EyeVu Hardware Team: Market Research

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1 Project Brief

Background: In many under-resourced countries, inter-cranial hypertension goes undiagnosed due to limited access to brain scanning devices which are very expensive to operate. A solution to this issue is instead diagnosing a papilledema by imaging the retina which is an indicator of a inter-cranial hypertension. Therefore, EyeVu is aiming to design a low cost retinal scanning device to identify papilledemas to narrow down those that need follow up scans and those that do not.

Project Description: We were tasked with providing a proof-of-concept for a handheld device which could be used in these low resource areas to image the retina. Our work should prove the feasibility of using "off-the-shelf" parts to contruct a device that is able to obtain an image of the retina.
Specific criteria outlined by our sponsor:

1. $< 40cm$ in length
2. handheld
3. open-source off the shelf electronics
4. <= 2 personnel to operate
5. obtain suitable image

2 Market Research

1. Common Opthalmoscopes in practice

   At the moment there are many devices to image the back of the eye on the market for professional optometrists. These are extremely high quality typically stationary devices which require a professional to operate them. However, they are relevant in our market research as the lens designs that are used can be simplified and reverse-engineered to our own device. Below you can see the advantages and disadvantages of the relevant devices.

Device	Advantages	Disadvantages
Opthalmoscope [1]	Uses one lens (and viewers eye) to image Handheld device	Does not capture an image £250-350
Fundus Camera	Captures Image Only uses 2 biconcave lenses Autofocus	Not Handheld £10,000+

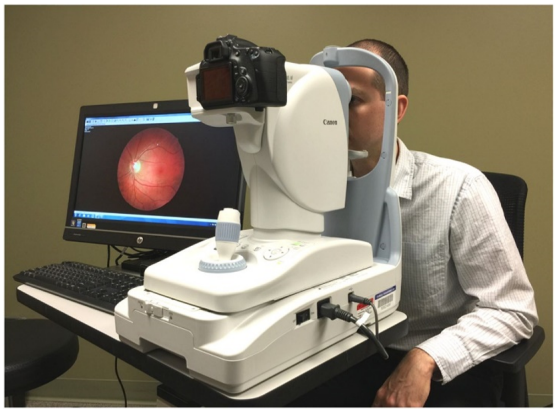

Figure 1: Left: Desktop Fundus Camera, Right: Handheld Opthalmoscope

2. Indirect Handheld Opthalmoscopes
   These devices have been designed for potable use and some for cheap implementation which is more in line with our project goals.

Device	Advantages	Disadvantages
Welch Allyn Panoptic Opthalmoscope [4]	Handheld Can capture image with iPhone Uses LEDs for illumination Charged with 2 batteries	£841 Requires additional iPhone software for autofocus Assumes access to iPhone
Optomed Arora IQ Handheld Fundus Camera [3]	Handheld Captures image High quality image 50 degree field of view (FOV)	Used by a professional Not robust design
ODocs Fundus Camera [2]	Handheld 3D printable Lightweight Durable/ Replaceable Uses 1 lens and Camera Lens	Assumes access to smartphone Manually adjustable

Having looked at these devices it was clear that cost would be one of the main challenges we would face during our design. Due to the project being defined in a low resource setting we also did not want to make

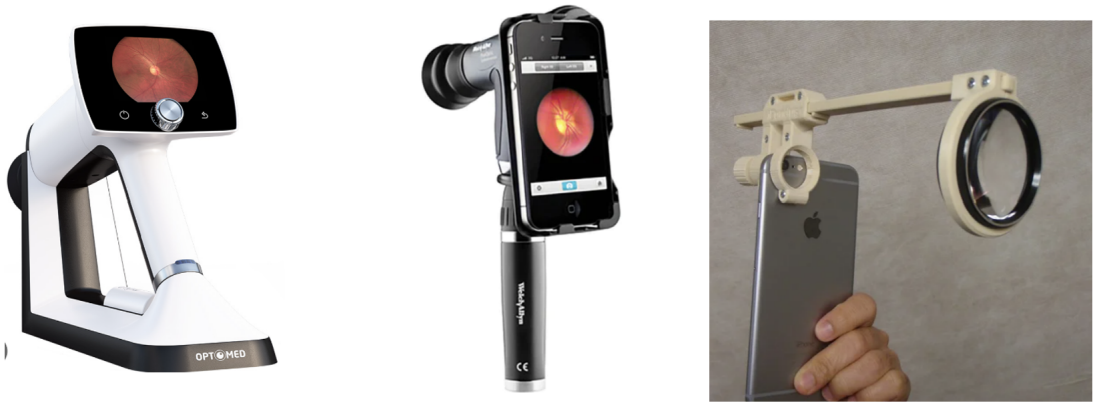

Figure 2: Left: Optomed Arora, Middle: Welch Allyn Panoptic, Right: ODocs Fundus Camera

any assumptions about available equipment such as monitors or iPhones that are able to download external software. It was also evident from this research that a lot of these designs would not be fit for purpose at the intended destinations, as it must be able to withstand high temperatures, potential exposure to dust and water and be easily repairable.

References

[1] Keeler. Medisave. Available online.

[2] oDocs. Autodesk Instructables. Available online.

[3] Optomed. Mainline Instruments. Available online.

[4] Welch Allyn. Medisave. Available online.