# Appendix A: GRADUATE CERTIFICATE – Pattern Recognition Systems (PRS) Project Proposal

|  |
| --- |
| **Date of proposal:** 03 October 2020 |
| **Project Title: Driver Drowsiness Detection (D3S) System** |
| **Sponsor/Client:** *(Name, Address, Telephone No. and Contact Name)*  **Academic Self Sponsored Project** |
| **Background/Aims/Objectives:**  Sleepiness can impair driving performance as much or more so than alcohol, studies show. (Dawson and Reid, 1997; Powell, 2001).  The American Automobile Association (AAA) estimates that one out of every six (16.5%) deadly traffic accidents, and one out of eight (12.5%) crashes requiring hospitalization of car drivers or passengers is due to drowsy driving. (AAA, 2010)  One analysis estimated the cost of automobile accidents attributed to sleepiness to be between $29.2 to $37.9 billion. (Leger, 1994)  (41%) admitted to having fallen asleep at the wheel at some point.; one in ten drivers (10%) reporting they did so within the past year. (AAA, 2010)  More than one-quarter of drivers (27%) admitting they had driven while they were “so sleepy that [they] had a hard time keeping [their] eyes open” within the past month (AAA, 2010)  Researchers estimate that more than 70 million Americans suffer from a sleep disorder. (Institute of Medicine, 2005) One of the most serious consequences of insufficient sleep is traffic accidents due to drowsy driving.  Experts suspect that even these disturbingly high figures underestimate the number of accidents or near-miss accidents due to drowsy driving because of drivers being unaware or not admitting they were drowsy at the time of the accident, or police not acquiring that information.  In spite of education to create awareness among driving community, policy initiatives by the Government to reduce the accidents numbers show no promising decline. In recent years, many of the luxury car companies have already moved in this direction but majority of the solutions are relatively employing complex sensors and devices which are costly and so is the need for simple, effective relatively low-cost solutions that can be used by everyone.  Drowsy driving is a prevalent and serious public health issue that requires a simple low cost, fool proof continuous monitoring system that can be used by everyone. |
| **Requirements Overview:**  There are several types of solutions   * Steering pattern monitoring * Vehicle position in lane monitoring * Physiological measurement * Driver face/eye monitoring   Steering pattern monitoring – It primarily uses steering input from electric power steering system. Learns driving behavior through steering input and compares it with the later rides. The system is based on the fact that the number of micro-corrections on the steering are lower than the one found in normal driving conditions[1, 2]. Any difference beyond threshold activates audio visual cues to draw attention. Monitoring this way only works when the driver actually steers the vehicle actively and does not activate automatic lane keeping system. The system can function reliably only at particular environments and is too dependent on the geometric characteristics of the road and, to a lesser extent, on the kinetic characteristics of the vehicle.  Vehicle position in lane monitoring – This method is based on the externally mounted camera(s) and associated software, which monitors the vehicle position relative to the lane. It depends on external factors such as road marking, weather, and light conditions.  Physiological measurement – Employs body sensors to measure parameters like brain activity, heart rate, skin conductance, muscle activity.  All the above types of models are relatively expensive.  Driver face/eye monitoring – This technique is simple and low-cost model relatively compared to other models and can be used in majority of the vehicles. The only limitation of this model is that the driver should not use dark colored spectacles that obscures the monitoring of eyes.  This technique monitors the state of eyes and if both the eyes are in a closed state for a defined threshold time, alarm is raised to draw attention of the driver. |
| **Resource Requirements (please list Hardware, Software, and any other resources)**  Hardware proposed for consideration: Device (Laptop) with camera  Software proposed for consideration:   * Numpy – Statistical and Scientific Computing * Cv2 – Computer Vision library * Dlib – Predictor and detector library * Imutils – Utility library for object landmarks * Matplotlib – Graphing library |
| **Number of Learner Interns required: (Please specify their tasks if possible)**  A team of three project members required to architect and implement this system. |
| **Methods and Standards:**   |  |  |  | | --- | --- | --- | | **Procedures** | **Objective** | **Key Activities** | |  | | **Requirement Gathering and Analysis** | The team should meet with ISS to scope the details of project and ensure the achievement of business objectives. | 1.        Gather & Analyze Requirements |  | | 2.        Define internal and External Design |  | | 3.        Prioritize & Consolidate Requirements |  | | 4.        Establish Functional Baseline |  | | **Technical Construction** | To develop the source code in accordance to the design. | 1.        Setup Development Environment |  | | To perform unit testing to ensure the quality before the components are integrated as a whole project | 2.        Understand the System Context, Design |  | | 3.        Perform Coding |  | | 4.        Conduct Unit Testing |  | | **Integration Testing and Acceptance testing** | To ensure interface compatibility and confirm that the integrated system hardware and system software meets requirements and is ready for acceptance testing. | 1.        Prepare System Test Specifications |  | | 2.        Prepare for Test Execution |  | | 3.        Conduct System Integration Testing |  | | 4.        Evaluate Testing |  | | 5.        Establish Product Baseline |  | |  |  | | **Acceptance Testing** | To obtain ISS user acceptance that the system meets the requirements. | 1.        Plan for Acceptance Testing |  | | 2.        Conduct Training for Acceptance Testing |  | | 3.        Prepare for Acceptance Test Execution |  | | 4.        ISS Evaluate Testing |  | | 5.        Obtain Customer Acceptance Sign-off |  | |  |  | | **Delivery** | Deploy the system into production (ISS standalone server) environment. | 1.        Software must be packed by following ISS’s standard |  | | 2.        Deployment guideline must be provided in ISS production (ISS standalone server) format |  | | 3.        Production (ISS standalone server) support and troubleshooting process must be defined. |  | |  |  | |

|  |
| --- |
| Team Name: **GROUP 1** |
| Project Title (repeated): **Driver Drowsiness Detection System** |
| System Name (if decided): **D3S** |
|  |
| Team Member 1 Name: MARADANA VIJAYAKRISHNA |
| Team Member 1 Matriculation Number: A0178453W |
| Team Member 1 Contact (Mobile/Email):  Mobile: 93896379  Email: mvskrishna@yahoo.com |
|  |
| Team Member 2 Name: Putrevu Manoj Niyogi |
| Team Member 2 Matriculation Number: A0213557E |
| Team Member 2 Contact (Mobile/Email):  Mobile: 94575890  Email: manojniyogi@yahoo.com |
|  |
| Team Member 3 Name: Sivasankaran Balakrishnan |
| Team Member 3 Matriculation Number: A0065970X |
| Team Member 3 Contact (Mobile/Email):  Mobile: 97379441  Email: bsivaa@gmail.com |

**Team Formation & Registration**

|  |  |  |
| --- | --- | --- |
| **For ISS Use Only** | | |
| **Program Name:** | **Project No:** | **Learner Batch:** |
| **Accepted/Rejected/KIV:** | | |
| **Learners Assigned:** | | |
| **Advisor Assigned:**  Contact: Dr Zhu Fangming / Lecturer & Consultant  Telephone No.: 65-6516 4681  Email: [isszfm@nus.edu.sg](mailto:isszfm@nus.edu.sg) / [fangming@nus.edu.sg](mailto:fangming@nus.edu.sg) | | |