



seeingmachines

## 2016 Intern Projects - Product Hardware Engineering Team

### Group Overview

Our group is responsible for engineering the hardware side of our commercial products. We are part of the Product engineering group which also includes a software, test and data teams.

Our group involves the following areas of responsibility:

- Evaluating and responding to Product Requirements as produced by Product management group.
- Repackaging technology from internal research groups for product use
- Prototyping for proof of concept designs, full designs or outsource in the following areas:
  - Electronics
  - Mechanical
  - Industrial Design
  - Firmware
  - Optics
- Run tests and experiments to validate proof of concepts and engineering samples.
- Provide outsourced manufacturing with support, engineering files and manufacturing documentation
- Liaise with suppliers, certification bodies, test houses and external engineering/industrial design houses
- Travel to suppliers to assist in mass production
- Travel to customers to assist in troubleshooting
- Assist other groups with hardware support.
- Provide Hardware Engineering support to field staff to evaluate field failures.

We are a multidisciplinary group with each member having skills across multiple areas which allows task assignment flexibility and a more interesting work load for the engineers.

We have historically focused on aftermarket products for vehicles. Previously the mining sector and now the over the road fleet market.

## Project

### Vibration motor improvement

Our system currently utilises a large vibration motor that is fixed to the driver's seat. It consists of a 12V motor with dual shafts each with an off axis weight attached. This vibration motor is pulsed to alert the driver on a fatigue event even if the vehicle cabin is noisy.

The vibration motor is expensive, bulky, time consuming to fit, requires motor driver and works only on a fixed voltage.



### Challenge

To improve this device we've come up with the following improvement requirements:

1. Reduce the cost
2. Reduce the size
3. Reduce the installation time
4. Allow it to run from multiple voltages (10V to 30V DC) with the same speed, with a current limit and directly from vehicle power.
5. Provide an enable signal
6. Provide a tacho feedback signal

It is assumed to reduce the size and cost the motor should be smaller. To have the driver receive the same amount of vibration it will need to be fitted closer to the driver, perhaps direct contact. However, we have to take into account of how the driver sits in a seat and the different types of seats available.

It is expected some studies will be required to assess:

1. Driver acceptance
2. Driver is sufficiently alerted
3. Installation time is improved

#### Desired Outcomes

- Schematic and mechanical design
- Proof of concept product and 3D mechanical design
- Experimental study justifying recommendations

Other projects to be defined...

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## 2016 Intern Projects - Machine Learning and Computer Vision Team

### About the Company

Seeing Machines builds image-processing technology that tracks the movement of a person's eye, face, head and facial expressions. The technology makes a regular camera intelligent: able to evaluate each facial movement, process it, and then interpret this data to better understand a person's behaviors.

### Project 1: Colour correction for Infrared (IR) Images

Many of the projects at Seeing Machines use cameras and they must be able to operate in bright sunlight, typical day conditions and at night. As a result we typically configure our cameras to capture infrared (IR) images, such as these:



As you can see in the above images, there are several issues:

- The IR light images of eyes are significantly different to the visible light spectrum
- The skin looks significantly different

The overall first impression for many is that they are looking at images of vampires.

This problem is similar to another common problem that has been popular recently which is to add colour back into grayscale images. Here's an example using a framework designed for gray to colour mapping:



The results are not ideal but give a good starting point for this project. Can you help us to modify IR images to give a better, more human, result?

### **What's involved?**

- This is a machine learning problem. As a starting point to ensure we have a good dataset, the project would use some frameworks and work on re-colouring grayscale images. The advantage in this problem is we can work with very large datasets. Just take existing colour images, convert to grayscale, recolour with the candidate algorithm and compare with the original image.
- A second step would be to modify the framework to work with IR images and to figure out the dataset(s) that would be required.
- Much of the project will involve coding in the appropriate language, which may be Python, C++ or similar.
- Support will be offered from others in the team to get up and running with GPU-accelerated algos.

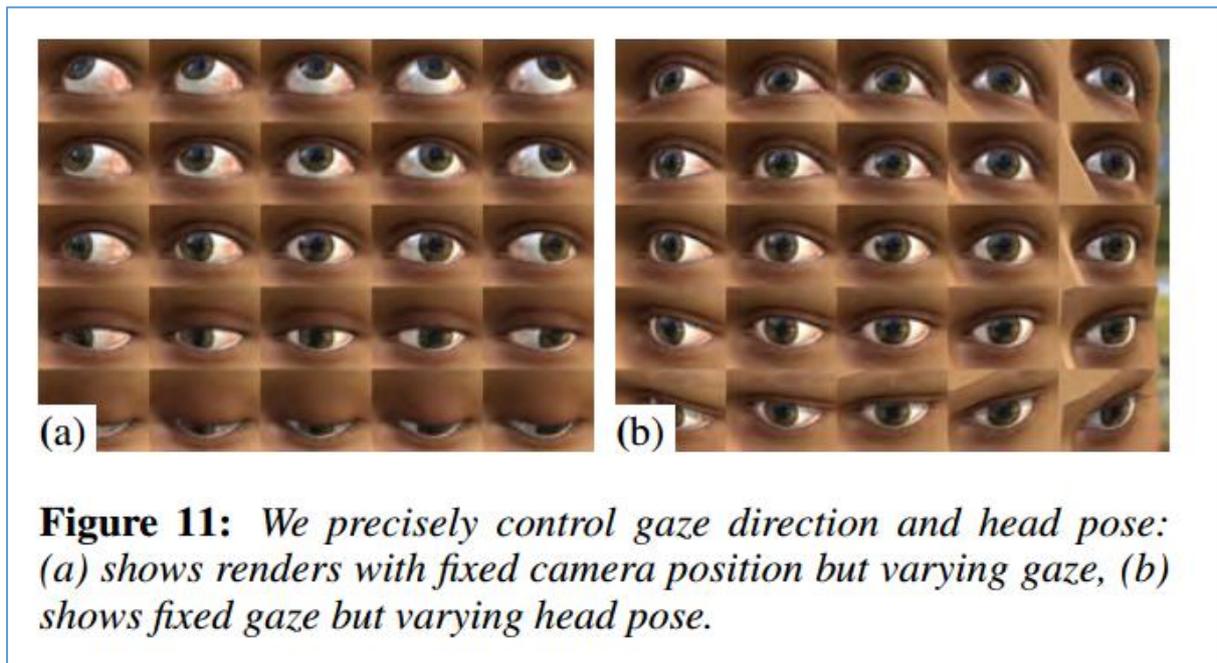
## Project 2: Generate synthetic data for an eye model

As part of our algorithm development we are depending more and more on large datasets and manually annotating 'ground truth'. For example, when looking at someone's eyes, where are they looking?

A recent research project has a tool called 'UnityEyes' which can generate a lot of synthetic eye data.

See: [https://perceptual.mpi-inf.mpg.de/files/2016/01/wood16\\_etra.pdf](https://perceptual.mpi-inf.mpg.de/files/2016/01/wood16_etra.pdf)

Here's an image from that paper showing some synthetic gaze data:



We likely don't need the level of detail provided by this tool for our research purposes, so this project would be to simulate a basic model of an eye that can be used to help with our algorithm development

### What's involved?

- A knowledge or 3d graphics (such as gaming) would be helpful
- Development would be in the most convenient programming language (such as C++) and can make use of other frameworks.
- This project would just be the start of an ongoing effort to generate synthetic data for use in computer vision algorithms

## **CONTACT**

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