# An Automated and Full-Proof Attendance Marking Scheme (TATTEND) Using Three Integrated Technologies

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**Abstract.** It is an established fact that we are facing difficulties in the attendance management. Presently the attendance in most of the organizations is marked manually on paper which is an error-prone process. Specifically, in educational institutions, a significant amount of time of both students and staff is wasted while marking the attendance manually. Further, there are additional malpractices like proxy and bunking which make this system flawed. To counter these problems, we propose a system *TATTEND* which achieves full transparency and it maintains the regular and accurate updating of the attendance in the database. The three technologies have been integrated to achieve a full-proof system for effective attendance marking. The concept is innovative and a fully automated one. The three technologies include the use of RFID, IR Motion Sensor and an Electronic Deadbolt.

**Keywords:** TATTEND**,** RFID (Radio Frequency Identification), IR (Infrared) Motion Detector, Deadbolt, Attendance Marking.

## 1 Introduction

*Radio-frequency identification (RFID)* is the use of an object (typically referred to as an RFID tag) applied to or incorporated into a product, animal, or person for the purpose of identification and tracking using radio waves. Most RFID tags contain at least two parts. The first part consists of an integrated circuit for storing and processing information, modulating and demodulating a radio-frequency (RF) signal, and other specialized functions. The second part is an antenna for receiving and transmitting the signal. There are generally two types of RFID tags: Active RFID tags, which contain a battery and thus can transmit its signal autonomously, and passive RFID tags,

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which have no battery and require an external source to initiate signal transmission. These tags obtain the energy from the magnetic field of the reader. They are smaller, cheaper and can be used for long time. Passive tags when placed near the reader, detects the radio signals which is generated by the reader. After detecting the signal it transmits its data to the reader. We are going to use passive tags for our application.

A *motion detector* is a device that contains a physical mechanism or electronic sensor that quantifies motion that can be either integrated with or connected to other devices that alert the user of the presence of a moving object within the field of view. An electronic motion detector contains a motion sensor that transforms the detection of motion into an electric signal. This can be achieved by measuring optical or acoustical changes in the field of view. Motion detectors are mainly used in for security systems. For example, motion detectors are typically positioned near exterior doorways or windows of a building for monitoring the area around the building. Upon detecting motion, they generate an electrical signal that is transmitted to a preselected audible alarm or lighting device which is then activated. For our application we are going to use an Infrared motion sensor. IR motion sensors have wide usage. They are also cheap.

A *Deadbolt* or *Deadlock* is a locking mechanism which cannot be moved to the open position except by rotating the lock cylinder. It is used for security to prevent intruders or any other unauthorized person from entering into a doorway. A deadbolt lock's job is to make it simple for someone with a key to move the bolt but difficult for someone without a key to move it. Deadbolt locks provide a door with extra protection because they are stronger than regular locks. This kind of lock cannot be bumped, picked or forced open. It can go with any door. There are several different styles of bolt locks, each made for a specific function. For our application we are going to use a deadlock which will open when the connected RFID reader intercepts a valid RFID tag.

In this paper a fool-proof system TATTEND was proposed to automatically detect the presence of an individual human. This system is going to function as an autonomous attendance marking system be it for students, staffs, employee in a company etc. This system makes the task of attendance management easier while allowing recording correct attendance status and making the same data available to all concerned. This can be made feasible by synchronizing a combination of RFID and IR motion sensing technology integrated with an electronic deadbolt.

The organization of the paper is as follows. In the 1st section we presented an introduction to RFID, Motion Sensor and Deadbolt. In section 2 of the paper we present some of the related work which has already been carried out in this regard. In section 3, section 4 and section 5 we describe about our proposed system TATTEND, a flowchart depicting its operation and step by step simulation of TATTEND. Section 6 discusses the significance of using our proposed solution and section 7 discusses some of the limitations associated with it. Finally some of the application areas where this proposed system could be used before conclusion.

## 2 Related Works

Though there are few research proposals that have already been proposed in this area but none of them is a full proof solution which is resistant to all sorts of malpractices in the attendance management system.

*Francisco Silva etal* [1] proposed architecture and a prototype of a system that uses distributed RFID over Ethernet. The system architecture is shown in figure 1.

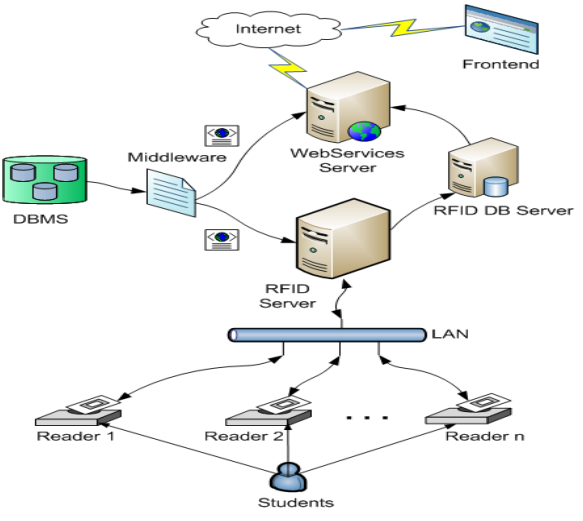


**Fig. 1.** System architecture as proposed by Francisco Silva et al.

In the proposed architecture one RFID reader is installed to each classroom. It is connected through LAN interface. RFID server, RFID DB Server, Frontend, Web Services Server, Middleware and DBMS which records the student attendance is present in this architecture. This system was used to mark the presence of students in an educational institution environment.

*Junhuai Li etal* [2] has proposed a scheme for Exercise Information System. The system architecture is shown in Fig.2.

It comprises the following layers: presentation layer, business logical layer, interface layer and data layer. The data layer acts as Database which stores information pertaining to each student and attendance data. The database interface provides access to the database while the hardware interface manages different types of hardware. The business logical layer organizes and realizes system business and the presentation layer provides user friendly interface. This system is based on RFID technology to promote students' attendance in extracurricular activities. It was used to analyze there fitness.

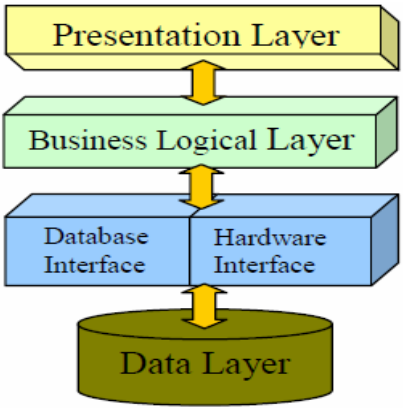


**Fig. 2.** System architecture as proposed by Junhuai Li et al.

*Sourish Behera etal* [3] proposed the use of UHF (Ultra High Frequency) tag for RFID Based Attendance Recording System. The overview of the system is shown in Fig. 3.

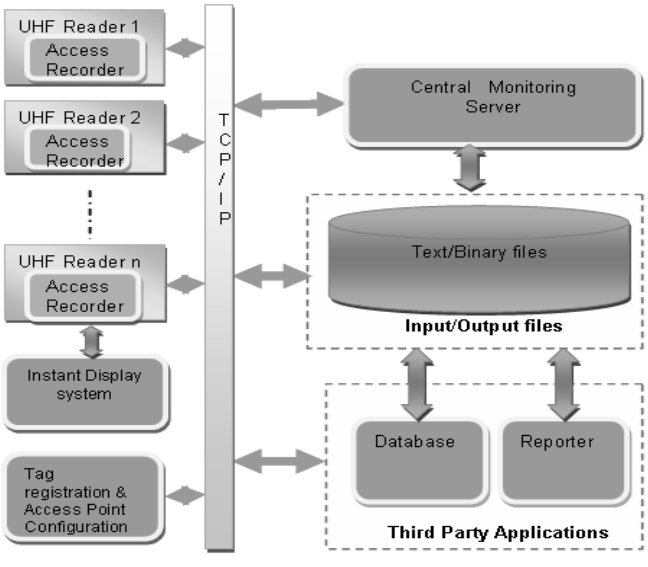


**Fig. 3.** Overview of the system proposed by Sourish Behera et al.

It consists of several UHF Reader situated in different areas. They are interlinked to each other and the main system over the TCP/IP network. The central monitoring server handles the actual collection of data and creation of reports. Here the

novelty lies in the utilization of UHF Antennae which makes the system completely ubiquitous.

These and other proposed systems though effective in the management of attendance but suffers from certain drawbacks. A person could carry several RFID tags (including that of his colleague) with him and get the attendance marked for all the RFID tags carried by him. It is difficult to trace out whether a person is carrying more than one RFID tag. Our proposed system TATTEND counters the malpractices and is a full proof solution in the management of attendance.

## 3 Proposed System

In the proposed solution to the stated objective of flawless attendance marking we are going to integrate three technologies namely RFID, IR Motion Sensing and Deadbolt. Initially a Smart Card (a RFID tag which is based on low frequency radio signal) Reader is installed with specifications according to the application. There will be two Smart Card Reader installed in a doorway – one each for entering the doorway and exiting from the doorway. A user who wishes to enter or exit through the doorway has to show his Smart Card in front of the Smart Card reader. The Smart Card has been configured before use and the required data pertaining to an individual has been electronically stored in it. A Smart Card has multiple read options i.e. it can be read multiple times by the Smart Card Reader. An Infrared (IR) Motion Sensor and an Electromechanical Gateway, using off the shelf [COTS] component are the other two major components used in our system.

The IR motion detector is used to detect the motion of the individual entering the doorway. It is placed just ahead of the electromechanical doorway. When an individual enters the doorway the IR Motion Sensor records his/her presence. Therefore, even if a person is carrying more than one Smart Card still the attendance will be marked for only one individual because the Smart Card reader and IR Motion Sensor are both synchronized. Only if a motion is recorded by the IR Motion Sensor the attendance for the intercepted Smart Card will be marked. The Electromechanical doorway will open when a valid Smart Card is placed in front of Smart Card Reader. It is used for both entrance and exit for an individual. The Electromechanical doorway automatically closes after allowing passage to an individual. The individual components are synchronized using middleware and controller board. A database is set up to store the required information. The database can contain whatever information is desired. In an educational institution the details regarding student, staff such as their name, registration number etc. and other pertaining data can be stored. A user interface program is provided to manage the work of the complete system.

### 3.1 Flowcharts

The following Flowchart shows the steps carried out during the entrance process of TATTEND -

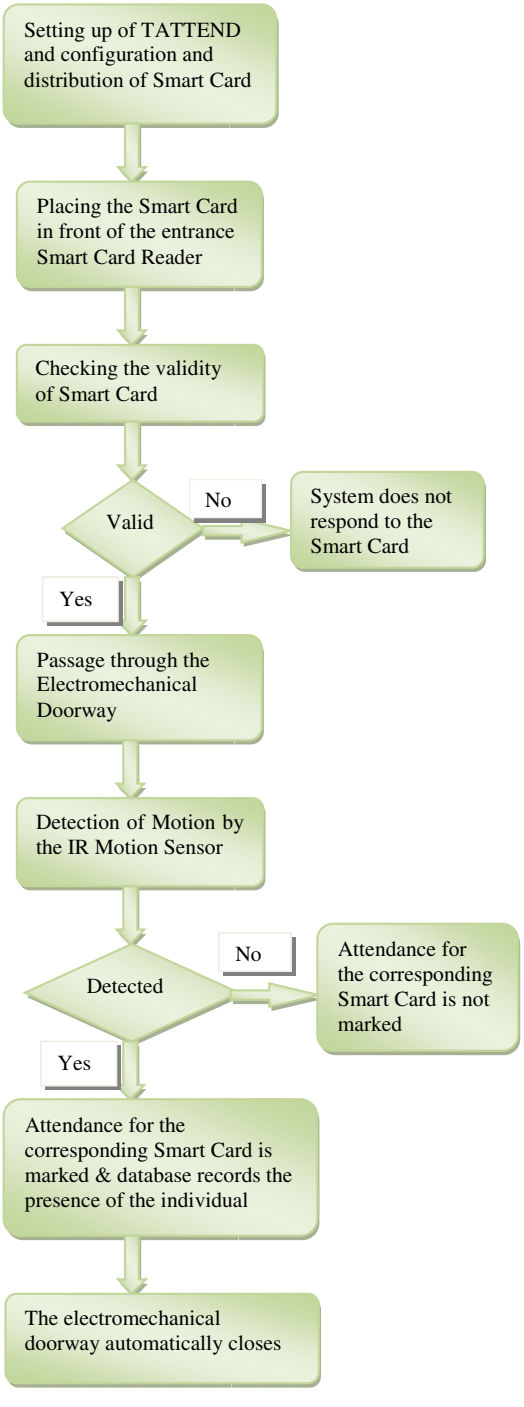


**Fig. 4.** Flowchart showing entrance in TATTEND

The following Flowchart shows the steps carried out during the exit process of TATTEND –

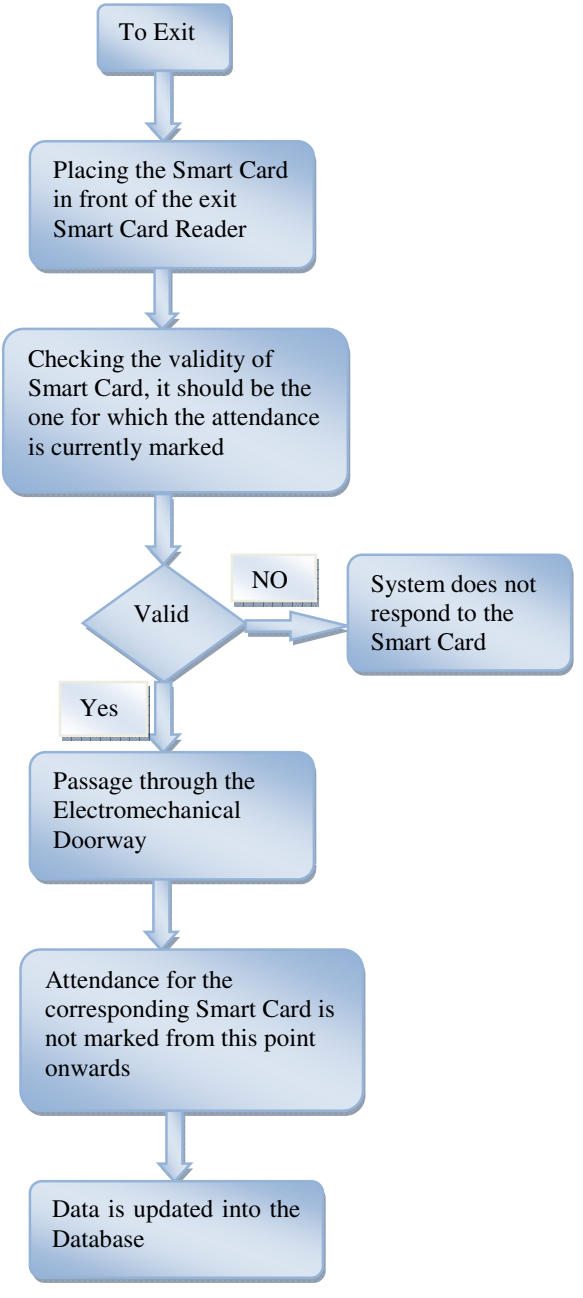


**Fig. 5.** Flowchart showing exit in TATTEND

## 4 Simulations

A step by step simulation to the preinstalled proposed system is presented here.

**Step 1:** A user places his Smart Card in front of the Smart Card reader in order to enter through the electromechanical doorway.

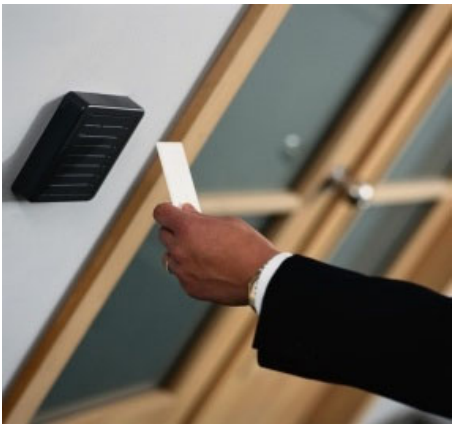

**Fig. 6.** A Smart Reader reading a Smart Card

**Step 2:** The Electromechanical doorway allows the passage to the individual on intercepting a valid Smart Card. Just ahead of the Electromechanical doorway is an IR Motion Sensor. If the individual passes through the electromechanical doorway then the IR motion sensor records motion. Only if a motion is recorded the attendance is marked for that individual. The doorway closes subsequently after allowing the passage to the individual.

**Step 3:** There is another Smart Card reader situated on the other side of the electromechanical doorway. When an individual wants to exit he/she again places the same Smart Card in front of the other Smart Card reader corresponding to which the electromechanical door opens. Now from that point onwards the attendance corresponding to that Smart Card is not counted. After allowing passage the electromechanical door closes again.

## 5 Significance

It is an established fact that we are facing difficulties in the attendance management. Presently the attendance in most of the organizations is marked manually on paper which is an error-prone process. Specifically, in educational institutions, a significant amount of time of both students and staff is wasted while marking the attendance manually. Further, there are additional malpractices like proxy and bunking which make this system flawed. To counter these problems, our proposed system achieves full transparency by maintaining the regular and accurate updating of the attendance in the database. The intrinsic process of this system is simple and reduces the

workload and maximizes the accuracy. Hence, our system highlights the importance of being physically present throughout the working hours as well as providing a sophisticated yet easy to use procedure for efficient management of a large database involving a big organization.

## 6 Constraints

TATTEND is by far a full-proof solution and is resistant against the malpractices in the attendance marking scheme. The attendance marking scheme is fully-automated with regular update of attendance. The installation cost though initially high but requires less maintenance. The initial LAN interfacing is also cumbersome. But keeping in mind the advantages the limitations can be accepted.

## 7 Applications

This system has wide variety of applications. In Institutes, it could be used for marking the presence or absence of an individual in regular academic classes, in auditoriums, Hostels, Libraries etc. It could be used at several workplaces including industries as an entry and exit marking scheme, instead of gate passes. Only a Smart Card is a must at all times.

## 8 Conclusions and Future Work

RFID is currently being used for a wide variety of applications. What we have proposed is a novel system which integrates three technologies namely RFID, IR Motion Sensor and Deadbolt. It is by far very useful in effective attendance management. It removes the present malpractices in attendance management and is a fully automated system for attendance marking. Thus it could be deployed at several places be it in Universities, workplaces etc. The initial cost is though a bit high but operational and maintenance cost is less. We are working on the cost factor to make the system less costly.

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