



Augmented Reality Headset

S.PRASANNA BHARATHI

Asst.Professor,Dept.of ECE,

SRMIST, Vadapalani

Chennai-600 026, India.

Prasannabharathi.s@vdp.srmuniv.ac.in

CHAMUNDEESWARILG

Asst.Professor,Dept.of ECE,

SRMIST,Vadapalani

Chennai-600 026, India.

Chamundeewari.g@vdp.srmuniv.ac.in

VIVEK RAM VASAN

UGScholar,Dept.of ECE,

SRMIST, Vadapalani,

Chennai-600 026, India.

Vivek435@gmail.com

M.SAI PRASHANTH

UGScholar, Dept. of ECE,

SRMIST, Vadapalani,

Chennai-600 026, India.

Mr.saiprashanth@gmail.com

Abstract—A novel design for the augmented reality(AR) vision headset is proposed in this work. This paper is about augmented reality headset used for industrial applications at a much cheaper cost. This headset uses gesture sensor and a camera to capture photos and videos by gesture input. It's also streams live real time sensor values. All sensor values are computed on cloud with NodeMCU and Using the on board camera can use object identification to identify objects in a complex environment such as industries and for indoor tours for the user. Athin OLED and magnifying lens is used to create a mixed reality. The headset is light and compact, which gives around 5 hours of battery life, and there is no heat dissipation and other radiation from the headset. It comes in an easy to mount frame, which is tough and durable.

Index Terms—Augmented reality(AR), Mixed reality(MR), Node MCU, Head mount display(HMD)

I.INTRODUCTION

AR Goggles is a mountable headset to a spectacle frame which displays information in a smartphone-like hands-free format. A typical Google glass or other similar version of this glass costs on an average around 1lakh-3lakh INR. This paper reduces the cost of making these goggles and gives certain features up to a closer extent. AR Goggles has a wide scope in various sectors of the industrial applications and can be used in day to day basis. This work shows how sensor data from the cloud and an efficient display function can be used to display data in augmented reality format for the user. The design components and the algorithm for collecting the IoT cloud Data is covered in this paper.

In 2013, Google developed the first augmented reality glasses^[1], Known as Google Glass. It works on a dual-core OMAP processor and has a RAM of 2GB, it has some features like a touchpad to move through different applications like weather and time. It also has a 5MP camera and can store photos and videos.

In 2015, Microsoft developed a prototype augmented reality device known as Microsoft HoloLens. It works using an intel processor and a HPU processor^[2]. Microsoft has a price constraint due to the battery and thermal cooling. The HoloLens has an inbuilt speaker to give out audio function. To overcome these shortcomings this headset aims to remove the discomfort and reduce the thermal

radiation to the user and makes this device an add-on to an existing spectacle.

The organisation of this paper is as follows: Section II briefly describes the various works by other researchers in augmented reality devices. Section III explains the overall working of the model. In section IV the assembly and the build is explained. In section V conclusion is made based on the performance comparison results.

II. RELATED WORKS

A. Review Stage

R. Silva, J. C. Oliveira, G. A. Giraldo (2016) paper presents an overview of basic aspects of Augmented Reality (AR) and designed a AR headset using an optic see through head mounted display(HMD) which has a scene generator and a tracking system^[3]. the whole setup is connected to a pair of glasses and the HMD display.

Thiago D'Angelo Has developed Augmented reality head mount display (ARHMD)^[4], which has many applications such as gaze tracking method and face recognition and alignment, human computer interaction and user attention detection and with eye centre location method. this methodology has classified into methods they are model based method and future based method. And they have six major algorithms they are frame capture and grayscale conversion, crop image, isophote calculation, centre voting and centre map calculation, and mean shift algorithm, eye centre location are major algorithms which are performed by Intel Edison computer model it has offers 4 GB storage with LPDDR3 1 GB memory 2 core processor.

III. Block diagram

This represents the entire working block of AR headset, ESP8266 Wi-Fi module is main controlling unit for AR headset. A small OLED is used to project the ultimate output of the project. Gesture sensor input used to capture the photo and record the videos. In order to magnify the display on eye centre we use convex lens, play reflector to bring mixed reality in front of the on eye. Reflecting glass is used to turn the direction of the image and the mixed augmented reality will be shown on the ploy lens. A special magnifying lens with 100mm focal length is used to change magnify the image projected on the mirror.

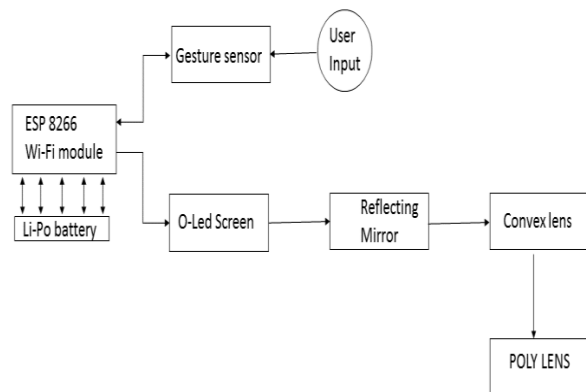


FIG.1.BLOCK DIAGRAM

IV. ESP8266 BASED SYSTEM DESIGN

A. NodeMCU ESP8266-Wi-Fi module

The ESP-8266 module supports Wi-Fi compatibility and has an onboard microcontroller board. It has a built in TCP/IP protocol stack and consumes less than 1.0mW power. Its ESP32^[6] chip set which is 32-bit micro controller. This microcontroller can load huge amount of data from the Wi-Fi and upload same amount of data which makes ESP8266 apt for this project.

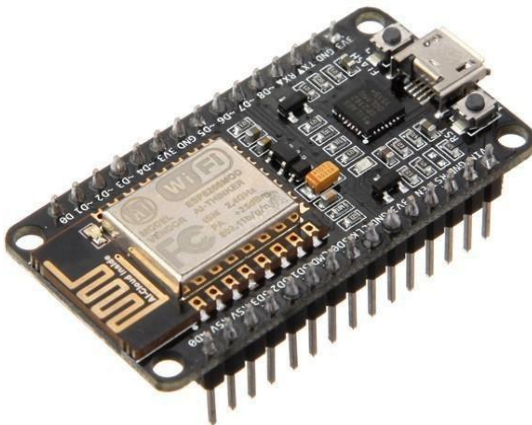


Fig.2. NodeMCU -ESP8266 with a Wi-Fi module

This processor has 80Mhz default speed, it gives 80Kilobytes of user data and 32 Kilobytes of instruction data. It allows the user to program the microcontroller easily using a USB port/cable. And all 16 general purpose pins can be used for interface external peripherals.

B. OLED display module

OLED displays are small in size but are readable because of the high contrast it can produce due to the OLED display. Diameter, but very readable due to the high contrast of an OLED display^[5]. OLED, small display with 1 inch diameter which has high contrast display which is made of 128*64 individual white O-Led display, this

display has made off with a controller chip and it also has a breakout with either an SPI or I2C interface, it has 1KB RAM which is sufficient to run display without buffering. And a pre-defined library is available to print text and bitmaps, pixels, rectangles, circles and lines and can be programmed easily, which can be powered up with 3v or 5v power supply.

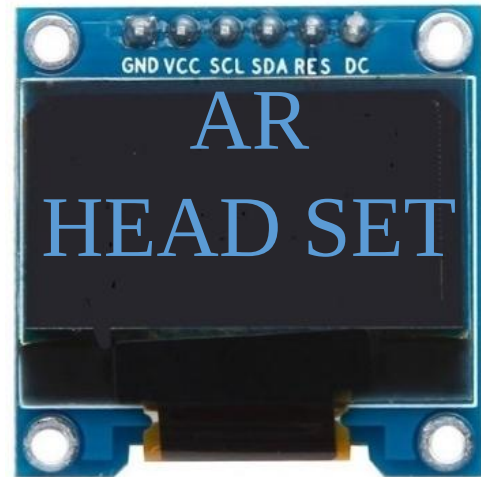


Fig.3. Head mounted display

C. Lenses

In order to magnify mirror image, we use 100mm convex lens, to bring better pixel we have used Unipolar lens which is thicker in middle and thinner at the edges and its converging image in short distance, image formed will be real and inverted with size of object. For example, camera, overhead projector, projector microscope is some of the application of magnifying glasses.

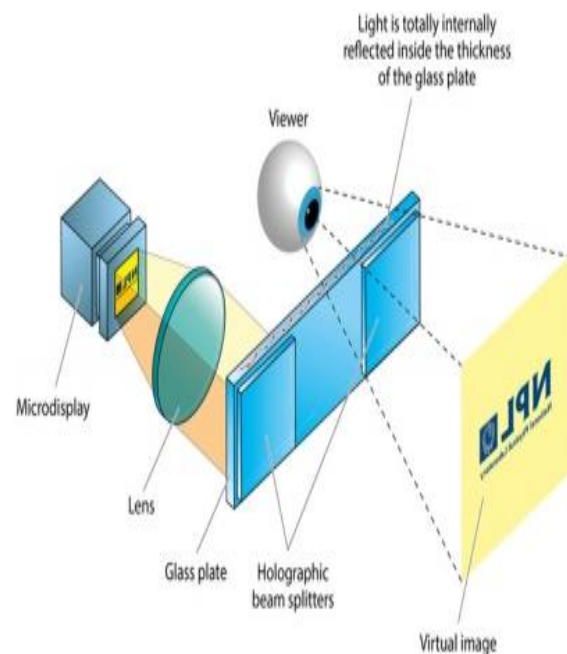


Fig.4. Head mounted display and lens working.

D. Enclosure design and assembly

The headsets enclosure design was carefully planned to occupy less space and fit all the required components, which dissipates heat and gives a natural vent. The design was perfected in AutoCAD 3D^[11] and the mould was 3D printed using PVL fibre. The enclosure comes in 2 parts so that it is an easy fix during a breakage and makes it easy for upgrades instead of changing the whole body.

Figure 5 will show the entire assembly of an Augmented reality headset in middle of the module ESP8266 is placed along with a 3.7Volt battery is also attached and one end of the head Mount is open for the charging port and the another end a reflector is placed to view the output. A mirror is placed parallel to LED display to turn the LED image on magnifying lens to reflector.

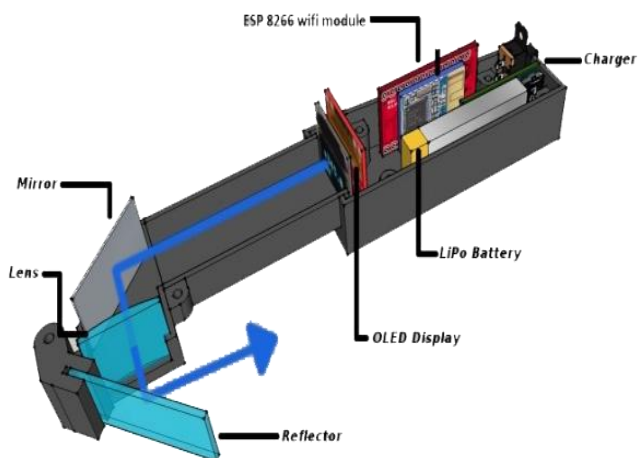
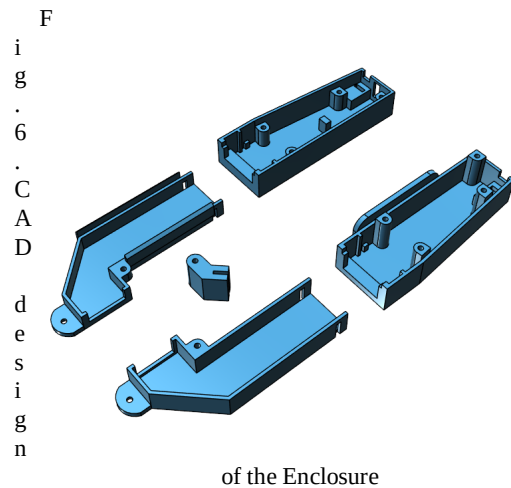


Fig.5.Assembly of Fig.5.AssemblyAR headset

A lithium ion battery powers the whole setup, provides 5 hours of backup, and it will be charged using a magnetic charger^[12]. OLED display is connected to the nodeMCU–ESP8266, the reflective mirror is placed perpendicular to the display and the holographic optic see through lens. The light rays get collimated and are reflected to the optic see through lens. The nodeMCU is connected to the IoT cloud and transmits the data values to the display. The assembly of the headset is as shown in Fig.5

A sketch has been made to bring the virtual design of the AR headset. The sketch was made using sketchup software. This entire enclosure weighs approximately 26 grams with pvl fibre material, it can be brought down to 12

grams by using carbon fibre material which is the lightest material available in the market



All CAD designs are made according to dimensions of ESP 8266 and a 3.7V lithium battery and the entire head mount will be around 1 Inch in width and 1.2 Inch in height in which the component will exactly fit in it. The entire enclosure weight is 26 grams which is very lightweight and it can easily attach goggles

E. Magnetic charging

The headset consists of a magnetic charging port, which works with a simple principle of magnetism. A metal plate is attached to the magnets and acts as a transfer medium to charge the lithium ion batteries of the headset

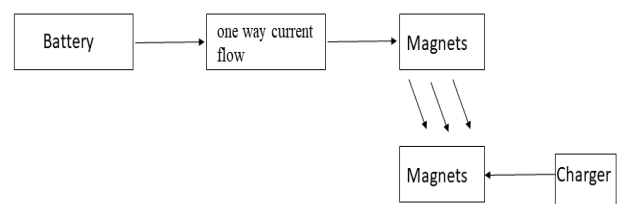


Fig.7. Diagrammatic representation of magnetic charging

Installation Guide

- Remove the magnetic adaptor from the cable and insert to ESP with the gold strips facing up

- Charging cable must be with gold strips up when it connected to magnetic adaptor to charging
- if the charging cable then more than 9 degrees it will not charge

Magnetic charging it's a wireless charging technology which is very easy and hand free to use.

IV. PSEUDO CODE FOR DESIGN

The scaled model Headset was tested using various parameters to check the efficiency and the algorithm and finally the sketch was uploaded to the NodeMCU. The Representation of the Headset is given in below flow chart.

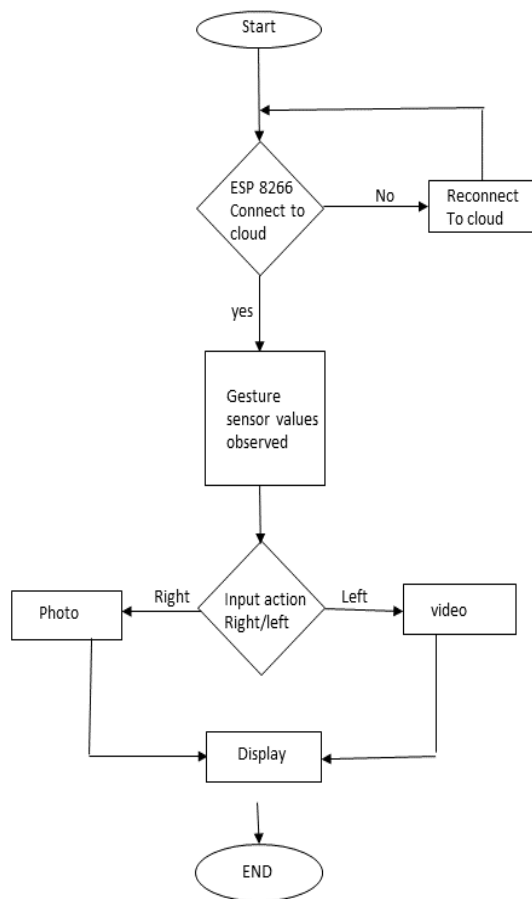


Fig.9.Flow chart

The algorithm is as follows:

A. Flow 1: Connecting to the cloud

- Pre-condition: The system connects to the cloud API key and validates the authentication key and password.

- Execution: The system obtains various sensor and analytical values from the cloud which can either be in text or pictorial form and then sends it to the display.

- Post-condition: The function is transferred back to the nodeMCU for the gesture sensor input.

B. Flow2: Obtaining the gesture sensor values

- Pre-condition: The nodeMCU uses the gesture sensor to obtain the values to execute the camera function.

- Execution: The hand movement is registered and it converts them into commands. Left to right movement takes a photo and right to left movement takes a video

- Post-condition: Once the action is captured the loop is repeated to capture any new hand movement.

V. IMPLEMENTATION AND RESULTS

The final headset displays a holographic image on the optic see through lens, that's gives the user an augmented reality experience, the setup is connected to a NodeMCU which communicates between the display and the cloud. It is used to display various parameters of industrial standards such as sensor values and other messages.

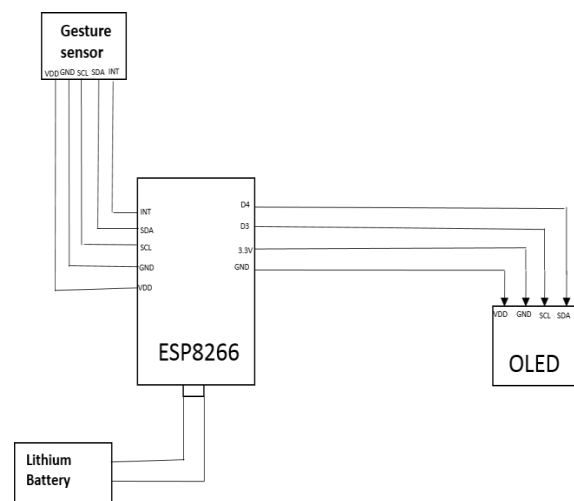


Fig.10.circuit diagram

This can create a large impact on the industry sector making handsfree operation possible in a complex-dynamic environment. The test was run and the headset showed no signs of overheating or heat. Although the proposed headset has many advantages, some of the setbacks are also found as follows: battery drain due to taking a lot of load from the display and the nodeMCU and gives 5 hours of working time and has to be addressed in the future.

VI. CONCLUSION

Finally, the goal of the project is achieved up to a closer extent. The headset can display various data in a handsfree format using augmented reality and is reliable and can last up to 5 hours of battery time. While the headset design was successful, there are many things that could still be done to improve the quality and the features of the project. As part of the future enhancement the battery and the component could be improved and its function be more predetermined to eliminate unwanted task which consumes more power. The lens used can be refined to a well suited holographic lens to give the user a better AR view. This AR headset can be used in industries and for hands free working environment in which real-time data can be display to certain worker group.

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