Machine Learning-Based Driving License Management through Wireless Ad-Hoc Networks using NFC

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Abstract: *Electronic Driving Record Frameworks (EDR) have been utilized in embracing essential consideration of the policing system; few additionally utilize such a framework by and by. To reducing ought and ensuring quality licensing service, a mobile ad hoc offline policing have the duty of maintaining law and order system can be applied through utilizing Near Field Communication (NFC) an innovative technique is built up to utilizations essential engineering aimed at driving license control facilities and predict their activities through classifier. For the benefit of the people's prerequisite the moveable license maintenance framework has been utilized comprehensively. The work features bringing drivers' records by the police in a solitary tap with an NFC tag to the NFC device. By way of the assistance of Near Field Communication (NFC), these succeeding plod should be embraced employing great need all together just as provisioning the license control of the drivers whenever and any place through the short-range wireless protocol. Presenting such technologies will stay away from license books and paper used for keeping up drivers' records physically. The system provides to maintain digitized information for every driver individually, easy access to the server, a database for the driver with archive data. A machine learning approach will focus for the prediction of the driver attitude basis on several parameters.*

Keywords: Classifier, EDR, NFC Device, NFC Tag, License, Wireless protocol.

I. INTRODUCTION

Mobile devices are constantly viewed with a person, consistently with the police or driver and just as through the area consciousness digital media. Consequently, the police and driver be able to utilize them for their supplementary enhancement and in addition to screen the license of the drivers with the assistance of license experts. To follow the drivers' license system the wireless device plays a fundamental job viewed as a rational device. The amazing life of the people have been upgraded by the assistance of the progression of science and technology. Simultaneously for some license service issues, cell phones are slowly utilized for their services. Such research is essential where results are so important. In the point of morals issue a colossal strain to be set that brought about by the profound quality of the human facilities.

The smart card reader/writer can also be created with the assistance of a wireless technology (RFID) method. It is shown to this paper emphases the NFC that gains access to utilize the NFC link created for each driver. The connection is produced a process for getting drivers' license history along with BRTA / police report. Consistent with the ISO/IEC18092 standard for NFC, in bolsters not just MIFARE and ISO 14443 A and B cards likewise for the four types of NFC Tag. The CCID and PC/SC both contain grievances of a reader ACR122U. With various types of gadgets and uses, it permits interoperability alongside the attachment USB gadget and likewise, it goes about as an attachment as well. ACR122U can read and write quicker furthermore, exact with the assistance of 124 kbps/24 Mbps speed of USB [1]. Up to 5 cm of separation, the ACR122U can be worked in ordinary.

Superior technologies, for example, POS stations, a real life uses frameworks, and vending machines ACR122U reader are utilized for allowing simple combination for example incorporated by an ISO 7816-3 SAM slats. At this point, ACR122U assumes a crucial job in every single boosted system. It is also accessible in the modular structure as well.

The ACRI22U NFC reader is perfect for equally micropayment exchanges in addition to secure individual uniqueness confirmation. The utilizations of ACR122U have been to a great extent utilized and executed in various fields, for example, ingress regulatory, E-payment, and E-ticketing, and so forth, likewise this ACR122U application explicitly is to be utilized in various system validation and fee booth collection method [2]. These sorts of various arenas remaining in the public arena are to a great extent benefited by the assistance of this specific application.

II. BACKGROUND STUDY

In case of the documents are needed instantly and in case those specific documents are not ready by the person, then and there the person has to fall varies problems.

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The necessity of versatile observing is to be expanded quickly and it is generally actualized in spots like the road just as in license services focuses. The

drivers are passing their maximum time on the road so a license controlling and maintaining application is needed. Cell phones, tablets, and a couple of other electronic devices that are viewed as convenient and effectively open are utilized such as a wellspring of digital media to gather, store and utilize license-based data of the driver. Between license provider and driver, the correspondence data have been imparted to the assistance of different modern technologies, for example, General Packet Radio Service (GPRS), Radio Frequency Identification (RFID), and Global System for Mobile Communication (GSM), Bluetooth, USB modem, and internet and so on [3]. The wireless protocol has a vital impact on the total license arrangement system of the driver. In this manner, not the license system but rather the license provider should be reliably checked and update the information through NFC enabled devices [4]. With the assistance of this observing procedure, the level of drivers can be justified in detail. The following conventional technique pursues the progression of getting to driver information by the police.

- The driving license is checked by police on the street.
- Identify the information.
- All papers are maintained manually.
- If any new issue has arisen, pen and papers are used.

The questions raised up once driving license information are stored immediately at the police data book and the huge time is taken for bringing definite data. The work additionally addresses the advantages and disadvantages of the physical stockpiling of driver data. Often this is a cause of being a traffic jam in Dhaka city. The troubles looked by keeping up driving license records in the book.

The work also depicts a couple of techniques for gathering and filing driver's data. The work also gives the technique utilized for getting to drives' data in a virtual situation. In here the system includes information sharing and documenting drivers' data. Every one utilizes conventional techniques for storing driver's data physically. While getting to their data mapping their precise data will be repetitive as the reported volume is gigantic. The electronic storage strategy replaces the customary technique for storing driver information where both physical and electronic strategies are utilized in parallel in this strategy [5]. The requirement for supplanting both these techniques turns out to be increasingly essential as these ideas become exhaustion.

A. Mobile Check Post

The driver's license management system is significantly focused on the entire procedure where the registration, information, and new issue can be store and access to the driver at any place [6]. These structures substantially are exposed to remain executed distinctly over and done with the mobile ad- hoc network. The preparation of e-license commonly not viewed as a subset. Fig. 1, depicts the relationship among the database and NCF device through NFC URL link. Some exceptional properties have been found in cell phones including being close to personal to the driver.
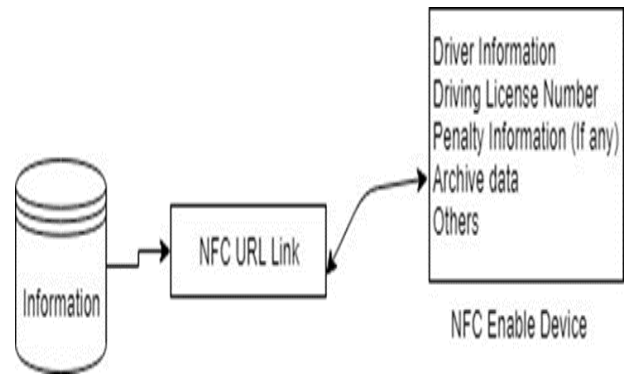

Fig. 1. NFC reader is accessing information though NCF URL Link.

Consistently with the driver and consistently on and just as giving in a social setting. In mass media, the portable is said to be one of the most useful assets just as a reasonable direct in conveying about the license subtleties. At present cell phones have been utilized among every single leading sector and truly it enormously makes sense. Other than the cell phones have long kept running in different fields, the use of this technology plays an indispensable job universally.

B. NFC-Tag

NFC protocol plays an essential job in all the current divisions everywhere throughout the world; it makes and turns into an extraordinary aid in every one of the ventures. Without the assistance of different methods joined with present-day technology, no industry to make due of its own. Consequently, humankind recovers an adequate measure of points of interest all the time. The technology we have examined here should be digital and upgraded up deeply for the welfare of the individuals just as comparing drivers. The informed point that we talked about present-day technology here is said to be none other than Near Field Communication (NFC). A lot of dissimilar numerous fields are additionally to remain incorporated into the NFC technology, for example, Education improvement, Economic, Credit line, Healthcare is yet to utilize this new technology [1,7]. Normally these sorts of the innovation utilized in different several applications are to fix another parameter to upgrade the individuals' lifecycles just as the social insurance procedure according to the framework.

When associating electromagnetic radio fields a sort of short innovation is utilized are supposed to be NFC. These times we ramble approximately a security break in all viewpoints, this is basic in different procedures and techniques utilizing the most recent and modern technologies. The security techniques we pursue and should be reinforced by their interest and should remain engaged in a request. Maybe the information of the NFC functioning is re-writable yet this is supposed to be just read type. For advancing innovation and setting by way of the key principles the detail is assumed particularly via the NFC Forum [8]. The business affiliations are additionally should have been accused of similar key guidelines. All the individual information, for example, credit/charge data,

organizing contacts information, PINs, region program information and other data are totally to be verified by means of the assistance of the NFC tag [9, 10]. There are four unique sorts of information as of the NFC gathering are supposed to give memory, security, and information maintenance, compose continuance, abilities concerning configurable, and so forth. With the assistance of these four distinct sorts of information, a particular correspondence speed is also to be incorporated.

III. SYSTEM ARCHITECTURE

The focusing of this paper is to create a server-based driving license and case management infrastructure in public and private transportation systems. Now the paper, the server system is demonstrated thru the NFC technology. The segments that are interconnection shown in Fig. 2. The NFC technology is combined wirelessly with the server-based driver information system where the NFC tag is stored information through an NFC URL link by the access of NFC enabled devices and vice-versa for the reading procedure [11].

Fig. 2, portrays the driver's license data process with the BRTA and in parallel with the driver enrollment system as well as the police report. The EDR server is used to store data. The technology naming NFC tag is used to access the driver URL link store in the NFC tag to deliver license information based reports. According to the procedure, all information of the driver should remain documented in pursuance of processes. These subtleties may remain gotten too effectively. Progressively it is exact, exhaustive and effective in its particular manner.

Such a kind of software is utilized for entering and spare the whole driver's data through the assistance of the EDR framework. Data of the driver is stored by the assistance of software and along these lines and the server is utilizing for storing. Thus the total information of the driver may be recovered in a split second. With the assistance of the EDR framework, the other fundamental information all are to be recovered in digitized duplicates. When the NFC tag is touched to the NFC reader the cases as being as follows the algorithm.

Algorithm: Document searching and load into database
1. For each NFC Tag_provided_by_BRTA/police
2. **if** NFC Tag. No = BRTA.NFC Tag. No **then**
3. Open Link. BRTA (Driver)
4. **then** [Checked and verified] and [store and updated data]
5. **else**
6. Blacklist. Penalty(Driver)
7. **end if.**
8. **if** fine is paid
9. **then** [stored and updated data]
10. **else**
11. Police report and [store and updated data]
12. **end if**
13. **Exit.**
14.

IV. PROPOSED METHOD

A. NFC and EDR Database

Through NFC signal, NFC tag and NFC enabled devices to create an ad hoc wireless network when both devices come in a range and the information will be utilized by NCF devices. Fig. 2, demonstrates the portrayal of the NFC Tag that is empowered in the cell phones for getting the signal of NFC signal. The NFC tag is supplanted through the assistance of NFC cell phones and deriver or police carry, it as a portable hand-held device. It is such a procedure that gets to the driver's license record that is stored in the EDR.
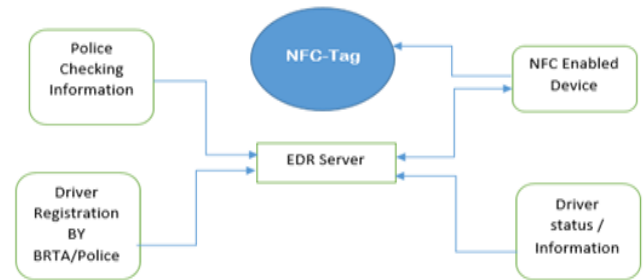

Fig. 2. Proposed System architecture based on NFC Link

Fig. 2, shows that the driver information is accessed by the NFC enabled device through the NFC URL ling (tag) when they come in a range. Once the driver information site is open and this will be occurred both offline and online. But for online activities must need an active web link. The access (NFC URL) link is made when storing driver license information in the server. The special access connection is made for the single driver and when the mobile NFC corresponds thru the NFC reader the accessing connection is controlled for getting to the driver's license information from the server. The License information covers equally their own and license based records that additionally incorporates their intermittent license review document. The data is placed in the server such as a solitary record coded as a connection.

There is an NFC provision empowered in cell phones. Not many computerized devices have NFC provisions [3]. Indeed, the greater part of the device doesn't have an NFC providing facility. Tag facilities are included to the NFC by copying a couple of utilizations that can change over the versatile measuring device as RFID empowered sensor gets to. The wireless technology NFC is actualized uniquely on a couple of devices which comprise of NFC Tag and for the device where such a Tag is not included, the NFC Tag is utilized in place of a choice. A database is considered shown in table 1 to use those data for the prediction of a driver's upcoming activities. All data are secondary and potentiality is 100% to collect such information by suing the proposed system. From the database, 365 days of one driver data are shown in table I.

B. Machine Learning Approach

Through machine learning, by using those data a model will develop to predict the possibility of an accident.

Table- I: Driver data

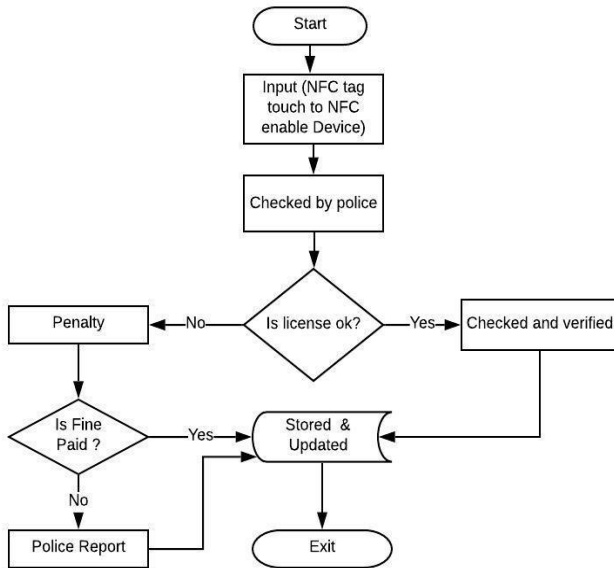| Signal Violence	Fake License	No License	License Category	Date Failed	Lane Change	Driving with Phone	No Seat Belt	Accident
6	0	0	1	0	4	10	1	Yes
5	0	0	0	0	6	6	2	No
--								
3	0	1	1	0	0	6	0	Yes

Fig. 3. Flow chart of working procedure

For this purpose, only 3 columns are considered to train and test the dataset. Such as Signal violence, Lane change, driving with phone and Accident. Prediction methods use a few factors to foresee obscure or future estimations of different factors [12]. Description methods discover the human-interpretable model that relates the information [13].

Several classifications are used to predict from given a collection of records called training set where each record contains a set of attributes, one of the attributes is the class. The objective is too inconspicuous records ought to be relegated a class as precisely as could be expected under the circumstances. A test set is utilized to decide the accuracy of the model. Ordinarily, the given informational index is into training and test sets, with a training set used to assemble the model and test set used to approve it [14].

Clustering is one the describing method was given a set of data points, each having a lot of attributes, and a likeness measure among them, discover cluster with the end goal. The points of data the similarities are more to each other in one cluster. In the points of data there are less corresponding to each other in distinct clustering. For similitude measuring Euclidean Distance is used if attributes are continuous.

At the point when the class value is nominal, the Kappa measurement is given. A value is more noteworthy than *0* implies that the classifier is showing better over the possibility. The equation of Kappa is defined as

$$K = \frac{p_o - p_e}{1 - p_e} \qquad (1)$$

In the event that the raters are in complete understanding, at that point $\kappa = 1$. On the off chance that there is no understanding among the raters other than what might be expected by some coincidence (as given by *pe*), $\kappa \leq 0$. A Kappa result of *0* implies that the outcome is equivalent as would be expected by some coincidence. In classifier, there is training and test sets, cross-validation and percentage split used to employ the feature vectors. In the event of Performance analysis, it isn't just accuracy, which is a thorough measurement, yet there are likewise some other unmistakable measurements for surveying a classifier's performance, since exactness may not be discovered reasonable for assessing the exhibition of a classifier worked from imbalanced informational indexes [14].

So the performance is measured of the classifier once the model is trained or cross-verified and also some other prominent performance assessment metrics using the test data set. In order for evaluating the performance of the classification model, a holdout method is used [14]. Once a decision is made by comparing the performance metric. Fig. 4 is shown as the classification task.

C. Approach of Classifier

Five classifiers are chosen to employ the classifier. C4.5 is a decision-based classifier that is depth-first construction and extremely fast at classifying unknown records.
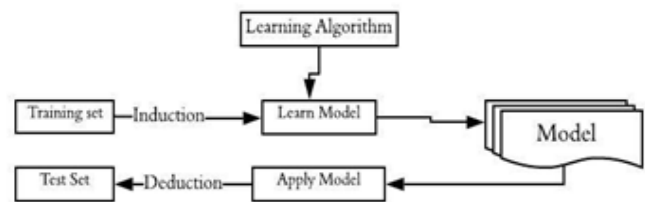

Fig. 4. Classification task

It sorts continuous attributes at each node and entire data to fit in memory. Construct subsets fecundate in one class or other specific nodes of the tree and also used to gain information. To measure the best split Gini index is needed to measure node impurity [13]. Gini Index for a given node *t*:

$$GINI(t) = 1 - \sum [p(j|t)]^2 \qquad (2)$$

Here $p(j/t)$ is the relative frequency of class j at node t). When a node *n* is split into *k* partitions, the quality of split is calculated as following and parent node *p* is split into k partitions as well as *ni* is the number of records in partition *i*.

$$GINI_{Split} = \sum_{i=1}^{k} \frac{n_i}{n} GINI(i) \qquad (3)$$

$$GainRatio_{Split}t = \frac{GAIN_{Split}}{splitINFO} \qquad (4)$$

$$\text{Where } SplitINFO = -\sum_{i=1}^{k} \frac{n_i}{n} \log \frac{n_i}{n} \qquad (5)$$

Moreover, the other classifier named IBk (instance-bases learning with parameter k) and it's in the lazy class folder in Weka [14]. *k*NN is the K parameter. This is K-nearest neighbor's classifier. Can choose fitting estimation of K dependent on cross-validation where default=1. It can likewise separation weighting.

Select the quantity of closest neighbors among 1 and the k value indicated utilizing hold-one-out assessment on the training data (use when $k > 1$) [14]. T*he k*-NN parameter indicates the quantity of closest neighbors to utilize when arranging a test instance, and the result is controlled by the majority vote.

To get more evaluation another classifier logistic is introduced under the function classifier. Class for structure and utilizing a multinomial logistic regression model with an edge estimator. On the off chance that there are k classes for n instances with m attributes, the parameter matrix B to be determined will be an $m*(k-1)$ matrix.

Class for a Naive Bayes classifier utilizing estimator classes. Numeric estimator precision esteems are picked dependent on an investigation of the training data. The NaiveBayesUpdateable classifier will utilize a default precision of 0.1 for numeric properties when the buildClassifier is called with zero training instances. To predict output Bayes theorem is one of a simple classifier and also a qualified probability model. For example, the probability that document d is represented by x= (x1, x2, …., x_n), is to be classified into one of m classes C1, C2,……, Cm, and model compute the desired class Ĉ through the equation:

$$\hat{C} = argmax_{k \in \{1, 2\ldots m\}} P\ (C_k)\prod_{i=1}^{n}\ P(x_i|C_k). \quad (6)$$

Another prominent classifier has used in a random forest, that considers K randomly chosen attributes at each node. It also has an option to allow estimation of class probabilities (or target mean in the regression case) based on a hold-out set (backfitting) [13]. It continues by amassing a huge number of decision trees at training time. At that point, it yields the class that is the model of the classes of the specific trees.

If there should arise an occurrence of performance analysis a confusion matrix for a 2-class (binary) issue uncovers the recurrence of true positives (TPs), true negatives (TNs), false positives (FPs), and false negatives (FNs). If there should arise an occurrence of a multiclass, i.e., n-class (n > 2) issue, the ensuing confusion matrix will be of measurement n × (n > 2). It very well may be noticed that this matrix has n rows, n columns, and n × n entries in total. From this framework, the frequencies of FPs, FNs, TPs, and TNs should be computed, which isn't legitimately conceivable. FP, FN, TP, and TN for class I are processed according to the methodology depicted in [16]:

$$TP_i = a_{ij}. \quad (7)$$

$$FP_i = \sum_{\substack{j=1\ j \neq i}}^{n} a_{ij} \quad (8)$$

$$FN_i = \sum_{\substack{j=1\ j \neq i}}^{n} a_{ij} \quad (9)$$

$$TN_i = \sum_{\substack{j=j \neq i}}^{n} \sum_{\substack{k=1\ k \neq i}}^{n} a_{jk} \quad (10)$$

In continuation of this procedure, a definitive confusion matrix of measurement 2×2 has the normal estimations of the n confusion matrix for all classes. Accuracy, sensitivity,

specificity, precision, false positive rate (FPR) and false negative rate (FNR)—these six performance metrics of a classifier are calculated by using this confusion matrix. After our classifier is trained, by utilizing test data collection, execution is computed in the index of these measurements. Considering the confusion matrix into account, accuracy, sensitivity, specificity, precision, FPR, and FNR are calculated in percentage as:

$$Accuracy = \frac{TP + TN}{TP + FN + FP + TN} * 100\% \quad (11)$$

$$Sencitivity = \frac{TP}{TP + FN} * 100\% \quad (12)$$

$$Specificity = \frac{TN}{FP + TN} * 100\% \quad (13)$$

$$Specificity = \frac{TN}{FP + TN} * 100\% \quad (14)$$

$$Specificity = \frac{TN}{FP + TN} * 100\% \quad (15)$$

$$FNR = \frac{FN}{FN + TP} * 100\% \quad (16)$$

There is a method estimation technique holdout method introduce here for choosing the data proportion aimed for training and testing independently [13]. This method separates the sample data set at the extent of around 66% (two-thirds) for training and around 33% (one-third) for testing. All together for disposing of the model overfitting issue, a validation set is utilized [16]. In consistence with this methodology, we split the first training data index into two smaller subsets. One subset is for training, though the other one is for validation. All together for building a multi-class confusion matrix and subsequent six binary confusion matrix that point the figuring of execution assessment measurements happens. We compute six matrices, in particular, accuracy, sensitivity, specificity, and precision, FPR, and FNR, in total.

Table-II: Assessment of experimentally assessed classifiers in terms of six standard performance metrics.

Classifier	Measurement Parameter					
	Accuracy (%)	*Sensitivity (%)*	*Specificity (%)*	*Precision (%)*	*FPR (%)*	*FNR (%)*
C4.5	86.29	20.00	95.41	37.5	4.59	80
K-NN	85.47	19.57	94.98	36.0	5.02	80.43
Logistic	87.67	10.87	98.75	55.6	1.25	89.13
Naïve Bayes	86.57	26.09	95.30	44.4	4.70	73.91
Random Forest	87.12	21.74	96.55	47.6	3.45	78.26

V. RESULTS AND DISCUSSSION

For the most part, the BRTA and police are exposed to pursue their individual EDR database. Here in the BRTA/police, the NFC tags are synchronized and for a short time stored. Consequently, the BRTA/police who access this EMR database can follow just about the explicit driver in detail. On the off chance that a driver (counterfeit/enlisted) is checked by BRTA/police, the detail license information about the individual can be gotten to just with the assistance of these NFC tags rather than looking through the driver record in packs of papers, the BRTA/police can without much of a stretch recognize the driver records with the full needed data by reviewed driver EDR.

About fig. 5, 6, 7, 8, 9, that refer to the threshold of the difference classifiers in the point of x-axis that shows the false positive and y-axis shows the true positive. It is shown also that the performance of each classifier represented as the point of changes of location. Actually, no model consistently outperforms the other but in here logistic is better than another basis on the metrics of a true positive and false positive. The area under the ROC curve (Receiver Operating Characteristics) is ideal and random guess when area = 1 and 0.5 respectively [13].

The driver's updated information must be updated in a decipherable and appropriate way in the EDR when the driver's license has been finished according to the system.
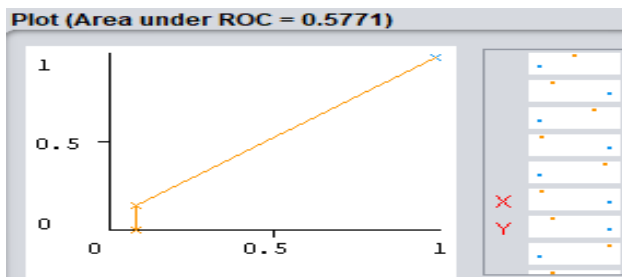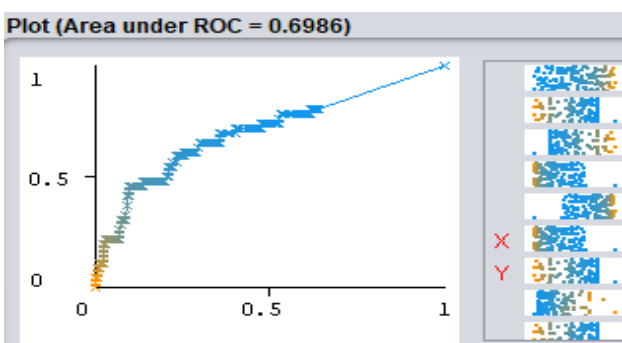

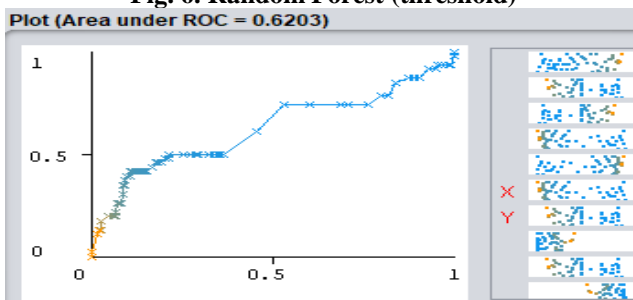**Fig. 5. Tree C4.5 (threshold)**

Fig. 6. Random Forest (threshold)
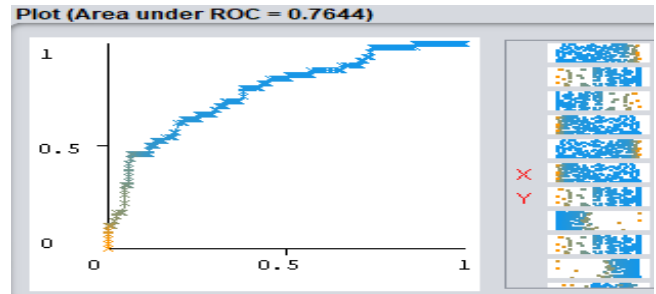

Fig. 7. *K*NN (threshold)
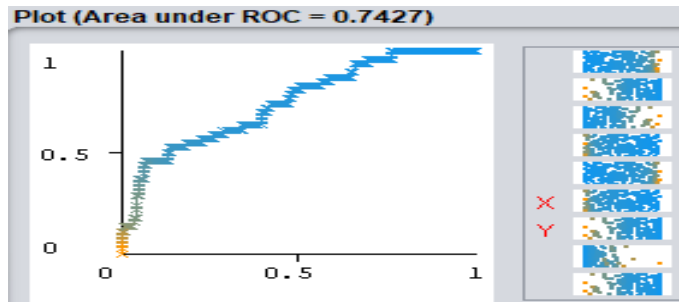

Fig. 8. Naïve Bayes (threshold)

Fig. 9. Logistic (threshold)

The relating driver's extremely significant important data should have been transferred consistently in the EDR system. The EDR software should be moved and synchronized back again with the NFC tags once when the driver renews the license. This is said to be just a piece of single information contain about the detail data of the police/BRTA report that occurred at a specific time. Fig. 1, gives license based information of the driver that incorporates all records of the driver, similar to license data, other case details pursued by the BRTA/police records. Regardless of the information volume, the access link gives special driver detail including the majority of their BRTA/police data.   It is shown from Table-II that Logistic gets the better of the other four classifiers as far as all estimations used, where *k*NN's execution is the least fortunate. If there should be an occurrence of accuracy, great accuracy is additionally accomplished by random forest, naïve Bayes, and C4.5. If there should arise an occurrence of the other four measurements, random forest, naïve Bayes, and C4.5 beats every single other classifier. Considering every one of the six metrics can attest that logistic plays out the best among every one of the five classifiers without reference to recognition of driver attitude.

V. CONCLUSSION

This procedure should have been executed with the assistance of modern technology. Accordingly, fundamental steps should be taken for this specific task. For this work, Real-Time Report is essential to finish in a legitimate way however this ought not to be occupied from the principle entrusting of driver's considerations. Proper information database, as well as safety measures, are needed to be followed in an order per rule. To improve quality assurance is mandatory, for this all protocol has to follow strictly. In this paper, the server system is exemplified by the NFC technology.

The NFC technology is integrated wirelessly with the server-based driver information system where the NFC tag is stored information through an NFC URL link by the access of NFC enabled devices and vice-versa for the reading procedure. Consequently, the BRTA/police who access this EMR database can follow just about the explicit driver in detail.

The machine learning technique is a significant circumstance to recognize the driver's attitude by using the classifier. Since this context plays a vital role in building the proposed driver management expert system. Here five prominent classifiers' performance has been presented in the unique circumstance of the driver management system. Logistic gets the better of the other four classifiers as far as all estimations used, where kNN's execution is the least fortunate.

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