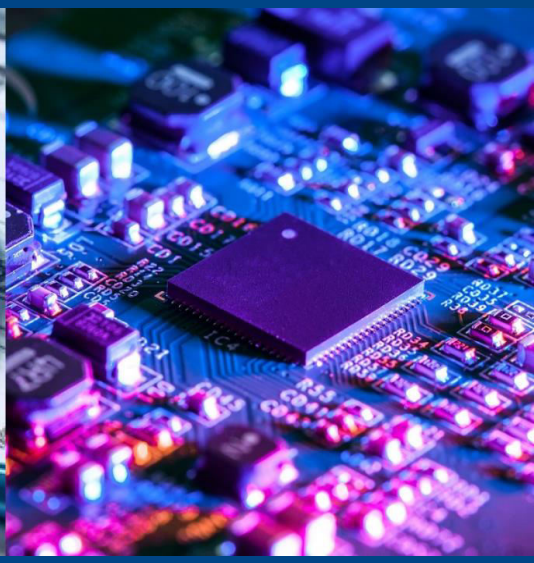
ISSN: 2582-7219





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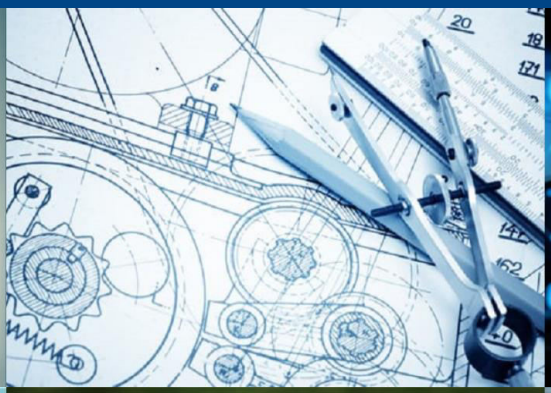

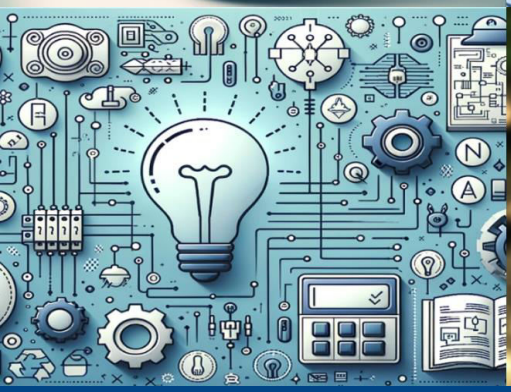

Impact Factor: 9.864

Volume 9, Issue 6, June 2026

© 2026 IJMRSET | Volume 9, Issue 6, June 2026| DOI:10.15680/IJMRSET.2026.0906023

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 9.864| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Mouse-Cursor Tracking: Simple Scoring Algorithm that Make It Work

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ABSTRACT: Mouse-cursor tracking has emerged as an effective behavioral analytics technique for understanding user interaction patterns in digital systems. By analyzing cursor movements such as speed, direction changes, pauses, click frequency, and movement patterns, meaningful insights about user engagement, attention, and authenticity can be obtained. This project focuses on developing a lightweight mouse-cursor tracking system that uses simple scoring algorithms to transform raw cursor movement data into interpretable behavioral scores. The proposed system captures real-time cursor coordinates and interaction events through web-based technologies and processes them using computationally efficient mathematical methods. Important behavioral features such as cursor velocity, hesitation time, movement smoothness, and click behavior are extracted and evaluated to generate normalized scores representing user activity and interaction quality. Unlike complex machine learning approaches, the proposed method emphasizes simplicity, low computational overhead, real-time applicability, and ease of implementation. The system is designed using technologies such as HTML, CSS, JavaScript, Java, Spring Boot, and MySQL, providing an interactive and scalable environment for monitoring user behavior. The generated behavioral scores can be utilized in various applications including usability analysis, fraud detection, e-learning assessment, adaptive user interfaces, and online monitoring systems. Overall, the project demonstrates that simple scoring algorithms are capable of providing reliable behavioral insights without requiring expensive infrastructure or high processing power. The proposed approach offers an efficient, practical, and scalable solution for modern human–computer interaction analysis and real-time behavioral monitoring systems.

I. INTRODUCTION

In recent years, understanding user behavior has become an essential part of designing effective and intelligent digital systems. Human–Computer Interaction (HCI) focuses on improving the communication between users and computer systems, and behavioral analytics plays a major role in this process. Among various behavioral analysis techniques, mouse-cursor tracking has emerged as a powerful and non-intrusive method for monitoring user interaction patterns. Cursor movements such as speed, pauses, clicks, scrolling behavior, and direction changes provide valuable insights into user attention, engagement, confidence, and decision-making processes. Unlike traditional analytics methods that only record clicks or page visits, cursor tracking captures detailed real-time interaction data that reflects actual user behavior.

This project, titled “Mouse-Cursor Tracking: Simple Scoring Algorithms That Make It Work,” aims to develop a lightweight and efficient system that analyzes mouse-cursor movements using simple scoring algorithms. The system captures raw cursor data from users and processes it to generate meaningful behavioral scores. Parameters such as cursor velocity, hesitation time, click frequency, movement smoothness, and directional changes are analyzed using basic mathematical formulas and threshold-based methods. These scores help in identifying user engagement levels, usability issues, and abnormal or suspicious behavior patterns.

The proposed approach focuses on simplicity, low computational complexity, and real-time applicability. Unlike advanced machine learning techniques that require large datasets and high processing power, the proposed scoring algorithms are easy to implement, interpretable, and suitable for deployment in resource-constrained environments. The system can be integrated into various applications such as usability testing, fraud detection systems, e-learning platforms, online assessments, and adaptive user interfaces.

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Overall, this project demonstrates that simple scoring mechanisms can effectively transform raw cursor movement data into useful behavioral insights, making mouse-cursor tracking a practical and scalable solution for modern digital systems and human–computer interaction analysis.

II. EXISTING SYSTEM

Existing mouse-cursor tracking systems mainly use complex machine learning and deep learning techniques to analyze user behavior. These systems collect cursor movement data such as speed, clicks, pauses, and movement patterns to study user interaction. Although they provide detailed analysis, they require high computational power, large datasets, and expensive infrastructure. Most systems focus on complex processing methods that are difficult to understand and implement in real-time environments. In addition, many existing systems are not suitable for low-end devices and may experience performance issues when handling large numbers of users simultaneously. Therefore, there is a need for a simpler and more efficient solution.

Disadvantages

- Requires high computational resources.
- Needs large labeled datasets for training.
- Difficult to implement and maintain.
- Not suitable for low-end or resource-limited devices.
- Increased processing time reduces real-time performance.

III. PROPOSED SYSTEM

The proposed system introduces a lightweight and efficient mouse-cursor tracking framework that uses simple scoring algorithms to analyze user behavior in real time. The system captures cursor movements such as speed, pauses, clicks, and direction changes through web-based event tracking methods. These behavioral features are processed using basic mathematical calculations and threshold-based scoring techniques to generate meaningful user behavior scores. Unlike complex machine learning models, the proposed approach focuses on simplicity, low computational overhead, and easy implementation. The system can be integrated into various applications such as usability testing, fraud detection, e-learning platforms, and adaptive user interfaces to provide reliable behavioral insights efficiently.

Advantages

- Low computational complexity and faster processing.
- Easy to implement and maintain.
- Supports real-time user behavior analysis.
- Cost-effective and suitable for large-scale systems.
- Works efficiently on low-end devices and platforms.

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IV. SYSTEM ARCHITECTURE

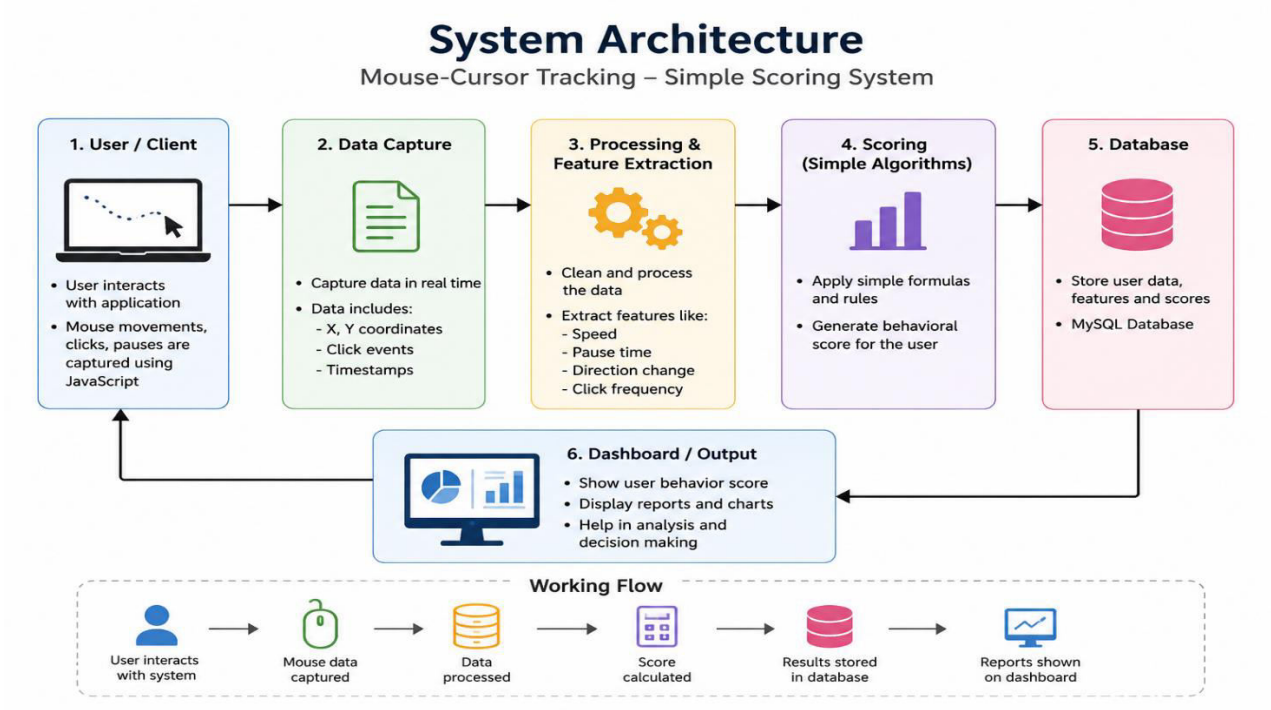

Fig no:4.1

V. MODULE DESCRIPTION

1. User Interface Module
2. Data Capture Module
3. Data Processing Module
4. Feature Extraction Module
5. Scoring Algorithm Module
6. Database Module
7. Analytics and Reporting Module

1. User Interface Module

This module provides the interaction layer between the user and the system. It is developed using HTML, CSS, and JavaScript. The module captures user activities such as mouse movements, clicks, scrolling, and pauses while the user interacts with the application. It also displays dashboards, reports, and behavioral analysis results.

2. Data Capture Module

The data capture module continuously records cursor-related events in real time using JavaScript event listeners such as mousemove, click, and scroll. It collects important information including cursor coordinates, timestamps, click frequency, and movement paths for further analysis.

3. Data Processing Module

This module preprocesses the collected cursor data before analysis. It removes duplicate or unwanted data, normalizes timestamps, filters noise, and organizes the captured information into a structured format. This improves the accuracy and efficiency of the scoring process.

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4. Feature Extraction Module

The feature extraction module calculates important behavioral parameters from the processed cursor data. Features such as cursor speed, pause duration, direction changes, movement smoothness, and click behavior are extracted to understand user interaction patterns.

5. Scoring Algorithm Module

This module applies simple mathematical formulas and threshold-based logic to generate behavioral scores. The calculated scores represent user engagement, confidence level, or suspicious activity based on cursor behavior patterns.

6. Database Module

The database module stores user details, cursor movement records, extracted features, and generated behavioral scores. MySQL is used to manage and retrieve data efficiently for reporting and future analysis.

7. Analytics and Reporting Module

This module displays behavioral insights through dashboards, charts, and reports. Administrators can monitor user activities, analyze interaction patterns, and identify unusual behavior using the generated scores.

IMPLEMENTATION

Technologies Used

- HTML, CSS, and JavaScript for designing the user interface and capturing mouse events.
- Java and Spring Boot framework for backend development and data processing.
- MySQL database for storing cursor movement data and behavioral scores.
- AJAX for sending real-time cursor data to the server without page refresh.

System Modules

- User Interface module for user interaction and dashboard display.
- Data Capture module for collecting mouse movements, clicks, pauses, and cursor positions.
- Data Processing module for cleaning and organizing captured cursor data.
- Feature Extraction module for identifying speed, pause time, direction change, and click frequency.
- Scoring module for generating behavioral scores using simple mathematical calculations.

VI. RESULTS

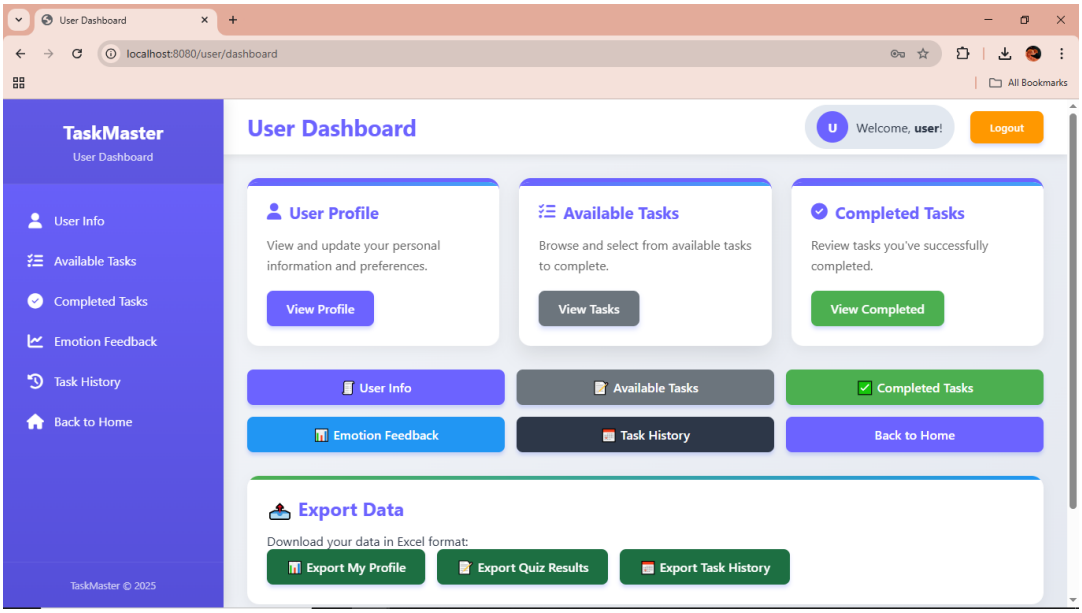

Fig no 6.1: User Dashboard

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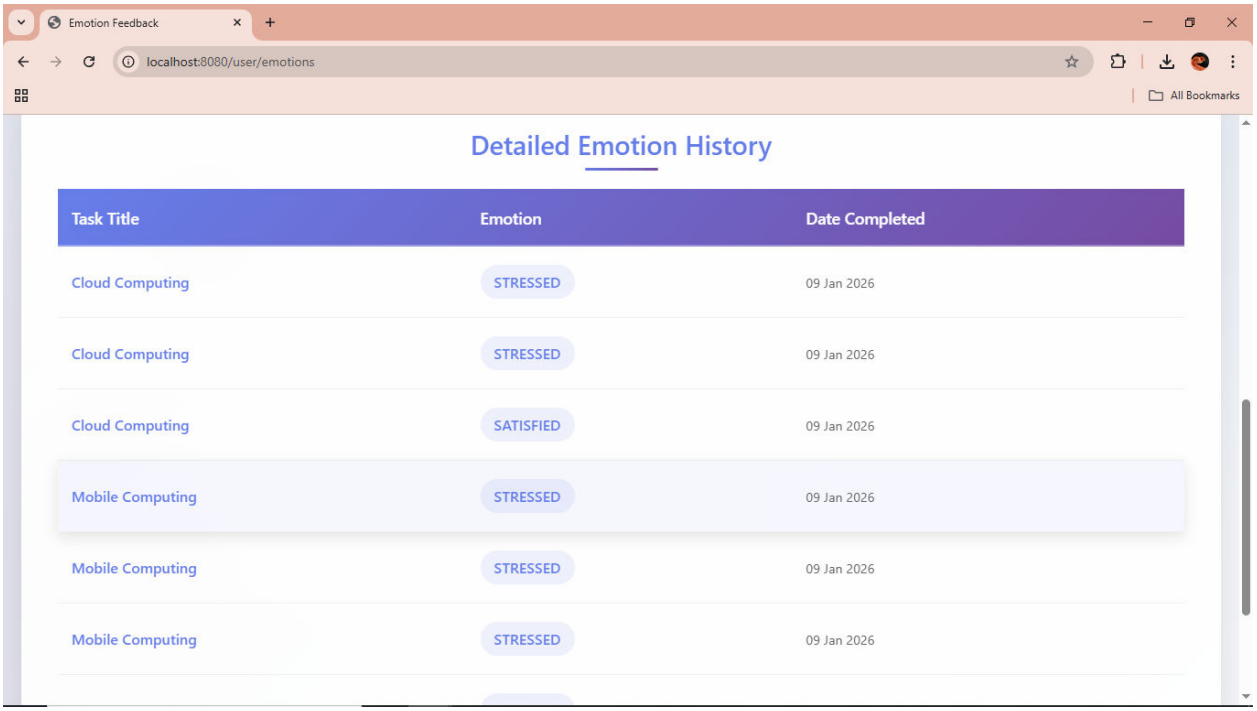

Fig no 6.2 :Emotion History

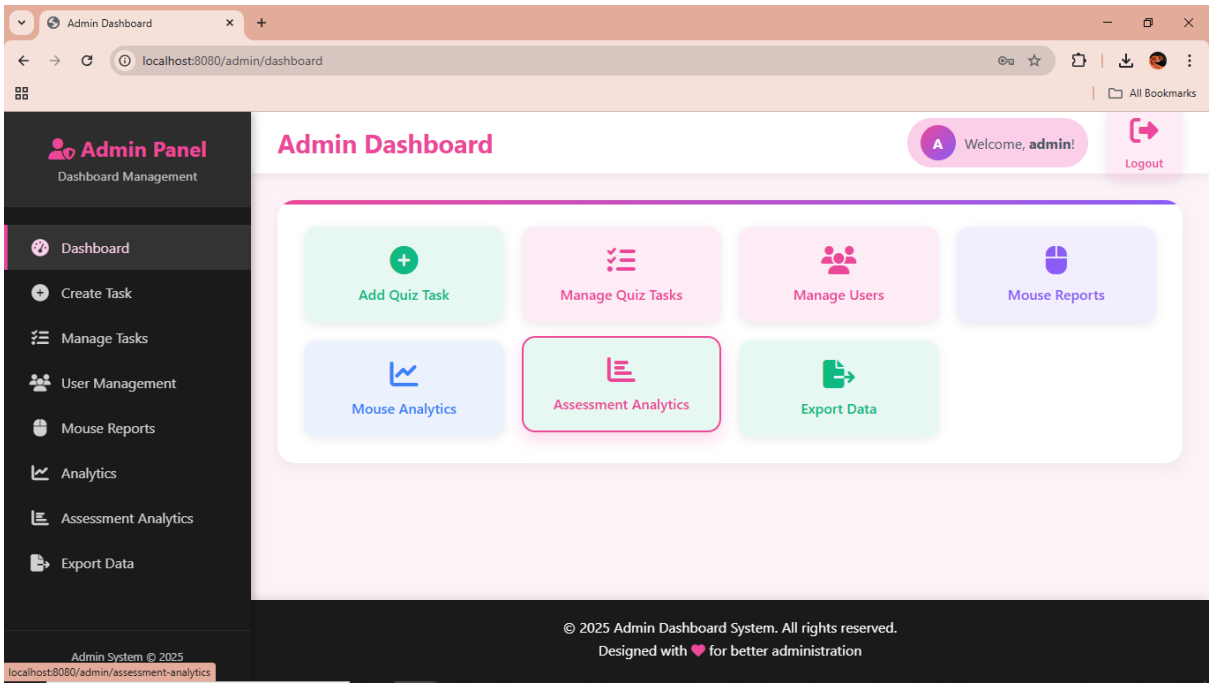

Fig no 6.3: Admin Dashboard

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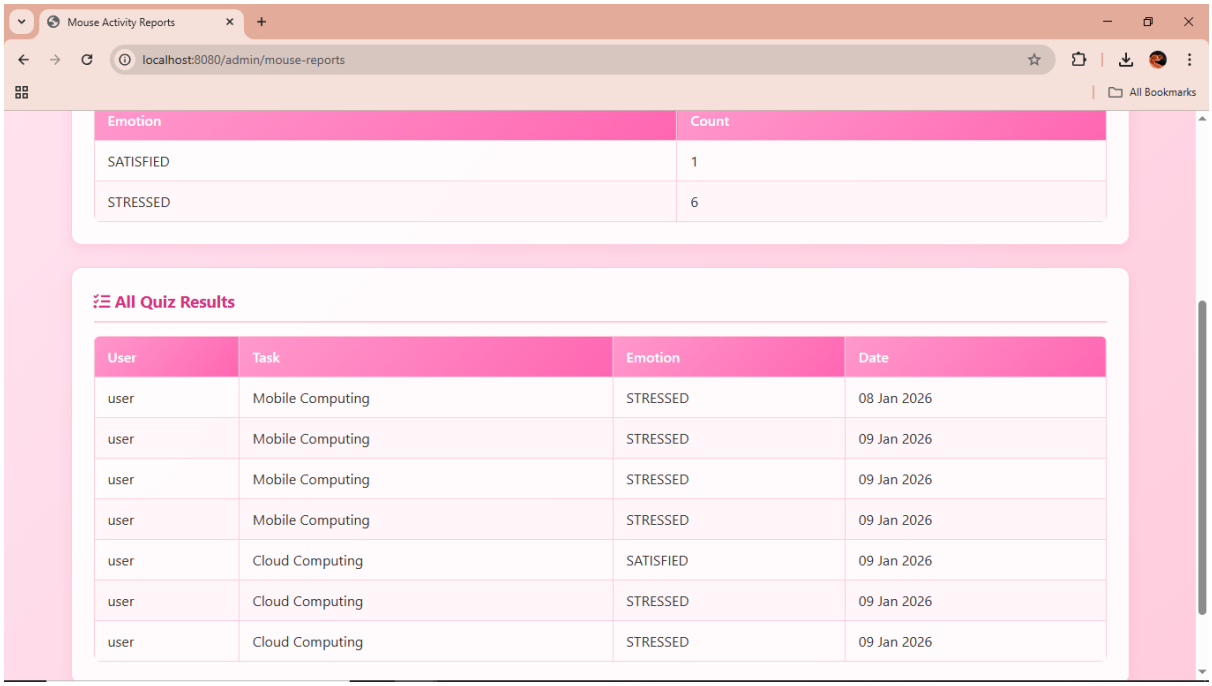

Fig no 6.4: Mouse Reports

VII. CONCLUSION

The Mouse-Cursor Tracking System using simple scoring algorithms provides an effective and efficient method for analyzing user behavior in digital environments. The system captures important cursor activities such as movement speed, pauses, clicks, and direction changes to generate meaningful behavioral scores in real time. By using lightweight mathematical calculations instead of complex machine learning techniques, the proposed system reduces computational cost and improves processing efficiency. This makes the application suitable for real-time environments and low-end devices without affecting performance.The project successfully demonstrates how cursor behavior can be used to understand user engagement, interaction quality, and suspicious activities. The system can be applied in multiple areas such as usability testing, fraud detection, e-learning platforms, online assessments, and adaptive user interfaces. In addition, the use of simple scoring algorithms makes the system easy to implement, maintain, and interpret.Overall, the project proves that simple behavioral scoring techniques are capable of producing reliable insights from mouse-cursor data. The proposed system is scalable, cost-effective, and practical for modern web applications, contributing to improved humancomputer interaction and real-time behavioral analysis in digital systems.

VIII. FUTURE ENHANCEMENT

The future enhancement of the Mouse-Cursor Tracking System can focus on improving accuracy, intelligence, and application scope. Advanced machine learning and artificial intelligence techniques can be integrated with the existing scoring algorithms to provide more accurate behavioral analysis and prediction. The system can also be enhanced to support touchscreens and mobile devices for cross-platform compatibility. Additional behavioral parameters such as scrolling patterns, keystroke dynamics, and eye-tracking data can be included to improve user behavior understanding. Real-time alert systems can be implemented to detect suspicious or fraudulent activities instantly. The project can further be integrated with cloud storage and big data technologies for handling large-scale user data efficiently. Improved data visualization using advanced dashboards and heatmaps can provide better analytical insights. Furthermore, implementing strong privacy and data security mechanisms will ensure safe and ethical handling of user interaction data in future applications.

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