DAYANANDA SAGAR UNIVERSITY

Devarakaggalahalli, Harohalli
Kanakapura Road, Ramanagara - 562112, Karnataka, India

SCHOOL OF ENGINEERING

Bachelor of Technology
in
COMPUTER SCIENCE AND ENGINEERING

Major Project Phase-I Report

NEUROLOGICAL DISORDER DETECTION USING GAIT ANALYSIS AND ASSISTING PARALYSIS PATIENTS

Batch: 36

By
C Bharat Reddy - ENG20CS0066
Ajay B Kattimani - ENG20CS0018
B V Shobaraj - ENG20CS0052
Bhaskar B - ENG20CS0058

Under the supervision of
Prof. Kavyashree Pattan
Computer Science and Engineering

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING,
SCHOOL OF ENGINEERING
DAYANANDA SAGAR UNIVERSITY,

(2023-2024)

DAYANANDA SAGAR UNIVERSITY

SCHOOL OF ENGINEERING

Department of Computer Science & Engineering

Kudlu Gate, Bangalore–560068 Karnataka, India

CERTIFICATE

This is to certify that the Major Project Stage-I work titled **"NEUROLOGICAL DISORDER DETECTION USING GAIT ANALYSIS AND ASSISTING PARALYSIS PATIENTS"** is carried out by **C Bharat Reddy (ENG20CS0066),Ajay B Kattimani (ENG20CS0018), B V Shobaraj (ENG0CS0052), Bhaskar B (ENG20CS0058),** bonafide students seventh semester of Bachelor of Technology in Computer Science and Engineering at the School of Engineering, Dayananda Sagar University, Bangalore in partial fulfillment for the award of degree in Bachelor of Technology in Computer Science and Engineering, during the year **2023-2024**.

Prof. Kavyashree Pattan Assistant/Associate/ Professor Dept. of CS&E, School of Engineering Dayananda Sagar University Date:	**Dr. Girisha G S** Chairman CSE School of Engineering Dayananda Sagar University Date:	**Dr. Udaya Kumar Reddy K R** Dean School of Engineering Dayananda Sagar University Date:

Name of the Examiner **Signature of Examiner**

1.

2.

DECLARATION

We, **C Bharat Reddy (ENG20CS0066), Ajay B kattimani (ENG20CS0018), B V Shobaraj (ENG20CS0052), Bhaskar B (ENG20CS0058),** are students of eighth semester B. Tech in **Computer Science and Engineering**, at School of Engineering, **Dayananda Sagar University**, hereby declare that the Major Project Stage-I titled **"NEUROLOGICAL DISORDER DETECTION USING GAIT ANALYSIS AND ASSISTING PARALYSIS PATIENTS"** has been carried out by us and submitted in partial fulfilment for the award of degree in **Bachelor of Technology in Computer Science and Engineering** during the academic year **2023-2024.**

Student **Signature**

Name1:

USN :

Name2

USN :

Name3:

USN :

Name4:

USN :

Place : Bangalore Date

:

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NOMENCLATURE USED

AI	Artificial Intelligence
DL	Deep Learning
GUI	Graphical User Interface
PHP	Pre-Processor Hyper text
MySQL	My Structured Query Language

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ABSTRACT

Gait analysis and classification is often used as a clinical tool for detecting and diagnosing neural diseases. Gait measurement and analysis is an enabling tool for intelligent healthcare and robotics-assisted rehabilitation. To categorize whether individuals with neuro diseases were affected, we use Machine learning concepts and algorithms. Individuals afflicted with Quadriplegia or permanent nerve damage face profound limitations in motor control, restricting their ability to interact with digital interfaces. This research proposes an innovative solution that leverages eye movements, slight head movements, and blinking as intuitive input modalities for computer navigation. The system aims to restore autonomy to these individuals, empowering them to communicate and engage with the digital world. By harnessing their remaining controlled faculties, this solution seeks to mitigate communication challenges associated with Quadriplegia and related conditions.

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CHAPTER 1 INTRODUCTION

Individuals experiencing permanent nerve damage encounter a deprivation of voluntary muscle control in specific muscle groups. Quadriplegia represents an extreme manifestation of this condition, where patients lose motor function in the area of the spinal cord. Addressing this challenge, a sophisticated software solution emerges, allowing Quadriplegia and permanent nerve damage patients to communicate and control the computer. Compatible with low-end computers, this software endeavors to redefine the paradigm through the utilization of eye movements as an intuitive means for cursor control, tapping into the subtleties of blinks as a language for mouse interaction. Our work introduces a pioneering system that fuses the realms of facial landmark detection, eye aspect ratio analysis, and real-time mouse emulation, fostering a novel and responsive interaction model.

Gait analysis is the study of human locomotion. To analyze and quantify how someone walks, it is necessary to isolate the shortest, unique, repeatable task during gait. Gait disturbance is the common symptom in most neurological diseases. Neuro diseases are the disorders that affect the brain as well as the nerves found throughout the human and spinal cord. The most common neuro diseases are epilepsy, Alzheimer’s disease, Parkinson’s diseases, seizures and many more.

To assess if a person has any neuro diseases, our goal is to build a support vector machine-based

predictor. This offers sufficient depth for a more thorough analysis of the disorders. It offers a clearer knowledge of the patients' conditions. This facilitates the work of medical professionals by offering a more accurate understanding of the disease.

2.1. SCOPE

The scope of this script is to control the mouse cursor using eye movements, specifically by tracking blinks and nose movements. The script is set up to continuously run until the user presses the 'q' key or the 'esc' key. To assess if a person has any neuro diseases, our goal is to build a support vector machine based predictor. This offers sufficient depth for a more thorough analysis of the disorders.

CHAPTER 2 PROBLEM DEFINITION

People suffering from Quadriplegia or permanent nerve damage, often resulting from conditions like carpal tunnel syndrome or peripheral neuropathy, face significant limitations in controlling their movements, typically restricted to head and eye motions. This creates a substantial barrier to interacting with computers and digital interfaces.

To address this challenge, we are developing a specialized solution that leverages eye and head movements, along with blinking, as input modalities for computer navigation. The primary problem is the lack of effective and tailored interfaces for individuals with severe motor limitations, hindering their ability to communicate and engage with digital technology. Current assistive technologies are often inadequate in meeting the unique needs of patients with Quadriplegia or nerve damage.

The prevalence of neurological disorders presents a significant challenge to healthcare. Early detection of these disorders remains a complex task, often leading to delayed interventions and suboptimal patient outcomes. Additionally, individuals with paralysis face limited mobility and independence due to a lack of tailored assistive solutions. Addressing these issues necessitates the development of advanced gait analysis technology that can accurately detect neurological disorders at an early stage and create personalized assistive applications for paralysis patients.

This problem statement calls for innovative solutions that bridge medical expertise, engineering, and machine learning to enhance diagnosis precision and offer effective mobility support for individuals with neurological conditions.

CHAPTER 3 LITERATURE SURVEY

[1] The text highlights the growing issue of computer vision syndrome (CVS) as more people use digital devices extensively. To address this, a study with 13 participants explored using data of eye blinks, collected through a computer webcam, as an indicator for predicting CVS in real time.

The results revealed a decrease in blinking rate (9 to 17 blinks per minute) associated with higher CVS scores, suggesting a direct link between reduced blinking and CVS. This finding is significant because it affects job satisfaction, visual function, and overall well-being. The study proposes developing a real-time CVS detection algorithm and a recommendation system for interventions.

Essentially, this approach aims to bridge the gap between existing CVS detection tools and real-life computer usage conditions, offering insights to enhance health, well-being, and performance during day-to-day computer activities.

[2] I've come across an interesting paper presenting a new algorithm that allows people with physical disabilities to control a computer cursor using their eye movement. The algorithm detects the position of the iris in the eye, mapping it to specific locations on the computer screen for left, right, up, and down movements.

It even lets users open and close folders or applications with a click. What's cool is that it doesn't need electrodes or infrared; just a PC or laptop with a webcam. I figured it's a practical and affordable solution. To implement it, the program takes quick snaps of the user from the webcam, processes each frame to track iris shifts, and then moves the cursor accordingly on the screen.

It's a creative way to make computer interaction more accessible for those with severe physical disabilities without the need for expensive equipment.

[3] I've come across an interesting paper which proposes a new algorithm for detecting neurodegenerative diseases (NDDs) using gait force signals. The algorithm combines a convolutional neural network (CNN) with wavelet coherence spectrogram to extract features from the gait signals. The features are then used to train a classifier to distinguish between the gait patterns of healthy controls (HC) and NDD patients.

The algorithm was evaluated using the Gait in Neurodegenerative Disease database, which contains gait data from patients with ALS, HD, and PD. The results showed that the algorithm was able to achieve an overall sensitivity of 94.34%, specificity of 96.98%, accuracy of 96.37%, and AUC value of 0.97.

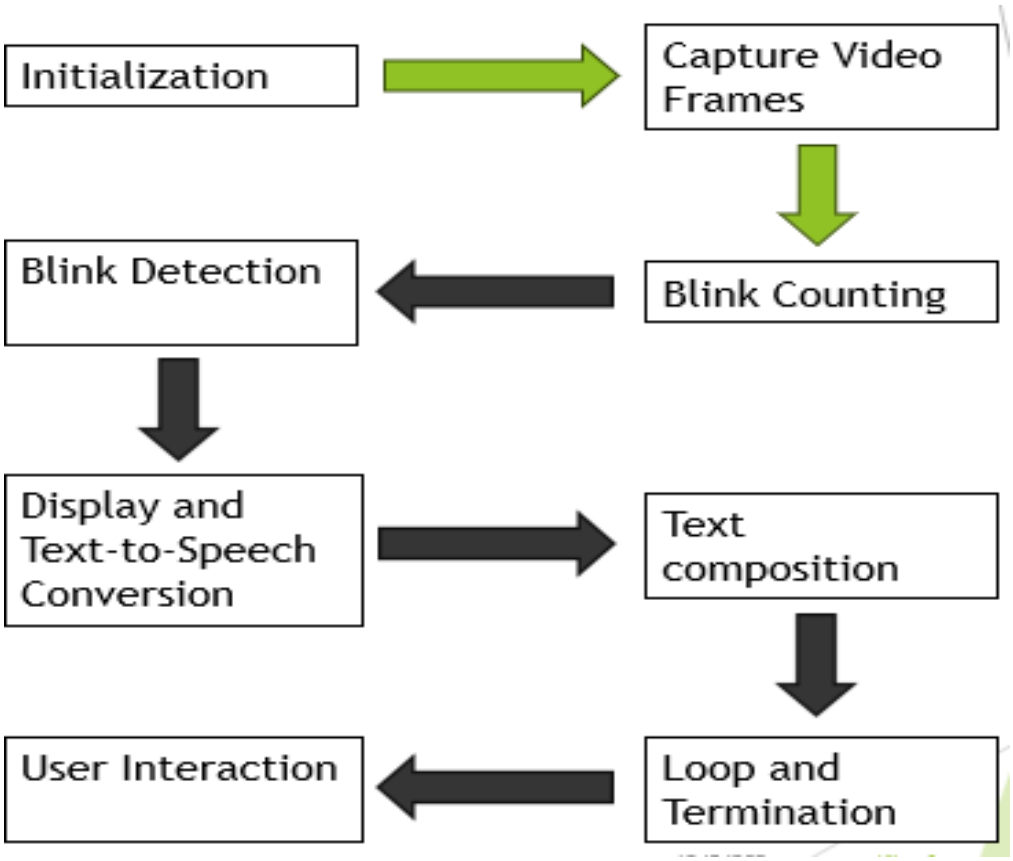
Overall, the paper presents a promising new algorithm for detecting NDDs using gait force signals. The algorithm achieved high performance in the evaluation study. However, further studies are needed to validate the algorithm on larger datasets and other types of NDDs.

[4] The paper presents a Systematic Literature Review that provides an in-depth analysis of the Parkinson's disease (PD) symptoms, Motor and Non-Motor Symptoms (NMS), the current diagnosis and management techniques used and their effectiveness. It also highlights the work of different researchers in use of wearable sensors and their proposals to improve the quality of life in a patient with PD by diagnosing, monitoring, and managing PD symptoms remotely using wearable sensors. This paper will be more useful for identifying existing research gaps, giving specialists greater understanding of the illness course, and preventing problems. In the course of their investigation, researchers combed through numerous databases and condensed their findings into 60 articles that addressed the management of motor and NMS.

Included were also the most recent analyses and studies on cutting-edge wearable technology for Parkinson's disease management. However, a lot of research has been completed with encouraging outcomes to add biopotential devices, audio recording, smartphones, and video recording to complement wearable readings to acquire an accurate insight into PD patients' wellbeing.

CHAPTER 4 PROJECT DESCRIPTION

4.1.PROPOSED DESIGN



Project Description:

Objective:

The project aims to develop a hands-free mouse control system using a webcam to track facial landmarks and interpret eye movements. The system allows users to move the mouse cursor, perform left and right mouse clicks, and interact with a computer using blinks and nose movements.

Components:

1. Facial Landmark Detection:
    - Utilizes the dlib library to detect facial landmarks in real-time.
    - Specifically focuses on the eyes (left and right) and the nose.
2. Eye Aspect Ratio (EAR) Calculation:
    - Computes the eye aspect ratio to determine the openness of the eyes.
3. Mouse Cursor Control:
    - Maps the movement of the nose to control the position of the mouse cursor. Uses PyAutoGUI to simulate mouse clicks when blinks are detected.
4. User Interface:
    - Utilizes OpenCV to display a real-time video feed with overlaid facial landmarks and cursor movement.

CHAPTER 5 REQUIREMENTS

5.1.FUNCTIONAL REQUIREMENTS

The functional requirements are activities that the system must be able to perform. The system provides the following functionalities:

• The system must be able to collect gait data from patients.

• The system must be able to analyze the gait data and identify patterns that are associated with neurological disorders.

• The system must be able to generate a report that summarizes the results of the analysis.

• The system must be able to recommend treatments for patients with neurological disorders.

• The system must be able to assist paralysis patients with their daily activities.

Software/System Requirements

Software Requirements

- Operating System : Windows 7 / 8 or above.
- Language : Python
- Tool : openCV, Sklearn

Hardware Requirements

- System : Intel i3 2.1 GHZ
- Memory : 4 GB
- Hard Disk : 80 GB.
- Webcam

CHAPTER 6 DELIVERABLES

1. Documentation:
   - Write a README file explaining how to use the script.
   - Include dependencies and installation instructions.

2. Code Comments:
   - Add comments to explain complex sections of the code.
   - Provide comments for variable names and functions.

3. Error Handling:
   - Implement error handling to manage potential issues gracefully.
   - Include messages for users in case of errors.

4. Configuration File:
   - Consider adding a configuration file for adjustable parameters
   (e.g., screen size, damping factor, eye aspect ratio threshold).

5. Testing:
   - Conduct thorough testing on different environments and conditions.
   - Ensure the script handles variations in lighting and user appearances.

6. User Interface (UI):
   - Develop a simple UI (Graphical User Interface) to make the script user-friendly.
   - Allow users to customize settings without modifying the script.

7. Package as Executable:
   - Explore packaging the script as an executable for easier distribution.
   - Tools like PyInstaller or cx_Freeze can help with this.

8. License:
   - Consider adding a license to your project.
   - Choose a license that aligns with how you want others to use and contribute to your Code.
9. Optimizations:
   - Optimize code for better performance if needed.
   - Profile the code to identify potential bottlenecks.

10. Security Considerations:
   - Ensure that the script does not pose any security risks.
   - If applicable, provide guidance on securing the system while using the script.

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