Department of Electronic and Telecommunication Engineering
University of Moratuwa

Spark Project

Team Phoenix

Group 08 - 19 Batch

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27 June 2022

1 Details of the Team

1.1 Group Name

Team Phoenix - Group 08 - 19 Intake

1.2 Group Leader's Name

Silva G.B.N.M.

1.3 Group members' information

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1.4 Mentors who have mentored your group

- Mr. Gershom Seneviratne
- Mr. Imdaad
- Mr. Dilanka Laknath
- Mr. Johny Jonathan

1.5 Special Supervisors

-None-

2 Problem Description

Our project was aimed to be a solution for the sky rocketing road accidents due to the drowsiness. According to the recent statistics reports we can observe that there is a clear and steap increment in the number of accidents per year. Though the majority of them taken place because of the being drunken, but the drowsiness still responsible for huge portion of it.

2.1 Our primary area of development

As above mentioned our project is lying mainly in the scope of ***Transportation & transport efficiency*** field.

2.2 Other Supporting areas

Though the accidents mainly occur due to factors which are embedded to roads and transportation it has a direct impact on health sector too. So we can identify ***Healthcare improvement*** area as a supporting areas to this development. Main reason is that if we can reduce road accidents we can save the resources which should have gone to those accidents and use them in other medical needs. We can save both man hours and physical goods too.

2.3 The problem statement and primary objective

Sri Lanka is a country which face many hardships since its independence. With the development of the economy, expansion of the vehicle usage were also increased. But due to the mismanagement of the authorities there were no any proper infrastructure to facilitate that high demand. Due to that mismatch the roads were platform for many fatal accidents. We can identify following reasons as the driving factors for the above incidents.

- Over speeding
- Drunken Driving
- Distraction to driver
- Avoiding safety measures
  - Eg :- Seat Belts & Helmets

We can subdivide **Distraction to driver** factor into many other sections among them drowsiness is holding a vital spot. No matter the reason, the probability of being fatal is equal for every of them. But the factors like over speeding, drunken driving and avoiding safety measures can be tolerated by the help of intervention of police officers. In Sri Lanka, traffic police section is doing a quite remarkable job to save citizens from avoidable accidents. The main reason is there are ways to monitor those problems and being able to identify them before anything happen. As an example, using balloon indicator to identify the drunken is a good way to keep drunken drivers away from driving seat. But there is no any way to measure drowsiness. Drowsiness can come to people to different times and different occasions. It is a very unique that we cannot identify in the before hand. So e think that these acts will emphasis the depth of this problem and the necessity of the problem too.

2.4 Impact on the global warming

Though we can't point out apparent advantages to the global warming from this project we can mention some indirect problems. We can save man power and resources that we have utilize if there is an accident.We can save the mainly fuel which may waste to the ambulances and rescuing vehicles. Then we can save the medical equipment wastage. Finally we can help people to live with their loved once until their proper destiny.

3 Solution Description

3.1 Arriving at your solution

3.1.1 Key findings of the research.

During our survey we have spread our focus on many areas. There were many key factors that we could identify through out that process. There are as follows,

- Lack of sleep is the main reason
- There were some people, who are experiencing sleepiness although they had a sufficient sleep.
- People are eager to purchase a solution but the expensiveness is a huge leap for them.
- Though there are solutions which are based on mobile phones the light from those phones are distracting drivers.

3.1.2 External support

We had a good guidance from the all four mentors who were assigned to us in the different period of times.Mr. Gershom and Mr. Imaad helped us during the initial phase. They monitored us so well in the early stages of training process which was less interesting although they were full of value. Those gentlemen pointed out the importance of this kind of training phase and they were worry that they could not be a beneficiaries of this kind of valuable process. Then the Mr. Dilanka Laknath and Mr. Johnny Jonathan also helped us to convert our thoughts into machine learning paradigm. Then there is a team member whose father is a police officer. He also gave many points to this cause and pointed out various unfamiliar points since he observe things from a view of a police officer. Then there was an another person whose mother is nurse. So she also helped us to widen our knowledge about this problem since she is also a person who has different perspective to this problem.

3.1.3 Critical evaluation of alternatives

We approached this problem in many ways by addressing them from various aspects.

- Most simplest way is the educating the people above this problem and force them to not to take any risks.
  - But the issue of this problem was that very traditional and there have been already taken placed. So we can't expect much more thinks about from it.
- Since we are in a world which has a limited supply of resources we decided to use the mobile phone as the main device to this problem. But after going through some feedback from our resource persons came to know that, it isn't going to work very well.
- Try to implement a device which we can install on roads and then to monitor the vehicles from that point of view. Problem was bad weather conditions would drag the results from those devices into a very doubtful situation.

So these are some key alternatives that we have gone through and we think that we could take the right decision.

3.1.4 Our Solution

Our solution is implement a RaspberryPi based device which are getting inputs from an IR camera and an acccelerometer. These inputs will be fed into Machine Learning model and output the results using voice message through a speaker.

3.2 Proof of Concept

As mention above this equipment contains four sections. They are,

- IR Camera
- Acceleromter
- Machine Learning implementation
- Speaker

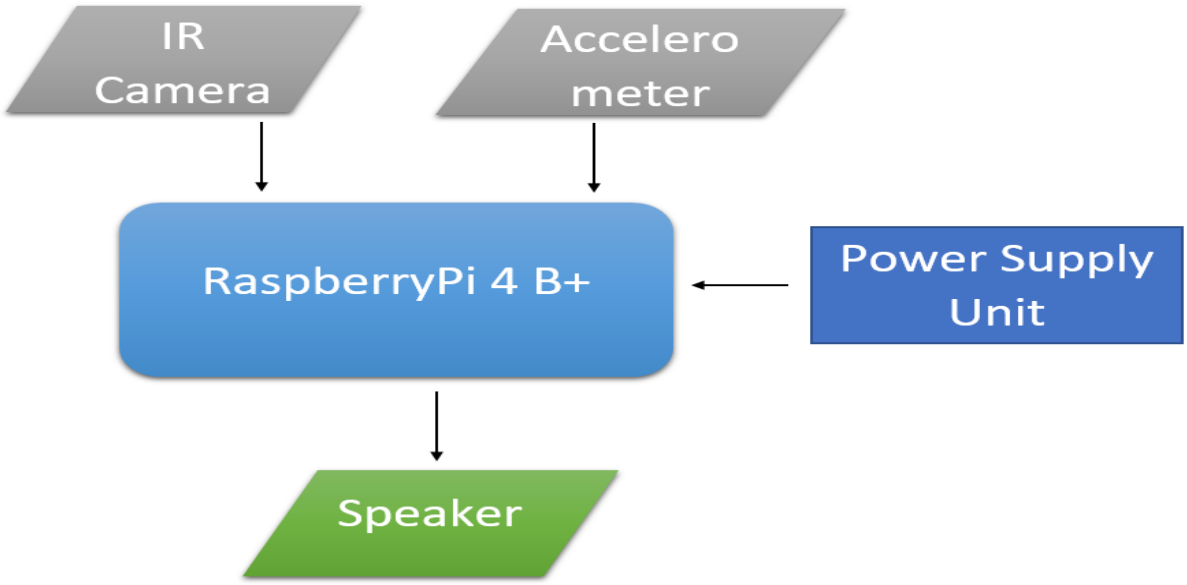

Figure 1: Diagram of the arrangement

3.2.1 Main features of the implementation

IR camera is the main input device to the system. The reason to use an IR camera is we can use it even in the dark light condition. If we had to use a normal camera then we have to use a flasher light to lighten the drivers face. Since that is a main distract to the driver we had to neglect that choice.

Main way to identify the person is sleepy or not is using the situation of the eye. If it closed we can make an warning to the driver to take some rest. If not he is good to go. We were able to train our ML model to even it could identify the status of the eye even the person is wearing a spectacles. These two pictures will give some idea.

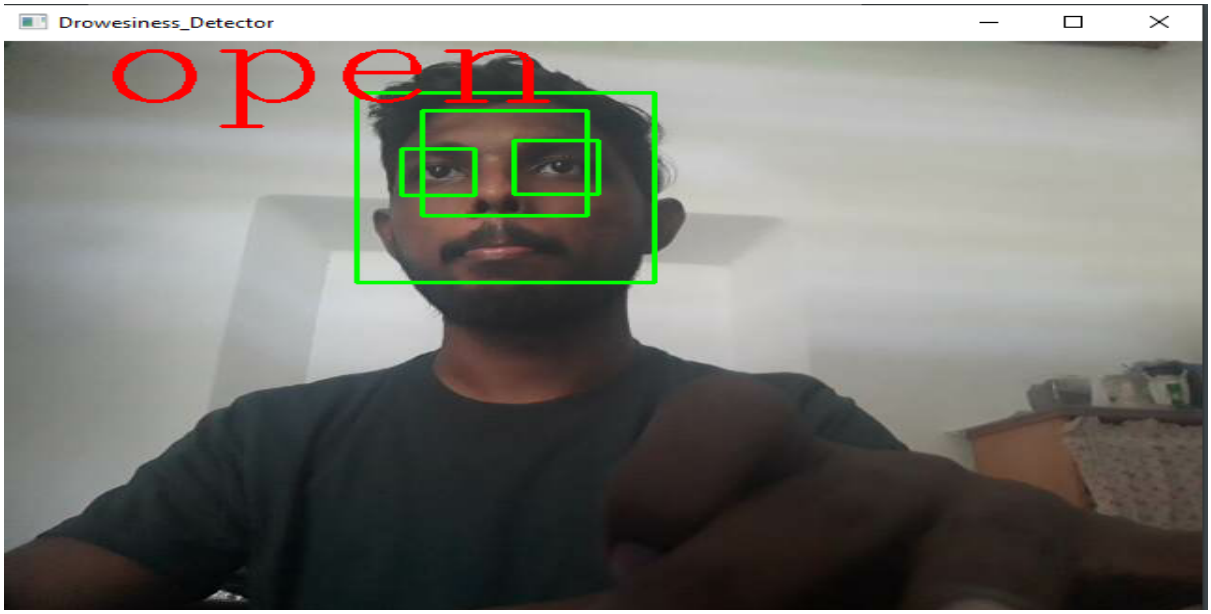

Figure 2: Detecting eyes without spectacles

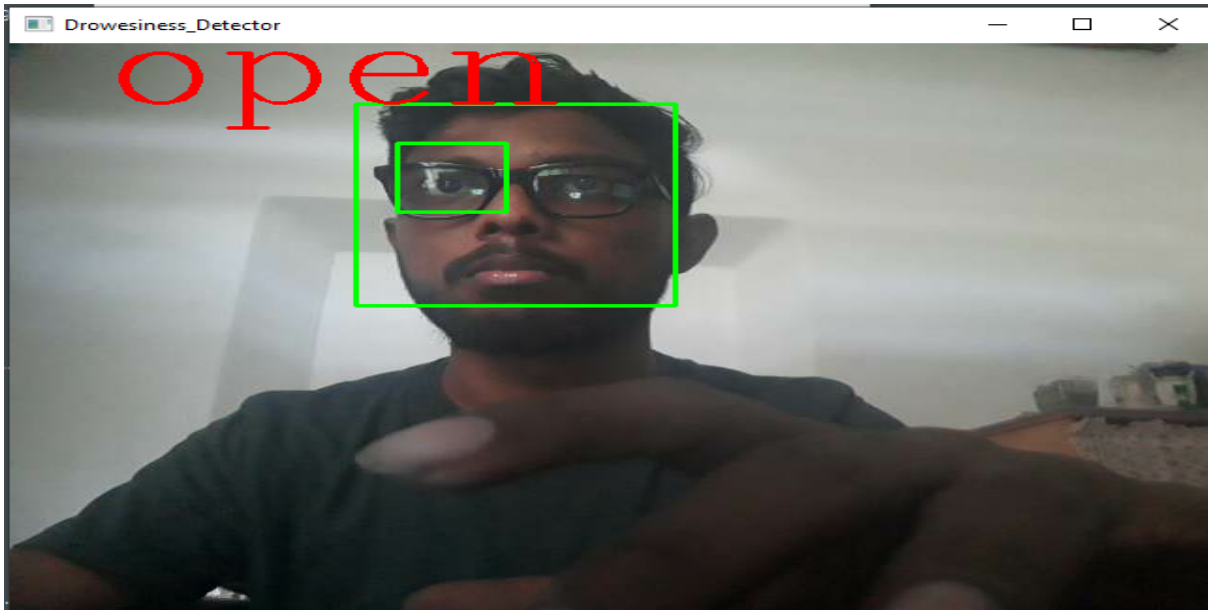

Figure 3: Detecting eyes with spectacles

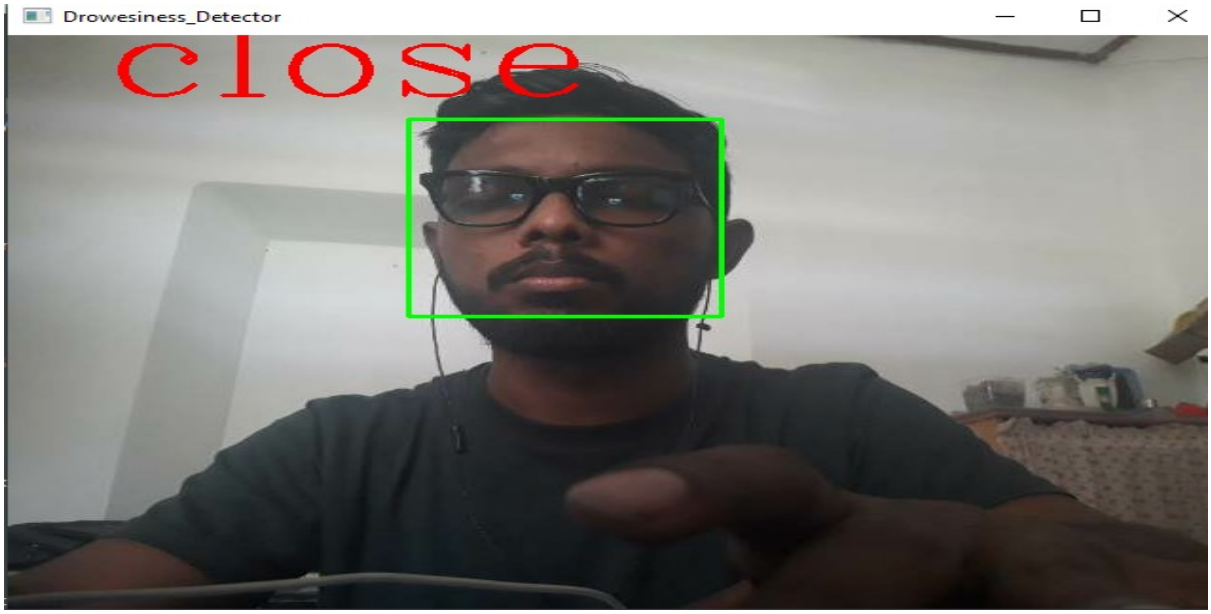

Figure 4: Detecting eyes without spectacles - Closed situation

Then we have used a accelerometer to monitor the speed and the turning speed of the vehicle. The system is considering two main cases.

- Case I
  - If the driver is not wearing any sun glass or something similarly cover his whole eyes, then the system will mainly depend on IR camera and the situation of the eye lid. i.e. is he open his eyes or not.
- Case II
  - If the driver is wearing sun glass then the system will depend still on the IR camera but to track drivers body position.Not only that system use inputs from the

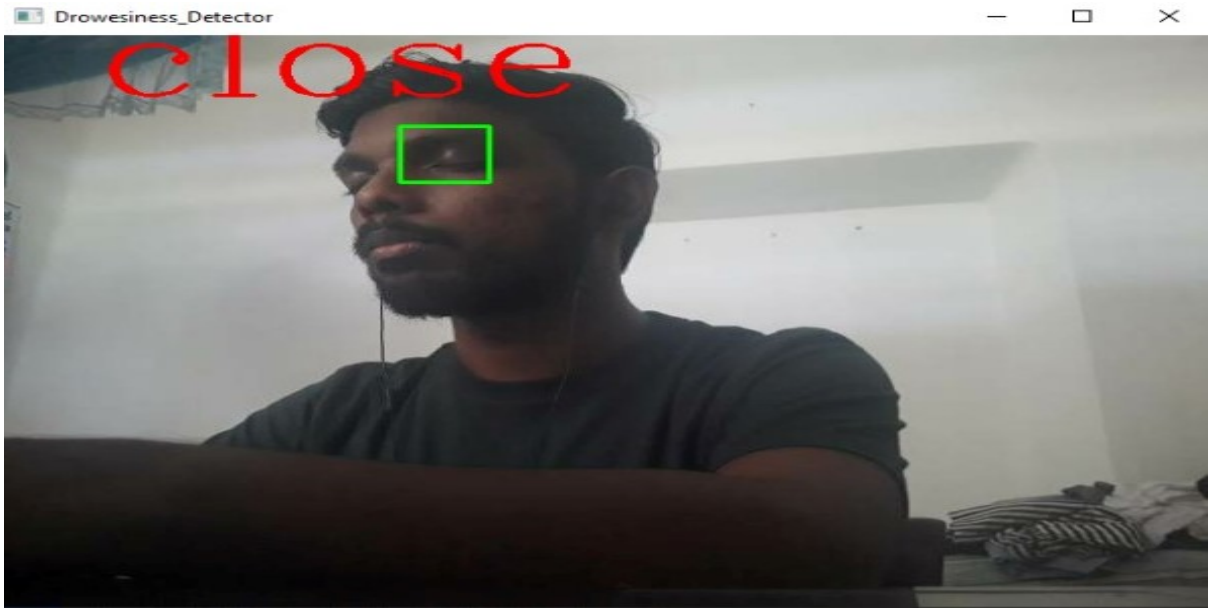

Figure 5: Detecting eyes with spectacles - Closed situation

accelerometer to take some idea about the driver's situation. i.e. If he takes sharp turns very often then it may suggest that driver may sleeping.

To track the body position we have used a Pose estimation module, but unfortunately we couldn't reach adequate results. Here is the image of the output.

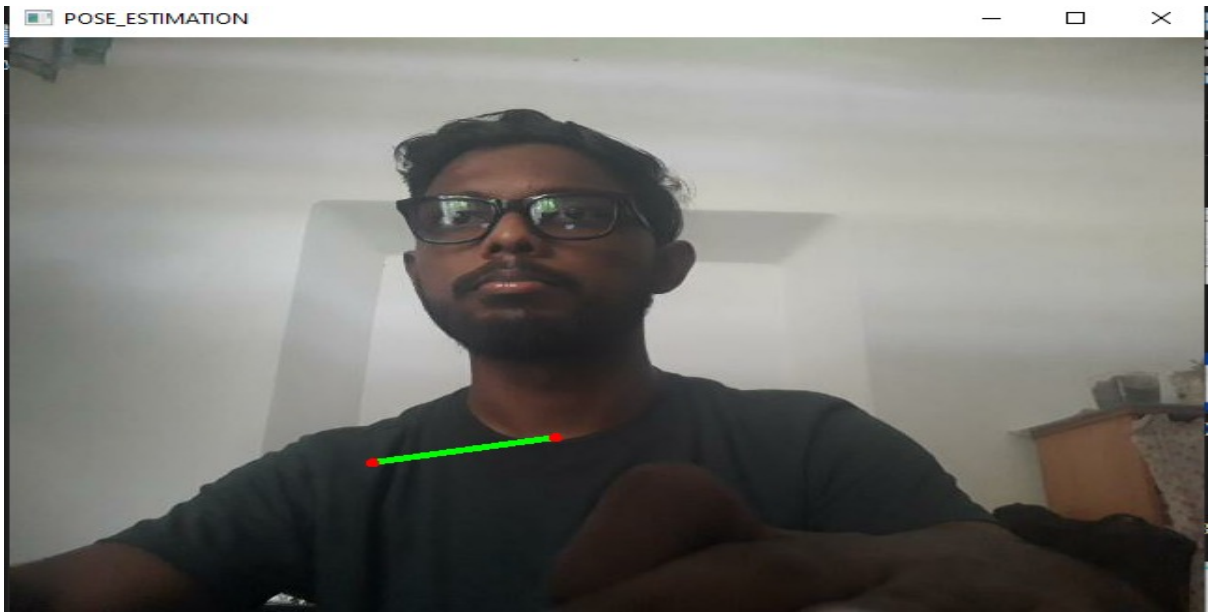

Figure 6: Post Estimation Module

3.2.2 Resources Used

We have used several machine learning data sets and libraries to fulfill this task. They are,

- Human Pose Estimation graph - OpenCV
- Haarcascade frontalface default

- Haarcascade eye
- MRLEyes dataset

3.2.3 Evaluation and Result

We could trained the model which is supposed to identify the status of the eye lid up to 92%. But the Pose Estimation Module only reached up to 70%. So the results were terrible.

3.2.4 Limitations and future work

Due to the current economic situation we couldn't find an accelerometer that we were hoping to take. So it was a huge limitation to fully check our system. We are expecting to reach that chip and complete our project in the future. Then we are expecting design an enclosure to the product too.

3.3 Sustainability

3.3.1 Sustainable Development Goals

As we know there are 17 goals in the SDG list. So our project won't contribute directly to all of them. But let's take it in this way. If some kid's both parents had to die due to an accident which was happened due to the drowsiness what would be the future of that person. Not both parents but in the communities like Sri Lanka father hold the major responsibility. So sudden death of a father would be turning point of those innocent kids' whole future. The main SDG goals are,

- No Poverty
- Zero Hunger
- Good health and well-being
- Quality education
- Clean water and sanitation

These are some key goals. How we can achieve those goals without the help of the father. We personally believe that it may be a very tough task to a housewife to handle. Even though there is no any clear link with SDGs, we think that our product can contribute to preserve those SDGs even in indirect manners.

3.3.2 Sustainability of the project

Since the almost all the components are depend silicon, we can expect that there may be a shortage to get the sufficient supplies. So we can consider that as the major sustainability issue which may this product may has to face in the future. Another thing is the current economic situation. Economic recessions in both local and global stages will make a severe impact on this product.

4 Social and Environmental Impact Assessment

4.1 Impact on climate change

As we pointed out above the there is no any strong direct impact on the climate from this product. But it can make many indirect services to the world by saving resources, human

labour and finally valuable human lives. On the other hand we can say that the we can save physical properties and hence we can make an impact to the climate change because if there was a damage we have to replace them. That means we have to waste natural resources to do it. So this product can make an impact to the climate change.

4.2 Research and assessment tools used

No any kind of research and assessment tools were used.

4.3 Risks involved

This product heavily make impacts on the human lives. One fraction of a mistake can cause to invaluable human life. So the involved risk is unlimited but we should try to improve our product to meet good quality standards.

4.4 Stakeholder Analysis

When we consider the stakeholders, people who use the roads are the main stakeholders of it. Then we can take their loved ones as the next stake holders. After that people who have properties near to the roads are also group of stakeholders. People who are doing repairing for those damaged vehicles also another bunch of stakeholders who are going to be negatively affected.

5 Logistics

5.1 Task breakdown and time frame

Period	Task
July 2021	Launching of the spark branch
August 2021 - January 2022	Spark Training Programs & Idea generation period
February 2022 - March 2022	Identifying ways to implement the generated ideas
April 2022 - May 2022	Implementing the solution
June 2022	End of the programme

5.2 Contribution to Spark Branch

Period	Task
Silva G.B.N.M.	Co-chair for PiMora 1 & PiMora 1.2, Volunteer for PiMora 1.3PiMora badge holder for all three PiMora series
Ayodya W.K.H.	Co-chair for PiMora 1.3 PiMora badge holder for all three series
Epa Y.H.A.	PiMora badge holder for all three series
Chathumini B.G.D.T.	Participants for all three PiMora series
Thenuwara T.A.	Participants for all three PiMora series

5.3 Budget

Component	Price ($)
RaspberryPi 4B	35
IR camera	8
SD card	6
Power Adopter	5
Speaker	3
Sensors and other requirements	14
Total	71