Portable Diabetic Eye-Retina Scanning Device Funding Proposal

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Purpose:

The purpose of the Portable Eye Scanning Device is to create a medical device that can be used to scan the retina of an eye from individuals who suffer from Diabetic Retinopathy. This disease is caused by high blood sugar that damages the blood vessels located in the retina; blood tends to stop passing through the vessels and this leads to swelling and leakage in retina which results in distorted vision and blindness [1]. Patients living among developing nations are the main victims of this disease and many of them lack the equipment or access to health care that would raise their awareness of the disease and prevent their loss of vision [3]. On the other hand, doctors and physicians don't have such medical devices to give them quick and easy results about determining the health state of a patient's retina; this device will shorten the length of test procedures and provide simple indications about the status of their patient's eye illness [2]. The device will be compact and portable so it can be mobile to use conveniently in regions that have limited access to electricity or power; it will contain a camera constructed on an embedded system with an LCD screen that will scan the retina of an eye, process the image scanning in the embedded system's database, and display the health state of the retina through the LCD screen.

Method:

At the heart of the Portable Eye Scanning Device will be the NVIDIA Jetson TK1, an embedded Linux development platform that contains the necessary ports, applications, and other hardware properties that enables this medical device to connect to other peripheral devices such as a retina-based camera and an LCD screen. A high-level system diagram of the proposed device is shown in Fig. 1. The retina camera's purpose is to perform the scanning of a patient's retina while the LCD screen will print out the health state of the patient's retina (Healthy vs Unhealthy). The device will run on rechargeable batteries and will have a battery-

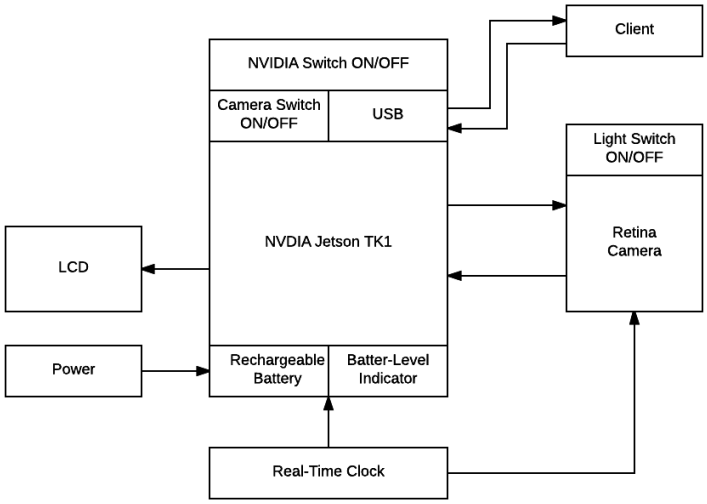

Fig. 1: Block diagram of the proposed device.

level indicator to notify end users about the state of the device's battery level. Clients will have options in downloading scanned images from the NVIDIA's database by connecting is USB ports to peripheral devices such as a computer. Shown below is a schematic of the project's architecture:

Timetable:

Currently, we are on the planning stage of the project and thus we must gather all the required resources such as: written and presentation proposals, advisors, electrical components and materials, and funding before we begin the implementation and testing of the project. Our presentation proposal will take place in the beginning of December, where we state our project idea and implementation in front of the staff and faculty of the Engineering Department. Winter break will be the period where we research and practice on developing computer algorithms as well as refresh our memories on Python Programming. Afterwards, when the Spring semester begins, we will begin the mechanical set up of the project such as making the peripheral devices (camera, LCD) compatible with the NVIDIA embedded platform. Then from February to May, we will be working on the electrical & software tasks of the project such as making the eye scanning tests work, implement machine learning to the device to be able to differentiate the difference between a good and bad retina, and to make the batteries to be capable of lasting for hours or days. May is the date for us to present and demonstrate our complete project in front of the faculty and students of the Engineering department.

Anticipated Results:

Our expectations are that the Portable Eye Scanning Device should learn how to differentiate the difference between a healthy vs unhealthy eye. By implementing machine learning, this medical device would become

'smarter' in differentiating the patterns of the blood vessels from the scans in determining the health state of an eye's retina [4]. We also expect the LCD display to print out the correct phrases resulted from the scans; if device configures that that the scanning of the retina was healthy it will print out 'Healthy', if the eye was not healthy then it will print out 'Unhealth'; we aim to achieve 85% sensitivity and above 95% specificity. Our third expectation is that the device should be fully functional on rechargeable batteries, as it is important for this device to be functional for long periods of time in places where electricity is out of reach.

Motivation:

The main importance of this project is to create a small and easy device that can be easily accessible to people around the world who don't have access to health care or technological equipment for these kinds of scanning procedures. This medical device will prevent possibly millions of patients from losing their eye vision before it's too late. The outcome of this project will also give doctors and physicians a basis in having medical devices that shortens the procedures to perform these types of tests scans on their patients who are diagnosed with Diabetic Retinopathy. Helping to raise the awareness of patients who are caught with the killer disease will prevent the illness to cause their vision to be distorted or loss forever.

Table 1: Budget

Part/Service	Quantity	Source	Description	Price
NVIDIA Jetson TK1	1	Amazon	Main processing and control unit of device	$199.99
16x2 Parallel LCD	1	Crystalfontz	Screen to display retina's health state	$5.48
Holybro Px4 Kitv1.31	1	getpfv.com	Camera to scan retina of an eye	$105
Yosoo Capacity Tester Indicator	1	Amazon	Battery level indicator for device	$7.99
TATTU 220mA 3s 35c Battery	1	getpfv.com	Rechargeable battery for device	$24.53
Soldering Kit	1	Amazon	Tools to solder/connect components together	$50
Electronic Components	N/A	N/A	Electrical components as needed	$19.98
Total				$412.97

References:

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Your Bibliography: American Optometric Association. (2017). *Diabetic Retinopathy*. [online] Available at: https://www.aoa.org/patients-and-public/eye-and-vision-problems/glossary-of-eye-and-vision-conditions/diabetic-retinopathy [Accessed 7 Oct. 2017].

[2] Portable Eye-Scanner to Revolutionize Detection of Diabetic Retinopathy

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Your Bibliography: Diabetes.co.uk. (2017). *Portable Eye-Scanner to Revolutionize Detection of Diabetic Retinopathy*. [online] Available at: http://www.diabetes.co.uk/news/2014/may/portable-eye-scanner-to-revolutionise-detection-of-diabetic-retinopathy-96133928.html [Accessed 11 Oct. 2017].

[3] WHO | Diabetes cases could double in developing countries in next 30 years

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[4] What Is Machine Learning? | How It Works, Techniques & Applications - MATLAB & Simulink

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