AUTISM SPECTRUM DISORDERS MONITORING SYSTEM USING IOT

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Abstract

A system based on the Internet of Things (IoT) is being created for society that offers constant monitoring without restricting the independence and privacy of autistic patients. This consistent, cyclical, and dysfunctional pattern of behaviors is linked to the severity of ASD (autism spectrum disorder) specifically. Utilising information from 3-D accelerometer sensors and gas sensors, a lightweight Internet of Things-based system can quickly identify nocturnal epileptic seizures. This system uses an accelerometer (ADXL 335) sensor, a gas sensor (MQ-2), a buzzer, and an IoT module (ESP 8266-12E) to monitor patients with autism disease in terms of their behavioural patterns. Data is stored in the cloud with the aid of an ESP 8266 - 12E NODE MCU. The ESP-12-based Systems serves as the hardware platform for the gyroscope and gas sensor, and its runs on that platform.

1. INTRODUCTION

AUTISM spectrum disorders (ASD), characterized by deficits in communication and social contact together with restricted, repetitive, and stereotyped patterns of behavior, represent a range of neurodevelopmental disabilities [6]. The growing of technologies such as ubiquitous computing and intelligence are improving the quality of health care and medicine treatments. In this work we focus attention on the autistic spectrum disorders (ASD), a group of variable neuron-developmental disorders that first arise during childhood, and generally follows a fixed progress without remission. Manifest symptoms gradually begin after the age of six months, become established by an age of two or three years and tend to continue through adulthood [5]. There are distinguished not by a single symptom but by a characteristic triad of symptoms: impairments in social interaction in communication; and restricted interests and repetitive behavior [7]. Even though ASD is a life-long disorder with no known cure, several studies have shown that children with ASD can learn how to act in social situations when they can specific scenarios. Most of the children with ASD exhibit a natural affinity for computer technologies that leads to a higher level of engagement and disruptive behaviors in computer-based interactions [8]. In particular, virtual reality (VR) technologies allow children with ASD to actively participate in interactive and immersive simulated situations. we are monitoring patient through the IoT and data are stored in the cloud storage help of ESP 8266 – 12E NODE MCU. Node MCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 unit.

2. LITERATURE REVIEW

The author [1] proposed the presented a novel collaborative virtual environment (CVE)-based social interaction platform for ASD intervention. An inventive low-cost intervention environment that encourages collaboration with peers and offers flexibility in communication may be created as a result of the development of CVE technology for ASD intervention. Using simple hand activities to cooperatively manipulate virtual objects that are tracked in real time by cameras, two kids can play a diversity of interactive games in a virtual reality environment with the help of the Communication Enhancement CVE system that has been demonstrated. Additionally, the dialogue Enhancement mode in these games, which enables players to share information and talk about game strategy using their gaze and voices, is intended to encourage natural dialogue and collaboration between players.

The author explained that a Mandarin-phonetic-symbol communication aid named as zhuyin communication board is developed for children with high-functioning autism. The Zhuyin communication board can be used on a tablet computer to help autistic youngsters communicate with others. Using the specially designed zhuyi communication board, an autistic youngster can press the proper phonetic symbols to communicate his thoughts. The created app offers a image-based test for learning Mandarin phonetic symbols of a variety of objects to attract the interest of autistic kids. In contrast to the conventional paper keyboard, the newly designed tool could display the typing phonetic symbol right away on the screen and offered the voice of zhuyin pronunciation to enhance the language comprehension abilities of autistic children [2].

The author discussed the designing and the developing of a Personal Health Records (PHR) system to assist clinicians and caregivers in the analyzing of clinical data and monitoring of anomalous gestures of patients with autism diseases. The detecting of anomalous gesture is made by using both Artificial Intelligence (AI) techniques and a framework based on formal methods. The research activity has been conducted in cooperation with clinicians of the Department of Child Psychiatry at Children's Hospital Santobono-Pausilipon in Naples [3].

This study suggested that well-executed monitoring and preventive programs had reduced the risk of CDs and limited their impact on patient health outcomes and government healthcare spending. In this research, we offer a framework to undertake appropriate nonintrusive monitoring, gather real-time patient data, and, when necessary and appropriate, provide medicinal and/or lifestyle interventions. The framework enables the smooth integration of various technologies, applications, and services because it is based on service-oriented architecture (SOA) and the Cloud. Additionally, it incorporates mobile technologies to efficiently gather and transmit critical data from wearable biosensors on patients while taking into account the restricted functionality, power consumption, and sporadic network disconnections of mobile devices [4].

3 METHODOLOGY

The recommended solution is based on WSN, which offers continuous monitoring while preserving the patient's autonomy and privacy. Identifying data with and without autism movement is the key objective. With the help of data from 3-D accelerometer sensors, this research aims to give a simple method for the early diagnosis of nocturnal repetitive behaviour

and epileptic seizures. To create the automatic autism detection system, datasets from patients with severe autistic disorder were employed. Proper acceleration, which differs from coordinate acceleration (rate of change of velocity), can be measured with an accelerometer. For instance, an accelerometer hidden on the surface of the Earth will detect an acceleration of g = 9.81 m/s2 straight upwards due to gravity.
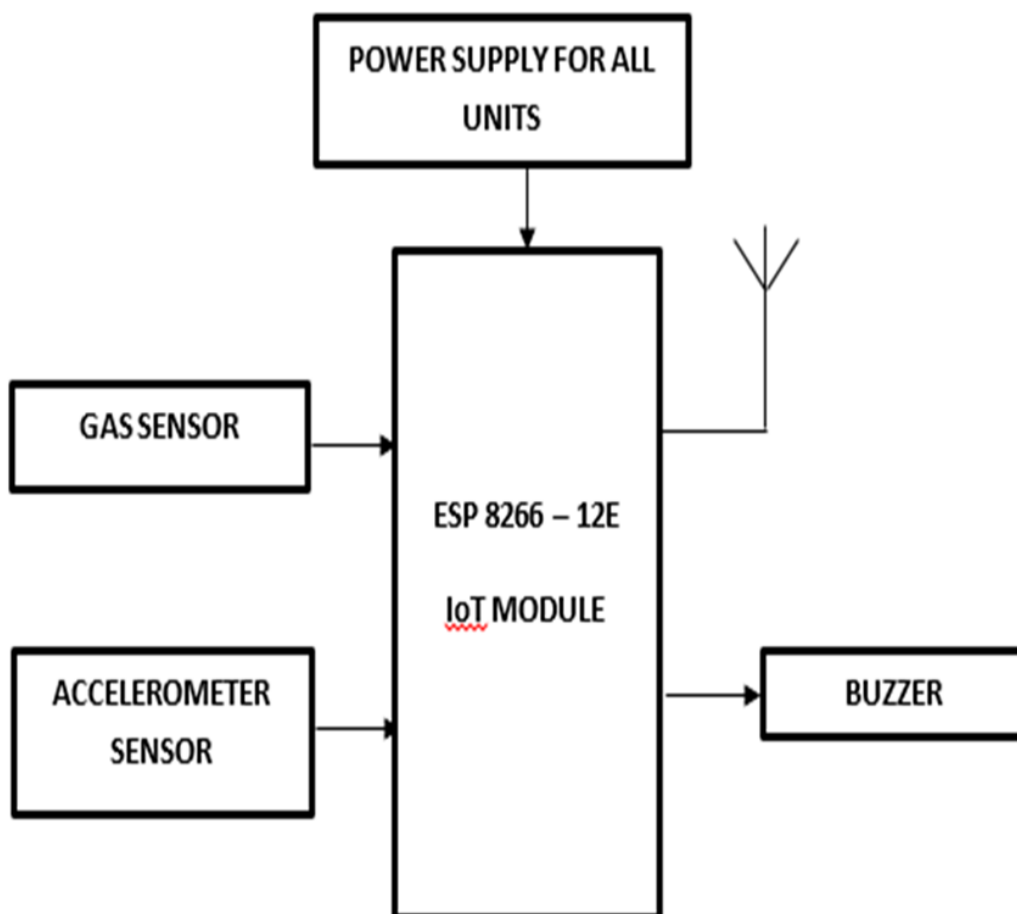

Fig 1 Proposed Methodology

In contrast, accelerometers in free fall declining at a speed of around 9.81 m/s2 towards the center of the Earth will record zero. Orientation may be quickly determined with a simple tilt switch. When the casing is upright, a pair of balls inside the tilt sensor make contact with the pins. The gas sensor detects environmental gas leaks. The IOT module, which can function as a microcontroller and a Wi-Fi module, receives the output from these sensors. When compared to predefined values that have been accumulated during the development period, the aforementioned sensor value must not exceed them. The buzzer will notify the caretaker to

prevent a fire accident in the event of a gas leak when the IOT sends a signal to the doctor or carer via the Cayenne server. Abnormal circumstances are monitored using the Cayenne app or website. The proposed methodology has been shown in Fig 1.

The advantages of this system are manifold, including low power consumption, providing an energy-efficient solution for continuous monitoring. Its comfortability ensures a non-intrusive and user-friendly experience for individuals with autism. The system's flexibility allows for adaptation to diverse scenarios and environments, while its ease of use makes it accessible and practical for both caregivers and healthcare professionals. In summary, the proposed solution not only addresses the technical aspects of autism detection but also prioritizes user experience and practical implementation.

3.1 Axis Accelerometer ADXL 335

Breakout board for Analog Device's three-axis ADXL-335 (Fig 2). The newest in a long and reliable line of analog sensors is this one. With only 320uA of power usage, the triple axis MEMS accelerometer ADXL335 has incredibly low noise and power consumption. The entire sensing range of the sensor is +/-3g.The board is sent completely tested and built, with external parts fitted. The onboard regulator is set to 3.3 volts, and each axis bandwidth is adjusted to 50 Hz by the provided 0.1 uF capacitors.
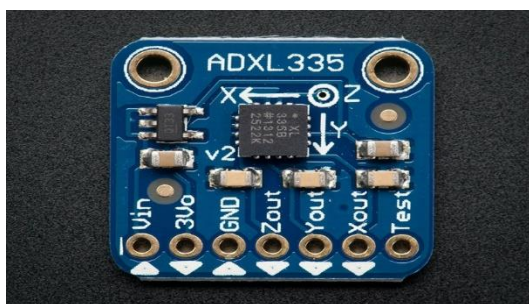

Fig 2 Axis ADXL 335

3.2 Gas Sensor

The basic tilt switch can easily be used to sense orientation. In the can are a pair of balls that build contact with the pins when the case is upright. Gas Sensor uses the detect the atmosphere gas as shown in Fig 3. These sensors output is given to esp 8266 microcontroller.
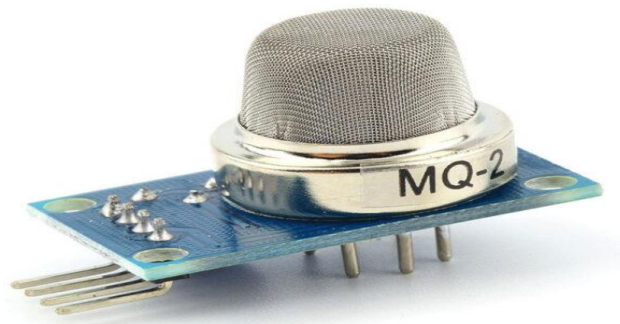
Fig 3 Gas Sensor

3.3 NodeMCU

NodeMCU is also an open source IoT platform (fig 4). It contains firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "Node MCU" by default, it refers to the firmware rather than the dev kits. This type of firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266.Using IoT we can do monitor and control the physical devices with the help of internet. It is used to connect the physical devices to Internet using ESP8266-12E module.
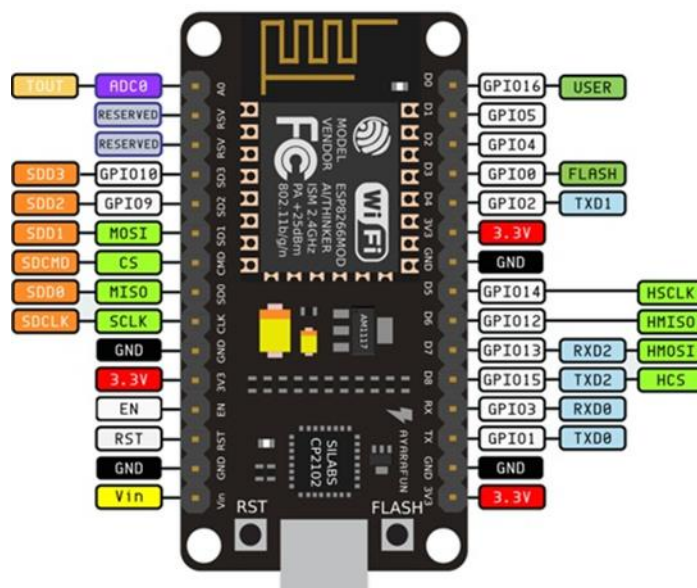

Fig 4 NodeMCU

4. RESULT

Collecting the necessary materials It is possible to assemble ESP8266, an accelerometer, a gas sensor, a buzzer, and other required parts. Making the circuit Any other circuit design software, such as Fritzing, can be used to create the circuit. Both a power source and a Wi-Fi network can be linked to it. The ESP8266 module can be configured to join a Wi-Fi network and transmit sensor data to the cloud. The MQTT protocol can be used to send the data. It is possible to test the sensors to make sure they are functioning properly, including the accelerometer and the gas sensor. A serial monitor can be used to view the data. You can build a dashboard for the system using the Cayenne app. It is easier to monitor when the sensor data is shown on the dashboard. The buzzer can be included into the circuit and set up to sound off when specific conditions are satisfied, such as when the gas sensor picks up on potentially harmful gases. Different circumstances, such as when a person with ASD wanders off or when a toxic chemical is discovered, can be simulated to test the system. It is possible to assess the system's efficiency in helping those with ASD.
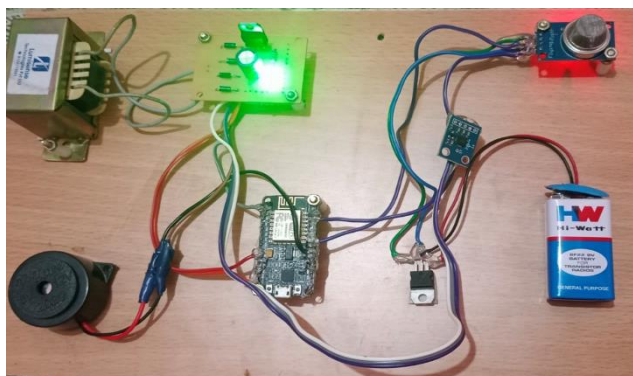

Fig 5 Autism spectrum monitoring system using IOT

5. CONCLUSION

Behaviour, speech, and social interaction are all hampered by the developmental disease known as autism spectrum disorder (ASD). This disorder is complex and has a wide range of symptoms, co-occurring diseases, and severity. Even though the actual cause of autism is still not fully understood, research has identified several genetic and environmental elements that may be involved in its development. whereas there is currently no cure for autism, early identification and treatment can significantly improve the outcomes for those afflicted by the illness. To treat specific symptoms or co-occurring problems as part of the treatment plan,

therapies like behaviour therapy, speech and language therapy, and occupational therapy might be used with medications. It's important to keep in mind that persons with autism have unique abilities, talents, and opinions that should be valued and admired.

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