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Technical Note

Access Control System at PRL

by
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Access Control System at PRL

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Introduction

Controlling entry of employees into a campus is a prime security requirement for an organization like ours. Earlier, in most of the private and government offices a simple register, filled in manually, would record entries and exits of the employees. Such a register also served as record of attendance for the employees. As the technology advanced, the attendance system also got upgraded. Nowadays, there are a number of technologies available in various organizations to automatically identify the staff members and maintain records of their attendance in the office. Some of the widely used technologies are bio-metrics, finger print, eye retina, Radio Frequency Identifications (RFID) etc. The Access Control System at Physical Research Laboratory uses RFID cards for confirming employee's identity and timing of his/her entry and exit from the Laboratory premises. The RFID card readers are mounted on the top of the turn style gates installed at the entrance. An RFID card is issued to each employee of the Laboratory. It uniquely identifies him/her through the employee's payroll number. The RFID cards of PRL are compatible with all other DOS Units/ISRO Centers. The RFID cards issued to temporary employees, however, are not compatible with other DOS Units/ISRO Centers and work only at PRL.

The RFID system at PRL

The RFID System in PRL is provided by Access Computech Pvt Ltd, Ahmedabad. They have provided contact-less RFID Smart Card readers (Refer **APPENDIX – A** for details of the RFID cards, Card Readers, turn style gates etc). They have also supplied the software which stores data of all the employees who flash their RFID Card in front of a RFID Reader. This data is very useful to trace all the employees' attendance as well as their IN and OUT timings.

PRL has 8 RFID Readers right now. These readers can be configured to read IN and OUT timings of the employees. Out of these 8 RFID Readers, 4 readers (2 for IN and 2 for OUT) are installed at PRL Main Campus near parking area. These readers are attached with a turn style gate in the Main Campus. 2 readers (1 for IN and 1 for OUT) are hand-held type and are usually with CISF personnel at the security gate and 2 (1 for IN and 1 for OUT) are installed at Thaltej Campus. As soon as an employee flashes his RFID Card in front of a reader, the reader senses the data written into the card and releases the solenoid locking mechanism in the gate so that the tripod turn style gate can be manually opened by a gentle push. All these card readers are connected to the RFID Server through the Local Area Network (LAN) of the Laboratory. These readers have in-built memory which can store up to 500 IN/OUT transactions of Employees. The card readers also have a battery inside which provides back-up of 1 hour in case of the mains power failure. Following diagram provides location of RFID Machines.

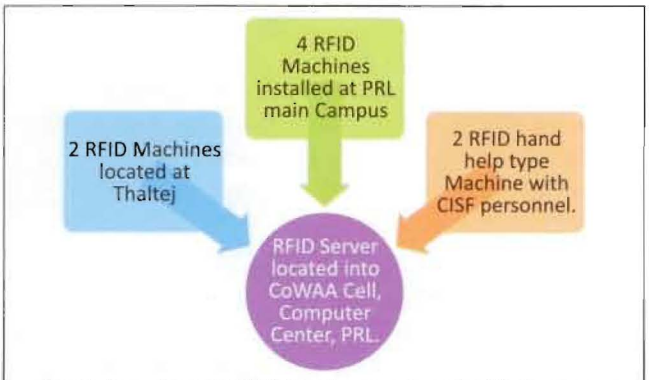


Fig. 1: Locations of RFID Readers connected with the server.

The Access Computech Pvt Ltd has provided a software which is based on **Visual Basic** as Front-end and **MySQL** as database. This software continuously logs IN and OUT timings of the staff members in the RFID Readers and fetches the data into the RFID server. This data is stored in **MySQL** Database (Refer **APPENDIX – B** for the software screen).

Whenever any employee, either a temporary or permanent, joins PRL, an RFID card is prepared and issued to him. His basic details are fetched from CoWAA[1] database ([1]*Computerised Working in administrative Areas (CoWAA) is an integrated software package developed at ISRO to enable computerized working in Personnel and General Administration, Accounts, Purchase, Stores and Finance.)* These data, along with soft copy of employee's passport size photo and signature is sent to Access Computech Pvt Ltd for printing on the card. Later on, these cards are configured in PRL to make them compatible with the RFID system established in PRL. This configuration is again divided into two types of flags:

1. **Permanent:** Permanent flag is set in the card only for a permanent employee so that his/her card will work with the other DOS Units/ISRO Centres.
2. **Temporary:** This flag is set in the card for a temporary employee of PRL. These cards will work only in PRL.

   The software provided by the Access Computech Pvt Ltd to log the transaction of IN and OUT stores data into the following format in the **MySQL** database.

   Database Name : **prlattend**

   Table Name : **punchdata**

   Table Fields :

   Empcode (e.g. if employeecode is 7832 it will store it as ABPR007832)

   Punchdate (Date of IN/OUT default format yyyy-mm-dd)

   Punchtime (Time of IN/OUT default format is HH:II where 'HH' stands for Hours and 'II' stands for minutes)

   Inout (A flag which states "I" for In and "O" for Out)

   Machineid (Machine id from which IN/OUT occurred)

As one can see above, the screen of a client PC machine is divided into three main parts.

Part 1) To provide Employee Code or select a Division or a Designation. At least, one of these three inputs must be selected.

Part 2) Date range for the data required. Selection of "**From Date**" and "**To Date**" is mandatory. One of the two radio buttons, "**All In-out Details**" or "**First in time and Last out time**" must be selected. Click on "**Send Mail**" if you want to send Emails to all Area Chairmen. The resulting report will appear in Part 3 after clicking the Submit button.

Part 3) This is a result area where output will be shown. After clicking the submit button a resulting report is displayed as a PDF page in the empty area below:

A nice date picker calendar is also provided to select "**From**" and "**To**" dates easily as shown below.

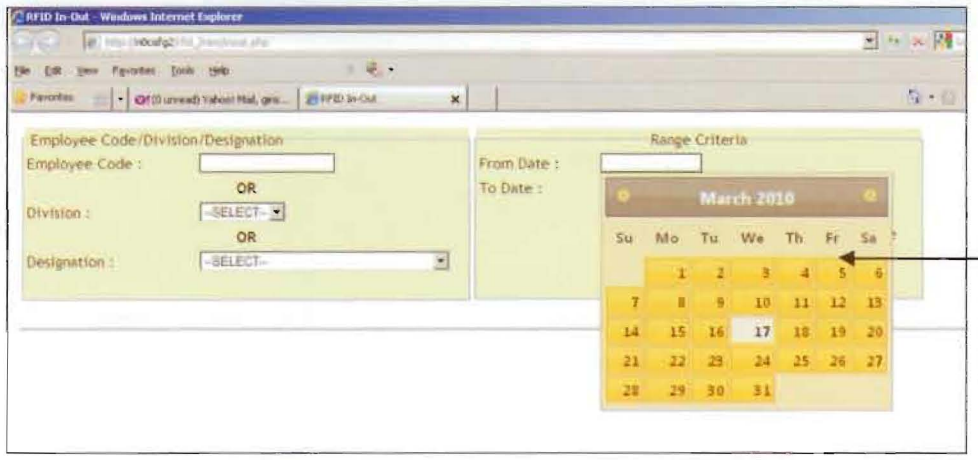


Fig.4: you can see nice date-picker in from date selection

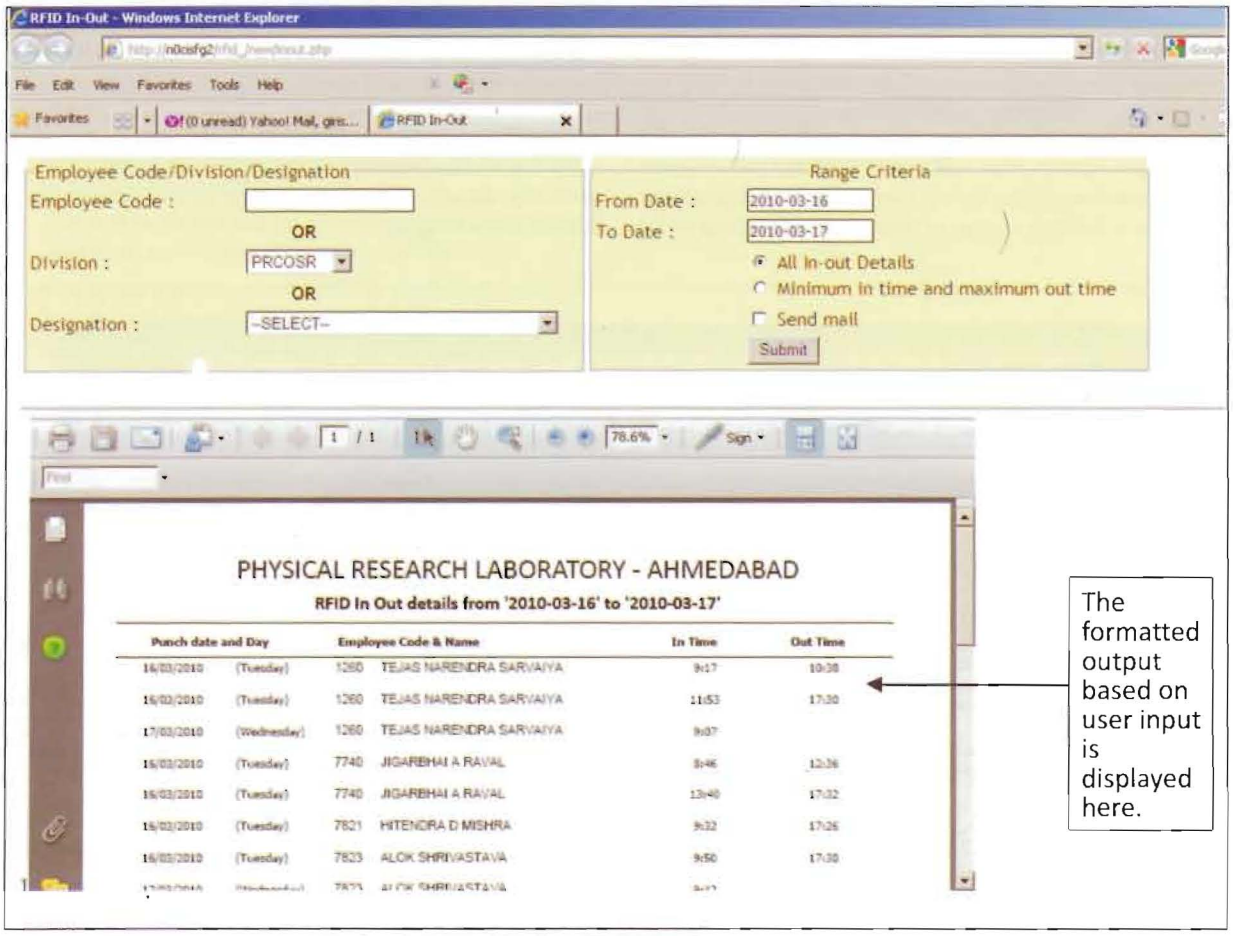


Fig.5: A sample output after giving input and clicking the submit button.

Thus, using a single screen, it gives outputs based on different criteria. Send Mail will work only if you have selected "All in-out details". If Division is not selected from the list, the mail will be sent to all the Area Chairmen otherwise the mail will be sent to the selected Division Area Chairman. It is very easy to provide necessary inputs and click on SUBMIT button to retrieve necessary information.

Details of the backend activities after submitting the input parameters

a. We need first to collect the data in our required format. The data into the database is in column format. Data shown below is a sample from actual the database. (The flag "inout" indicates, "I" for entering into PRL and "O" for going out from PRL for an employee in the corresponding row of the table).

empcode	punchdate	punchtime	inout	machineid
ABPR007832	2010-01-20	09:21	I	9
ABPR007832	2010-01-20	12:43	O	4
ABPR007832	2010-01-21	09:03	I	9
ABPR007832	2010-01-21	16:00	O	2
ABPR007832	2010-01-21	16:17	I	3
ABPR007832	2010-01-21	18:01	O	4
ABPR007832	2010-01-22	08:57	I	3
ABPR007832	2010-01-22	18:05	O	2
ABPR007832	2010-01-25	08:42	I	9
ABPR007832	2010-01-25	17:28	O	4
ABPR007832	2010-01-27	08:58	I	3
ABPR007832	2010-01-27	17:57	O	2
ABPR007832	2010-01-28	09:02	I	9
ABPR007832	2010-01-28	17:54	O	2
ABPR007832	2010-01-29	09:03	I	9
ABPR007832	2010-01-29	18:01	O	2

Table 1: Original data of RFID

b. This data should be changed into the row-wise format as shown below. We have separate data for employee code and employee name which comes from CoWAA. (Please see the color combination to understand the difference between the raw data and formatted data).

empcode	empname	punchdate	name of day	in time	out time	duration
ABPR007832	GIRISH PADIA	2010-01-20	Wednesday	09:21:00	12:43:00	03:22:00
ABPR007832	GIRISH PADIA	2010-01-21	Thursday	09:03:00	16:00:00	06:57:00
ABPR007832	GIRISH PADIA	2010-01-21	Thursday	16:17:00	18:01:00	01:44:00
ABPR007832	GIRISH PADIA	2010-01-22	Friday	08:57:00	18:05:00	09:08:00
ABPR007832	GIRISH PADIA	2010-01-25	Monday	08:42:00	17:28:00	08:46:00
ABPR007832	GIRISH PADIA	2010-01-27	Wednesday	08:58:00	17:57:00	08:59:00
ABPR007832	GIRISH PADIA	2010-01-28	Thursday	09:02:00	17:54:00	08:52:00
ABPR007832	GIRISH PADIA	2010-01-29	Friday	09:03:00	18:01:00	08:58:00

Table 2: Formated data of RFID

c. We created a database sub routine called procedure "**inout_detail_all**" in **MySQL**. After execution of this procedure, the data will be formatted as per the above output.

d. The procedure "**inout_detail_all**" has 5 parameters.

- Employee code
- Division Code
- Designation Code
- From Date
- To Date

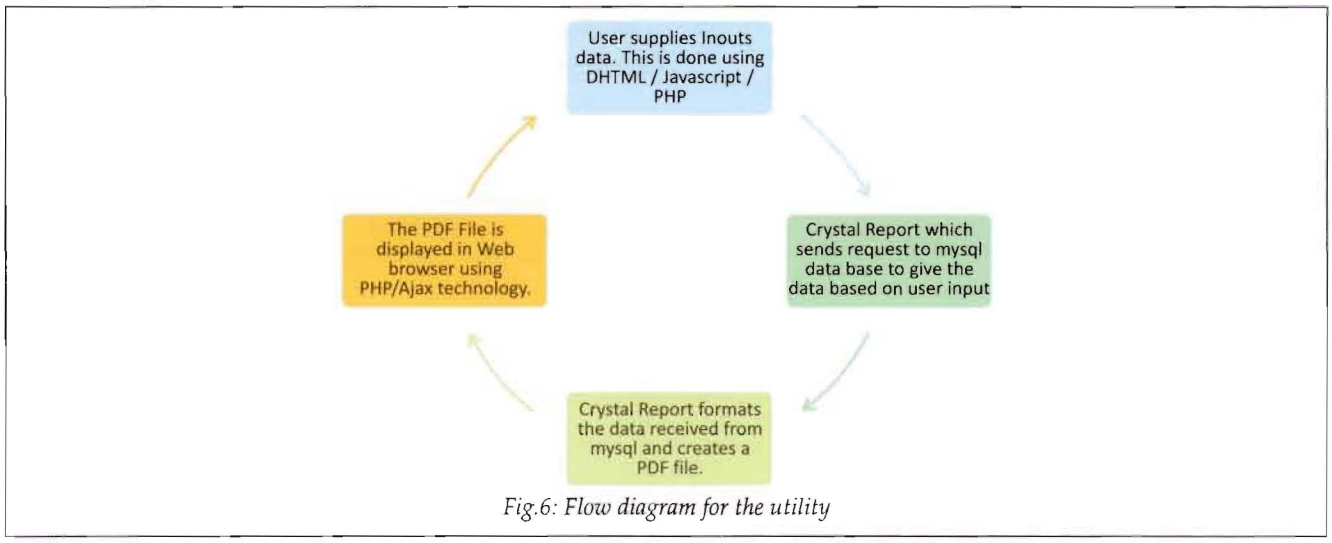


Fig.6: Flow diagram for the utility

As soon as the parameters are submitted, a report is generated in the required form. This procedure is used for complete IN-OUT details of employees. This sub-routine resides into the database so it is much faster than any other interface and can be used multiple times with multiple applications.

e. Similarly, for "First in time and Last out time," another procedure named in "**inout_detail**" is developed which uses same parameters as sub-routine "**inout_detail_all**" and generates a little different output than the same.

f. Up to this point, we have completed the formatting of the data into the database. Our **PHP** application now will call the **Crystal Reports** using **COM** Objects. The **Crystal Reports** will call the procedures "**inout_detail_all**" or "**inout_detail**" based on the inputs provided by the user. **Crystal Reports** will now format the data and will create a **PDF** file. Once the **PDF** file is created it is very easy to show it in the browser. We have created "**crViewerFunction.php**" to convert the data generated in the **Crystal Reports** into the Portable Document Format (**PDF**). A sample structural diagram of the flow of this application is like below:

g. This is sufficient for displaying data on the screen. Now what if we want to send this PDF file as an email? PHP has inbuilt support to send the mails. Our requirement to send the emails is little specific. We need to send the details of the employee to the area /division chairman under whom he/she is working. PRL has a structure where each employee is assigned a single Division. Each Division has a division head called Area Chairman. The details of employees' division and their Area Chairmen are easily available from the CoWAA. Also, we have seen that we can retrieve the IN-OUT details of all the employees after selecting a Division. Also, a PDF file using Crystal Reports can be created for the division. Our concern is now to send the Email to the area chairmen with a PDF file report attached to it. We created a reusable component to send Emails. The software will check whether "Send Mail" button is clicked. On meeting this condition, A loop will start to fetch division name, area chairmen and email address. The loop will create a PDF file using Crystal Reports for each division. PHP's mail function will serve the rest of the part to send this PDF file to the area chairmen. This loop will be terminated on completion of this job.

Conclusions

The Access Control System at PRL Main Campus and Thaltej Campus is, thus, working very satisfactorily. We plan to extend the system at two of our other field stations at Udaipur Solar Observatory, Udaipur and Infrared Observatory, Mt. Abu in a near future.

Acknowlwdgements

The authors wish to thank Prof. J. N Goswami, Director, PRL, and Shri. Y. M. Trivedi, Registrar, PRL, for their continuous encouragement and valuable guidance during the development and operation of the Access Control System in the Laboratory. Shri. D. V. Subhedar, CoWAA Group, helped in giving valuable suggestions for making this note presentable. Shri. Satay Sai Madhu of CoWAA Group was involved in installation of RFID units and their testing in the initial phases of the project. The staff members of the PRL Computer Centre provided Local area Network support at Main Campus and Thaltej campus of the Laboratory. Construction and Maintenance Division (CMD) provided logistic support to maintain the RFID Readers at the gates both the laboratory Campuses in Ahmedabad.

Appendix – A1

Contact-less smart card reader, SENTINEL-Prox MF, uses RFID technology with onboard TCP/IP communication channel. The contact less PVC smart cards (Mifare-based conforming to ISO 14443-A) compatible with these card readers have built in read/write memory of 1 Kbytes. A block schematic and the Technical brochure for the Sentinel-Prox MF card reader is reproduced below.

The Mifare card has a dimension of 85.7 x 54 mm with card thickness less than 0.9 mm. It has an embedded wire loop antenna adjacent to its periphery and a MF1ICS550 IC chip in it. A few salient features of the technology are given below.

MIFARE RF Interface

- Contact less transmission of data and supply energy (no battery needed)
- Operating distance: up to 100 mm
- Operating frequency: 13.56 MHz
- Data transfer: 106 kbps
- Data integrity: 16 bit CRC, parity, bit coding, bit counting

Typical transaction time < 100 ms

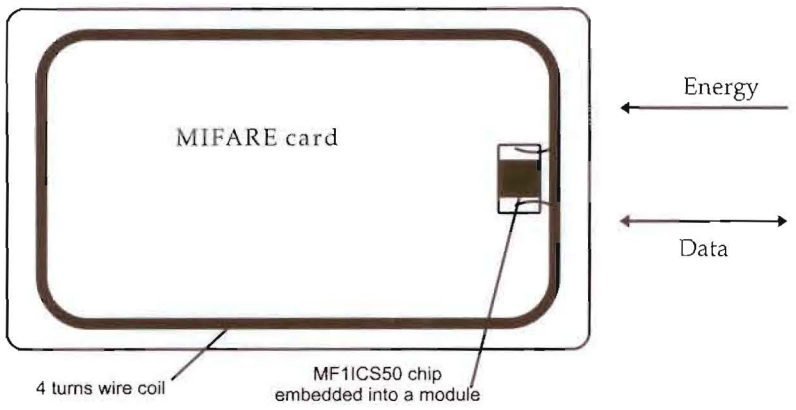
EEPROM

- 1 Kbyte, organized in 16 sectors with 4 blocks of 16 bytes each
- Data retention of 10 years
- Write endurance 100,000 cycles.

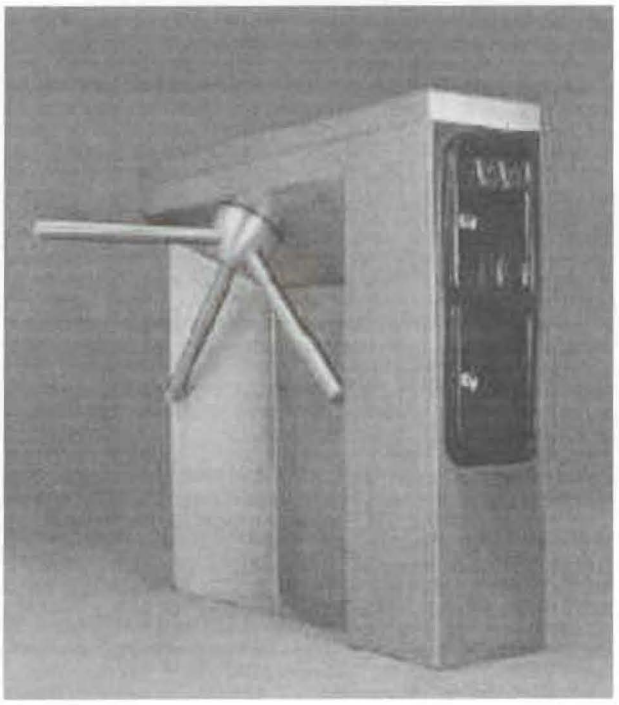
Security

- Mutual three pass authentication
- Unique serial number for each device

Appendix – A2 (Mifare Card)



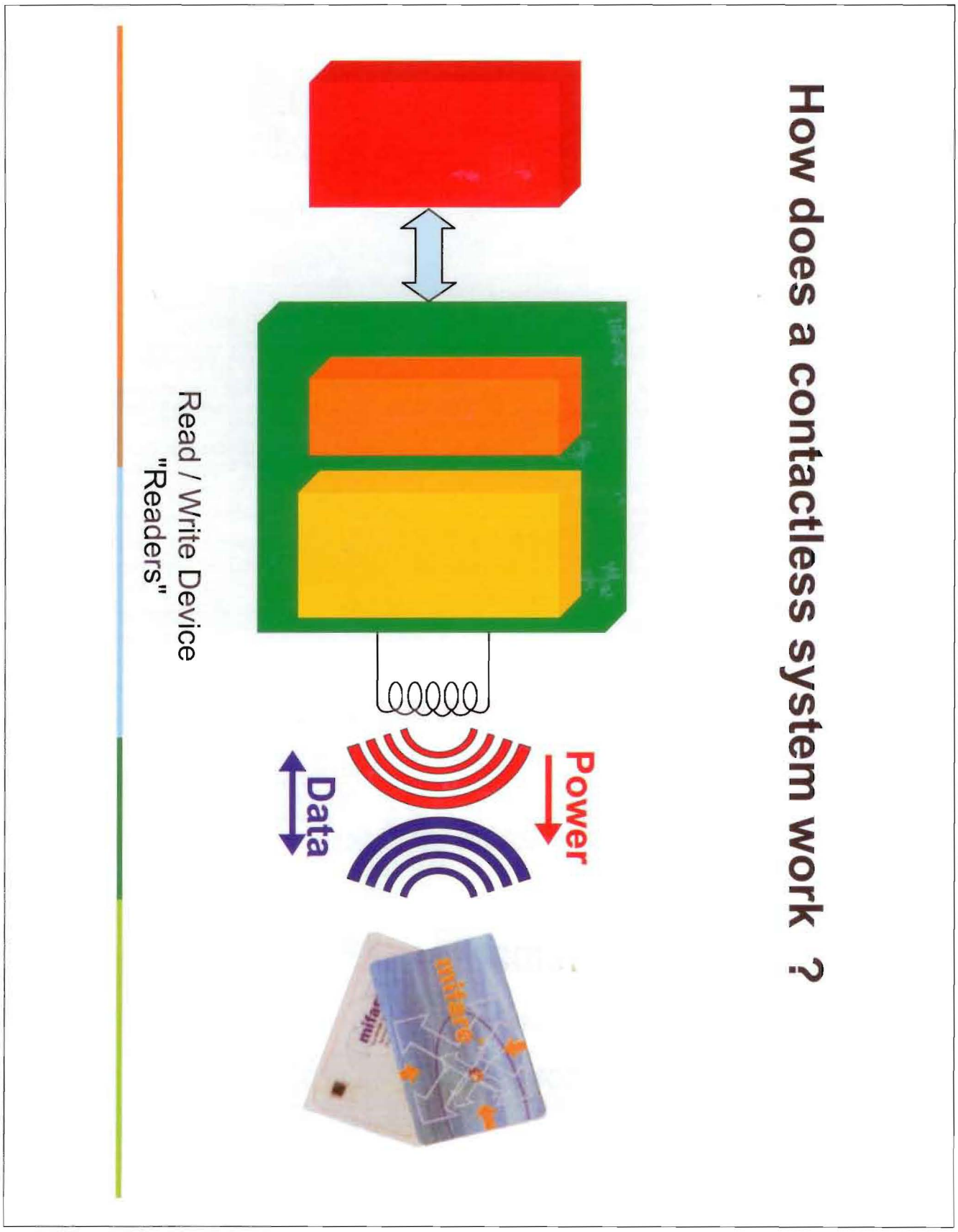
Appendix – A3 (Turn style Gate)



Salient Features:-

* No slip clutch provides smooth, silent, two-way rotation
* Optional Breakaway clutch assembly allows one-way turnstiles to be used as emergency exits.
* can be used at entry and exit points.
* Clock-wise or counter-clockwise rotation.
* Constructed from steel tubing.
* ASC turnstiles have welded polished end caps.
* Standard highly polished chrome finish.
* Stainless and power coat finishes available.
* Low Maintenance.

Appendix – A4


How does a contactless system work ?
Read / Write Device
"Readers"
Power
Data
mifare

Appendix – B

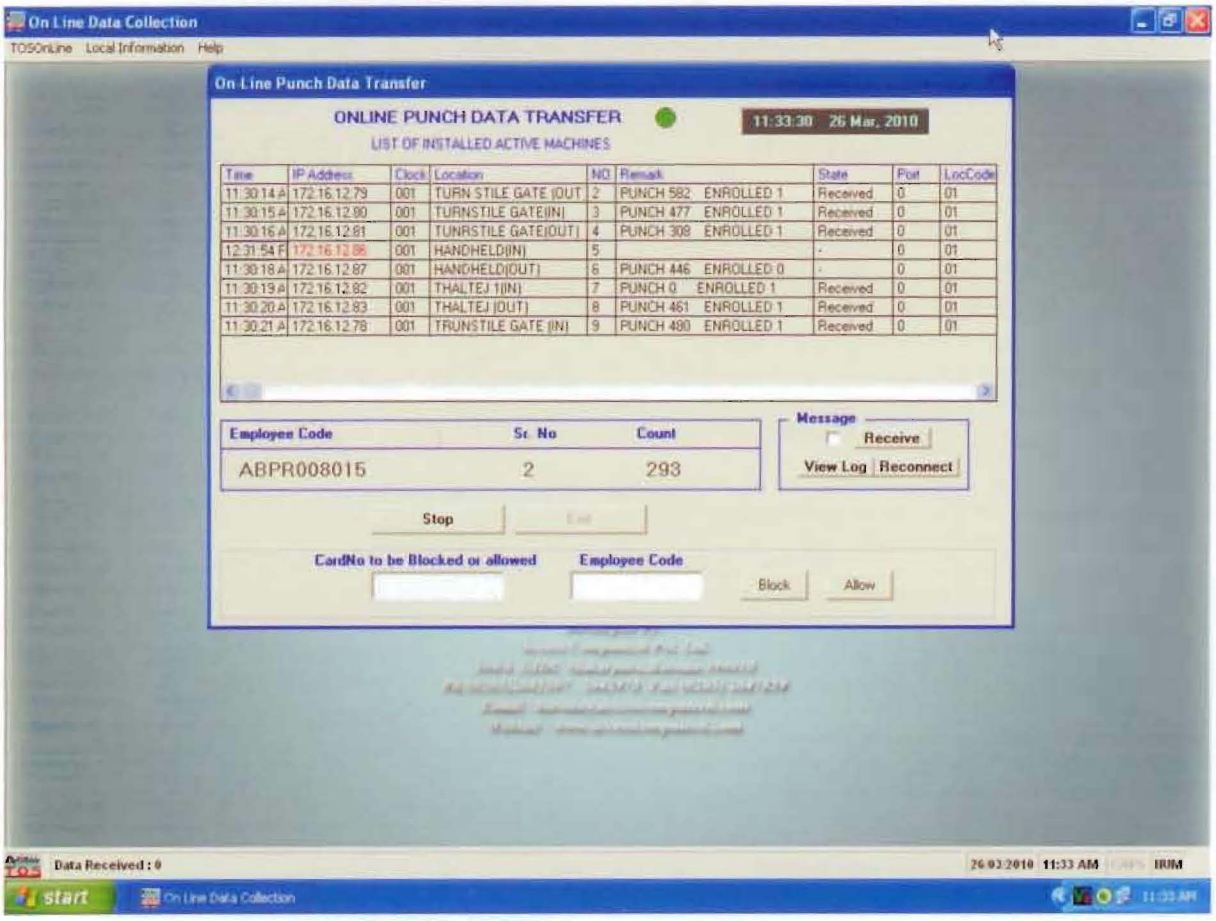


Fig.7: RFID Software provided by vendor to continuously retrieve IN-OUT data from the RFID readers