Arduino Based Smart Glasses

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Abstract- *The main objective of this electronic document is to depict Arduino based smart glasses as Head Worn Device (HWD) to display real-time information on multi-meter directly in user's field of vision using suitable techniques. This report will discuss the development of the architecture behind a simple but unique and effective model of Smart Glasses. This glasses will pave the way to serve for more complex tasks that is to provide users with information and services relevant to their contexts through an augmented vision.*

I. INTRODUCTION

We have worked upon designing of the optical system such that information on the O-LED display is shown by this system comprising of combination of lenses, mirrors and translucent materials such as acrylic glass that give the user an augmented sense of vision. Hence now the implementation of a unidirectional communication link that delivers the real time information from multi-meter to the Arduino that will display it over the O-LED display remains a pending problem. Making design compact is also an issue.

II. BLOCK DIAGRAM

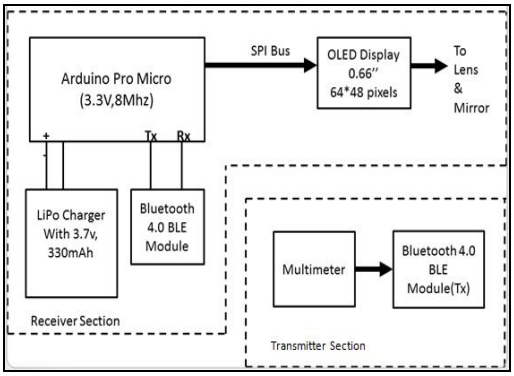

Figure 1.

III. WORKING

The need for designing of the hardware such that information on the O-LED display is shown at Distance of Distinct Vision i.e. 25 cm to the human eye and still keeping the design compact as well as providing an augmented sense of vision of information to the user led us to the solution that the phenomenon of 'Pepper's Ghost' and creation of virtual images by the convex lenses and plain mirrors will do the same. Augmented vision is achieved as shown in the below steps.

The data once displayed on the O-LED display the augmented vision is provide by the virtual image of the information created by the convex lens.

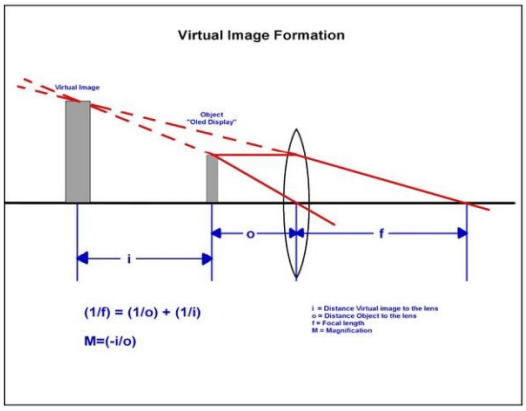

Figure 2. Virtual image formation by convex lens

The virtual image of information on O-LED is obtained the plane mirror that acts as virtual object for the convex lens and hence provides an advantage of making the design compact. Consider the object ABCD with its axis as ZZ' as shown in the figure. The mirror being placed at an angle of 45 degrees to the object the axis of image formed i.e. Z1Z1' is perpendicular to the axis of object i.e. ZZ'. The convex lens is fixed such that the principal axis is parallel to the image and the addition of distances and

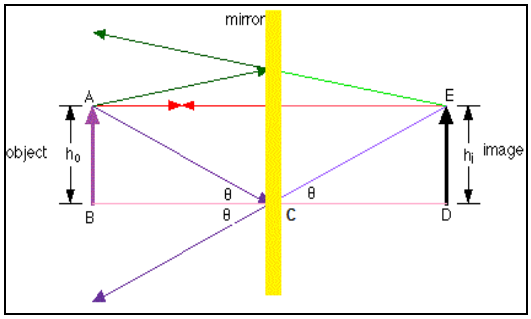

Figure 3. Virtual image formation by plane mirror

convex lens is such that their combined distance is less than that of focal length of lens in order to get the virtual,

magnified and erect image of information at a distance of or greater than DDV of the virtual image in mirror acting as virtual object for convex lens. The virtual reality experience is based on the principle of Pepper's ghosts provided by translucent acrylic glass placed at an angle of 45 degree to observer and principal axis. It acts as a reflector to the virtual object which is actually virtual image formed by convex lens. Since it is acting as reflector the image is sensed at a distance which is the addition of distances between reflector and lens as well as distance at which image is obtained from pole.

Pepper's Ghost Phenomenon: The light when incident on a transparent material some of them is reflected some of the light is refracted and some is tress-passed depending accordingly to the Fresnel's Laws. Most of the light from the lit stage is passed through the glass, while some of the light from the hidden room is reflected to the audience giving them an illusion of ghost

The lens formula used is (1/v) - (1/u) = (1/f). Keeping the values as u = -7.3cm with f=10cm we did in our project we get an v =-27.03cm where the negative values indicates it lies in the left side of lens and a magnification (M=3.7)

IV. COMPONENTS

1. Arduino pro micro (3.3V)
2. Bluetooth enabled Digital Multi-meter
3. Bluetooth Module.
4. O-led display(0.66")
5. Lipo-Battery (330mAh)
6. Lipo Charger
7. Convex Lenses of focal length 10 cm
8. Acrylic glass (3cm/5cm)
9. Plane Mirror (2cm/4cm)

V. DESCRIPTION OF COMPONENT

A. Arduino Pro Micro

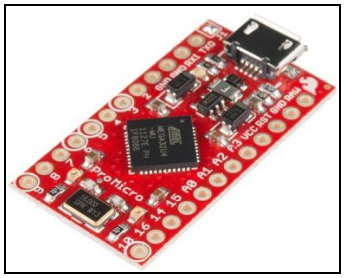

Figure 4. Arduino Pro Micro

Arduino pro micro has 9 channels of 10-bit ADC, 5 Pulse Width Modulation (PWM) pins, 12 Digital I/Os as well as hardware serial connections Rx and Tx. Running at 16MHz and 5V, this board is also compatible with previous Arduino-compatible boards with an added advantage of its portability. There is in-built voltage regulator so it can accept voltage up to 12volt DC.

B. Bluetooth Module 4.0

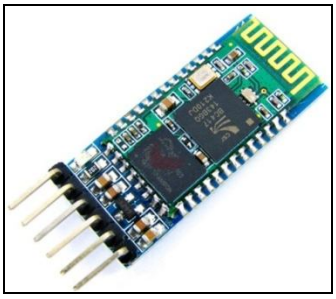

Figure 5. Bluetooth Module 4.0

Low energy consumptions are provided by Bluetooth 4.0 module. This module has integrated antenna and is able to run Bluetooth protocols and profiles. A maximum communicating range of 100 meter line of sight distance, a maximum data rate of 3 Mbps, and a frequency band of 2.40GHz to 2.48GHz.

C. Fresnel lens

Figure 6. Fresnel Lens

Augustin Fresnel (French Physicist) invented this lens in 1822 to use in lighthouses. The Fresnel lens are thin as paper but allows the magnification just like regular glass lenses do. The focal length of this lens is 10cm.

D. O-LED display:

Figure 7. O-LED Display

The graphic OLED display module consists of 64x48 individual blue OLED pixels. Diagonal of this module is I2C/4-wire serial interfaced. A power supply of 3.3V is needed as it has its own built in voltage. There is no need of backlight since the display makes its own light simultaneously reducing the power required for the operation of OLED. That is why the display has high contrast, wide range of viewing angle and a high range of operating temperature. Connector are not needed as the FPC is the soldering type that is to be soldered directly on PCB.

It's easily controlled by microcontroller units such as 8051, PIC, AVR, ARDUINO, ARM and Raspberry Pi.

E. Bluetooth Enabled DMM:

The tool may be used for debugging of electronic circuit, circuit testing, design and manufacture, education and training, automobile maintenance and testing. Some of it's features are:

1. Data- saving, recalling and comparatively analyzing.
2. It is remote control supported and the measured value is known via voice-reading
3. Display: 6000 count.
4. Resistance: 600.0Ω or 6.000kΩ or 60.00kΩ or 600.0kΩ or 6.000MΩ or 10.00MΩ.
5. Frequency 40Hz - 400Hz.
6. More than 1 device could be monitored, assuring more measurement safety.

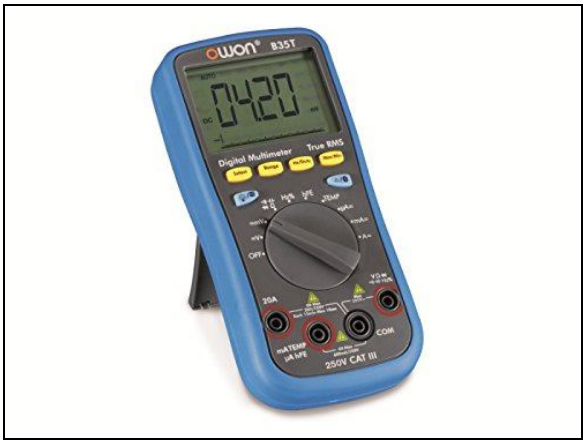

Figure 8. Bluetooth enabled DMM

VI. FUTURE SCOPE

a. Next generation of glasses can be constructed : If the communication between glass and device is made bidirectional and the extending the number of connected devices in the network simultaneously making communication peer to peer next generation of glasses can be constructed.
b. Navigation and calling : If the glasses are associated with cellular technologies and internet features of calling could be possible.
c. Improved to next level by image transmission : In addition to these the project can be taken to a whole next level by enabling image transmission hence video calling, live video streaming and navigation can be possible.
d. Merging of Sixth sense technology : Merging of Sixth sense technology can make Human Computer Interface control hands free and hence can be used as universal remote control
e. Sighted companion for blind and deaf people : Sighted companion for blind and deaf people by giving them information of environment by perceiving info of surroundings. Can be a help for deaf people by bone conduction technology.
f. Smart Glass for Training and Education

VII. CONCLUSION

1. In short spectacle based computer providing an augmented vision will be residing directly in front of vision of our eyes and hence accidents of technicians will be avoided.
2. Sky's the limit when considered these technology. One can do so much with these glasses that probably is the reason to cause these powerful technology under theethical concerns of society.

3. Despite these glasses have pros and cons, only advantages can be seen at foundation levels and hence is the boon when explored at basic levels.

VIII. ACKNOWLEDGMENT

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