**Proposal :**

As per the mail that was sent to us, the device can be used directly for detection of few conditions of the eye by using image processing directly on the video or the image that you get from the camera.

The conditions like Cataract,Glaucoma,Presbyopia,Pterygium can be detected using the device without any hardware additions using simple image processing.

I have explained the detection of one of the conditions elaborately below :

**Cataract:**

A **cataract** is a clouding of the lens inside the eye which leads to a decrease in vision. It is the most common cause of blindness and is conventionally treated with surgery. Visual loss occurs because opacification of the lens obstructs light from passing and being focused on the retina at the back of the eye.

What are you trying to do? Articulate your objectives using absolutely no jargon.

* **How is it done today, and what are the limits of current practice?**

An eye exam will be given to test how well you can see (remember to bring your glasses or wear your contacts to the appointment). Your doctor will also dilate your pupil in order to examine the condition of the lens and other parts of the eye.

* **What's new in your approach and why do you think it will be successful?**

Cataracts are basically classified, based on their location into Nuclear(NC), Cortical(CC)

1. **Nuclear cataracts** result due to the gradual opafication and yellowing of the intraocular lens nucleus. The **usual NC structure is circular** when the affected lens is photographed.
2. **Cortical cataracts** develop in the cortical regions surrounding the nucleus of the eye lens. They usually have a **characteristic elongated shape**, unlike NC, and appear as spokes around the central nuclear region of the len

The basic operation is to take a image and process the image using the following technique:

The lens image is extracted from the patient's image, magnified, resized and converted into a grey scale image and then the cataract is detected by comparison with healthy eye's mean grey intensity value.

Once the cataract is detected then it is classified as NC or CC by using a digital mask, Edge Detection and Circular Thresholding after Morphological Noise Reduction. This method will basically classify the Cataract into NC and CC

* **Who cares?**

Implementing this particular method will standardize the entire process of detecting a cataract. The talk given to us by a doctor at LVPEI stressed on the fact that presently we need a optical device that can do three basic functions :

1. Detection | 2.Quantification | 3.Progression

Thusthis method will detect the cataract, quantify it with respect to the radius and over a period of time we also can see the progression of the cataract quantitatively.

* **If you're successful, what difference will it make?**

The good repeatibility of the automated system is very useful since even expert opthalmologists and eye specialists show repeatability problems which may lead to disagreement among physicians.

So now you have a way to standardize the cataracts and classify them into NC or CC

The time required to perform the test will be very less in comparison to the eye exams that you would have to go through to identify the cataract.

* **What are the risks and the payoffs?**

The only constraint here is the healthy eye's mean grey intensity value. This value should be calibrated using a wide range of dataset images.

The other shortcomings of the software are that the algorithm is sensitive to gray level variations which leads to the error measured.

* **How much will it cost?**

This method is very cost effective as you just have to take the image from the camera that is attached in the primary device and process the image on the micro-controller that you have mounted on the device.

* **How long will it take?**

The prototyping of the device can be done be done swiftly, the testing part of the device will take a bit more time.

The duration for detecting the cataract will just be the time required for processing the image which would be effectively very less than actually doing the various eye exams.

* **What are the midterm and final "exams" to check for success?**

The understanding that I have of this question is that the amount of accuracy or repeatibility of this method when compared to the examination by a doctor.

This can be checked by taking a dataset of images where the two types of contours have been detected by previous manual method and then applying the above image processing to the images and correlate the result. This can be regarded as an exam for success.

**Other Hardware Additions(proposed):**

The hardware addition that i think should be added to the device is a sytem for the feedback from the user. This feedback will help to diagnose diseases like Lazy Eye where the user gives a feedback when he/she sees the image thus helping in diagnosing the condition.