

Eye controlled Home Automation

Ms. Tripti Prabhakar Vishwasrao¹, Mr. Ganesh Kishor Desai², Mr. Mahadeo Vikas Ajgaonkar³,
Mr. Prathamesh Vinayak Gardi⁴, Mrs. R. R. Kulkarni⁵

^{1,2,3,4,5} Department of Electronics and Telecommunication Engineering, Finolex Academy of Management and Technology, Ratnagiri.

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Abstract - The constant demand to improve daily living standards for paralysis patients or general people serves as a motivation to develop newer technology. The tasks once performed by big traditional computers are now solved with smaller smart devices. The study here talks about the development of a blink sensor device which is used for automated home designs. This sensor can detect an intentional blink from a normal blink, which is useful for all common people to regulate their home devices at ease without any help. Also, there are some added features in this project like as wireless communication between transmitter and receiver. This type of system doesn't use any voice assistant or any smartphone application to send command signals, due to which the use of the system becomes simple and everyone can use it. The system which is controlled by eye movements, can be used in companies where most of the work is done by sitting in front of the computers and concentration is necessary. Such home automation systems make human life comfortable whenever necessary.

Key Words: Arduino, Digital IR sensor, Motors, Glass Frame, nRF 24L01+

1. INTRODUCTION

In the era of modern technology, automation is taking place everywhere. From Home to Industries, the blessing of an automated system has improved the efficiency by a large magnitude. One of the great examples of the Automation System is the Home Automation. Some of the largest tech giants like, Google, Amazon, etc. already have flooded the market with the smartest home automation systems. There are many companies available in the market which provide the services of home automation. Some of them provide this service with voice control while some others provide it through mobile apps. But the user cannot concentrate on other things while giving commands to those devices. While using voice assistants for automation, pronunciation of commands must be accurate. If the user is using an app to control devices, then the user needs to carry a smartphone and watch on screen while sending control signals. Giving commands to those devices through eye movements can solve this problem. The system is designed such that users can concentrate on other things at the same time. This type of home automation can be helpful for paralyzed people also. Therefore, we decided to work on an automation technology, which people can control easily using their eyes.

The another plus point of the system is the components used in the system. The cost of these components is very less which reduces the overall cost of the system. These components are easily available in market. The programs which are used to perform the automation task are also designed such that

possibility of errors will be minimum. User can easily understand the commands which he has to use by listening the information given at the start of the system. By observing and analyzing in all aspects, this can be said that it is the best system in the domain of automation.

2. LITERATURE SURVEY

After analyzing certain review papers it has been observed that existing Home automation systems are based on protocols like voice control or device control. Generally devices including Bluetooth or wi-fi modules are used in home automation as they are efficient to control the things present in the surrounding area. Similarly, voice commands are also used to control things. The particular commands are pre-installed on the controlled to process further according to those commands.

Some automation systems are providing the facility of the internet, due to which it is possible to control things kept home even though the person is situated somewhere else in the outside world. Due to the use of such systems Home automation is becoming more popular in society as they provide comfort and luxury to people.

In the case of Home Automation using Eye Movements, certain projects have been implemented. These projects were build to make the Home Automation more comfortable and easy to use. Out of those projects some projects were comprised of microcontrollers like Arduino whereas others were using processors like Raspberry Pi. The main role is performed by the eye blink detection module used in such systems.

After some modifications paralyzed people can also use technology. They should be able to use devices which are considered to be basic in our day to day life is the main aim of this project. GSM module is used for communication, through which the message is sent to the system through which the command will be given to the system and according to that signal applications will be turned on or off.[1]

In this paper the guidelines are given to develop a user-friendly automation system. The complexity of hardware is reduced. Opto Coupler is the device used to detect eye movements [2].

Some systems utilize EOG (Electrooculography) signal for home automation. Paralyzed people can control things using brain waves. Signals are captured by electrodes and are further processed in python. In such cases amplification plays an important role.[3]

To observe the fatigue condition of the driver using his / her eye movements can be done by eye movement detection. By monitoring the eyes and mouth, the symptoms of driver fatigue state are checked. The system comprises of Eyeblink detection module including a camera.[4]

Some industries are developing technology for ALS affected patients. ALS is a disease due to which certain parts of patient's body stop working. They are making projects in which Camera mouse software is used for the detection of eyeball movements[5].

Along with these sources there are many research papers and projects in which various image processing methods are used for detection of eye blink. The System that can assist the paralyzed people System can be made which observes the eye movements using digital techniques. Digital image processing techniques like Haar Transform, Blinking detection using Contour extraction and Gabor detection are used.

In many projects various sensors like opto – coupler are used for detection of eye movements. Whereas in some projects the ETU driver is used to give remote access to user for the system.

3.PROPOSED SYSTEM

3.1 Analysis/Framework/Algorithm:-

Steps to use the system:

Step 1: Start the system and apply goggles on the eyes.

Step 2: As the system gets started, check that whether the system is displaying output correctly or not.

Step 3: Listen to the information about the eye blink patterns which will be given at the starting of the system.

Step 4: Blink the eyes as per pattern to run the application which you want.

Algorithm of program:

1. Mention the libraries which are required for the program.
2. Define the variables and counters.
3. Define the status of the pins.
4. The first two seconds are considered as control signals to start the system. Hence before the execution of every sequence eyes must be closed for two seconds. This two-second time is already adjusted in the program.
5. The sensor values are stored in the variables described above.
6. Those values are then compared with different combinations stored previously.
7. When the input taken from sensors match with any combination of applications then that particular application will be turned on or off.

3.2 System requirements:

3.2.1.Glass Frame:-



Fig. 3.2.1: Glass Frame

Ordinary glass frame with normal glass to setup IR sensor so that IR reflects on the eye and receiver can receive the signal and Arduino Mega with a five-volt battery and RF Transmitter to transmit data to another Arduino to control Relay.

3.2.2 Digital IR Sensor:-

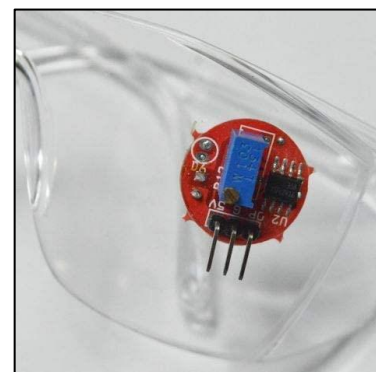


Fig. 3.2.2: Digital IR sensor

Digital IR sensor is used in this system to detect intentional eye blink. The delay between the two eye blinks is considered in the program so that the system will not send any unintended value for further processing. Due to the use of digital sensors the input sequence will only contain zero's and one's which reduces the complexity of the system. This digital IR sensor is fitted on the glass frame.

IR transmitter and Receiver, Opamp and variable resistor(Trimmer pot) are the three main parts of this system.

IR LED Transmitter : IR transmitter is nothing but LED, which emits light in the range of infrared frequency. There are certain ranges in which light rays are divided according to their frequencies. The frequency of IR rays is very small than the visible light range. Hence human eyes cannot observe this light..

Photodiode Receiver : Everyone in the world of electronics is known about the Photodiode which generates electric signal as soon as light is incident on it. It is a semiconductor device operated in reverse bias condition. Due to this property of photodiode, it is used as optical receiver in digital IR module.

This photodiode detects the light transmitted from IR led transmitter and generates current proportionally.

Variable Resistor : Variable resistor is a device whose resistance can be changed manually. In our case it is used to adjust the distance range between the IR transmitter – receiver and eyelids. The distance between eyelids and IR sensor varies from person to person. Hence variable resistor is necessary in our project for better performance.

OPAMP : OPAMP is used as a voltage comparator in IR module which is used in our system.

3.2.3 Arduino Mega:-



Fig. 3.2.3: Arduino Mega

Arduino Mega 2560 is a microcontroller which is used in automation projects due the various features provided by it. The Atmega 2560 is the backbone of Arduino Mega 2560. In our system two such microcontrollers are used: one at transmitter side (Arduino 1) and other at receiver side (Arduino 2). The Arduino 1 is connected to digital IR sensor which detects the eye movements. This Arduino converts the signals coming from the sensor into electric signal and transmits them on nRF 24L01+ module. On the receiver side other nRF 24L01+ module receive those signals wirelessly and send them to Arduino 2 for controlling applications.

5V RF Relay Module:-



Fig. 3.2.4: 5V RF Relay Module

5V RF relay module is used to connect Arduino controller to applications. The relay module which is used in this system can manage four applications simultaneously. The state of relay can be made high or low using program.

3.2.5 nRF 24L01+ Module:-

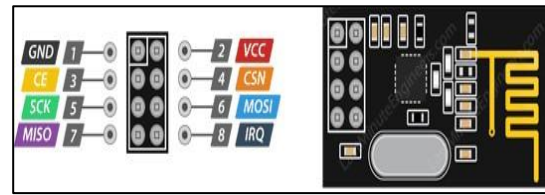


Fig. 3.2.5 : nRF 24L01+ Module

nRF 24L01+ is the module which is used for wireless transmission in our system. One module is attached to transmitter side while the other one is attached at receiver side. The module which is attached at transmitter side is configured as Master and the module which is attached at receiver side is configured as Slave to follow SPI protocol for communication. There are six nodes available on this module.

3.3 Design Details:-

The system contains Sensors like Digital IR sensor and Microcontroller Arduino Mega. The digital IR sensor is fitted inside the glass frame which captures the movement of the eye. The signals are sent to the transmitter from the sensor for wireless transmission. The receiver receives the signals and sends them to the Arduino mega for further processing. And according to that signals applications at the end will start working.

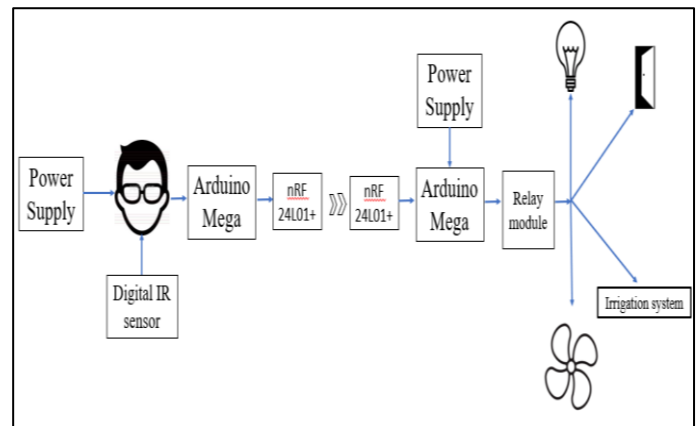


Fig. 3.3: Block Diagram

3.4 Methodology:-

The system consists of four major embedded electronics components: Digital IR sensors as the Eye Blink sensor, Arduino compatible Micro-controllers, and nRF 24L01+. Additionally, a rechargeable lithium ION battery is attached with the both Transmitter Glass Frame Module and the Receiver Module. Both Transmitter Glass and Receiver Modules are connected wirelessly. The digital IR sensor is a Reflective Optical Sensor which can measure the intensity of IR bounced back on the eye or eyelid. As of its' cheap price and availability it suits best for our needs. When the eyes are closed the reflection value gets lower than when the eyelids are open. Therefore, it is easy to identify whenever the user closes the

eyes for a specific interval. As eye blink is a natural process of the human body, therefore, specified patterns are specified to activate the system. Whenever the user closes the eyes for 2 seconds, the system identifies it as the start for taking action and gets ready. Otherwise it will take the eye blink as usual unintentional human behavior and the system will do nothing. Here the input will take after the system is ready to take the action after triggering the IR sensor and this system will work as per instructions.

4. CONCLUSION

This venture is essentially for paralysis patients who endure a great deal. The attempt is made a little bit through this venture so that at any rate they can control the home appliances. An additional plan is made to enhance this venture with better showing advantages an eye blink sensor is a transducer which detects an eye blink, and gives a yield voltage at whatever point the eye is shut that can help the patient to control the home apparatus and others, for example, switch on-off the light or control the fan speed and also call for assistance. To sum up we want to say this is doing works using Arduino and various sensors was a great experience as many valuable things are learned. This project will be useful mainly for paralysis patients and senior citizens. Though we are thinking about the prototype of the project our design is ready but to introduce it in real life a lot more improvements and also equipments are needed. One of the main motives of this project was to help patients to make their life easier and our system will be fulfilled when we can use the system in real life and people will be benefited.

5. RESULTS

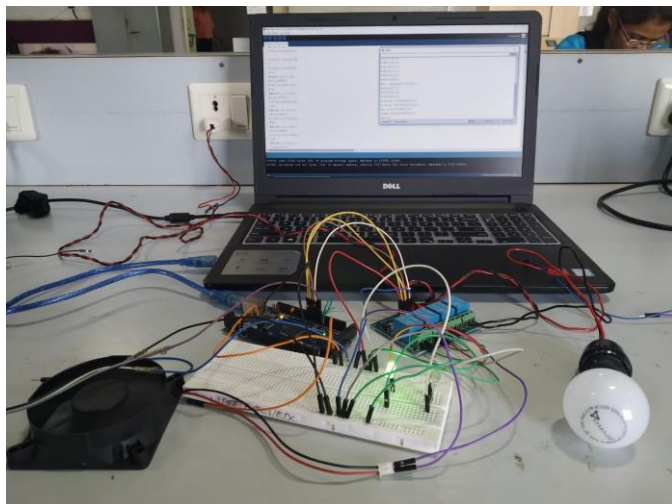


Fig. 5.1: Turning on fan using sensor module

Here, it can be observed that the fan is turned on after the perfect combination is passed through eye movements. Laptop screen is used for verification purpose only.

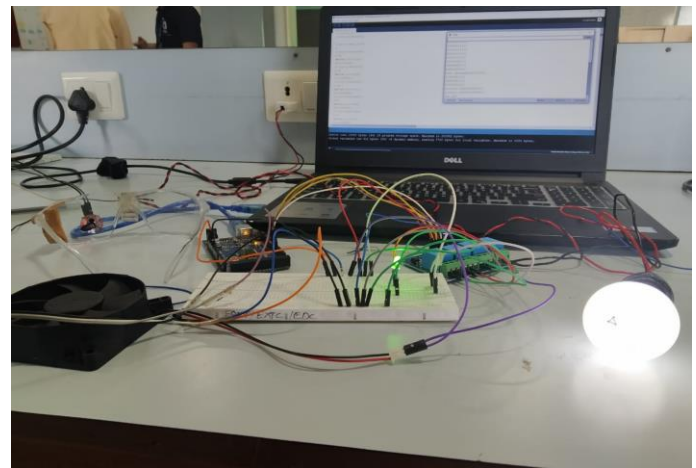


Fig. 5.2: Turning on bulb using sensor module

Like as fan, bulb can be also turned on by sending the appropriate signals through eye movements. Figure above indicates the same.

6. FUTURE SCOPE

The proposed automation system is very helpful for all people. Still some more modifications can be done in system to make it better. The system can be connected to Internet so that the data can be stored on the cloud and more facilities can be provided to user. The current system can be made more compact and precise in future. Including new technology will make the system more accurate.

7. REFERENCES

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