Electronic Theft Deterrent Biometric Module: An Automated Immobilizer and Access Control System for Millennium Vehicles

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Abstract:
We conducted an experimental Analysis of security platform in some millennium vehicles across Nigeria through the use of questionnaire, observation, and oral interview within the automobile dealers, vehicle owners and users within Lagos Nigeria. Our aim/objectives is to investigate, compare, and contrast the available anti-theft systems in the millennium cars around Nigeria, and to proposed and recommend the best security platform to prevent automobile theft. It was discovered that majority of vehicles available for sales at automobile showroom, and those currently been cruised on Nigeria roads lack required security system to deterred vehicle theft or stealing from vehicle. Prominent vehicle security systems available in Nigeria are manual and most rampart is use of locks, alarm, and kill switch which is not efficiency compare to criminal tendency related to automobile criminal activities. Hence we proposed a complete anti- Theft Deterrent Biometric Module (TDBM): An automated immobilizer and Access control system for automobile systems, which if implemented it will prevent completely theft of motor vehicles and content's within.

Keywords: *Automobile theft, biometric, millennium cars, Nigeria, Immobilizer*.

I. INTRODUCTION

A. *Background to the Study*

Consequent to the increase in demands for automobiles rises for individuals, family, business organization, and government; there has been a continuous increase in the number of car thefts. Traditionally, a key used to enter and start the cars, if someone else finds the keys; he/she can use it to steal the car or contents from it. To prevent the rate of car theft from increasing, a complete solution is required especially in this era of computer, and ICT advancement, where almost all vehicles manufactured from year 2000 upward (millennium vehicles) are fully mechatronic system [1].

There are number of affordable and effective automobile theft-prevention options in vogue. These seem not to be effective and efficient as there is increase in vehicle robbery and attack [2].

The millennium automobiles systems are no longer mere mechanical devices due to integration of digital and analogue computers system that coordinated some of its internal networks, the transformation in millennium automobiles has contributed to advancements in car safety in recent time [3]. Current achievements and progression in mechatronics (i.e. is synergistic integration of mechanical engineering, with electronics and intelligent computer control in the design and manufacturing of industrial products and processes) is a great factor to intensify the application of computer engineering technology in automobile security [4]. The rate of increase in car theft in this part of the world has reached an alarming rate. Consequent to this development, engineers in Nigeria have been performing researches aimed at providing a lasting solution to this endemic act [5].

Automobile robbery and hijack has become rampart in current Nigeria situation i.e. theft of vehicle and theft of property from an automobile is of highest crime victimization record in Nigeria. Percentage of Victims who reported their Victimization to the Police has Automobile robbery 80%, and Automobile theft 77% respectively in Lagos. Those who reported their victimization to the police did so for different reasons, the most important reasons are; to recover lost property, Insurance claim, apprehension and punishment of offender, to stop it happening again, to get help from the police [6].

Over the past decade, vehicle theft has remains a common and costly property crime. There are number of affordable and effective automobile theft-prevention options in vogue. These seem not to be effective and efficient as there is increase in vehicle robbery and attack.

This research work is to investigate, compare, and contrast the available anti-theft systems

in the millennium cars around Nigeria, and to proposed and recommend the best security platform to prevent automobile theft which is currently a challenge in Nigeria and it environ.

The researchers compare and contrast the car security platform available and proposed and recommend the best towards complete elimination of automobiles theft in Nigeria system.

In this paper, we proposed the design and development of a real time finger print recognition system as control platform. This security system can recognize the person who enters in the car and it will check whether he/she is authorized person or not. The research documentation is as follows: Literature survey on automobile theft and available computer-based security system in Nigeria; Research methodology and framework, Proposed System design architecture, and finally the conclusion and recommendation.

B. Significance of Study

The significance of this study is to prevent automobile theft and robbery in Nigeria.

C. Problem Statement

Presently, criminal records as related to automobile robbery and hijack has become rampart in current Nigeria situation i.e. theft of vehicle and theft of property from an automobile is of highest crime victimization record in Nigeria. Consequent, there is need for a complete solution to this menace to deterred the intend criminal in that area.

D. Objectives of the Study

The main objective of this research work is to investigate, compare, and contrast the available computer-based security system in the millennium cars around Nigeria, and to recommend the best computer-based system that will bring ends to automobile theft and robbery in Nigeria.

II. LITERATURE REVIEW

A. General Criminal Victimization Prevention Measures

According to [7] individual attempt to reduce their risk of criminal victimization through three mechanisms:

- Avoiding sites of high risk of victimization – avoidance;
- Installation of protective mechanisms such as gates, window bars, fences, electronic monitoring and alarm systems – target hardening
- Insurance of self and property to minimize victimization cost

B. Auto Theft in Lagos Nigeria

The figures from the Lagos State Police Command indicated that 1,184 stolen cars was recovered from thieves in Lagos and environs in 2012, 359 were Toyota vehicles of different models while Honda had 143. "Thieves often target mainstream vehicles that can readily be resold or stripped down for parts; luxury cars are far from immune. They tend to look for models that are in plentiful supply – and which may need collision and other repair parts, as a sizable number of stolen vehicles are stripped down rather than re-sold whole [8].

It was revealed that from January to July, over 600 cars were stolen in the state. Car snatchers are back to business, and no day passes without reports of cars snatched from their owners within the Lagos metropolis. Although some of the cars stolen, was recovered by police. The alarming rate of car theft has thus given Lagosians increasing cause for concern as it has heightened insecurity issues in the country [9].

C. General Automobile Criminal VictimizationPrevention Measures

Some of the available automobile criminal prevention measures to reduce risks of car theft are [10]:

- Vehicle Tracking Systems: A vehicle tracking system combines the use of automatic vehicle location in individual vehicles with software that collects these fleet data for a comprehensive picture of vehicle locations. Modern vehicle tracking systems commonly use GPS or GLONASS technology. This system doesn't prevent theft but helps you find your car should it be stolen. No other car security system does this.
- Locks: use of locks such as:

– Steering wheel lock: This kind of lock is perhaps the most commonly found. What it does is it fits on your steering wheel, locking it, and making it very difficult to steer the car while the lock is still fitted. See the diagram below
– Tire lock: These are locks for one of your tires, very similar to those used on illegally parked cars.
– Pedal Locks: Pedal locks work similarly to steering wheel locks in that the former locks the brake and gas pedals, preventing the thief from using the pedals to drive off your car. Unlike steering wheel locks, pedal locks are harder to compromise because it is more difficult to cut the pedals than the steering wheel.
– Gear locks: Gear locks prevent the thief from shifting gears; thereby, preventing your car from being driven off. Unlike steering wheel and pedal locks, gear locks are much less common.
– Security window tint: Car windows are the weakest link in the car security system because they can be easily smashed. To make it more

difficult to smash and break the windows, car security window tint can be installed.

- Kill switch: This is a very cheap and yet effective way to deter car theft. A switch is fitted to the car ignition and the switch hidden somewhere in the car. To start your car, you need both car key and to turn on the hidden switch. Without the two, your car won't start.
- Car alarm system: The car alarm system at the most basic level should raise the alarm (by sounding the car horn) whenever a door, trunk, or hood is opened. Car alarm systems typically add other security levels such as engine immobilizer (to prevent hot wiring because they key must be present to start the car), vibration or shock alarm (for example, when a car window is being smashed), and car tilt alarm (to prevent the car from being jacked up to have your car towed away or your car sports rim stolen).

The diagrams in figure 1, illustrate some of the automobile criminal victimization prevention measures with lock as described above.

Fig. 1a: Stoplock that covers the hub and cannot be removed even if the steering wheel is cut provided the lock is installed correctly.

Fig. 1b: Tire clamp/lock is a good way to prevent towing of your car.

Fig. 1c: Tire/wheel lock

Fig. 1d: Pedal lock to prevent pedal usage

Fig. 1e: Gear Lock to prevent gear movement

Fig. 1f: Security tint to make it harder to smash car windows

III. RESEARCH METHODOLOGY

A. Data Collection Method

The form of data collection method used was:

- An inspections of inbuilt Security System available on the new and foreign used (popularly known as Tokunbo) vehicles from the motor dealers in Lagos.
- Inspection of security system available in some selected vehicles among the private car owners in Lagos state Nigeria

B. *Data Analysis*

Vehicle Security System in Nigeria

Twenty-three selected motor vehicle dealers where millennium cars (Toyota, Nissan, Mazda, Mitsubishi, Honda, and Mercedes benz) ranging from 2002-2012 model were visited, an six-hundred and seventeen (617) vehicle was inspected on pretention that our research teams are potential buyers. The table below gives the statistics of inbuilt security system in vehicle examined:

TABLE I: Data Obtained from Motor Dealers shop Sample Population (617)

Security Type	Availability	Non-Availability
GPS vehicle tracking	111	506
Brake pedal lock or steering wheel lock	539	78
Kill switch	-	617
Biometric Security	-	617
Central lock system	617	-
Car security window tint	41	576
Car alarm	39	578

Thirty seven (37) volunteer car owners, allows us access to their cars for inspection and also gives response to some question asked on security system available on their system. The table II gives the statistics of security system in vehicle examined:

TABLE II: Data Obtained from Vehicle Owners Sample Population (37)

Security Type	Availability	Inbuilt	Non-Availability
GPS vehicle tracking	-	-	37
Brake pedal lock or steering wheel lock	19	Yes	18
Kill switch	33	No	4
Biometric Security	-	-	37
Central lock system	37	Yes	-
Car security window tint	8	Yes	29
Car alarm	21	No	16

C. *Discussion of Result*

From the result obtained and tabulated as presented in table 1. Out of 617 motor vehicles examine from auto dealer showroom in Lagos. It was observed that GPS vehicle tracking, is available 111 vehicles, Brake pedal lock or steering is available in 539, kill switch and Biometric security is zero, while central lock is available in in all vehicles, Car security window tint is available is available in 41 out of 617 sampled population, while car alarm is available in 39 out 617 sampled.

Careful examination of the result presented in table 1 showed that the new and fairly used car (Tokunbo) has a fair in-built security platform to prevent criminal activities from either stealing from the vehicle or stolen the vehicle itself. This technology is not enough to prevent vehicle related criminal activities in a country like Nigeria where vehicle theft has become rampart in recent time. In table 2, we present a result of sampled 37 vehicles from volunteer car owners, of all the sampled population, Non has GPS tracking, nor biometric system as a security platform. The few sampled vehicle with kill switch, car alarm was not inbuilt,

while lock (brake pedal lock, steering wheel lock, etc) were not in-built, and central lock was present in all the vehicles.

From the data obtained from table 1, and 2, and further interaction through observations and oral interview of the vehicle owners and users. It was discovered that vehicle owners invest personally to prevent their vehicles from potential criminals through the use manual locks review in the literature review section, use of kill switch, car alarm; some even go to extent of using voodoo to protect the vehicles potential robbers.

From our investigation it was discovered that all the major available security system to protect vehicles from potential criminal are not really helpful as with little or no effort the potential criminals can still find their way and perpetuate the crime. Also the common approach to protect automobile from theft in Nigeria is the use of locks which has some disadvantages. From our research we discovered the most advantageous means of protecting vehicle from potential criminal is through the use of the biometric system that will incorporate the vehicle user biometric features to access the vehicles. Hence we proposed Ant-Criminal Biometric Technology Based System for Automobile System.

IV. PROPOSED SYSTEM ARCHITECTURE

A. Hardware

In this section we present the architecture design of the proposed system. Electronic Theft Deterrent Biometric Module: There are three section considered in this design. First the biometric finger print module that needs to be activated to gain entrance into the vehicles, second is the physical key that starts the engine, and biometric fingerprint that fully activate engine control unit from sensors for optimal performance with particular reference to gear control. Figure 2 gives the general overview of the system architecture of the system.

There are two categories of security that the system will provide if implemented in an automobile system: firstly it prevent criminal activities related from stealing from the vehicles since only individual which his/her biometric finger prints been enrolled into the access security system, and identify by FPR-1 can only have access to the interior section of the vehicle. When such person enters the vehicle he can open doors for other to enter. So stealing from the vehicle by intruder is completely eradicated.

If an individual get access to the system, and he has the key to start the engine, as he/she start the engine, he would be prompt to enroll his/her finger print for authentication to activate engine control unit for optimal performance with particular reference to gear control. If the person is authenticated, the engine control unit will be activated and gear control automatically unlock itself and the vehicle ready for motion otherwise the vehicle remain on it is permanents state of rest.

B. Software

In this work we separate the access control section, from engine control and mobility section. The reason for this is that we are of the opinion that many people could be given access right to access information from the vehicles, while limited access is proposed for those that can access and drive the vehicle. Hence we proposed software design; the flow chart for the proposed program is as given in figure 2.The user's number will be set, which must be greater than or equal to 1. After which the users name will be enroll follow by his/her biometric. After the detail has been entered, the user right will be assigned which shall be either single, double access or both.

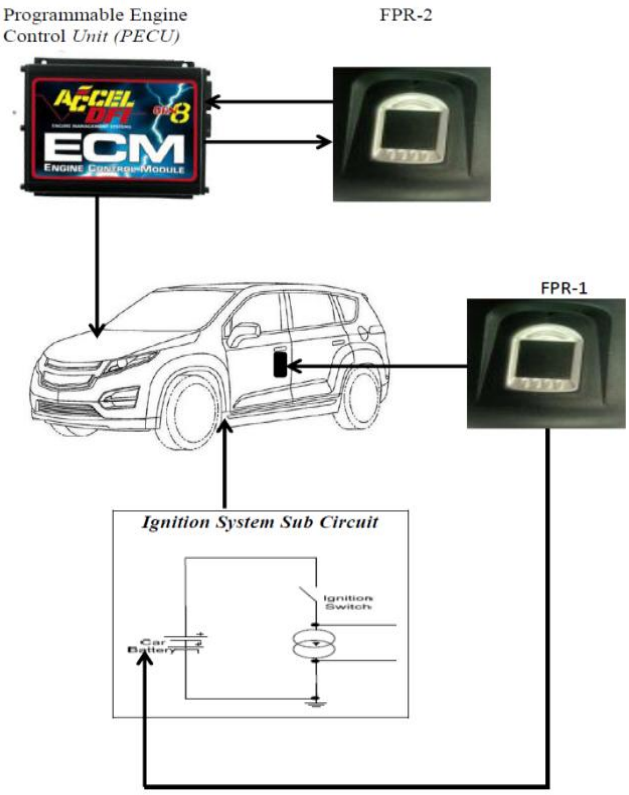

Fig.2. General Overview of the Proposed System

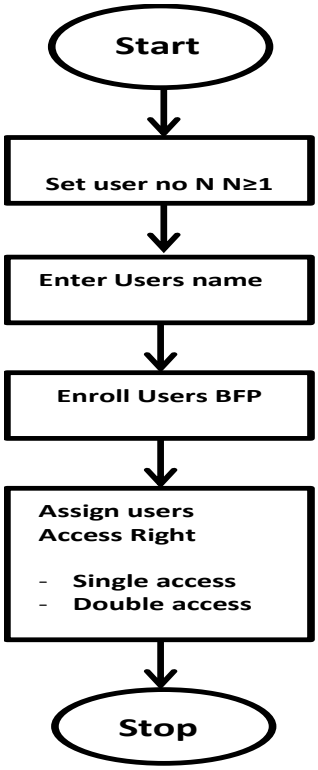

Fig. 3. Program Flowchart of the proposed System

V. CONCLUSION

In this paper, we have conducted practical and theoretical investigation of auto-theft security system in the millennium vehicles around Nigeria. The result of investigation revealed that available security systems are not robust enough to deter auto-theft criminal from their usual criminal activities. Hence we proposed real time multifactor security system that will use biometric module. The system will serve as an Immobilizer and access control system. There are two categories of security that the system will provide if implemented in an automobile system: firstly it prevent criminal activities related to stealing from the vehicles since only individual which his/her biometric finger prints been enrolled into the access security system, and identify by FPR-1 can only have access to the interior section of the vehicle. When such person enters the vehicle he can open doors for other to enter. So stealing from the vehicle by intruder is completely eradicated. If an individual get access to the system, and he has the key to start the engine, as he/she start the engine, he would be prompt to enroll his/her finger print for authentication to activate engine control unit for optimal performance with particular reference to gear control. If the person is authenticated, the engine control unit will be activated and gear control automatically unlock itself and the vehicle ready for motion otherwise the vehicle remain on it is permanents state of rest. With the adoption of standards and community awareness, this technology will become more and more acceptable to avoid and control vehicle theft.

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