An IoT-based System for Supporting Children with Autism Spectrum Disorder

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***Abstract*— Autism spectrum disorder (ASD) affects one out of every 54 children, according to statistics. In this paper, we use the Raspberry Pi to build a system that evaluates the efficiency of a Smart monitor for helping children with Autism Spectrum Disorder (ASD) learn and improve their quality of life. Many autistic children are very motivated and interested in Computers and smart monitors. Assistive technology systems like these encourage children with autism to communicate more. Our proposed framework demonstrates that it can support children with ASD by teaching them new skills.. It helps them in making choices, respond, and tell parents what they are interested in, identify their needs, think, and maybe even feel. We implement and evaluate the performance of a new system based on Internet of Things (IOT) for supporting learning and improving the quality of life for children with Autism Spectrum Disorder (ASD). Moreover using this System the ASD kids can easily learn any Subjects with ease. Strategies for supporting the large number of students with autism spectrum disorder (ASD) in the area of literacy**

Keywords*— CNN, Social distancing, Computer vision, COVID-19, Person detection

I. INTRODUCTION

ASD (autism spectrum disorder) is a neurological/developmental disorder that affects a person's actions and speech. The signs of this condition are most often found in children under the age of eight. The symptoms are often seen in their interactions and changes in their behavior. Learning disabilities, hyperactivity, and anxiety disorders are also possible symptoms. The ASD is depicted in various statistical portals raising worldwide. Unfortunately, no information about how many people in Bangladesh have ASD has been discovered. Since there is no current treatment for autism, the study discussed here focuses on children with autism. The main aim of care is to build a supportive and safe environment. Several studies have shown that children with autism can exercise social interaction in an interactive setting, despite the fact that ASD is a lifelong condition with no proven cure. Traditional educational strategies for ASD, on the other hand, are expensive, unavailable, and ineffective due to a lack of resources and low motivation. Computer-based approaches have shown that ASD children communicate better with technology in recent years. Many children with ASD have a natural affinity for computer technology, which aids them greatly in their learning. Children with ASD will use virtual reality (VR) technology to actively engage in engaging and immersive simulated scenarios. Several VR-based programs have been developed to teach essential living skills to children with ASD, such as driving and social skills, and the findings indicate that children with ASD were able to understand, use, and respond appropriately to virtual environments, with the possibility of transferring these skills to real life.In this paper, we suggest and introduce a new framework for promoting, learning and enhancing life quality based on an assistive smart framework. Several VR-based programs have been developed to teach important living skills to children with ASD, such as driving and social skills, and the results show that children with ASD can understand, use, and react appropriately in virtual environments, with the potential to translate these skills to real life.

The majority of assistive research focuses on students with ASD. Autism is a neurological condition that influences an individual's capacity to impart and social. One of the difficulties in addressing this issue is determining how to use technology to assist these children. Another developing populace that may profit by assistive applications in a custom curriculum, recuperation, and different fields is the elderly. Individuals with intellectual inabilities, just as formative and social issues, advantage from this preparation. The justification the expansion in kids with ASD is hazy. Early intercession is fundamental for long haul achievement, yet even with early mediation, numerous people actually need broad help for the remainder of their lives.

Since there is no treatment for Autism, the children with ASD are being used as test subjects. The aim is to provide a learning environment for the students.

Instead of eliminating face-to-face intervention, our proposed framework provides learning activities for ASD students in the form of differentiated directions. Our proposed framework would provide a clear, concrete, self-paced learning environment that promotes improved visual information processing. Students with ASD who engage in this learning environment on a daily basis will change and

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improve their concentration and reduce anxiety-related behavior.

II. Related Works

Clinicians, the legal system, and policymakers are the primary users. The DSM arose from census-gathering systems established by the Psychiatric Hospital and the Army Manuel. Since its publication in 1952, revisions have been made to the overall number of psychiatric illnesses, as well as the removal of those that are no longer deemed mentally ill . In contrast to the theory nosology used in DSM-III, the Recent Editions of DSM have gained a lot of acclaim for the way they standardized clinical diagnosis based on empirical evidence. However, the use of subjective lines between psychiatric illness and human distress treatment sparked a lot of debate and criticism[1].

[2]. Differentiation refers to a teacher who focuses on the educational needs of an ASD student or a small group of students rather than the conventional way of teaching a class, in which all of the students are treated the same. In ten chapters, this book examines how school leaders can create classrooms that are open, personalized, and differentiated: [1] "Understanding Differentiated Instruction: Laying the Groundwork for Leadership"; [2] "Reasons for Optimism About Differentiation: Its Basis in Theory and Research"; [3] "Lessons from the Literature of Change: What Differentiation Leaders Need to Know"; [4] "Establishing Conditions to Initiate Systemic Change"; [5] "Practical Strategies for Implementing a Differentiation Growth Plan";[6] "Staff Development That Supports Differentiation"; [7] "System Growth Toward Differentiation"; [8] "Communicating with Parents and the Public About Differentiation"; [9] "Growth Toward Differentiation in Context: A Case Study of Change in Process"; and [10] "Planning for the 'What' and 'How' of Differentiation". Six articles in the appendix, you'll find guides and checklists. and questionnaires, which school leaders may find useful in planning for and supporting the transition to more academically sensitive classrooms.[3].Developing Social Intelligent Robots has as its aim the development of robots that appear to have natural social characteristics. The territory depends on the robot's actual epitome, which permits it to interface with users in a social and drawing in way, just as its basic capacity to move and act freely. Socially assistive robotics, for example, is one of the components that focuses on assisting human users through social rather than physical contact. Early results indicate that socially assistive robotics, a new interdisciplinary research area with wide horizons of exciting and urgently needed research, has a great deal of promise. Notwithstanding the way that socially assistive automated innovation is as yet in its beginning phases, the following ten years will see robots utilized in medical clinics, schools, and homes with treatment offices that can screen, analyze, treat, backing, and help their clients. At this basic crossroads in its development, the board specialized local area and the recipient populaces ought to work together to shape the field toward its normal effect on improved human personal satisfaction.[4].This paper discusses the history and key reasons for the AuRoRA (Autonomous Robotic Platform as a Remedial Tool for Children with Autism) research project. We contend that versatile robot innovation can likewise be utilized in a significant and deductively testing application region: autism rehabilitation. The first steps in building a robotic platform as a remedial device, as well as the findings of the initial trials, are discussed. We study continuous research and infer that this application territory can possibly propel our comprehension of human-robot interface plan while likewise supporting autistic children's recuperation. Recommended learning model for autism children using deep neural network ,which helps the autism children to recommend the specific profile of learning style to improve education[15].

III. Proposed Architecture

The proposed framework is to create a device that helps parents of autistic children grow their children in a skilled manner by allowing them to learn music and watch videos using a keyboard, raspberry pi controller, and smart display. Smart objects are becoming more capable of detecting, finding, sensing, and communicating because of technological advances, resulting in new ways of contact between people and things, as well as between things themselves. We suggest combining Web and sensor technology. Utilizing the way that understudies with autism are magnificent at utilizing innovation, we proposed and presented an advanced e-learning strategy to improve the kids' concentration by coordinating PC and study hall exercises. Below fig1 shows the proposed system process design.

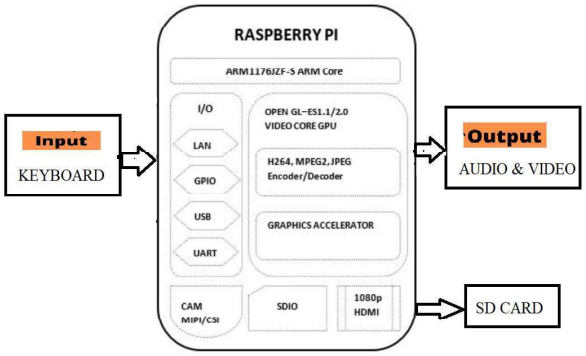

Fig 1: System Process design

1) In this scheme, the Raspberry Pi is a low cost Personal Computer that runs Linux and has a progression of GPIO (General Purpose Input/Output) sticks that can be utilized to control electronic parts for actual registering, and it fills in as a small scale PC for youngsters.

2) A shrewd screen shows photographs, music, and math abilities as they click the keypads on the console.

IV. System Implementation

The Arm11 processor, which is executed on the Raspberry Pi Board and is associated with a screen, camera, and SD card, controls the whole gadget. Both of the parts are associated utilizing USB connectors. The Raspberry Pi is the handling module's fundamental segment; the Raspberry Pi's allure comes from its little size and ease. The minuscule structure factor PC could be utilized as a minimal effort home theater PC (HTPC) or an optional low-power PC, as indicated by aficionados. Schools and organizations, for

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instance, may profit by conveying an armada of PCs for a portion of the expense of traditional work area towers.

The gadget's smaller size makes it simple to stow away, devours little power, and, with the correct case, can be taken cover behind the showcase. It can likewise be utilized in specialty applications including computerized signage.

There are three modules in our framework

- Raspberry PI Invoice
- Raspbian OS Setup
- Functional Modulo
- Smart Monitoring Audit

The Raspberry Pi modulo is the most important part of the ASD students' IOT-based framework. It serves as the system's controller. Its various components

1) ARM CPU/GPU -- I Broadcom BCM2835 System on a Chip (SOC) — this is a Broadcom BCM2835 System on a Chip (SoC) with an ARM central processing unit (CPU) and a Video core 4 graphics processing unit (GPU). The CPU is in charge of all computations that make a machine work (inputting data, performing calculations, and generating output), while the GPU is in charge of graphics output.

2) GPIO — These are uncovered universally useful input/output points focuses that real equipment specialists would have the option to dabble with.

3) RCA — An RCA jack may be used to connect analogue TVs.

4) Audio out — This is a 3.55-millimeter jack for connecting audio output devices such as headphones or speakers. There is no sound.

5) LEDs — Light-emitting diodes, which can be used for your entire indicator light needs.

6) USB (Universal Serial Bus) — This is a universal communication port for a wide range of peripheral devices (including your mouse and keyboard). Model A has one and Model B has two. Utilize a USB hub or attach your mouse to your keyboard if it has one to increase the number of ports.

7) HDMI — It stands for High Definition Multimedia Interface. You can connect a high-definition television or other compatible system to this connector with an HDMI cable.

8) Power — This is a 5v Micro USB power connector that can be plugged into any power supply that is compatible.

9) SD card slot — A full-sized SD card slot is available. An SD card with an operating system (OS) must be used to start the device. They can be bought from distributors, but in the event that you have a Linux machine and the time, you can likewise download an operating system and save it to the card yourself.

10) Ethernet — This connector is only accessible on the Model B and allows for wired network connectivity. It serves as a connection between the user and the computer system. It receives the user's input and transmits it to the Smart Monitor.

The Following steps are carried out in order to run a Working framework.

Step 1: Remove the Pi from the counter static sack and position it on a non-metallic surface.

Step 2: Connection the Presentation; associate one finish of the HDMI link to the Pi's HDMI port and the opposite finish to the T's HDMI port.

Step 3: Connect the Ethernet link from the switch to the Pi's Ethernet port.

Step 4: Connect a USB mouse to one of the Raspberry Pi's ports.

Step 5: Fitting the USB Console into the other USB port on the Pi.

Step 6: Join the Pi to the miniature USB charger, however not to the force supply yet.

Step 7: The Raspbian working framework is introduced on the SD card.

The Module’s Main function is to initiate a particular Key button to a particular Audi or Video visuals. The connecting is done using Python and Embedded C. Initially sample video for autistic children are assigned to the keys in the keyboard. The users can changer the videos or the keys which is pressed to play the media file, if necessary. The Major advantage of this modulo is that Any Video or Audio which is required for the ASD students can easily be replaced with already Existing Video and Audio. The Functional modulo is easier to replace AV Visuals.

The Module’s Main function is to display the Audio and Video which is used to configure the desired Audio or Video Visuals. The Main process is to match the desired AV required to the desired output required. The Smart Monitor works on the output given by the User. Depending on the Key assigned to a particular Audio/Video it displays the required. Games, Audio and Video can be played by the Smart Monitor Audit.

V. EXPERIMENTAL RESULTS

Once the Raspberry Pi is connected to a LCD display (Monitor or TV) and the power supply cable is connected, the user can open the Python shell and run the program

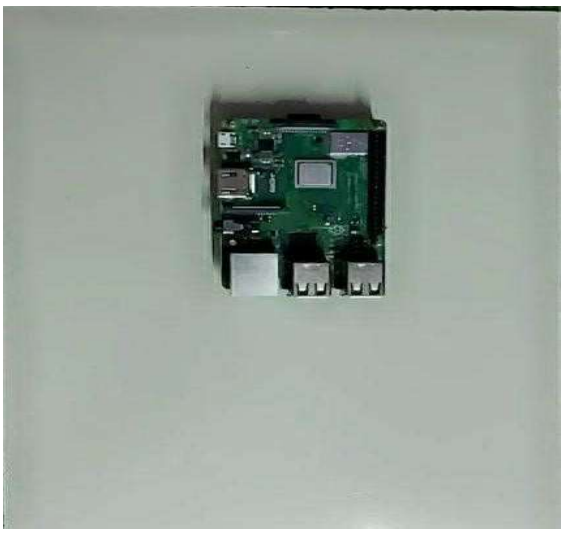

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Fig.2: Raspberry Pi used for implementation

The above fig2. depicts the Raspberry Pi used for the implementation of this project

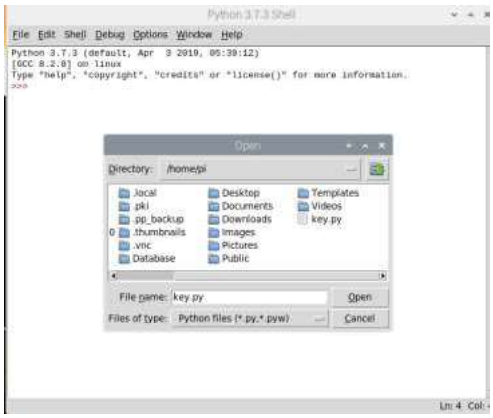

Fig.3: Screenshot of saved code file

The above fig.3 shows the image of the Raspberry Pi command terminal and the program file saved in Python

After running the program, in the Python output shell, when the user enters the appropriate key, the corresponding audios or videos for the autistic children will be played.

Fig.4: Python output shell

Fig 5. Screenshot of Sample Output video1

Fig 6. Screenshot of Sample output video 2

VI. CONCLUSION

In this paper, we implement and evaluate the performance of a new system technology for supporting learning and improving the quality of life for children with ASD. The experimental results showed that the smart environment can help children with autism stay focused during their learning and can maximize their ability to reach their peak attention. The child's task performance is enhanced and the child will be able to learn new language skills, social skills, appropriate behavior and academic skills. The IOT based model further helps the ASD(Autism Spectrum Disorder) Student's to interact with people in Real time Environment using a Virtual Environment where they have simulated sequence of situation . Also, using this Model, we can help the ASD kids in learning Science or Math's according to the Subjects that they wish and it can be upgraded to other levels when they finish their level and this helps them in a interactive and easier learning.In the future, we would like to work with more children with different learning abilities and through experiments to evaluate the effectiveness and make adjustment to our proposed system. Also, we would like to use the proposed system with purpose of improving the quality of life for children with ASD. This System can be used in the future as an Interactive tool for ASD kids. The AV visuals using Raspberry Pi can be used for the purpose of more and more learning favorable concepts for the ASD kids. The Open CV platform can open a wide range of possibilities for the Autistic kids. It can also increase Employment too as they can easily sustain in a work environment using the Platform which gives them a Virtual Environment which helps them in Real Environment.

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