Analysis of Yawning Behavior in IoT based of Drowsy Drivers

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Abstract - Driver fatigue is one of the main causes of road accidents. It is essential to develop a reliable driver drowsiness detection system which can alert drivers without disturbing them and is robust to environmental changes. In this project yawning behavior as a sign of drowsiness in spontaneous expressions of drowsy drivers in simulated driving scenarios. We analyze a labeled dataset of videos of sleep-deprived versus alert drivers and demonstrate the correlation between hand-over-face touches, face occlusions and yawning. We propose that face touches can be used as a novel cue in automated drowsiness detection alongside yawning and eye behavior. Moreover, we present an automatic approach to detect yawning based on extracting geometric and appearance features of both mouth and eye regions. Our approach successfully detects both hand-covered and uncovered yawns with an accuracy of 95%. Ultimately, our goal is to use these results in designing a hybrid drowsiness-detection system.

*Key Words***:** IoT, Keyword, Database, Security, Network, Cloud, AI

1. INTRODUCTION

This paper presents a car door safety system which has two major features: 1) sense objects when car door is opened with audio and visible light warning, 2) transmit alert by low power wireless communication which a technology based on IEEE 802.11ah named Sigfox has been chosen when the crash detected. The car door safety system which this paper presented is based on popular microcontrollers and sensors, it is easy to build, integrate and low cost. Unmanned Aerial Vehicles are becoming more and more popular to meet the demands of increased population and agriculture. Drones equipped with appropriate cameras, sensors and integrating modules will help in achieving easy, efficient, precision agriculture. The proposed solutions related to these drones, if integrated with various Machine Learning and Internet of Things concepts, can help in increasing the scope of further improvement. In this paper, the related work in this field has been highlighted along with proposed solutions that can be integrated into the drone using Raspberry Pi 3 B module.

2. LITERATURE SURVEY:

Yawning is an involuntary behavior that is symbolized by wide open mouths. There have been several attempts to detect yawning, most of which focus on the measure of mouth opening. For example, Qiang Ji et al. [2] detected yawning using the openness of the mouth represented by the ratio of mouth height to width. Similarly, Tie sheng Wang et al. also used this method to define mouth openness, and detected yawning if the ratio is above 0.5 in more than 20 frames in videos with a frame rate of 30 frames per second. Shabnam Abtani et al. [1] detected yawning by first detecting the yawn component in the face independent of the mouth location, and then using mouth location to verify the validity of the detected component. Wang et al. [3] extracted the mouth region of interest using color analysis, then segmented skin and lip pixels, and got lip features by connected component analysis. Then they took the mouth region geometric features to make up an eigenvector as the input of a backpropagation neural network, acquiring the output of three mouth states: normal, yawning, or talking. Lu et al. [3] located the driver's face region using the difference between two images, and then located the midpoint of the nostrils using a directional integral projection method. The yawn is then detected by calculating the vertical distance between the midpoint of nostril and the chin. However, these algorithms use geometric features only, which make them difficult to differentiate between normal mouth opening (e.g. speaking, smiling, coughing) and yawning. There are also some other disadvantages in geometric-based methods. First, they are highly dependent on the geometry of drivers' faces, making them sensitive to different face poses and their results are very much dependent on their individual implementations. Second, mouth geometric features can be inaccurate in some cases due to different head orientations, illumination conditions, existence of a beard or mustache, or acute lip movement. Third, most of these methods are not able to detect hand-covered yawning since the hand covers most of the mouth corners.

There is also some work in which other specific features are extracted to train machine learning algorithms. Saradadevi et al. [1] used a cascade of classifiers to detect the mouth, then trained on yawning images using an support vector machine (SVM). Fan et al. [2] proposed a method using a Gravity-Center template to detect the face, and then used Gabor wavelets of mouth corners and Linear Discriminant Analysis to detect yawning. Azim et al. [3] presented a system in which the yawning detection method used Viola-Jones face detection to locate the face, extracted the mouth window, and then searched for the lips through Figure 1. Sample images of yawns from our spontaneous video dataset. spatial fuzzy c-means clustering. Ibrahim et al. [4] proposed a method to detect yawning based on mouth opening, mouth covering and

facial feature distortions. Then classification of local binary patterns (LBP) features extracted from the mouth when covered by a hand is used for mouth-covered detection. However, these previously-mentioned algorithms using appearance-based features have complex algorithms and classifiers, making them unrealistic to implement with a camera system inside the car with low processing power, and require training on datasets with large samples.

3. ALGORITHM:

Data Algorithm : Manual Algorithm (IoT)

Manual algorithm is an algorithm for finding the relation between data sets in a real-time environment, which may represent, for example, temperature display.

Algorithm Steps:

• Read data from sensor and detectors module.

• Store data on database.

• Sync system with database and real time entity's.

• Represent data as per user sort.

• Perform alarm and alert system.

• Apply the same algorithm again until user req.
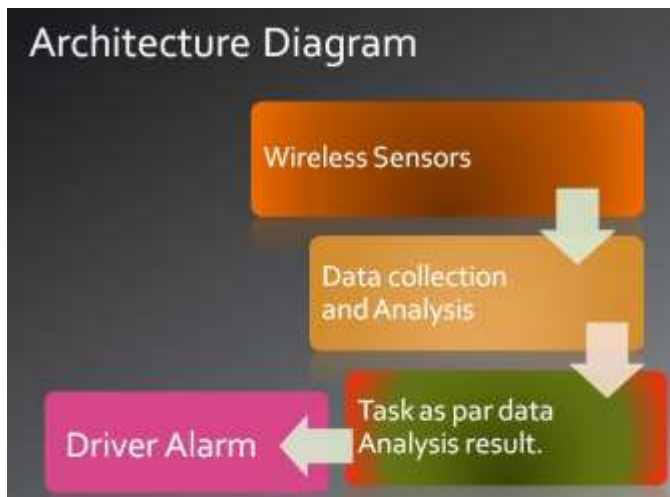
4. SYSTEM ARCHITECTURE:

Fig -1: **System Architecture**

System Design In order to enhance the accuracy rate of detection to the fatigue state of the pilot, this system extracts four state variables from the eye condition: It contains the frequency of blink, the average degree of opening eyes, the eye stagnation time and the longest time of closing eyes. According to the parameter value of the pilot's sober condition by statistics, it can make the corresponding judgment by the fatigue state of the pilot.

Considered the changing driving environment, the detection system must work normally in the night or the situation of inadequate lighting, therefore, this system adopts the camera with light source(automatic opening when the light is inadequate) to gather sequence image, in order to reduce the disturbance from the external environment. When the system reads in the frame image, it carries on the denoising and the image intensification process to the image first, and then obtains two real eye points. Afterward, it adopts the target tracking method to track the already targeted eye point [18]. At last, it can calculate the area of the eyes and make the judgment and the early warning to the fatigue state of the pilot.

5. SOFTWARE AND HARDWARE:

- Hardware
  - Intel i5 processor
  - 4 GB ram
  - 500 GB HDD
  - Sensors
  - Micro Controllers
- Software
  - JDK 8
  - Netbeans
  - MSSQL Server 2008 R2
  - Arduino IDE

6. CONCLUSION

We introduced a new method for real time driver yawning detection and proved that yawning is an important cue that should not be neglected in drowsiness detection systems. Moreover, we analyzed the presence of face touches in drowsy versus alert videos of natural drivers expressions and proposed the use of face touches as a novel indicator of the drowsiness state. We also presented a method for automatic detection of spontaneous yawns based on fusing geometric and appearance features extracted from both the mouth and eye regions. Our approach invariant to different lighting conditions, skin color, and individual facial appearance differences. The proposed algorithm is also computationally simple and efficient.

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