Detection Of "Abandoned" Vehicles In Public Vehicle Parking Environment [Based On Time]

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ABSTRACT

It is common to come across "Abandoned" Vehicles [AV] in many of the public Vehicle Parking Environment [VPE] facilities. Very few if any of these vehicles are really abandoned; in most scenarios Motorists drive into a public VPE facility then walk out, creating an impression that they are going to be back in a short while, only to return after a day or so. Lack of proper data sharing for Vehicle Verification [VV] is not making the situation any better. In some cases, vehicles are left and nobody turns-up to claim them for days, the public VPE company is left in limbo, not knowing what to do with such vehicles since they do not have a proper mechanism to verify vehicle ownership. "Abandoned" vehicles pose security risk to the company managing the VPE facility and the public. This study seeks to establish occurrences of AV[s] within the County of Nairobi, and to develop a prototype named "Owner Vehicle Verification System" [OVVS], which will do Vehicle Verification [VV] for "abandoned" vehicles by "fetching" for vehicle ownership information from a "dummy" KRA registry, and "return" information on the "abandoned" vehicles.

Keywords: "Abandoned" Vehicle[s], Vehicle Verification, Motorist[s], and Vehicle Parking Environment.

1. INTRODUCTION

Approximately 2 million vehicles were registered in Kenya in the year 2013. About 60% of these vehicles were in Nairobi alone, creating an urgent demand for public Vehicle Parking Environment [VPE] services for Motorists. A report on mitigation of road traffic in the metropolitan Nairobi, stated that the expected exponential growth of population in Nairobi will about 14 Million by the year 2030 (Gachanja, 2015). This growth in population comes with increased vehicle ownership, and vehicles must be parked somewhere at some point if they are on the road (Muema, et al., 2014).

The Kenya Airports Parking Services Limited [KAPS Ltd] is a company registered and headquartered in Kenya's capital city-Nairobi. It started operations in 1999 providing parking services within the County of Nairobi, then later expanded to the wider East African region. Its core business is parking services, but over the years it has expanded implementing technologies such as; Automatic Number Plate Recognition [ANPR], Access Control, Revenue Management Systems, and Facility Automation (Kenya Airports Parking Service Ltd, 2015).

To achieve the main and specific objectives of this study, the Parking Facility Manager [PFM], and the Parking Facility Officers [PFO] from selected VPE facilities managed by KAPS Ltd, were engaged for proper understanding of the daily operations at the VPE facilities. The researcher was taken through policies [drafted by KAPS Ltd, and in line with County Government regulatory] regarding the use of the public VPE, which all Motorists and PFOs were required to follow to ensure quality of service and safety.

2. STATEMENT OF THE PROBLEM

Very limited research has been done [if any] on AV[s] and its associated security risks in Kenya. Fujita described anything that has a potential to attract offenders [with the intention to commit a crime] in a location as a crime generator. In his example, "A person notices that every time he visited a shopping mall there were many cars left unattended and unlocked in the parking lot for a long period. The person steals a car one day and tells his friends about his successful offense. Consequently, new thieves began to come to the mall's parking lots to take advantage of such criminal opportunity" (Fujita, 2011). With regards to (Fujita, 2011) the AV in public VPE would be the crime generator.

The presence of bold public disclaimer signages in public VPE reading, "Park Vehicle at Your Own Risk", is an indicator of likelihood of theft of/in vehicles, or the facility owner distancing himself from taking responsibility incase a criminal event occurs. Moutou stated that parking space is a scarce asset and should be open for sharing. He elaborated using a scenario depicting that, a public VPE was full, only to be realized later that the same vehicles had occupied the same parking spaces for more than 24 hours, therefore denying other Motorists a fair opportunity to utilize the facility (Moutou, 2013).

The study appreciated the fact that KRA vehicle registry is the only authoritative and comprehensive vehicle database that has extensively recorded all vehicles registered in Kenya (University of Nairobi Enterprise and Services Ltd, 2014). Therefore, authentic data on vehicle ownership could only be sourced from KRA. Lack of reliable data sharing mechanism between the public VPE facilities and KRA created a gap which the researcher intends to fill.

2.1 RESEARCH OBJECTIVE

The objective of the study was to investigate occurrences of AV[s] in selected public VPE facilities within the County of Nairobi, and to develop a prototype-called Owner Vehicle Verification System [OVVS], for detection of AV[s] in public VPE.

The study had the following specific objectives;

- To establish that there are cases of AV[s].
- To identify Motorists' requirements for a secure public VPE facility.
- To develop a Vehicle Verification prototype.
- To test the Vehicle Verification prototype.

3. LITERATURE REVIEW

The study reviewed similar literatures done in the past. There was no guarantee that a specific approach used to solve a research problem elsewhere, could successfully be implemented to solve a similar research problem

on a different environment. The researcher borrowed ideas from similar research and contextualized them to fit the current local environment.

3.1 DEFINITION FOR "ABANDONED" VEHICLES

The Vermont Government defined AV[s] as, a vehicle with or without a valid registration, and has been parked either on a public or private property [or along a highway] for more than 48 hours without the permission of the property owner (Vermont Government, 2016). In Kenya, the Government authorities, and specifically the County Government of Nairobi, does not have a specific definition for AV[s]; this is probably an area that needed to be addressed in future. For the purposes of this study, and in the Kenyan context, AV[s] shall be defined as; any vehicle that remains parked either in a public or private Vehicle Parking Environment [VPE] facility for more than 24 hours, without a notification of overstaying for such duration.

3.2 INSTANCES OF "ABANDONED" VEHICLES

As witnessed at the Milimani Courts parking yard in the heart of Nairobi, evidence of AV[s] is real in Kenya (The Star, 2016). In Birmingham, a very expensive Mercedes S-Class was "abandoned" at Broadway Plaza public VPE for over 3 years accumulating a total of £14000, equivalent to Ksh.1997708.69/= (Linning, 2014).

Figure 1: "Abandoned" Vehicles at Milimani Courts public VPE-Nairobi

Source (The Star, 2016)

3.3 AUTOMATIC NUMBER PLATE RECOGNITION

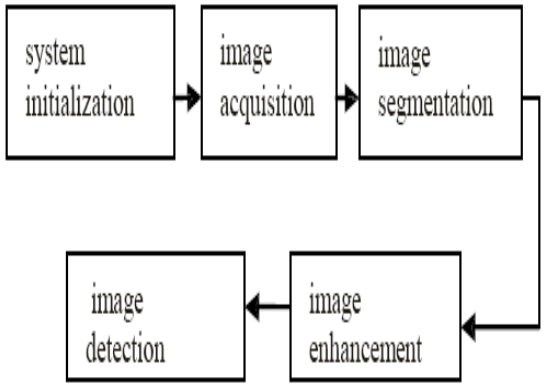
A variety of Automated Number Plate Recognition [ANPR] existed and were deployed for various use namely; traffic control, violation of traffic, control of access to cities, and vehicle parking facilities (Atanassov, 2012). ANPR was originally utilized for traffic control and road toll collection then later adopted by other users like public VPE facility operators, and lately by the law enforcement authorities. At KAPS Ltd, the ANPR system works in three basic steps as follows; [i] Camera targets and captures the vehicle number plate [ii] Compares the number plate against a locally created "hot" list database [iii] The driver/operator is alerted of the "hot" list match details (Kenya Airports Parking Service Ltd, 2015).

Action need to be taken to avoid conflict and to provide economic, social, and environmental benefit for public VPE facility users (A. Yass, et al., 2010). KAPS Ltd documented that their ANPR relies on a "hot" list of number plates created by ANPR- processor to recognize stolen vehicles (Kenya Airports Parking Service Ltd, 2015). This list is not comprehensive enough to include all registered vehicles in Kenya, as confirmed by a report on the inventory of vehicles in Kenya by the University of Nairobi, that KRA is the only official body mandated to register all motor vehicles in Kenya (University of Nairobi Enterprise and Services Ltd, 2014). Therefore, the ANPR at KAPS Ltd can only get a match for Vehicle Number Plates [VNP] that exists in its "hot" list.

3.4 INTELLIGENT PARKING SYSTEM

Intelligent Parking System consisting of five modules was designed. The procedure to identify parking location was done by the System Initialization module, digital images storage was done by the Image Acquisition module, which linked to a processing unit. The Image Segementation unit seperated objects from background and adjusted pixels to improve on contrast, then Image Enhancement module removed noise. The last stage involved Image Detection module, which determined rounded image. The concept was to discover parking system by image processing rather than the use of sensor (Yusnita, et al., 2012).

Figure 2: System Module

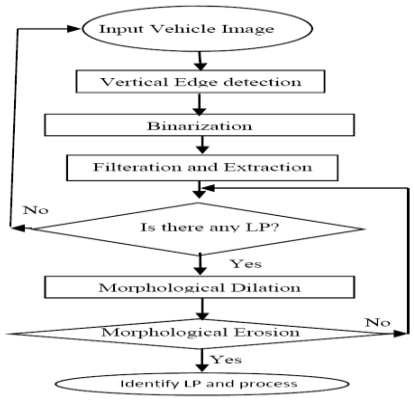


Source (Yusnita, et al.,2012)

3.5 AUTOMATIC PARKING MANAGEMENT SYSTEM

Automatic Parking Lot Management system was developed (Olatinwo & Shoewu, 2013), and (Rashid, et al., 2012) proposed to improve and develop Automatic Parking Management Systems and Parking Fee Collection, based on vehicle registration number recognition. Data acquisition was done via ultrasonic sensors to count available parking space. Acquisition of vehicle image was done at the entrance.

Figure 3: License Plate Recognition Flow Chart



Source (Rashid, et al., 2012)

3.6 WIRELESS PARKING MANAGEMENT SYSTEM

A wireless system was proposed, transactions were carried out wirelessly and Motorists could be informed of the available parking space via a GPS navigation system, and an algorithm could assist drivers to choose a parking slot (Rane, et al., 2014).

3.7 MOBILE PARKING SYSTEM

Assessment on adoption of Mobile Parking System [MPS] was done in Nairobi, and it was realised that majority of respondents were attracted to MPS because a bigger percentage of respondents had access to mobile phone, and 87% to 88% of the respondents believed adoption of such systems will maximize effeciency of the payment, and 81% agreed that it will improve customer experience (Muema, et al., 2014).

3.8 MOBILE PHONE-BASED PARKING SYSTEM

A Mobile Phone-Based Parking System was proposed with the objective of automating the management of parking facilities within the City of Nairobi. The system could allow Motorists to identify vacant parking slot within a parking facility using a mobile phone, and effectively be able to transact for the motorist (Kinyanjui & Kahonge, 2013).

3.9 "ABANDONED" VEHICLES, AND ASSOCIATED RISKS

Two children suffocated and died while playing in an AV in Kisumu (KTN, 2016). Government vehicles were abandoned and vandalized in a public VPE in Nairobi (The Star, 2016). On a report borne out of their 24th meeting (Eastern and Southern Africa Anti-Money Loundering Group, 2012) considered motor vehicle smuggling a global problem. These smuggled vehicles eventually utilized public VPE[s]. Scarcity of parking spaces and the ever-increasing population of vehicles on roads, have occasioned numerous problems to the County Government of Nairobi and Motorists (Ongeche, 2016). Attempt was made to develop a system to detect AV[s] using real time occlusion tolerant detection (Hassan, et al., 2012).

4. DATA ANALYSIS/ FINDINGS

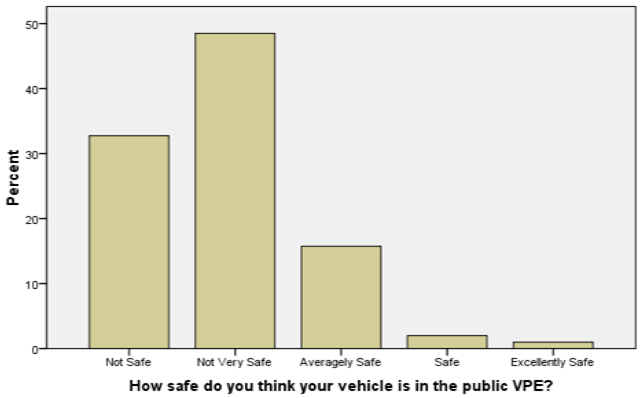
4.1 QUESTIONNAIRE FORMS

The study focused on Motorists as the main target group. No vehicle can park itself in a public VPE, it must be driven or be controlled remotely by someone. This was the reason as to why Motorists were selected as the main target group. The study relied upon primary data collected from the main target, and the VPE facility employees. The use of questionnaire forms is said to be best suited for acquiring data from literate people (C.R. Kothari, 2004). Motorists were served with questionnaire forms which were structured with closed ended questions, to get information with respect to security and vehicle parking behavior. 400 Motorists utilizing 6 VPE facilities within Nairobi, were served with questionnaire forms. Data from the questionnaires were coded using the SPSS version16 application, and frequency analysis was done. The questionnaire addressed objectives [a] and [b].

Figure 4: A Graph Establishing Occurrences of "Abandoned" Vehicles

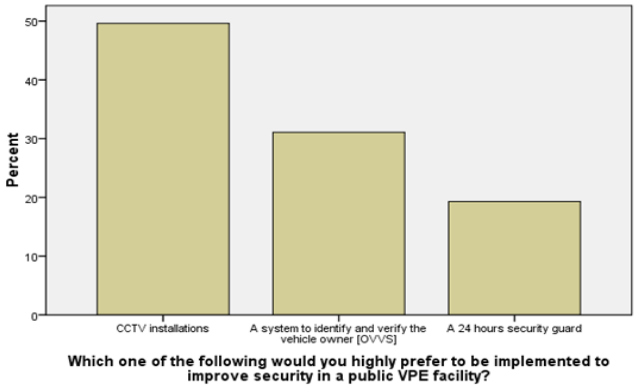
The findings of the analysis to the question targeting the first [a] objective indicated that 40% of the 400 Motorists who were served with the questionnaire forms, agreed that at one point, they left their vehicles parked for more than 24 hours in public VPE, and as such, these vehicles were deemed to be "abandoned" with regards to the definition of "abandoned" vehicle in this study. A solid 60% of the 400 Motorists who filled the questionnaire form agreed that they utilized public VPE, but the registered different views with regards to security of the public VPE facility. From the analysis, 32.8 % felt that the public VPE is not safe, with a bigger percentage of 48.5% thinking that the public VPE is not very safe. 15.8 % of Motorists thought that public VPE was averagely safe in terms of security, leaving 2% as those who thought that the public VPE is safe, and only 1% thinking that the public VPE is excellently safe. The diagram below shows Motorists' views with regards to safety in the public VPE facility.

Figure 5: Motorists' Views Regarding Safety in Public VPE



The researcher sort to find out what requirements could be implemented to improve security in the public VPE facilities. Three options of requirements were presented to the Motorists to choose. Findings from the analysis showed that 49.5% of Motorists preferred that CCTV should be implemented to improve security, followed closely by 31% of Motorists, who preferred a new system [OVVS] to be implemented, while 19.2% preferred that a 24-hour security guard should be implemented.

Figure 6: Motorists' Security Requirement Preference



4.2 ONE-ON-ONE INTERVIEW

One PFM offered to give detailed information through a one-on-one interview. The PFM revealed that work at VPE facilities was done on shifts of 8 hours, and the number of PFOs for a single shift depended on how busy the VPE facility was. The PFM took the researcher on a systematic process of how the current system is used for the detection of "abandoned" vehicles. Several crucial revelations were made during the one-on-one interview with the PFM;

- The system in use for the identification of AV[s] is purely manual, and is prone to errors and inconsistencies.
- Work in the VPE facilities is done on shifts and due to shortage of staffing, sometimes PFOs are forced to work beyond normal working hours. This causes fatigue and contributes to a lot of human error and

inconsistencies in preparing the EoS report, which is very important for the manual identification of AV[s].

- There were reported cases of vehicle vandalism, especially on vehicles that were "abandoned". Vehicle parts like, headlamps, side mirrors, and wheel-caps were vandalized.
- Signage with warnings a message, "Park Vehicle at Your Own Risk", was used to protect the VPE facility company from legal litigation.
- There was a challenge of getting vehicles ownership information for "abandoned" vehicles due to tough Government bureaucracy and policies.
- The County authority policies and laws are silent on "abandoned" vehicles, sometimes PFMs don't know how to handle issue of "abandoned" vehicles.

4.3 MANUAL REPORTS & DOCUMENTATIONS

Hand written materials such as the "End-of-Shift" [EoS] reports and lists were used to record case of "abandoned" vehicles. Each PFO was required to prepare the "End-of-Shift" report before handing-over shift to the next PFO. The EoS report is a manually [Hand-written] prepared report, done on a 6-quire black book, where details such as; the number of vehicles that have remained parked overnight, and any incidents are recorded. Evident cases of "abandoned" vehicles were witnessed as follows;

- Nakumatt-Lifestyle……. 2 "abandoned" vehicles
- Eastmatt Supermakrket……...1 "abandoned" vehicle
- Valley Arcade…… 2 "abandoned" vehicles

Evident Photos of "Abandoned" Vehicles at Different VPE within Nairobi

Figure 7: "Abandoned" Vehicle at Valley Arcade public VPE facility

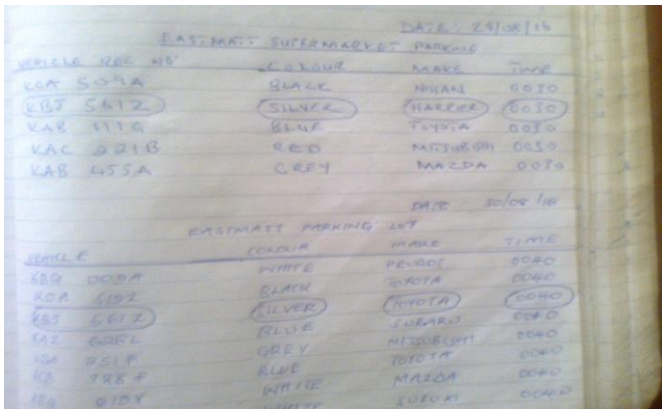
Figure 8: "Abandoned" Vehicle at Eastmatt Supermarket VPE Facility

4.4 THE CURRENT MECHANISM FOR DETECTING "ABANDONED" VEHICLES

Currently, the mechanism in use to identify and detect AV[s] is purely manual. Every PFO was required to write a report called "End-of-Shift" report on a black book commonly referred to as the "Hand Over Report Book" or simply the HORB. The EoS report enlists all vehicles that have remained parked at the time of handing over shift to the next PFO. This trend is continued by all other PFOs, and it would take very keen eyes to identify and detect "abandoned" vehicle when going through the EoS reports in the HORB. The difference in the details such as; the time when a specific vehicle moved in to park, duration/time the vehicle has remained parked, the vehicle registration number, and where the vehicle is physically parked, are very crucial information to help decide whether a vehicle is "abandoned" or not.

With respect to the definition of "abandoned" vehicle in the Kenyan context in this study, ideally, the PFO should be able to identify and detect "abandoned" vehicle after the third shift [after 24 hours], but this is not usually the case-because, PFOs are humans and are prone to errors [such as; forgetting to write a report, suffer fatigue, omission/commission errors, or just failing to go through the EoS report]. Because of this, there are documented evidence of vehicles being "abandoned" for 3 months, 3 years, and even 5 years. All these renders the current mechanism prone to errors, unreliable, and inconsistent. In some cases where the PFO identified "abandoned" vehicles, he/she was required to follow the company policy which dictated that such cases be reported to the PFM, should escalate the matter to the head office, where the company lawyer will pick the case up and contact the vehicle owner after verifying the vehicle ownership details from the relevant authorities. Excerpts of EoS report and list with a clearly marked-out circle to emphasize the cases of "abandoned" vehicle are found below;

Figure 9: An Excerpt of the End of Shift [EoS] Report



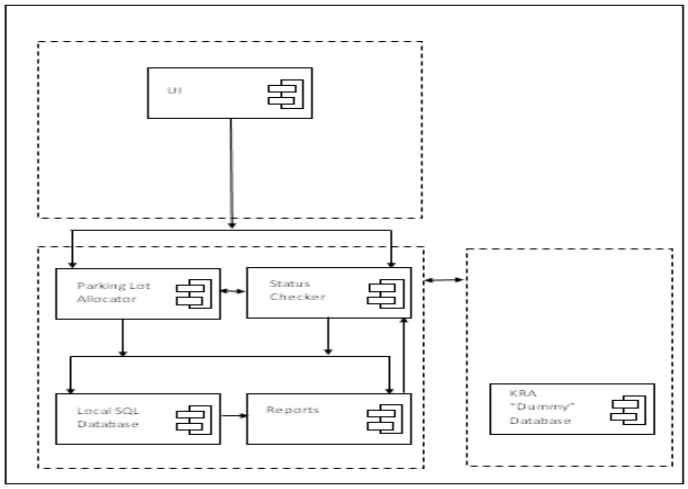
4.5 THE SYSTEM DEVELOPMENT METHODOLOGY

The prototyping software development methodology was used for the development of the OVVS prototype. The justification for using the prototyping approach for the development of the prototype was based on Jamwal's analysis, where prototyping software development model stood out as a model with no risk analysis, high user involvement, good guaranteed success, simple, and was found to be more flexible (Jamwal, 2010). Also (Nguyen & Vai, 2010) shared a similar perspective, where they stated that, Rapid Prototyping is a customer oriented software development model that puts more emphasis on validation, and that it throws its weight on strong advantages such as; very low risk of inappropriate user requirements, uncommitted and accommodates new changes during development, and has a good support for market.

4.6 THE SYSTEM ARCHITECTURE

The system architecture shows specific components of a system, how they are structured and interconnected (Coulouris, et al., 2011). The OVVS architecture is depicted below;

Figure 10: The OVVS Prototype Architecture



4.7 CODING & DEVELOPMENT

The .Net platform was used for coding. The choice of .NET was informed by the fact that Microsoft widely supports it, and that, it is widely available in almost all Windows based OS (Tutorialspoint, 2017). During coding, each module/component was repeatedly subjected to the user and recommended changes were included, in line with the Prototyping requirements which dictates that the three middle phases [Design, Prototype Development, and Customer evaluation phases] must iterate to improve acceptance by customer (Nguyen & Vai, 2010).

4.8 THE DESIGN OF OVVS PROTOTYPE

The researcher used his knowledge and the information collected from both the target group [Motorist] and the KAPS Ltd employees to come up with a blue-print design for the OVVS prototype. Some of the phases involved were;

- UI [User Interface] design
- The Database design [for both local, and KRA "dummy" Database]
- Reports structures.

The User Interface [UI] was designed to be as simple as possible, strategically positioning screen elements for the user to easily locate them, re-enforced clarity, user-centered, and with a high degree of better results. Objects like, Menus, Buttons, Scrollbars, and such like were used to increase the ease of use. Sense of security was provided by the provision for user login authentication. It was included to ensure some level of security and integrity of the stored data. It made sure that only a legitimate user gained access to the system and rights to other system modules via the UI.

The OVVS was designed to have a local database for local data storage. Data such as; make of a vehicle, vehicle number plate, color, and login/log out date/time were stored in the local database. The local database does not contain enough data/information to authoritatively match the vehicle details to a vehicle owner, for the purposes of identifying the vehicle owner. In this respect, a "dummy" KRA database was designed to fill the gap. The "dummy" KRA database was created in this project because of the Government bureaucracy, and policies which could not allow the researcher to link the prototype to the real KRA database. The choice of simulating the KRA database was inspired by the fact that KRA is the only [at the time of this study] authority that is mandated by the Government to register all vehicles in Kenya, and as such, it is the only authority that has a comprehensive register of all vehicles/owner registered in Kenya. When "abandoned" vehicle was detected, a query was made to the "dummy" KRA database with respect to the data of the "abandoned" vehicle in the local database, and when a match was found, the vehicle ownership details such as, phone number, National Identification number/Passport number, or other contacts, were used to locate and contact the vehicle owner. Below is section of a function, fetching for vehicle owner information.

Figure 11: A Function to "Fetch" for Vehicle Owner Information

```
Function GetOwner(ByVal regno As String) As String
    Dim ans As String = "NOT FOUND"

    Try
        ConnOpenKra()
        ComKra.CommandText = "SELECT * FROM tblkra_sample WHERE car_number_reg = '" & regno & "'"
        ComKra.Connection = CnnKra
        Dim dbDR As MySql.Data.MySqlClient.MySqlDataReader = ComKra.ExecuteReader
        dbDR.Read()
        If dbDR.HasRows = True Then
            ans = dbDR("first_name") & " " & dbDR("middle_name") '& " " & dbDR("last_name")
        End If
        dbDR.Close()
        CloseConnOpenKra()
    Catch ex As Exception
        MsgBox(ex.Message)
    End Try

    Return ans
End Function
```

4.9 THE LOGICAL OPERATION

The logical operations determined the status of a vehicle in the public VPE facility. For instance, a logic code pegged on time-duration was used to check how long a vehicle has remained parked and compared this with the normal hours required for any vehicle to remain parking. In accordance with the definition for "abandoned" vehicle in this study, a vehicle status for a vehicle that has remained parking for more than 24 hours was reading "abandoned" status. On the other hand, a vehicle that remained parking for less than 24 hours, had its status reading, "cleared for exit". logics were also used where the system needed to "fetch" for information from a remote resource. In this case, the "dummy" KRA registry was the external resource where detail information on vehicle ownership could be "fetched". An instance of a logic fetching for information from the "dummy" KRA registry is shown below.

Figure 12: An Excerpt of a Logic from the "Dummy" KRA Vehicle Registry

```
Public Class FormKRAinfo
#Region "FORM'S FUNCTIONS"
    'fetch KRA information
    Public Sub view_krainfo()
        ConnOpenKra()

        ComKra.CommandText = "SELECT * FROM tblkra_sample WHERE car_number_reg = '" & selected_krainfo_car_plates & "'"
        ComKra.Connection = CnnKra
        Dim dbDR As MySqlDataReader = ComKra.ExecuteReader
        dbDR.Read()
        If dbDR.HasRows = True Then
            txtvehicleRegno.Text = dbDR("car_number_reg")
            txtfname.Text = dbDR("first_name")
            txtlname.Text = dbDR("last_name")
            txtmname.Text = dbDR("middle_name")
            txtgender.Text = dbDR("gender")
            txtkrapin.Text = dbDR("KRA_PIN")
        Else
            Me.Close()
            MsgBox("No records found in KRA DATABASE")
        End If
        dbDR.Close()

        CloseConnOpenKra()
    End Sub
#End Region

    Private Sub FormKRAinfo_Load(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles MyBase.Load
        view_krainfo()
        btnsave.Select()
    End Sub
```

4.10 THE OVVS PROTOTYPE TESTING

The working and functionality of the OVVS prototype was tested using three approaches namely;

- Unit Component Testing
- Test on Ease of Use

– The General System Test

4.10.1 UNIT COMPONENT TESTING

Each module was separately tested on how it interacted with other Modules, how it accepted input, process, and output results. They were checked for correctness, consistency, and conformity.

4.10.2 TEST ON EASE OF USE

The ease of use was tested by comparing how easy it was to reach resources, and process a transaction. Features and objects such as; Windows, Icons, Mouse, and Pull-down menus [WIMP] were effectively used to make user interaction with the prototype be easy and simple.

4.10.3 GENERAL SYSTEM TESTING

The OVVS prototype system was for 7 days. Vehicle details were entered and then vehicle status monitored-with special interest to vehicles that remained parked for more than 24 hours. According to (Klumpp, 2013) anything digital may be distributed or shared via the internet to any other remote computer. With regards to this, XAMPP, which is an abbreviation for Cross-Platform, Apache, MySQL, PHP, and Perl (Walia & Gill, 2014), and a combination of four web servers namely; Apache, MySQL, PHP, and Perl, was used for testing the OVVS prototype without having to access the internet.

5. CONCLUSIONS

Observations were made during system testing and compared to the current manual system, the following conclusions were made;

5.1 CONSISTENCY

Detection of "abandoned" vehicles was maintained within 24hours, counting from the moment a vehicle was parked in the public VPE. This was not true when using the manual system which was adversely affected by factors like; human error, user fatigue, thereby creating a possibility of detecting "abandoned" vehicle even after one week.

5.2 FASTER VEHICLE VERIFICATION

During testing, the time taken to verify vehicle ownership for "abandoned" vehicles was drastically reduced to a matter of few seconds, because the OVVS prototype allowed a for direct link to the "dummy" KRA registry, unlike the manual system which relied on bureaucratic processes [from one Government/authority office to the other] which could take many days.

5.3 VANDALISM

According to the PFM, cases of vandalisms were targeted towards "abandoned" vehicles in the public VPE. A reduction of cases of vandalism was highly minimized as there were no cases of "abandoned" vehicles, and

where a vehicle was identified as "abandoned" the vehicle owner was contacted in good time and advised to remove his vehicle from the public VPE facility. This in turn improved security in the public VPE.

5.4 REDUCED CASES OF AV[S]

Testing showed reduced cases of "abandoned" vehicles in the public VPE when the OVVS was used for 7 days. Promoting optimal utilization of VPE facility.

5.5 RECOMMENDATIONS

The researcher proposed the following recommendations with regards to the issues surrounding the problem under study, and the prototype;

- Further research to confirm the applicability and success of this study and its deliverables to other regions within or without the country is recommended.
- Manual mechanism of identifying and detecting "abandoned" vehicles has been found to be very prone to error, ineffective, unreliable, and inconsistent. Inclusion/implementation of automated system such as the OVVS in public VPE is recommended.
- Since the OVVS concentrates on the identification of "abandoned" vehicles and vehicle/owner information, further studies on how the OVVS can be integrated to other existing systems used in public VPE facilities is recommended.
- Government authorities don't have a clear definition for "abandoned" vehicle, and as such policies and regulations are silent on this. Further research is recommended on how policy and regulations can be used towards solving the problem of "abandoned" vehicles in Kenya.

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7. APPENDIX

List of Abbreviations and Acronyms		
1	AV	Abandoned Vehicle.
2	ANPR	Automatic Number Plate Recognition.
5	EoS	End of Shift report
8	GPS	Global Positioning System.
10	HORB	Hand Over Report Book
11	HTTP	Hypertext Transfer Protocol.
12	IS	Information System.
13	JKIA	Jomo Kenyatta International Airport.
14	KAPS [Ltd]	Kenya Airports Parking Services Limited.
15	KRA	Kenya Revenue Authority.
16	Ksh	Kenya Shillings.
18	MPS	Mobile Parking System.
20	OVVS	Owner Vehicle Verification System.
21	RDD	Research Design and Development.
22	SDLC	Software Development Life Cycle.
23	SMTP	Simple Mail Transfer Protocol.
25	VNP	Vehicle Number Plates.
26	VPE	Vehicle Parking Environment.
27	WIMP	Windows, Icons, Mouse, and Pull-down menus
28	XAMPP	Cross-Platform, Apache, MySQL, PHP, and Perl.

Definition of Key Terms		
1.	"Abandoned" Vehicle.	Any vehicle that remains parked either in a public or private Vehicle Parking Environment [VPE] facility for more than 24 hours, without a notification of overstaying for such duration.
2.	Motorist[s].	Vehicle owner[s] or person[s] who drive vehicles.
3.	Vehicle Parking Environment.	A public vehicle parking environment that is available to Motorists to utilize at a fee.
4.	Vehicle Verification	A process of ascertaining that a vehicle belongs to a person by confirming details from an authoritative source.