IJDI-ERET

INTERNATIONAL JOURNAL OF DARSHAN INSTITUTE ON ENGINEERING RESEARCH AND EMERGING TECHNOLOGIES
Vol. 11, No. 1, 2022
www.ijdieret.in

(Review Article)

Review on Automobile Crime Prediction Model

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Abstract

Misconduct and crime of all sorts are the popular problems that bother humanity in general. This research work seeks to review and suggest the best solution to this problem. From this study, it was noticed that most research carried out has been focused on monitoring, controlling, and tracking automobile crimes, a process that has become difficult as in producing good results to adequately combat these crimes. Monitoring, tracking, and/or controlling automobile crimes are not most reliable due to certain conditions such as atmospheric or weather conditions, lack of knowledge, etc. So, with this challenge, this study reviews and suggest a better solution to this problem. If implemented, the suggested solution will help reduce the rate of automobile crimes by providing relevant authorities with good predicted results as information for battling automobile crime effectively. The suggested solution involves implementing a model using a good and best dataset alongside the best deep-learning algorithm. Finding shows that deep-learning algorithm provides successful, general, accurate, and fast result analysis. The obtained dataset should be filtered for noise and other unwanted values to ensure accuracy, reduce computation time, and provide an adequate understanding of the solution.

Keywords: Automobile Crime, Crime Prediction, Crime prevention, Prediction Model

1. Introduction

The high number of automobiles in cities around the world contributes to the high rate of automobile crimes in the world [1]. Developed countries such as the United States, United Kingdom, Jamaica, Sweden, and Canada, have a variety of Information and Communication Technology tools for reporting, monitoring, controlling, managing, and fighting automobile crime [2].

Owing to the materiality that, research in the aspect of Automobile Crime Prediction is quite rare. [3] states that Tesla has shown some interest in this aspect of automobile crime prediction, but further efforts to make Tesla's predictions more dramatic will help reduce automobile crimes more [3].

Against this background, the motivation for this research is to effectively predict automobile crimes and notify responsible authorities in advance so that they can be prepared before an automobile crime occurs. To achieve this goal, this study uses the following objectives: (i) To properly study automobile crime, (ii) To propose a model for predicting automobile crime, (iii) To evaluate and test the validity of the model proposed using areal-world dataset.

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ISSN 2320-7590 (Print) 2583-3863 (Online)

2. Related Works

[3] presented a method using machine learning and a fifth-generation cellular network to monitor roads and how some automobiles behave on this road. Though the proposed system presented the ability to produce a good result in traffic management, automobile control, and providing an alternative route to road users, the system cannot be used in developing countries like Nigeria that lack a fifth-generation cellular network which is one of the key techniques used for the implementation of this proposed system.

[4] discussed the use of an interactive global positioning system which uses the global positioning system and a global system for mobile to monitor and secure automobiles. The paper presented a system equipped with possibly most of the theft systems to enable it to make an automatic call on accident, interact with users and provide accurate positioning of the automobile. With the level of success achieved with the implementation, the system accuracy comes short in the presence of bad weather conditions.

[5] proposed a monitoring system for an automobile that is based on the internet of things. It uses fourth-generation long-term evolution, Raspberry pi, a global positioning system, Accelerometer, and Ultrasonic sensor to get the necessary data needed to monitor automobile systems efficiently in real-time. Even with this technology in place, the system lacks efficiency

in local areas where there's no fourth-generation cellular network.

[6] implemented a Smart Monitoring and Analysis System using the Internet of Things developed based on an android phone application, an onboard diagnostics II system, and a database management system based on the cloud.

[7] implemented an automobile monitoring system with the use of an Ultrasonic sensor, Temperature sensor, Gas sensor, Infrared sensor, Global Positioning System module, and Blynk Internet of Things platform for the transfer and visualization of data.

Table 1. Further Summary of Related Works

Author(s)	Findings	Method/ Algorithm Used	Gap/Limitation
[3]	Focused on-road monitoring and automobile behaviors on the road.	Used machine learning and fifth-generation cellular network.	The system can't be used in developing countries.
[4]	Presented a system that is equipped with theft sensors that enable automatic calls in the case of an accident.	The system uses an interactive global positioning system and global positioning system.	The system is limited in the case of bad weather conditions.
[5]	Get data from the automobile then uses it to monitor the automobile systems in real-time.	The system is based internet of things which uses fourth-generation long-term evolution, Raspberry pi, a global positioning system, accelerometer, and ultrasonic sensor.	Limited efficiency in local areas with a rare or limited fourth-generation cellular network.
[6]	Implemented a smart monitoring and analysis system for automobile systems.	Uses the internet of things based on an android phone application, an onboard diagnostics II system, and a cloud-based database management system.	
[7]	Presented an automobile monitoring system by transferring and visualizing data.	Used an Ultrasonic sensor, Temperature sensor, Gas sensor, Infrared sensor, Global Positioning System module, and Blynk internet of things platform.	
[8]	Proposed an automobile monitoring and tracking system that transmits all the monitored information between the various devices and servers in the network of the systems.	Used Embedded C programming, LPC2148 based unit, global positioning system, global system for mobile, and subscriber identification module-800.	The system is dependent on a good network provider that is mostly available in big cities.
[9]	Presented a management system for monitoring automobile systems and forecasting traffic state.	Used internet of things that are based on the Beidou satellite positioning system and the Lora communication system.	The drawback of the study is the lack of local knowledge.
[10]	Implemented a smart system for monitoring automobiles with the use of sensors	Used a Short Message Service, Multimedia Message Service connected to Google maps.	The study lack effectiveness in areas where there's a limited or bad network.
[11]	Presented an intelligent architectural system for monitoring and controlling traffic in cities.	Used Internet Protocol cameras.	The study lack a Network Video Recorder.
[12]	Proposed a realistic concurrent monitoring system and independent-learning algorithm for smart predictions.	Used Raspberry Pi, K-Nearest Neighbor, and Naïve Bayesian algorithms and used Bluetooth and a Fourth-generation Dongle network as the methods for handling data transmission.	Distance and application areas is the drawback faced by the study.

[8] proposed an automobile monitoring and tracking system made up of Embedded C programing language, an LPC2148 based unit, Global Positioning System, Global System for Mobile, and Subscriber Identification Module-800 to transmit all the monitoring information between the various devices and servers involved in the system. The system is focused and

implementable in cities where there's a global system for mobile and a good network provider as the system requires a Subscriber Identification module.

[9] presented a management system for monitoring automobile systems and forecasting traffic state. The system uses the internet of things based on the Beidou satellite positioning system and the Lora communication system. Though the paper gave an accuracy of 80%, the system is limited in developing countries like Nigeria where there's little or lack of knowledge about the Beidou satellite positioning system.

[10] used a Short Message Service, Multimedia Message Service connected to Google Maps to implement a Smart system for monitoring automobiles with the use of some sensors like the magnetic and infrared sensor. But in a situation where there's a limited or bad network, the system won't work efficiently.

[11] present an intelligent architectural system for automobile monitoring and control that is implemented using Internet Protocol cameras. The system will need a network video recorder to serve the video archive in other to increase the system reliability.

[12] proposed a realistic concurrent monitoring system and independent-learning algorithm for smart predictions which uses Rasberry Pi, K-Nearest Neighbor, and Naïve Bayesian algorithm for predicting Graphics Processing Unit running, Vehicle state, and Vehicle life respectively. The system is implemented to use different methods such as Bluetooth and a fourth-generation Dongle network for handling data transmission. Even with 92% accuracy, the system was faced with the problem of distance, application area, and sensor requirements.

2.1 Summary of Related Works: In summary, it can be seen that there are rare studies carried out on automobile crime prediction. With the prediction model in place, it gives proper direction on how this automobile crime can be successfully battled in real-time since adequate information from the proposed prediction model will be available.

3. Challenges and Possible Solutions

3.1 Monitoring, Controlling and Tracking System.: Finding has shown that more interest has been on Monitoring, Controlling, and Tracking automobile crimes. This existing system are faced with limiting factors such as:

- Network issues: Most of these systems depend on networks for working. Most developing countries lack the required network architecture for running this system to work properly.
- Environmental/Natural issues: These issues include atmospheric conditions, bad weather, and knowledge on how these systems work are limiting issues related to the proper functioning of these systems.
- Infiltration issues: Since most of the existing systems are network-dependent, they are prone to attacks and infiltration. And when attacked the functionality fails, thereby hampering the proper working such system.

3.2 Possible Solution: Generally, the existing systems are limited by the time of providing the required information. Monitoring systems check and try to provide the information in real-time but could be limited by the weather condition or bad network. The controlling system tries to regulate this crime as it occurs and tracking systems try to hunt down this crime. None is providing information to relevant authorities beforehand.

With the above-mentioned findings that this review suggests an Automobile Crime Prediction system should be implemented to provide beforehand the necessary information to relevant authorities to enable them combat this crimes.

3.3 Benefit of Possible Solution:

- Time: From findings, the suggested system (Automobile Crime Prediction) if implemented will provide the necessary information before the crime is actually committed (since it's a prediction system).
- Not Fully Dependent on Network: The suggested system can be used when there's good network to predict future crime before they're occur.
- Infiltration: Even if the system is infiltrated, there is less effect as there's time to fix and it might have predicted future crimes already. Same applies to natural and environmental issues.

4. Suggested Prediction Process for Automobile Crime Prediction

Technological growth has created an avenue for upgrade and change for accuracy, efficiency, or effectiveness. Monitoring and controlling automobile crimes with the available ICT tools have yielded limited results or produced good real-time results due to all kinds of factors as exposed in the literature review.

In addition to the efforts made by other researchers, this review suggest a better solution to tackle the drawbacks faced by other existing systems. The suggested ACP if implemented, is meant to provide accurate predicted information in other to reduce the limitation(s) of the existing studies. To successfully provide a solution of such standard, this review will suggest the best approaches, algorithms, methods that are appropriate for automobile crime prediction. In doing this, the research suggest the use of a Deep-Learning algorithm and a well-analyzed datasets that is related to automobile crimes. This dataset should be treated before processing in other to remove data noise and anomalies. Python programming language can be used for implementing the prediction model bearing in mind

that it conforms to deep-learning algorithm principles. Below Figure 1 shows the schematic view of the stages that maybe involved in the suggested solution.

4.1 Dataset to Be Employ: For experimentation of the suggested solution, dataset from Kaggle's official website can be used. The usefulness of datasets cannot be overemphasized. The suggested model should cover relevant aspects of automobile crime such as reckless driving, vehicular assault, refusing to stop for police office, seatbelt violation, speeding, road sign violation e.t.c [13], [14].

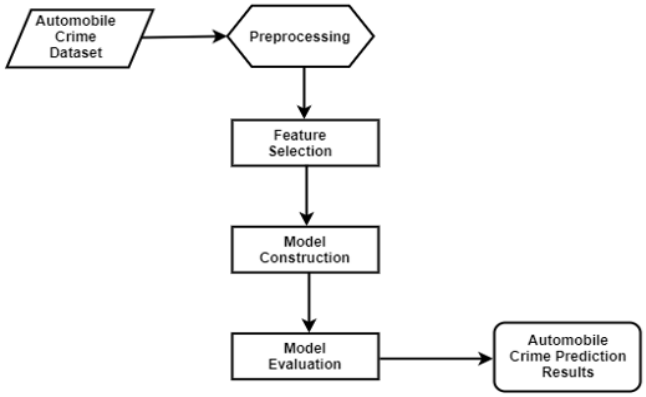

Figure 1. Graphical Representation of Suggested Solution

4.2 Dataset Filtering: Before processing data, the data must be pre-processed in other to remove unwanted signals such as noise and other anomalies [15]. Aiming at accuracy and effectiveness are most the reasons for making sure that datasets are free of any sort of noise, duplicate, and missing values or attributes of any kind that may hamper the good result to be obtained [16]. Therefore, to avoid all these issues, the best cleaning technique should be used to attain the best result from the suggested solution.

4.3 Feature Selection/Extractions: This is where filtering to reduce irrelevant or repeated features found in the dataset. Obtaining a good dataset to provide accuracy, reduce computational time, create an understanding for the model both in retaining subset or in creating a new subset, is one of the problems faced when undertaking a research study [17]. Using this method decreases the requirements for the model. Using this filtering method comes with some advantages such as: (i) Working faster, (ii) Scalability, (iii) Independent of the classifier, (iv) Compared to other methods, its computation complexity is better, (v) Possesses a generalizable property [18]. With the above-mentioned advantages of filtering datasets before processing, it will help improve the model accuracy and performance toward providing good automobile crime results.

4.4 Prediction Model Construction: The suggested prediction model should or can be designed using a deep-learning algorithm. From findings, deep-learning algorithm is suggested due to its successfulness, versatility, level of accuracy, fast analysis of concealed and incredible problems that are related to the prediction model in other to produce good and accurate results [19]. It possesses some important keys such as generative adversarial networks, convolutional neural networks, and model transfers that have helped to provide a new phase for processing information in this modern era [20].

4.5 Model Evaluation: Model evaluation is one of the key parts of constructing a model. To access the effectiveness of the of the suggested automobile-crime prediction model. Several evaluation metrics like Accuracy, Precision, Recall, and F1-score should be utilized. But it should be noted that, model performance is evaluated based on the kind of issue involved or the researcher wish to solve [21]. It is a very useful method to evaluate the performance of the result from the used algorithm. For knowing the rate of accuracy, the confusion matrix tries to find the numbers of True Positive, True Negative, False Negative, and False Positive. The formula TN + TP / TP + FP+ TN + FN can be used for calculating the accuracy of the result obtained.

Where
TN = number of True Negative
TP = number of True Positive
FP = number of False Positive
FN = number of False Negative
[22].

5. Conclusion and Recommendation

This study is basically a review of existing works on Automobile Crime Control . Findings indicate that rare interest has been shown in the area of prediction but more have been done towards the area of monitoring and controlling automobile crimes. This effort so far has not yielded many results as infiltrations, network and natural issues have limited the implementations carriedout by most researchers. Environmental issues like bad atmospheric conditions and lack of knowledge and / or necessary facilities to run most of these proposed solutions have successfully reduced the effectiveness and implementation in developing countries. .
Several works has been focused on automobile crime monitoring, controlling, and tracking. Therefore, this study recommends that more attention be given towards predicting automobile crimes in other to sufficiently tackle the issues arising from automobile crimes.

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