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Towards A Novel Prototype for Superpower Glass for Autistic Kids

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Abstract- This paper presents a novel design and implementation of medical glass with integrated sensors for measuring temperature and detecting medical conditions, including epilepsy and other illnesses, with a specific focus on helping autistic children. The glass provides real-time health monitoring, enabling parents and caregivers to closely monitor the health status of the child. Moreover, the glass incorporates an educational feature that teaches kids of 4 to 8 years some practical life skills such as animal and plant identification, letter and number recognition, and basic knowledge of Quranic surahs. The paper highlights the importance of such technology in promoting the health and well-being of children while also facilitating their educational development. The use of scholarly language throughout the paper ensures a thorough and insightful analysis of the technology's potential to benefit children with various health conditions. The glass were designed and implemented according to practical standards of glass scales, and it was experimented with children and achieved a good response.

***Keywords*:** Autistic; kids; Education; Monitor; Glass.

I. INTRODUCTION

Wearable technologies have paved the way for innovative solutions in healthcare and education. One such advancement is the integration of sensors into glass, enabling them to measure temperature, detect medical conditions, and serve as an educational tool for children. In this paper, we present a novel approach to utilizing glass with integrated sensors to benefit autistic children, specifically in monitoring their health and supporting their educational development. The glass are designed to provide real-time monitoring of temperature and illness detection, including epilepsy and other medical conditions. By wearing these glass, autistic children can have their health status closely monitored, allowing parents and caregivers to proactively manage their well-being. Furthermore, the glass incorporate an educational component, aimed at children between the ages of four to eight, to enhance their practical life skills, such as animal and plant identification, letter and number recognition, and basic knowledge of Quranic surahs. The glass can be working for around 6 hours and Wearing glass itself does not affect vision, but sometimes they are used as prescription glass. However, video viewing is limited to short periods during the day, not exceeding 10 minutes. The video's duration is short, it's like a short video for interesting education. The glass feature a flexible holder that allows the screen to be conveniently positioned out of sight when not needed, ensuring that it doesn't obstruct the user's vision when not in use. The use of academic language throughout the paper underscores the rigorous analysis of this innovative technology's potential benefits for children with autism. The paper highlights the significance of this multidisciplinary approach, bridging healthcare and education to empower autistic children and improve their overall quality of life. The findings of this study contribute to the growing body of literature on wearable technologies and their applications in supporting health and education for special needs children.

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By leveraging the potential of glass with integrated sensors, this research aims to make a meaningful impact on the well-being and educational outcomes of children with autism. Overall, this paper presents a unique and holistic perspective on the utilization of glass with sensors for health monitoring and educational support in the context of autism, with potential implications for other similar populations as well. [1][2].

II. LITERATURE REVIEW

Smart glass is a wearable device that can be called a head-mounted display (HMD) system, it is capable of presenting information to the user, and the type of information they are capable of presenting can vary widely. They can present texts, blood pressure, directions, and incoming calls. They are like smartwatches. They offer the convenience of doing anything on your mobile without holding it to do it. We can't consider that any smart glass are augmented reality just because it projects the information on a screen.AR stands for augmented reality, it can be described as the technology that merges reality and the virtual world by live-streaming imaginary videos. These videos are enhanced by computer graphics and are projected to reality through AR smart glass or headsets or through screens on mobile devices. AR technology is making a buzz now in all the applications and the world is considering a life with AR as the future.AR applications are now in everyday life. Most of us were introduced to AR technology through POKEMON GO and filters from Snapchat. So, we can say that all AR glass is smart glass, but we can't say that every smart glass is AR glass. According to the latest reports by Marketsandmarkets, AR will be showing growth in the market of approximately 72.7 billion dollars in 2024. As companies, colleges are interested in investing in applications that support AR technology [3][4]. Google Glass added features on their smart glass to be used for autism and they called them "superpower glass where the glass can detect expressions to help the child in understanding facial expressions it is also connected to a mobile application that contains several gameplay videos where parents can observe and evaluate what the kids are playing and if it is useful or not [5][6]. Google made another version of these glass called "empowered glass" Modern SG, instructional modules focusing on socioemotional and behavioral management abilities make up Empowered Brain. SG are thin, transparent head-worn displays that can give users instructions through both visual and aural cues. Through an integrated sensor array that includes a camera, microphone, touchpad, "blink" sensor, gyroscope, and accelerometer, Empowered Brain can gather a wide range of user data. These sensors are used by modules in Empowered Brain to provide social communication and cognitive skill coaching. this digital strategy may benefit those who have ADHD and ASD.[7][8].

III. PROPOSED STRUCTURE

The ESP32-CAM comes with integrated Wi-Fi modules, which facilitate video streaming or image processing. Using image processing with Python, there is a library called OpenCV that is used to capture people's expressions and help the child recognize their emotions. The Adafruit (1.14 "240x135 Color TFT Breakout LCD screen) displays a compact display unit that provides a high-resolution color display. The screen is positioned at a 45-degree angle with a mirror for reflection and comes with a PMMA plano-convex lens, an acrylic lens with a diameter of 30 mm, and a focal length of 100 mm, which is a common type of lens used in optical systems.

The video is received through Firebase and web and mobile data, and the tutorial program is selected for use with the user. The MLX90614 infrared (temperature sensor) and MPU6050 (fall detection sensor) data is captured and sent to Firebase, and then displayed on the web and mobile devices. The data is received and sent to Firebase via ESP32, a precise Wi-Fi network processor. While designing the glass using 3D printing, a lithium battery was included, and a charger and converter were used to achieve optimal performance.

Illustrating the structure of the station divided into the following stages as shown in figure (1).

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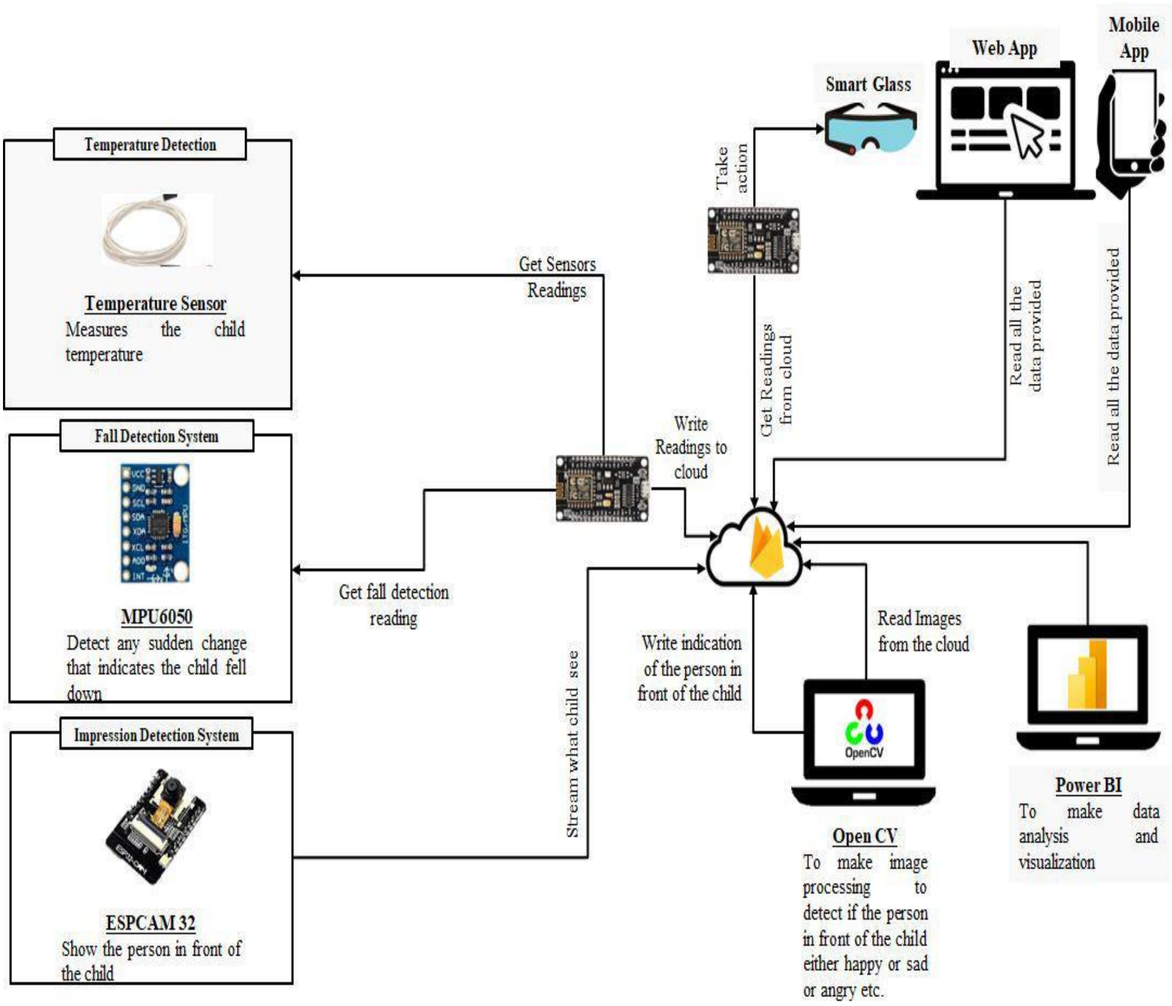
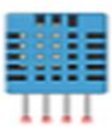
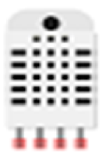


Figure 1: Proposed Structure of the Research

Stage 1: Temperature system

Temperature sensors are used in a variety of medical applications, including blood temperature monitoring, digital thermometers, organ transplant temperature monitoring, and control. The sensors which we choose are selected from Tables (1)[9].

Table 1: Difference of Temperature sensor [9]

Sensor	DHT11	DHT22	LM35	DS18B20	BME280	GY-906
Image						
Measures	Temperature Humidity	Temperature Humidity	Temperature	Temperature	Temperature Humidity pressure	Temperature
Cost	low	Moderate	low	low	Moderate	High
Preferred	Less preferred	Less preferred	Less preferred	Less preferred	Less preferred	more preferred

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In the end, by choosing GY-906 because it integrates both the infrared thermopile detector chip and the signal conditioning ASIC in the same TO--39 and that makes it more compact and convenient for non-contact temperature measurements.

A. Gy-906 Sensor:

A high accuracy non-contact infrared temperature sensor from me lexis, model number MLX90614 shown in figure (2), is at the center of the module as shown in Figure below. This sensor doesn't require physical contact to measure temperature, unlike most others. Two temperature readings are produced by the MLX90614: an object temperature and an ambient temperature. [10]

1. The non-contact value "observed" from the sensor is the object temperature (To).
2. The temperature on the sensor die is measured by the ambient temperature (Ta).

Figure 2: Temperature Sensor Model [10]

Stage 2: Fall detection system.

The purpose of a fall detection system is to warn users via online and mobile applications if a child falls. We were choosing between 2 sensors shown in Table (2),[11].

Table 2.Fall Detection sensors [11]

Sensor	**MPU 6050**	**GY-50**
Image		
Axes	6 rotations	3 rotations
Cost	Moderate	Moderate
Preferred	more preferred	less preferred

In the end, By choosing MPU6050 as it is a 6-axis IMU (Inertial Measurement Unit) that can measure both the gravitational acceleration and the rotational velocity along three axes.

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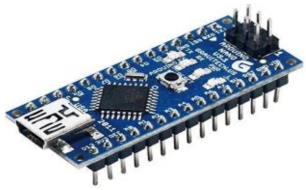
A. Sensor (MPU6050):

The MPU6050 sensor module has an accelerometer and gyroscope sensor. Accelerometer gives information about the angle {x, y, z}, while the gyroscope determines the orientation. We will contrast the amplitude of the acceleration with the threshold value in order to identify the fall. This makes it versatile and accurate for motion-tracking applications. The gadget emails and notifies the individual in question if it detects a fall. Here, a microcontroller and Wi-Fi module called NodeMCU [microcontroller] ESP8266 are used to transmit data to the cloud. Cleared in Table (3) [12].

Stage 3: Microcontroller

Table 3. Difference between Microcontrollers [13]

Point of View (POV)	Node MCU	Arduino nano
Image		
Microcontroller	ESP8266	ATmega328p
Memory	4MB	32KB
Cost	cheap	expensive
Operating voltage	3.3v	7-12v
Energy consumption	low	high
Board size	small	small
Cost	High	Moderate
application	security alarm	embedded system

Node-MCU

We preferred to go with NodeMCU instead of Arduino Nano because the Node-MCU fits our work better than the Arduino Nano as it will take the readings from the sensors, fall detection system, expression system, and from the cloud and upload it to the glass.

Stage 4: Smart Glass Design Process

Smart glass will display the videos that will be connected to the mobile application and the website. These videos will help the child to learn help in controlling his stress level and make things easier for him, for his parents at home, and easier for his teachers. The glass's weight is around 200gm weight. The glass will have two boxes. The glass' structure consists of:

1. TFT display stands for thin film transistor, it's a liquid crystal display. TFT offers good quality, the colors are clear and most importantly it can be programmed easily by Arduino. There are two models of TFT where it can provide a touch screen, and some don't. It also has an SD card to store data, which is a perfect feature not in all the displays. We are using the TFT ST7789 driver [14].

2. Battery: The most widely utilized rechargeable battery chemistry today is lithium-ion. The gadgets we use daily, such as electric cars and mobile phones, are powered by lithium-ion batteries. Lithium-ion batteries are made up of a protective circuit board and one or more lithium-ion cells. Once the cells are inserted inside a device with a protective circuit board, they are referred to as batteries.

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3. Chargers: We are using lithium-ion chargers module 1A (TP4056) with battery protection (USB Micro) and will use 2 chargers for the two 2 batteries, one on each side, the camera side and the TFT side.

4. converter: A boost converter is a step-up Dc-Dc converter, it enhances the input voltage so the value of the output will always be bigger than the input. It is also named step up chopper so we are using it to step up the voltage of the battery to 5v where the node MCU can operate.

5. Mirror, lens, reflector
   We used a mirror so that when a video is displayed on the TFT it's not actually the TFT that's streaming, the video will reflect off a mirror then pass through the lens then be reflected by a reflector directly to the eyes of the child. [15].

Figure 3: Proposed Design for the Glass

When a video is displayed on the TFT it's not actually the TFT that's streaming, the video will reflect off a mirror then pass through the lens then be reflected by a reflector directly to the eyes of the child. A proposed model was implemented using a solid work tool; Figure (3) [15].

A. AR Therapy Design Process

1. Effect of videos on ASD

Numerous studies over many years have shown the ability of educational videos to consolidate information in the minds of children and may outperform the ability of male and female teachers, as they can provide children with reading, writing and arithmetic experiences. This article discusses future prospects for the impact of video on the learning of students with autism in Malaysia. This study focuses on the use of video by experts, identifying the behavior of students with autism in their use of video and identifying video limitations and ways to overcome them. The study showed that some educational videos, especially those whose protagonists use technical solutions, such as graphics and music, can teach children high experiences. Through these videos, children can build early informational and technological skills, make them more qualified for future jobs, raise their readiness for them, and modify the behavior of autistic children. The authors of the study believe that there is no need to wait until the autistic child becomes an adult, to acquire those skills that he will need throughout his working life, but rather that he can be prepared for them from an early age. The study also indicated that educational videos showed great effectiveness during the Corona pandemic and became a "lifeline" for autistic children in light of the decline in the role of schools due to the closures that accompanied the pandemic. We made the videos used in the smart glass to help the autistic child in several aspects, the most important of which

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is calming the child and the second is educating the child; where it is known about an autistic child that he suffers from a lot of anxiety while practicing daily life Anxiety may appear in autism spectrum disorder as social phobia, excessive worry, Meltdowns, and harming themselves. People with ASD can find dealing with change very stressful. This made us think of making videos to draw his attention when he gets nervous and jittery and starts to hurt himself. This is in terms of calming the ASD child. But the most important reason for making videos is the educational aspect of the child with autism. [16]

The videos focus on teaching the autistic child all aspects of life to acquire various skills and languages. The videos will be displayed on the screen of the smart glass in two cases:

1. The first is when the sensors detect stress and tension, so before going to a worse phase like self-harm the videos are played. These behaviors are known by sensors placed on one end of the smart glass touching the head of an autistic child.
2. The second is through the parents or teachers, they can control what the child sees from the video clips on the smart glass screen, and this part is more related to the educational aspect. The videos displayed on the smart glass screen are controlled through a (mobile Application or website) available to parents and teachers.

2. Categorization of videos

To make things easier for an autistic child and to teach him in an organized manner, the videos have been divided into several categories. Each level is designed for a specific age range, where the biggest concern was not to burden the autistic child [15][16].

We divided the videos into three levels:

- First level of teaching complete sentences, which includes teaching an autistic child (about animals, birds, colors, fruits, and vegetables). At this level, we were keen to teach the child colors, animals, vegetables, birds, and fruits to expand the child's perceptions and raise his understanding.
- The second level of education, where it is necessary at this level to teach the child the human body, family, home, and transport.
- Third-level content:
    a. stories
    b. situations
- Forth level is to teach the child to pray, and this was done for several reasons:
    a. Increased connection with God and increased faith
    b. Keeping away from bad deeds.
    c. Improve health.
    d. Executing God's command

B. Expression Detection System

Many autistic children fail to develop friendships, in part because they struggle with social skills such as understanding facial expressions. Using flashcards of diverse facial expressions to help children with ASD detect emotions is a key component of behavioral treatment. The Stanford team used Google Glass' built-in camera in conjunction with software customized to run on a smartphone as an intervention that caregivers used at home with their children to supplement clinic-based therapy [17].

1. Design Process

Computer vision and machine learning programs are developed using numerous programming languages, the most common are Python, C/C++, JavaScript, MATLAB, Julia, Shell, R, Typescript, and Scala. Our selection was Python as the developing language for our work. Python is an interpreted, object-oriented language for high-level programming. It was developed by "Guido Van Rossum" and was first published in 1991. Its advantage is its compatibility for implementing small as well as large applications in a straightforward and simple way that allows reusability and readability of code [18]. Python also supports multiple programming types, such as functional, imperative, and procedural programming which are essentially like the C language and its methods and forms. In fact, our choice of Python language was based on a number of reasons that gave it an advantage over other programming languages:

- Simplicity of Python over other programming languages and ease of debugging and code tracing.

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- Python is an open-source language, which allows a huge amount of open-source documentation.
- The fast compilation speed of Python fits with our requirement of high-speed processing as the application depends highly on time synchronization between the three modules.
- Python has wide and robust standard libraries to use for application development. The standard libraries assist in using the various modules available for Python, which add functional features without having to write more code.

2. *Camera Selection*

To fulfill the objectives of the work, the camera had to be selected based on several requirements:

- High resolution to be able to do facial recognition of the person in front of the child at a distance of up to 10m.
- Can be integrated with the cloud to send the impression to the smart glass.
- Small size to mount on the smart glass.

The comparison between available cameras in the commercial market is shown in Table (4).

Table 4: Comparison between Cameras [19]

Point of Comparison (POC)	ESP Cam 32	Mini Wi-Fi Camera
Image		
Resolution	2MP, 1600 x 1200	1MP
Size	27 x 40.5 x 4.5 mm	14.3 x 9 x 4 cm
Cloud Integration	Easily integrated	Hard to be integrated
Price	High	High
Preferred	More preferred	Less preferred as hard integration with cloud

Stage 5: Software Applications

By developing a software system consisting of a web-based application as well as a mobile application that allows parents to monitor their children. It also teaches children from four to eight years of age through augmented reality.

A. *Web Application*

The Frontend of the application assumes responsibility for the interface and aesthetic appearance of the software. While there are various programming languages employed in Frontend development, HTML, CSS, Bootstrap, and JavaScript are among the most popular. These languages were utilized in the development of the application to produce superior results in external design. HTML is responsible for external drawing, CSS for internal shape and color, and JavaScript for object movement, resulting in a more dynamic website appearance. Bootstrap, a library of HTML, CSS, and JavaScript, providing pre-built code, is also employed as the optimal choice for developing responsive designs. Turning to the backend is responsible for storing, analyzing, organizing, and displaying data on the website. The language of choice for backend development is PHP, a server-side language requiring the Apache server for proper functioning. Despite its age, PHP is a powerful language with many advantages, and we chose XAMPP as the best option for PHP development However, the language is not user-friendly, as it requires the retrieval of NoSQL data from Firebase using the API and JSON languages, a highly challenging task.

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We also utilized the FPDF library to create reports, including medical reports that can be sent to an institution or physician to review the case. Additionally, we employed PHP to create login and logout pages. All Programming Languages Used in our proposed interface are shown in Figure (4).

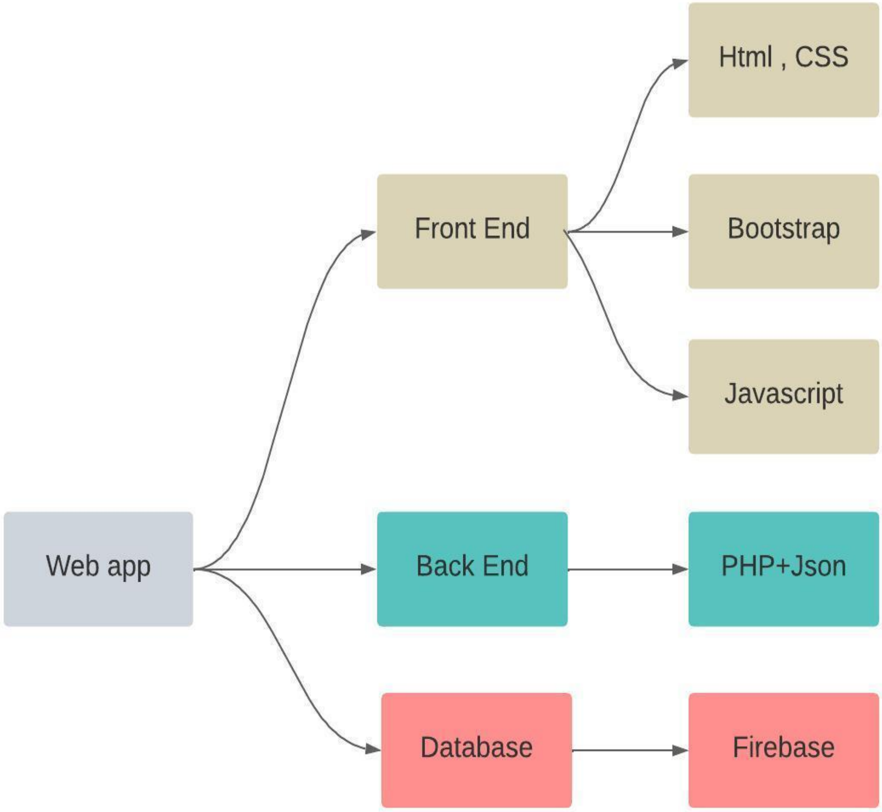

Figure 4: Programming Languages Used

B. *Mobile Application*

The aim of the mobile app figure (5) is to display and monitor the data by the administrator coming from the hardware, at anytime and anywhere. In addition to the problem of following up on subscription status by the user. The mobile app is developed in Flutter which is a framework from Google based on the Dart programming language. Discussing the potential benefits of using mobile applications in the education and support of autistic children; while more research is needed to identify the most efficient application categories and best practices, the use of mobile technology can provide an immersive and engaging learning experience for children with autism. A new mobile application is presented that utilizes augmented reality technology and various sensors to monitor children's safety and well-being. This application aims to provide a communication and educational tool for kids to learn about everyday things and to notify and alarm caregivers if something happens. While there are potential drawbacks associated with mobile applications, the use of advanced technology holds promise for improving education and care for autistic children. The application is powered by Google Firebase, a real-time database that stores the application's data. The mobile application utilizes various sensors to monitor the children, including fall detection, temperature, and stress levels. The mobile application provides three interfaces: educational, content reading of sensors, and profile pages.

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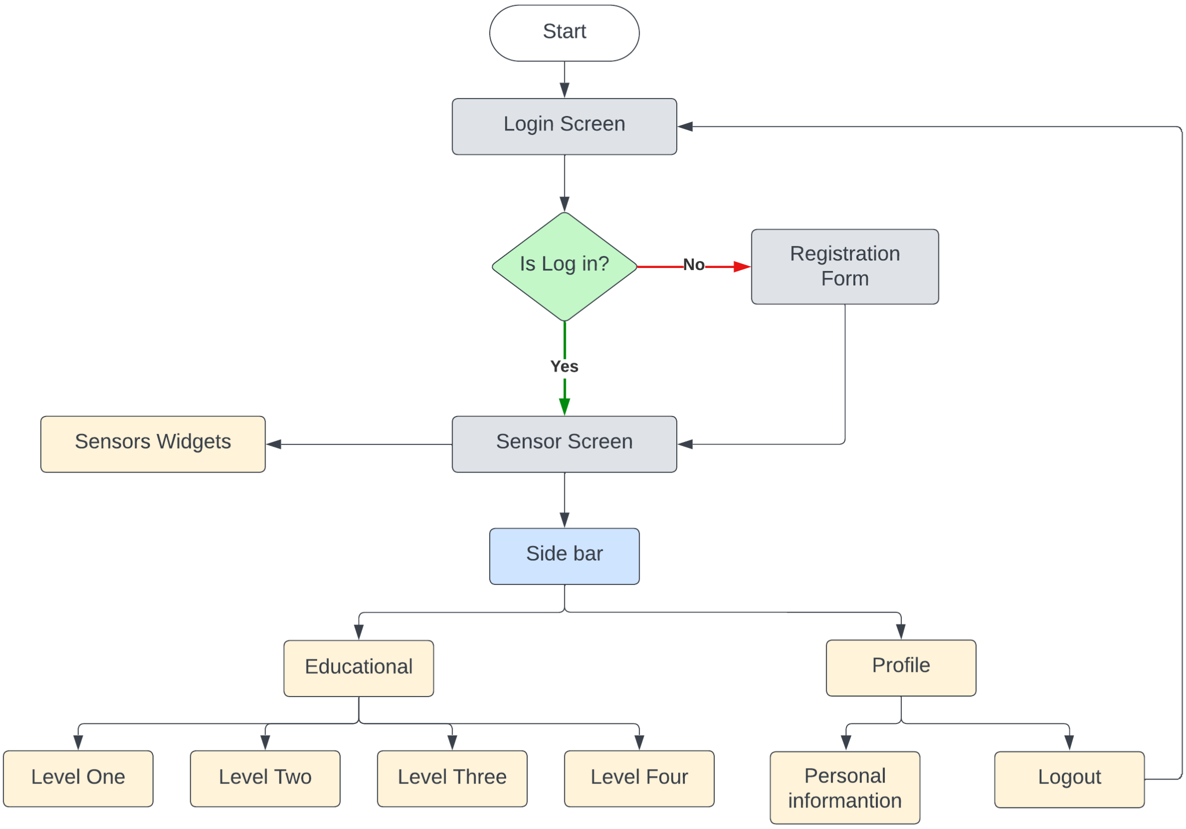

Figure 5: Mobile App Flowchart

C. *Cloud Fire store*

Use our flexible, scalable NoSQL cloud database to store and sync data for client- and server-side development. Cloud Fire store is a scalable, adaptable database from Firebase and Google Cloud for servers, browsers, and mobile applications. Similar to Firebase Real-time Database, it includes offline support for mobile and web so you can create responsive apps that function regardless of network delay or Internet connectivity. It also keeps your data synchronized among client apps with Real Time listeners. Cloud Functions and other Firebase and Google Cloud solutions, such as Cloud Firestore, are also offered with seamless integration. [20].

IV. RESULTS

A. *Temperature Sensor Result*

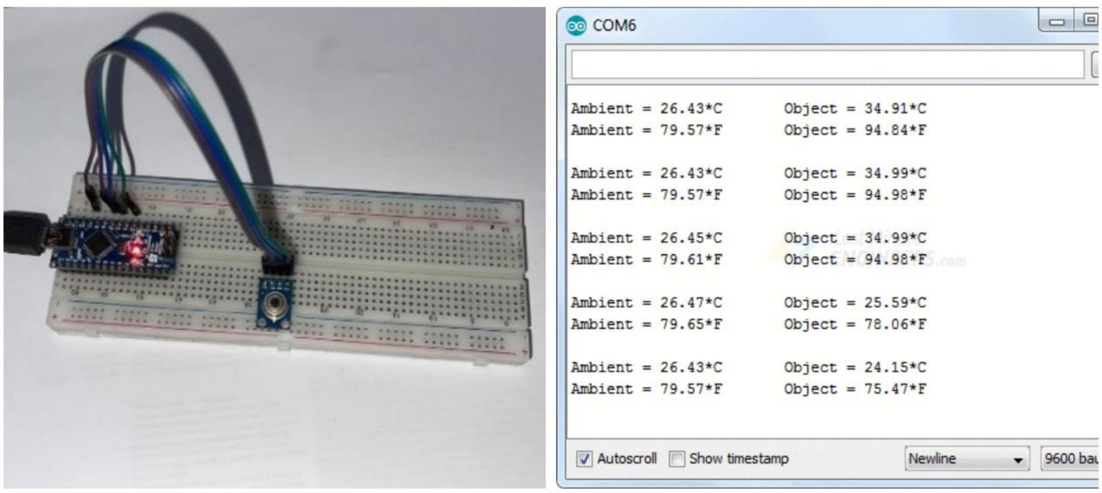

Figure 6: Temperature Sensor & Read data.

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The temperature sensor is tested and measured using Arduino serial port; Figures (6) and (7).

B. Integration Temperature Sensor with cloud and Web-App

By connecting the Node-MCU with Firebase to a specific user in order to upload the data to the Fire Store and the Website Download the data from Fire Store; figure (8).

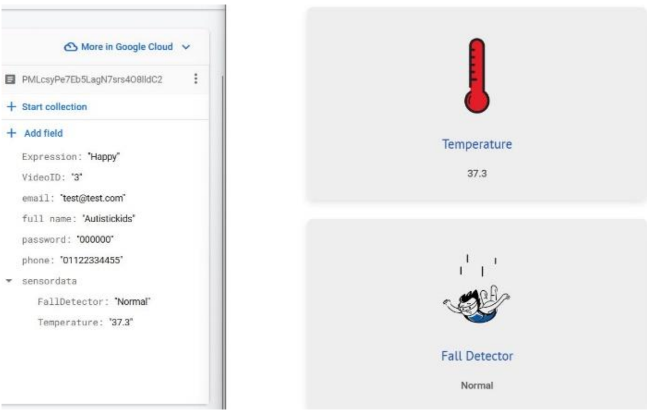

Figure 7: Integration between website and temperature sensor

C. TFT and Smart glass

As shown in Figure (8), displaying one of the educational videos on the TFT and the videos could be numbers, letters, and animals. They are displayed as frames with the least delay possible so that they can be synchronized with the voice of the video that will be heard from an external earpiece added to the glass.

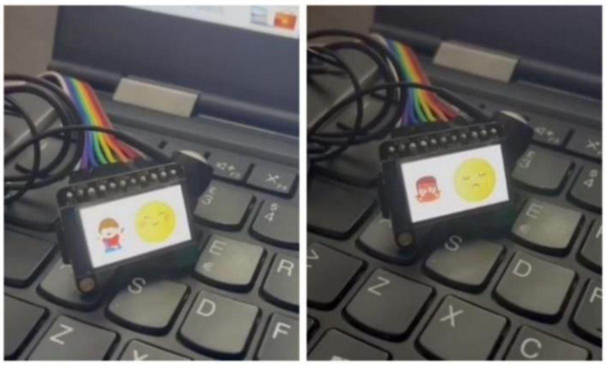

Figure 8: TFT implementation

D. Expression detection

By managing to code the camera to recognize four of the main core emotions that the child is going to face daily, to help him understand the main emotions of the people around him and thus communicate easier and learn more about social communication, Figure (9).

Figure 9: Expression detection

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E. Web Application:

As shown in Figure (10) website ability to generate customized reports for each child, incorporating essential data such as their photo, medical reports, address, phone number, medical status, and other relevant information that can aid the physician or institution. Moreover, a dedicated page presents popular articles on autism and ways to manage it, as well as identifying the most effective specialized medications. This page serves as a knowledge enhancer for children with autism. Furthermore, there is a page designed to collect sensor readings and monitor the child's temperature, mood, seizures, or other issues, thereby providing a better understanding of their condition and mood. Finally, A dedicated webpage for remote learning through TFT is also available, comprising four levels of children's learning divided into specific topics.

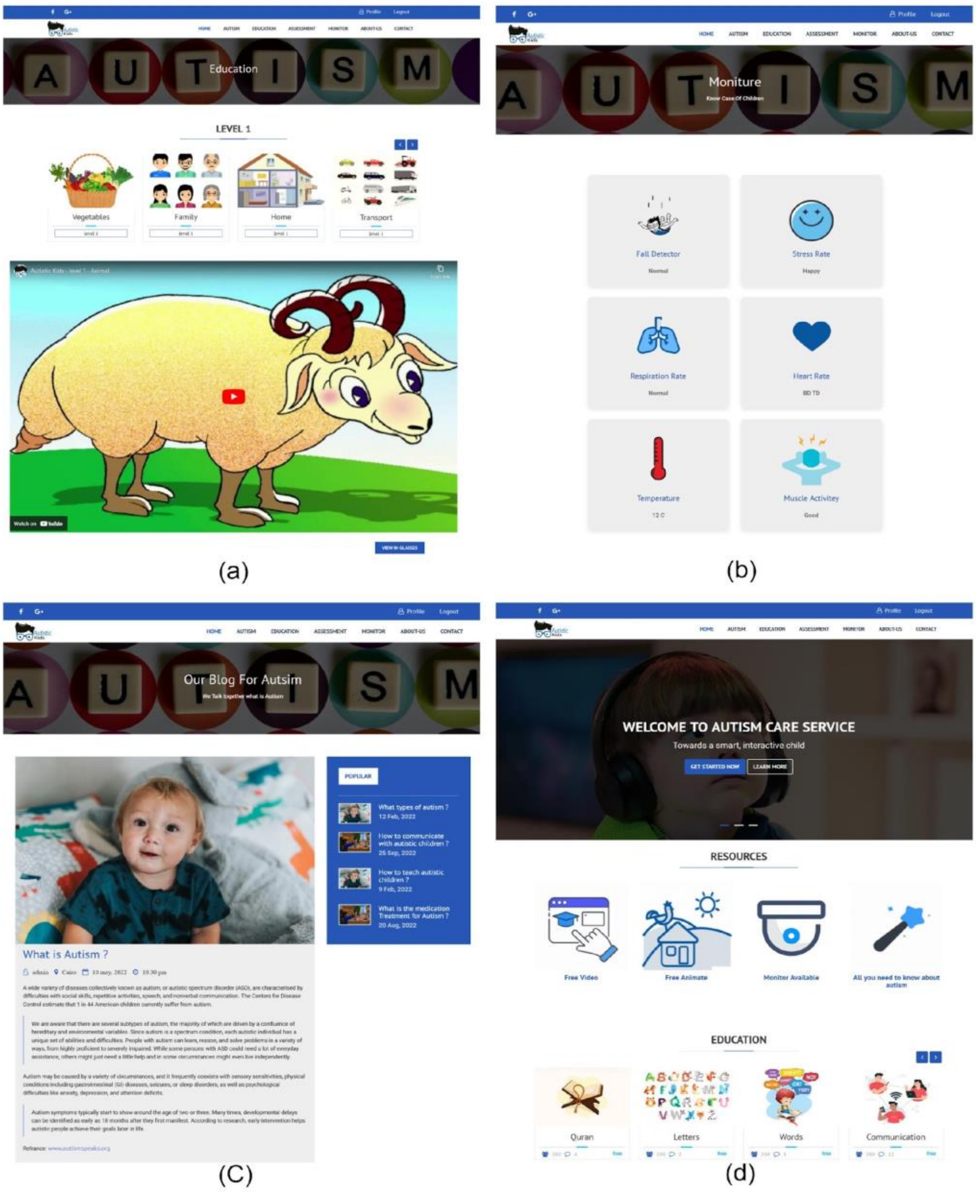

Figure 10: (a) Education Page, (b) Monitor Page, (c) Essay Page, (d) Home Page

F. Mobile application:

For the mobile application shown in Figure (11), the right figure is the User interface (UI) displayed in the user account. While the figures left show the content reading of the sensors, the interface displays the data collected by the sensors in real-time, allowing caregivers to monitor children's well-being. The interface also includes fall detection, temperature monitoring, and stress monitoring capabilities. If the sensors detect a fall or high levels of stress, the application alerts caregivers. The educational interface provides a series of interactive educational activities using AR technology. The activities are designed to be engaging and interactive, with visual and auditory feedback to reinforce learning. This page is designed for the child to stream videos through AR glass. It contains educational content that can be used under the supervision of the parent and is sectioned into four

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levels. Each level is designed for a specific age range. The profile page interface allows caregivers to manage the profile page and all data that have been drawn from the signing-up process. Caregivers can also set up alerts and notifications for sensor data.

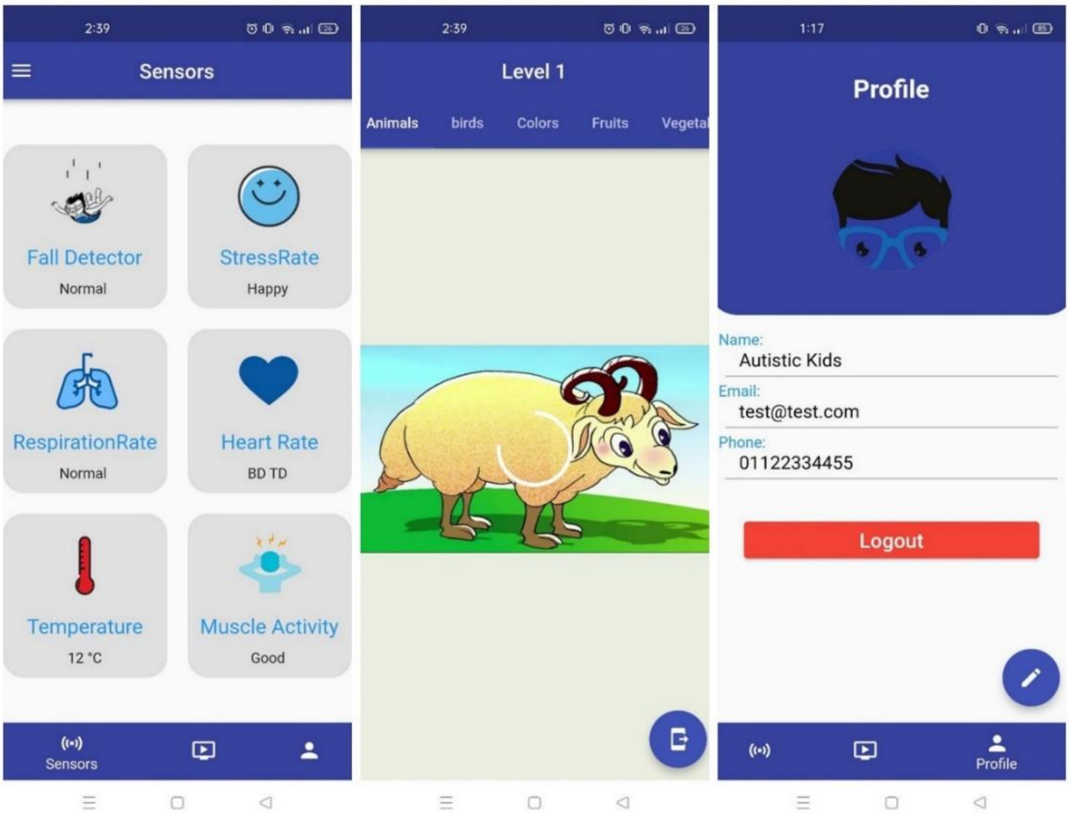

Figure 11: Sensors Screen, Educational Screen, and Profile Screen

G. Cloud Fire store

The firestore database in Figure (12) is categorized into collections and each collection is subdivided into documents and each document is subdivided into collections and so on mainly having THREE tables and a fetch table containing a group of entities. [21].

1. Table (One): USER DATA Contain registration Data where every user_ID contains:
   - A. Video ID that should be streamed through the glass
   - B. Date-of-birth
   - C. Email
   - D. Password
   - E. Phone number
2. Table (Two): Acts as an Excel sheet containing:
   - A. User ID for each glass (Account)
   - B. Sensors and their Readings.
   - C. Current Video that should be streamed through AR glass.
3. Table (Three): It's related to the videos section. (One: Many)

   Where Five videos can be streamed in multiple glass at the t same time

   A. Videos Category
   B. Videos Link

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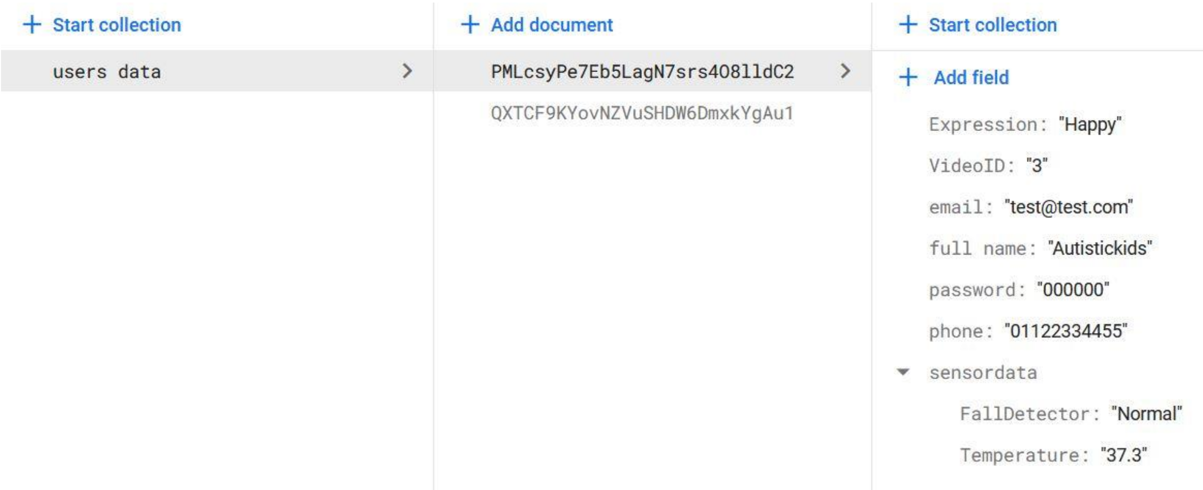

Figure 12: Database of Firestore

V. PROTOTYPE MODEL

Finally, the design is sketched first using a suitable CAD tool and implemented using a LASER CNC machine. The prototype was built on the standard scales of medical glass and 2cm was added from both left and right positions which contain all circuit components; Figure (13). The glass is experimented on by a child; he looks satisfied with the glass's weight, design, and functions.

(a) (b)

Figure 13 Prototype Model; (a) glass design, (b) real product on child

VI. CONCLUSION

The use of smart glass equipped with fall detection sensors, temperature sensors, and expression detection technologies, along with a mobile application and website for monitoring, has the potential to significantly improve the lives of individuals with autism spectrum disorder. Technology can provide real-time alerts to caregivers or parents in case of a fall or changes in body temperature, helping to prevent accidents and injuries. Additionally, expression detection technology can help individuals with autism recognize and respond appropriately to facial cues and emotions, enhancing their social communication skills. However, further research is necessary to fully evaluate the effectiveness of this technology and its impact on the lives of individuals with autism. Overall, the integration of smart glass technology into the management of autism holds great promise for improving the quality of life for individuals with the condition and their families. Manufacturing a product like smart glass for autistic children would require expertise in electronics, sensor technology, software development, and user experience design. It would be ideal to partner with companies that specialize in wearable technology or assistive devices for healthcare purposes. Conducting market research and reaching out to potential manufacturers with experience in these areas would be a good starting point to find the right manufacturing partner for this product.

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REFERENCES

[1] Yousef, A.M., Roshdy, E.H., Abdel Fattah, N.R. et al. Prevalence and risk factors of autism spectrum disorders in preschool children in Sharkia, Egypt: a community-based study. Middle East Curr Psychiatry 28, 36 (2021). https://doi.org/10.1186/s43045-021-00114-8

[2] Elbahaaey WA, Elkholy MH, Tobar SS, El-Boraie H. Egyptian children with autism spectrum disorders: risk factors and comorbidity in relation to disease severity. Egypt J Psychiatr 2016;37:59-69

[3] Smart glass using Internet of Things. (May 2020). International Research Journal of Engineering and Technology (IRJET).

[4] Rauschnabel, P. A., & Rossmann, A. (2017). Exploring User Adoption of Augmented Reality Applications based on Pokémon Go. Lecture Notes in Informatics (LNI)-Proceedings, 119-130.

[5] Stanford University School of Medicine

[6] Google Glass helps kids with autism - Stanford Medicine Children's Health (stanfordchildrens.org)

[7] Empowered Brain | Brain Power | Empowering Every Brain (brain-power.com)

[8] Improvement of Attention-Deficit/Hyperactivity Disorder Symptomsin School-Aged Children, Adolescents, and Young Adults WithAutism via a Digital Smartglasses-Based Socioemotional CoachingAid: ShortTerm,UncontrolledPilotStudy(https://www.researchgate.net/publication/324179893_Improvement_of_AttentionDeficitHyperactivity_Disorder_Symptoms_in_SchoolAged_Children_Adolescents_and_Young_Adults_With_Autism_via_a_Digital_Smartglasse s-Based_Socioemotional_Coaching_Aid_Short-Term)

[9] Uday, Sreedevi & Chandran, Jyotsna & Joseph, Amudha. (2018). Detection of Stress using Wearable Sensors in IoT Platform. 492-498. 10.1109/ICICCT.2018.8473010.

[10] MLX90614 Datasheet MLX90614_rev001.pdf (sparkfun.com)

[11] Al-dahan, Prof. Ziad & Bachache, Nasseer & Bachache, Nasseer. (2016). Design and Implementation of Fall Detection System Using MPU6050 Arduino. 180-187. 10.1007/978-3-319-39601-9_16.

[12] MPU 6050 Datasheet MPU-6000-Datasheet1.pdf (tdk.com)

[13] ESP8266 Datasheet (2018) - ESPRESSIF SYSTEMS (SHANGHAI) CO., LTD.

[14] Melissa LeBlanc-Williams (2023). Adafruit 1.14" 240x135 Color TFT Breakout LCD Display.

[15] Video Modelling and Behaviour Analysis: A Guide for Teaching Social Skills to Children with Autism (Book).

[16] Arduino Data Glasses for My Multimeter : 8 Steps (with Pictures) - Instructables

[17] Wilson, K. (2013) ‘Incorporating video modelling into a school based intervention for students with autism spectrum disorders’, Language, Speech, and Hearing Services in Schools, 31, 105–117.

[18] Basel Kikhia, et al, “Utilizing a Wristband Sensor to Measure the Stress Level for People with Dementia,” Sensors, 2016.

[19] Washington, Peter Yigitcan et al. “SuperpowerGlass: A Wearable Aid for the At-Home Therapy of Children with Autism.” Proc. ACM Interact. Mob. Wearable Ubiquitous Technol. 1 (2017): 112:1-112:22.

[20] "Google launches Cloud Firestore, a new document database for app developers". TechCrunch. 3 October 2017. Retrieved 2018-07-16

[21] Lichtendahl, K. C., Andrasko, J., & Boatright, B. (2022). Google Cloud Platform: Cloud Storage. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.4133739