

**AI in Smart City (STEMIP Junior Nurture Program and Winner of Secondary School Group in the AI Robotics Vision and Automation Technology Challenges Competition)  
Driver Drowsiness Detection System**



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(<https://www.youtube.com/watch?v=5zoE5GPGjDU>)



Figure 1 Driver Drowsiness Detection System - the winning team in the secondary school group

To detect drivers’ drowsiness, drivers’ eyes are detected first by Bayesian probability and then the Eye-Aspect-Ratio (EAR) is calculated based on the length and width of the drivers’ eyes by simple arithmetic operation. Transport companies can analyse the drivers’ drowsiness records using simple statistical methods such as calculation of mean, average of drowsiness and presentation of drivers’ drowsiness frequencies. The analysis result can be presented using bar chart. Transport companies can analyse the statistics and schedule the rest time of the drivers to ensure that no driver works in a fatigue status. The experimental results showed that the system is able to detect the driver’s drowsiness with 95% accuracy, even if the driver wears a mask or glasses.

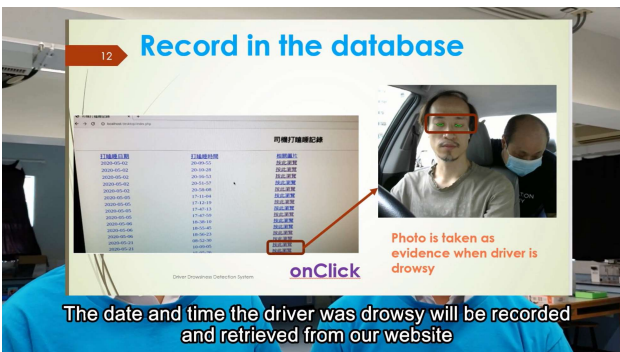


Figure 3 Driver Drowsiness Detection System - the winning team in the secondary school group.

*“It is an amazing piece of work! The system can be used in driving safety monitoring, and some other applications like pilot safety control, security guard monitoring, classroom supervision, patient risks monitoring, etc,”* said Dr Adela Lau, Deputy Director of HKU SAAS Data Science Lab.

Through collaboration with HKU SAAS Data Science Lab in the STEMIP Junior Nurture Program (the competition), the student group from Heung To Secondary School (Tseung Kwan O) invented the Driver Drowsiness Detection System (DDDS) and converted the STEM education into innovation and practice (STEMIP). The DDDS involves STEM knowledge and skills such as Mathematics (probability), Engineering (Microcontroller and electronic appliances), and Technology (Python programming skills). The system integrates a new feature of voice and email system to give immediate alerts to the driver and the transportation company for risk assistance. It can greatly reduce the accident rate caused by driver’s drowsiness.



Figure 2 Driver Drowsiness Detection System - the winning team in the secondary school group

The Bayesian probability, one of the basic AI models that the secondary school students have already learnt, is a simple machine learning tool of the AI family. The detection is based on the calculated posterior probability according to the Bayes’ theorem given by

$$P(D_i|x_i) = \frac{P(D_i) * P(x_i|D_i)}{P(x_i)}$$

where  $P(D_i)$  is the probability of drowsy state,  $P(x_i)$  is the probability of occurrence of characteristic  $x$ ,  $P(x_i|D_i)$  is the probability of occurrence of characteristic  $x_i$  during the drowsy state,  $P(D_i|x_i)$  is the probability of drowsy state when characteristic  $x_i$  occurs. Through this competition, students can reflect their learning and apply the STEM into innovation and practice.

*“You and I can do it! (你和我都能做得到!),”* said Mr Tung Shek WONG (the project mentor & teacher) and Mr Fei TANG (the Principal). 🧠🔄