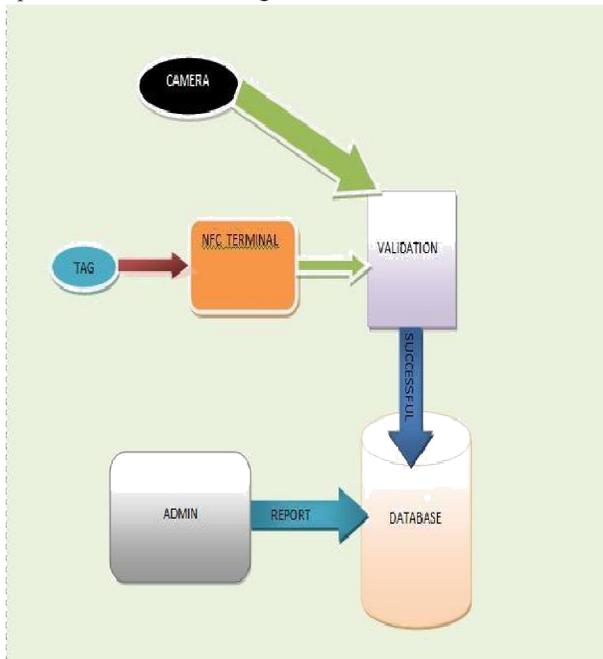


Fig 4: The actual implementation

C. Working

The Method to be implemented is very simple and not complex. The user is been registered initially at Registration department and then provided back with a unique Tag id; Here the user has a NFC tag which will be tapped on NFC Reader (Here NFC Reader is module of the Raspberry Pi). Raspberry Pi is a platform which makes the implementation easy and the most important factor cost effectiveness is satisfied, the raspberry pi is connected to an NFC module. As soon as tag is tapped on NFC Reader server will connect to database, as soon as connection is achieved, facial authorization through camera will take place and connection to database through server will be achieved to check validation; if validation succeeds, attendance will be uploaded and a confirmation/success message will be sent to user registered with particular mobile number. (If NFC tag Action is valid and Camera authentication is valid) then Upload attendance Else "Validation failed". If validation fails it means that a particular id_tag for which the validation failed was not registered initially or misuse of any other student's id_tag took place. Administration has power to generate reports and edit student information. The main aspect for an academic improvement is attendance. This system will provide a replacement to manual attendance and will save time.

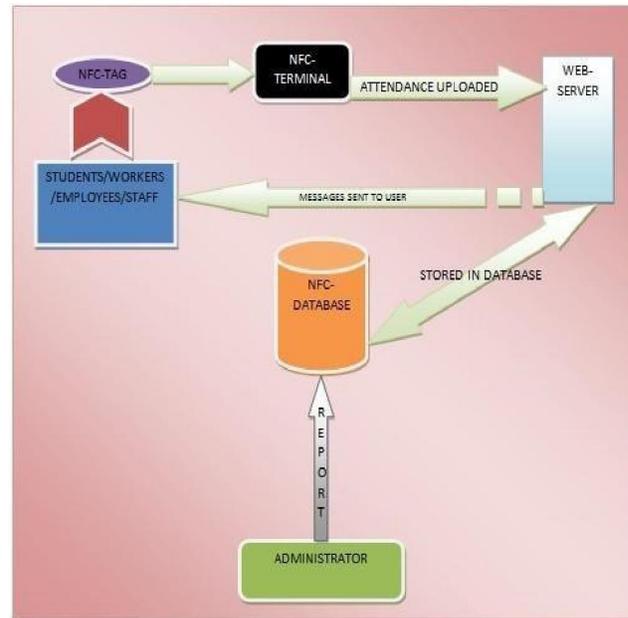


Fig 5: Tag id implementation

We are assuming that the proposed system will be used by students/staffs. There are some factors we will be assuming as per the user such as,

- [1] The user has tapped his id tag before a lecture start time or at the exact time or after the lecture started.
- [2] The user is connected with server as soon as he taps his id and if his valid id after tapping is responded with successful Attendance marked .
- [3] The user's NFC tag is activated, valid as well as registered on network.
- [4] Services of networks are activated. i.e. Internet.
- [5] The new user must have registered in the admin.

D. Equation

Let us consider that we have a database 'D' with 'n' number of attributes such as user name, id, address, photo etc.

$$D = \{A \mid A \in \text{Information of Student}\}$$

Here D is the set of all A such that A is information of user which is to be stored on server.

Consider following functions :

STORE (D, SERVER): Here Administration enter student's information into the database at server.

Let us consider that the receiver provides us with values 'X' for every input it obtains from the tag that is found on the Tag id of the student. So we can further assume to have a set 'S' to have values 'n' number of detected values at a particular instance. Let us denote the current situation in the following manner

$$S = \{X \mid \forall X \in D \exists ID \text{ for Tag}\}$$

Here S is the set of all X such that for all X there exists Id for tag.

Now, for some X value that matches with some value inside the database when Admin accesses database:

1. GET (D, X, SERVER): Admin get all information about Student from server.
2. PUT(X, SYM, P, SERVER): Here Admin will upload Students details on server also with Attendance.
3. GET(X, REPORTS, SERVER): Here Admin will gets Student's reports from server.

IV. CONCLUSION

Real time attendance is monitored without any wastage of time i.e. the time used for roll calls would be eliminated. Parents can consult teachers about the academic progress instead of calling their respective teachers for attendance. It provides implementation of new technology by teachers to achieve an overall attendance of an individual directly without any manipulations from attendance sheet. It can be noted that it is highly secured authentication system because of facial authorization and even students attending lectures can be easily noticed. No illegal attendance by other individuals because of this authorization.



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