

2 General

2.1 Overview

Automatic Gate (AG) is separated with entry gate, exit gate, and reversible (bi-directional/uni-directional) gate. And according to type of door, AG is separated with normal gate and wide gate (this can also use as luggage gate). By installed AG, a station is separated with free area and paid area. When a passenger tries to enter into paid area, or come out from paid area, AG checks the validity of ticket. If the ticket is valid, AG opens sector door for the passenger to pass over the gate. And if the ticket is invalid, AG stays closed for prohibition of the passenger's passage, and guides the passenger to ticket office. When a passenger pass exit gate with a token, the token is captured, and in case of card, electronic value is deducted.



Figure 1 Typical appearance drawing of AG

2.2 Gate Type

2.2.1 Aisle type

Gates are installed on the station in a typical array of aisles. Four types of aisles are as follows:

- (1) Entry Gate
- (2) Exit Gate
- (3) Reversible Gate (bi-directional)
- (4) Wide Gate

The Entry Gate, Exit Gate and Reversible Gate consist of common hardware modules and have the same physical size. The cabinet size of gate is 1900 X 1100 X 300mm (W X H X D), the aisle width is 550mm.(Wide Gate : 900mm)

Reversible Gates are set to operate in different mode in different time, including entry mode, exit mode and reversible mode. Gates operate either as entry or exit Gates, will indicate "enter" signal at appropriate end, and indicate "stop" signal at the opposite end. Gates operate in bi-directional mode. Once a ticket is inserted from either direction, the Gate will suspend entry and ticket processing and indicate "stop" signal at the opposite end until the passenger has pass the Gate.

Wide Gates are designed for handicapped passenger and convenience of a passenger with luggage.

The form of each type of gate is as follows:

- (1) Entry Gate

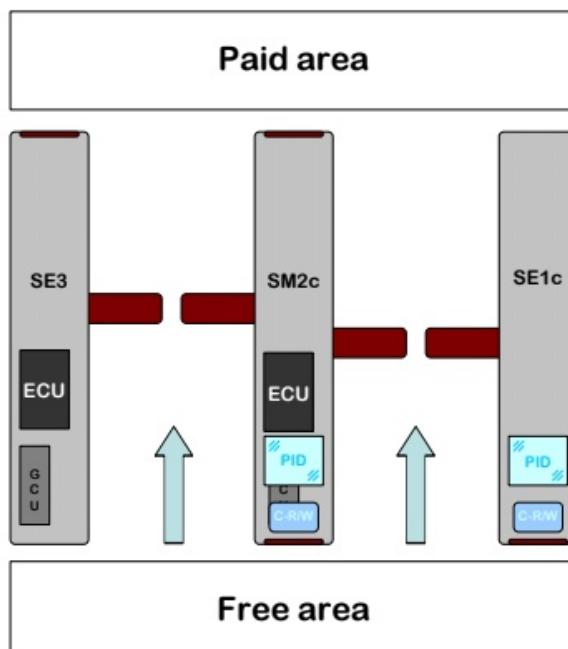


Figure 2 Entry Gates

(2) Exit Gate

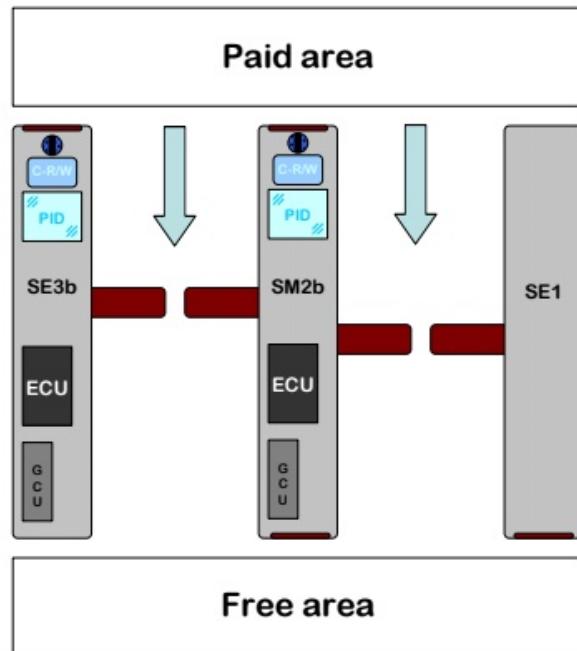


Figure 3 Exit Gates

(3) Reversible Gate

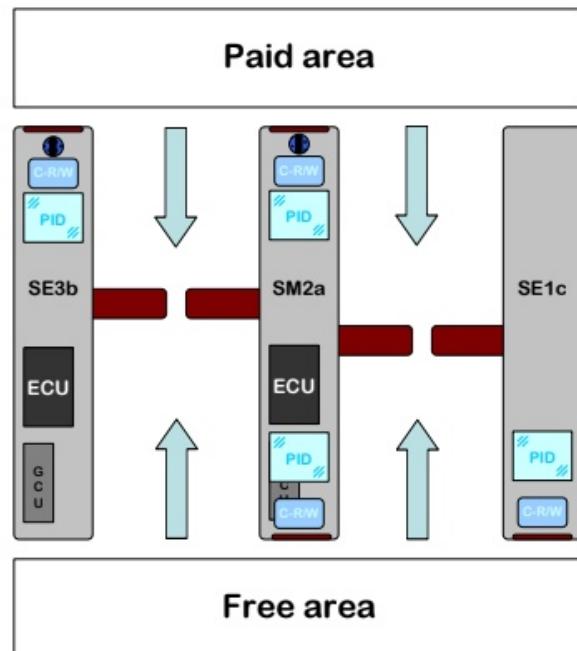


Figure 4 Reversible Gate (center) and End Gates

(4) Wide Gate (Type A)

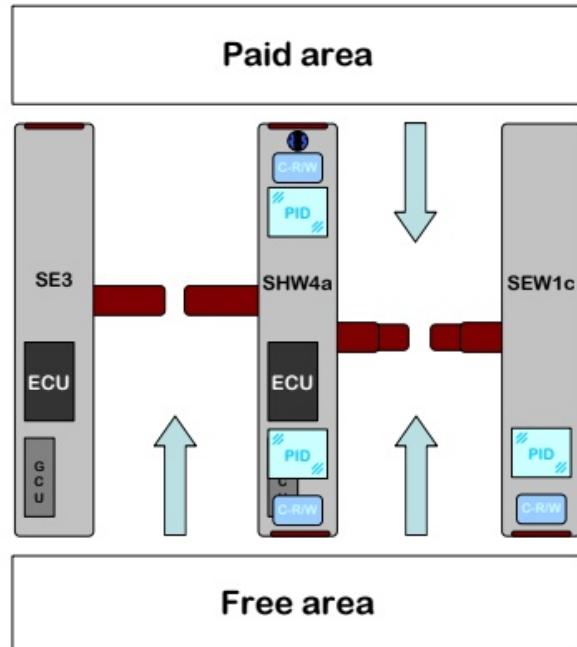


Figure 5 Wide Type A Gates (Center and Right-end)

(5) Wide Gate (Type B)

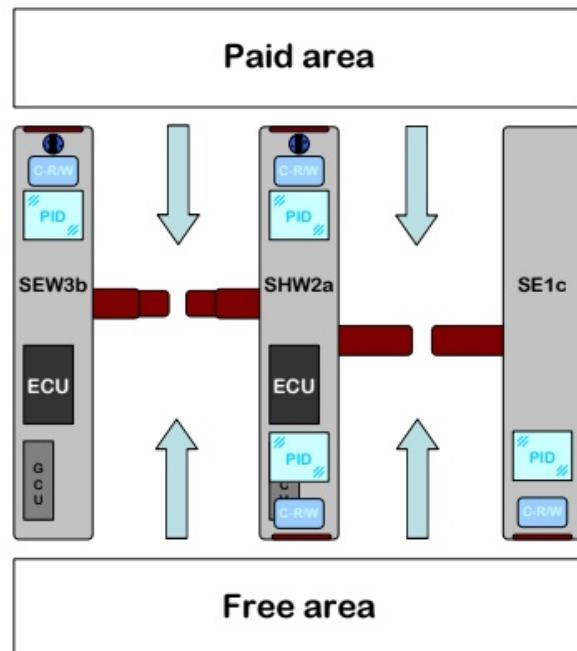


Figure 6 Wide B Type Gates (Center and Left-end)



2.3 Basic Functions

2.3.1 Mode Control

AG has following modes and can be set to selected mode in according to the operation purpose.

- Operation mode : In Service, Out Of Service, Failure, Maintenance
- Aisle mode: Entry, Exit, Bi-Directional
- Door mode: Normally Closed, Normally Open
- Special mode: Time Override, Entry/Exit Override, Station Close, Emergency, Incident, High Security

2.3.2 Processing ticket

AG CRW reads/writes data on a ticket and checks the validity of it based on the business rule of Jaipur AFC system. Passengers presenting a valid ticket can pass the gate, and passengers with an invalid ticket should go to EFO to adjust the ticket.

If a passenger presents multiple tickets (2 or more) on the reader in the same time, reader will reject to detecting tickets. Only one ticket can be detected by reader in one process. (Anti-collision feature)

Types of fare media can be used at the gate are as follows:

2.3.2.1 Contactless Smart Token (CST, ISO 14443 Type A)

- Single Journey Ticket
- Child Ticket
- Paid Ticket
- Free Ticket

2.3.2.2 Contactless Smart Card (CSC, ISO 14443 Type A)

- Stored Value Card (SV)
- Tourist Ticket (Tour)
- Staff / Employee Pass (EP)
- Test Ticket (TT)
- Group Ticket (GT)
- Prepaid Card
- Weekly/Monthly Pass
- Trip Pass
- Promotional Ticket

2.3.2.3 NFC Media (ISO 18092 compliant)

- For test purpose.

2.3.3 Passenger Service



AG provides services for passenger as follows;

- Displaying mode of AG on the passenger information display
- Indicating the availability of AG on the Direction Indicator
- Ticket processing base on the business rule
- Collecting valid token to token container
- Returning invalid token to return cup
- Displaying ticket processing result on the passenger information display
- Passenger safety

2.3.4 Staff Service

AG provides following categories of maintenance service for staffs;

- Operation Management
- Data inquiry
- Mode control
- Module Test
- AG configuration
- Error reset

Details of staff services are described on the chapter "5.4 Staff Service".

3 System Architecture

3.1 Hardware Configuration

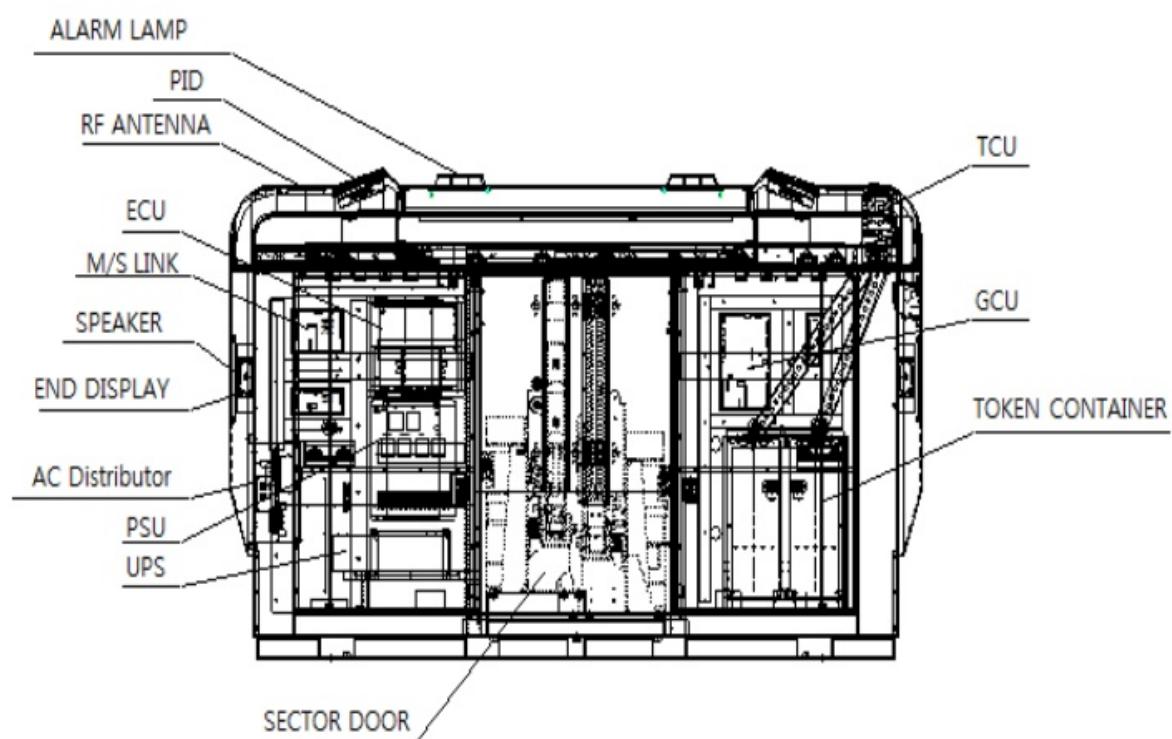


Figure 7 Internal and External layout of the AG



System	Item	Specification	
Cabinet (Enclosure)	Dimension(mm)	$1900 \pm 2.0(W) * 1100 \pm 2.0(H) * 300 \pm 2.0(D)$	
	Width of aisle	550mm(Normal), 900mm(Wide)	
	Material, Color	1) Outside steel of enclosure • Material: ANSI 304 grade Stainless steel 2.0 mm • Finishing: Hairline Brushed 2) Plastic top cover (for Entry, Exit, Dummy) • Material: PC-ABS • Color: Pantone 2425c	
	Control method	Sector Door barrier	
	Passenger Sensing	20 infrared sensors Sensor height : 910mm	
Electronic Control Unit (ECU)	Processor	ULV Celeron-600M CPU	
	Memory	512MB	
	Disk	1GB CF Card, 256MB DOM	
Gate Control Unit(GCU)	Processor	32 Bit Processor (ARM7TDMI) Internal clock – 44.2368Mhz About 40MIPS (Million Instructions Per Second: MIPS is processing time of instruction. This specification is provided by processor manufacturer.)	
	Memory	256KB Flash, 64KB SRAM	
Card Reader / Writer	CPU	32bit RISC	
	Communication Protocol with Host	RS232 or RS422	
	RF Module Method	ISO14443 TYPE A	
Sector Door	Type	Normal Type	Wide Type
	Operation speed of Door	≤ 0.5 sec	≤ 0.7 sec
	Dimension	-Open $270.0 \pm 4.0(D)$ * $703.7 \pm 1.5(H)$ * $290.4 \pm 1.5(W)$ mm -Close $526.7 \pm 4.0(D)$ * $703.7 \pm 1.5(H)$ * $290.4 \pm 1.5(W)$ mm	- Open $292.2 \pm 4.0 (D)$ * $753.7 \pm 1.5 (H)$ * $291.4 \pm 1.5 (W)$ mm - Close $665 \pm 6.0 (D)$ * $753.7 \pm 1.5 (H)$ * $291.4 \pm 1.5 (W)$ mm
	Weight	< 18 Kg	< 30 Kg
	Material, Color	• Material: Outer layer of flaps constructed from polyurethane foam • Color : Pantone 361c	
	TCU Size(mm)	$135 \pm 0.5(W) * 175.6 \pm 0.5(H) * 110 \pm 0.5(D)$	
	Token Container Capacity	2000 pieces/container, We can be designed according client requirements	
	PID is a LCD screen type.		
Passenger Information Display(PID)	Screen Size	6.4 Inch (Diagonal)	
	Display Format	$640(W) * 480(H)$	
End display	LED	Red, Green, Yellow lamp	
Passenger Detecting Sensor	Sensor	20 sets	
	Weight	17g	
Buzzer	Min. Sound Pressure	90dB at 12VDC/30cm	



System	Item	Specification	
	Level		
Speaker	Type	YDT5090-1	
	Output S.P.L	84±3Db	
Power Supply Unit(PSU)	Input voltage (V)	AC176 ~ 265	
	Output Rated Voltage (V)	5.3, 12.5, 24 (according to Input voltage)	
Uninterrupted Power Supply(UPS)	Rated Capacity	500VA (300Wat)	
Alarm Lamp	LED	Yellow/ Red/ Green LED	
Power Consumption	Power Consumption of AG	Normal Operation -Voltage: 220.00 AC -Current: 1.22 A -Power: 199.12W	Peak Operation -Voltage: 221.00 AC -Current: 1.71 A -Power: 331W

Table 2 Description of Internal configurations

3.2 Software Architecture

AG application software uses multi-thread architecture. This chapter describes multi-thread software architecture of AG and functions of each thread.

3.2.1 Process Architecture

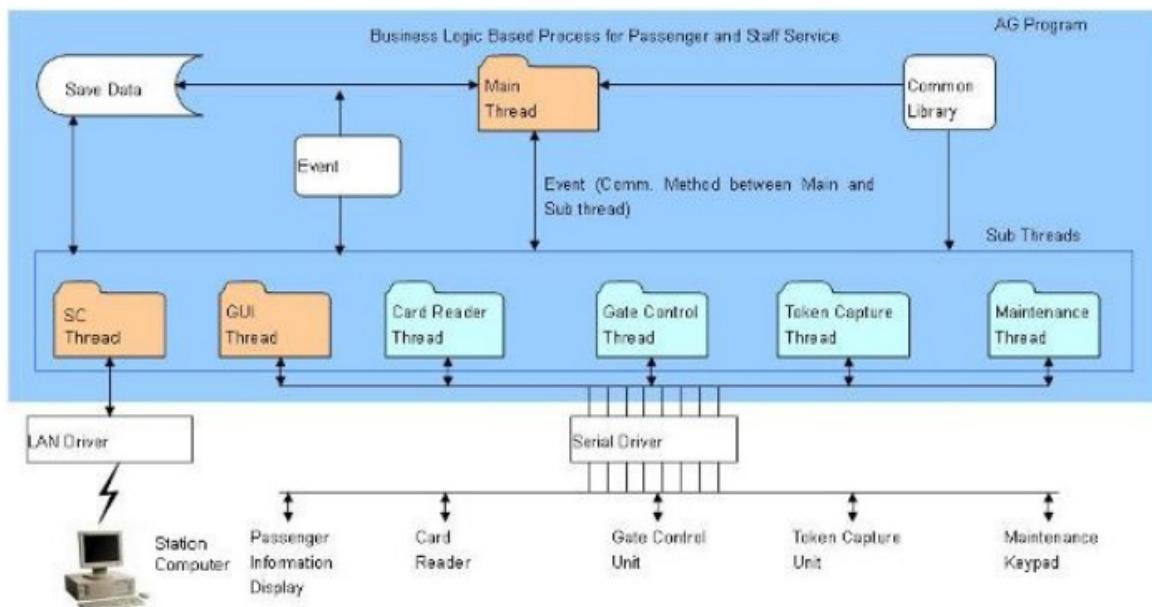


Figure 8 Software Architecture of AG

Thread	Descriptions
Main Thread	Main control thread of AG. It monitors AG operation status and make a passenger service.
SC Thread	Station Computer Communication Thread. It receives the parameter data and commands from Station Computer. It sends a transaction data, AG Status, and events generated in the AG.
GUI Thread	GUI Processing thread. It receives a display information and event from Main Thread, and displays information on the PID.
CRW Thread	CRW Communication and Control Thread. It sends command and receives a response from entry/exit CRW. It controls CRW and processes reading and writing a card.
Gate Control Thread	Gate Control Unit Communication and Control Thread. It monitors pass of passenger in a gate passage by communicating with a gate control unit. It controls Direction Indicator and Sector door.
Token Capture Thread	Token Capture Unit Communication and Control Thread. It detects token insertion by monitoring status of token capture unit. It controls token collection and return by sending command to token capture unit.

Thread	Descriptions
Maintenance Thread	Maintenance Thread. It receives key value entered by staff, and executes the matched maintenance function.

Table 3 Thread List of AG software

3.2.2 Overall Architecture

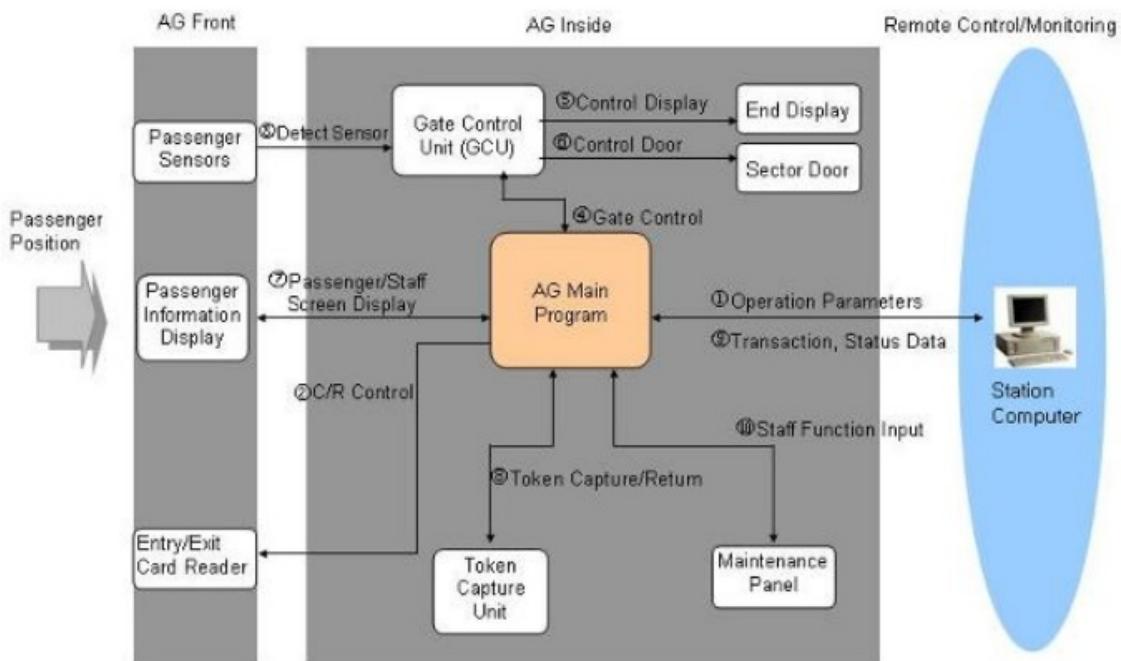


Figure 9 Block Diagram of AG

- (1) **Operation Parameters:** When AG runs the AG main application, the AG main program will download the operation parameters from Interface Server.
- (2) **CRW Control:** The AG main program initializes the CRW and process tickets.
- (3) **Detect Sensor:** 20 sets of sensors detect a passenger flow and throw the information to Gate Control Unit (GCU)
- (4) **Gate Control:** The AG main program sends appropriate command to GCU. If a passenger is valid, AG main program will send open command to GCU. When the sector door is about to close, if a passenger is in safety zone, the door will stay open until passenger pass over because of safety for passenger. But passenger will stay at safety zone more than predefined time like as 10seconds, gate will close door.
- (5) **Control Display:** It shows if the gate is available or not.
- (6) **Control Door:** GCU controls the status of sector door. (open or close)
- (7) **Passenger / Staff Screen Display:** It shows information of ticket status, balance, validity or operation status.
- (8) **Token Capture Unit:** At the exit gate, when a passenger inserts a token into Token Capture Unit(TCU), TCU takes and moves the token to the antenna for processing token. If the token is valid, TCU captures the token to token container. If the token is invalid, TCU returns the token to the return



cup.

(9) Transaction and Status Data: If a transaction data is made, AG main program saves the transaction data and sends a transaction data to SCS immediately. Status data is sent to SC in real time basis from equipment. Whenever SCS receives status data from equipment, SCS transmits it to CCS in real time basis. Event data will transmit to SCS in real time basis from equipment. AG upload transaction data, status data and event data to SCS using TCP/IP socket communication. When it is communication failure between AG and SCS, SCS cannot receive any data from equipment. But when recover communication, equipment upload its current status and transaction stored at AG to SCS.

(10) Staff Function Input: Maintenance staff operates functions through the maintenance panel.

3.2.3 Software configuration

AG software is stored in DOM (Disk on Module). Following figure describes configuration of AG main application.

DOM (E:\)	Folder	Description
AGApp (Folder)	Bin	<ul style="list-style-type: none">- Execution file (Main application)- DLL files (Module control / fare analysis API)- INI files (Display information / Maintenance script files)
	Data	<ul style="list-style-type: none">- Transaction Data- Cutoff data- Token Stock Data
	Image	<ul style="list-style-type: none">- GUI images- Advertisement images
	NTP	<ul style="list-style-type: none">- Time synchronization program with SC
	Param	<ul style="list-style-type: none">- Parameter files

Table 4 Software configuration

1) Execution files

Main application file. This is registered on Windows Startup. When the AG is turned on, Main application starts automatically and provides service.

2) DLL files

Dynamic Linked Library files. This is used for sub-module control, fare analysis and etc.

DLL files are changeable according to Main application.

3) INI files

- Display information

The script of GUI is included. Messages are changeable with this. The detail of display information INI file is as follows

```
// For "Please, Present Ticket" message //
[MSG11]
ScreenHindi = —I;kœfVdVšfn£k;¢a      ← Non Unicode font (Hindi Message)
ScreenEnglish = Please,|Present Ticket   ← English Message
```

Messages are configurable by modification of above sentences.

- Maintenance Script

The script of maintenance mode is included. Messages are changeable with this. The detail of maintenance script INI file is as follows

```
// 2.2. Transaction Data Query//
[22] ← Menu number
ScreenEnglish = <Transaction Data>|Select No.|1.Entry Transaction List|2.Exit
Transaction List
```

4) Transaction Data

AG saves transaction data for pre-defined time. This is also saved in CF card (D:\) for backup and in offline folder(E:\) for transmission to SC.

Following figure describes Transaction save flow.

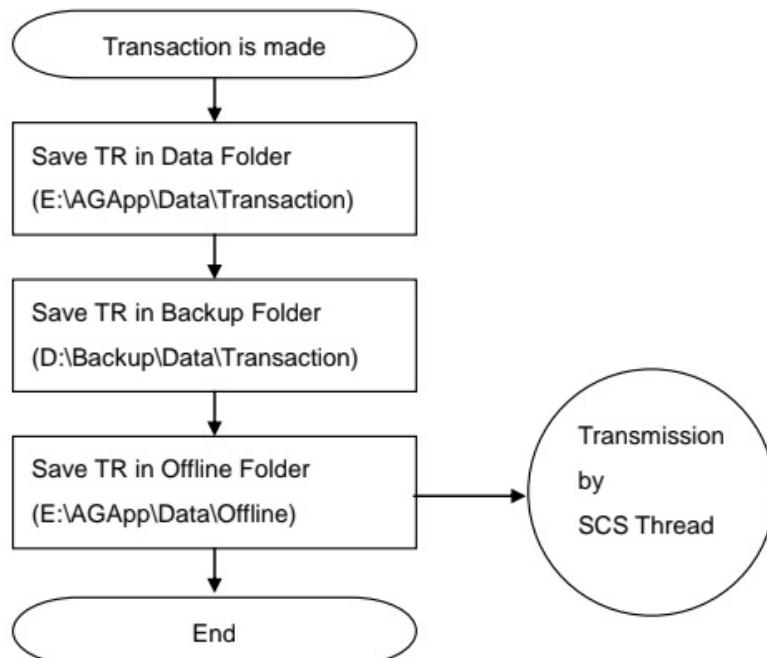


Figure 10 Transaction save flow

The transaction data in "Transaction" folder is original data. And the transaction data in

"Backup" folder is for backup.

The transaction data in "Offline" folder is for transmission to SC. Transmission is done by SC thread of main application. The transaction data which is sent completely is removed. (Only in Offline folder)

5) Cut off data

Cut off data is a summary data per a day. The transaction count and amount is accumulated from previous cut off time to next cut off time.

Following figure describes Cut off data save flow

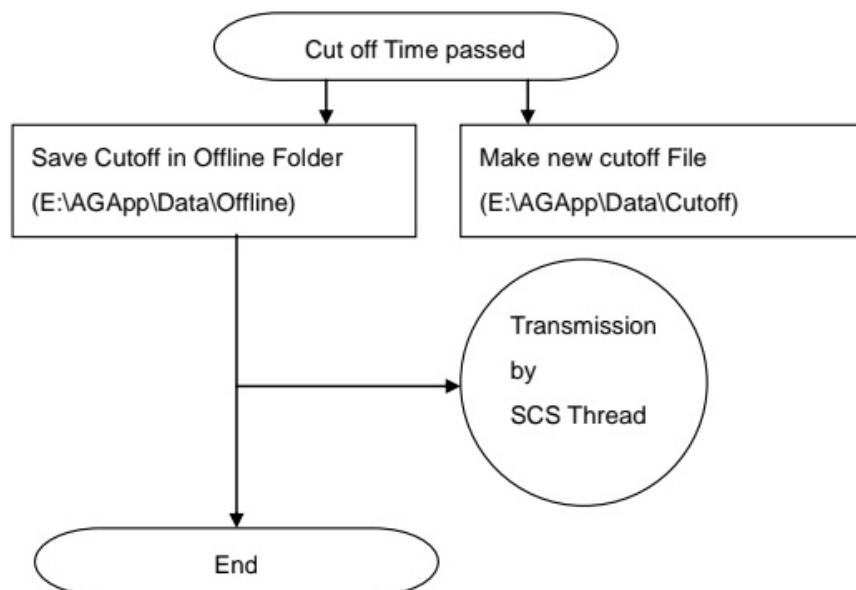


Figure 11 Cut off save flow

When the transaction has been made, Cut off data is changed and saved. So when cut off time has passed, saved cut off data is sent to SC. And AG makes new cut off data and accumulate data on new cut off.

Cut off data files are separated by date.

6) Token stock data

If operator retrieves token container, previous token stock data is made and is sent to SC.

The save flow of token stock data is same as transaction.

7) GUI image

GUI image files are stored. Those files are downloaded from SC by a parameter.

8) Time Synchronization program

Time synchronization program is registered on Windows startup. This program synchronizes the time with SC.

9) Parameter files

Parameter files are stored in "Param" folder, which are downloaded from SC.

4 Function

4.1 Gate Modes

Gate Modes can be classified into operation mode, aisle mode, door mode and special mode.

4.1.1 Operation Mode

The operation mode of gate is as follows:

- IN SERVICE
- OUT OF SERVICE
- FAILURE
- MAINTENANCE

The operation mode can be set by a control command from the Station Computer and by a local command on the maintenance menu.

4.1.1.1 IN SERVICE

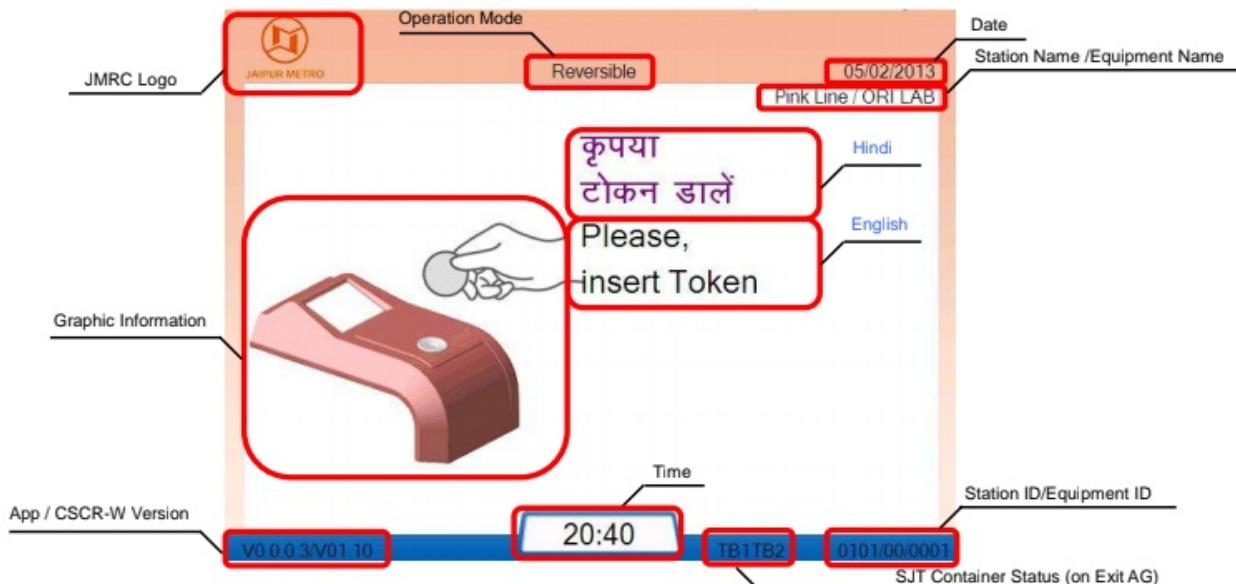


Figure 12 PID – In Service Mode

"IN SERVICE" is the mode that provides services to a passenger normally. In this mode, gate operates as follows:

- PID displays the message of "Present Ticket" or "Insert Token"
- Direction Indicator shows green arrow which means that passage is available.
- CRW is activated and starts to process a ticket.
- Sector door is opened or closed depends on the door mode.
- If a valid ticket is processed successfully, sector door is opened immediately, and



one passenger is allowed to pass the gate.

- If no valid ticket is processed, any attempt to pass the gate is prohibited.

4.1.1.2 OUT OF SERVICE

"OUT OF SERVICE" is the mode that stops services to a passenger. In this mode, gate operates as follows:

- PID displays the message of "Out of Service"
- Direction Indicator shows red cross which means that passage is unavailable.
- CRW is deactivated and stops to process a ticket.
- Sector door is closed and any attempt to pass the gate is prohibited.

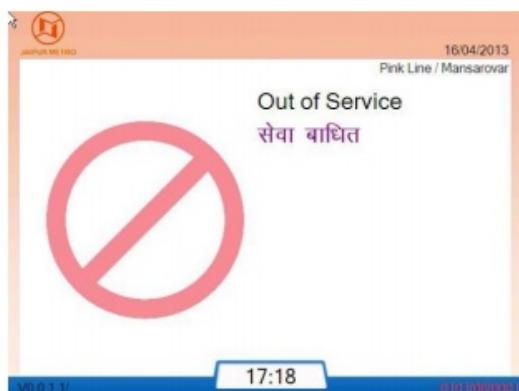


Figure 13 PID – Out of Service Mode

4.1.1.3 FAILURE

"FAILURE MODE" is the mode that stops services to a passenger by a device fault. In this mode, gate operates as follows:

- PID displays the message of "Failure mode" and a device error code.
- Direction Indicator shows red cross which means that passage is unavailable.
- CRW is deactivated and stops to process a ticket.
- Sector door is closed and any attempt to pass the gate is prohibited.

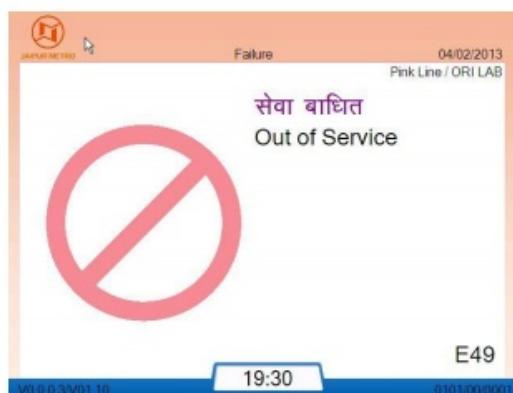


Figure 14 PID – Failure Mode



"FAILURE" mode cannot be set by a command, but can be changed by gate itself when a critical device fault is occurred. In this mode, gate checks device fault automatically, and if the device fault is cleared, gate restores the original mode.

4.1.1.4 MAINTENANCE

"MAINTENANCE" is the mode that provides maintenance services to a staff. In this mode, gate operates as follows:

- PID displays the message of "Maintenance" and maintenance menu items that a staff selects.
- Direction Indicator shows red cross which means that passage is unavailable.
- CRW is deactivated and stops to process a ticket.
- Sector door is closed.

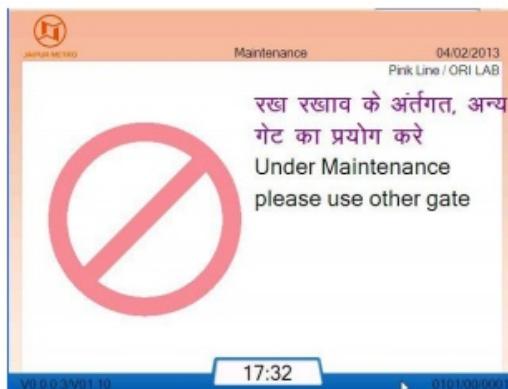


Figure 15 PID - Maintenance Mode

4.1.2 Aisle Mode

The Aisle Mode of gate is as follows:

- ENTRY
- EXIT
- REVERSIBLE

The Aisle Mode can be set by a control command from the Station Computer and by a local command on the maintenance menu.

4.1.2.1 ENTRY

"ENTRY" is the mode that allows a passenger to pass a gate from the free area to the paid area and inhibits any attempt to pass a gate from the paid area to the free area. In this mode, gate operates as follows:

- PID at the free area displays the message of "Present Ticket",
- Direction Indicator at the free area shows green arrow, and Direction Indicator at the paid area shows red cross.
- CRW at the free area is activated and starts to process a ticket. CRW at the paid area(if exists) is deactivated and stops to process a ticket.
- Sector door is opened or closed depends on the door mode.
- If a valid ticket is processed successfully on the CRW at the free area, sector door is



opened immediately, and one passenger is allowed to pass the gate from the free area to the paid area.

- If no valid ticket is processed, any attempt to pass the gate is prohibited.



Figure 16 PID – Entry Mode

4.1.2.2 EXIT

"EXIT" is the mode that allows a passenger to pass a gate from the paid area to the free area and inhibits any attempt to pass a gate from the free area to the paid area. In this mode, gate operates as follows:

- PID at the paid area displays the message of "Present Ticket",
- Direction Indicator at the paid area shows green arrow, and Direction Indicator at the free area shows red cross.
- CRW at the paid area is activated and starts to process a ticket. CRW at the free area(if exists) is deactivated and stops to process a ticket.
- Token Capture Unit(TCU) is activated and start to process a token.
- Sector door is opened or closed depends on the door mode.
- If a ticket is detected (CSC Type), CSCR-W at the free area(if exists) is deactivated and stops to process a ticket.
- If a ticket (CST Type) is detected on insertion slot of TCU, the slot is opened automatically and the ticket is inserted into TCU.
- If a valid ticket (CSC type) is processed successfully on the CRW at the paid area, sector door is opened immediately, and one passenger is allowed to pass the gate from the paid area to the free area.
- If a valid ticket (CST type) is processed successfully on TCU, the ticket is collected into token container, sector door is opened immediately, and one passenger is allowed to pass the gate from the paid area to the free area.
- If the ticket (CST type) is invalid on TCU, the ticket is returned to return cup and the attempt to pass the gate is prohibited.
- If no valid ticket is processed, any attempt to pass the gate is prohibited.
- If both two token containers are full state, AG operates under "Card only mode".



Figure 17 PID – Exit Mode

Refer to following figure for easy comprehension of CST ticket process flow.

CST Process Flow at Exit

- 1) Insertion to token slot
- 2) Validity check in TCU
- 3) If valid, collects into token container
- 4) If invalid, evacuates to return cup



Figure 18 CST Process Flow at Exit

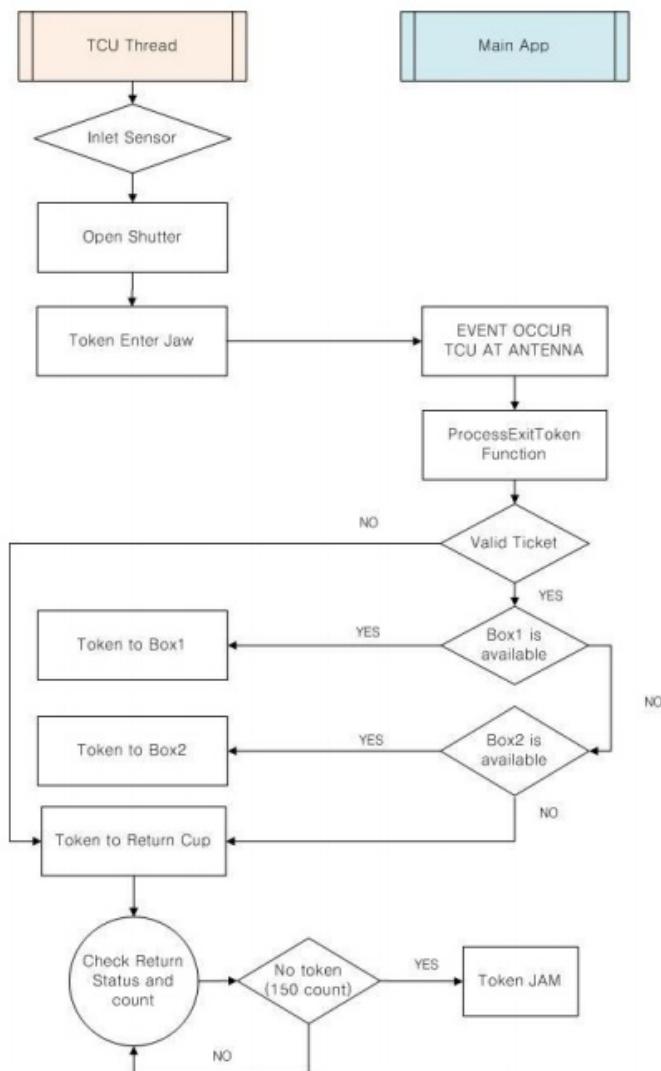


Figure 19 Exit Token Process Flow Chart

Refer to following figure for check Token Capture Unit(TCU) status Data flow chart.

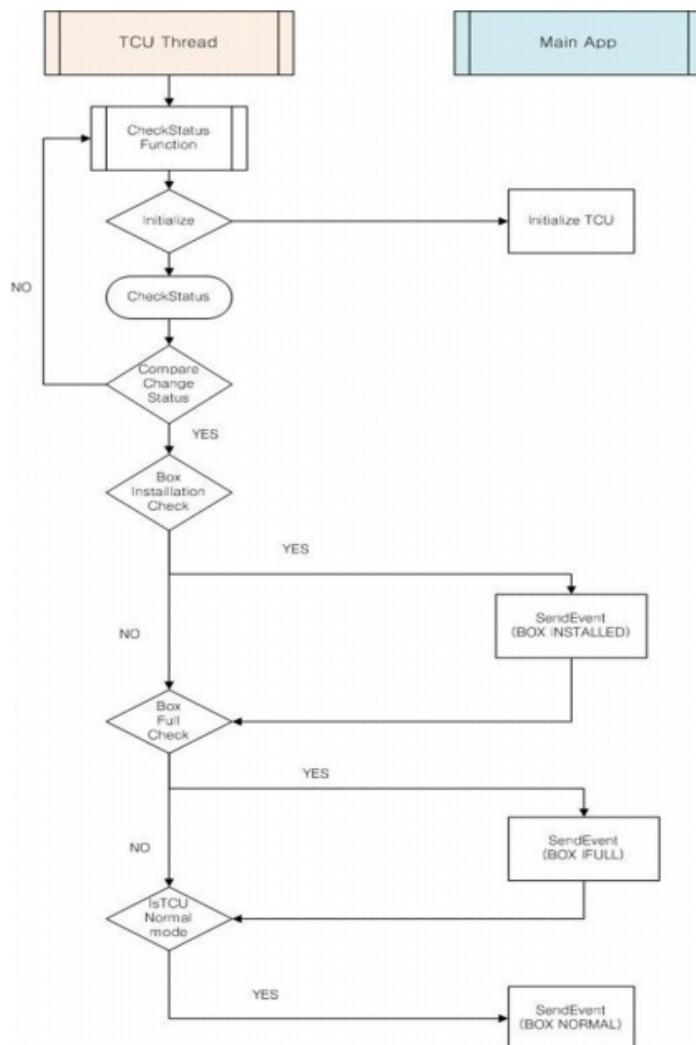


Figure 20 Check status of TCU Flow Chart

4.1.2.3 REVERSIBLE

"REVERSIBLE" is the mode that can provide services of both entry and exit mode on a gate. Once a valid ticket is processed successfully on one area, the passenger service of another area is temporarily stopped. When a validated passenger passed through a gate, the passenger service of another area is activated automatically. In this mode, gate operates as follows:

- PID at the free area and the paid area displays the message of "Present Ticket",
- Direction Indicator at the free area and the paid area shows green arrow.
- CRW at the free area and the paid area is activated and starts to process a ticket.
- Sector door is opened or closed depends on the door mode.
- Once one CRW is processing a valid ticket successfully, another CRW is temporarily deactivated until a validated passenger passes through the gate.
- If no valid ticket is processed, any attempt to pass the gate is prohibited.



If one side is under processing ticket, the other side displays "Please Wait" on PIDM.

- If no valid ticket is processed, any attempt to pass the gate is prohibited.

4.1.3 Door Mode

The door mode defines the door stand-by state at the idle time in the "IN SERVICE" mode.
The door mode of gate is as follows:

- NORMALLY CLOSED
- NORMALLY OPEN

The Aisle Mode can be set by a control command from the Station Computer and by a local command on the maintenance menu.

4.1.3.1 NORMALLY CLOSED

In the "NORMALLY CLOSED" mode, sector door is closed at the idle time in the "IN SERVICE" mode. Gate operates as follows:

- Sector door is closed at the idle time
- If a valid ticket is processed successfully on the CRW, sector door is opened immediately, and a pass of the gate is allowed. After a passenger is passed over from one area to another, sector door is closed and wait for the next passenger.
- If any attempt to pass the gate without a validation is detected, sector door is still closed.

4.1.3.2 NORMALLY OPEN

In the "NORMALLY OPEN" mode, sector door is open at the idle time in the "IN SERVICE" mode. Gate operates as follows:

- Sector door is open at the idle time
- If a valid ticket is processed successfully on the CRW, sector door is still open, and a pass of the gate is allowed. After a passenger is passed over from one area to another, sector door is still open and wait for the next passenger.
- If any attempt to pass the gate without a validation is detected, sector door is closed immediately. When the illegal attempt to pass the gate is cleared, sector door is open again, and wait for the next passenger.

4.1.4 Special Mode

The special mode of the gate defined as followings:

- Time mode override
 - Under this mode, exit gate let the passenger enter or leave in case of overstaying in the paid area.
- Entry / Exit override
 - Under this mode, gate will not check of ticket entry/exit sequence.
- Station Close



- "STATION CLOSE" is the mode that can be set after closing operation of station until next operation is started. In this mode, gate operates as follows:

- 1) PIDM displays the message of "STATION CLOSED"
- 2) Entry Direction Indicator shows red cross which means that passage is unavailable. And CRW is deactivated and stops to process a ticket in entry.
- 3) Exit Direction Indicator shows green arrow which means that passage is available And Only valid exit is permitted.
- 4) Sector door is closed and any attempt to pass the gate is prohibited.

- Emergency Mode

- There are 3 ways to set emergency mode as following.

- 1) Hard wired Emergency Button

If AG receives emergency signal from the hard wired emergency button, AG changes mode into EMERGENCY.

- 2) Emergency message from SCS

If the SCS sends EMERGENCY message to AG, AG changes mode into EMERGENCY.

- 3) Loss of Power

If AG receives loss of power signal from UPS, AG changes mode into EMERGENCY.

- "EMERGENCY" is the mode that provides an emergency evacuation of passengers and staffs. In this mode, gate operates as follows:

- 1) PIDM displays the message of "EMERGENCY".
- 2) Direction Indicator at the exit side shows green arrow and Direction Indicator at the entry side shows red cross.
- 3) CRW is deactivated and stops to process a ticket.
- 4) Sector door is opened and gate can be freely passed to any direction.
- 5) In EMERGENCY mode, AG does not open shutter even though sensor detect a token in emergency case.

- Incident Mode

- 1) No entry is possible through gates.
- 2) Token is captured at exit gate as in normal mode.
- 3) Exit checks are bypassed. No value or trip is deducted from CSC at exit gate.

- High Security Mode

- Under this mode, gate will announce special warning when the card listed on High security list is presented at gate. Any card can be put in High Security list

4.2 Passenger Service

4.2.1 Valid Passenger at the Entry Gate

In the IN SERVICE mode, gate displays the message of "Present Ticket" on the passenger information display, and displays green arrow on the Direction Indicator at the entry gate. The CRW at the entry gate is activated and waits for a CSC or a token.



Figure 21 Waiting a ticket on the entry PID

If a passenger presents a CSC or a token on the entry antenna, the CRW reads and checks the validity of the ticket.

If the ticket is valid, entry information is written on the ticket and the ticket information is displayed on the passenger information display. And then, gate opens (in case of normally close) the sector door to allow the validated passenger to pass the gate.

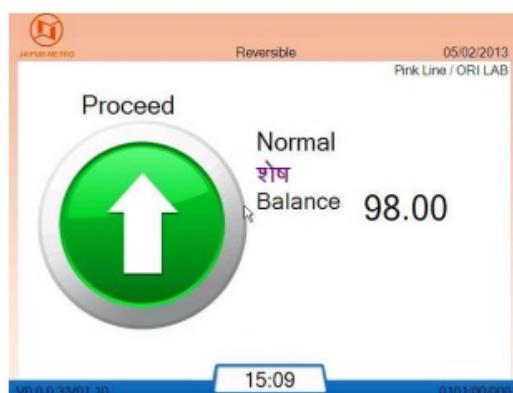


Figure 22 Entry information on the entry PID

The gate stores all transaction data which are related with gate operation in the storage and the back-up storage. The gate will send those data to CCS through SCS. All data came from AG will be uploaded to SCS, and SCS will upload those data to CCS.

When the passenger passes over from free area to paid area, gate closes sector door (in case of normally close) and waits for the next passenger.

AG can accept 45 passengers per minute and process up to 35,000 passages per day.

4.2.2 Valid Passenger at the Exit Gate

In the IN SERVICE mode, gate displays the message of "Present Ticket" on the passenger information display, and displays green arrow on the Direction Indicator at the exit gate. The CRW at the exit gate is activated and waits for a CSC or a token.



Figure 23 Waiting a ticket on the exit PID

If a passenger presents a CSC on the exit antenna, the exit CRW reads and checks the validity of the ticket.

If a passenger inserts a token into an inlet slot of token capture unit, token capture unit carries the token to the antenna for processing token, and the exit CRW reads and check the validity of the token.

If the ticket (CSC or token) is valid, exit information is written on the ticket, and the ticket information is displayed on the passenger information display. And then, gate opens (in case of normally close) the sector door to allow the validated passenger to pass the gate.

In case of valid token, it is collected to the token container.

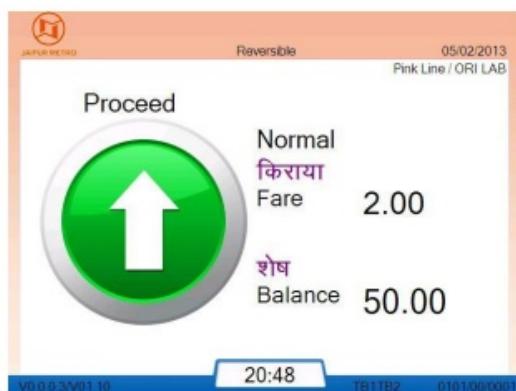


Figure 24 Exit information on the exit PID

The gate stores all transaction data which are related with gate operation in the storage and the back-up storage. The gate will send those data to CCS through SCS. All data came from AG will be upload to SCS, and SCS will upload those data to CCS.

When the passenger passes over from paid area to free area, gate closes sector door (in case of normally close) and waits for the next passenger.



AG can accept 45 passengers per minute and process up to 35,000 passages per day.

Gate will not allow the exits from the same station within user defined time limit after entry from same station.

4.2.3 Invalid Ticket at the Entry Gate

If a passenger presents an invalid ticket at the entry gate, gate displays invalid ticket information with error code.



Figure 25 Ticket invalid information on the entry PID

4.2.4 Invalid Ticket at the Exit Gate

If a passenger presents an invalid CSC at the exit gate, gate displays invalid ticket information with error code as same as the entry gate.

If a passenger inserts an invalid token at the exit gate, gate displays invalid ticket information with error code, and image of collecting token. Invalid token is returned to the return cup.



Figure 26 Token invalid information on the exit PID

After the token in the return cup is collected by the passenger, gate activates the CRW and waits for another ticket.

4.2.5 Illegal entrance of Gate

If a passenger without a valid ticket enters a gate and reaches to the zone which determines illegal passenger, gate closes the sector door (or remains the sector door closed) to inhibit passenger from passing over, and makes an alarm until passenger leaves the gate.

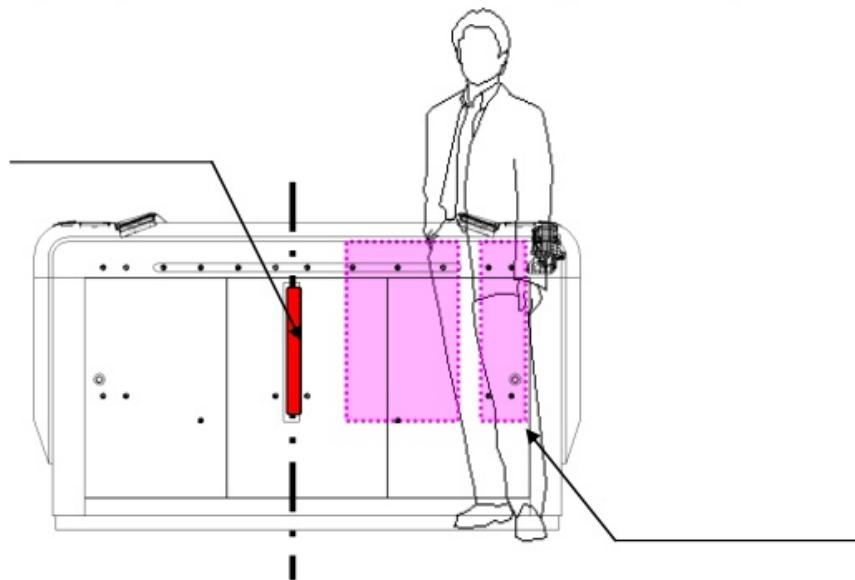


Figure 27 Illegal entrance of Gate

After a passenger leaves the gate, Gate stops the alarm, and opens the sector door in case of normally open mode.

4.2.6 Passenger Safety

Passenger safety is the most important function of the gate. When a passenger is detected on the safety zone while closing the sector door, gate basically opens the sector immediately to prevent the passenger from being injured by the movement of the sector door. (Under safety function activated) But if the safety function is deactivated, after gate detects passenger at safety zone more 10 seconds (configurable), gate will close sector door in force. Safety function is configurable by parameter.

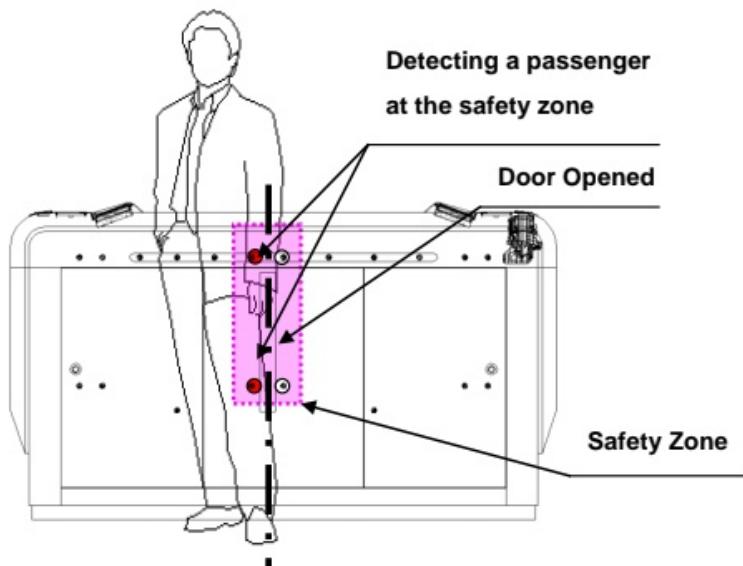


Figure 28 Detection at the safety zone

4.2.1 Tailgating

If a passenger tries to get in the gate before previous passenger's pass, AG regards next passenger as tailgating passenger. Then AG makes an alarm (Buzzer sound, Alarm lamp) and prohibits the passenger by closing door.

The AG guarantees approximately 20cm distances for recognition of tailgating pass.

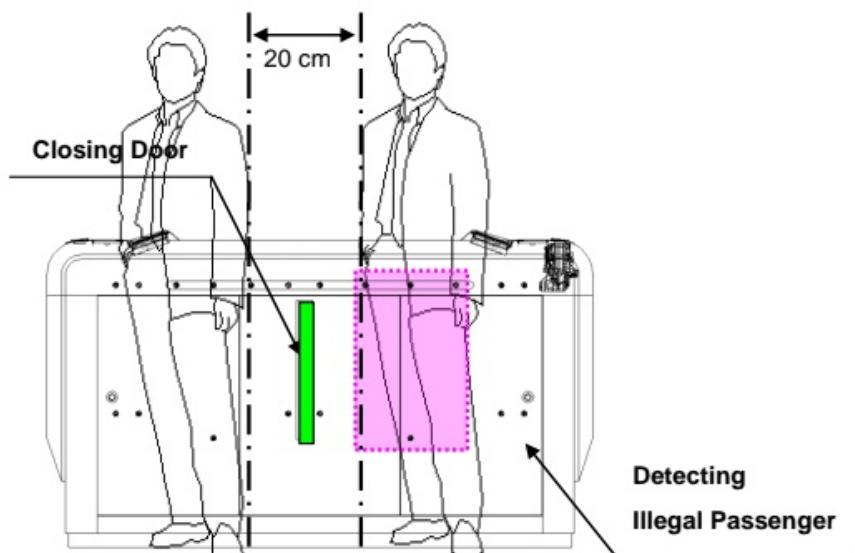


Figure 29 Tailgating of Gate



4.3 Automatic Top-up

4.3.1 Sequential Process

1. For enabling the automatic top up process of CSC (hereafter called 'Top up'), passenger has to register his/her CSC at authorized transit facility (such as EFO or dedicated website).
2. Each CSC is linked to the specific Bank Account, and after receiving the confirmation from Bank, authorized transit facility will initialize the card by setting top up flag on the card to 'on'.
3. Next time whenever passenger presents the CSC at entry gate and the value remaining on the card drops below a threshold amount, then makes top-up request transaction and sends it to CCS within 15 minutes.
4. While the passenger is making journey, the request for top-up will reach to the Bank system. After internal bank process, the bank server will send a confirmation result about the request to CCS within 30 minutes.
5. CCS will send this authorized information to all gates.
6. Once AG received the authorized information, the pre-selected value will be automatically added to the requested card in the next tag at entry gate.
7. AG will send add value transaction to the CCS.
8. CCS gathers this information and submits report to Bank Company. Bank pays it.



Figure 30 Top-up transaction on the PID (Sample)

4.3.2 Process Method

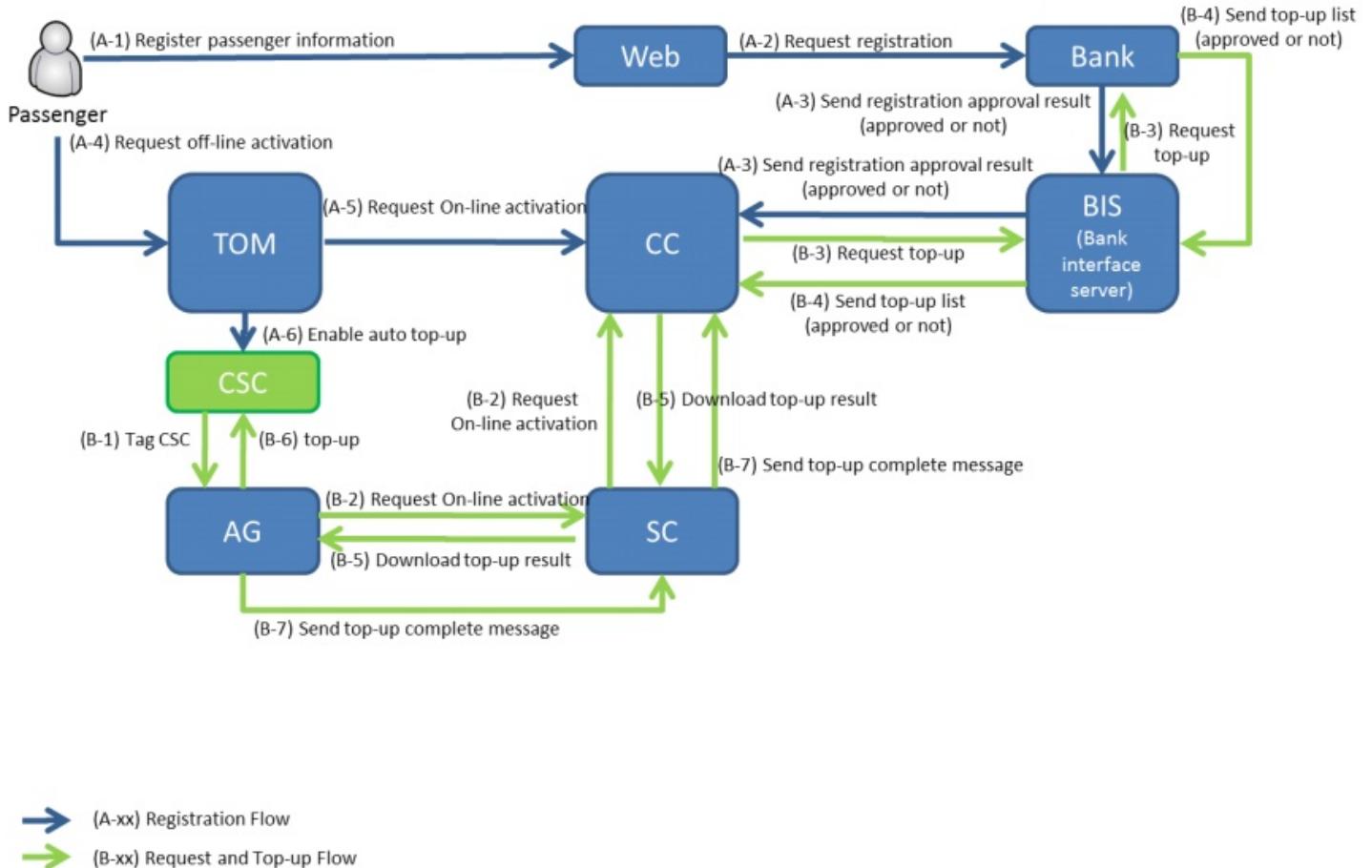
There will be two types of method for automatic top up of card as below:

- Credit before debit
- Debit before credit

Those methods will be discussed and the most secure method will be decided after the bank contractor and implementation method is selected.

Therefore, here we describe an example process diagram of auto top up.

4.3.2.1 Debit before credit



- 1) A passenger registers his information over the web page to the Bank.(A-1 to A-2)
- 2) The bank send top-up list with the approval result (approved or not) to the CCS. (A-3)
- 3) The passenger request activation at TOM and after the query of CCS, the operator changes auto top-up status to enable on CSC. (A-4 to A-6)
- 4) The passenger tags the CSC at AG, AG send the on-line activation request to the SCS. (B-1 to B-2).
- 5) The top-up request is sent to the bank and result response returns from the bank. (B-3 to B-5).
- 6) This result send back to AG and top-up on CSC completed. (B-5 to B-6). When the CSC top-up completed, it posted to the CCS through SCS for the clearing. (B-7)

Note

If the transaction from Bank is declined before add value amount to CSC, AG will not allow user take the service of auto top up.



5 Staff Service

Gate provides following categories of maintenance service for staffs;

- Operation Management
- Data inquiry
- Mode control
- Module Test
- AG configuration
- Error reset

These staff services can be accessed after login of authorized staff.

Staff can access service menu depending on the Role-Privilege Relation parameter.

All staffs have own Operation Type(Role) code and it is matched in Role-Privilege Relation parameter.

Field	Description
Operator Type	<ul style="list-style-type: none">• Operator Type (corresponding to the Card Type code defined in the field transaction dictionary) :<ul style="list-style-type: none">■ 60 = CC Supervisor■ 61 = Patron agent;■ 62 = Maintenance agent;■ 63 = Station supervisor agent;
Privilege Code	<ul style="list-style-type: none">■ 0401 = Operation Service■ 0402 = Data Query■ 0403 = Service control■ 0404 = Maintenance■ 0405 = Device configuration■ 0406 = Error Reset, (each Sub Units status check, error delete and execute right)

Table 5 Role-Privilege Relation

5.1.1 Operation Management

Gate provides following staff services for operation management;

- Token retrieval from token container 1
- Token retrieval from token container 2
- Change Container1 ID
- Change Container2 ID

5.1.2 Data Inquiry

Gate provides following staff services for data inquiry;

- AG Operation status inquiry
- Parameter inquiry
- Entry transaction data inquiry
- Exit transaction data inquiry
- Register data inquiry
- Import/Export data inquiry



5.1.3 Mode Control

Gate provides following staff services for mode control;

- Operation mode: IN SERVICE, OUT OF SERVICE, TEST MODE
- Aisle Mode: ENTRY, EXIT, REVERSIBLE
- Door mode: NORMALLY CLOSE, NORMALLY CLOSE
- Fare mode: Entry/Exit Override, Time Override, Incident, Station Close, Emergency, High Security

5.1.4 Module Test

Gate provides following staff services for module test;

- CRW
- GCU: Passenger sensors, Sector doors, lamps, Direction Indicators
- TCU: Sensors, Solenoids, Return lamp, Capture test. TCU solenoid is a shutter located at the token insertion slot. AG test and diagnose status of all modules.
- Sound
- Shutdown
- Reboot

5.1.5 AG Configuration

Gate provides following staff services for AG configuration;

- Device Configuration: Station ID, Device ID, IP Address
- SC IP Address Set
- Software version inquiry
- Parameter version inquiry

5.1.6 Error Reset

Gate provides following staff services for error reset;

- All reset
- Entry CRW reset
- Exit CRW reset
- GCU reset
- TCU reset

6 Interface

6.1 SCS Interface

AG communicates with SCS by using LAN communication. AG downloads several files and message from SCS, and uploads data and message.

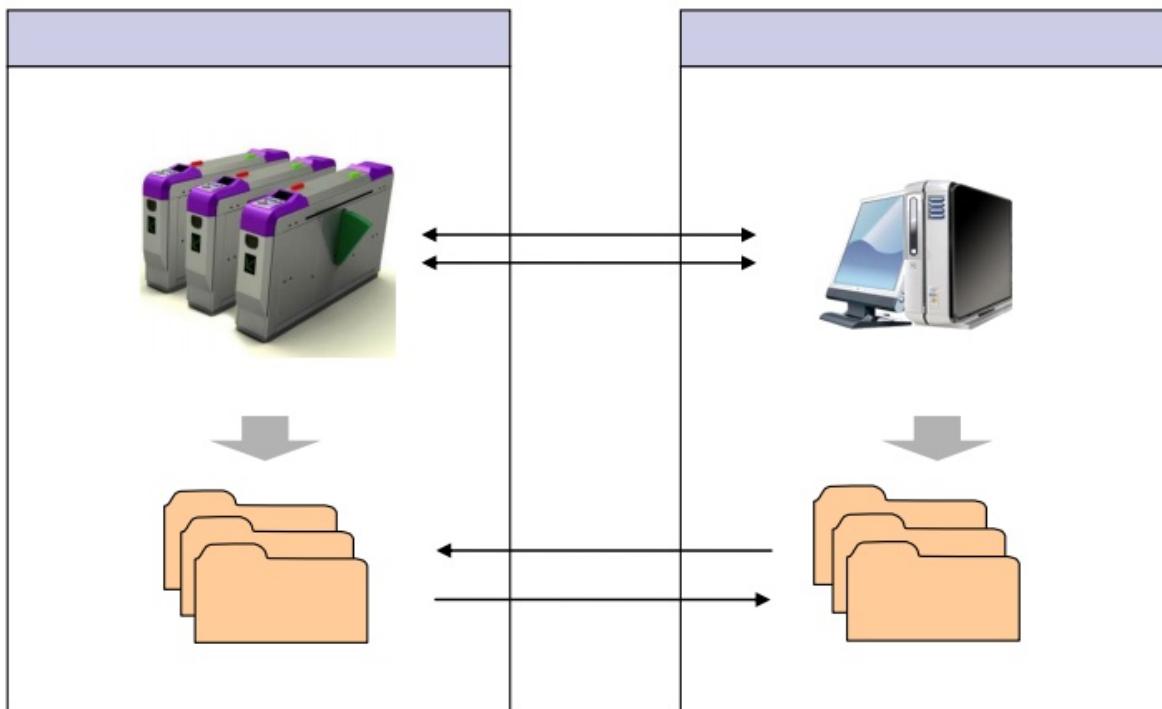


Figure 31 Interface with SCS

6.1.1 Upload

AG uploads the following data to SCS. AG will back up data for minimum 7 days. Those data will be not purged before transferred to SCS.

- Transaction data
- Token Retrieval data
- Cut off data
- Audit register data
- Status data
- Event data
- Non-Resettable Registers

6.1.1.1 Non-Resettable Registers

AG uploads the following registers to SCS. There will be at least 25% spare registers available for future use.

- Number of passenger for different ticket type entered / exited.
- Value charged to different ticket types.



- Number of tokens processed.
- Individual register on the number of transactions failed
- Number of times out of service
- Number of times in maintenance mode
- Number of times gate forced open.
- Number of times tailgating.

6.1.2 Download

AG downloads the following data from SCS.

- Parameter Files (Fare table, Blacklist and operation parameters)
- AG application and image files
- Control command from SCS

7 Other Information

7.1 Log management

7.1.1 Log file

Log files are separated by date. File naming rule is as follows:

YYYYMMDD.txt (Ex. 20100922.txt)

Files are stored on "LOG" folder of DOM as follows:

E:\AGApp\log\YYYYMMDD.txt

7.1.2 Log Detail

In a log file, following items can be checked.

Item	Description
Application Start/End	The process of application start and end log
Parameter Sync.	Parameter synchronization process log between SCS and AG through FTP Parameter type Parameter version Parameter process result
Equipment status change	AG status change log (refer to Status code table)
Detected Ticket Info	Detected Date/Time Ticket ID Ticket Status
Ticket Process result	Ticket Error code Ticket Read/Write result Deducted amount and balance
Transaction process result	Transaction save result Transaction sending result
Communication data with SCS	Received data from SCS Sent data to SCS

Table 6 Log Detail

7.2 Display Management

7.2.1 Parameter file for display

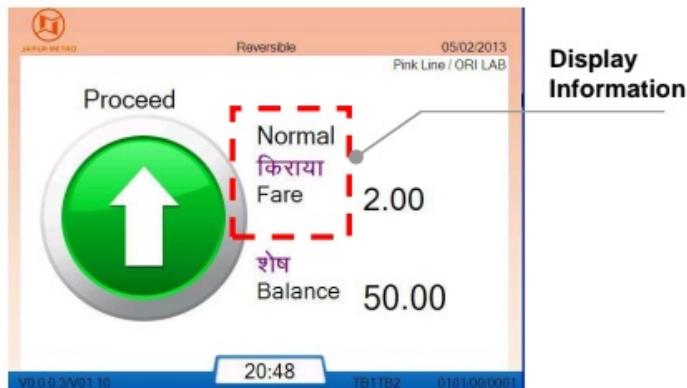


Figure 32 Display Messages

The display information is configurable locally by following parameter file.

Configurable File	Description
AG Display Parameter (DisplayScreen.ini)	Display information for passenger is included.
Ticket Parameter	Ticket Name (to be displayed on PIDM) is included.

Table 7 Display Information

7.2.2 Display configuration file Detail

AG display parameter (DisplayScreen.ini) is as follows:

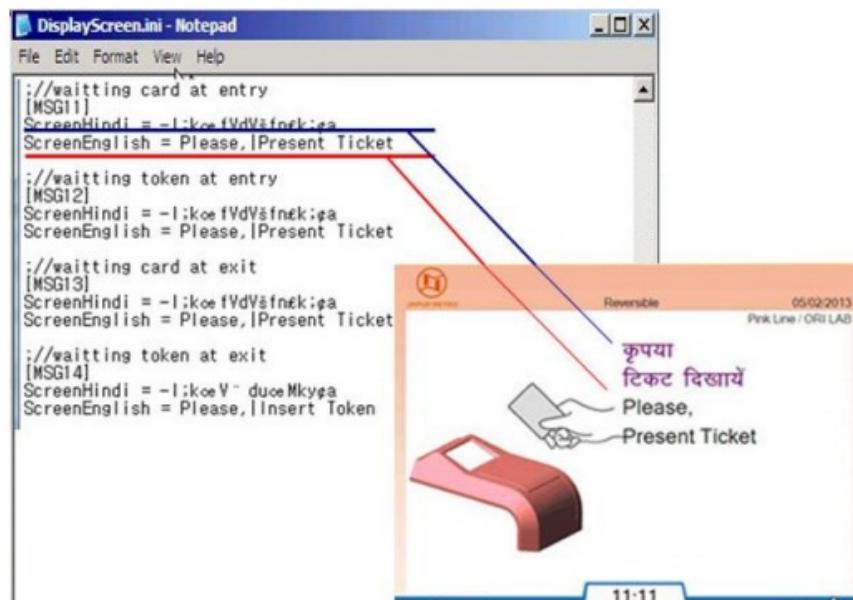


Figure 33 Display configuration file

Each message is made by using windows font files provided by Jaipur Metro and can be capable of displaying 4 rows of 30 alphanumeric characters, 12 mm high and include some special characters such as direction arrow and no entry symbol. At validation of ticket, the ticket type and amount is displayed at the screens of gates.

The configuration file is downloadable from SCS. When new display configuration file is downloaded, AG restart application and load new messages and displays them on Passenger Information Display.

Display configuration file is in "BIN" folder of AG.