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Analysis Of Eye Pressure For Glaucoma Patients

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ABSTRACT

When people hear the word “glaucoma,” many of them connect the eye disease with elevated eye pressure (also known as intraocular pressure or IOP). However, the relationship between glaucoma and eye pressure is complicated and has changed over time. The main objective of the project is to wireless pressure sensing eye pressure guard has been developed for monitoring the progress of Glaucoma and eye pressure (Eye pressure grinding during sleep) and for protecting the Eye pressure.

Keywords: Eye pressure, Glaucoma, IOP fluctuation and Wireless pressure sensing.

1. INTRODUCTION

The major risk factor for development and progression of glaucoma is elevated intraocular pressure (IOP), with Goldmann applanation tonometry (GAT) the reference standard for measurement. However, conventional tonometry has limitations because the patient must go to their clinician for measurements and thus readings tend to be obtained infrequently. The result is poor understanding of peak IOP and IOP fluctuation. Although the significance of diurnal and long-term IOP fluctuations remains uncertain, it is unsatisfactory to base treatment decisions on a small number of measurements of what is a highly dynamic variable.

A fuller understanding of IOP fluctuation can be assessed by admitting patients for repeat measurements; however, this is logistically difficult, especially as up to 75% of individuals have peak IOP outside office hours. A potential, more accessible, solution is for patients to measure their own IOP by self-tonometry. Home monitoring and application of patient-generated data are not new and have been successfully used in other conditions (eg, hypertension and diabetes). Recently, a novel device designed for home IOP monitoring has become available, the Icare HOME (TA022; Icare Finland Oy).

The Icare HOME is a rebound tonometer that quantifies IOP by measuring the deceleration of a magnetized disposable probe as it rebounds from the surface of the cornea. The device does not require instillation of topical anesthesia and has been reported to provide repeatable readings with good agreement with GAT. However, testing one's own IOP may be technically difficult, and it is not certain whether self-tonometry is acceptable to patients. The aim of this study was to determine whether patients with glaucoma can measure their own IOP and to evaluate patients' perceptions of self-tonometry.

2. WHAT IS CONSIDERED HIGH EYE PRESSURE?

What Is a Normal Eye Pressure Range? Normal eye pressure is between 10mmHg and 20mmHg. Eye pressure that's typically associated with glaucoma is above 21mmHg, but eye damage can develop at a lower or higher pressure for some people. The front part of your eye is filled with a clear liquid called aqueous humor

In many forms of glaucoma, the eye pressure is high. What is considered “too high”? Patients ask me this all the time, and I tell them it depends.

First, we know that statistically speaking, having eye pressures over 21 mmHg (millimeters of mercury) is not very common in a generally healthy population. We also know that eye pressure tends to increase as we get older since the drainage system does not function as well.

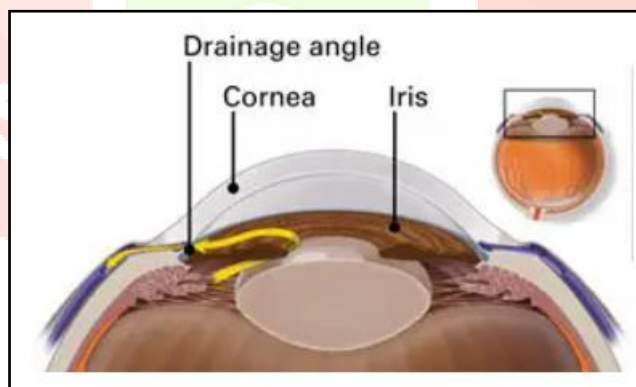
Second, we know that an optic nerve that is healthy can withstand a higher eye pressure than an optic nerve that is unhealthy. For example, patients who have optic nerves that already have signs of damage likely need lower eye pressures to prevent worsening of glaucoma.

Third, the eye pressure that is “too high” for your optic nerve is sometimes determined over time. Let's say you begin treatment with an eye drop to lower eye pressure, and it is successful in lowering your eye pressure by 20 percent. However, your glaucoma continues to progress slowly. In that case, despite the initial eye pressure lowering, your ophthalmologist may determine that this new lower eye pressure is still “too high” and your eyes need to have even lower eye pressure.

Finally, it is important to realize that most patients with the most common form of glaucoma, primary open-angle glaucoma, have elevated eye pressures but do not feel pain or have other symptoms. Glaucoma is often called the “silent thief of sight” because patients do not have symptoms until late in the disease when they notice central vision loss.

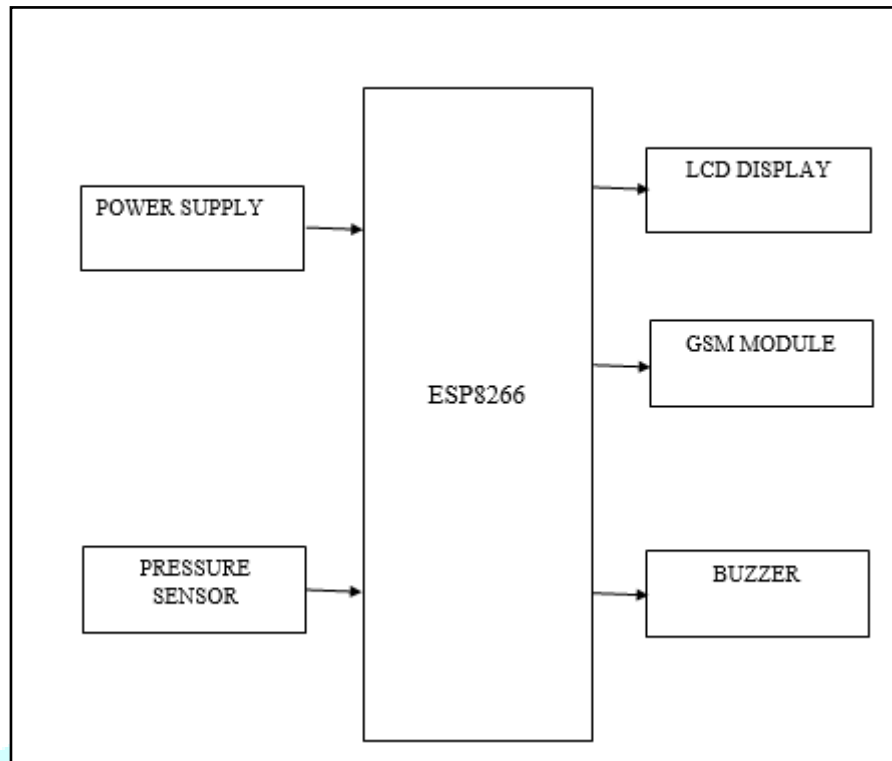
3. WHAT IS THE MAIN CAUSE OF GLAUCOMA?

Your eye constantly makes aqueous humor. As new aqueous flows into your eye, the same amount should drain out. The fluid drains out through an area called the drainage angle. This process keeps pressure in the eye (called intraocular pressure or IOP) stable. But if the drainage angle is not working properly, fluid builds up. Pressure inside the eye rises, damaging the optic nerve.



If the drainage angle is blocked, fluid cannot flow out of the eye, causing pressure to increase. The optic nerve is made of more than a million tiny nerve fibers. It is like an electric cable made up of many small wires. As these nerve fibers die, you will develop blind spots in your vision. You may not notice these blind spots until most of your optic nerve fibers have died. If all of the fibers die, you will become blind

4. BLOCK DIAGRAM



4.1 WORKING PRINCIPAL

In this proto type. We focuses on the type pressure sensors based on contact-sensitivity mechanism. In the aspect of sensor technology, the material selection and process fabrication of flexible pressure sensors with contact structure are studied. At the same time, the packaging technology of sensor devices is studied according to the demand of long-term implantation into the human body. In this paper, a Piezo Resistive Sensor pressure sensor with ESP8266 contact structure is fabricated by microcontroller. The pressure sensors which convert pressure change signal into capacitive signal. The working principle of typical capacitive pressure sensors is shown in block diagram. GSM Module is used to send abnormal data to the corresponding persons.

5. HARDWARE DESCRIPTION

5.1 POWER SUPPLY

The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op-amp. The advantages of using precision rectifier are it will give peak voltage output as DC; rest of the circuits will give only RMS output.

5.2 PRESSURE SENSOR

An eye pressure sensor, also known as an intraocular pressure (IOP) sensor, is a device used to measure the pressure inside the eye. This is a crucial measurement for diagnosing and managing eye conditions such as glaucoma, a disease that can damage the optic nerve and lead to vision loss if not treated. Elevated intraocular pressure (IOP) is one of the primary risk factors for glaucoma.

5.3. HOW EYE PRESSURE SENSORS WORK

Eye pressure sensors measure the force exerted by the fluid inside the eye (the aqueous humor) against the eye's walls. This pressure measurement is important for detecting abnormal pressure levels, which could indicate a risk of glaucoma.

Applications of Eye Pressure Sensors:

Glaucoma Screening: The primary use of eye pressure sensors is for early detection of glaucoma. Elevated IOP is a significant risk factor for glaucoma.

Post-surgery Monitoring: After eye surgeries like cataract surgery or LASIK, eye pressure must be monitored to ensure that it remains within safe levels.

5.3.1. ESP8266 CONTROLLER

The ESP8266 (Electronic Stability Program) module enables microcontrollers to connect to 2.4 GHz Wi-Fi, using IEEE 802.11 bgn. It can be used with ESP-AT firmware to provide Wi-Fi connectivity to external host MCUs, or it can be used as a self-sufficient MCU by running an RTOS-based SDK

PIN DESCRIPTIONS

Power Pins:

VCC: 3.3V power supply

GND: Ground

Control Pins:

CH_PD: Chip Power Down (active low, connected to VCC for normal operation)

RST: Reset (active low)

UART Pins:

TXD0 (GPIO1): Transmit data (connected to the serial interface of your microcontroller)

RXD0 (GPIO3): Receive data (connected to the serial interface of your microcontroller)

5.4 LCD DISPLAY

LCD 16x2 is a 16-pin device that has 2 rows that can accommodate 16 characters each. LCD 16x2 can be used in 4-bit mode or 8-bit mode. It is also possible to create custom characters. It has 8 data lines and 3 control lines that can be used for control purposes.

SPECIFICATIONS OF 16X2 LCD

Display Size: 16 characters × 2 rows

Operating Voltage: 4.7V to 5.3V

Current Consumption: 1mA (without backlight)

Interface: Parallel (4-bit or 8-bit mode)

Driver IC: HD44780 (or compatible)

Character Size: 5×8-pixel matrix

Backlight: LED (optional)

5.5 BUZZER

An Arduino buzzer is also called a piezo buzzer. It is basically a tiny speaker that you can connect directly to an Arduino. You can make it sound a tone at a frequency you set. The buzzer produces sound based on reverse of the piezoelectric effect.

5.6 GSM MODULE

The SIM800A is a popular GSM/GPRS module that allows for communication over GSM networks. It's widely used in various IoT and embedded applications due to its compact size and versatile features.

Here are some key features of the SIM800A module:

Quad-band Support: Operates on GSM 850MHz, EGSM 900MHz, DCS 1800MHz, and PCS 1900MHz².

Interfaces: RS232 interface for easy connection with computers or microcontrollers².

Power Supply: Requires a voltage supply of 9VDC to 12VDC with at least 2A peak current capability.

Low Power Consumption: Down to 1mA in sleep mode.

AT Commands: Controlled via AT commands for easy integration and control.

Built-in SIM Card Holder: For easy SIM card installation.

Network Status LED: Indicates the status of the network connection.

The SIM800A module is ideal for applications such as remote data monitoring, fleet management, vending machines, and more

6. CONCLUSION

In this project a wireless sensor for measuring the Eye pressure Arduino on the palate is presented. The proposed device consists of sensors and a conditioning and transmission circuit. The sensor is fabricated with screen printing technique on a plastic substrate at low temperatures. The conditioning and transmission circuit is introduced and the building blocks are briefly described. The sensor thickness and the compact circuit size can reduce the discomfort in the oral cavity. Preliminary experimental results are reported and discussed.

7. REFERENCE

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