Non-Invasive Glucose Monitoring Based on Single Wavelength Using Augmented Reality

Rajalaksmi R[1], Sweatha A[2], Vasumithra S[3], Priyanka G[4]
1, Associate Professor, 2,3,4 Students, ECE,Panimalar Engineering College, Chennai, India.

Abstract

Surgeons are constantly looking for new technologies to enhance their operations in the environment. Because blood must be extracted via a skin prick, BGM (Blood Glucose Monitoring) approaches are invasive. However, researchers are working to make BGM non-invasive by employing NIR (near-infrared) rays. NIR technology has flaws that prevent it from being used in healthcare settings, such as light ray absorption in human tissue, larger SNR (signal-to-noise ratio), and poor accuracy. Applications to stay augmented reality (AR) are being examined for their potential use by surgeons as it becomes increasingly readily available, cheap, and accessible. The insertion of artificial data into any number of senses to help a user accomplish tasks with greater efficiency is recognized as augmented reality (AR).

Keywords- BGM, NIR, SNR, AR, PIC micro controller and IoT

I.INTRODUCTION

The articles submitted for this special issue attest to the continued interest in augmented and virtual reality technology to offer new business possibilities in consumer electronics. More researchers will be motivated to work in these areas and advance the field as a result of their experiences. A computer system created to carry out one or more unique tasks is called an embedded system with real-time computing constraints. It frequently has hardware and mechanical parts incorporated into it. Specific criteria must be met for embedded systems to be used. Typically, it can only accomplish certain tasks or has limited resources.

LITERATURE SURVEY

The use of 3-D virtual objects that are integrated into a 3-D natural environment in real-time for activities in manufacturing, visualization, planning routes, entertainment, and defense has become known as augmented reality [1].

The advancement of mobile networks for communication from the beginning to the current generation is covered in this paper, along with a summary of study efforts towards the fifth generation (5G), as well as the key needs of 5G networks as well as upcoming technologies. The overview includes information on technologies like Massive-MIMO, Millimeter-waves, and beamforming; however, full-duplex mode and Small Cells which are used to meet 5G criteria.[2] Since the 1960s, the field of augmented reality has been developing steadily with the goal of fusing the actual and virtual worlds.[3] The two key platforms for mobile devices AR applications are hardware-based and app- based, but hardware-based implementation is expensive and limited in flexibility, while app-based implementation necessitates extra loading and implementation and is problematic for cross-platform deployment [4]. Developers usually have knowledge of mobile operating systems from a native development approach and compose native code in a C dialect. Developers or teams are required to support applications across a variety of smart platforms for a variety of organizational or market-related reasons.[5] Enhancing mental wellbeing through the combination of art-based user research and scientific interfaces.[6]

This study suggests a pyramidal third-streamed network (PTSN) that converts the complete connection layer into entirely convolutional layers with a novel convolution structure to extract

multiresolution characteristics from images of pyramidal structures. According to the testing findings, PTSN is more accurate than alternative techniques [7].

Maintenance training for virtual reality and augmented reality technology includes topics like safety, reuse, cost savings, timeline compression, and efficacy enhancement.[8] High latency, as well as bandwidth, and computational power, are needed by contemporary apps like augmented reality, connected cars, video streaming, and gaming. The edge computing paradigm that mixes the use of cloud computing and mobile communication has recently been expanded to include Mobile Edge Computing (MEC) [9].

Information discovery and delivery have been reinvented by augmented reality, which brings more information from the virtual realm to the physical one. [10] A broad class of "mixed reality" (MR) displays, including augmented reality (AR) displays, are included in the reality- virtuality (RV) spectrum. Seven examples of current display concepts that juxtapose actual objects and artificial ones are used to describe AVMR displays. Different MR display systems can be distinguished from one another by key elements like the underlying scene's characteristics, how it is observed, the observer's context, as well as a three-dimensional taxonomic paradigm. [11]. Since gaming is now so common and can keep people entertained for hours on end, teachers are looking to gamification for ways to involve students in the same way that video games engage players.[12] MEC, which offers minimal latency as well as substantial bandwidth while allowing applications to take advantage of cloud capabilities, is an essential tool that allows providers to open up their infrastructure to new applications and IT ecosystems. [13] Although traditional location service platforms offer a conceptual metaphor that the user must comprehend and put into practice, location-based services offer a convenient method to filter information according to the present location. [14] This paper compiles images of an indoor environment's ceiling and examples of ubiquitous computer uses.

We put the system into action on handheld devices and conducted field testing in various workplace buildings to show that it was feasible. [15] To make globally registered overlays, the database is required to be built, kept up-to-date, provided, and utilized by the user's applications.[16] In this article, a brand-new indoor localization algorithm based on data-level fusion and Bayesian filtering is proposed. To determine the probability's overall optimum value, it employs simulated annealing. [17] A worldwide gaming community has been sparked by Pokemon Go, an augmented reality game that combines mobile devices with physical discovery in the actual world.[18] According to the findings of a recent survey by the international law company Perkins Coie LLP, expenditure on both mixed reality (VR) is increasing, with the gaming industry being predicted to draw the most money. However, there are also advances in the real estate, military, and retail sectors. In the upcoming year, developers will concentrate on developing more social and cooperative AR and VR experiences, with 81% of their efforts going towards developing AR tools and apps for smartphones.[19] Fixed internet connectivity, Wi-Fi, and mobile networking are all covered in the Cisco Annual Internet Report's global forecast and analysis of the digital evolution across various business sectors. On users of the internet, devices, and connections as well as the performance of networks and novel application requirements, quantitative projections are given. [20]

II. SYSTEM ANALYSIS

EXISTING SYSTEM*:* The medical data of a user can be monetized on an excel, or notepad but cutting the segmented part takes time and is difficult for critically acclaimed patients [21].

PROPOSED SYSTEM: Augmented reality technology can be used to monetize medical data without a lens, allowing for easy access to patient data and secure operations. Data can be stored as medical records in the computer for further use and can be monitored with minimal harm. It also reduces time and secures operations [22].

III. METHODOLOGY OF WORK

TRANSMITTER:

We have developed a transmitter section including our components such as non-invasive, heartbeat, respiratory& temperature sensors.

Fig 1. Transmitter Setup

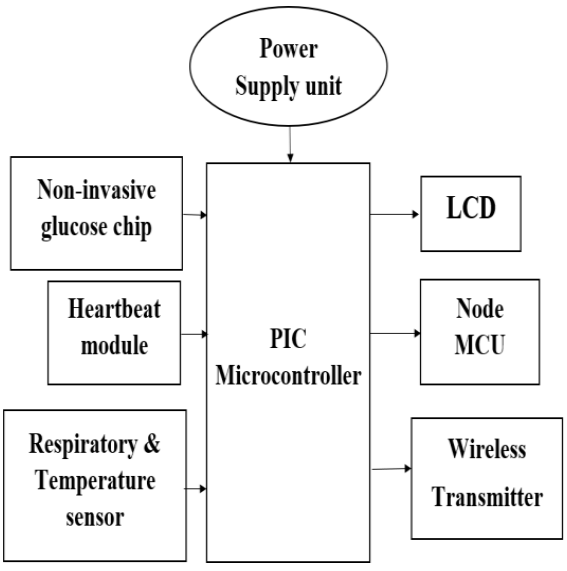

Fig 2. Block Diagram of Transmitter

RECEIVER:

The AR glass is connected with node MCU for viewing the output.

Fig 3. Receiver Setup

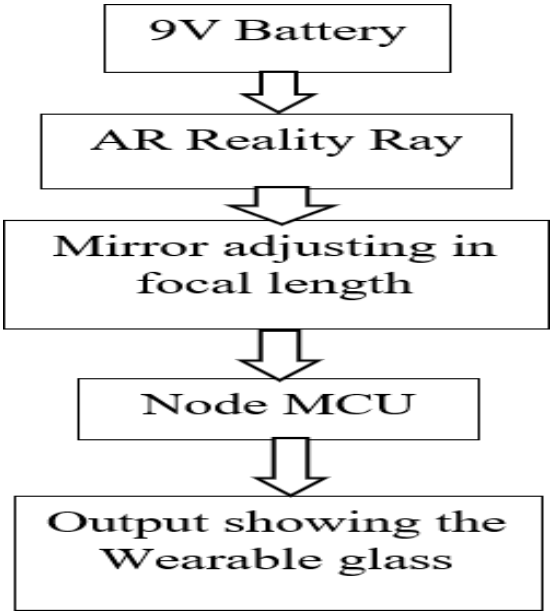

Fig 4. Block Diagram of Receiver

SYSTEM REQUIREMENTS:

SOFTWARE REQUIREMENTS:

- Embedded c
- MP Lab

HARDWARE REQUIREMENTS:

- Pic Controller
- Node MCUIOT Modem
- Non-invasive glucose sensor
- Heartbeat module
- Respiratory & Temperature sensor

ADVANTAGES

Without a lens, augmented reality technology may be utilized to commercialize medical data, facilitating simple access to patient information and safe operations. Medical records can be preserved as data on the computer for later use and monitoring with no risk. Moreover, it speeds up and safeguards processes.

LIST OF MONITORED VITALS

The measured vitals of the patients are included in the table below.

SYMBO L	*PARAMETER*	*UNIT*
HB	Heartbeat rate	Beats/ second
Tm	Body Temperature	Fahrenheit
GL	Blood Glucose level	Mg/ dL
RS	Respiratory rate	Breaths per minute

Table 1. List of Monitored Vitals

ALGORITHM

- Initialize the power supply
- Activate the Node MCU for connection with AR glass.
- Initialize IOT Modem communication via Wi-fi.
- Blow air in the respiratory sensor to measure the respiratory rate.
- Long Press the heartbeat sensor to detect the heartbeat rate.
- Shake your finger before the non-invasive glucose sensor to detect glucose levels.
- Long press the Temperature (LM35) sensor to denote body temperature.
- Display all the parameters in the LCD and AR glass
- Allow patients to track all their above-mentioned parameters via Data Log.

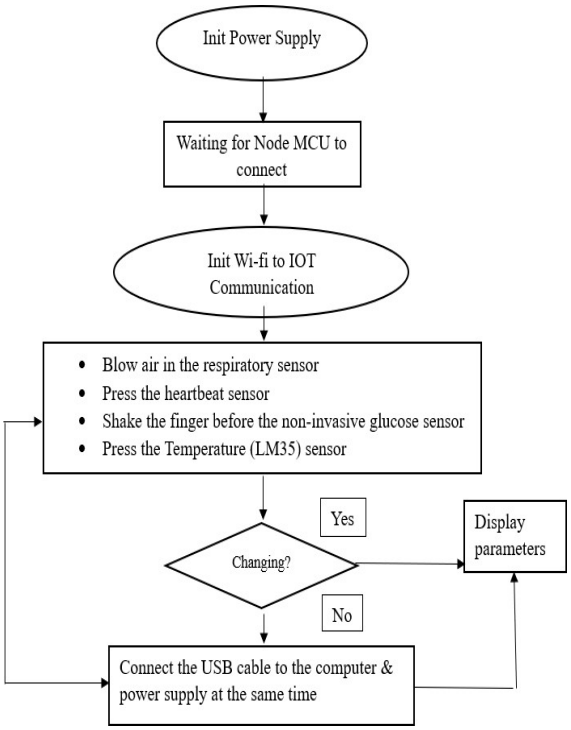

Fig 5. Procedure in the flowchart

IV. RESULTS AND DISCUSSIONS

The Red light (RL) is utilized for a few seconds to pass in the human finger, and the light reflected by the finger is caught by a photodiode. A photodiode serves as a type of transducer, transferring energy from light to electric power, which is then processed through the ATMEL chip and provided on the LCD. This technique allows for greater precision and higher accuracy [23].

MEASURE TABLE:

We have comprehended the accuracy rate and refresh time in the following table [24].

Period	Refresh Time[s]	Accuracy [%]
1	(i) 1.02± 0.04	98.4 ± 1.4
2	(ii) 1.16 ±0.05	97.0 ±0.0
3	(iii) $9.10^{-4} \pm .10^{-5}$	96.0 ±0.0

Table 2. Measure Table

DATA OUTPUT:

LOG ID	*DATA*	*Log date*
1	1234	28/03/2023
2	Temp:30	28/03/2023
3	Temp:32	28/03/2023
4	Tm=023	21/03/2023
5	RS=004	21/03/2023
6	HB=063	21/03/2023
7	GL=116	19/03/2023
8	Tm=024	19/03/2023

Table 3. Data Output

AR GLASS OUTPUT:

Fig 6. AR Glass Output

LCD OUTPUT :

Fig 7. LCD Output

DATA LOGS:

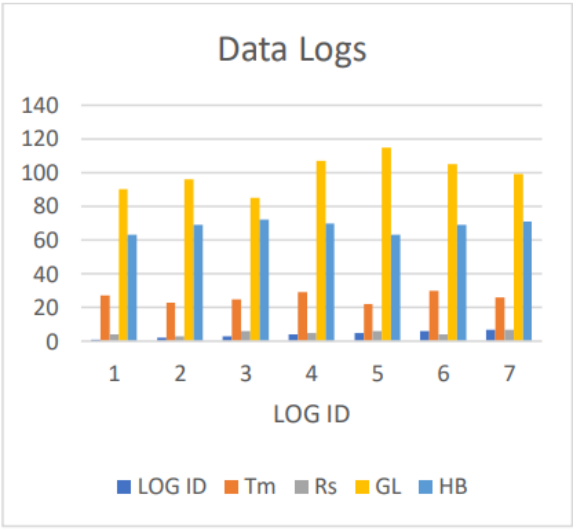

Fig 8. Data Logs

V. CONCLUSION

This paper presents a review of Web AR at three distinct domains: the Mobile AR principle, the challenges, along with technologies necessary for when augmented reality meets the Internet as a whole and the various Web AR development technique. It provides guidelines as well as a reference point for developers and researchers to use in their smartphone applications to provide users with an immersive ubiquitous AR experience. The forthcoming 5G networks offer a reliable and effective platform for widespread promotion of augmented reality, and this MEC model demonstrates a new computing paradigm trend. Edge servers enable scalable and adaptive contact and communication between cloud services and network boundaries, as well as between servers at the edge and mobile gadgets. As an outcome, we have discovered an excellent rate of accuracy.

VI. FUTURE ENHANCEMENT

The non-invasive gadgets are extremely popular and have a global market worth at least $1 billion annually.

The creation of non-invasive technologies, however, has been impeded by unsupported assertions that have turned out to be deceptive, if not fraudulent.

In conclusion, the non-invasive glucose monitoring issue is still not fully resolved, and more work is still required to realize the vision of a dependable and affordable gadget for the benefit of diabetes patients.

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