FORECASTING STRESS OF DRIVER

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Abstract— *The level of stress for drivers will have a greater impact while driving. Driver stress may affect driver performance and creates many accidents. Stress is something we cannot able to physically see and identify. At present, only current stress level estimation is focused. Also, monitoring of the present level is established. We have proposed real data collection; IoT based sharing and data analytics. To obtain driver stress we have used heartbeat sensor and eye blink sensor to predict the stress level and drowsiness of the driver during driving. The real time data are processed from Net beans as an excel file to R programming studio for data analysis. In R programming clustering and classification are processed for normal or abnormal conditions of the driver.*

Keywords— Sensor; Stress; Data Analytics; R Programming

1. INTRODUCTION

Big data is a set of voluminous and complex data. Big data previously has only three dimensions such as Volume, variety and velocity and now included veracity and value as added dimensions. Big data contains structured, semi-structured and unstructured data. These data can be captured by sensors connected to the internet of things. It deals with the growth in the volume of structured and unstructured data, the speed at which it is created and collected. Big data often comes from multiple sources and arrives in multiple formats. The challenge of big data is to capture, store, analyze and visualize the data. From the collected data, predictive analysis can be done and this analysis can be applied in various fields such as crime security, health care and resource management. It provides cost-effective results. Big data is used to understand the customers and their preferences. And can obtain a complete clear picture of their most valuable customers.

Human aspects are accountable for many of the road accidents. Cognitive errors arrive in highly cognitive challenging conditions in which the cognitive load as assessed by the driver is high and the actions taken by the driver to handle those conditions are not suitable in many instances. Being able to detect the evolution of the driver's cognitive load and stress levels and to predict highly challenging situations is crucial in order to provide help to the driver to better handle these situations. The stress of drivers will have a great impact on driving. Driver stress may affect driver performance and creates many accidents. Many innocent lives are lost because of driver stress level.

We designed a system for the estimation of future stress level of drivers during driving. It can also be used for finding the drowsiness of the drivers. The heartbeat sensor and eye blink sensor are used to detect driver stress and driver pupil dilation. Predicting the driver stress can be detected and resolved through the application of big data technique (R Programming). By predicting it in earlier time, will reduce the risk and also suggest possible solutions for the current situation of the driver. Hence it will have a great impact among the people.

2. RELATED WORKS

[1] The Effect of Stress on Cognitive Load Measurement is a method in which the cognitive load measured is based on the effect of current stress level. Due to difference in the stress and normal stress level there is change in the Galvanic Skin Response value. By using the GSR value feature extraction is done.

[2] Driver Cognitive Distraction Detection Using Driving Performance Measures mainly concentrate on finding the driver cognitive diversion state; Controlled Area Network bus data is used to pull out the characteristic parameters. The measure selections such as driving performance measure, driver physical measures, hybrid measure are used.

[3] A comparison of heart rate and heart rate variability indices in distinguishing single-task driving and driving under secondary cognitive workload is the approach in which the heart rate variability measures is used to differentiate the concentrated driving and when driving under some unstable mental workload. The driver and vehicle information collected is synchronized using Volvo XC90. The data analysis is done to find out the changes in the cognitive workload.

[4] Recognizing Academic Performance, Sleep Quality, Stress Level, and Mental Health using Personality Traits, Wearable Sensors and Mobile Phones is a method to analyze the physiological and behavior of human pattern. The correlation analysis of performance, sleeping quality (PSQI-Pittsburg Sleep Quality Index), stress level (PSS-Perceived Stress Scale) and mental level (MCS-Mental health Composite Score) is done. The feature selection technique is used. The received stress is classified into high and low level stress.

[5] Cluster-Based Analysis for Personalized Stress Evaluation Using Physiological Signals is the approach to evaluate interpersonal stress. Both clustering and cluster-wise stress evaluation is done using K-Means algorithm and general regression neural network respectively. The feature extracted is based on the impact of the stress.

3. PROPOSED SYSTEM

We designed a system to predict upcoming levels of stress in a real-time environment based on current levels of stress and driving actions. The proposed system will be able to detect driver stress and driver's drowsiness. For this we used heartbeat sensor and eye blink sensor as input. The heartbeat sensor will be clipped in finger of the driver and the eye blink sensor will be fixed in the vehicle.

The driver data are collected from these sensors are transmitted to the microcontroller and using RS232 cable the real and dynamic driver data are transmitted to the system. Once a Serial Port object has been created, communications through the physical port are conducted through standard Input Stream and Output Stream objects. These streams send and receive information as bytes, integers or arrays of bytes. The real time data from the COM port are obtained using Net beans and saved in SQL database. The real time data can be monitored by vehicle service centers.

These data are then classified and clustered for normal or abnormal conditions of the driver. A huge amount of multidimensional data has been collected from these sensors. Mining knowledge from these big data is a highly demanding. It far exceeds human's ability to analyze these huge data. The classification is done using k-means algorithm. The clustering is done using Naive Bayes algorithm. The driver data are encrypted and each driver data are stored in public cloud server namely DropBox. RC4 algorithm is used for encryption of the driver data.

The advantages of the proposed system is, it will predict driver stress level in advance and prevent accidents. It has the efficient architecture invoking real time data collection, data sharing and data analytics. It also detects drowsiness of the driver. It can able to monitor all the vehicle driver behavior using Internet of Things (IoT).

Correlation indexes for the predicted future stress signal and the current stress are calculated. The confusion matrices are calculated. Two various training data and validation situations have been considered to evaluate the validity of results and their concept validity. They are as follows: First, train the system for a particular user with part of the data and validate it with the remaining data for the same user. Next, train the system for a particular user with all the data and validate those data with all the data for a different user.

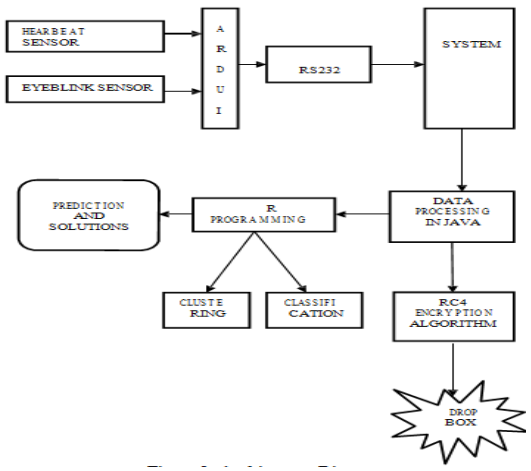

Figure 1: Architecture Diagram

4. ALGORITHM

1. Naive Bayes

Naive Bayes technique is easiest to understand when described using binary or categorical input values. It is called naive Bayes or idiot Bayes because the calculations of the probabilities for each hypothesis are simplified to make their calculation tractable. Nevertheless, the approach performs surprisingly well on data where this assumption does not hold. The representation for naive Bayes is probabilities. A list of probabilities is stored to file for a learned naive Bayes model.

2. K-Means

K Means Clustering is an unsupervised learning algorithm that tries to cluster data based on their similarity. Unsupervised learning means that there is no outcome to be predicted, and the algorithm just tries to find patterns in the data. The algorithm iterates through two steps. First, Reassign data points to the cluster whose centroid is closest. Then, calculate new centroid of each cluster. It can handle larger datasets than hierarchical cluster approaches. It also improves the overall solution.

3. Rivest Cipher

The RC4 encryption algorithm is a shared key stream cipher algorithm requiring a secure exchange of shared key. The symmetric key algorithm is used identically for encryption and decryption such that the data stream is XORed with the generated key sequence. The algorithm is serial as it requires successive exchanges of state entries based on the key sequence. Hence implementations can be very computationally intensive.

5. WORKING PRINCIPLE

In this project, to overcome the challenge we have proposed real data collection, IoT based sharing and data analytics. To obtain driver stress we have used heartbeat sensor and eye blink sensor to predict the stress level and drowsiness of the driver during driving. The eye blink sensor being used is based on IR. If the eye is closed the relevant output is high. If the eye is opened the output is low. This output is given to logic circuit to indicate the alarm. By this we may come to know whether the eye is in closing or opening position. Thus find the drowsiness and unconsciousness of the driver. The heart rate measure kit is used to monitor the heart rate of the driver. The result is displayed on a screen via the serial port and is saved for future analysis. In real time these sensors would be embedded in the driver glass. The driver data are collected from the sensors transmitted to the microcontroller and using RS232 cable the real and dynamic driver data are transmitted to the system. The real time data from the COM port are obtained using Net beans and saved in SQL database. The real time data can be monitored by vehicle service centers, bus owners and nearby vehicle boarding point. The real time data are processed from Net beans as an excel file to R programming studio for data analysis. In R programming clustering and classification are processed for normal or abnormal conditions of the driver. The driver data are encrypted using Rivest Cipher (RC4) encryption

algorithm and each driver data are stored in public cloud server namely DropBox.

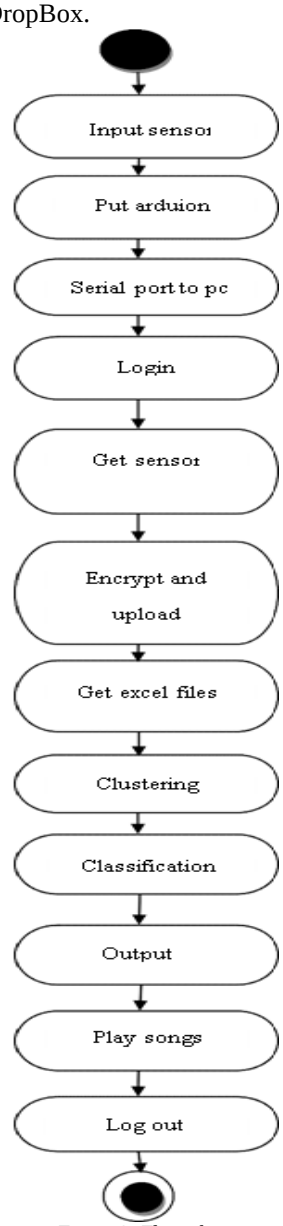

Figure 2: Flow chart

6. IMPLEMENTATION

The implementation of "Forecasting Stress of Driver" is developed by using JAVA as the front-end tool and while MYSQL as the back end tool.

A. INFORMATION SENSING:

The driver physiological data is acquired from the sensors. Then the sensors data is transmitted to the system using the Arduino Uno. Java API in the Net Beans is used for the proper serial communication to acquire data serially from these sensors.

B. DATA COLLECTION AND PROCESSING:

The real time data obtained using the Net Beans are processed as the excel file to the R Programming Studio for the data analysis. The real time data is also encrypted and stored in the cloud. In R Programming classification and clustering are for the normal and abnormal condition of the driver.

C. ALERTING THE USER:

After the analysis, if the abnormal condition of the driver physiological condition is predicted then alert song is played to alert the driver. The message is also delivered to the admin to know the condition of the driver.

7. CONCLUSION AND FUTURE WORKS

The main goal is to predict the upcoming stress of driver rather than assessing the current levels of stress. Based on the previous driving action, the upcoming stress is predicted. Since wearable sensor is being used more accurate data is collected leads to accurate result. The future work may focus to improve the reliability on non-intrusive signal detection. More accurate result can be achieved. The relationship between the stress and the events happening while driving such as traffic light and the road conditions can also be considered.

REFERENCES

[1] Conway, Ian Dick Zhidong Li1, Yang Wang and Fang Chen, "The Effect of Stress on Cognitive Load Measurement", in Human-Computer Interaction— INTERACT. Berlin, Germany: Springer, 2013, pp. 659– 666.

[2] Lisheng Jin, Qingning Niu, Haijing How, Huacai Xian, Yali Wang and Dongdong Shi, "Driver Cognitive Distraction Detection Using Driving Performance Measures", IEEE Transactions on Intelligent Transportation Systems ,2012.

[3] Bruce Mehler, Bryan Reimer and Ying Wang, "A comparison of heart rate and heart rate variability indices in distinguishing single-task driving and driving under secondary cognitive workload", International Symposium on Human Factors in Driver Assessment, Training and Vehicle Design,2011.

[4] Akane Sano, Andrew J. Phillips, Amy Z. Yu, Andrew W. McHill, Sara Taylor, Natasha Jaques, Charles A. Czeisler, Elizabeth B. Klerman and Rosalind W. Picard, "Recognizing Academic Performance, Sleep Quality, Stress Level, and Mental Health using Personality Traits, Wearable Sensors and Mobile Phones" ,IEEE International Conference on Wearable and Implantable Body Sensor Networks(BSN),June 2015.

[5] Qianli Xu, Tin Lay Nwe and Cuntai Guan, "Cluster- Based Analysis for Personalized Stress Evaluation Using Physiological Signals", IEEE Journal of Biomedical and Health Informatics, Vol. 19, No. 1, January 2015.

[6] Boon-Giin Lee and Wan-Young Chung, "Wearable Glove-Type Driver Stress Detection Using a Motion Sensor", IEEE Transactions on Intelligent Transportation Systems, Vol.18, October 2016.

[7] Antonio Lanata, Gaetano Valenza, Alberto Greco, Claudio Gentili, Riccardo Bartolozzi, Francesco Bucchi, Francesco Frendo and Enzo Pasquale Scilingo, "How the Autonomic Nervous System and Driving Style Change With Incremental Stressing Conditions During Simulated Driving", IEEE Transactions On Intelligent Transportation Systems, Vol. 16, No. 3,June 2015.

[8] Jennifer A. Healey and Rosalind W. Picard, "Detecting Stress During Real-World Driving Tasks Using Physiological Sensors", IEEE Transactions On Intelligent Transportation Systems, Vol. 6, No. 2, June 2005.

[9] Changxu Wu and Yili Liu, "Queuing Network Modelling of Driver Workload and Performance", IEEE Transactions On Intelligent Transportation Systems, Vol. 8, No. 3, September 2007.

[10] M. Itoh, E. Kawakita, and K. Oguri, "Real-time estimation of driver's mental workload using physiological indexes," in Proc. ITS World Congr., 2010, pp. 1–11.

[11] J. H. Kim, Y. S. Kim, and W. S. Lee, "Real-time monitoring of driver's cognitive distraction," in Proc. Spring Conf. Korean Soc. Autom. Eng., May 2011, pp. 1197–1202.

[12] Y. Zhang, Y. Owechko, and J. Zhang, "Learning-based driver workload estimation," in Computational Intelligence in Automotive Applications, vol. 132, D. Prokhorov, Ed. Berlin, Germany: Springer-Verlag, 2008, pp. 1–17.