International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 03 | March - 2023 Impact Factor: 7.185 ISSN: 2582-3930

SENSOR NETWORK FOR QUANTIFICATION OF INFANT GENERAL MOVEMENTS FOR THE DIAGNOSIS OF CEREBRAL PALSY

Dr.B.Sankaragomathi[1], P.Ajaychandran[2] , G.Hariprasanth[3] , T.Javakar[4] , K.Manoj[5]

[1]Professor,[2,3,4,&5] UG Students, BE, Final Year,
Department of Biomedical Engineering
Sri Shakthi Institute of Engineering and Technology, Coimbatore, India

---

Abstract: One of the main causes of sudden infant death syndrome (SIDS) is causes of newborn deaths while they are sleeping. We matched several devices to the infants to increase their safety. emerging fields of study for the creation of Infant Night Watch. The Wearable IoT Device, the Gateway, and Medical Interface make up this Smart Wearable System (SWS). Body temperature, heart and breathing rates, and blood oxygen level all be monitored by the Wearable IoT Device, which is a wireless sensor node built into a chest belt.
This collection of data is delivered to the Gateway using wifi technology, which the user can access via the H Medical Interface. In the event of a critical occurrence, the patient's mobile will sound an alarm that is audible. The Baby Night Watch is a crucial tool for medical research since it enables the viewing of historical physiological data and its export to various dataset types. The SWS has the capacity to recognise circumstances that could pose a life-threatening hazard to a child, according to experimental experiments.

Key words – Body Temperature, Heart rate, breathing rates, blood oxygen level, smart wearable system.

I.INTRODUCTION

Being a non-progressive neurological condition, cerebral palsy (CP) is frequently linked to a range of developmental impairments, including strabismus (misalignment of eye). Through the use of a camera, the eye's image is collected, enabling rapid examination and periodic evaluation of children with CP. In addition to analysing the performance of CP children on a regular basis, we also recorded the eye movements of 40 children with CP (aged 3 to 11 years) who had modest motor impairment. The use of bio-medical image processing and machine learning classification algorithms in today's diagnosis and identification of specific diseases, as well as in reducing the risk of all diseases, is crucial. In this work, a computational methodology is presented for the automatic diagnosis of CP children's improvement and performance evaluation. The complementary medical assessment methods have demonstrated tremendous promise for CP children's nystagmus and strabismus diagnosis and treatment. The suggested approach uses machine learning to identify the aberrant eye conditions in CP children and assess and quantify the performance improvement. The Neural Network Classifier findings indicate the best classification accuracy at 94.17%. Specificity Rate and Sensitivity Rate were absorbed at 0.9800 and 0.9165, respectively. The suggested method for non-invasive, automatic detection of anomalies in CP children provides a more accurate assessment of performance progress.

In the medical industry, a typical use of wearable computing is the Realtime health monitoring system. But current technology does not take into account designing a monitoring system for surveillance of people with cerebral palsy. Techniques for the delivery of healthcare are now possible thanks to advancements in internet technology. The goal of this research was to create and develop cutting-edge technical solutions to provide a more proactive and dependable environment for medical care. We also go through an experimental model built on IoT architecture that is intended to monitor the health of kids with cerebral palsy. The sensor shield and cloud platform that collect the sensor data are essential to the framework. The sensors collect data on a number of variables, including temperature, blood oxygen level, heart rate, and blood pressure, and send it to a cloud storage platform via a microcontroller. This study offers the first real-time analysis that can deliver data easily within this framework averaging 1.77 seconds overall.

II. SURVEY

Health-related Quality of Life (HRQOL) refers to a set of characteristics that may have an impact on health because they are associated with an increased risk of chronic diseases linked to low levels of physical activity. The paper by Gilson KM, Davis E, Reddihough D, Graham K, and Waters E [1] aims to produce this. Conditions like cerebral palsy that are persistent and disabling are especially appropriate for HRQOL (CP). The purpose of this study is to evaluate the quality of life for kids with cerebral palsy. Measuring people's stress levels has become a crucial component of behavioural research for physical and mental diseases undertaken within the biopsychosocial framework, according to A. Tazarv, S. Labbaf, S. M. Reich, N. Dutt, A. M. Rahmani, and M. Levorato [2]. The following a number of controlled laboratory-based stress assessment studies. The findings of these studies, however, may not necessarily apply well to real-world situations. The level of wearable sensor technology today enables us to create systems that continuously monitor physiological signs indicative of stress while collecting context. In this study, we present a stress monitoring system that uses wearable sensors from Shimmer3 ECG, Shimmer3 GSR+, and Empat-ica E4 to provide objective daily stress measurements in typical settings based on three physiological signals: electrocardiogram (ECG), photoplethysmogram (PPG), and galvanic skin response (GSR). On a total of 17 subjects, we

conduct controlled stress assessment tests where we successfully identify stress with 94.55% accuracy for 10-fold cross-validation and 85.71% accuracy for subject-wise cross-validation. The device measures stress in regular settings with 81.82% of the time. Additionally, in order to reduce false alarms, we filter the low-confidence readings and investigate if motion artefacts have an impact on stress evaluation.

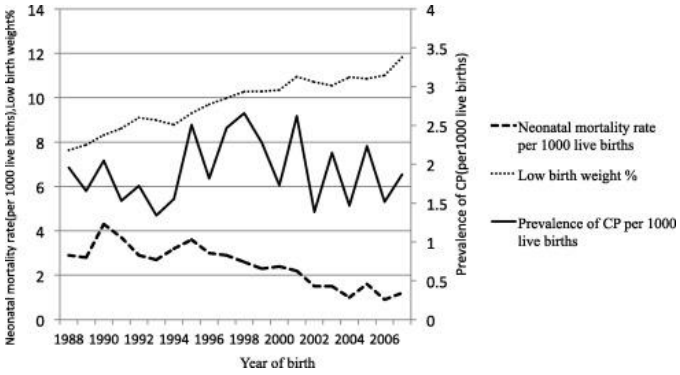
The approach suggested by I. Ishaq and E. A. A. Karajah,[3] This study introduces the "Heart monitor" monitoring health station system for vital signs. Patients' body temperatures and heart rates can be recorded in the cloud using a system called Heart Monitor. The medical personnel can then access the cloud services in real-time to keep track of the patients' health at any given time and location. A cell phone that is attached to this system will transmit an alarm if the heart rate readings start to become abnormal. It will automatically phone the doctor or the person whose number is stored in the system after five aberrant readings. The system has been examined and contrasted using an ECG gadget. The outcomes display a 97.4% accuracy is very good. The second study we looked at was written by H. Chen et al. The outcomes demonstrate the suggested system's ability to produce high-quality signals. The wearable sensor platform offers hope for long-term, continuous monitoring of newborns. For clinical decision support on the infant health status, the platform's multimodal physiological and behavioural information can be further analysed. A study by F. Ghassemi, M. S. Hoseinzadeh, and A. Ekhlasi has also been reviewed by us. [5] The radio receiver and transmitter modules in this gadget allow two distinct circuits to connect with one another. The first circuit contains the MAX30205 thermometer sensor, which is employed in this study and monitors body temperature with high accuracy. The sensor's control mechanism is a radio transceiver on the UNO Arduino board acts as the microprocessor, and it sends the temperature reading to the second circuit. The temperature that the receiver sent is received and shown on the display in the second circuit. The gadget was also built with an SMS module, which enables the second circuit to send a warning message to the designated cellphone number if the temperature rises above the typical human body temperature threshold. Seven samples were used to test the device's performance, and the results were compared to those of a reference digital thermometer. Less than 0.1 °C on average separated the recorded temperatures from the temperature determined by the reference thermometer.

III. PROBLEM IDENTIFICATION FOR BLIND

1. Price: A lot of these gadgets are rather pricey and might not be within everyone's means.
2. Complexity: Certain gadgets have a high learning curve and are difficult to operate, which might be a barrier for some people.
3. Reliability: A number of variables, including ambient light, the weather, and the surrounding environment, might have an impact on the accuracy and reliability of these devices.
4. Restricted accessibility: Access to repair and maintenance services may not be readily available for many of these devices in all countries.
5. **Interoperability:** Some devices may not be compatible with other technologies, making it difficult to use them together.

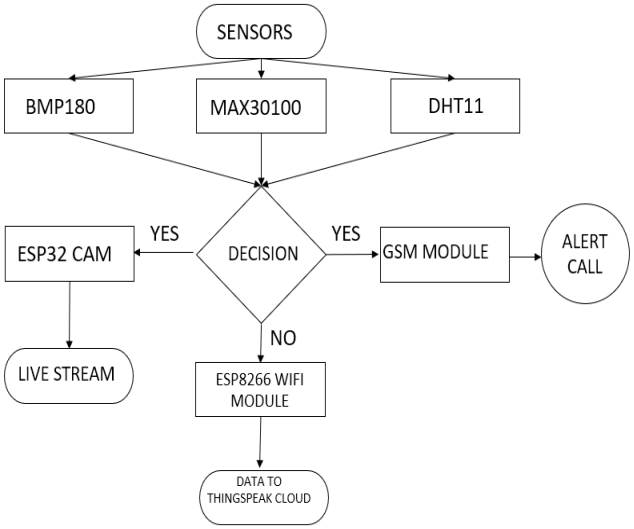
3.1 Statistics:

Cerebral palsy is one of the most typical causes of motor disability in kids (CP). According to the most recent definition of CP, it is a collection of long-term abnormalities of movement and posture development that restrict activity and are brought on by issues with the growing brain of the foetus or child that are not progressing. The definition of CP has changed throughout time, and the illness has a wide range of aetiologies and clinical manifestations. When compared to the group of children who were born with a body weight of less than 1500 g, the incidence of CP is 70 times higher than the average frequency of 2.08 per 1000 live births in Europe.

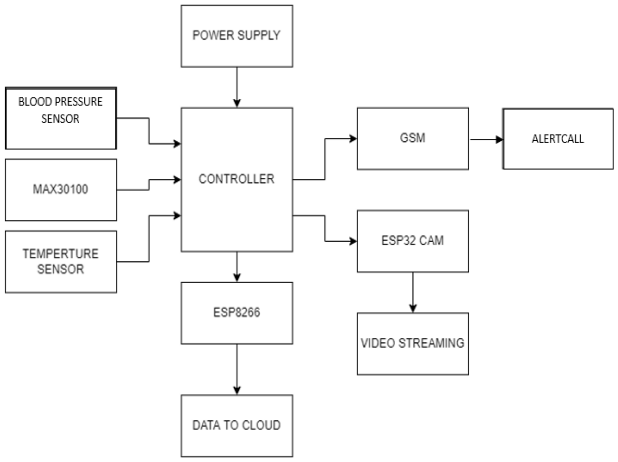


IV. PROPOSED METHODOLOGY

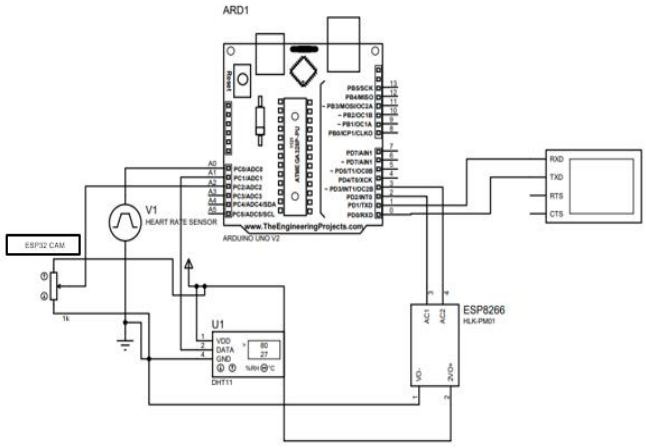
4.1 FLOW CHART:



4.2 BLOCK DIAGRAM:



4.3 CIRCUIT DIAGRAM:



4.4 METHODOLOGY:

Sensor sensing:

The sensors BMP180, MX30100, and LM35 will gather data from the child and communicate it to the Arduino UNO as well as a fixed ESP32 camera module. In advanced resolution mode, the BMP180's pressure measuring range is 300 to 1100 hPa with an accuracy of 0.02 hPa. Piezo-resistive technology serves as the foundation for its excellent accuracy, toughness, and long-term stability. A versatile sensor, the MAX30100 is employed in many different applications. Both a pulse oximeter and a heart rate monitoring sensor are present. The sensor has two Light Emitting Diodes, a photodetector, and a number of low noise signal processing components to measure pulse oximetry and detect heart rate. The temperature sensor measures a known temperature measurement using the fundamental principles of a diode. Every time the temperature varies by 1 oC, the sensor will sense the change and display a 10 mV voltage. The voltage across a diode rises as the temperature rises.

Pre-processing:

These data will be received by the Arduino UNO which will validate the data, according to the programmed value which programmed by Arduino IDE.

GSM Module:

The chip or circuit that will be used to establish communication between a mobile device or computer and a GSM or GPRS system is known as a GSM module or GPRS module**.** An alert call will be sent if the data obtained indicates low or high blood pressure, temperature, heart rate, or SPO2 levels.ESP32 camera module & wifi module

Data's and camera module:

The camera module may be accessed via the connection we receive from the wifi module, and all the data captured from the sensor will be transferred to the thinkspeak cloud platform. In that all data's will be visualized in numbers and also in graph method.

4.5 COMPONENTS REQUIRED:

- ARDUINO UNO
- BMP180
- DHT11
- MAX30100
- ESP32 CAM
- ESP8266 MODULE
- GSM
- POWER SUPPLY

4.6 SOFTWARE USED:

- Language : Java
- IDE : Arduino IDE

V. CONCLUSION

The cerebral palsy-related chronic motor impairment is relatively common and is associated with a range of developmental issues. In this group, where premature birth accounts for almost half of cases in poor countries, cerebral palsy prevalence has appeared to be falling over the past ten years. Although continuous foetal heart rate monitoring has been developed, the prevalence among full-term neonates has remained largely stable. The treatment of children with cerebral palsy requires a multidisciplinary, comprehensive, and coordinated approach. Teenagers with cerebral palsy in wealthy countries report a similar quality of life to teenagers without the disability, with the exception of severe instances. Many approaches have the potential to reduce the prevalence of cerebral palsy, such as reducing the risk of preterm birth, giving pregnant women antenatal steroids, treating mothers

who are anticipated to give birth before 30 weeks gestation with magnesium sulphate, using hypothermia for newborns with hypoxic-ischemic encephalopathy, and using caffeine for babies with extremely low birth weight.

VI. ACKNOWLEDGEMENTS

We have great pleasure in presenting this report on "SENSOR NETWORK FOR QUANTIFICATION OF INFANT GENERAL MOVEMENTS FOR THE DIAGNOSIS OF CEREBRAL PALSY", we would like to express our gratitute to Sri Shakthi Institute of Engineering and Technology, HOD of Biomedical Engineering Prof. B.Sankaragomathi. We take this opportunity to thank all those who have contributed in successful completion of this project.

References

[1] Gilson KM, Davis E, Reddihough D, Graham K, Waters E, "Quality of life in children with cerebralpalsy: implications for practice.", J Child Neurol, Vol: 29, No: 8, PP:1134-40, doi: 10.1177/0883073814535502, 2014 May 27.

[2] A. Tazarv, S. Labbaf, S. M. Reich, N. Dutt, A. M. Rahmani and M. Levorato, "Personalized Stress Monitoring using Wearable Sensors in Everyday Settings," 2021 43rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC), Mexico, 2021, pp. 7332-7335, doi: 10.1109/EMBC46164.2021.9630224.

[3] E. A. -A. Karajah and I. Ishaq, "Online Monitoring Health Station Using Arduino Mobile Connected to Cloud service: "Heart Monitor" System," 2020 International Conference on Promising Electronic Technologies (ICPET), Jerusalem, Palestine, pp. 38-43, doi: 10.1109/ICPET51420.2020.00016, 2020.

[4] H. Chen et al., "Design of an Integrated Wearable Multi-Sensor Platform Based on Flexible Materials for Neonatal Monitoring," in IEEE Access, vol. 8, pp. 23732-23747, doi: 10.1109/ACCESS.2020.2970469, 2020.

[5] F. Ghassemi, M. S. Hoseinzadeh and A. Ekhlasi, "Design and Implementation of Wireless Body Temperature Monitor with warning system via SMS," 2020 6th Iranian Conference on Signal Processing and Intelligent Systems (ICSPIS), Mashhad, Iran, pp. 1-5, doi: 10.1109/ICSPIS51611.2020.9349541, 2020.

[6] S. Mukherjee, A. Ghosh and S. K. Sarkar, "Arduino based Wireless Heart-rate Monitoring system with Automatic SOS Message and/or Call facility using SIM900A GSM Module," 2019 International Conference on Vision Towards Emerging Trends in Communication and Networking (ViTECoN), Vellore, India, 2019, pp. 1-5, doi: 10.1109/ViTECoN.2019.8899504.

[7] D. Zhong, Z. Yian, W. Lanqing, D. Junhua and H. Jiaxuan, "Continuous Blood Pressure Measurement Platform: A Wearable System Based on Multidimensional Perception Data," in IEEE Access, vol. 8, pp. 10147-10158, doi: 10.1109/ACCESS.2020.2965245, 2020.

[8] J. Jilek and M. Stork, "Home Blood Pressure Monitors For 21st Century," 2022 International Conference on Applied Electronics (AE), Pilsen, Czech Republic, PP: 1-4, doi: 10.1109/AE54730.2022.9919887, 2022.