

An Intelligent In -Vehicle Wireless Multilingual Over-Speed Announcer and Reporter

Victor O. Matthews¹, Etinosa Noma-Osaghae², Stanley Uzairue Idiake³

^{1,2,3} Department of Electrical and Information Engineering, Covenant University, Ota, Ogun State, Nigeria.

Abstract - The invention of the speed limiter was a great boost to the goal of reducing accidents caused by over speeding. But most of the speed limiters in use today are very rigid and cannot be adjusted. This gives drivers no room for flexibility while driving especially in emergency situations. In this paper, a multilingual speed limiter that gives voice prompts in selected languages is proposed. The proposed speed limiter does not automatically limit the speed at which a vehicle moves but gives vocal warnings to drivers as they are approaching the speed limit set by road safety regulatory agencies. Failure to slow down and stay within the speed limit triggers the speed limiter's reporting system and the driver is automatically ticketed.

Key Words: Speed Limiter, Internet of Things, GSM, GPS, Smart, Highway, Road

1. INTRODUCTION

Around the world, accidents caused by over speeding have increased in recent times. There is a renewed subtle campaign of high-speed driving that is sweeping the world today [1]. Over speeding is a main cause of accidents on highways and roads. A lot of drivers do not watch their speedometers while driving on the road [2]. This lapse in driving etiquette usually leads to devastating accidents that could be avoided by driving at safe speeds [3].

The economic implications of accidents caused by over speeding are numerous. In fact major highways are usually dotted with billboards that remind drivers of the dangers of over speeding [4]. Accidents caused by over speeding could lead to permanent or temporary injuries, psychological problems, loss of lives and exorbitant medical bills. There is also the probability of losing valuable people with skills that can help economies grow and make organizations flourish. A lot of families have been thrown into deep agony by the loss of loved ones in over speeding induced accidents. This list of the economic cost of road accidents caused by over speeding is very vast.

Individuals, organisations and governments have already taken proactive steps to curb the menace of accidents caused by over speeding. The most useful invention that has helped to "force" drivers to use their vehicles at safe speeds on the highway is the speed limiter. The speed limiter puts a cap on the highest speed at which a vehicle can move. Although a great invention, many speed limiters, due to the cap placed on the speed at which a vehicle can move, do not give drivers

the flexibility needed to move quickly out of tight emergency situations.

A more flexible solution is now needed. This submission is true in an environment where highway kidnapping as well as robbery is the order of the day most especially in sub-Sahara Africa and majority of the Arab world. This paper presents a possible solution that has the added value of being able to ticket defaulters who intentionally violate laid down rules and regulations regarding speed limits. The speed limiter proposed in this paper gives vocal warnings instead of fixing speed limits. It warns drivers about their proximity to the speed limit and advises them to slow down. The proposed speed limiting system automatically fines drivers that exceed the set speed limit.

In Nigeria for example, one other major cause of road accidents are bad roads. The proposed speed limiter can be used to generate funds for road repairs. The proposed system can also be used to fund the medical bill of road accident victims.

The vocal warnings can be given in any language. In this proposed model, the languages are Yoruba, Igbo and Hausa. These are the major languages in Nigeria commonly referred to as "WAZOBIA". The proposed speed limiter is cellular networked (GSM) [5] [6] [7] and Global Positioning System (GPS) [8] [9] [10] enabled and road safety agencies are at liberty to set speed limits by the use of special commands that are received by the antenna of the speed limiter.

The remaining part of the paper is organized as follows; a brief literature review is given about similar works in section II, a detailed account of how the proposed speed limiter was designed and implemented is presented in section III. The paper is concluded and a list of references is given.

3. METHODOLOGY

The speed limiting device was developed as a "speed manager" that helps to reduce over speeding related accidents on highways and roads. It was also designed as a means of generating revenue for the Government. The device works in this format, the road safety agency sets a speed limit for vehicles by sending an SMS code to the device. Upon receiving the code, the device's speed limit is set (for example, if a speed limit of 80km/hr was sent, the speed limiter automatically adjusts its speed to the value given in the message it received). The prototype was powered by a

12V automobile plug as shown in Figure 2. The Global Positioning System (GPS) antenna was mounted on top of the vehicle for maximum signal reception from space satellites. A GSM/GPRS module embedded in the device automatically takes note of the speed at which the car is moving and its current location. As the driver accelerates and moves towards the assigned speed limit (e.g. 80km/h) the device senses this and triggers an electronic relay switch that activates a vocal warning that has been previously recorded on the audio module, announcing in any of the three major Nigerian languages, namely Yoruba, Hausa and Igbo popularly referred to as 'WAZOBIA', that the driver is rapidly approaching the speed limit. The vocal warning also advises the driver to slow down. This announcement comes at about a few units away from the set speed limit. In this case, 70km/hr, and ten units away from the set speed limit of 80km/hr. The vocal warning also tells the driver that a report would be logged in the regional and central database should the driver exceed the assigned speed limit. Any attempt by the driver to exceed the speed limit automatically triggers the reporting mechanism of the speed limiting device. Whenever the speed limit is exceeded, the device reports the driver and his vehicle through a cellular network to the regional database of the road safety agency. The regional database passes the information collected from the device to the central database.

The device is a machine to machine (M2M) system. Whenever the driver is reported, the central database, with specially deployed software, picks the information and acts accordingly. The central database tickets the defaulting driver and automatically deducts the fine from the driver's bank account instantaneously. A message, to inform about the fine and the corresponding bank account deduction is sent by the central database to the defaulting driver's email and mobile number. The central database is able to do this because it has a link to the bank verification numbers (BVN) and comprehensive records of all duly registered drivers and their vehicles. The database was sectioned into two. They are the Road Safety Regional Database (RSRD) and the Road Safety Central Database (RSCD) as indicated in Figure 1.

If the fine cannot be automatically deducted from the driver's bank account for any reason, within twelve (12) hours from the time the electronic penalty ticket was raised, the central database triggers a second variant of information level. The central database sends an alert for the arrest of the offending driver to the closest road safety outpost to the current location of the ticketed vehicle.

Figure 1 shows the network diagram of the multilingual over-speed reporting system. Figure 2 and Figure 3 depict the hardware of the implemented system. Figure 4 and Figure 5 are the speed limiting and ticketing flowcharts respectively.

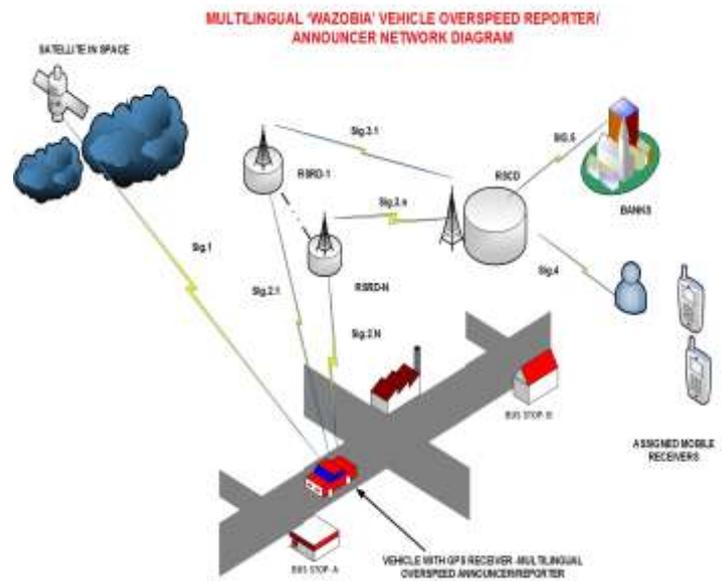


Fig -1: Multilingual Vehicle Over-speed Reporter Network Diagram

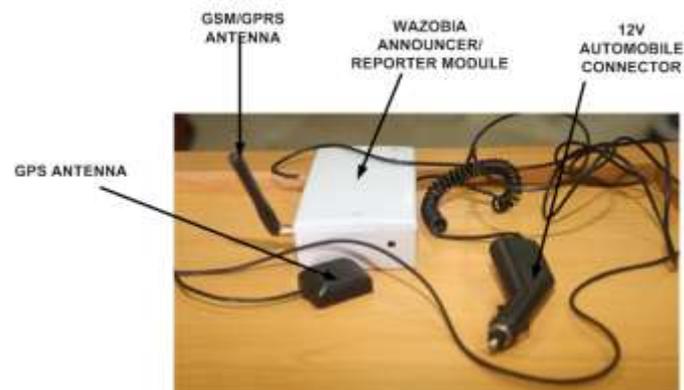


Fig -2: Implemented Multilingual Over-speed Reporting System



Fig -3: Internal Circuitry of Implemented Over-speed Reporter.

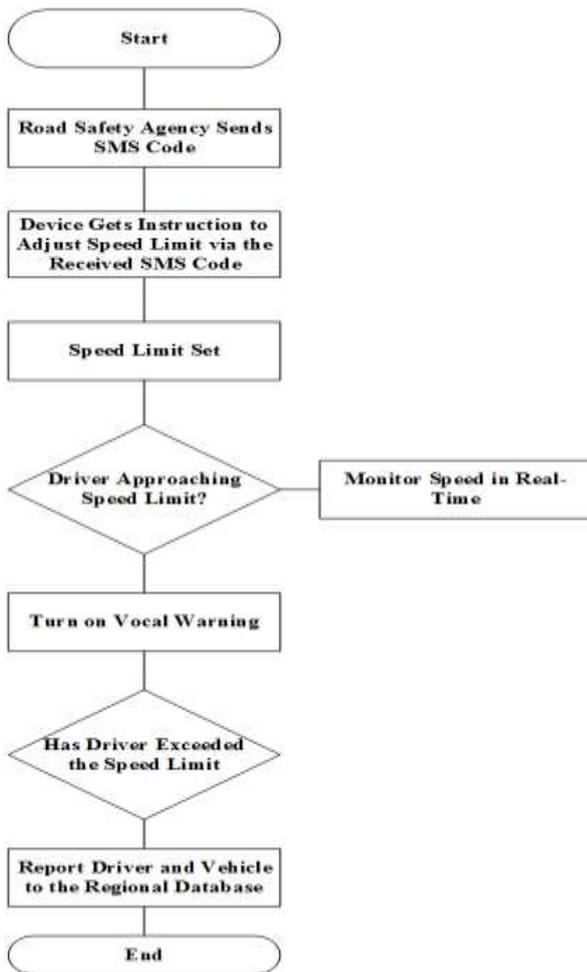


Fig -4: The Flowchart for Speed Limiting Algorithm

Speed Limiting Algorithm:

- STEP 1: Initialize speed-limiting device’s functionalities
- STEP 2: Send SMS code with instructions to set speed limit
- STEP 3: Set speed limit
- STEP 4: Is the driver approaching the speed limit
- STEP 5: If the driver is approaching the speed limit
GOTO STEP 6
- ELSE
GOTO STEP 4
- STEP 6: Turn on vocal warning
- STEP 7: Has the driver exceeded the speed limit?
- STEP 8: If the driver has exceeded the speed limit
GOTO STEP 9
- GOTO STEP 9

- ELSE
GOTO STEP 5
- STEP 9: Report driver and vehicle to regional database
GOTO STEP 5

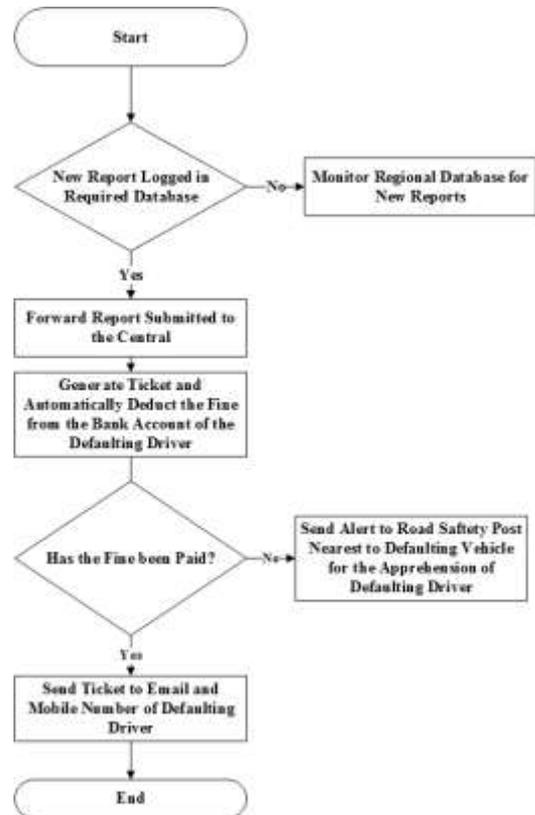


Fig -5: The Flowchart for Ticketing algorithm

Ticketing Algorithm:

- STEP 1: Initialize ticketing process
- STEP 2: Check to see if there is a new report logged in the regional database
- STEP3: If there is a new report
GOTO STEP 4
- ELSE
GOTO STEP 2
- STEP 4: Forward report submitted to the central database
- STEP 5: Generate ticket and automatically deduct fine from driver’s bank account.
- STEP 8: If the fine has been paid

STEP 7: Send fine ticket and bank deduction message to the driver via email and SMS

GOTO STEP 2

ELSE

GOTO STEP 9

STEP 9: Send alert to road safety agency closest to defaulting vehicle.

GOTO STEP 2

CONCLUSION

The proposed speed limiting device practically deals with the challenge of accidents caused by over speeding. The funds generated from the paid fines can be used to repair and maintain roads. The funds can also be used to settle the medical bills of road accident victims

The system gives vocal speed limit warnings to drivers in multiple languages as pre-recorded by the road safety agency. It removes the rigid restrictions of conventional speed limiters and gives drivers the much needed flexibility to drive at speeds higher than the limit if there is a need for it. This of course, comes with a fine. The device can also operate a varying speed limits by automatic adjustment based on the command it receives from the road safety agency via its GPS/GSM enabled receiver.

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