HUMAN COMPUTER INTERACTION BASED HEAD CONTROLLED MOUSE

[1] Mrs. Srilatha Puli, [2] Dandem Ajay Kumar , [3] Baddam Rithvik Reddy, [4]Kenche Vaishnavi[5], Cheera Kavya
[1] Assistant Professor, Department of CSE, Sreyas Institute of Engineering and Technology,Telangana, India.
[1] srilatha.puli@sreyas.ac.in
[2,3,4,5] Department of CSE, Sreyas Institute of Engineering and Technology, Telangana, India
[2]ajaydandem123@gmail.com , [3] baddamrithvik@gmail.com ,[4] vaishnavikenche563@gmail.com , [5]Kavyacheera25@gmail.com

Abstract
Controlling the mouse by a physically challenged person is really a tough one It is very difficult for a physically challenged person to control the mouse. We have suggested this mouse cursor control utilizing head as a way to help those who are unable to use a mouse physically. This other method uses head and eye motions to control the mouse to access a computer. A key real-time input method for human-computer communication—which is crucial for those with physical disabilities in particular—is head movement. A unique eye control system is suggested in this system that uses a webcam and doesn't require any additional hardware in order to increase the eye tracking technique's dependability, mobility, and usability in user-computer interaction. The suggested system's main goal is to offer an easy-to-use interactive mode by only by the user's facial expressions. The suggested solution explains how to utilize a webcam and Python to control the cursor on the screen by implementing both iris and head position tracking. It's incredibly difficult for someone with physical disabilities to control the mouse. We have suggested utilizing the head to control the mouse pointer in order to provide a solution for those who are unable to use a real mouse. This is a different approach to utilizing your head and eyes to manipulate the mouse when accessing a computer. One essential real-time input method for human-computer communication is head movement, which is crucial for those with physical disabilities. To enhance the dependability, portability, and usability Using a Webcam and no additional hardware, a novel eye control method is proposed in this system to take use of eye tracking approach in user-computer communication. The goal of the suggested system is to offer an easy-to-use interactive mode that solely makes use of the user's facial movements. The suggested method uses machine learning with Python to implement both iris and head position-based cursor movement, which may be utilised to control the cursor on the screen via a webcam.
Keywords: Head Movements, Webcam, Face, and Mouse.

I INTRODUCTION

In the ever-evolving landscape of human-computer interaction (HCI), one of the most remarkable innovations is head-controlled mouse technology. This revolutionary advancement has the potential to redefine how individuals, especially those with physical disabilities, interact with computers and digital devices. Head-controlled mice enable users to navigate, click, and interact with the digital world through the subtle movements of their head, providing a profound sense of independence and accessibility.

Traditional computer mice and input devices have served as the primary means of interacting with computers for decades. However, they pose limitations for individuals with limited dexterity, paralysis, or other physical impairments. These limitations have inspired researchers and engineers to develop alternative solutions, leading to the emergence of head-controlled mouse technology.

Empowering Accessibility The core mission of head-controlled mice is to empower individuals with physical disabilities to access and use digital technology. These devices break down barriers that have long hindered equal access to information and communication. By harnessing the power of head movements, users can perform tasks that were once challenging or impossible, such as browsing the internet, sending emails, playing games, or controlling smart home devices.

How Head-Controlled Mice Work At the heart of this technology is the utilization of cameras and sensors that track the movement of the user's head. These cameras capture real-time data, allowing the system to translate head movements into cursor control on the computer screen. A simple tilt of the head can serve as a surrogate for moving a physical mouse, while specialized gestures can mimic clicks and other interactions. This seamless translation between head movements and on-screen.

Applications beyond Accessibility While the primary focus of head-controlled mice is to enhance accessibility for individuals with physical disabilities, their applications extend beyond this core mission. These systems have found use in diverse fields, including gaming, virtual reality (VR), and augmented reality (AR). Gamers can use head-controlled mice for a more immersive experience, while professionals in VR and AR benefit from the added layer of control and precision.

As promising as head-controlled mouse technology is, it is not without its challenges. Ongoing research aims to address issues related to accuracy, calibration, and user adaptability. Researchers are working to make these devices more intuitive and efficient, ensuring a smoother experience for users.

Ethical and Privacy Considerations:

The development of head-controlled mouse technology also brings up important ethical and privacy considerations. These devices capture detailed data about the user's head movements and may raise concerns about data security and user consent. Ensuring that these technologies respect user privacy and data protection is a crucial aspect of their development and deployment.

The Future of Human-Computer Interaction: Head-controlled mouse technology represents a significant stride toward a more inclusive, accessible, and interactive digital world. As researchers continue to innovate and refine these systems, the potential for their integration into mainstream technology becomes increasingly likely.

II LITERATURE SURVEY

The advancement of technology has led to the Development of various human-computer interactions (HCI) systems, including those based on facial and ocular movements for cursor control. In one proposed system, the mouse cursor can be controlled using facial movements, with a suggested algorithm for a multimodal HCI system that efficiently controls all mouse actions, Including clicks and scrolling. The system also offers the possibility to add functions to cover practical situations, and the use of HCI techniques can control other Computer-generated biases [1]. Another system employs the Raspberry Pi and OpenCV for cursor control using eyeball movement based on the Eye Aspect Ratio (EAR)

method, which can be expanded to cover all mouse tasks [2]. A third system also employs Dlib and the Haar Cascade algorithm for cursor control based on eyes and facial movements, which can be improved through additional techniques such as clicking events and interfaces using eye movement and blinking [3]. Another facial expression-based system uses the Viola & Jones algorithm and a standard web camera to record the subject's emotion and send data, enabling physically disabled individuals to use the mouse cursor independently [4,10]. In a system based on eye movement, the mouse cursor is controlled using limbus tracking, pupil tracking, electrooculography, and saccade, which has some limitations related to head movement and squinting [5]. Another system enhances cursor control using eye mouse with Haar- like object etectors, Hough man Circle Detection, OpenCV, and separate techniques for detecting the iris, but it lacks scrolling and red-eye effect detection [6,11]. A system that utilizes the Raspberry Pi and specialized hardware for controlling the movement of eye and co-ordinate with the cursor movement and function employs the center of the pupil for the same purpose. These systems offer various benefits for HCI, including enabling physically disabled individuals to use the computer independently, providing new ways to interact with the computer, and advancing the field of HCI through the

Application of IoT [7]. This paper describes a real-time approach for detecting eye blinks and winks using video and MATLAB software. The approach involves eyes and facial pair localization, optical flow classification, & analysis. The methodology which is introduced in this study has been verified & tested under various environments & has shown high accuracy in detecting blinks and winks, and performing mouse analogous functions [8]. This research proposes an algorithm that operates the movements of mouse in computer using the

movements of iris tracking. It can benefit physically handicapped individuals to communicate and perform computer tasks. Iris movement can move the cursor, while blinking the eyes can perform mouse clicks and scrolling functions [9]. A face detection methodology is introduced using support

DOI:10.48047/INTJECSE/V15I4.60 ISSN: 1308-5581 Vol 15, Issue 04 2023

vector machines & spectral histograms. The method groups face images together and achieves higher efficiency on Datasets which were
used commonly and provides robust classification of non-facial & facial outlines under diverse situations [14].It represents new facial detection system using neural network methodology and logics that carefully inspects even smaller aspects of a Recognized image data and adjudicates amongst numerous networks for achieving higher performance. Data that consists of face examples of positive attribute are aligned for purpose of training, and similarly the negative attributed data/examples are collected using a bootstrap algorithm

III EXISTINGSYSTEM

A vision –based human computer is presented in the paper. The interface detects voluntary eye-blinks and interprets them as control commands. The employed image processing methods include HAAR-like features for automatic face detection and template matching based eye tracking and eye blink detection. Interface performance was tested by 49 users . The test results indicate interface usefulness in offering an alternative mean of communication with computers . The interface is based on a notebook equipped with a typical web camera and requires no extra light sources . The interface application is available on-line as open-source software. The previous systems used complex algorithms . The was based on the biometric identification techniques.Several commercially availa**ble** head-controlled mouse systems and software applications exist, catering to various disabilities and use cases. These systems are continually evolving to offer improved accuracy and ease of use, making them more accessible and versatile for users with diverse needs. The specific technology and software may vary depending on the manufacturer and the user's requirements. Some systems may integrate with other assistive technologies to provide a more comprehensive solution for individuals with disabilities.

IV PROBLEM STATEMENT

In our increasingly digitized world, the ability to interact with computers and digital devices is not merely a convenience but an essential aspect of daily life. From communication to education, employment to entertainment, digital technology has become a ubiquitous presence. However, for a significant portion of the population, particularly those with physical disabilities, accessing and using these technologies is far from straightforward. Traditional computer input devices such as mice and keyboards, while efficient for many users, present insurmountable barriers for individuals facing mobility impairments or dexterity challenges. The result is a profound disparity in access to digital resources and services. The problem at hand is the pressing need to bridge this accessibility gap, ensuring that individuals with physical disabilities can engage with the digital world on their terms, with the help of head-controlling mouse technology.

4.1 Objective

Our goal is to make it simple for "amputees"—those without arms—to perform their daily tasks. With the aid of our quadriplegics or amputees (those who have all four limbs paralyzed) can use and operate the mouse using their facial features and eye movements. to develop a system that will only use a webcam to use human eyes and facial features as a pointing device for the computer system to provide a user-friendly human- computer interaction project. The objectives are outlined below:

- Face and Eyes Detection
- Eye Corners extraction
- Develop an algorithm to calculate point of gaze-based on eye features found
- Develop a GUI to show results
- Develop a simple Calibration technique

V PROPOSED SYSTEM

A hands-free human computer interface was developed in order to help patients manipulate computers using facial movements .Algorithm presented in this project performs operations deeply centered on predicting the EYE lands marks of the given face. PyAuto GUI library was used to control the mouse cursor. We defined five motions as the basis of head movements, namely, standard head, head left, head right, head up, and head down, the face which represents the detected head (the head In this project refers to front area of the face.

DOI:10.48047/INTJECSE/V15I4.60 ISSN: 1308-5581 Vol 15, Issue 04 2023

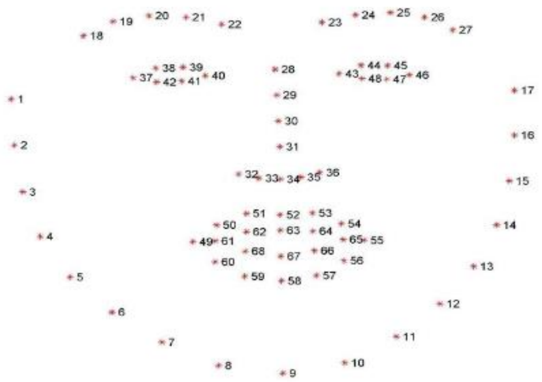
5.1 Advantages

1. for disabled Quick response time
2. Customised processing
3. Small memory factor
4. Really helpful people

VI METHODOLOGY

The process involves using a Face detection Model to obtain an image of the face through a video stream from a camera or webcam. Subsequently,the Landmark Detection Model is employed to detect various features like the mouth, left and right eyes, and other facial attributes from the acquired face image. The Head Pose Estimation Model is then utilized to determine the head's movements, which correspond to the motion of the computer mouse cursor The accurate orientation of the computer mouse cursor relies on the collaborative outcomes of both the Landmark Detection Model and the Head Pose Estimation Model, which are integrated by the Gaze Estimation Model. The Gaze Estimation Model plays a vital role in deciphering facial expressions to ensure precise positioning of the mouse pointer

The system relies on facial recognition to identify and process specific areas on the face, including the mouth, right eye, left eye, nose, and jaw. These predicted marks are used to enable the system to detect and respond to different facial movements, such as mouth opening, squinting of the eyes, and winking.



The pre-existing facial landmark detector contained in the dlib library is employed to approximate the placement of 68 coordinate pairs (x, y) that correspond to various facial features on the visage By performing expected facial expressions, specific features can be produced that enable us to detect blinks through Eye-Aspect-Ratio and yawns through Mouth-Aspect-Ratio. These actions are programmed using the PyAutoGUI module to manipulate the mouse cursor.

VII IMPLEMENTATION

During the implementation process, the first step Involves defining all the necessary threshold values

And initializing counters of frame and frame length, which are used to drive mouse action. The next step is to obtain the facial corners from the HOG face sensor and gain the indicators of facial landmarks for the mouth, both eyes, and nose. Following this, the face in the image frame isconverted into grayscale format, and the facial marks coordinates (x, y) are stored in a NumPy array. Subsequently, the Eye Aspect Ratio and Mouth Aspect Ratio are computed. Finally, a bounding box is drawn exactly from the center of the nose, and the necessary functions can be performed within that bounding box.

Code is a program that uses facial landmarks detection to perform mouse actions such as left and right clicks, scrolling, and moving the cursor. It uses OpenCV, Dlib, and PyAuto GUI libraries.

The program first defines some helper functions to calculate the eye aspect ratio, mouth aspect ratio, and direction between two points. It then initializes some variables such as the thresholds for triggering mouse actions and the counters for each action.

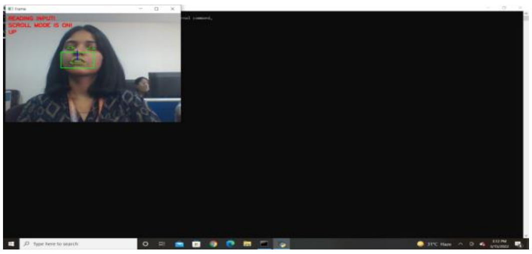
Subsequently, the software sets up Dlib's facial detector and predictor and obtains the indices of the facial landmarks corresponding to the left and right eyes, nose, and mouth. Within the primary

DOI:10.48047/INTJECSE/V15I4.60 ISSN: 1308-5581 Vol 15, Issue 04 2023

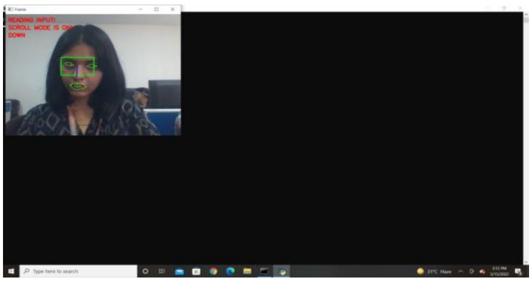
sequence of instructions, the software captures a video frame from the webcam, alters its dimensions, and converts it into a grayscale format. Following this, it proceeds to detect any facial features present within the grayscale image and determines their exact spatial position. Specifically retrieves the coordinates for the left and right eyes, mouth, and nose landmarks of the detected face region.

The software computes the aspect ratios for the eyes and mouth and uses them to trigger mouse actions such as left and right clicks and scrolling. It also uses the direction function to move the cursor when the mouth is open. Finally, the program displays the webcam frame and waits for a key press to exit

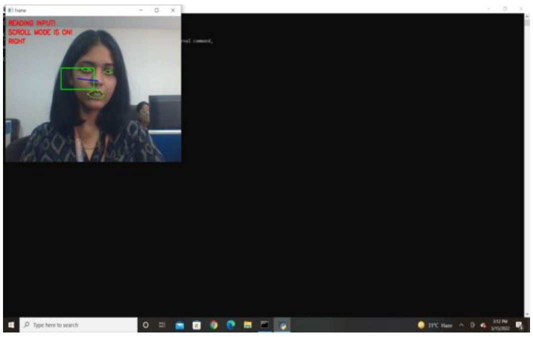
VIII RESULTS



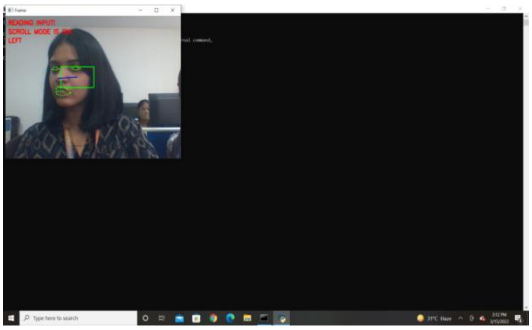
UP MOVEMENT



DOWN MOVEMENT



RIGHT MOVE



LEFT MOVE

IX CONCLUSION

Head-controlling mouse technology represents a significant advancement in the field of assistive technology and human-computer interaction. It is a powerful tool that empowers individuals with physical disabilities by providing them with an alternative means of interacting with digital devices. This technology, which leverages head movements to control the mouse cursor, offers a range of benefits, including increased independence, improved accessibility, and enhanced quality of life for

its users.
As we've explored in this discussion, the design and implementation of head-controlling mouse systems are multifaceted. The technology involves specialized hardware, sophisticated software, and a user-centric approach. The importance of design in these systems cannot be overstated, as it directly influences accessibility, usability, user experience, and the broader societal impact. with physical disabilities and inspire positive change in the broader community**.**
The system has been tested and implemented successfully and thus ensured that all the requirements as listed in the software requirements specification are completely fulfilled. In case of erroneous input corresponding error message are displayed. Top down integration strategy decision making occurs at upper levels in the hierarchy and is encountered first. If major control problems do exists early recognitions is essential. If depth first integration is selected a complete function of the software may be implemented and demonstrated.

REFERENCES

1. SRILATHA PULI, A MACHINE LEARNING MODEL FOR AIR QUALITY PREDICTION FOR SMART CITIES, DESIGN ENGINEERING || ISSN: 0011-9342 | YEAR 2021 - ISSUE: 9 | PAGES: 18090 – 18104
2. SRILATHA PULI, QUALITY RISK ANALYSIS FOR SUSTAINABLE SMART WATER SUPPLY USING DATA PERCEPTION, INTERNATIONAL JOURNAL OF HEALTH SCIENCES ISSN 2550-6978 E-ISSN 2550-696X © 2022, HTTPS://DOI.ORG/10.53730/IJHS.V6NS5.9826, 18 JUNE 2022
3. SRILATHA PULI, URBAN STREET CLEANLINESS, JOURNAL OF ALGEBRAIC STATISTICS VOLUME 13, NO. 3, 2022, P. 547-552, HTTPS://PUBLISHOA.COM, ISSN: 1309-3452
4. SRILATHA PULI, SELF-ANNIHILATION IDEATION DETECTION, NEUROQUANTOLOGY | JUNE 2022 | VOLUME 20 | ISSUE 6 | PAGE 7229-7239 | DOI: 10.14704/NQ.2022.20.6.NQ22727
5. SRILATHA PULI, CRIME ANALYSIS USING MACHINE LEARNING, YMER|| ISSN: 0044-0477, APRIL 2022
6. SRILATHA PULI, N-GRAMS ASSISTED YOUTUBE SPAM COMMENT DETECTION, YMER || ISSN: 0044-0477, APRIL 2022
7. SRILATHA PULI, ANALYSIS OF BRAND POPULARITY USING BIG DATA AND TWITTER, YMER|| ISSN: 0044-0477, APRIL 2022
8. SRILATHA PULI, CYBER THREAT DETECTION BASED ON ARTIFICIAL NEURAL NETWORKS USING EVENT PROFILES,THE INTERNATIONAL JOURNAL OF ANALYTICAL AND EXPERIMENTAL MODAL ANALYSIS, ISSN NO:0886-9367
9. SRILATHA PULI, FACE MASK MONITORING SYSTEM, THE INTERNATIONAL JOURNAL OF ANALYTICAL AND EXPERIMENTAL MODAL ANALYSIS, ISSN NO:0886-9367
10. SRILATHA PULI, IOT BASED SMART DOOR LOCK SURVEILLANCE SYSTEM USING SECURITY SENSORS, ADVANCED SCIENCE LETTERS E-ISSN:1936-7317
11. SRILATHA PULI, SAFETY ALERTING SYSTEM FOR DROWSY DRIVER, 9TH INTERNATIONAL CONFERENCE ON INNOVATIONS IN ELECTRONICS & COMMUNICATION ENGINEERING (ICIECE-2021), PAGE – 40
12. N. SWAPNA SUHASINI, SRILATHA PULI, BIG DATA ANALYTICS FOR MALWARE DETECTION IN A VIRTUALIZED FRAMEWORK, JOURNAL OF CRITICAL REVIEWS, ISSN:2394-5125 VOL.7, ISSUE 14, JULY – 2020
13. SRILATHA PULI, BLOCK CHAIN BASED CERTIFICATE VALIDATION, INTERNATIONAL JOURNAL OF SCIENCE AND RESEARCH (IJSR), ISSN: 2319-7064 SJIF (2022): 7.942, VOLUME 11 ISSUE 12, DECEMBER 2022, PAPER ID: SR221219113003, DOI: 10.21275/SR221219113003, WWW.IJSR.NET
14. MRS. SRILATHA PULI, ENERGY EFFICIENT TEACHING-LEARNING-BASED OPTIMIZATION FOR THE DISCRETE ROUTING PROBLEM IN WIRELESS

SENSOR NETWORK, INTERNATIONAL JOURNAL OF EARLY CHILDHOOD SPECIAL EDUCATION (INT-JECS) DOI: 10.48047/INTJECSE/V14I7.296 ISSN: 1308-5581 VOL 14, ISSUE 07 2022.

15. MRS. SRILATHA PULI, A HYBRID BLOCK CHAIN-BASED IDENTITY AUTHENTICATION SCHEME FOR MULTI- WSN, INTERNATIONAL JOURNAL OF EARLY CHILDHOOD SPECIAL EDUCATION (INT-JECS) DOI: 10.48047/INTJECSE/V14I7.296 ISSN: 1308-5581 VOL 14, ISSUE 07 2022
16. MRS. SRILATHA PULI, IMPLEMENTATION OF A SECURED WATERMARKING MECHANISM BASED ON CRYPTOGRAPHY AND BIT PAIRS MATCHING, INTERNATIONAL JOURNAL OF EARLY CHILDHOOD SPECIAL EDUCATION (INT-JECS) DOI: 10.48047/INTJECSE/V14I7.296 ISSN: 1308-5581 VOL 14, ISSUE 07 2022
17. MRS. S.SUNITHA, MRS. SRILATHA PULI, MULTILEVEL DATA CONCEALING TECHNIQUE USING STEGANOGRAPHY AND VISUAL CRYPTOGRAPHY, INTERNATIONAL JOURNAL OF EARLY CHILDHOOD SPECIAL EDUCATION (INT-JECSE) DOI:10.48047/INTJECSE/V15I1.1 ISSN: 1308-5581 VOL 15, ISSUE 01 2023
18. MRS. SRILATHA PULI, BLOOD BANK MANAGEMENT DONATION AND AUTOMATION, SPECIALUSIS UGDYMAS / SPECIAL EDUCATION 2022 1 (43), HTTPS://WWW.SUMC.LT/INDE.PHP/SE/ARTICLE/VIEW/1995
19. N. S. SUHASINI AND S. PULI, "BIG DATA ANALYTICS IN CLOUD COMPUTING," 2021 SIXTH INTERNATIONAL CONFERENCE ON IMAGE INFORMATION PROCESSING (ICIIP), SHIMLA, INDIA, 2021, PP. 320-325, DOI: 10.1109/ICIIP53038.2021.9702705.
20. MRS. SRILATHA PULI, KEY-AGGREGATE PROXY RE-ENCRYPTION WITH DYNAMIC CONDITION GENERATION USING MULTILINEAR MAP, JOURNAL OF SURVEY IN FISHERIES SCIENCES 10(1) 2023, PAGES - 2679-2685, E-ISSN: 2368-7487.
21. MRS. SRILATHA PULI, MRS. SUNITHA SURARAPU, DEEP LEARNING-BASED FRAMEWORK FOR ROBUST TRAFFIC SIGN DETECTION UNDER CHALLENGING WEATHER CONDITIONS, JOURNAL OF SURVEY IN FISHERIES SCIENCES 10(1) 2023, PAGES – 2650-2657, E-ISSN: 2368-7487.
22. MRS. SRILATHA PULI, MRS. SUNITHA SURARAPU, LICENSE PLATE IMAGE ANALYSIS EMPOWERED BY GENERATIVE ADVERSARIAL NEURAL NETWORKS (GANS), JOURNAL OF SURVEY IN FISHERIES SCIENCES 10(1) 2023, PAGES – 2693-2698, E-ISSN: 2368-7487.
23. MRS. SRILATHA PULI, MRS. SUNITHA SURARAPU, FOOD CALORIE ESTIMATION USING CONVOLUTIONAL NEURAL NETWORK, JOURNAL OF SURVEY IN FISHERIES SCIENCES 10(1) 2023, PAGES – 2665-2671, E-ISSN: 2368-7487.
24. MRS. SUNITHA SURARAPU, MRS. SRILATHA PULI, AN INTEGRATED ARCHITECTURE FOR MAINTAINING SECURITY IN CLOUD COMPUTING BASED ON BLOCKCHAIN, JOURNAL OF SURVEY IN FISHERIES SCIENCES 10(1) 2023, PAGES – 2608-2616, E-ISSN: 2368-7487.
25. MRS. SUNITHA SURARAPU, MRS. SRILATHA PULI, TWO LEVEL LSTM FOR SENTIMENT ANALYSIS USING LEXICON EMBEDDING AND POLAR FLIPPING, JOURNAL OF SURVEY IN FISHERIES SCIENCES 10(1) 2023, PAGES – 2750-2756, E-ISSN: 2368-7487.
26. MRS. SUNITHA SURARAPU, MRS. SRILATHA PULI, TASK FAILURE PREDICTION IN CLOUD DATA CENTERS USING DEEP LEARNING, JOURNAL OF SURVEY IN FISHERIES SCIENCES 10(1) 2023, PAGES – 2742-2749, E-ISSN: 2368-7487.