Smart Device Enabled With Non-Intrusive Thyroid Scrutinizing and Integrating Through Non Proximate Sensing for Timely Recognition

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Abstract—Traditionally, thyroid monitoring has been conducted through either monitoring basal body conductance or analyzing blood samples. Our study focuses on the former method, utilizing conductance acquisition facilitated by an electrode, amplifier, and node MCU. The designed module not only performs conductance acquisition but also incorporates a calibration method to optimize sensor design. Moreover, we propose an algorithm developed using embedded C, which enables implementation with blood samples, thus providing a less time monitoring approach. The envisioned model holds potential for enhancing thyroid detection capabilities, paving the wave for advancement in healthcare technology.

Keywords— Node MCU, Basal body, Embedded C, Electrode,
Amplifier ,Sensor.

I. INTRODUCTION

Stress is an involuntary reaction that is often present in our daily lives. This reaction can be interpreted as a bodily shift from a calm state to an excited state in order to preserve our organism. When a person experiences stress, their body may undergo physiological changes such as an increase in heart rate, deeper breathing, pupil dilation, muscle tension, sweating, and other factors that alter physical and emotional stability. These changes and their associated triggers are common in human day-to-day experiences. Stress helps tune the body to face daily challenges like memory acquisition or attention, but if stress becomes chronic, it can lead to poor decision-making or decreased performance.

Furthermore, prolonged stress can cause a wide range of diseases such as diabetes, cardiovascular disorders, or immune irregularities. Stress has become one of the most studied phenomena in medicine, with an annual cost of $300 billion in the United States (US), and its prevalence has been increasing in recent years, playing a significant role in the healthcare industry. Stress is a reaction that puts the body on alert. When stress is managed effectively, it can be beneficial for individuals to perform under pressure. Moderate stress can help individuals remain attentive and ready to face challenges. However, excessive stress can lead to problems.

The response to stress can be critical in emergency situations, such as when a driver has to stop suddenly to avoid an accident. But stress is not always a reaction to immediate events; it can also result from long-term or progressive situations, such as divorce, relocation, or changes in schools or jobs. Long-term stress can manifest as low-intensity but persistent, causing difficulties for individuals. Chronic stress can have a significant impact on health if these symptoms persist and reach high levels, leading to anxiety or breakdowns. Long-term stress can also lead to various diseases and affect overall well-being.

Short-term stress can decrease productivity, create doubts in important decisions, or lead to work accidents. The Yerkes-Dodson Law establishes a relationship between arousal and performance. Performance increases with

arousal when individuals feel relaxed, reaches its peak at optimal arousal levels when individuals are fully engaged in a task, and decreases when individuals experience anxiety or breakdowns. The current challenge is to explain how short-term stress can be measured and its relation to performance. Various approaches have been proposed to interpret the Yerkes-Dodson curve. The typical approach is to use self-assessment questionnaires, but this method can be intrusive. Another approach is to measure physiological signals or hormones to extract relationships between different variables, but this method also has high variability. Moreover, external factors such as noise can disrupt interpretation.

II. LITERATURE SURVEY

a. A Compressed Sensing Based Decomposition of Electrodermal Activity Signals

The measurement and examination of Electrodermal Activity (EDA) present applications in various fields ranging from market analysis to seizure identification to human stress assessment. Regrettably, the analysis of EDA signals is complicated by the overlap of numerous elements that can obscure the signal information associated with a user's reaction to a stimulus. We illustrate how straightforward preprocessing followed by an innovative compressed sensing based decomposition can alleviate the effects of the unwanted noise components and aid in uncovering the underlying physiological signal. The suggested framework enables the decomposition of EDA signals with demonstrable limits on the retrieval of user responses. We evaluate our method on both synthetic and real-world EDA signals from wearable sensors and illustrate that our approach allows for more precise retrieval of user responses compared to existing techniques..

b. cvxEDA: a Convex Optimization Approach to Electrodermal Activity Processing

This paper introduces a new method to analyze electrodermal activity (EDA), which reflects the activity of the sympathetic nervous system. It breaks down skin conductance into three parts: the phasic component, the tonic component, and a noise term. By using techniques like Bayesian statistics and convex optimization, the model provides a detailed understanding of EDA. The algorithm was tested in different scenarios and showed promising results in accurately detecting stimuli and describing emotional responses. This research could have significant applications, especially in the field of affective computing..

c. Diagnosis of Hypothyroidism Using Infrared Thermography

Thyroid issues have become more common lately. They affect our body's metabolism and can either slow it down or speed it up. The pituitary gland controls the production of thyroid hormones. If there's a problem with this gland, it can cause hormone imbalances and various health problems. Usually, thyroid issues are detected through a blood test. This study compared using images instead of just blood tests to catch thyroid problems early.

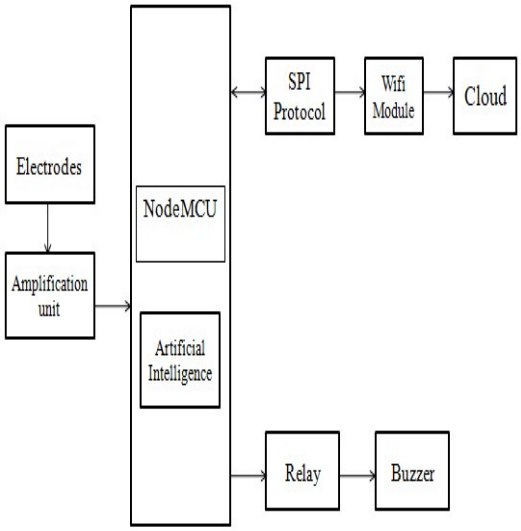
They took thermal images of 63 people and used computer programs to analyze them. Out of the group, 37 were healthy, and 26 had thyroid issues. The computer programs were pretty good at telling the difference between healthy and affected people. So, using thermal images along with computer analysis could help spot thyroid issues early.

d. An Energy Efficient Sensor for Thyroid Monitoring through the IoT

This article introduces a sensor for monitoring thyroid levels in IoT systems. The design is both energy-efficient and easy to use. Instead of blood samples, it measures basal body temperature for thyroid monitoring. It uses a ring oscillator, counter, and controller to acquire temperature data. The module also includes a calibration method to fine-tune the sensor design dynamically. A prototype of the sensor and controller, built using Simulink, is also described.

III. PROPOSED METHOD

An affordable thyroid monitoring system is developed for analysis the thyroid level and Nervous activities produced, by using sensors placed on any areas and a necessary amplification system for processing of thyroid signals in time and frequency domain is done for the analysis of various pulmonary diseases. By analyzing the signal pattern we are able to distinguish between normal and infectious thyroid and quick medical attention is given to people suffering from pulmonary disorders which seem to be a relief for the rural population in controlling the number of deaths.



a. ELECTRODES

Electrodes are conductive materials used to establish electrical contact with a non-metallic part of a circuit, typically in the context of electronic devices or biological systems. They play a crucial role in various applications, such as electrochemical sensors, medical devices like ECG or EEG machines, and neuroscience research for recording neural activity.

b. NODE MCU (microcontroller unit)

The NodeMCU ESP8266 is a popular development board that utilizes the ESP8266 Wi-Fi module. It's commonly used for IoT (Internet of Things) projects due to its low cost, built-in Wi-Fi capabilities, and easy programmability using the Arduino IDE or other compatible platforms.

c. SPI Protocol

The Serial Peripheral Interface (SPI) protocol is a synchronous serial communication interface commonly used for short-distance communication between integrated circuits or peripherals. It involves a master device communicating with one or more slave devices using a shared clock signal, data lines, and often a select line for each slave device.

d. WIFI Module

Wifi used as a wireless communication capabilities, such as IoT (Internet of Things) devices ,remote monitoring system . These modules enable devices to connect to local networks or the internet, allowing them to send and receive data wirelessly.

IV. CONCLUSION

We suggest a fresh approach to electrodermal responses that we co-created. Various bodily characteristics for pinpointing the thyroid. This was devised to verify comprehensive feature extraction and yield understandable outcomes via machine learning algorithms. The technique outpaces other established methods in speed and is adaptable to wearable sensor networks. A thorough review of existing methodologies. A research paper on thyroid identification has been submitted. The entire innovative system that detects thyroid reactions incorporates suggested methodologies. The system captures real-time physiological signals. For classification, a five-tier grading system is employed

V. FUTURE EXTRACTION

The thesis examines how different smart watches with commercially available sensors measure heart and electrodermal activity. It compares the sensitivity of electrodermal activity signals to detect changes or artifacts. Shimmer sensors are used, which are placed on the fingers, while other options include EmpaticaE4 and Q sensor, worn snugly on the non-dominant wrist. These sensors communicate via Bluetooth, enabling wireless data transmission without the need for a direct line of sight. Empatica E4 provides data on electrodermal activity, heart rate, R-R interval, device position, and angular velocity, while Q sensor focuses on galvanic skin activity with superior quality compared to EmpaticaE4. Additionally, the Shimmer3 'ExG Unit' captures EMG and ECG signals, with electrodes placed on the chest for ECG and on the biceps for EMG, along with a reference electrode positioned away from the muscle being measured.

REFERENCES

[1] C.Nagarajan and M.Madheswaran - 'Experimental verification and stability state space analysis of CLL-T Series Parallel Resonant Converter' - Journal of ELECTRICAL ENGINEERING, Vol.63 (6), pp.365-372, Dec.2012.

[2] C.Nagarajan and M.Madheswaran - 'Performance Analysis of LCL-T Resonant Converter with Fuzzy/PID Using State Space Analysis'- Springer, Electrical Engineering, Vol.93 (3), pp.167-178, September 2011.

[3] C.Nagarajan and M.Madheswaran - 'Stability Analysis of Series Parallel Resonant Converter with Fuzzy Logic Controller Using State Space Techniques'- Taylor & Francis, Electric Power Components and Systems, Vol.39 (8), pp.780-793, May 2011.

[4] C.Nagarajan and M.Madheswaran - 'Experimental Study and steady state stability analysis of CLL-T Series Parallel Resonant Converter with Fuzzy controller using State Space Analysis'- Iranian Journal of Electrical & Electronic Engineering, Vol.8 (3), pp.259-267, September 2012.

[5] Nagarajan C., Neelakrishnan G., Akila P., Fathima U., Sneha S. "Performance Analysis and Implementation of 89C51 Controller Based Solar Tracking System with Boost Converter" Journal of VLSI Design Tools & Technology. 2022; 12(2): 34–41p.

[6] C. Nagarajan, G.Neelakrishnan, R. Janani, S.Maithili, G. Ramya "Investigation on Fault Analysis for Power Transformers Using Adaptive Differential Relay" Asian Journal of Electrical Science, Vol.11 No.1, pp: 1-8, 2022.

[7] G.Neelakrishnan, K.Anandhakumar, A.Prathap, S.Prakash "Performance Estimation of cascaded h-bridge MLI for HEV using SVPWM" Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:750-756

[8] G.Neelakrishnan, S.N.Pruthika, P.T.Shalini, S.Soniya, "Perfromance Investigation of T-Source Inverter fed with Solar Cell" Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:744-749

[9] C.Nagarajan and M.Madheswaran, "Analysis and Simulation of LCL Series Resonant Full Bridge Converter Using PWM Technique with Load Independent Operation" has been presented in ICTES'08, a IEEE / IET International Conference organized by M.G.R.University, Chennai.Vol.no.1, pp.190-195, Dec.2007.

[10] M Suganthi, N Ramesh, "Treatment of water using natural zeolite as membrane filter", Journal of Environmental Protection and Ecology, Volume 23, Issue 2, pp: 520-530,2022

[11] M Suganthi, N Ramesh, CT Sivakumar, K Vidhya, "Physiochemical Analysis of Ground Water used for Domestic needs in the Area of Perundurai in Erode District", International Research Journal of Multidisciplinary Technovation, pp: 630-635, 2019

[12] Nithin Sai; Pavan Sai; Ajay; Praveena Nuthakki: Smart LPG Gas Leakage Detection andMonitoring System

[13] into the Field IEEE- 2023 International Conference on Smart Systems and Inventive Technology(ICSSIT)

[14] Mariselvam; Siva Dharsini: IoT Based Level Detection of Gas for Booking Management using integrated sensor 2021

[15] Sejal Shah; Aakash Parashar; Chanchal Rai; Sagar Pokhariyal:IOT Based Smart Gas Leakage Detection and Alert System 2021 on International Conference on Advances in Science & Technology(ICAST)

[16] Purva Duggal, Akshay Pawar, Poorva Kalkatte,Prof. Rushikesh Bhalerao: LPG Leakage Detection and Smart Gas Booking System (2020)

[17] Anusuya.k Kanimozhi.S; Rathna.S; Sindhuja.S: Gas Leakage Detection and AutomaticGas Booking Alert Systemusing IoT 2019 (IJERT)

[18] Mudit Sagar; Yasir Imam; Anushu Yadav; Md Tabish Zahir; Pinki Yadav: A Review onGSM Based LPG Leakage Detection and Controller 2022.