

# Driver Fatigue Detection System and the Status Transmission

Pooja Shende<sup>1</sup>, Dr. S. W. Warade<sup>2</sup>, A. R. Kondelwar<sup>3</sup>

Department of Electronics and Telecom, Priyadarshini College of Engineering, Nagpur, Maharashtra, India<sup>1</sup>

Head of Department, Department of Electronics & Telecom, Priyadarshini College of Engineering, Nagpur,  
Maharashtra, India<sup>2</sup>

Assistant Professor, Department of Electronics and Telecom, Priyadarshini College of Engineering, Nagpur,  
Maharashtra, India<sup>3</sup>

**ABSTRACT:** This paper describes the methods of detecting the early signs of fatigue/drowsiness while driving. By identifying and analyzing the various parameters and variables, the detection the loss of alertness prior to driver falling asleep is possible. From the response of this technique one can detect that the Loco-Pilot is able to drive or not. And the status can be transferred online to the base station to take the safety measures in case of emergency. A hardware system has been developed to acquire variables, as well as an algorithm to detect fatigue via image processing taking into account the other aspects. Mainly this project presents hardware cum software technique for fatigue detection in train driver and transmitting the status via GSM.

**KEYWORDS:** Fatigue detection, SVM, GSM, MEMS, PIR sensor, Drowsiness

## I. INTRODUCTION

In spite of the excellent safety record of Indian Railways as a means of transportation, there have been instances when pilots have allowed the train to cross a point since the pilot is not able to take the note of the signals. According to a survey and statistics, 30% of the accidents are due to the sleepy state. Many of these incidents have resulted in collisions, some involving loss of life, involving damage to equipment or property. Majority incidents are the result of a driver due to falling asleep or might be died etc. Since 19th century, many methods have been developed to detect fatigue/drowsiness in train drivers ever since they began and methods were introduced to try to prevent them. With earlier systems having both the warning and train stop systems. In earlier approach, a warning system i.e. an alarm is used for providing the awaking mode for Loco Pilot. Alarm sounds in the driver's cabin whenever a train is nearby some caution or stop signal. If the driver is not able to acknowledge the alarm because of some sleepy scenario or dead, the train brakes are applied automatically.

Taking in account all these methods, a hardware system is designed for detecting the real time status of the loco pilot which will capture the fatigue, motion and heartbeat rate of the loco pilot providing alertness to the driver. By adopting these features developed system is manufactured by intelligently integrating software and hardware used for detecting the current state of the train diver. System captures the status via sensors in hardware and via image processing in software and status is transmitted to the base station to take the appropriate action. At the same time, alarm is buzzed to alert the pilot controls the speed of train as per the status. Over all it's a smart technology with optimized integration of hardware and image processing to avoid accidents.

## II. RELATED WORK

Many methods have been developed to detect fatigue in train drivers ever since they began and methods were introduced to try to prevent them. Earlier systems have both the warning and train stop systems. In past, a warning system i.e. an alarm is used for providing the awaking mode for Loco Pilot for avoiding accidents. Alarm sounds in the

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driver's cabin whenever a train is nearby some caution or stop signal. If the driver is not able to acknowledge the alarm because of some sleepy condition, the train brakes are applied automatically. The system is called AWS (Automatic Warning System). However, this AWS system was not efficient in detecting the drowsiness due to which railway has to face many problems. Therefore, we have designed a hardware system along with the software which uses the image processing to send the status of driver to the base station.

### III. SCOPE OF RESEARCH

With great development in the railway system and the continuous input of new technologies to the railway transportation safety, the work timings of the pilots are not flexible. Moreover, the non-reasonable timetable and work environment of the train drivers will easily cause them out of order, doze off, and fatigue driving. Due to all these factors, fatigue driving is becoming a big issue. Aim of the system is to measure precisely the development and progression of driver fatigue and loss of alertness, and to provide counter measures to address it, through a field study undertaken within the framework of a realistic driving environment. Thus, the guarantee and supervision of the system has to be ensured and so the status is also transferred via GSM module to the authorized person at the base station. The project intends to develop the train drivers 'fatigue detection and recognition system with speed control and status transmission.

Detection is based on PIR and MEMS sensors used in the hardware. Both the sensors together detects whether the pilot is awake, sleepy/dead, and drowsy and controls the speed of train for safety purpose.

### IV. PROPOSED METHODOLOGY

The system consists of a microcontroller ATmega16 which drives the entire circuit and takes the appropriate action. Both the sensors are connected to MIC which uses ADXL335 to measure acceleration with a minimum full-scale range of  $\pm 3$  g. It can measure the static acceleration of gravity in tilt sensing applications and also senses dynamic acceleration resulting from motion, shock, or vibration. PIR sensor and MEMS is used to detect the fatigue/drowsiness. PIR (Passive Infrared sensor) senses the changes in the motion occurring in front of it depending on the radiation emitted by the body. And MEMS (Micro-electromechanical sensors) is a smart device which senses the neck fall when it stays there for some time. Microcontroller reads its analog value to detect the status of driver. A LCD with 16 x 2 alphanumeric dot matrix display is used to display the status. Main objective is the speed control of train in case of emergency which is achieved by 4 modes

Case1- When PIR senses motion, MEMS senses no sudden head fall

1. Pilot is awake, no emergency
2. Train continues to move in normal speed
3. No SMS is sent

Case2- When PIR senses no motion, MEMS senses sudden head fall

1. Pilot is drowsy
2. Train stops
3. Alarm is sounded to alert the Loco-Pilot

Case3- When PIR senses motion, MEMS senses sudden head fall

1. Pilot is drowsy
2. Train's speed is reduced to half as compared to normal speed
3. Alarm is sounded to alert the Loco-Pilot

Case4- When PIR senses no motion, MEMS senses no sudden head fall

1. Train speed is stopped
2. Alarm is sounded to alert the Loco-Pilot, and an SMS is sent to the base station

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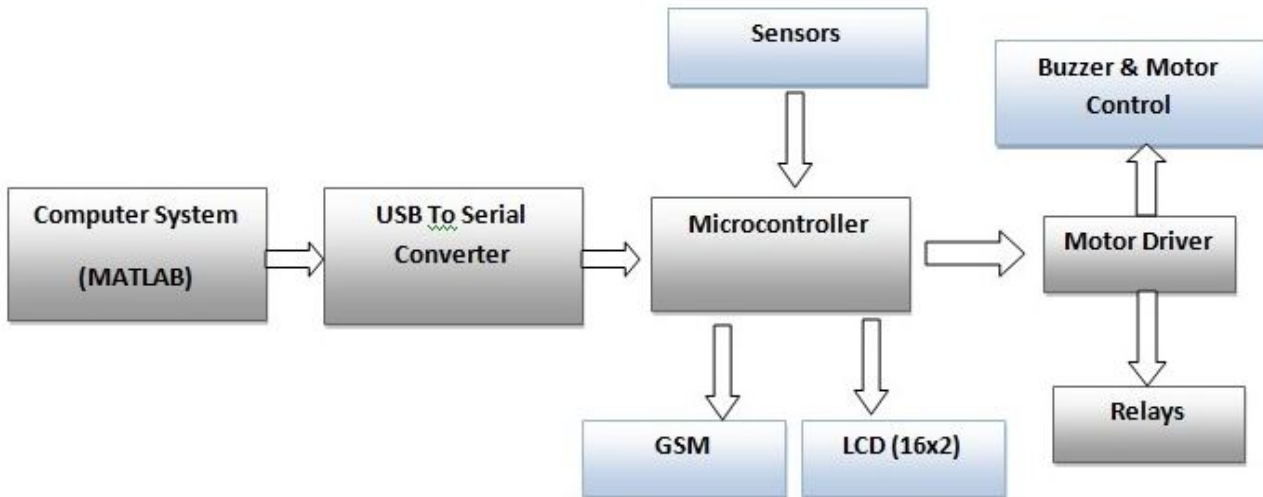


Fig.1 Block diagram of proposed system

Software implementation of the proposed system is represented in fig. 2. As shown in flow chart, as soon as the device is started, the sensor starts detecting the movement and gives the appropriate output. If there is no motion and the driver is found sleepy or dead, the train is stopped automatically and message is sent to the base station. If any motion is detected without any fatigue the sensor again starts detecting the movements. If any motion is detected along with the fatigue, the alarm starts buzzing and the speed of the train is slowed down. These comparisons are also made through image processing.

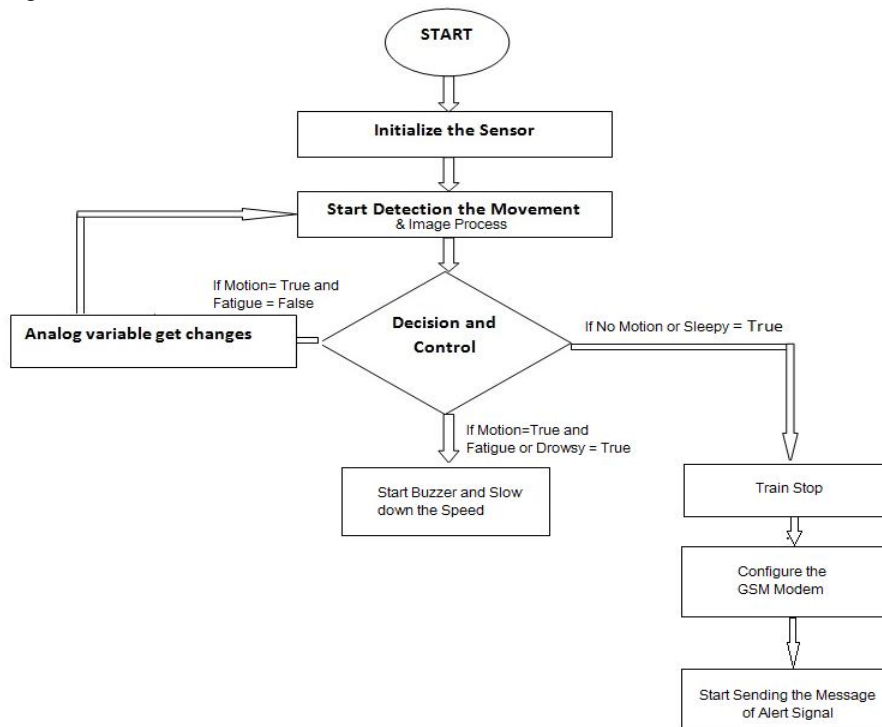


Fig.2 Flow chart of proposed system

## V. EXPERIMENTAL RESULTS

Following are the results of MatLab through SVM technique. Base image frame is the image in awake state and it is then compared with the other images in the database to give the appropriate result. Result is declared on the basis of white counter i.e. the whiteness between the visual features. Depending on the white counter value, the status of the pilot is judged.

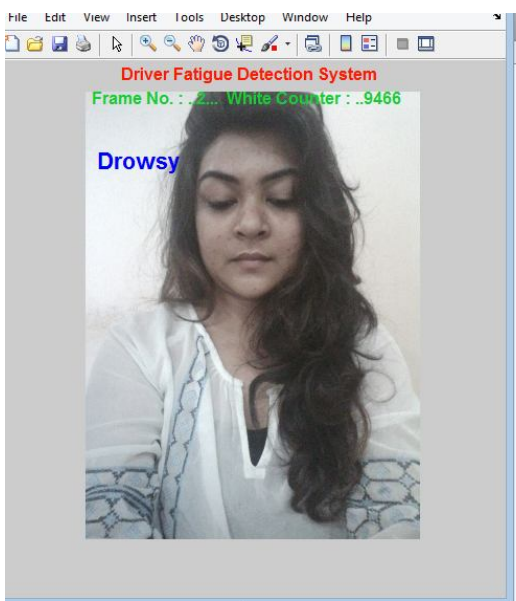


Fig.3 Drowsy

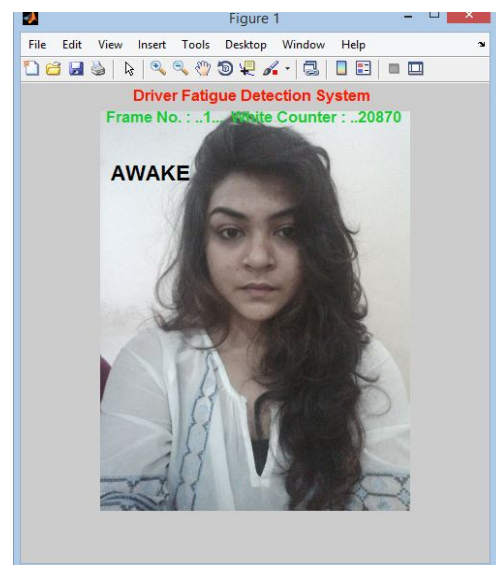


Fig.4 Awake

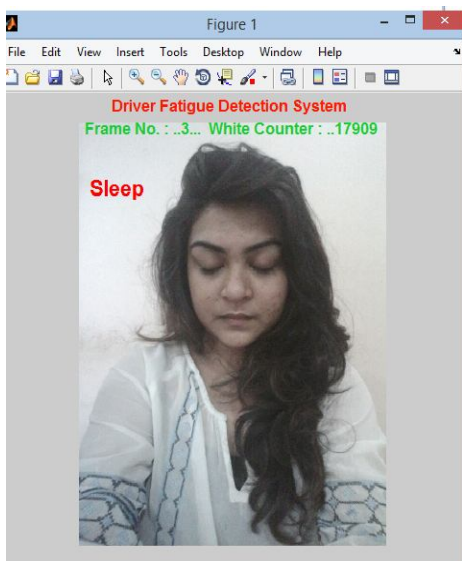


Fig.5 Sleepy

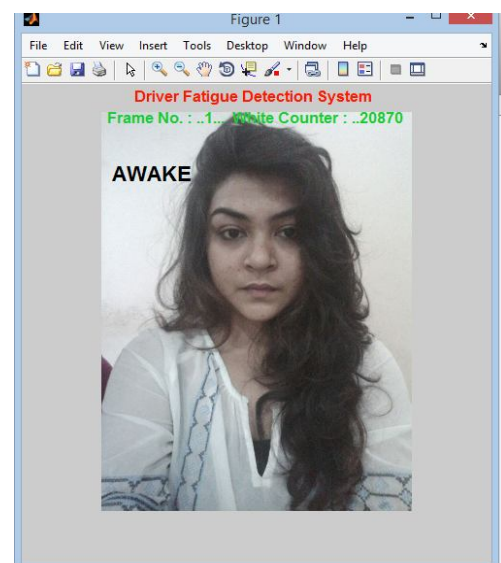
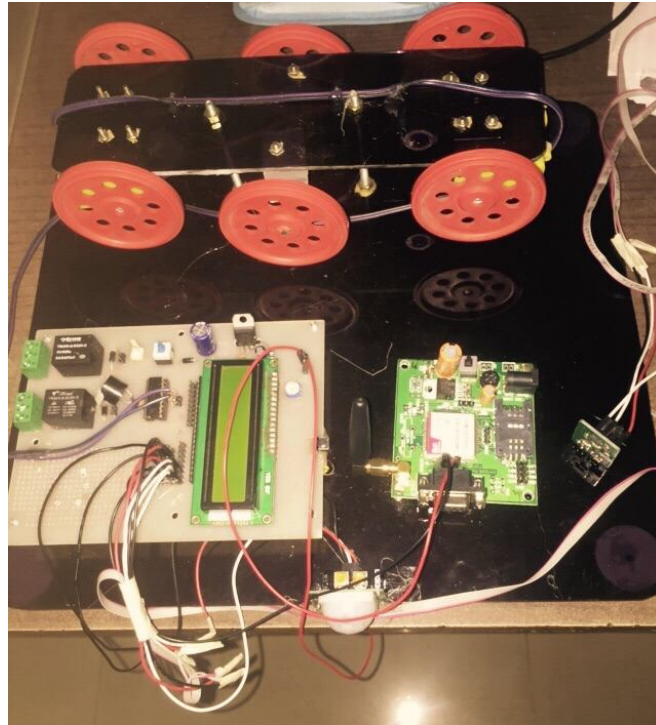


Fig.6 Awake

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We have implemented a hardware system along with the software which uses the image processing for fatigue detection. This system will help in determining the status of the loco pilot to avoid accidents in railway.

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