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Smart Glasses – An Intelligent Real-Time Information Displaying Device

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Abstract - *Recent advancements in electronics and smart technology have focused on creating smart devices having multiple features. With the launch of Google Glasses, the head-mounted display has become a popular technology that included many features which solve daily life problems. This paper proposes designing, implementation, features, and future scope of Smart Glasses. Smart Glasses are wearable head-mounted display that is attached to the frame of spectacles or sunglasses. Using the module of Smart Glass, spectacles work as a transparent screen to show phone notifications without hindering the sight of the user. Smart Glasses can be used in daily life activities such as driving so that the user can focus on hands-on activities and can receive notifications without getting distracted. The objective of the project is to implement a real-time information processing virtual display at a low cost.*

Key Words: **Smart Technology, Smart Device, Head-mounted Display, Virtual Display, Real-time Information Processing.**

1. INTRODUCTION

Today, innovations emerge every day; one such innovation is Augmented Reality. Smart phones and media devices have become commonplace, and they are an excellent way to access sound, video, and the internet. [1] In 2010 Google came up with a product called Google Glasses that could provide a head-mounted screen showing the exact display of a smart phone screen. [2] Smart Glasses are one such device having real-time caller-id display functioning, useful when hands-free notification perceiving is required without actually holding a device. The device can also show the exact date and time to the user. [3] For displaying information to the spectacle screen, concepts of Refraction, Reflection and Magnification are utilized. The module of Smart-Glasses is attached to a spectacle frame. The module can be detached and again attached to the same or any other spectacle frame. The casing consists of a micro-controller, a serial input receiving component, a display screen, a mirror & a lens that is attached to the transparent thin film in the end. The tilted thin film is directed to the eye of the user wearing the module. When the module is paired with a smart phone, serial data of date and time or caller-id is sent to the serial input device. The data is then processed by the micro-controller and redirected to the display screen. In the Smart-Glasses project, the Bluetooth HC-05 module was used as a serial input device, Arduino Nano ATmega328p was used as a micro-controller and a 128x64p SSD-1306 OLED screen was used as a display screen. The information was shown to the user, using the reflection and magnification phenomenon.

These phenomena are described below:-

Reflection- When a Beam of Light is redirected towards the source, when it falls on the surface of an object, then this phenomenon is called 'Reflection of Light'.

Governing laws- The angle between the normal and the incident ray is equal to the angle between the reflected ray and the normal. Both of these rays, The incident point and the normal exist on the same plane.

Magnification- It refers to the process of optically magnifying an object with the use of lenses.

2. RELATED WORKS

The use of a computing device that can be worn as an accessory in day-to-day life, to send or receive information is called Wearable Device Technology. The technology of Smart Glass has emerged recently in the market but various day to day applications have been derived out of it. In 1981, Steve Mann developed a helmet comprising of an antenna that could send or receive data wirelessly [4]. The revolutionary optical head-mounted display was developed by Google X that could replicate the smart phone screen. It was an interactive device with various gesture features as well as voice assistance [5]. The data was shown to the user through an LCOS-display. The device also had a camera that could record frames in 720 pixels. The screen was titled to a 45° angle to reflect the rays to the eyes of the user.

The major issue of the device was the tiny space available for the components and the inclusion of too many features within the device, due to that, fast processing could not be done by the device. Furthermore, the LCOS display required a continuous power supply resulting in heating of the module. Object detection using retinal Smart Glasses was proposed by Babak Taraghi [6], which can be extremely helpful in self-driving cars and robotics. The fourth generation of Smart-Glasses was proposed in [7]. A MEMS scanner was proposed by [8] using Smart-Glass technology

that was able to record the contraction and functioning of the iris. For marking the attendance of students the smart retinal glass was proposed by [9] that could also store the data in the cloud. By [10] a method to use Google-Glass in surgery with the help of an inbuilt camera was suggested.

3. COMPONENTS REQUIREMENT

1) OLED SSD1306 display.
2) Bluetooth Module HC-05.
3) Arduino Nano ATmega328p.
4) Jumper wires.
5) Lens, Mirror and Transparent film.
6) Casing for the device.
7) Battery.

3.1 COMPONENTS DESCRIPTION

- A 0.96 inch 128x64p SSD-1306 OLED screen display is used to show the output obtained from the Arduino in the Smart Glass module.
- Bluetooth Module is used to receive serial input from the paired mobile phone after which it sends data to Arduino Nano.
- Arduino Nano is a 14 pin micro-controller that operates on 5V or 3.3V. It processes the input from the Bluetooth module and commands the OLED display.
- Lens, Mirror and film are used to show visible information to the user without hindering the sight.
- A battery is used as a Power supply for the real time information processing in the device.

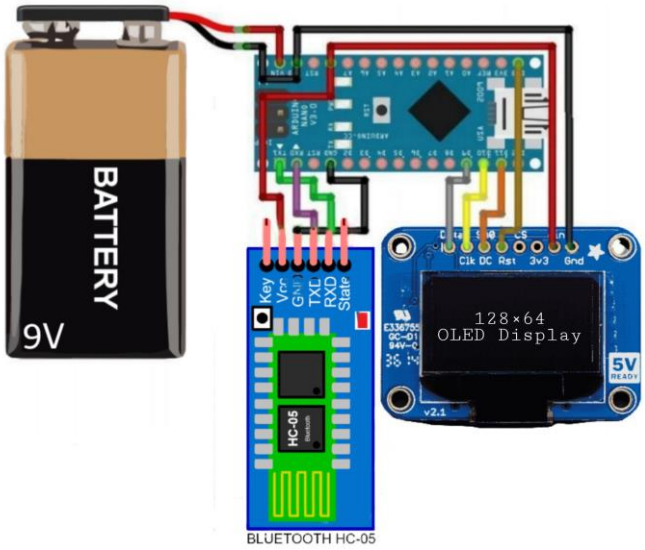

Fig. 1 : Connection Diagram

4. SOFTWARE REQUIREMENT

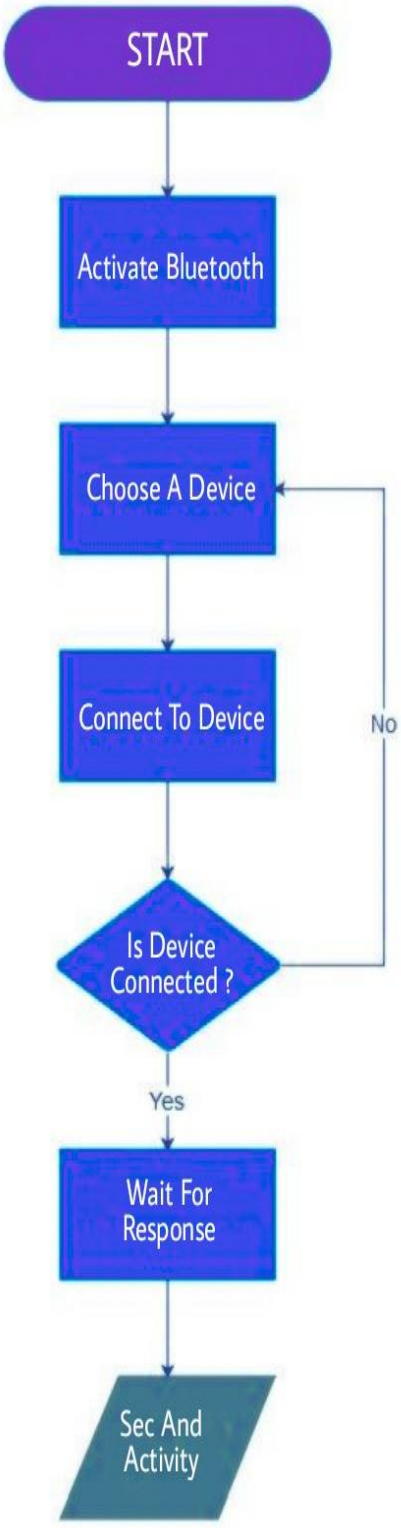

Fig. 2 : Application Flow Chart

A smart phone application provides an interface for the connection and serial communication with the Bluetooth module.

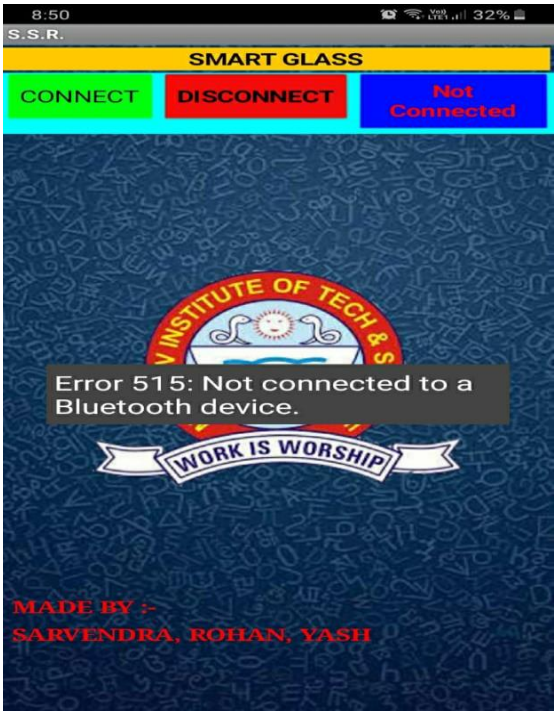

Fig. 3 : Application Not Connected

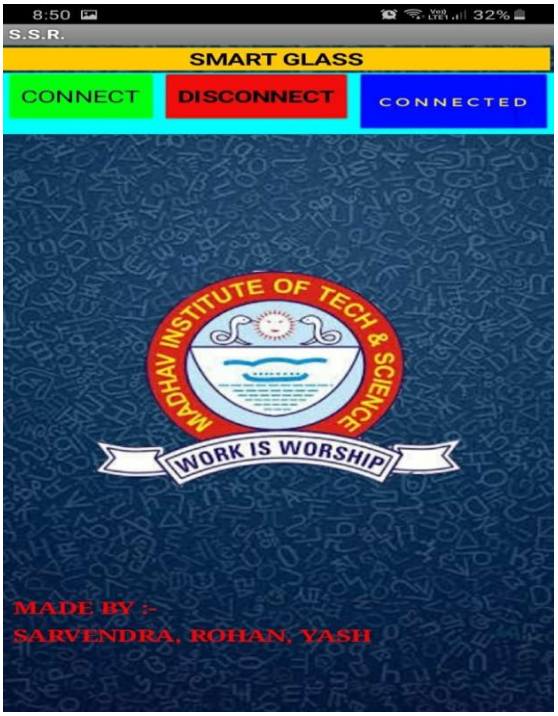

Fig. 4 : Application Connected

5. WORKING

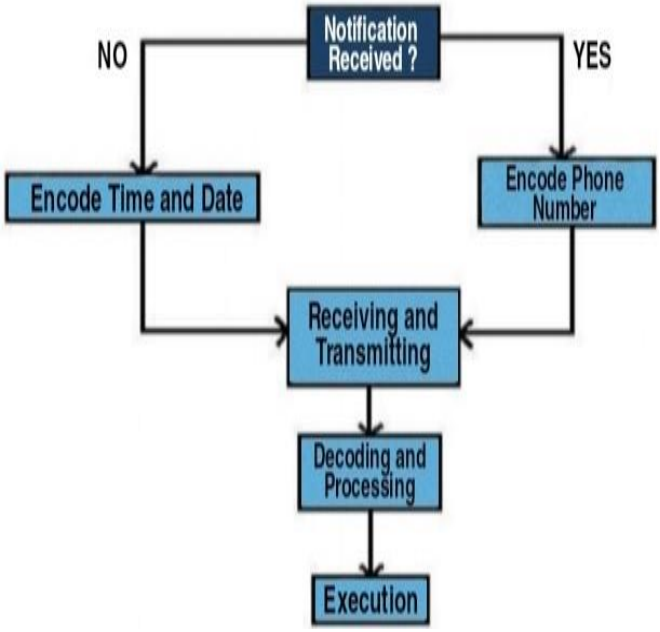

Fig. 5 : Flow Chart of Working

The smart phone application is paired with the Bluetooth module. The Bluetooth module continuously gets serial data through the phone. If a call is made to the paired device, the caller-id of the caller is sent to the module which is directed to Arduino. The Arduino processes the input and then commands the OLED display to show the notification of the call along with the caller-id in real-time.

If there is no notification on the phone, then the real-time data of the date and time is sent to the Bluetooth which is further processed by Arduino and shown on the OLED display.

Fig. 6 : Smart Glass

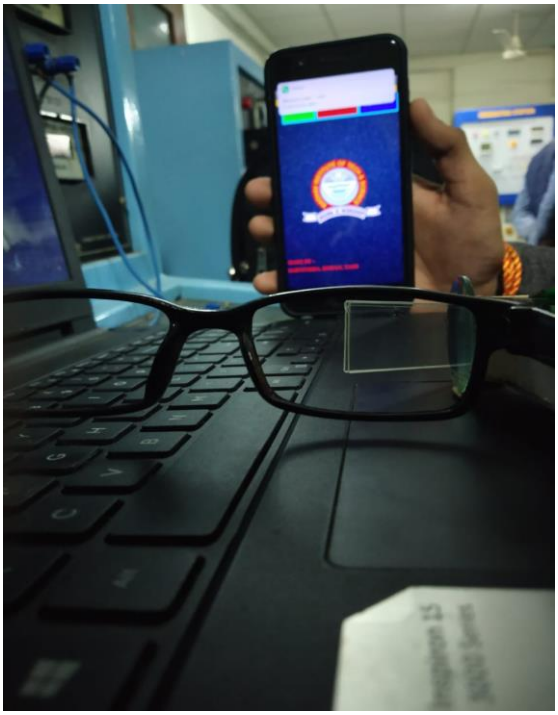

Fig. 7 : Device Not Connected

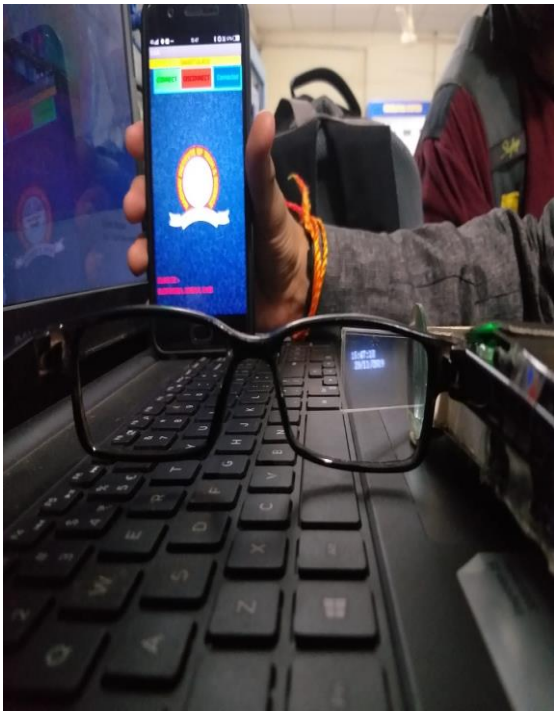

Fig. 8 : Device Connected, Showing Date and time

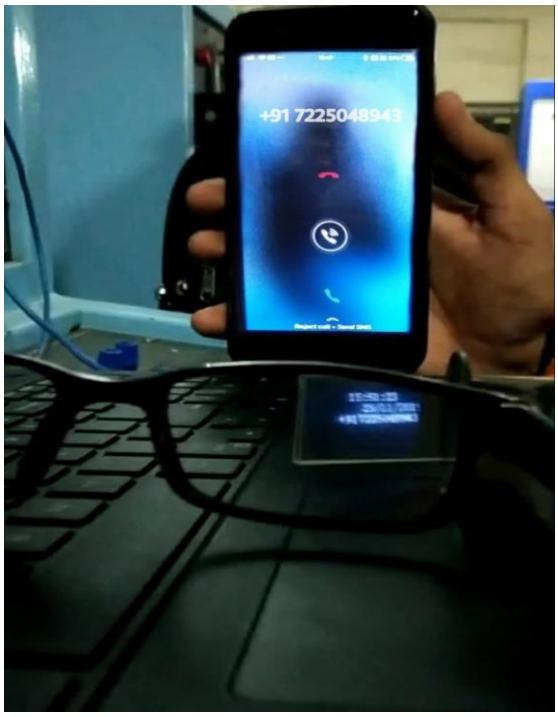

Fig. 9 : Caller Details on the screen

A one-side silver polished mirror is attached to the module casing. It is at an angle of 45° to the OLED screen. The mirror reflects the light by a 90° angle. Then the attached convex lens magnifies the image in such a way that the user can view the image. Then the rays are again reflected by 90° by the thin transparent film which is titled at an angle of 45°. By using the reflection and magnification phenomenon the user can view the information at the spectacle screen easily without any hindrance to the sight.

The smart phone application pairs the Bluetooth module with the smart phone. When notification of call appears on the smart phone, the serial data of caller-id and notifications alert is sent to the Bluetooth module else the serial data of Date and Time is sent.

6. FUTURE SCOPE

The module uses Bluetooth technology for communication which is fast, reliable and secure. The range of communication is 10M and supports the latest Bluetooth version. The module is attachable to any spectacle or sunglasses frame. It does real-time information processing with the help of a smart phone application which works on Android 4.4 and above. The Use of a lens and transparent film provides a clear view of the screen to the user without hindering sight.

The module of Smart Glass can provide its niche utility of displaying real-time phone notifications. But the module can be used in various domains such as Medical Surgery,

Defense, Teaching and could be used to solve other daily life problems where the hands-free display is needed, by changing the Arduino and smart phone application coding as per utility. With the use of smaller micro-controllers, the size of the module can be reduced.

The components such as GPS, camera, Bluetooth earphones, etc can be added to the module that can include more functionalities but also increase the cost and size of the module.

7. CONCLUSION

The low-cost, efficient, highly effective and real-time information processing head-mounted display of Smart Glasses was created and the proposed functionalities were implemented. Smart Glasses can be used when the user's hands are not free to hold a device and the user simultaneously needs to perceive information from a screen. It can be attached to any usual spectacle frame easily. It is lightweight and economical and its components are easily available. By software and hardware changes the functionalities can be easily increased.

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