NFC Based Driver System

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Abstract— Drowsiness may be a multidimensional feature that researchers over the past decade have found difficult to define. Indeed, it's one of the leading contributing factors in traffic accidents worldwide. Solving the matter became critical when the planning of earlier accident prevention systems was found ineffective for alerting the driving force. It is said that prevention is best than cure. Keeping this thing in mind we have designed an NFC Based Driver System which will help to solve this problem to a great extent. Our system consists of an NFC-based device that is connected to the engine. Whenever the driver wishes to start the vehicle, he/she has to place his/her NFC Key/Card on the device. Once it is placed on the device then the device communicates with the server and checks for the driver details. If the driver has already driven any vehicle for more than the threshold time in total then the vehicle, he/she is trying to drive will not start. This will ensure that the driver drives any vehicle for only a limited time per day. Hence, the driver would not be exhausted and the risk of accidents will automatically decrease. Since the driver's NFC Key/Card remains the same for all vehicles, hence total time for which the driver has driven can be easily calculated. This data is even synced to the cloud and can be viewed by Transport System owners. Additionally, a python-based system is also designed to check drowsy drivers based on the facial features extracted which will add more efficiency to the system and make it robust.

Keywords: IoT, NodeMCU, drowsiness detection, Arduino.

1. INTRODUCTION

Currently, transport systems are an important part of human activities. We all can be a victim of drowsiness while driving, simply after a too-short night sleep, altered physical condition, or during long journeys. The sensation of sleep reduces the driver's level of vigilance producing dangerous situations and increases the probability of an event of accidents. Driver drowsiness and fatigue are among the important causes of road accidents[15]. Every year, they increase the amount of deaths and fatalities injuries globally. In this context, it is important to use new technologies to design, and build systems that can monitor drivers and measure the duration of driving during the entire trip. In this project, a module for NFC Based Driver System is presented to reduce the number of accidents caused by driver fatigue, and thus improve road safety. This system treats the automatic detection of driver drowsiness based on various information. An Android App is also designed for the same. Drowsiness and fatigue are multidimensional features that researchers over the past decade have found difficult to define. Indeed, it's one of the leading contributing factors in traffic accidents worldwide. Solving the matter became critical when the planning of earlier accident prevention systems was found ineffective for alerting the driver [8]. Hence, keeping all things in mind and to increase the safety of the driver we have planned to design a system that does notallow drivers to drive any vehicle beyond the threshold (maximum hours per day) time.

The basic concept behind this system is a device and an android app-based system. The device developed is an NFC-based system that is used to collect timestamps of the driver activities and calculate the total duration for which the driver drives the vehicle per day. The device sees to it that the total time for which the driver drives does not, exceed the threshold value to avoid overtime driving which may lead to an accident due to fatigue or drowsiness. The driver's profile can be viewed on an Android App and the total time for which the driver has driven any vehicle. Additionally, a python-based image recognition system is also designed to check drowsy drivers based on the facial features extracted which will add more efficiency to the system and make it robust.

2. LITERATURE SURVEY

In 2007, Arimitsu et al. [3], developed the driving simulator with the seat belt motor retractor which was used in a commercial vehicle, to provide the vibration stimulus to the drivers. The limitation of this paper was the variation of the portions, which were stimulated by the seat belt. In 2008, Liang et al. [4], proposed a novel brain-computer interface (BCI) system that can acquire and analyze electroencephalogram (EEG) signals in real-time to monitor human physiological as well as cognitive states, and in turn, provide warning signals to the users when needed. The accuracy of the BCI system is slightly less when compared to the existing systems to detect drowsiness. In 2010 Lin et al. [5], proposed a deviceincludes a wi-fi physiological signal-acquisition module and an embedded signal-processing module. In case of defects in the EEG monitor then the detection of drowsiness may decrease. In 2011, Kohji Murata et al [6], advanced a non-invasive device to discoverpeopleusingbelow the affect of alcohol through measuring organic signals. The algorithm for the time series of the frequency fluctuations generated in this study has this potential. In 2012, Picot et al. [7], the features used bythe EOG-based detector are voluntarily restricted to the features which will be automatically extracted from video analysis of equivalent accuracy. Despite its good performance, the method is slightly less accurate than some of the systems. In 2013, Oyini Mbouna et al. [8], the proposed scheme uses visual features such like eye index (EI), pupil activity (PA), and HP to extract critical information on no alertness of a vehicle driver. If the pupil is red then it fails to detect the eye of the driver. In 2014, Issey Takahashi et al. [9], triggered CRPS through paced breathing (PB) the use of pulse sound, which synchronized with heartbeats. For greater safety, methods got to be developed to physiologically overcome drowsiness. In 2016, J. Pilataxi et al. [10], presented a driving assistance system that detects drowsiness in the driver. If the robot fails the work will not be performed. Very recently in 2017, Qian et al. [11], proposed a method of Bayesian-copula discriminate classifier (BCDC) to detect individual drowsiness based on the physiological features extracted from electroencephalogram (EEG) signals. This look atmay besimilarly generalized to different experimental environments to discover vigilance degree or driving force drowsiness. In 2017, CemBila et al. [12], presented a summary of research on ICT-based support and assistance services for the security of future connected vehicles. It is hard to provide a systematic overview of open research challenges at a granular level.

3.METHODOLOGY

EXISTING METHODOLOGY

Most of the systems studied or seen in the literature review are based on image processing techniques where a camera continuously monitors the driver's face to detect drowsiness of fatigue. If the driver seems to be drowsy the system alerts the driver through sound. Other devices use EOG, EEG, or Heart rate sensors to monitor the driver's status and provide alerts accordingly.

Disadvantages :

- Requires expensive devices such as cameras and boards such as Raspberry Pi.
- Chances of false alerts for drowsiness and fatigue.
- Needs to be attached to the driver's body for collecting values.
- Requires more and continuous processing.

PROPOSED METHODOLOGY

This device continuously monitors data and processes it for determining alert situations. They act when the driver is about to get drowsy or fatigue hence may get late while alerting the driver. System based on Raspberry Pi and OpenCV image recognition uses facial features like pupil movements to determine whether a driver is drowsy or not. While other systems use body monitoring through various sensors to determine fatigue and provide alerts to the driver.

The proposed system must also perform up to the mark. The features and algorithms should do the required task efficiently and correctly and any malfunction must be notified immediately. The system should also be able to efficiently manage the requests made by the user.

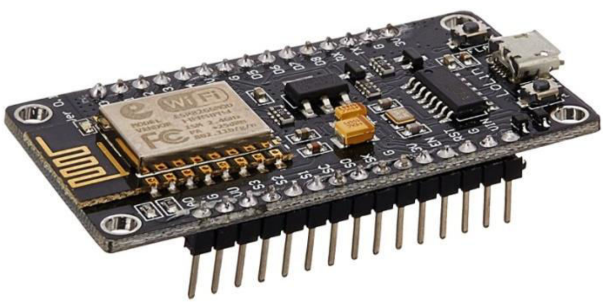

Fig3.1: NodeMCU

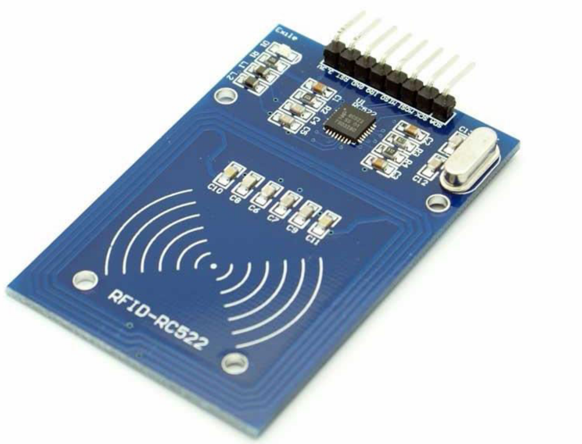

Fig3.2: NFC Reader/Writer: RC522

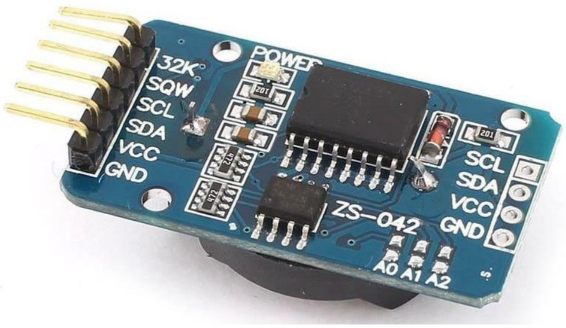

Fig 3.3: RTC: DS3231

- Reads NFC Card of the driver to get details regarding driving duration.
- Registers Initial and Final timestamp during driving.
- Calculates and stores duration value to NFC over cloud storage.
- Alert's driver if the time exceeds the daily threshold value.
- Profile of driver can be displayed using Android App.
- Cloud storage to save data remotely in the presence of the internet.
- Image processing for finding drowsy features using OpenCV.

Advantages :

- Easy to implement and use with less initial cost and maintenance.
- Significantly lowers the risk of accidents.
- Less power consumption.
- Early Prevention as well as live status using a camera.
- Checks for the actual physical condition of the user.

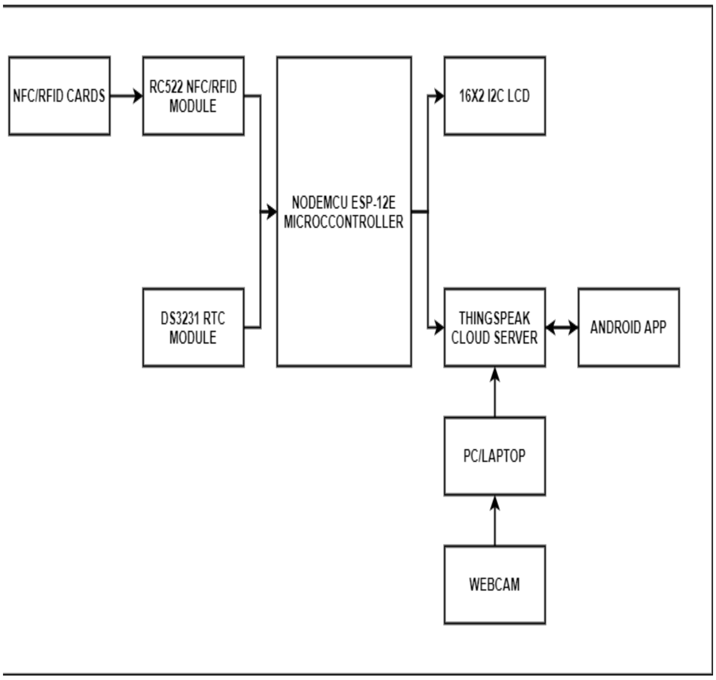

Fig3.4: BlockDiagram

4.IMPLEMENTATION

The system is developed using NodeMCU ESP-12 Microcontroller Board. It is a wi-fi-enabled board and hence provides various additional functionalities as compared to any other board such as Arduino Uno.It supports various interfaces such as I2C, SPI which makes work easier. An RC522 module is used as NFC Reader Writer. It is connected using an SPI interface to the NodeMCU board. A real-time clock RTC DS3231 is used in the system to register timestamps of activities performed. It is connected to the NodeMCU board using the I2C interface. One more device connected to the NodeMCU board using the I2C interface is a 16x2 I2C LCD. It is used to display activities and provide alert notifications to the driver.

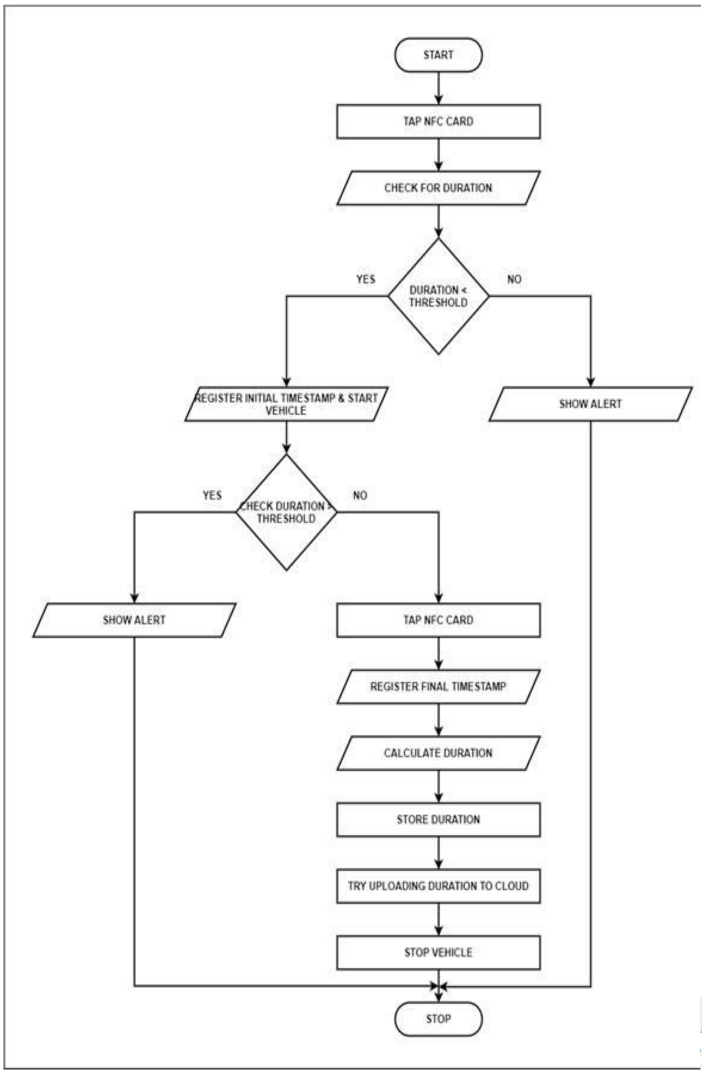

Fig 4.1: Flowchart of Proposed System(1)

When a driver enters a vehicle and taps the NFC Card the device checks for any previously available duration.If the duration is available it is compared with a threshold. If it is greater than a threshold then the driver isn't allowed to drive the vehicle and an alert notification is displayed. If the duration is less than a threshold then the initial timestamp is registered and the vehicle starts.

The device continuously monitors for duration surpassing the daily threshold value. If anytime it surpasses the daily threshold value an alert is passed to the driver to stop the vehicle. The driver can stop the vehicle by tapping the NFC Card for the second time. This registers the final time stamp and then duration is calculated and added to the previous duration to find the total duration. This duration is then stored in cloud storage. Then the vehicle stops. The profile of the driver can be viewed by the owner with daily duration using the Android App developed for this system. During the complete process, a camera-based system constantly monitors for the driver getting drowsy during driving using OpenCV. The status and alert for the same are updated over the cloud, in the app, and on LCD Display.

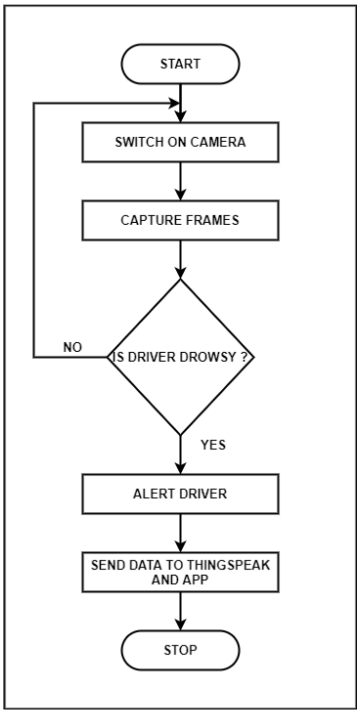

Fig 4.2: Flowchart of Proposed System(2)

5. RESULTS

Given below are the screenshots of the implementation of the proposed system described in the paper.

A	B	C	D	E	F	G	H	I	J
ated_at	entry_id	field1	field2	field3	field4	field5	field6	field7	field8
21-04-03 08:02:26 IST	1	6	0	12	1	9	0	8	1
21-04-04 08:02:26 IST	2	8	0	10	1	6	0	8	0
21-04-05 08:02:26 IST	3	0	0	6	0	6	0	9	0

Fig 5.1: DATABASE

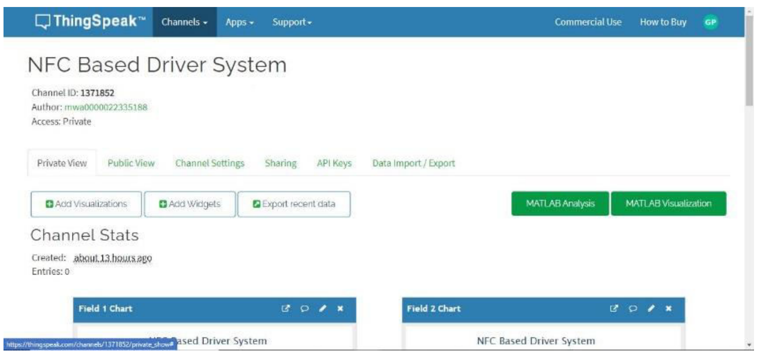

Fig 5.2: ThingSpeak Channel Status

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 05 | May - 2021 ISSN: 2582-3930

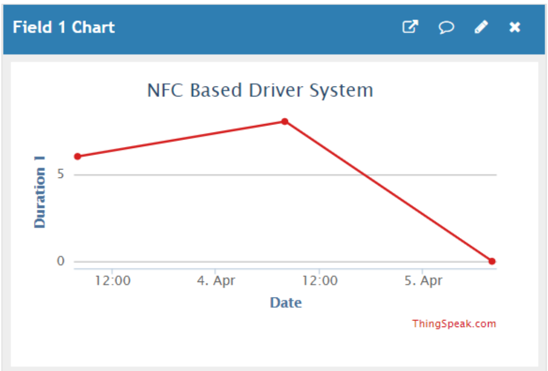

Fig 5.3: Graph of Duration 1 (Field 1)

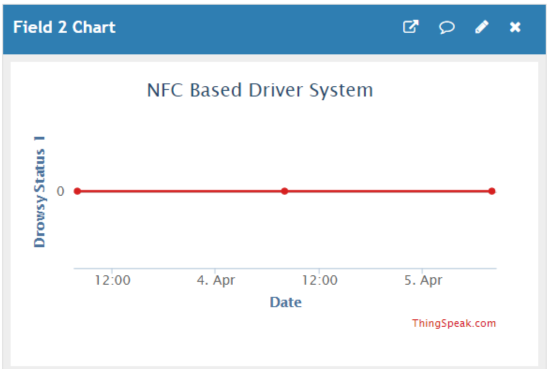

Fig 5.4: Graph of Drowsy Status 1(Field 2)

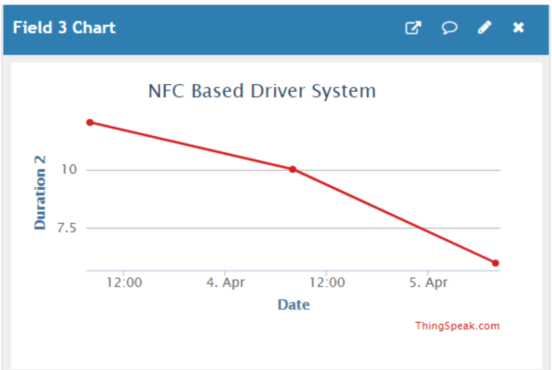

Fig 5.5: Graph of Duration 2(Field 3)

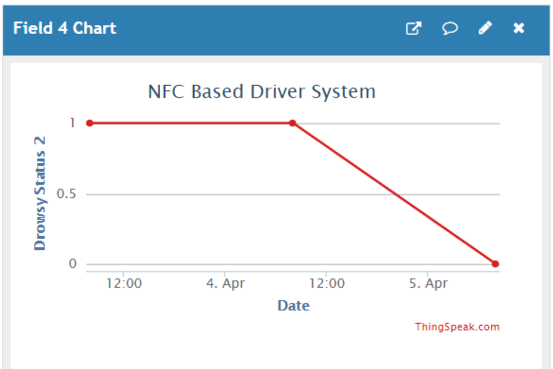

Fig 5.6: Graph of Drowsy Status 2(Field 4)

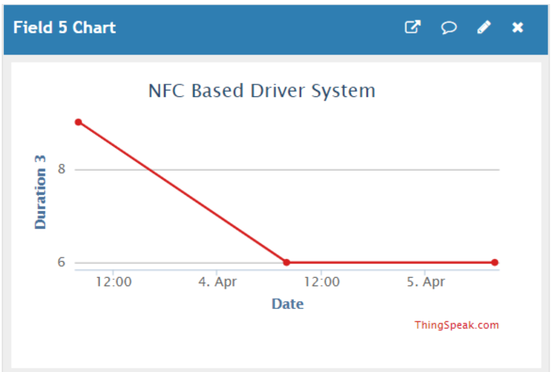

Fig 5.7: Graph of Duration 3(Field 5)

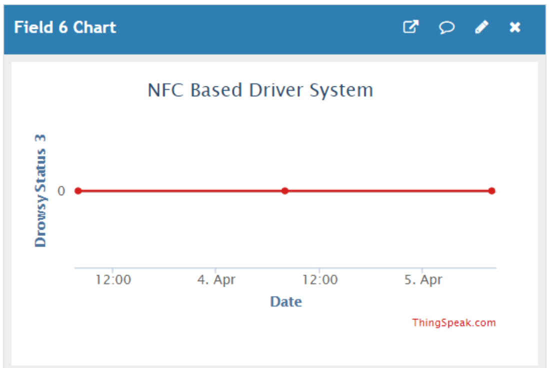

Fig 5.8: Graph of Drowsy Status 3(Field 6)

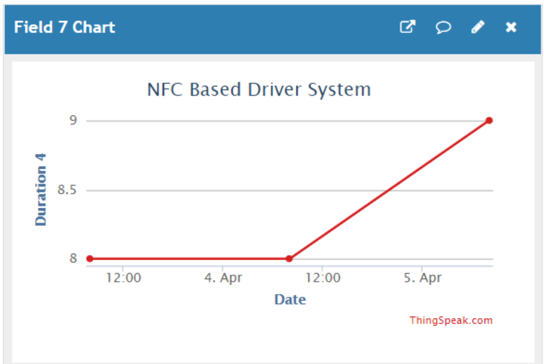

Fig 5.9: Graph of Duration 4(Field 7)

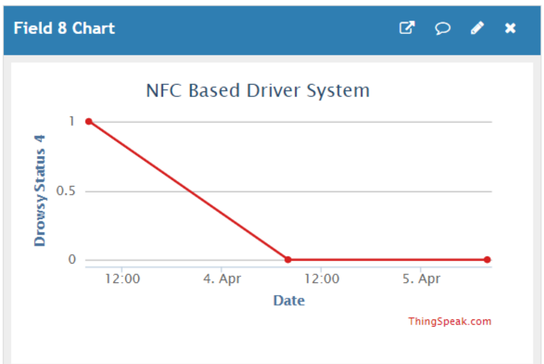

Fig 5.10: Graph of Drowsy Status 4 (Field 8)

APP SCREENSHOTS

Given below are the screenshots of the Application (NFC Based Driver System)

Fig 5.11: Screen 1 of App

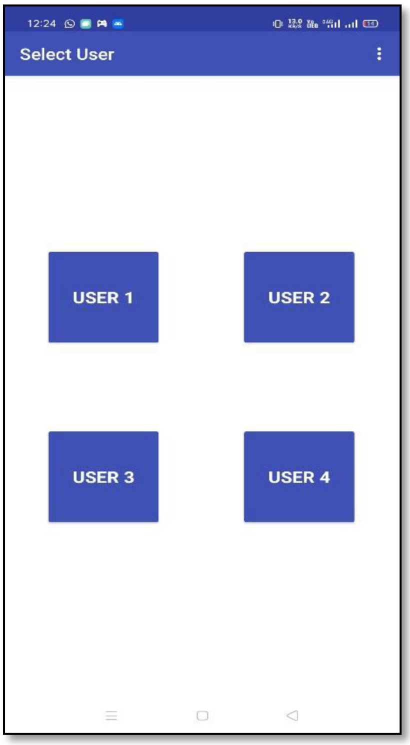

Fig 5.12: Screen 2 of App
Shows All Users

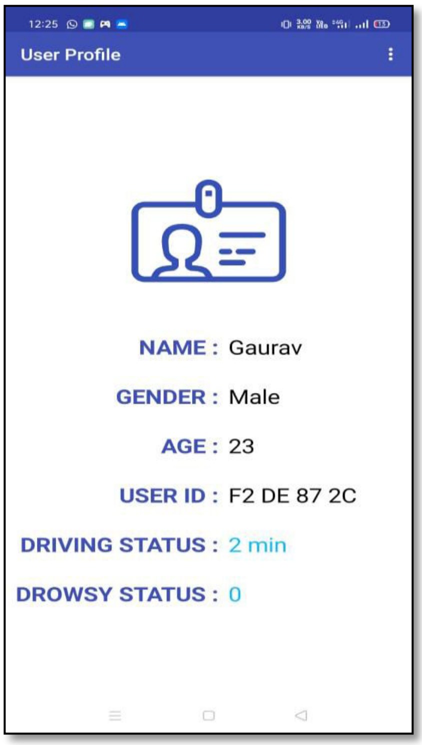

Fig 5.13: Screen 3 of App
Shows Users Information and Status

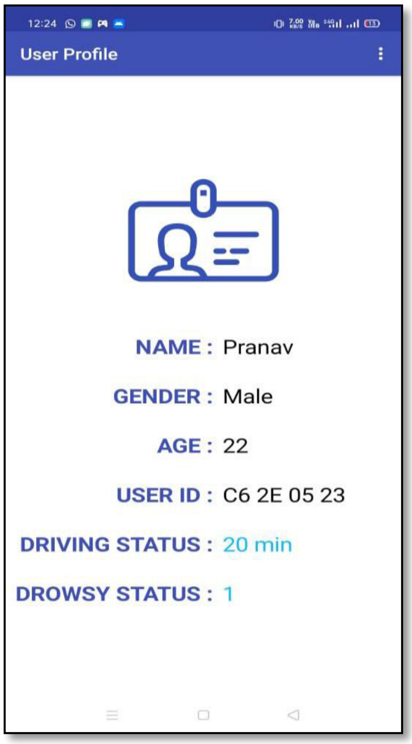

Fig 5.14: Screen 4 of App
Shows Users Information and Status

Fig 5.15: Screen 5 of App
Shows Users Information and Status

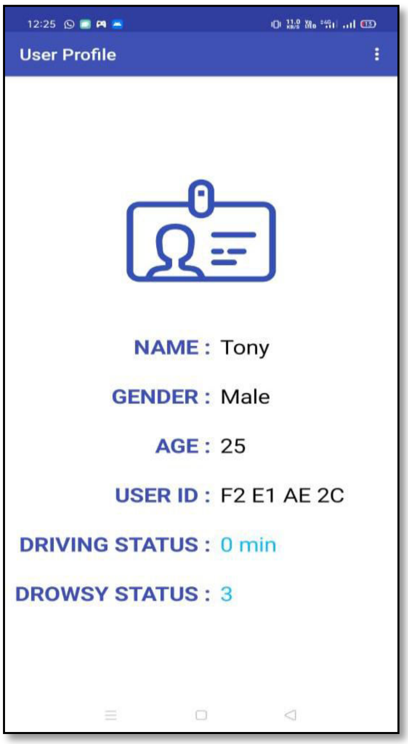

Fig 5.16: Screen 6 of App
Shows Users Information and Status

6. CONCLUSIONS

As the system requirement and therefore the required components can be easily made available this project can be implemented easily. It will provide safety to drivers and change the way of their driving as well as the system. It has been presented the original design of the NFC Based Driver System with an extremely reduced cost. It is a reliable system with quick and easy installation. The system might be easily extended. It will improve system scalability and reduce accidents due to fatigue and drowsiness.

ACKNOWLEDGEMENT

We would really like to express our special thanks and gratitude to Prof. Nikita Patil. She was a constant force of help and guided us accurately and efficiently through all the problems that we faced during our research work. We would also like to extend our gratitude towards our Principal, Dr. S. P. Kallurkar, and HOD of Computer Department, Prof. Suvarna Pansambal for their beneficial guidance and all the project coordinators, for their perseverance without which completing this research project would be very difficult.

REFERENCES

[1] Y Saito, M Itoh, and T Inagaki, Driver Assistance System With a Dual Control Scheme: Effectiveness of Identifying Driver Drowsiness and Preventing Lane Departure Accidents, in IEEE Transactions on human-machine systems, vol. 46, no. 5, page no 660-672, 2016.

[2] KT Chui, K F Tsang, H R Chi, B W K Ling, and C Kit Wu, An Accurate ECG-Based Transportation Safety Drowsiness Detection Scheme, in IEEE Transactions on industrial informatics, vol. 12, no. 4, page no 1438-1443, 2016.

[3] S Arimitsu, K Sasaki, H Hosaka, M Itoh, K Ishida, and Akiko Ito, Seat Belt Vibration as a Stimulating Device for Awakening Drivers, in IEEE/ASME Transactions on mechatronics vol. 12, issue 5, page no 511- 519,2007.

[4] C Lin, Fellow, Y Chen, T Huang, T Chiu, Li-Wei Ko, in Sheng-Fu Liang, H Hsieh, S Hsu, and Jeng-Ren Duann, development of a wireless brain-computer interface with embedded multitask scheduling and its application on real-time drivers drowsiness detection and warning in IEEE Transactions on biomedical engineering vol. 55, issue 5,page no 1582-1592, 2008.

[5] C Lin, Fellow, C Chang, B Lin, S Hung, C Chao, and I Wang, A RealTime Wireless BrainComputer Interface System for Drowsiness Detection in IEEE Transactions on biomedical circuits and systems, vol. 4, no. 4,page no 214-221, 2010

[6] K Murata, E Fujita, S Kojima, S Maeda, Y Ogura, T Kamei, T Tsuji, S Kaneko, M Yoshizumi, and N Suzuki noninvasive biological sensor system for detection of drunk

driving in IEEE Transactions on information technology in biomedicine 15, no. 1, page no 19-25, 2011.

[7] A Picot, S Charbonnier, and A Caplier, On-Line Detection of Drowsiness Using Brain and Visual Information, in IEEE Transactions on Systems, Man, and cybernetics part a: systems and humans vol. 42, no. 3, page no 764-775, 2012.

[8] Boon-Giin Lee and Wan-Young Chung, A Smartphone-Based Driver Safety Monitoring System Using Data Fusion in Sensors 2012, 12, 17536-17552; doi:10.3390/s121217536

[9] R OyiniMbouna, Seong G. Kong, and M Chun, Visual Analysis of Eye State and Head Pose for Driver Alertness Monitoring, in IEEE Transactions on intelligent transportation systems, vol. 14, no. 3, page no 1462-1469, 2013.

[10] I Takahashi, T Takaishi, and K Yokoyama Overcoming Drowsiness by Inducing Cardiorespiratory Phase Synchronization, in IEEE Transactions on intelligent transportation systems vol. 15, no. 3, page no 982-991, 2014.

[11] J. Pilataxi, W. Vian and D. Chavez, Design and Implementation of a Driving Assistance System during a Car-like Robot When Fatigue within the User is Detected, in IEEE Latin America transactions vol. 14, no. 2, page no 457-463, 2016.

[12] D Qian, B Wang, X Qing, T Zhang, Y Zhang, X Wang, and M Nakamura, Drowsiness Detection by Bayesian-Copula Discriminant Classifier Based on EEG Signals During Daytime Short Nap in IEEE Transactions on biomedical engineering vol. 64, no. 4, page no 743-754, 2017.

[13] CemBila, FikretSivrikaya, M A. Khan and Sahin Albayrak, Vehicles of the Future: A Survey of Research on Safety Issues, in IEEE Transactions on intelligent transportation systems vol. 18, no. 5, page no 1046-1065, 2017.

[14] Driver Drowsiness Detection System Based on Visual Features Fouzia, Roopalakshmi R, Jayantkumar A Rathod, Ashwitha S Shetty, Supriya k Alva's Institute of Engineering And Technology, Shobhavana Campus, Mijar, Moodbidri.

[15] Anilkumar, Jameer, Balaji, Jyoshna, Nandhini, Vehicle Driver drowsiness detection system using Raspberry pi in Journal of Emerging Technologies and Innovative Research (JETIR) Volume 6, Issue 3, March 2019.