International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 3 March 2023, pp: 682-685 www.ijaem.net ISSN: 2395-5252

Detection of ADHD Based on Iot

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Date of Submission: 01-03-2023 Date of Acceptance: 10-03-2023

ABSTRACT
Attention Deficit Hyperactivity Disorder (ADHD) is a neuro developmental conditions which impacts on a significant number of children and adults. Currently, the diagnosis of such disorders is done by experts who employ standard questionnaires and look for certain behavioral markers through manual observation. In order to ease this work, a novel methodology is presented to aid diagnostic predictions about the presence/absence of ADHD using a wearable IoT monitoring system which can be used for the collection of quantified data of patients by which the parent or the guardian can monitor the kids easily. A monitoring system of cognitive state in usual behavior without restraint using mainly wireless EEG and ECG sensors is implemented.

I. INTRODUCTION

ADHD is abbreviated as Attention Deficit Hyperactivity Disorder, around 5.3% of world's population suffer from this disorder. This rate has been increasing steadily since past 5 years and is most common in kids. It usually begins in early childhood and quite often the symptoms persist into adulthood. It is widely believed that both genetic and environmental influences contribute to the underlying cause of this disorder. ADHD includes inattention, hyperactivity and impulsive subtypes that constitute separable but substantially correlated dimensions. The criteria used by current diagnostics are based on symptoms, requiring the patient or their relatives to evaluate the frequency, intensity and duration of symptoms. Due to the absence of biological markers of the disorder, the diagnosis might be subjective. In this regard, measurement of brain signals, blood pressure monitoring, heart rate and motion detection studies have been developed with IoT in order to overcome this issue and to achieve a diagnostic based on quantitative data. It has been suggested that digital tools might be an aid for kids with ADHD in their everyday life and this project is set out to understand how Internet of Things (IoT) • technology specifically could be helpful.

II. LITERATURE SURVEY

[1] Mrs. Fadilla Zennifa, "MONITORING OF COGNITIVE STATE ON MENTAL RETARDATION CHILD USING EEG, ECG AND NIRS IN FOUR YEARS STUDY", 2018.

In this project the methodology adopted is by investigating the effect on neurophysiology in mental retardation children using EEG, ECG and NIRS without restraint using a wireless EEG system. The measurement system was done by attached electrode of EEG and ECG, NIRS probe, biological Amplifier, transmitter, NIRS measurement unit, accelerometer to subject. NIRS showed the increasing in all states from oxyhemoglobin analysis.

[2] Mr. Shashank Jaiswal, Mr. Michel F., and Mr. David Daley, "AUTOMATIC DETECTION OF ADHD AND ASD FROM EXPRESSIVE BEHAVIOR IN RGBD DATA", 2018.

This project the use of depth capturing cameras to monitor the activities of people are enabled. A 3D skeletal model of human body is created using RGB-D image sequences. Using this skeletal model, they tracked 14 reference points corresponding to skeletal joints and use them to detect certain body gestures often found in children having ADHD. For detecting such gestures, they used Dynamic Time Warping.

[3] Dr. Daniel Einarson, Dr. Fabian Segerstrom and Mrs. Petra Sommar Lund, "IOT- SUPPORT SYSTEMS FOR PARENTS WITH ADHD AND AUTISM", 2019.

A smart watch is used for pulse measurements. RFID-tags are used for purposes of communication. Storing data is implemented via a cloud services. Software is developed at the smart phone for explicit user interaction. A distributed system is developed to connect users of a group to share one's mental health status.

[4] Mr. Chin-Ling Chen, Mr. Yung-Wen Tang, Mr. Nian-Qiao Zhang and Mr. Jungpil SHIN,

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"NEUROFEEDBACK BASED ATTENTION TRAINING FOR CHILDREN WITH ADHD", 2020.

Participant's attention and relaxation via alpha, beta, theta, and delta parameters. A brainwave instrument used in this study. The Conners Continuous Performance Test Conners Kiddie Continuous Performance Test (CPT/KCPT) are games. It provides the target and non-target to the system for assessing children's attention in this study. The attention of children will generate 9 parameters to provide aid for further studies.

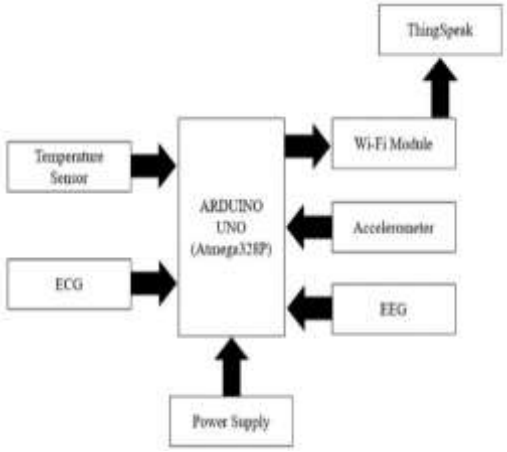
[5] Mrs. Chandana S and Mrs. Vijayalakshmi K., " AN APPROACH TO MEASURE AND IMPROVE THE COGNITIVE CAPABILITY OF ADHD AFFECTED CHILDREN THROUGH EEG SIGNALS", IEEE 18th International Conference on Advanced Learning Technologies,2021.

This project is mainly designed to predict the probable region of brain that shows abnormality due to ADHD syndrome. EEG data of non-ADHD and ADHD study participants of age group 4-17 years has been collected following a protocol which contains 4 events Eyes close. Eyes open, Visual Cue and Motor activity. Single map

analysis and Frequency map analysis is performed. Comparative analysis is carried out between the non- ADHD and ADHD participants. 3D plotting of the EEG signals is performed for ease of visualization. Neural network algorithm is used to distinguish between non-ADHD and ADHD participants for the same task performed.

[6] Mr. Damaris Eveline A E and Mrs. Anushka Tyagi, "SMART MONITORING SYSTEM FOR AUTISTIC PATIENTS", International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering, 2022. The objective of this project is to monitor the children with Autism by a self-updating monitoring system. 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 he developed in a vast manner. There are a wide range of behaviors mentioned as stereotypies. The position detector and audio detector are used to detect the child activity continuously.

III. EXPERIMENTAL WORKS



Overall Block diagram

The central part of the model is Arduino which connects all the familiarity filters. The methodology is mainly designed to predict the probable region of brain that shows abnormality due to ADHD syndrome. The Arduino is connected with a temperature sensor, ECG, EEG, audio detector sensor, accelerometer and a Wi-Fi module. Any changes in temperature either high or low, the temperature sensor senses the body temperature and send the value, any abnormal audios are detected by audio detector sensor and send the abnormality messages. EEG data of non-ADHD and ADHD study participants of age group 3-10 years has been collected following a protocol which contains 4 events- Eyes close, Eyes open, abnormal sounds and Motor activity. Single map analysis and Frequency map analysis is performed. Comparative analysis is carried out between the non–ADHD and ADHD participants. 3D plotting of the EEG signals is performed for ease of visualization. Neural network algorithm is used to distinguish between non-ADHD and ADHD. Higher power and higher standard deviation are found in the ADHD patients when eyes closed, eyes open and in motor activity, which is an indication of hyper active nature. However, in the non – ADHD participants, all the parameters show significantly lower values. An ECG is used to help diagnose and monitor conditions affecting the heart. These recorded values are transmitted through Wi-Fi module for analysis.

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Design Requirements

1. Arduino UNO

Arduino UNO

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. It simplifies the process of creating any control system by providing the standard board that can be programmed and connected to the system without the need to any sophisticated PCB design and implementation. It is an open-source hardware, anyone can get the details of its design and modify it.

2. Temperature sensor

Temperature Sensor

The MLX90614 is an infrared temperature sensor for non-contact temperature measurement. It can measure temperatures within the range of -70 to 380 degree Celsius with an accuracy of about 0.5C at room temperature. The principle of operation of Infrared thermometers is simple, all bodies at a temperature above 0 Kelvin (absolute zero) emit an infrared energy which can be detected by the infrared thermometer sensor. Its design includes a lens that focuses the infrared energy being emitted by the object in front of a detector. The detector converts the energy into an electrical signal which then can be passed to a microcontroller to interpret and display in units of temperature after compensating for the variation in ambient temperature.

3. Accelerometer

Accelerometer

The HVM200 is a small rugged vibration meter with built in Wi-Fi that can be used to measure hand-arm, whole body and general vibration. It includes the metrics and frequency weightings needed to measure human vibration. This 3-channel meter meets the requirements of ISO 8041:2005 and it is designed to measure per ISO 2631-1, 2 & 5 and ISO 5349 in support of the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) and the directive 2002/44/EC. This makes the HVM200 an ideal choice for an instrument used to demonstrate compliance with human vibration requirements and regulations worldwide.

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4. EEG Sensor

EEG Sensor

An EEG test evaluates the electrical activity of the brain. EEG scans are performed by placing EEG sensors small metal discs also called EEG electrodes on your scalp. These electrodes pick up and record the electrical activity in your brain. The collected EEG signals are amplified, digitized, and then sent to a computer or mobile device for storage and data processing. It can help doctors establish a medical diagnosis, researchers understand the brain processes that underlie human behavior, and individuals to improve their productivity and wellness.

5. ECG Sensor

ECG sensor

An electrocardiogram records the electrical signals in the heart. It's a common and painless test used to quickly detect heart problems and monitor the heart's health. ECG machines are standard equipment in operating rooms and ambulances. Some personal devices, such as smartwatches, offer ECG monitoring. Ask your health care provider if this is an option for you. An electrocardiogram is a safe procedure. There is no risk of electrical shock during the test because the electrodes used do not produce electricity. The electrodes only record the electrical activity of the heart.

IV. CONCLUSION

The proposed method is used for detection of ADHD in test subjects based on IoT. Use of certain sensor models which collects the data for further monitoring and detection of ADHD. Thus, the data collected can help in detecting the presence of ADHD in children and thereby ensuring medication at the preliminary stage of disease. This in turn helps in minimizing the risks in children caused due to ADHD in future and help them to gain enough attention from parents and teachers. Thus, the project revolves around creating a better and healthy future for the upcoming generations.

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