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Augmented Reality Based SMART GLASSES

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ABSTRACT

Smart- Glasses are the wearable computing device which can be attached to the spectacles or sunglasses of the user and can be paired with Smart Phones, via Bluetooth or Wi-Fi. In this paper, the authors are using the concept of Augmented reality to put a projection of user's smartphones notifications such as Date, time, incoming calls, text messages to the user's spectacles which acts as a virtual transparent screen to show those notifications while at the same time viewer can be interactive to surroundings without hindering his/her usual tasks in real-time.

Keywords : Smart- Glasses, Augmented reality, the wearable computing device

I. INTRODUCTION

Today new technologies are emerging every day, one such technology is Augmented Reality, Smartphones & media devices are very popular & are a great way to receive audio, video and accessing the internet. After 2010, the Google Glass came in the market which was the wearable device in form of glasses helped to continue lots of research & applications [1]. One of the uses of this device is to avoid accidents. Most accidents happen in the city due to the distraction caused by phone calls while riding. This could be developed as a device that helps in delivering message notifications and navigates users through the helmet, causing lesser distractions thereby making it a safe ride. To make up the projection onto the glass screen the authors are utilizing the following concept

- The basic laws of physics namely Reflection & Magnification.
- Microcontroller Arduino NANO ATmega328p & its programming.
- Bluetooth module HC-05 for the integration of IoT.
- 3-D designing using Solid Edge.
- Laser-guided cutting for making the case.

This paperwork is inspired by the idea of a Smart multimeter display created by Alain's project [23]. Even further our vision to extend this work is to integrate an image recognition camera & integrate machine learning & Artificial intelligence to automate the process of attendance system in the classroom. In the proposed design, the device is made as a mounting on frame which can be joined with any glass spectacles [2]. It runs on Arduino Nano Micro-controller having ATmega328p Microcontroller (MC), which is programmed to connect with Smart-Phones through an android application. A Bluetooth module, named HC-05 is interfaced with Arduino Nano to connect with smart-phones. A DC battery of 9V is used as the power supply for Smart- Glass. SSD1306, 0.96" OLED display is interfaced with Arduino Nano, which displays the data received from Smart-phones, Smart-

Phone application is used to transmit data of the phone, i.e.; Date, Time, Notifications of Phone call and Text messages [3].

Reflection & Magnification phenomena

Reflection of Light is the process of bouncing back the ray of light which falls on the surface of an object [5].

There are three laws that govern Reflection and Refraction.

1. The angle of Incident Ray with Normal(i) EQUALS Reflected Ray with Normal(r). (i=r)
2. Popularly known as **SNELL'S LAW** it is n1*sin i=n2*sin e where 'i' is the same as above is the angle of refracted beam with normal.
3. The incident ray, reflected ray, refracted ray and the Normal at the point of incidence all lie in the same plane. The plane is referred to as *plane of incidence.*

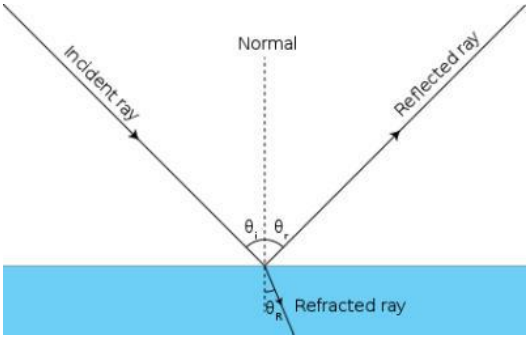

Fig. 1. Reflection of Light [6].

Properties of Reflection by plane mirror [7]. -

1. The size of the image is equal to that of the object.
2. The image formed is as far behind the mirror as the object is in front of it.
3. The image is laterally inverted.
4. The image formed by a plane mirror is always virtual and erect.

Magnification by the Lens (magnifying glass)

A magnifying glass is a convex lens that is used to get a magnified image of an object. The lens is fixed in a frame with a handle. It consists of many very narrow concentric ring-shaped lenses, such that the combination acts as a single lens but is much thinner. This is known as the Fresnel lens [8].

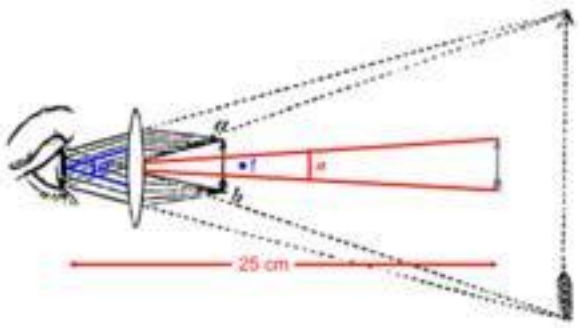

Fig. 2. Concave lens (Magnification process)

magnification is calculated using the lens' maker's equations [10]

$$1/f=1/v-1/u \quad (1)$$

Where f is the focal length of the lens, u is the distance of the object from the lens and v is the distance the image is formed from the lens.

$$M = vu \quad (2)$$

The size of an object's image is larger (or smaller) than the object itself by its magnification, M. The level of magnification is proportional to the ratio of v and u. An image that is double the size of the object would have magnification M=2.

Application

The following are the applications of our developed project & its technology in the real world.

Medical Field - In MRI scanning & to do complex surgeries, AR technology can go to the in-depth and efficiency of tasks such as examining the human body in an interactive 3D format.

Modern Market - In today's shopping trend, shoppers are using their smartphones to compare prices & look information on products they are using, by developing an AR app that shoppers can use to have a demo simulation.

Manufacturing & Maintenance - One of the biggest industrial use cases of AR is for repair and maintenance of complex equipment. Whether it's a car motor or an aircraft machine, repair and maintenance staff are beginning to use AR headsets and glasses while they perform their jobs to provide them with useful information on the spot, suggest potential fixes, and point out potential trouble areas. This use case will only continue to get stronger as machine-to-machine IoT technology grows and can feed information directly to AR headsets.

Designing - In interior design & architecture and construction, AR is helping to simulate their final products & structures. The use of headsets enables architects, engineers, and designers to view directly their buildings and models to see how their designs might look, and even make virtual plans on the spot. City planners can even model how entire city layouts might look using AR headset visualization. Any design or modeling work involving designs is a perfect tool for AR.

Education Field - The smart classes are becoming smarter by advent of 3D viewing technologies, making the projections of course materials & chapter contents, learning is more
enhanced & students become more interactive to view everything in 3D.

Entertainment & gaming industry - The biggest use is in the gaming industry, with the games like Pokémon – go, AR technology makes the game more interactive & livelier as every event seems to happen in the real world. Users feel better immersed in the game making the whole new experience. In entertainment sector, making devices using IoT that can stream audio, video news feed in front of viewer's eyeglasses opens a whole new range of market for these devices.

Public Safety & defense - At times of emergency today, people will immediately reach for their smartphone to find out what's going on, where to go for escape, and people are safe or not. First responders can arrive on the scene of a fire or earthquake trying to figure out who needs help, and the best way to get them to safety. AR is solving both issues of public safety, responders wearing AR glasses can be alerted to danger areas and show in real-time individuals that need assistance while enabling to still be aware of their surroundings. For those in need, geolocation enabled AR can show them directions, and the best route to, safe zones and areas with firefighters or medics. Military or intelligence spy's wearing AR glasses can monitor any suspect or terrorists.

Working of the proposed design

The following are the main steps that are implemented during the whole process [3].

- Notifications Received.
- Encoding.
- Transmitting and Receiving.
- Decode and Process.
- Execution.

The app on the phone creates a virtual server between the Bluetooth module & Arduino Nano. Data in the graphic form such as time & incoming call notification is transmitted to 3 Arduino's digital pin. The digital pin being connected to OLED forms the visual. Visual formed is reflected by a mirror at 45 degrees' inclination in the case. Reflection received is magnified by a concave lens & then projected to acrylic screen forming a prism-like 3D projection of visual to the human eye.

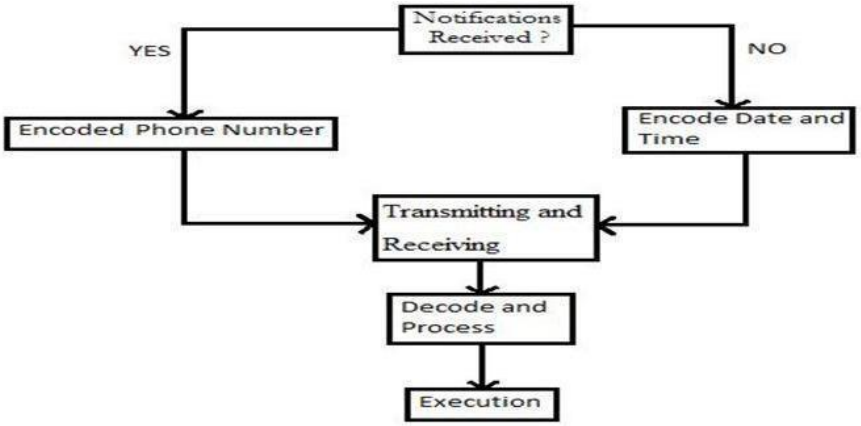

Fig. 3. Programming logic of proposed design [19]

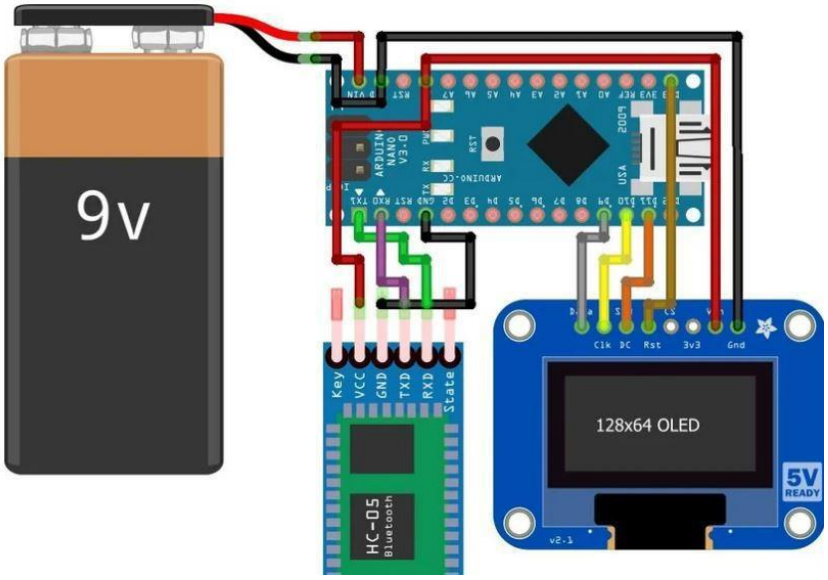

Fig. 4. Circuit Diagram 1 of the proposed design [19]

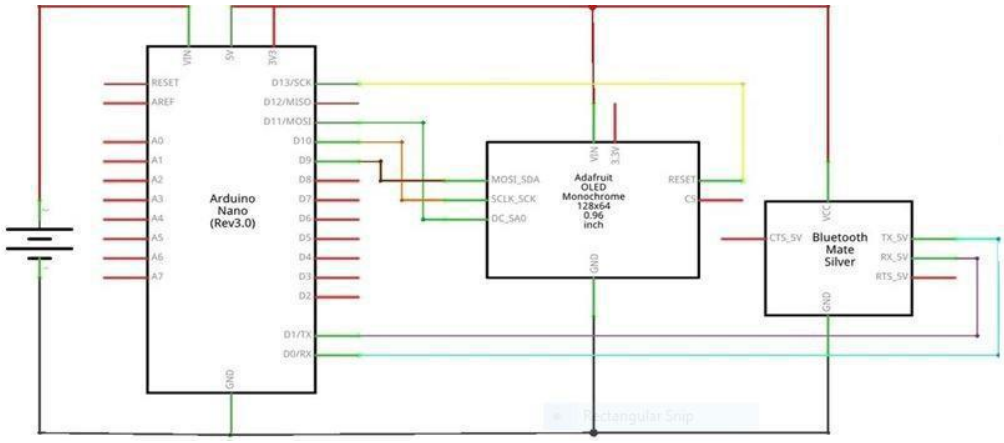

Fig. 5. Circuit Diagram 2 of the proposed design [19]

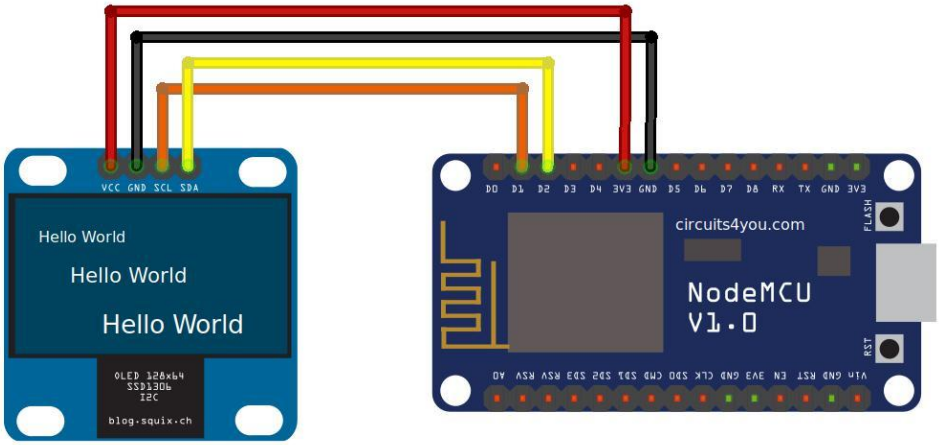

Fig. 6. Alternative Circuit drawn using Circuit.io [21]

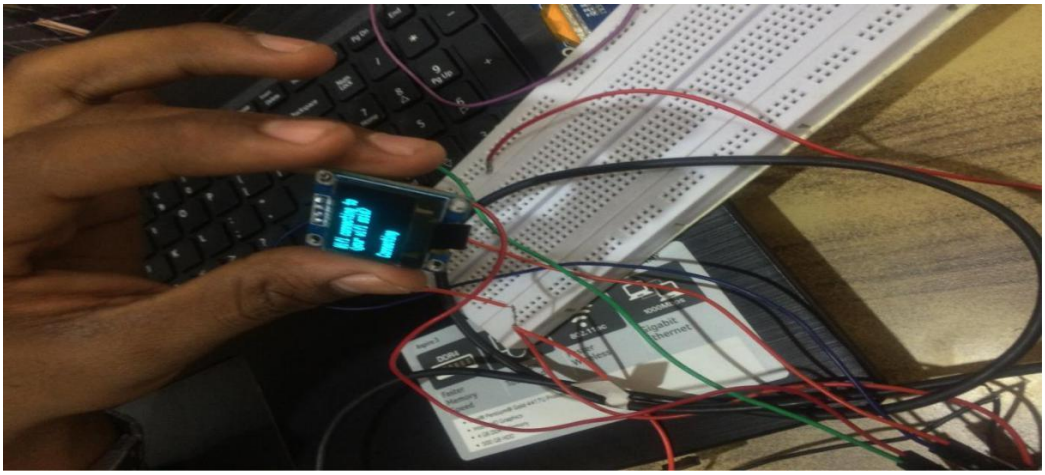

Fig.7. Hardware Picture 1 of the proposed method

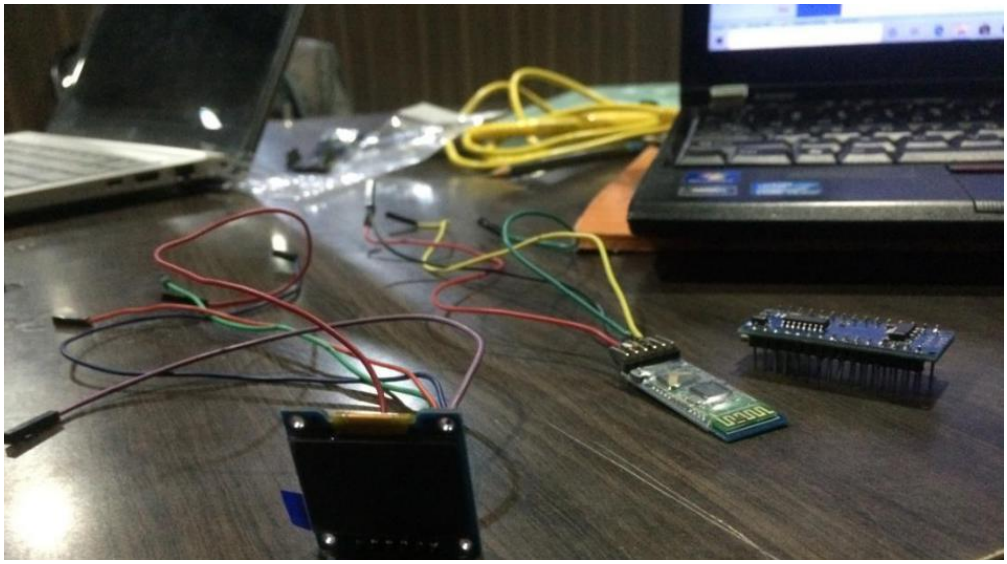

Fig.8. Hardware Picture 2 of the proposed method

Conclusion

The AR-based smart glass is successfully made having following features & advantages. It is Cheaper compared to HUD glasses in market and can also be made using household materials and makeshift things. It also Light-weight & can be carried easily anywhere, In other sense, it is Portable economically. The author developed IoT based products in such a way that it is Easily wearable & of stylish in looks. It Can also be used in various inter-disciplinary fields such as defense & security, education & Gaming.

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