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Dementia Disease Prediction by Using Internet of Things and Nodejs

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Abstract: ***Dementia is not a single disease; it's an overall term like heart disease that covers a wide range of specific medical conditions, including Alzheimer's disease. Disorders grouped under the general term "dementia" are caused by abnormal brain changes. These changes trigger a decline in thinking skills, also known as cognitive abilities, severe enough to impair daily life and independent function. They also affect behaviour, feelings and relationships. Alzheimer's disease accounts for 60 to 80 percent of cases. Vascular dementia, which occurs because of microscopic bleeding and blood vessel blockage in the brain, is the second most common cause of dementia. In order to overcome this problems and provide proper treatment to theelder people our project aims at developing an application for elderly age people dementia prediction where I can lively monitor the blood glucose, blood pressure, blood oxidation level which is measured using the sensors and if the condition is abnormal the SMS API will send a message to a mobile phone of the care taker or the old age home in-charge. The web application developed in this project displays the three parameters to the user on a computer that can be lively monitored using IoT. An efficient real time microcontroller is used to process the information and a Wi-Fi gateway is used to transmit the data wirelessly. Thus this project helps in taking care of the elder people at the right time and avoid difficulties.***
Keywords: MQTT protocol, Publishing, Subscribing, Web application module.

I. INTRODUCTION

Dementia is the loss of cognitive functioning, thinking remembering, and reasoning and behavioral abilities to such an extent that it interferes with a person's daily life and activities. These functions include memory, language skills, visual perception, problem solving, self- management, and the ability to focus and pay attention. Some people with dementia cannot control their emotions, and their personalities may change. Dementia ranges in severity from the mildest stage, when it is just beginning to affect a person's functioning, to the most severe stage, when the person must depend completely on others for basic activities of living. Signs and symptoms of dementia result when once-healthy neurons (nerve cells) in the brain stop working, lose connections with other brain cells, and die. While everyone loses some neurons as they age, people with dementia experience far greater loss. While dementia is more common as people grow older (up to half of all people age 85 or older may have some form of dementia), it is not a normal part of aging. Many people live into their 90s and beyond without any signs of dementia. One type of dementia, front temporal, is more common in middle-aged than older adults. The causes of dementia can vary, depending on the types of brain changes that may be taking place. Alzheimer's disease is the most common cause of dementia in older adults. Other dementias include Lowy body dementia, front temporal disorders, and vascular dementia. It is common for people to have mixed dementia combination of two or more types of dementia. For example, some people have both Alzheimer's disease and vascular dementia. Various disorders and factors contribute to the development of dementia.

II. SYSTEM ANALYSIS

A. Existing System

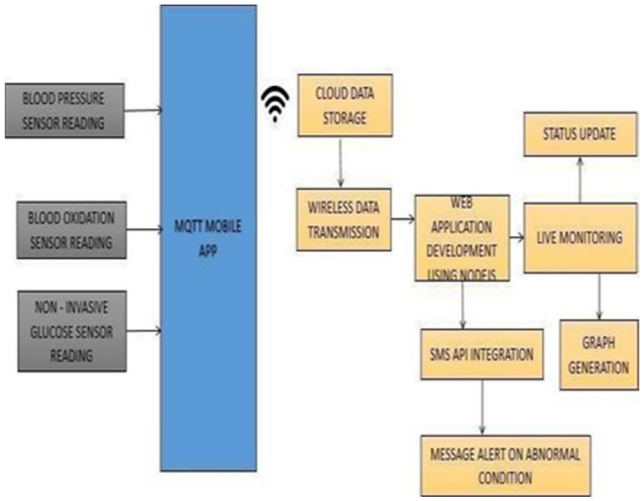
Alzheimer's disease (AD) accounts for 60-70% of all dementia cases, and clinical diagnosis at its early stage is extremely difficult. As several new drugs aiming to modify disease progression or alleviate symptoms are being developed, to assess their efficacy, novel robust biomarkers of brain function are urgently required. This study aims to explore a routine to gain such biomarkers using the quantitative analysis of Electroencephalography (QEEG). This paper proposes a supervised classification framework which uses EEG signals to classify healthy controls (HC) and AD participants. The framework consists of data augmentation, feature extraction, KNearest Neighbour (KNN) classification, quantitative evaluation and topographic visualization. Considering the human brain either as a stationary or a dynamical system, both frequency-based and time-frequency-based features were testedin 40 participants.

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B. Proposed System

In order to overcome this problem and provide proper treatment to the elder people our project aims at developing an application for elderly age people dementia prediction where we can lively monitor the blood glucose, blood pressure, blood oxidation level which is measured using the sensors and if the condition is abnormal the SMS API will send a message to a mobile phone of the care taker or the old age home in-charge. In this project we will be making use of prebuilt MQTT application to push the blood glucose, blood pressure, blood oxidation level value to the could instant of using sensors. The web application developed in this project displays the three parameters to the user on a computer that can be lively monitored using IoT. Graph will also be plotted for all the three value which will be helpful in determining the patient condition. Thus this project helps in taking care of the elder people at the right time and avoid difficulties.

C. System Archiecture



III. SYSTEM MODULE

A. MQTT Protocol

MQTT (MQ Telemetry Transport) is an open OASIS and ISO standard (ISO/IEC PRF 20922) lightweight, publish-subscribe network protocol that transports messages between devices. The protocol usually runs over TCP/IP; however, any network protocol that provides ordered, lossless, bi-directional connections can support MQTT. It is designed for connections with remote locations where a "small code footprint" is required or the network bandwidth is limited.The MQTT protocol defines two types of network entities: a message broker and a number of clients. An MQTT broker is a server that receives all messages from the clients and then routes the messages to the appropriate destination clients. An MQTT client is any device (from a micro controller up to a full-fledged server) that runs an MQTT library and connects to an MQTT broker over a network.Information is organized in a hierarchy of topics. When a publisher has a new item of data to distribute, it sends a control message with the data to the connected broker.The broker then distributes the information to any clients that have subscribed to that topic. The publisher does not need to have any data on the number or locations of subscribers, and subscribers in turn do not have to be configured with any data about the publishers. If a broker receives a topic for which there are no current subscribers, it will discard the topic unless the publisher indicates that the topic is to be retained. This allows new subscribers to a topic to receive the most current value rather than waiting for the next update from a publisher. When a publishing client first connects to the broker, it can set up a default message to be sent to subscribers if the broker detects that the publishing client has unexpectedly disconnected from the broker. Clients only interact with a broker, but a system may contain several broker servers that exchange data based on their current subscribers' topics. A minimal MQTT control message can be as little as two bytes of data. A control message can carry nearly 256 megabytes of data if needed. There are fourteen defined message types used to connect and disconnect a client from a broker, to publish data, to acknowledge receipt of data, and to supervise the connection between client and server. MQTT relies on the TCP protocol for data transmission. A variant, MQTT- SN, is used over other transports such as UDP or Bluetooth. MQTT sends connection credentials in plain text format and does not include any measures for security or authentication. This can be provided by the underlying TCP transport using measuresto protect the integrity of transferred information from interception or duplication.

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B. Publishing

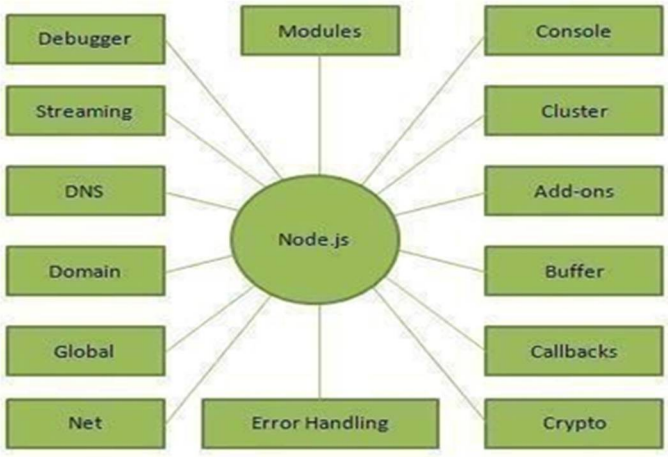
Sending messages using an already connected Mqtt Client is very straightforward. We use one of the publish() method variants to send the payload, which is always a byte array, to a given topic, using one of the following quality-of- service options**.**

C. Subscribing

The subscribe() variant used above takes an IMqtt Message Listener instance as its second argument. In our case, we use a simple lambda function that processes the payload and decrements a counter. If not enough messages arrive in the specified time window (1 minute), the await() method will throw an exception. When using Paho, we don't need to explicitly acknowledge message receipt. If the callback returns normally, Paho assumes it a successful consumption and sends an acknowledgment to the server.If the callback throws an Exception, the client will be shut down. Please note that this will result in loss of any messages sent with QoS level of 0.Messages sent with QoS level 1 or 2 will be resent by the server once the client is reconnected and subscribes to the topic again

D. Web Application Module

Web app development is a significant process for a variety of diverse business nowadays. It allows for the development of software that can be accessed via an internet browser, making it rapidly accessible from anywhere.Web application development is the creation of application programs that reside on remote servers and are delivered to the user's device over the Internet. A web application (web app) does not need to be downloaded and is instead accessedthrough a network. An end user can access a web application through a web browser such as Google Chrome, Safari, or Mozilla Firefox. A majority of web applications can be written in JavaScript, Cascading Style Sheets (CSS), and HTML5.Web application development will typically have a short development life-cycle lead by a small development team. Front-end development for web applications is accomplished through client-side programming. Client refers to a computer application such as a web browser. Client- side programming will typically utilize HTML, CSS and JavaScript. HTML programming will instruct a browser how to display the on- screen content of web pages, while CSS keeps displayed information in the correct format.JavaScript will run JavaScript code on a web page, making some of the content interactive. Server-side programming powers the client-side programming and is used to create the scripts that web applications use. Scripts can be written in multiple scripting languages such as Ruby, Java and Python. Server-side scripting will create a custom interface for the end-user and will hide the source code that makes up the interface. A database such as MySQL or MongoDB can be used to store data in web application development.



E. SMS API Integration Module

A SMS API is well-defined software interface which enables code to send short messages via a SMS Gateway. As the infrastructures for SMS communications and the internet are mostly divided, SMS APIs are often used to 'bridge the gap' between telecommunications carrier networks and the wider web. SMS APIs are used to allow web applications to easily send and receive text messages through logic written for standard web frameworks. We will be using text local SMS API for our integration which enables us to easily integrate our SMS services with your website, software or CRM application in PHP, ASP,.NET, Java or any other language. The integrated solution of Text Local and Optimove makes it easy to plan and execute marketing text message campaigns, based on the advanced customer segmentation available in Optimove.

IV. SYSTEM RELATED WORKS:

A. *Pholpat Durongbhan, Yifan Zhao, Senior Member, IEEE, Liangyu Chen, Panagiotis Zis, MatteoDe, Marco, ZoeC. Unwin, Annalena Venneri, Xiongxiong He, Sheng Li, Yitian Zhao, Daniel J.Blackburn, and Ptolemaios G.Sarrigiannis,"A Dementia Classification Frame work using Frequency and Time-frequency Features based on EEG signals",,IEEE Transaction Neural Systems and Rehabilitation Engineering, Vol.1534-4320,2019.*

Alzheimer's disease (AD) accounts for 60-70% of all dementia cases, and clinical diagnosis at its early stage is extremely difficult. As several new drugs aiming to modify disease progression or alleviate symptoms are being developed, to assess their efficiency, novel robust biomarkers of brain function are urgently required. This study aims to explore a routine to gain such biomarkers using the quantitative analysis of Electro encephalography (QEEG).This paper proposes a supervised classification framework which uses EEG signals to classify healthy controls(HC) and AD participants. The framework consists of data augmentation, feature extraction, K Nearest Neighbour (KNN) classification, quantitative evaluation and topographic visualization. Considering the human brain either as a stationary or a dynamical system, both frequency-based and time-frequency-based features were tested in 40participants. a) The proposed method can achieve up to 99% classification.

B. *HuiYang, PeterA.Bath," The Use of Data Mining Methods for the Prediction of Dementia: Evidence from the English Longitudinal Study of Aging", IEEE Journal of Biomedical and Health Informatics, Vol.2168-2194,2019*

Dementia in older age is a major health concern with the increase in the aging population. Preventive measures to prevent or delay dementia symptoms are of utmost importance. In this study, a large and wide variety of factors from multiple domains were investigated using a large nationally-representative sample of older people from the English Longitudinal Study of Ageing (ELSA). Seven machine learning algorithms were implemented to build predictive models for performance comparison. A simple model ensemble approach was used to combine the prediction results of individual base models to further improve predictive power. A series of important factors in each domain area were identified. Dementia in later life has emerged as a significant public health challenge in recent years with continuing increases in life expectancy. Strategies for preventing or all eviating dementia symptoms in older people are much needed. In this study, a wide variety of factors(over 400 variables) from multiple domains, from a large nationally representative sample of older people (ELSA), were explored to identify characteristics associated with dementia in older adults.

C. *Fasih Haider, Member, IEEE, Sofifia de la Fuente and Saturnino Luz, Member, IEEE,"An Assessment of Paralinguistic Acoustic Features for Alzheimer's Dementia Recognition in Spontaneous Speech",IEEE Journal of Selected Topics in Signal Processing,Vol. 14, No. 8, August 2016.*

Speech analysis could provide an indicator of Alzheimer's disease and help develop clinical tools for automatically detecting and monitoring disease progression. While previous studies have employed acoustic (speech) features for characterization of Alzheimer's dementia, these studies focused on a few common prosodic features, often in combination with lexical and syntactic features which require transcription.

We present a detailed study of the predictive value of purely acoustic features automatically extracted from spontaneous speech for Alzheimer's dementia detection, from a computational paralinguistic perspective. The effectiveness of several state-of-the-art paralinguistic feature sets for Alzheimer's detection were assessed on a balanced sample of Dementia Bank's Pitt spontaneous speech dataset, with patients matched by gender and age.

V. CONCLUSION

This project proposes a web application development for Dementia Prediction System to develop as a consumer electronics product with low computational cost and high accuracy outcomes for automatically monitoring and recognizing the critical parameters of elderly people living alone. Moreover, this system can be utilized for all patients monitoring and is also very promising for real-time applications because of the fast processing time. It is useful for elderly aged people.

VI. FUTURE WORKS

The web application for dementia prediction system implemented in this project can be further developed to use as a product in real time it can be further analyzed for higher accuracy. Thus by implementing this in real time will help all the elder people to predict the disease presence at the earlier stage

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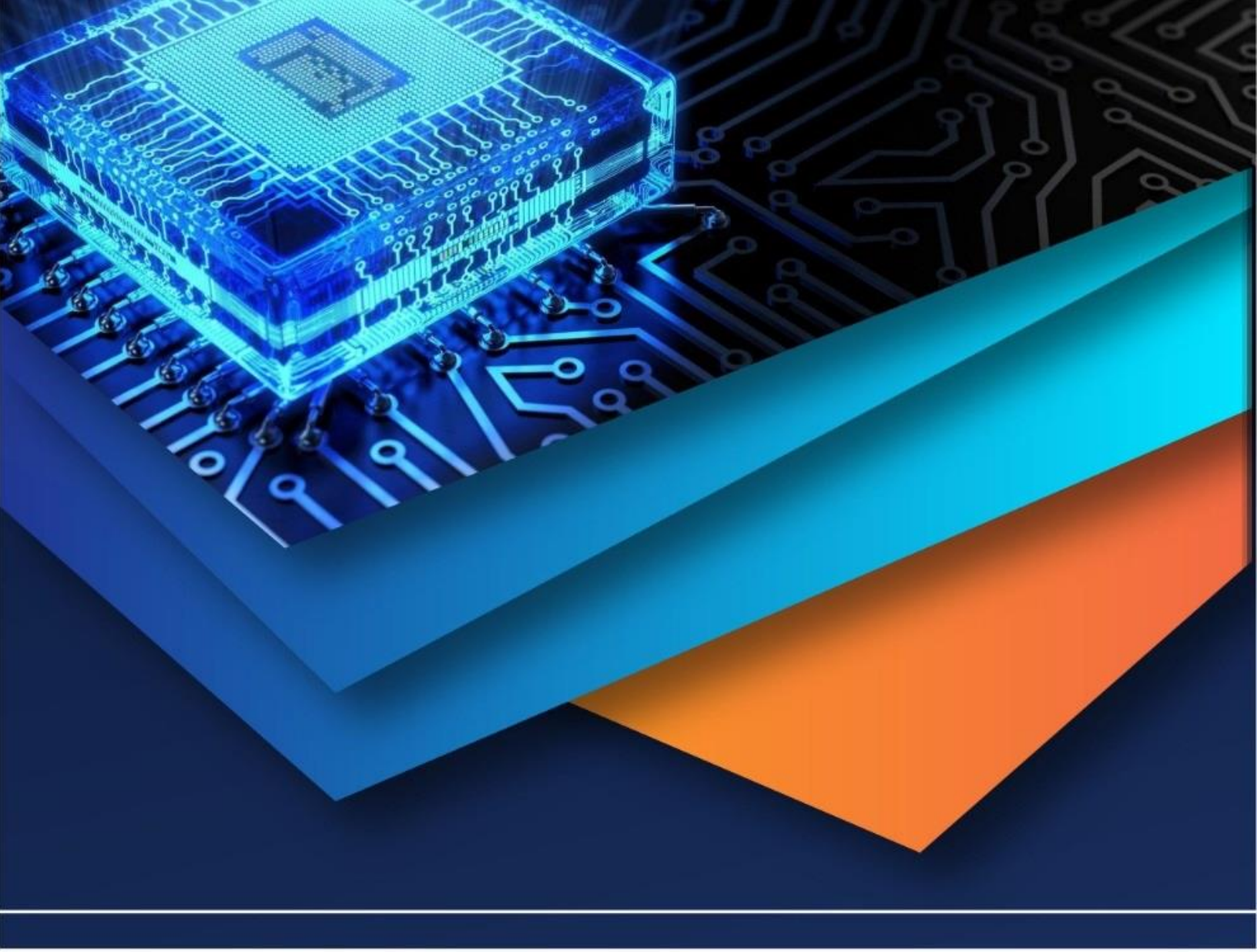
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