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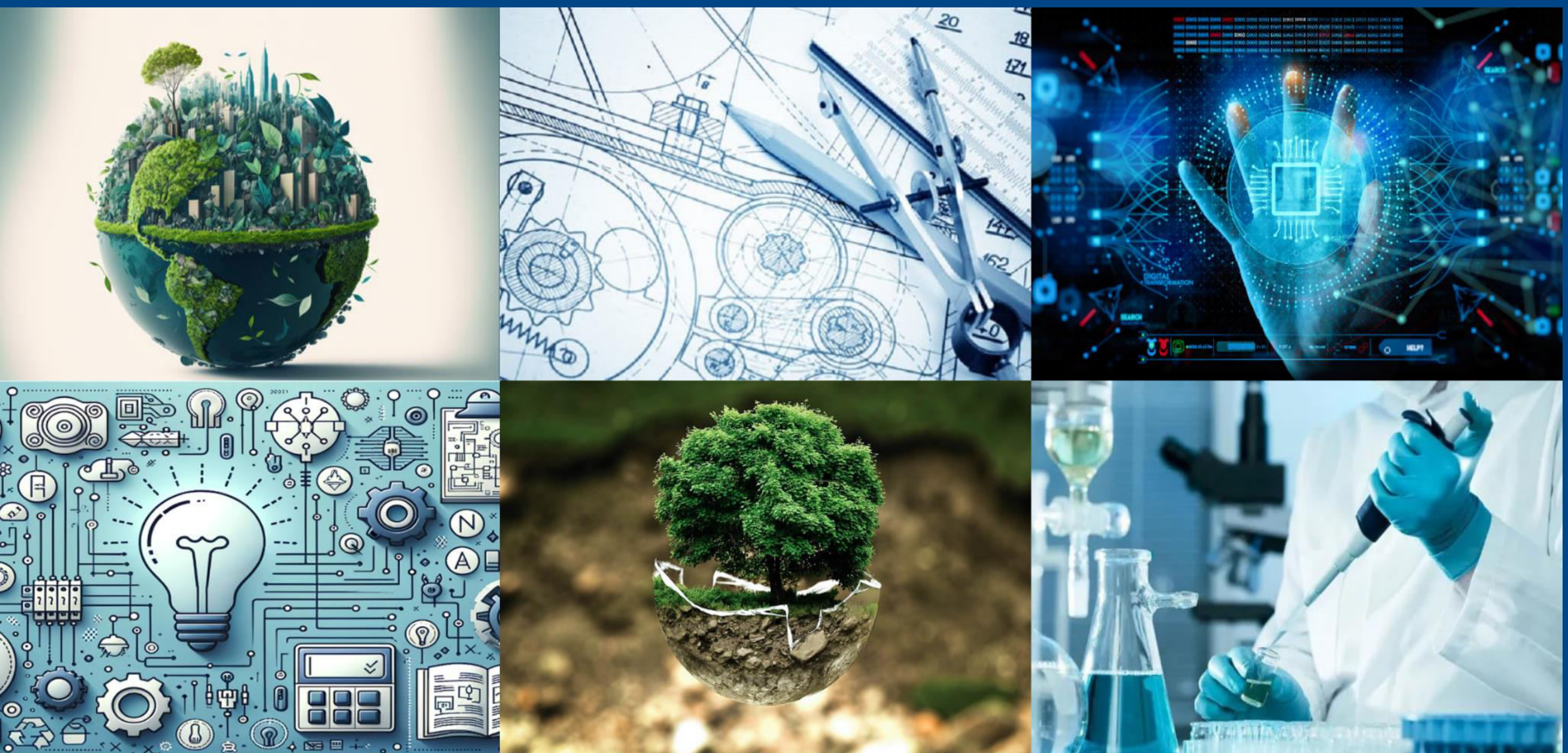

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Arduino Based Smart Glass Augmented Reality Headset

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ABSTRACT: the paper highlights the importance of user experience design in AR headset development and provides insights into how Arduino can be leveraged to create immersive and engaging AR experiences. It explores the different sensors that can be used in AR headsets to track head movements, gestures, and other inputs. The combination of Arduino and augmented reality (AR) technology has led to the development of affordable and customizable AR headsets. This research paper explores the various ways in which Arduino-based AR headsets can be designed, built, and programmed. The paper discusses the different types of AR displays that can be used, such as monocular or binocular displays, and their advantages and limitations. Moreover, the research paper addresses the challenges that arise in the development of AR headsets, such as power management, computing performance, and calibration. It also proposes solutions to these challenges using Arduino-based hardware and software.

Finally, the paper examines the potential applications of Arduino-based AR headsets in various fields, including education, entertainment, healthcare, and manufacturing. It presents several case studies to demonstrate how AR headsets can be used to enhance learning, improve productivity, and transform the way we interact with the world around us. Overall, this research paper aims to provide a comprehensive overview of the design, development, and applications of Arduino-based AR headsets.

KEYWORDS: Nano R3, AR, MIT App Inventor

I. INTRODUCTION

Augmented reality (AR) has become a rapidly growing field, with potential applications in various domains such as education, entertainment, healthcare, and manufacturing [2]. AR technology enables the overlaying of digital content onto the real world, enhancing the user's perception and interaction with the physical environment. However, AR headsets that provide an immersive and interactive experience can be expensive and inaccessible to many people. Arduino, an open- Source hardware, and software platform, offers a cost-effective solution for developing AR headsets that are customizable and accessible to a wider audience [1]. Arduino-based AR headsets enable designers and developers to build their own devices using various components such as sensors, displays, and microcontrollers. This flexibility allows for the creation of AR headsets that can be tailored to specific use cases and user needs [4]. The aim of this research paper is to explore the potential of Arduino-based AR headsets and their applications. The paper will discuss the design, development, and programming of AR headsets using Arduino, and examine the challenges and solutions involved in creating effective AR experiences [3]. It will also explore the various sensors, displays, and other components that can be used in AR headsets, as well as the potential applications of this technology in different fields [2]. The research paper seeks to provide a comprehensive overview of the possibilities and limitations of using Arduino for AR headset development and its impact on the broader AR industry [9].

II. RELATED WORK

Related work in the field of Arduino-based AR headsets has shown promising results in terms of creating affordable and customizable AR devices [10].

One such study by Boer et al. (2017) developed an AR headset using an Arduino microcontroller, a monocular display, and an accelerometer [12]. The System was used to overlay virtual objects onto real-world environments and was shown to be effective in providing an immersive AR experience [15].

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Another study by El-Bakry et al. (2020) developed an AR headset using an Arduino board, a binocular display, and a camera-based tracking system. The system was used to provide real-time object detection and recognition, enabling users to interact with virtual objects in real-time [5].

Moreover, a study by Karim et al. (2020) developed an AR headset using Arduino and 3D printing technology. The system was used to overlay real-time sensor data onto the user's view, enabling users to monitor environmental conditions in real-time [17].

In addition to these studies, various Arduino- based AR projects have been developed by the open-source community [16]. These include the AR Sandbox project, which uses an Arduino board to control a projector and Kinect sensor to create an interactive sandbox that responds to user gestures.

Overall, related work in the field of Arduino- based AR headsets has demonstrated the feasibility and potential of using Arduino as a cost-effective and customizable platform for creating AR devices [14]. However, more research is needed to explore the full potential of this technology and address the challenges involved in creating effective and immersive AR experiences [6].

Augmented Reality (AR) technology is rapidly advancing and becoming popular in various fields such as education, healthcare, and entertainment [8]. However, the cost and complexity of existing AR headsets limit their accessibility to the general public. Furthermore, most commercial AR headsets are designed to meet specific use cases, limiting their flexibility and customization [9]. The complexity of existing AR headsets also makes it difficult for individuals or organizations to develop custom applications and experiences for their users [6]. Therefore, there is a need for a low-cost and user-friendly AR headset that can be easily built and customized by individuals or organizations.

The objective of this research paper is to design and develop an Arduino-based Augmented Reality headset that is affordable, customizable, and easy to use [13].

To conduct a comprehensive literature review of existing AR headset technologies and their limitations [12]. This includes exploring the current state-of-the-art AR headset technologies, their features, and their limitations in terms of cost, accessibility, and customization [3].

To design and build an Arduino-based AR headset that is low-cost and user-friendly [9]. This involves selecting appropriate hardware components, designing a custom PCB, and developing firmware and software to support AR applications.

Table 1: comparative study

Sr.no.	Methodology	Application/advantages	Drawback	Future scope
[5]	Raspberry Pi, OpenCV	Communication aid for deaf and dumb individuals	Limited use case	Improved communication techniques
[6]	Arduino, OpenCV, Fisherfaces	Emotion recognition for individuals with autism spectrum disorders	Limited to facial emotion recognition	Expanding to full body emotion recognition

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[10]	Arduino, Vuforia, Unity3D	Maintenance instructions display for industrial applications	Limited to maintenance applications	Expanding to healthcare and education
[13]	Arduino, Eye-tracking sensors, text-to-speech converter	Device control aid for individuals with disabilities	Limited eye-tracking accuracy	Integration with machine learning algorithms
[19]	Arduino ultrasonic sensors	Navigation and reaing aid for visually impaired individuals	Limited obstacle detection accuracy	Integration with machine learning algorithms

III. PROPOSED WORK

The smart glass component works with the consideration principle and the light-focusing principle. The information exhibited on the OLED screen is returned by the mirror and exhibited on the anti-reflective glass and then attentive on the screen by the mirror. The component is powered by a rechargeable 370 mA Li-Polymer battery. With the help of a USB charging circuit, Arduino Nano's power is controlled by the switch. The Bluetooth HC-05 module is controlled by Arduino Nano to show the received output on the OLED screen.

An Arduino Microcontroller has an ATmega328p microprocessor, which is ordered to connect with Smartphones through a Smartphone application. A Rechargeable battery of 5V is used as the power supply for Smart Glass. An OLED display is merged with ATmega328p, which is used to exhibit the data received from Smartphones. Smart-Phone applications are used to transmit data of the phone, i.e., Date, Time, Notifications of the Phone call and Text messages.

These are the main steps that are designed during the whole process:

1. Execution
2. Encoding.
3. Decode and Process.
4. Transmitting and receiving.
5. Notification Received

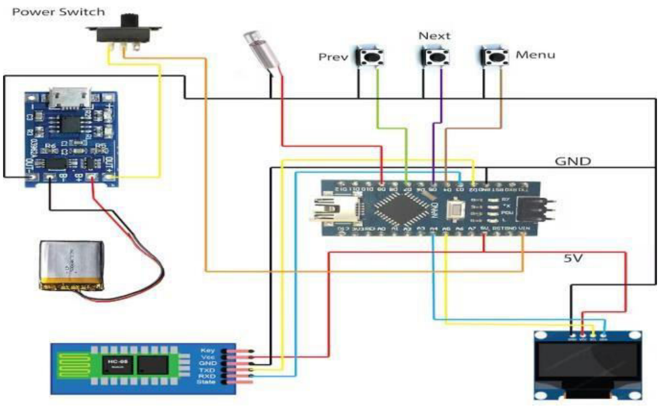

Fig.1. System Architecture

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The above circuit will interchange with the application through the Bluetooth module

1. It should receive notifications on the smartphone.
2. This notification should be encoded via the mobile application to be sent via the Bluetooth client.
3. The encoded signal data should be received by the Bluetooth module HC05 and proceed onto the Arduino Nano for d e c o d i n g and forwarding.
4. The Arduino should forward the signal to the display unit and will receive an optimum output.

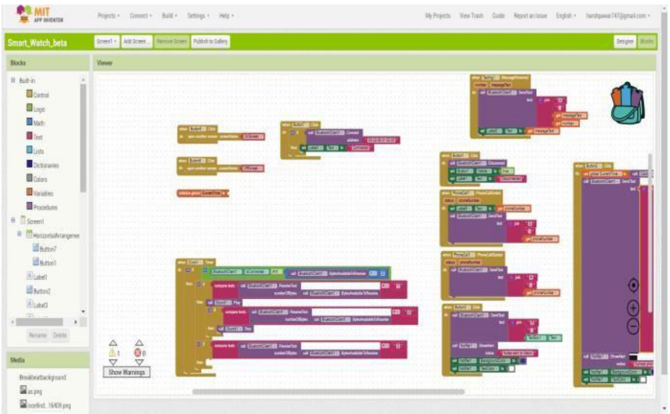

Fig.2 App Build using MIT App Inventor (Output1)

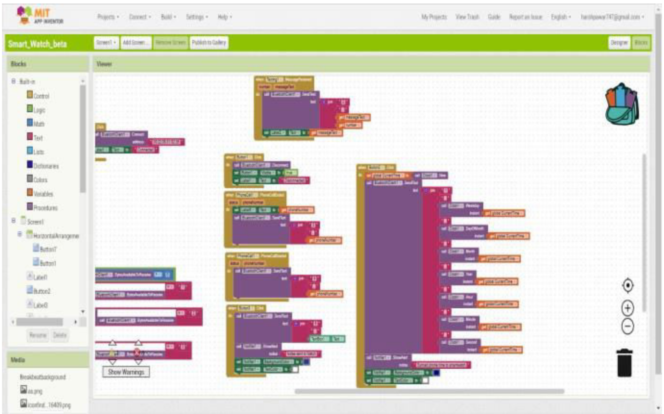

Fig.3 App Build using MIT App Inventor (Output2)

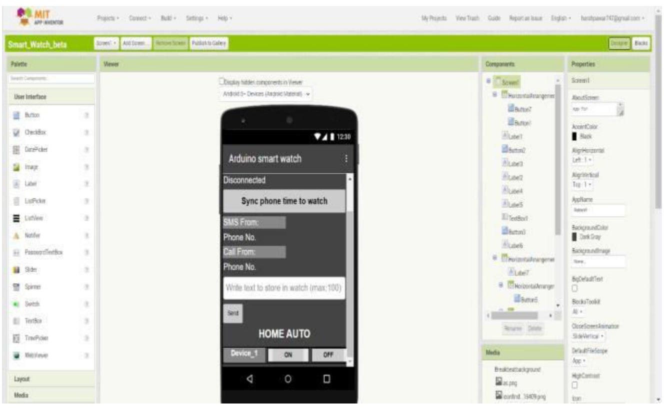

Fig.4 App Build using MIT App Inventor (Output3)

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Massachusetts Institute of Technology App Inventor is a web application unified development environment originally maintained by Google and now carried by the Massachusetts Institute of Technology (MIT). It allows strangers to computer programming to design application software apps for two Android operating systems, Android, and iOS. It uses a graphical user interface (GUI) very alike to the programming languages Scratch programming language and Star Logo, which grant users to punch up visual components to make an application that could run on mobile devices. In designing App Inventor, work ready within Google on online development environments, Google extract upon significant primary research in educational computing. Overall, our system should work with the Bluetooth module to access the notifications of a smartphone to appear on the screen.

Thus, in order to work on construction an Android application was the first concern, overall, different modules and network buttons was to be obtained and placed properly. Definite blocks in the app inventor that interchange with the Bluetooth client are evaluated and assembled according to the requirements to pass on the notifications of the smartphone to the display unit join to the spectacles. The App Inventor programs relate how the phone should acknowledge certain events: a button dated pressed, the phone is actually vibrating, or the user is dragging his finger over a canvas.

IV. RESULTS AND CONCLUSION

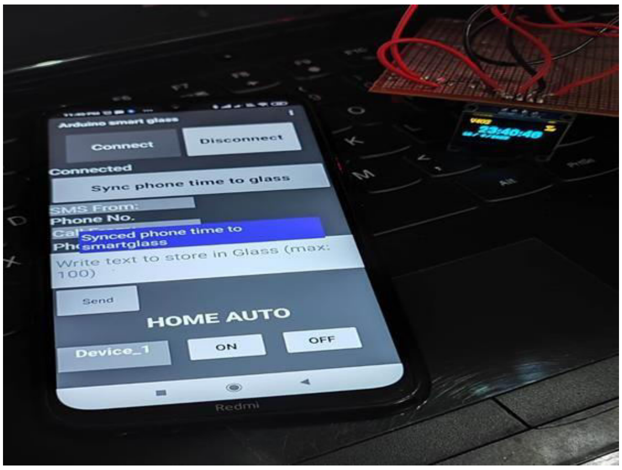

Fig.5 Showing date and time

As the system supplies basic notifications which are examined through the smartphone connected via Bluetooth HC05.

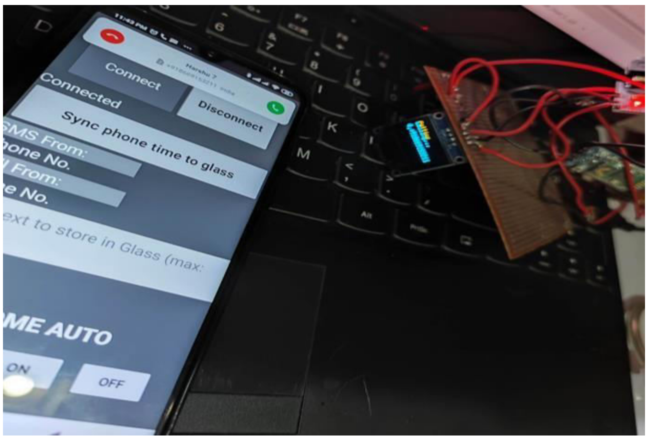

Fig.6 showing call received

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The call is built from an unknown device to the system phone and its returns by appearing the call coming to it with the phone number.

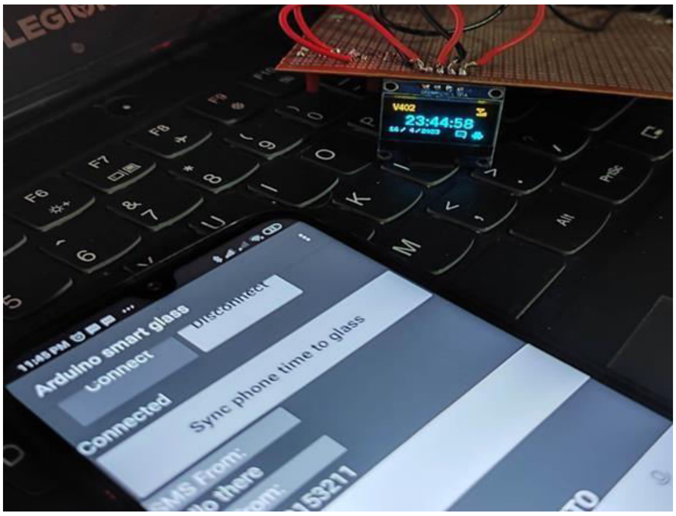

Fig.6 showing text notification

Here the message collected by phone is shown in the form of notifications with a message icon in the corner. The paper demonstrates how to build a smart spectacle with basic features. Basic features like times, dates, and notifications in different scenarios. This architecture is designed to be cost-effective and it is very environmentally friendly. As this is the first prototype of our design, with utmost Probability in future we are going to wear these glasses. The prototype just contains the basic feature of notifications such as time and date, messages, and calls. The next version can include advanced features like checking the humidity of the surroundings, temperature, and many others. Audio assistance, smart speakers and voice control functions can be included in advanced versions. A camera can be added to smart spectacles for facial recognition. As it develops for face recognition, we can push the limitation further by including a 360° view. Using Machine learning and Artificial Intelligence these glasses can be used for reading texts which will be beneficial for blind people. Improvisation can be done at an advanced level; a virtual reality environment can be provided. Also, smart glasses have vast scope in Augmented Reality. As technology advances navigation options along with audio options can be added.

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