

Automation System of Vehicle Requisition in Public Sector, Rwanda

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Abstract— Requisition in Rwanda is one of the main process or activity in public sector because at the end of each year, Rwanda Office of the Auditor General (OAG) have been evaluating and doing assessment of “How government assets are used in each public institution” Then requisition process started to help public institutions to know the trace for management of their assets. This paper is focusing on vehicles as one of the assets in Public Sector.

Currently, vehicle requisition process in Rwanda Public Sector, it is for time and cost consuming. Because everything related on this process has been doing by manual. A lot of vehicles' requisitions makes much time for waiting the approval or denial of any hierarchical staff due to his/her absence. And employees spend much time to leave their offices to get submit the vehicles requisitions forms. It makes time waste for report generation. Also the large amount of cost has been spending for paper printing out, gate keeper salary and printer ink cartridge. Objectives of this study is to reduce time and cost spent in vehicle requisition process by developing a web based system. It will reduce extra time of employees leaving their offices for reports generation, also Radio Frequency Identification (RFID) technology will help employees to know availability of vehicles at real time in parking.

Keywords & Phrases— *Process, Public Sector, Request, Requisition, RFID, Rwanda, Time waste, Vehicle,*

I. INTRODUCTION

Rwanda government owns vehicles for facilitating government employees while they are performing official government business, employees share vehicle available through vehicle requisition process.

One of Rwanda's public institutions that depends heavily on vehicles is NISR (National Institute of Statistics of Rwanda), currently it owns 59 vehicles, NISR is the primary statistical agency in Rwanda [1], in NISR vehicle requisition process also is the one of the main activities because it is supporting NISR employees in requesting vehicle available

while they are coordinating and collecting reliable data in the whole country.

Rwanda government in 2000 adopted a new vision of vision 2020 which aims to transform Rwanda into a knowledge based of economy [6], for that Rwanda strives to leverage Information and Communications Technology (ICTs) in all sectors of the economy and is registering tremendous progress. An internet penetration in Rwanda grew from less than 1% in 2000 to 13% at the end of December 2013 by construction of fiber optic in the whole country, and all public institutions have internet connection; in additional internet penetration. Rwanda has a plan of investment in 4G LTE network for increasing penetration of internet, whereby end of 2016 4G LTE network is expected to increase at 95% [14].

Vehicle requisition process in Public Sector Rwanda up to now is done manual which lead the delaying of many activities and operations, due the long time of waiting the approval from managers sometimes requester change their departure time. That is why we tough to develop a web-based system which can reduce time and cost. It also can share information through parking system controlled by Arduino board and RFID technology.

II. RELATED WORKS

There are many car sharing services in the world and it is helpful for people while they are trying to rent a car in short periods of time. RFID technology make car sharing services more easily for people who are borrowing the vehicles [5], opening the door when they are using after they reserved it through web-based system or mobile application.

A. Times Car Plus

Times Car Plus is a Japanese car sharing service. They provide to their members a membership card which they will use it to unlock the door of the vehicle they reserved. People are able to rent or reserve the car in short time whenever,

wherever need through Car Times Plus web-based system or mobile application [12].

B. CAR2GO

The CAR2GO is a Canadian car sharing service. The CAR2GO member wants to reserve the vehicle in few minutes, she/he can use vehicle through CAR2Go web-based or mobile application wherever as long as she/he has a CAR2GO membership card [8].

Most car sharing service using web-based system to help their members to rent or reserve the vehicle in short time wherever they are. While the membership card helps to unlock the door vehicle. This is automated, no man-power service to reduce labor cost.

In Rwanda, there is no automated system such as car sharing services. But this project objective is to reduce time and cost spent in vehicle requisition process. That is why we thought to use Arduino board and connect on it two RFID reader (Check-In and Check-out parking gates RFID reader) [2] rather than car sharing services has Card reader on each vehicle [8] [12].

III. EXISTING VEHICLE REQUISITION PROCESS SITUATION

A. Mainly steps required in NISR's vehicle requisition process

Currently, vehicle requisition process in NISR is proceeding by following 8 steps:

(1) A requester must fill out a vehicle requisition form with the required details and take it to the head or director of the department. Then, the head or director of the department will check whether the requested use is needed and whether the items filled out on the form are properly.

The requester can receive “approved” if the head thinks it is needed, or “denied” if he/she thinks it’s not necessary. Also, he/she can send it back to the requester if the requisition is not written well.

(2) The requester takes the recommended vehicle on requisition form from the director of the department to the logistics officer.

(3) The logistics officer confirms the vehicle on the requisition form and contacts the institution’s driver to determine which vehicle is available.

(4) The requester receives the confirmed vehicle on requisition form from the logistics officer to the head of Corporate Services.

(5) Then, the head of Corporate Services will authorize the requisition if it is needed or deny the requested vehicle being taken.

(6) The requester receives the authorized vehicle requisition form from head of Corporate Services and presents it to a driver.

(7) The requester receives the vehicle with a driver, and the requester shows the form to the gate keeper.

(8) Finally, when the requester returns, he/she must take the vehicle requisition form back to the logistics officer so that it can be used later for reporting.

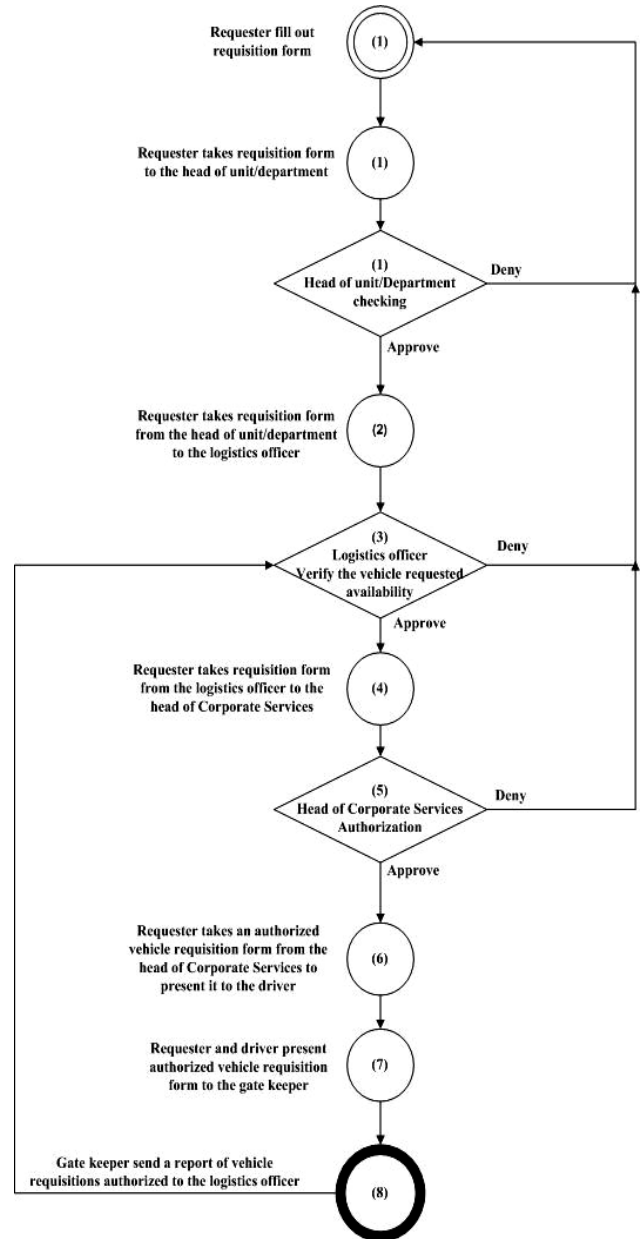


Fig. 1. Current situation of requisition process in NISR

Figure 1 shows 8 steps requester must follow to request a vehicle in official government business use.

B. Current situation analysis

Conducting this project, the questionnaires that are focusing on time spent in vehicle requisition process are distributed 45 samples and submitted them in NISR. We got the feed-back from 30 from the respondents. Then the data are used in analyzing current situation of vehicle requisition process in Rwanda public sector.

TABLE I. TOTAL TIME FROM 30 RESPONDENTS USED IN VEHICLE REQUISITION PROCESS

Process	Different comments	Total time used/Process(days,h:m)
1	Replacing an Empty Ink cartridge activity took 25 min/Rejected/ we did a meeting at 8AM	18hours and 34 minutes
1'	Approved	13hours and 16minutes
1''	Approved	2hours and 21minutes
2	Rejected/ no vehicle was available	22hours, and 50minutes
2'	Approved	18hours, and 42minutes
3	Approved/ after lunch time/ The approval delayed because manager was busy in a meeting	3days, 8hours and 24minutes
3'	Approved	1hours
	Gr. Total(days, h:m)	6days, 13hours and 7minutes

Table 1 shows the total time of the requisition process and different kind of comments that explain why requests delayed for each process. It summarized after all 30 forms from the responds in NISR are combined.

The steps (1) to (8) showed in Figure 1 are into process 1 to 3 of table 1.; Process 1, 2, and 3 are equivalent as follow:

- Process 1: Print out, fill and submit form to the Head of Department which is equivalent of step 1 in Figure 1.
- Process 2: Submit a form to the Logistics Officer this process combined steps 2, 3 and 4 in Figure 1.
- Process 3: Submit a form to the Head of Corporate Services, this process 3 is equivalent of step 5 in Fig 1.

Regarding the process 1', 1'', 2'' or 3'of table 1, if one process is rejected then requester must start from process 1. And the reason we renamed them 1'', 1''' or 2'', 2''' means, it can show how many times requester repeated the process.

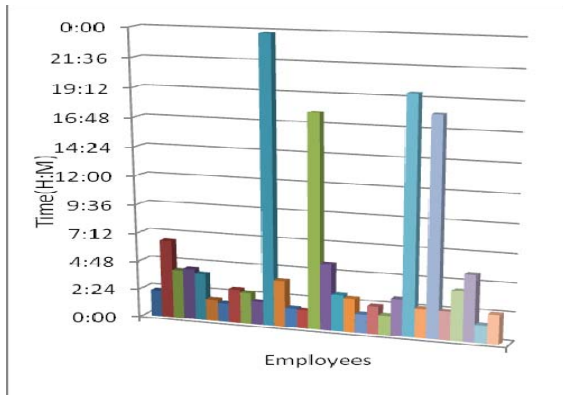


Fig. 2. Proportions of total time spent for a single vehicle requisition from 30 employees(respondands)

Figure 2 shows proportions of total time used for each vehicle requisition. It shows total time each respondent spent to request for rent a single vehicle. Figure 2 shows many requests took more than 2 hours to get approval from managers. It means time consuming. And new system will be able to reduce the waste. Because the new system can check vehicle's availability automatically, and requester can make a requisition without leaving her/his office. Additionally managers can receive notification of new coming requests and approve or denial immediately as long as they have internet connection.

Data collected from 30 respondents showed grand total time equal to 6 days, 13 hours and 7 minutes as it is showed in Table 1. It also shows us an average of 5 hours and 14 minutes and Standard deviation of 6 hours and 1 minute.

IV. NEW SYSTEM WITH RFID TECHNOLOGY

Vehicle requisition process in Rwanda public sector, it is time and cost consuming as we showed it in previous section. After considering Rwanda situation and car sharing services we thought to resolve this problem by developing a web-based system which share data with parking system using RFID technology and arduino board.

The new system of vehicle requisition is a web-based system; it will assist the requesters to access on the system wherever they are without leaving their office as long as they have internet connection.

Also this system share vehicle information with Parking System. This will remove steps (2), (3) and (4) which showed in Figure 1. Parking System operates with automated gate/barrier and RFID technology [3], this will remove steps (6), (7) and (8) which showed in Figure 1 as well. So we hope all those improvement in new system will save time in requests approval and in fast operation of checking authorized or unauthorized vehicle. Additionally it will realize to open or close the gate/barrier automatically, and to save the money for the work of no human (gate keeper) involvement.

Figure 3 below shows whole system architecture of this project. The left side describe web-based vehicle requisition process, the right side, it is parking system and both side together share one database.

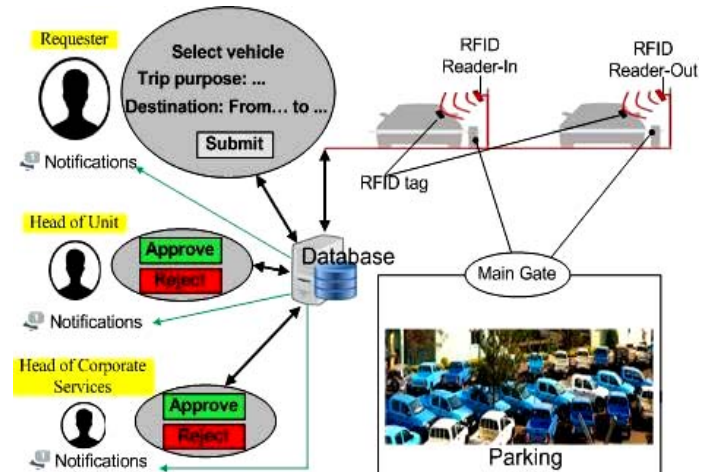


Fig. 3. System architecture

The system mainly functions:

1. System management
2. Vehicle requests management
3. Requests notifications
4. Reports generation
5. Parking management

A. System management

We can register the users and give them the different privileges based on their position or job title they have in organization. Then system is able to manager all those users while they want to login on the system. Also system is able to manager all vehicles added in the system database. So that users can know which vehicle is available or not and after she/her got final approve from her/his supervisor, system will assign to her/him automatically vehicle he/she requested.


A web form titled "Employee Information" with a light gray background. It contains several input fields: "First name", "Last name", "Birthdate", "ID Card No", "Email", "Cell Phone", "Position" (a dropdown menu with "-----Select-----" and a downward arrow), and "Department" (a dropdown menu with "-----Select-----" and a downward arrow). At the bottom right, there is a light gray "Add" button.

Fig. 4. Add new user page

Figure 4 shows a web page for adding new user, while new employee is registered in organization automatically she/he will received initial user account information via her/his email which she/he may change it after login at Vehicle Requisition System.

A web page for the "VEHICLE REQUISITION SYSTEM". It features a green header bar with the system name in white. Below the header is a dark blue bar. The main content area has a light gray background and is titled "Login". It contains two input fields: "Username" and "Password", each with a red asterisk to its right. Below these fields is a light gray "Login" button.

Fig. 5. Login page

Figure 5 shows a login page, for system security reason after user added in the system she/he may login. And system is able to manager user authentication.

B. Vehicle requests management

The new web-based system manages vehicle requests whereby the requester is able to:

- (a.) submit her/his new vehicle request,
- (b.) check request status,
- (c.) view all requests submitted,
- (d.) view vehicle information after received final approve,
- (e.) edit request rejected
- (f.) resubmit it again.

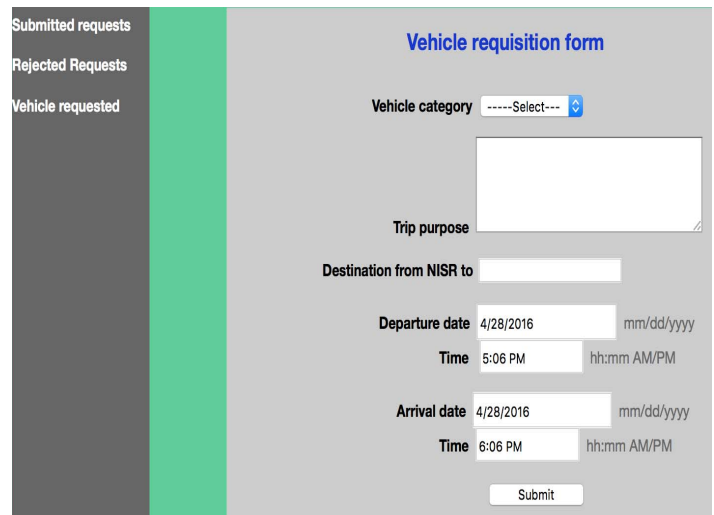
A web form titled "Vehicle requisition form" with a light gray background. On the left, there is a vertical sidebar with three items: "Submitted requests", "Rejected Requests", and "Vehicle requested". The main form area contains several input fields: "Vehicle category" (a dropdown menu with "-----Select-----" and a downward arrow), "Trip purpose" (a text area), "Destination from NISR to" (a text field), "Departure date" (a date field with "4/28/2016" and "mm/dd/yyyy"), "Time" (a time field with "5:06 PM" and "hh:mm AM/PM"), "Arrival date" (a date field with "4/28/2016" and "mm/dd/yyyy"), and "Time" (a time field with "6:06 PM" and "hh:mm AM/PM"). At the bottom right, there is a light gray "Submit" button.

Fig. 6. Vehicle requisition page

Figure 6 shows a web page of new vehicle requisition form for a requester. She/he can fill when she/he want to request a vehicle.

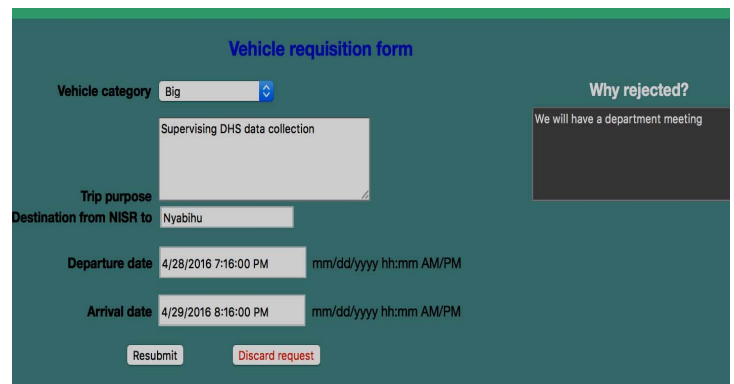
A web form titled "Vehicle requisition form" with a dark teal background. It contains several input fields: "Vehicle category" (a dropdown menu with "Big" and a downward arrow), "Supervising DHS data collection" (a text area), "Trip purpose" (a text area), "Destination from NISR to" (a text field with "Nyabihu"), "Departure date" (a date field with "4/28/2016 7:16:00 PM" and "mm/dd/yyyy hh:mm AM/PM"), and "Arrival date" (a date field with "4/29/2016 8:16:00 PM" and "mm/dd/yyyy hh:mm AM/PM"). At the bottom, there are two buttons: "Resubmit" and "Discard request". On the right side, there is a dark gray box titled "Why rejected?" with the text "We will have a department meeting".

Fig. 7. Resubmit request rejected page

Figure 7 shows resubmission of request rejected. This page help the requester to edit her/his request, to reject and resubmit it again without back to start point in vehicle requisition process as we want to reduce time.

Edit account
Logout

Approve
Reject

Head of Corporate Services

All requests submitted

	Employee Name	Job Title	Trip Purpose	Destination	Departure Time	Arrival Time
Select	TWEHEYO	Student	Collecting Data	Kacyiru	4/29/2016 7:15:00 PM	4/29/2016 8:16:00 PM
Select	KABERA	Student	Supervising DHS data collection	Nyabihu	4/28/2016 7:16:00 PM	4/29/2016 8:16:00 PM

Fig. 8. Requests approve/ reject page

After vehicle request submitted, requester will wait approval from her/his manager. Figure 8 shows web page which managers use for requests approval whereby manger can approve or reject it.

C. Requests notification

All users are able to receive emails notification according to their privileges they have to this vehicle requisition system. For example, if user is a requester, then she/he is able to receive email notification about her/his requests status. Or if user is a manager, then she/he is able to receive email notification of new requests submitted so that she/he can approve or reject it as soon as possible.

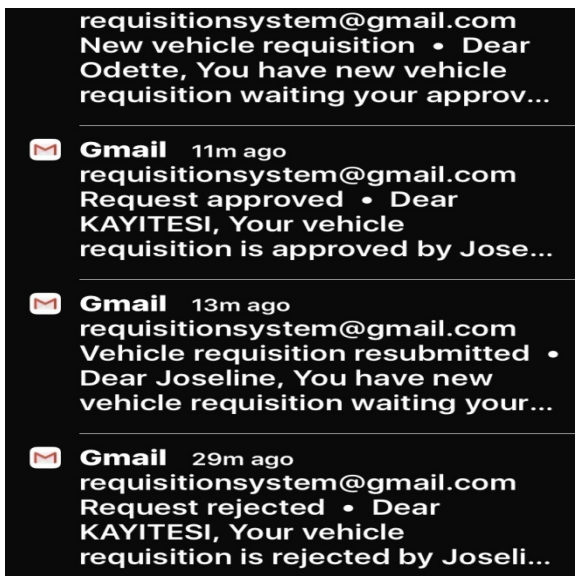


Fig. 9. Emails notification

Figure 9 shows different emails notification from vehicle requisition web-based system to the users according to their privileges they have to the system.

D. Reports generation

The vehicle requisition web-based system is able to generate different reports in a short time. Users may have a look at the information or print it out.

Vehicle(s) requested history

Name	Position	Destination	Veh. Plate#	Veh. model	Driver Name	Time-Out	Time-In
Thierry	Enumerator	Muhanga	RAB 828 C	HIACE	Bosco	15:22 3/15/2016	15:23 3/15/2016
Patrick	Enumerator	Musanze	RAD 603 X	Toyota	Bosco	15:58 3/15/2016	15:58 3/15/2016
Didas	Team Leader	Huye	RAB 828 C	HIACE	Bosco	17:40 3/16/2016	17:42 3/16/2016
Dancila	Enumerator St.	Kanombe	RAD 603 X	Toyota	Bosco	17:41 3/16/2016	17:42 3/16/2016
Rahab	Enumerator St.	Musanze	RAC 903 Z	NISSAN	Bosco	17:41 3/16/2016	17:41 3/16/2016
Jean Marie	Network Suppr.	Karongi	RAB 323 Y	Toyota	Bosco	20:21 3/17/2016	20:23 3/17/2016

Fig. 10. Vehicles requested report

Parking status

active Vehicle(s)			
Plate Number	Veh. Model	Veh. Category	Driver Full Name
RAC 888 Z	NISSAN	Big	Bosco RWAKA
RAD 603 X	Toyota	Medium	Bosco RWAKA
GR 603 H	NISSAN	Small	Jimmy KAYUMBA
RAB 323 Y	Toyota	Big	Bosco RWAKA

desactive Vehicle(s)			
Plate Number	Veh. Model	Veh. Category	Driver Full Name
RAB 828 C	HIACE	Medium	Bosco RWAKA
RAB 888 C	Toyota	Small	Jimmy KAYUMBA
RAC 675 B	Toyota	Big	Jimmy KAYUMBA

Fig. 11. Vehicles status in parking report

Figure 10 and 11 show different reports user may want to see or print out, where she/he may want to see all vehicles requested history as shown on Figure 10; also she/he may want to see how many or which vehicles are available or not in parking, Figure 11.

E. Parking management

The parking system is controlling by RFID reader which is connected on Arduino board. Each vehicle has RFID tag, when requester wants to take a vehicle out or come in parking. RFID reader will check in short time if vehicle is authorized or not by reading vehicle's tag. If vehicle is authorized, gate will open and update vehicle status information. Other user can know which vehicle is available or not. In case vehicle is not authorized gate will not open.

Home Logout

Edit

Parking status

	Vehicle Type	Category	Tag ID	Plate #	Driver name	Driver ID#	Time In	Vehicle status
Select	Toyota	Big	7890	RAB 323 Y	Bosco	1198780007452086	4/19/2016 12:22:15 AM	active
Select	HIACE	Medium	74246	RAB 828 C	Bosco	1198780007452086	3/22/2016 11:49:29 PM	desactive
Select	NISSAN	Big	6677	RAC 888 Z	Bosco	1198780007452086	4/23/2016 9:05:21 PM	active
Select	NISSAN	Small	22345	RAC 903 Z	Bosco	1198780007452086	3/23/2016 7:34:32 PM	desactive
Select	Toyota	Medium	4294963653	RAD 603 X	Bosco	1198780007452086	4/19/2016 12:29:29 AM	active

Fig. 12. Vehicles information in parking

Figure 12 shows basic information of vehicles. Whereby data of “vehicle status” changes by requests approval and parking system after RFID reader checked vehicle’s tag.

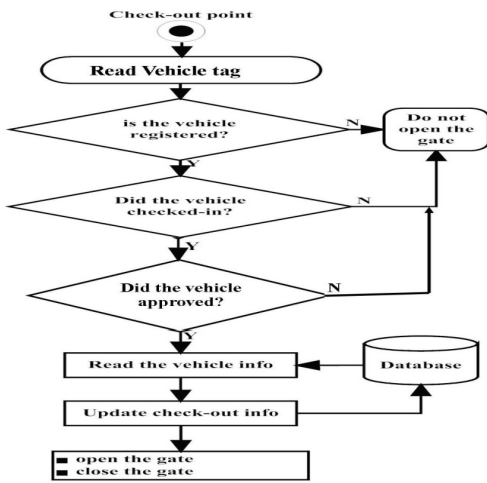


Fig. 13. Vehicles check-out process

After requester received final approval when she/he can take the vehicle out of parking, parking system will perform check-out process as shown in Figure 13.

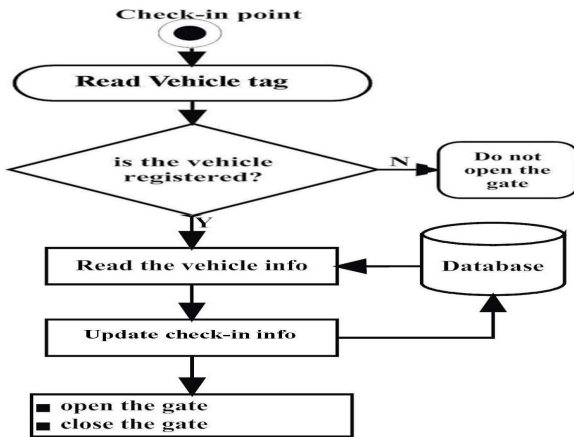


Fig. 14. Vehicles check-in process

Figure 14 illustrates Check-in process. When requester turns back a vehicle or after registered a new vehicle in vehicle requisition database, parking system also performs check-in process.

V. CONCLUSION

According the analyzing the data of current situation of vehicle requisition process in Rwanda Public Sector, and functions of our prototypes (Vehicle Requisition and Parking Systems) shows that new system will assist public institutions in speed up activities of vehicle requisition process and vehicles management. We can expect it increases the efficiency and services delivery in Rwanda public institutions.

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