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Smart Monitoring System for Autistic Patients

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Abstract : This paper reports on a wearable IoT monitoring system which can be used for the collection of quantified data of patients with Autism Spectrum Disorder (ASD) by which the parent or the guardian can monitor easily. The objective of the project is to monitor the children with Autism by a self-updating monitoring system. Autism is referred to behavioural disorder because of the repeated and non-functional activities of the patients. The long-term objective of the project is to use this system for data-driven detection, therapy, intervention, and progress monitoring for children with Autism. This project consists of accelerometer sensor, GPS module, Wi-Fi Module, Audio sensor, Temperature sensor connected to Arduino UNO. The accelerometer is used to detect the child's activity continuously. The data is transferred to the mobile phones of the guardian or the parent by which the needs can be fulfilled or accidents may be prevented. Using the data collected over a period of time, intervention of this disorder can be developed in a vast manner.

Keywords: - Autism Spectrum Disorder, Monitoring system, Intervention, Arduino

1. INTRODUCTION

Autism is a mental condition characterized by difficulty in communicating and using language and abstract concepts [1]. Autism Spectrum Disorders (ASDs) is a brain developmental disorder characterized by impairments in social reciprocity and communication and the presence of restricted or repetitive activities. The term "spectrum" refers to the variation in the type and severity of symptoms. The etiology of autism is organic though no single pathologic event has been identified as uniquely or universally associated with the disorder [1]. According to the survey of CDC's Autism and Developmental Disabilities, about 1 in 44 children has been identified with autism.[2]. Mild symptoms may function on their own but severe symptomatic require support substantially in their daily lives. It is a disability that could not be easily figured out by the public. Sometimes it is misunderstood by the general public that they judge as "odd" behaviour or sometimes consider as naughty and the parents are not taking control of their child. This causes discomfort among parents that they rather don't want to take their autistic child with them to public places [3]. The cause of autism spectrum is uncertain. But the risk factors can be genetic conditions. Treatment is generally behavioural therapy and teaching them the coping skills. Some medicines can be of help sometimes but there is no evidence to support that is a very strong solution[4]. Autistic patients cannot express their feelings or cannot ask what they need to their guardian due to lack of consciousness. In this paper, a wearable Arduino-based device by which the parents or caregivers of autistic children can monitor their movement and their health condition even from a remote place using Smartphone or any wireless communication. Another severe anxiety of the parents of autistic children arises when they go outside of the home. In case, if they are lost or go outside of home subconsciously in absence of their parents, it will be difficult to find them as they cannot communicate with people like normal people. Taking this fact into account, a feature to locate the actual position of an autistic child is added with this wearable device. Parents will be able to identify their child's location by using the information which will be delivered to their Smartphone on a regular basis from that wearable device.

2.METHODOLOGY

Proposed System

This is an overview of stereotypic behaviour in autistic spectrum disorder (ASD). This repetitive, non-functional, fixed pattern of behaviour is associated with autism severity but it is not specific for ASD. There are a wide range of behaviours mentioned as stereotypies. It usually starts in early childhood and its severity is associated with outcomes and severity of autism in adolescence and adulthood. It is usually co-morbid with other psychiatric problems and its pathophysiology is not exactly known. Management is most likely behavioural. However, promising new ideas and evidence are emerging from neurobiology and developmental psychology that identify neural adaptation, lack of environmental stimulation, arousal, and adaptive functions as key factors for the onset and maintenance of restricted and repetitive behaviours (RRBs) [5]. This project consists of Arduino UNO audio detector, position detector, temperature sensor, alarm system, Liquid Crystal display and WI FI module. The position detector and audio detector are used to detect the child activity continuously. The wifi module is used to monitor the child activity continuously.

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The proposed idea has two parts of development. The hardware and the software part. In the hardware part, there are sensors, detectors and a data processing unit. The software part has Arduino and ThingSpeak.

A. Hardware Development

Temperature Sensor:

The temperature sensor used here is LM35. It consists of three pins Vcc, Gnd, and Signal. It has high calibration with linear and minimal output impedance capable of producing an output voltage linearly proportional to the human body.

Accelerometer:

Motion sensor MPU 6050 has the characteristics such as small package size, low power consumption, high accuracy and repeatability, high shock tolerance, and application specific performance programmability – all at a low consumer price point .

Audio Detector:

KY038 is the model of audio detector used. It has 3 main components on its circuit board. The sensor unit measures the area physically and sends an analog signal to the amplifier which amplifies the signal and sends to the comparator which switches the digital out and LED if the signal falls under a specific value. The sensitivity can be controlled by the potentiometer.

GPS Module:

The NEO-6M GPS module is a well-performing complete GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability. With the power and signal indicators, you can monitor the status of the module.

Wifi Module:

The ESP8266 WiFi Module is a networking device since its main function in any system is to be able to connect to any nearby WiFi network for uploading or downloading data hence enabling IOT.

Buzzer:

HX1 is an alarm which can alert the wearer that something is not good.

B. Software Development

Arduino

Arduino Nano which is an ATmega 328 based microcontroller platform with 16 KB of flash memory for storing code, 2 KB of SRAM and 1 KB of EEPROM is the core of this project [6]. Arduino Nano consists of 14 digital pins and 8 analog pins as I/O. Digital pins have the ability to provide or receiving a maximum of 40 mA and analog pins are able to provide 1024 different values.

ThingSpeak

ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak. It has the advantage of executing the MATLAB code, the online analysis can be done with ease.

2.1.1 Block diagram

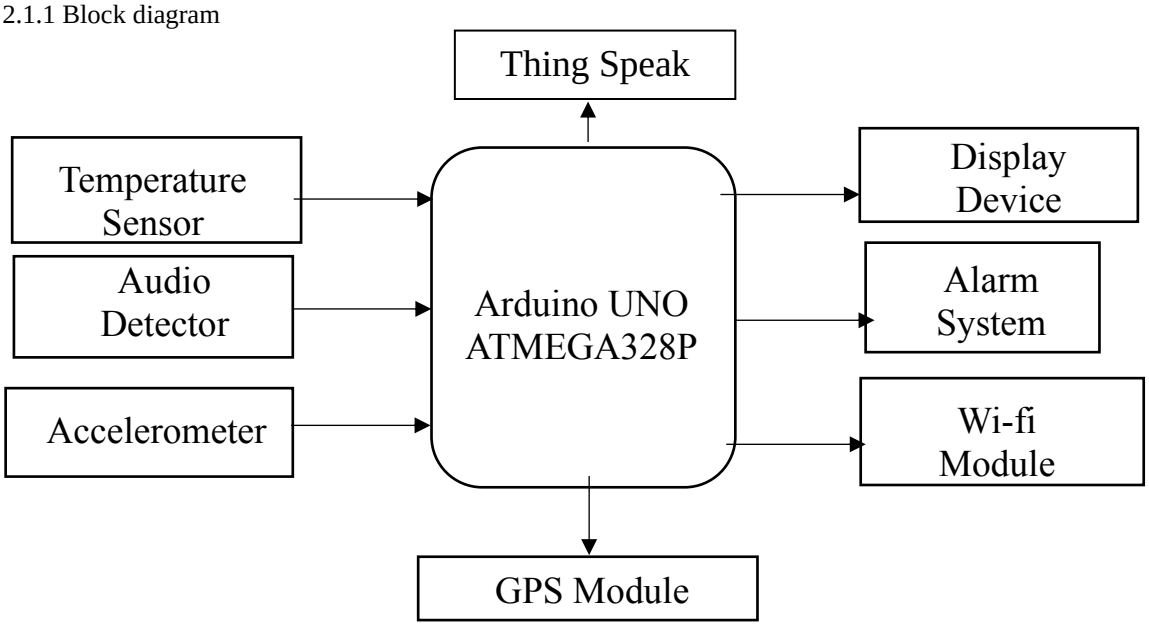

Fig .1. Block Diagram of proposed work

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BLOCK DIAGRAM EXPLANATION

The block diagram of the model of autistic learning which includes many familiarity filters. The central part of the model is Arduino which connect all the familiarity filters. The Arduino are connected with temperature sensor, audio detector sensor, potion detector sensor, display device, alarm system and a Wi-Fi module. Any changes in temperature either high or low the temperature sensor sense the body temperature and send the value, any abnormal audios are detected by audio detector sensor and send the abnormality messages, likewise potion detector sense any changes in the position of patient and send messages. All these messages are sent through wifi module. And the results are displayed in the displayed device. The overall function of this model is done by power supply to this wearable device[7].

3. RESULTS AND DISCUSSION

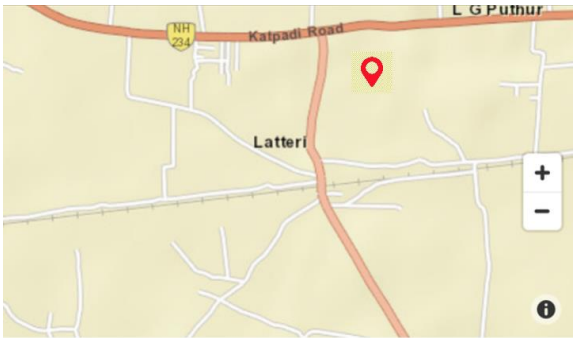

Fig.2. Display of the location of the patient

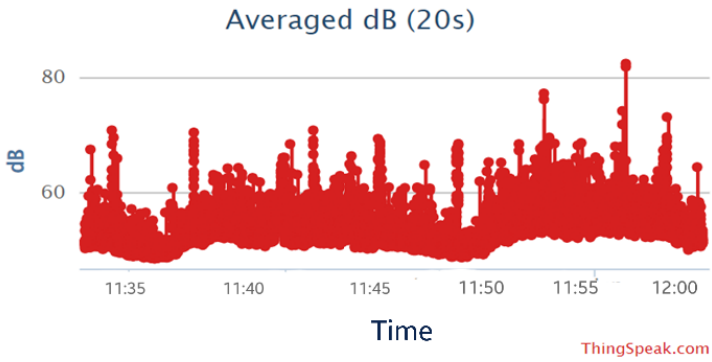

Fig.3. Display of audio detected from the patient

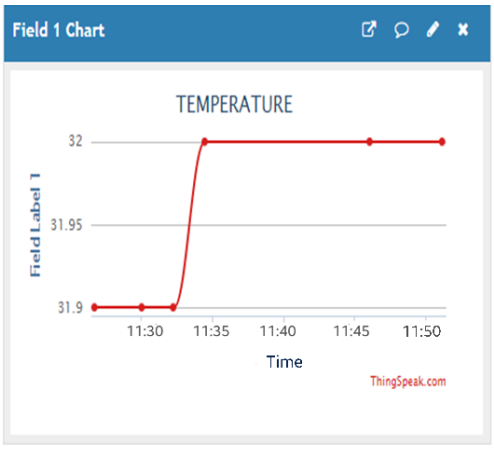

Fig.4. Display of temperature of the patient

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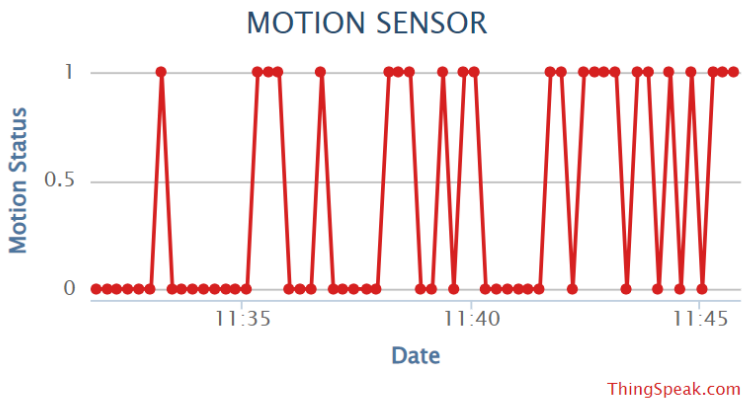

Fig.5. Display of the movement of the patient

These are the results obtained in the mobile of the caretakers and/or patients.

4. CONCLUSION

Autism is a life-long developmental and incurable disability. The perception of autism disorder has been evolved sixty years ago. In our conclusion the small part of autism disorder is physically active. Past years the financial concern, lack of opportunities and socio-demographic are indicated as major limitations of their physical activities. Today it is recognised as an independent neurological disorder. The output of this project has come as desired. In future, this outcome can be made into a product for other related disorders too.

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