Asian Journal of Applied Science and Technology (AJAST)
(Open Access Quarterly International Journal) Volume 2, Issue 2, Pages 395-399, April-June 2018

Detection of Glaucoma in Retinal Image Using Raspberry PI

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Article Received: 29 January 2018 *Article Accepted: 26 February 2018* *Article Published: 17 April 2018*

ABSTRACT

Glaucoma is a serious eye disease that can be defined as the characteristic optic neuropathy, or disease of the optic nerve. If it is ignored or left untreated, which can possibly leading to damage of the optic disc of the eye and results in visual field loss due to the lack of communication between the retina and the brain. This may lead to irreversible vision loss. It is the second conducting movement of blindness around the world. The disease normally occurs when there is an increase in level of intra-ocular pressure (IOP) of eyes and gradually damages the vision field. This occurs due to the imbalanced production and drainage of the fluid in the eyes. Since the normal eye pressure ranges from 10-21 mm Hg. Were the ocular hypertension is a range of eye pressure greater than the normal range. (i.e. above 21mmHg). Based on the causes and effects, Glaucoma can be further categorized in to four types such as open-angle, angle-closure, congenital, and normal tension or low tension glaucoma. Normal tension glaucoma usually damages the optic nerve and can lead to lose the sight, inspite of abnormal pressure in the eye. The term angle refers to the distance between the iris and cornea. Any variations found with in this distance can lead to open-angle and angle-closure glaucoma. Since the angle-closure glaucoma is very painful. It causes rapid damage to the vision field of eyes as compared to the open-angle glaucoma. The primary objective of this project is to detect the disease Glaucoma. As the disease progresses, vision starts to become hazy, and can lead to irreversible vision loss. Therefore, early detection of glaucoma is needed for prevention.

Keywords: Raspberry Pi developing board, Fundus Image, Glaucoma, Iridocorneal Angle, Optic Disc.

1. INTRODUCTION

India is well known for contagious eye diseases. About fifty percent of the population are affected by such eye diseases. Glaucoma is relatively common, especially in older adults and can cause damage to optic nerve if left and treated. In India 11.2 million people aged 40+ years are affected by glaucoma. Since the diabetic patients are more vulnerable to the disease. Thus we require the system which can provide exact differentiation in the variation of normal eye and the affected eye. Depending upon the variation that is further compared with the database of stored image features.

To achieve the better enhancement to deploy the increase of Glaucoma in the country, Data Acquisition using Raspberry Pi was introduced [1]. For improving the performance of detection of eye disease by the automatic reference with the databases of Raspberry Pi [2]. The objective of this work is to design a simple, easy to detect, microcontroller-based circuit to monitor and record the variation of affected eye images that are continuously notified and to give the result. This makes the proposed system to be an economical, portable and a low maintenance solution for detection of eye disease applications, especially hospitals and for small nursing homes [3].

The combination of Raspberry Pi developing board, camera module and database of storing images became an innovation technology in this digital world. In this digital world images are collected via web camera module and those data are transferred to Raspberry Pi board.

The rest of the paper has been designed as follows, section-2 proposed system, section-3 hardware design and development, section-4 system simulation, result & discussion and section-5 conclusions.

2. RELATED WORK

Imran Qureshi, proposed the method in which first to Initialize the training database and resize the images of 150*150 resolution. Then to detect the edges by using combined Canny with Sobel techniques, and finally to find edge features. Here the mean or average filter was used to remove the unwanted noises. Since the features extracted from the test image are compared with the features available in the training set. Along with the skew divergence distance measurement the colour, Edge and texture features had been found. This method provides more accuracy in the rate of processing the image.

Laszlo Kovacs *and* ***Rashid Jalal,*** presented a cloud based data websites, which collects data from camera module and transfers the data through USB to the Raspberry Pi. Using the LCD the body of the affected eye can be monitored.

3. SYSTEM OVERVIEW

This system consists of camera module, Raspberry Pi developing board and the stored image databases. The camera module captures the images from the affected patient's eye together collects the various parameters of that affected eye and send the data to the Raspberry Pi board. Then it compares the images with the stored image database with in and shows the result of the progress in a monitor which helps the effective detection of Glaucoma more easily with low cost.

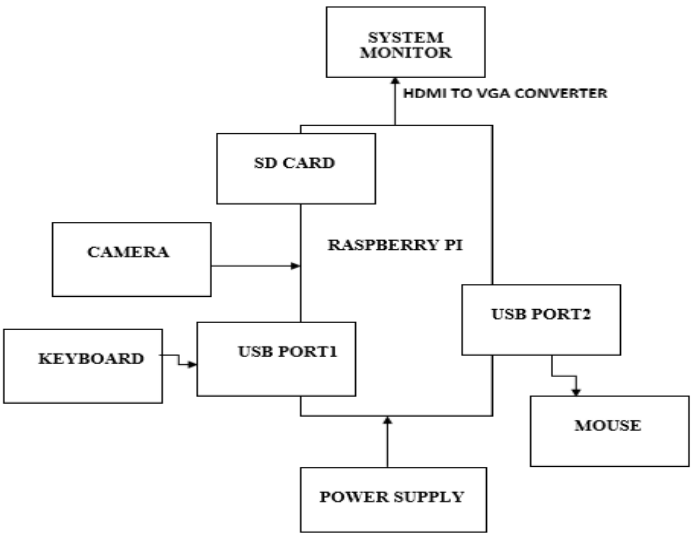

Fig.1 : Concept Diagram

4. METHODOLOGY

Raspberry Pi

Raspberry Pi is a small barebones computer designed and manufactured by the Raspberry Pi foundation, a charity of United Kingdom (UK). Along with an objective of providing low-cost computers, it was developed. It has a

Broadcom BCM2835 system on a chip (SoC), which includes an ARM1176JZF-S 700 MHz processor. Video core IV GPU and was originally shipped with 256 Mb of RAM, later upgraded (Model B & Model B+) to 512 Mb. It does not include a built - in hard disk or solid - state drive, but it uses on SD card for booting and persistent storage, with the Model B+ using a Micro SD Raspberry Pi being a very cheap computer has attracted millions of users around the world. Thus it has a large user base.

Camera

This is the simple and cost effective web camera series can be used in machine vision, barcode detection and object tracking. Web camera module solves the problem of implementing high resolution; high quality video and images. The web camera super-speed connectivity enables it to capture images at 720p (HD)@60fps. Open CV has a functionality to work with standard USB webcams.

SD card

An SD card (secure-digital card) is an ultra-small flash memory card designed to provide high capacity memory in a small size. SD cards are used in many small portable electronic devices such as digital cameras, handheld computers, digital video camcorders, audio players, mobile phones, etc.

USB port

The Universal Serial Bus (shortly USB), is a standard cable connection interface for personal computers and consumer electronic devices. It is an industry standard for short distance digital data communications. It was developed to define cables, connectors and protocols for connections, communications and power supply between personal computers and their peripheral devices.

Power supply

The AC voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired DC output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.

LCD display

A Liquid Crystal Display is used to display the image outputs of captured images after comparing with the images that are already fed up with in.

Keyboard & Mouse

A keyboard is a typewriter style device which uses an arrangement of buttons or keys to act as a mechanical lever or electronic switch. A mouse is a handheld pointing device that detects two dimensional motion relative to a surface. The motion of a pointer on a display which allows a smooth control of the graphical user interface.

Hardware design

Fig.2: Hardware connection setup

Software

The Raspberry Pi integrated environment or Raspberry Pi 3 software (IDE)-contains a text editor for writing code, a message area, a text console, a toolbar with button for common functions and a series of menus .It connects to the Raspberry Pi hardware to upload programs and communicate with them.

5. EXPERIMENTAL RESULTS

Inputs do not come from a physical switch; it could be from a camera module. The output can also be comparing the images with the stores database in the Raspberry Pi board which we are preferred for.

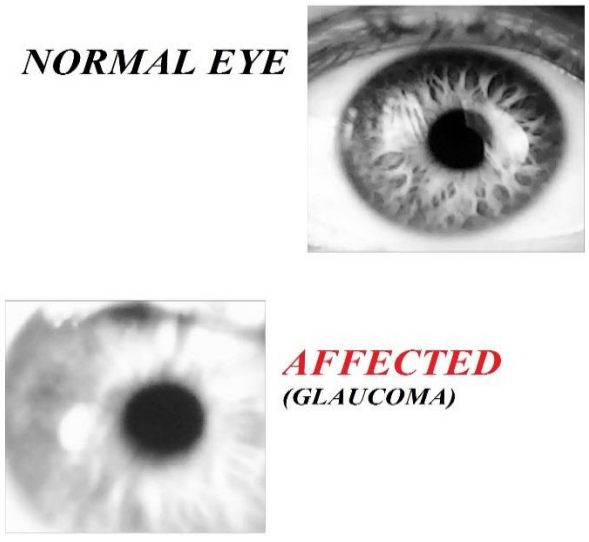

Fig.4. Result of the project

6. CONCLUSION

A complete automated system can be designed for the accurate detection of Glaucoma using web camera, Raspberry Pi board and LCD display. This system is implemented using the reliable image processing algorithms

in order to detect and classify the infected eye. The result shows the proper and accurate diagnosis of Glaucoma. The proposed method can process, recognize and analyse the affected eye based on the variations among the pre-processed images.

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