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# The Author Device Eye-Tronic

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## ABSTRACT

*Eye-Tronic is a proprietary device that measures the distance from the display of an electronic device to the user's eyes. This invention, consisting of an Arduino, an Ultrasonic sensor, a buzzer and a box made by 3D printer, aims to protect eye health.*

*Keywords*: *eye-tronic, Arduino, eye health, internet of things (IoT).*

## INTRODUCTION

Nowadays, the topic of the health of our eyes is more and more in focus. That is why we decided to create Eye-Tronic (Fig. 1). Most commercially available eye-tracking devices rely on video cameras and processing algorithms to track gaze. However, emerging technologies are making inroads that make camera-less eye tracking more accessible. Knowing this fact, we use an ultrasonic sensor and the Arduino microcontroller in our device, making the task of keeping distance from electronic devices easier. The goal of the development is to reduce as much as possible the risk of eye damage due to too small and incorrectly observed distance from the monitor.

## EXPERIMENTAL

The report has been developed by presenting information on a wide range of topics and issues that are directly relevant to the development of the Eye-Tronic proprietary device. These issues relate to trends under IoT policy related to encouraging the emergence of such inventions, the operation of microcontrollers and certain electronic components, 3D modelling and printing, and recommendations for healthy use of digital devices.

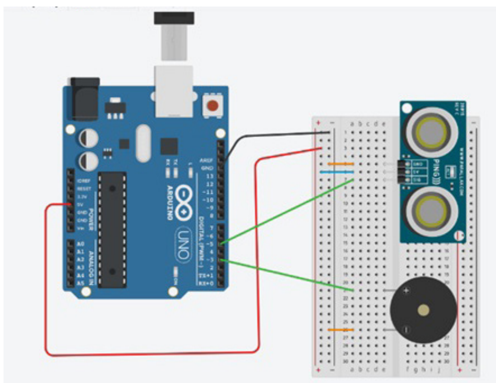

Fig. 1. Sample Electrical Schematic of the Eye-Tronic Device.

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**Materials and equipment**

- Ultrasonic sensor - Ultrasonic
- Arduino
- Wires
- Fusion 360 for 3d modeling
- 3D printer
- Filament PLA

**Steps for project implementation**

- Physical construction of the electrical circuit.
- Programming.
- Building the box that will house the device.

**Programming Arduino**

Using the C++ based Arduino language, we program the Arduino microcontroller to measure the distance using the ultrasonic sensor and to signal one of its pins when the distance is less than 60 cm. We do this to activate the beeper (buzzer) when we bring our eyes too close to the monitor.

After successfully connecting and programming the Arduino, you can design a compact box to contain the microcontroller and sensor. We chose a unique design and use a 3D printer to make the box.

Once we have the box, we fit the microcontroller, ultrasonic sensor, and beeper into it.

We need to attach (position) the box appropriately close to the display of the electronic device so that the sensor can measure the distance between the monitor and our eyes in the correct way. When we get too close to the monitor, then the beeper will signal us to move away.

## RESULTS AND DISCUSSION

The Internet of Things (IoT) policy outlines guidelines, regulations, and standards governing the deployment, use, and management of optimized devices and systems that are used in both every day and specialized use cases [1].

Due to this policy, many opportunities have been created for the use of sensors, microcontrollers as well as open access to programming and other functionalities.

Building on the above information, we propose the creation of a custom device that consists of an Arduino, an Ultrasonic sensor, a beeper (buzzer) and a box made using a 3D printer. The device aims to protect the eye health.

One of the parts used to make this device is an Ultrasonic sensor. Sensors are the primary converter of physical or chemical effects into a usable electrical signal. These devices are an integral part of automated control and regulation systems. The difference with a sensor versus a meter is that the sensor itself has no preset fixed values for the quantity being read. A sensor is usually part of a multi-meter system, but it does not operate independently. To perceive information from it, its signal first needs to be amplified and read into the system. Sensors are integrated in many devices that we use every day, such as the magnetic sensor in mobile phones, the motion sensor, etc. Their possible applications are practically limitless. The generic term sensor is related to the development of automatic control systems (ACS) as a component of the generalized logic chain: sensor - control device - actuator - control object. Sensors enable the interaction of modern electronic technology with the environment [2].

The ultrasonic sensor is based on the principle of reflecting the sound wave to obtain the distance to an object. Ultrasonic waves are high frequency sound waves above 20 000 Hz (20 kHz).

Ultrasonic sensors have two main components: a transmitter and a receiver, which are connected to a piezoelectric crystal (Fig. 2) [3]. An alternating voltage is applied to a metal plate to produce ultrasonic waves that are emitted into the air. This sensor emits ultrasound at a frequency of 40 000 Hz, which propagates through the air. If an object stands in the path of the sound, then the ultrasonic waves will be reflected and received back by the receiver in the sensor. Given the travel time and speed of sound, you can calculate the distance between the sensor and the object in front of it. This reflected wave produces an alternating voltage of the same frequency. Fig. 1 shows an illustration of the operation of the ultrasonic sensor.

To complete our project - Eye-Tronik, we need to use microcontrollers [4]. And now a few words about them.

Microcontrollers are extremely small microcomputers that are completely self-contained on a single chip. We need one to connect all the individual parts.

We can define a microcontroller as a simplified computer - one that is typically designed to repeatedly execute a basic program [5]. Microcontrollers are usually designed to perform a single automated task, as pre-programmed by the user, in a single device. They are designed to execute this job repeatedly (or in what is called a time loop).

Microcontrollers contain a microprocessor as one of their key components, but this is usually a much less complex and dynamic form of CPU (Fig. 3). This is because the microcontroller is usually limited to performing one very specific job.

A microcontroller usually works in conjunction with other types of components and electronic circuits connected via a printed circuit board (PCB).

One of the most popular and affordable microcontrollers now is the Arduino [6]. Arduino is a hardware and software platform used to build electronics. We can tell the board what to do by sending it a set of instructions.

An Arduino consists of both a physical programmable board (often called a microcontroller) and a piece of software, or integrated development environment, that runs on your computer, used to write and upload computer code to the physical board [7].

Unlike most previous programmable boards, the Arduino doesn't need a separate piece of hardware (called a programmer) to load new code onto the board - you can simply use a USB cable. In addition, the Arduino IDE uses its own programming language.

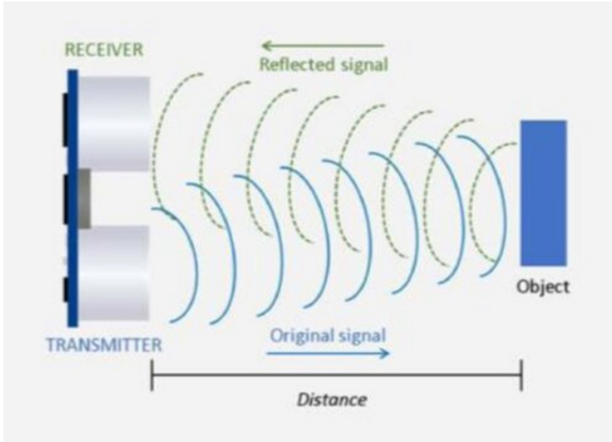


Fig. 2. Illustration of the operation of the Ultrasonic sensor.

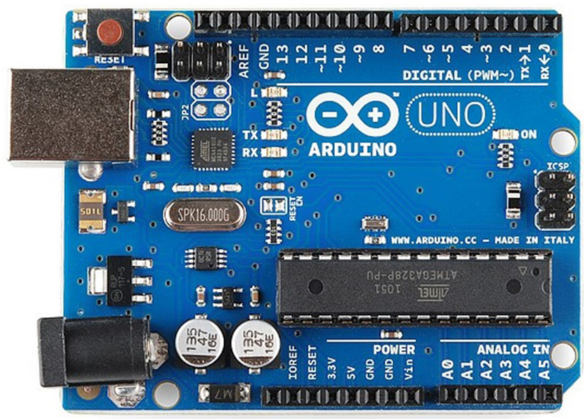

Fig. 3. The Arduino microcontroller.

Although Arduino is a popular choice for many projects, there are alternative approaches and technologies available for making our Eye-Tronik. One example of this is the Raspberry Pi.

Raspberry P. is defined as a minicomputer about the size of a credit card that is compatible with any input and output hardware device such as a monitor, TV, mouse, or keyboard [8].

Although computers have become so common, they are still not widely available in developing countries. This imbalance in access

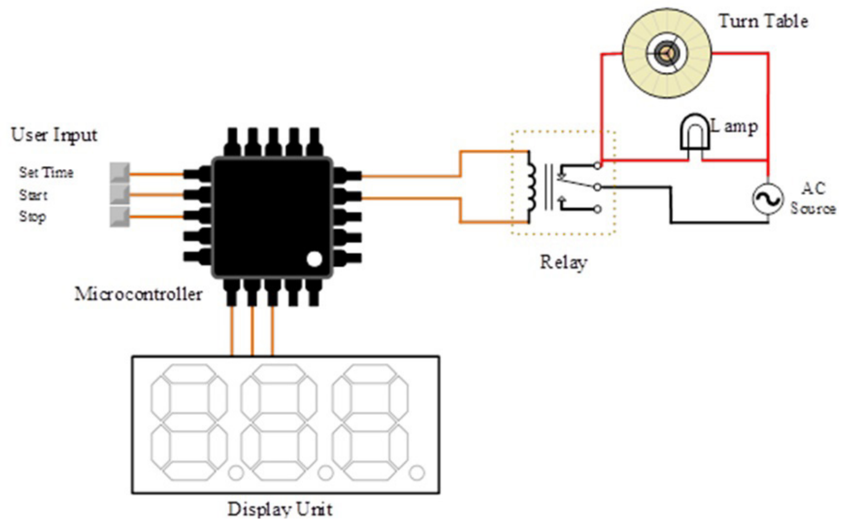


Fig. 4. Illustration of a real application, where the microwave oven can be controlled using microcontrollers.

to computers and programming technology led to the development and creation of the Raspberry Pi computer.

The main difference between the Arduino and the Raspberry Pi is that the Raspberry Pi is a general-purpose computer that runs an operating system like any other computer. On the other hand, Arduino is a microcontroller programmed to perform specific tasks [9]. This is exactly why we chose the Arduino microcontroller to implement our project, namely Eye-Tronik.

The time has also come to describe the most common applications of the microcontroller, and we will provide examples of its use in different situations.

Microcontrollers can also be used to control various devices, such as a microwave oven. As shown in Fig.3, the microcontroller can be used to obtain information from the user to set the timing, start and stop the operation.

Microcontrollers are also used to read sensor readings. So, we can connect light sensors so that we can detect the light intensity and automatically control the devices like streetlights. This also helps to save electricity as the light will never stay on during the day.

Another application of a microcontroller using sensors could be devices that need temperature control as in air conditioners. The microcontroller can be used to measure the current temperature and depending on the temperature value, the corresponding devices can be switched on or off.

Another application of microcontrollers is that they can play an important role in taking quick action in case of fire [10]. Microcontrollers can detect fire using heat and smoke sensors. They can be connected directly to the fire control room via Wi-Fi or mobile network. In this way, the response time of the fire department can be minimized, and the damage can be reduced.

As we know, the vehicles are moving towards self-driving cars. Microcontrollers can be used for several purposes, speedometer and auto braking. Ultrasonic sensors can be used to detect the speed of the vehicle while the auto braking algorithm can also be developed based on ultrasonic sensor.

There are many more applications of microcontrollers, but we'll move on to what we've done, how we've done it, and what made us do it.

Before that, we need to clarify what the experts' recommendations are for working with digital devices. For optimum comfort, your monitor should be 70-80 cm away from your eyes. Ideally, you should look at the computer screen at an angle of 15-20 degrees. To meet this condition, you need the top of the monitor to be 10-12 cm below eye level. This way, the eyelid covers more of the front surface of the eyeball and the eyes are better moistened. It is recommended to take 15-minute breaks every 2 hours of computer work. This is not only good for the eyes, but also for the whole body. Use the short breaks to blink, stretch and stretch [11].

## CONCLUSIONS

In this paper, we propose components and steps to develop the proprietary Eye-Tronic device, which aims to measure the distance from the display of the electronic device to the user's eyes and signal when we get too close to the monitor. The device can be created using a programmable microcontroller, an ultrasonic sensor, a beeper, and a box in which to place the parts.

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