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A Desktop Application for Workplace Computer Engagement Monitoring Using Visual Analytics

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Abstract

Evaluating employee workplace engagement requires multiple indicators and systematic measurement approaches. Quantifying employee productivity remains a persistent challenge in organizational performance management. To address this gap, this study addresses three research inquiries: (1) A desktop application that focuses on capturing the engagement of the user, specifically active windows, mouse clicks, keystrokes, and idle time. The captured data is visualized as bar graphs and pie charts, with downloadable reports reflecting each user's engagement. (2) The application includes multiple tabs that enable tracking, reflection, and generation of reports based on user activity. This pilot study focused on functional validation of the system rather than statistical generalization, reflecting its exploratory nature without reliance on participant data. (3) On evaluation using the Black Box Testing for its functionality, the Desktop Application for Workplace Computer Engagement Monitoring Using Visual Analytics system obtained an excellent result for its functionality, thereby achieving the study's objectives.

Keywords: assessment, effectiveness, faculty development, program, PPST, PMS, Institutional requirements, theorem of improvement

INTRODUCTION

In the study of Vitak et al. (2023), their findings emphasize that the acceptability of workplace surveillance largely depends on context, and that diminishing employees' privacy and autonomy can intensify existing power imbalances, particularly for those in vulnerable positions. Parker et al. (2022) mentioned that employees who choose to work remotely, monitoring practices introduced during the pandemic have become normalized, suggesting that heightened surveillance will likely remain a feature of the workplace regardless of location, meanwhile the transition to remote work during the pandemic affected women in the workplace disproportionately (Chauhan, 2022). Many employees tend to view workplace surveillance more negatively when the purpose for collecting sensitive data is unclear, often perceiving it as a misuse of authority (Sannon et al., 2022).

Modern workplace productivity assessment increasingly relies on data-driven methodologies and advanced analytics tools. The transition to remote work during the pandemic affected women in the workplace disproportionately (Chauhanet al., 2022) as they have advocated for a more nuanced understanding of how heightened surveillance and cross-boundary data flows affect individuals and workplaces (Marwick et al., 2022). It has been observed that greater dependence on email, video conferencing, and messaging heightened stress and conflict among many employees, particularly women. Building on these concerns on how the pandemic has reshaped the future of work, this study examines how the expansion of workplace surveillance during and beyond the pandemic may reinforce existing inequalities and power imbalances, ultimately compromising employee privacy and well-being (Pennington et al., 2022).

Visualizing data can be entertaining, and complex, visual analytics (VA) has grown rapidly over the past two decades. It has evolved from a problem-driven convergent area of research at the intersection of visualization, data mining/analytics and statistics (Ebert et.al., 2021). To provide an intuitive interface, visualization techniques need to be used; nevertheless, the visualizations themselves need to be carefully selected so that end users may quickly and easily understand them without requiring a great deal of training (Qu et al., 2015). It can be difficult to assess employee performance at a company where the workload and responsibilities of different employees vary greatly. This includes knowing how quantitative measurements of employee achievements relate to supervisor expectations and the main drivers of good performance (Zhao et al., 2020).

This research utilized visual analytics to measure workplace computer engagement, particularly to address the following research questions:

1. How can visual analytics effectively capture workplace engagement?

2. What engagement patterns emerge from computer activity data?

3. How do stakeholders evaluate such monitoring systems?

The theoretical framework links user activity indicators such as keystrokes, mouse clicks, and active windows to engagement theory and productivity models. This study fosters a desktop application for Workplace Computer Engagement, that determines the activity levels through these engagement indicators and evaluates the application using Black Box Testing for its functionality to guarantee that the system's functionalities operate as intended. As a result, the researcher could concentrate on testing, troubleshooting, and improving the many characteristics of each role in the system.

The system is designed to comprehensively monitor user engagement by capturing real-time data on active processes, keystrokes, and mouse clicks during working hours. Both Admin and User interfaces include core tabs Dashboard, Tracking, Analytics, and Reports. However, the Admin panel uniquely includes additional functionalities: a Search Capability Tab for locating users and a Register Tab for adding new users. Key information such as attendance, tracking details, and active processes is accessible to both user types. Within the Analytics Tab, user activity is visualized through graphs that display keystroke and mouse click counts. A Date Range selector enables time-specific analysis, while Graph Frequency options (hourly, daily, monthly) allow dynamic viewing of engagement trends. Below the graph, visual analytics provide a detailed breakdown of user actions within selected timeframes. A pie chart further categorizes user activity based on process types of Lifestyles, Socials, Entertainment, Productivity, and Others according to the selected date range, offering an at-a-glance summary of how time is allocated across different task categories.

On top of this, the desktop application only runs on windows users; phones and tablets are not allowed to access the application, even iOS users. The .Net 6.0.302 framework is needed for the desktop application to be used. The summary of the reports is also downloadable but only limited to the following file formats: Pdf, Excel, HTML, and Word. An internet connection is required for the application to be utilized.

LITERATURES

According to (Ebert et al., 2021) emphasize the importance of integrating human-centered approaches with analytical tools to effectively manage and interpret large datasets. Visual analytics allows users to explore complex data visually, supporting decision-making processes across various domains. (Qu & Chen, 2015) demonstrate the real-world impact of visual analytics. (Wolfe, 2015) adds that teaching students how to interpret data visually is crucial in fostering analytical thinking.

Studies on predictive analytics (Siegel, 2016; Elkan, 2013; Ibrahim, 2015) show how data mining techniques can uncover patterns that assist organizations in forecasting outcomes and making informed decisions. These works explain how the science of prediction supports operational and strategic objectives across industries. Sentiment analysis and social data visualization have also been explored in relation to user-generated content. (Chang et al., 2017) analyzed hotel reviews using deep learning to extract meaningful patterns from customer feedback. Similarly, (Hoque & Carenini, 2014) developed *ConVis*, a visual tool to analyze blog conversations, enhancing understanding of public sentiment and interaction dynamics.

Literature Matrix. In corporate environments, employee monitoring tools like *Teramind, ActivTrak, Controlio, Hubstaff, StaffCop, LiquidPlanner and Microsoft Power BI.* The researchers conducted a comparative analysis of existing monitoring software to evaluate their features and capabilities. The comparison focused on seven key aspects:

1. keystroke and mouse click tracking,
2. graph visualizations,
3. report generation in multiple formats (PDF, Excel, and CSV),
4. date range selection,
5. time tracking functionality,
6. visual analytics, and
7. process type categorization.

This evaluation provided insights into the strengths and limitations of each software, guiding the development and enhancement of the developed system.

Table 1
Monitoring Matrix of Existing Software

Existing Monitoring Softwares	1	2	3	4	5	6	7
Teramind's	✓	✓				✓	
ActivTrak		✓			✓	✓	
Controlio	✓	✓		✓	✓		
Hubstaff	✓	✓		✓	✓		
StaffCop		✓			✓		
LiquidPlanner		✓		✓			
Microsoft Power BI		✓		✓			

The comparative analysis identified the common features across all monitoring software reviewed. Tools like ActivTrak and Teramind offer advanced reporting that provides both managers and employees with performance insights, though they lack flexible Date Range tools. Controlio offers limited process categorization, only distinguishing between productive and distracting activities. To address these limitations, the developed desktop application introduces enhanced features, including a Date Range selector for hourly, daily, and monthly graph views, and customizable report exports in PDF, Excel, Word, and HTML. It also includes refined keystroke and mouse click tracking, and a more detailed categorization system for user activity: Social, Entertainment, Productivity, Lifestyle, and Others. Moreover, unlike existing software, the developed system incorporates visual analytics that not only reflect user engagement but also identify specific processes and websites accessed providing more actionable overview for administrators and users alike.

METHODS

System Development Methodology. The Spiral Model is the methodology used in developing desktop applications. The Spiral Model was initially proposed by (Boehm, 1988), a very important software development life cycle model.

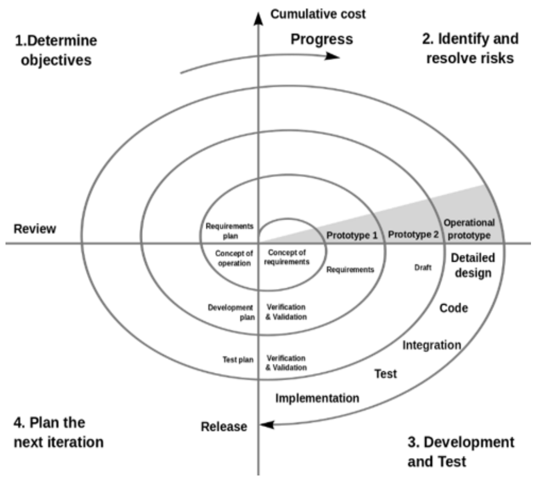


Figure 1
Spiral Model

The spiral model's unique feature is its capability to handle risks. The spiral model represents the help of a spiral, but the number of loops is subjective and depends purely upon the project. The said model consists of 4 phases, namely: Design, Implement, Playtest, and Evaluate phase.

In the Design phase, the researcher identified requirements such as report formats, visual tools, and system components, guided by literature review and planning. The Implementation phase involved iterative prototyping starting with UI and activity tracking, then refining data visualization using bar and pie charts, and finally expanding report generation features. During the Playtest phase, the system was tested using Black Box Testing. In the Evaluation phase, their feedback was used to improve the system, with final assessments confirming its effectiveness in tracking engagement, visualizing data, and generating reports.

System Requirements and Design. The goal of workplace computer engagement with applied visual analytics is to track the engagement of a user, an employee, or any worker. Their engagement that will be captured and measured will be derived from (keystrokes, mouse clicks, and open software or application). To accomplish this goal, workplace computer engagement with applied analytics was designed to reflect a user's engagement, which will be represented in visual analytics form such as a bar graph and pie chart.

Research Design Components. Upon user login, the system captures keystrokes, mouse clicks, and active windows, converting them into engagement data. This data proceeds to a visualization stage, generating bar graphs, pie charts, and detailed reports on attendance, tracking, and interaction metrics. These outputs inform administrators, enabling them to assess user engagement and make evidence-based decisions for monitoring, evaluation, and strategic improvement.

Task 2. Focuses on evaluating engagement. At the admin level, total keystrokes and mouse clicks are shown in a bar graph, while a pie chart displays the categories of websites or software used categorized into lifestyle, productivity, entertainment, and socials. All engagement data, including attendance and tracking reports, can be exported in PDF, Excel, Word, or HTML formats.

Task 3. Supports the decision-making process of administrators. Engagement reports help assess user performance based on the complexity and nature of the task – whether it was self-initiated or assigned. Weighting for different job types can be considered. Visual graphs assist managers in evaluating user participation and engagement effectively.

Application of Visual Analytics in the Study. There are a wide variety of choices when it comes to showing visualizations. However, the most appropriate visualization is how you understand and visualize the data and its composition. The objective is to show to your superior, or even a user, a clear presentation and how they process this visual information. Thus, this study utilized bar graphs and pie charts to visualize the engagement of a user.

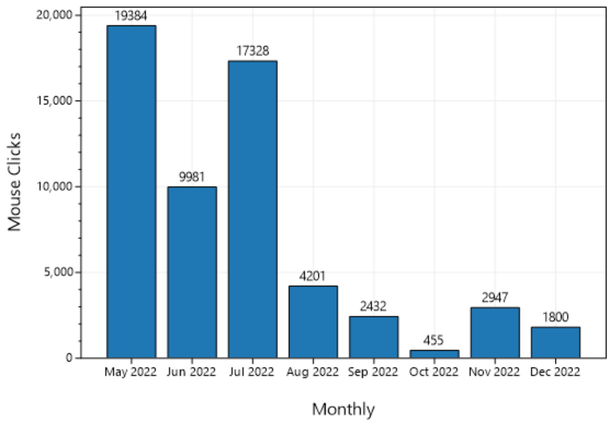


Figure 2
Sample bar graph presentation

Bar Graph. It is the most used for comparing the quantities of different categories or groups wherein the values of a category are represented using the bars. Under the Analytics Tab, the bar graph is configured in horizontal bars; the height of the graph varies based on the total number of captured keystrokes or mouse clicks.

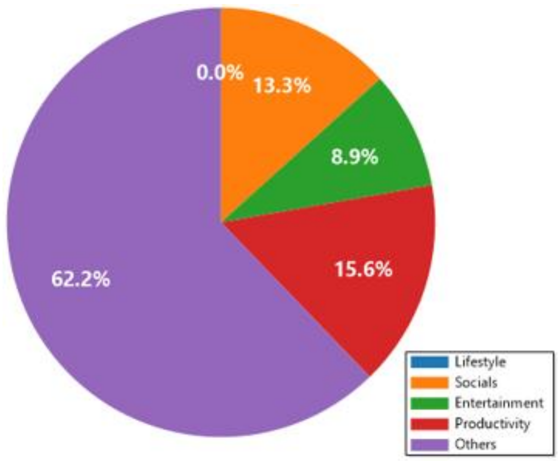


Figure 3
Sample pie chart presentation

Pie Chart. A pie chart is used to categorize a user's engagement. It is classified and reflected in each slice of the pie. Sample categories are the following: productivity, lifestyle, entertainment, and socials. The other software or applications that are not captured will be categorized as others. The percentage of each category is reflected in each slice.

Keystroke and Mouse click. The developed applications only capture the number of the keystrokes and mouse clicks and not the actual value that is being clicked by the user.

Current Active Window. The developed application captures the current active window that has been opened and engaged by the user within 60 to 120 seconds and all of them will be reflected in the tracking detail report furthermore all the captured names of the active window that has been opened will be categorized as, lifestyle productivity entertainment and socials.

Ethical Consideration. To address potential ethical concerns associated with monitoring software, this study focused solely on functional validation through Black Box Testing and did not involve human participants. The evaluation was limited to verifying system features such as activity tracking, visualization, and reporting within a controlled environment. No personal or user-specific data were collected during testing. Nonetheless, because workplace monitoring tools inherently involve sensitive information such as keystrokes, active windows, and application usage, the study highlights the importance of adhering to data privacy regulations, implementing strong security safeguards, and ensuring transparency and accountability in future real-world applications.

Data Privacy and Compliance Considerations. The deployment of workplace monitoring software raises important questions about data privacy, employee autonomy, and compliance with existing data protection frameworks. Given that the system collects user activity data such as keystrokes, mouse clicks, and active windows, strict safeguards are required to prevent misuse or unauthorized access.

Workplace monitoring software must balance productivity tracking with respect for employee privacy. Since it records sensitive engagement data (keystrokes, mouse clicks, active windows), strict safeguards are essential to prevent misuse. Compliance with data protection laws, transparency with employees, and secure handling of information are critical to ensuring ethical and responsible use.

RESULTS

RQ1. How can visual analytics effectively capture workplace engagement?

Tracking user activity during working hours, including keystrokes, mouse clicks and active processes.

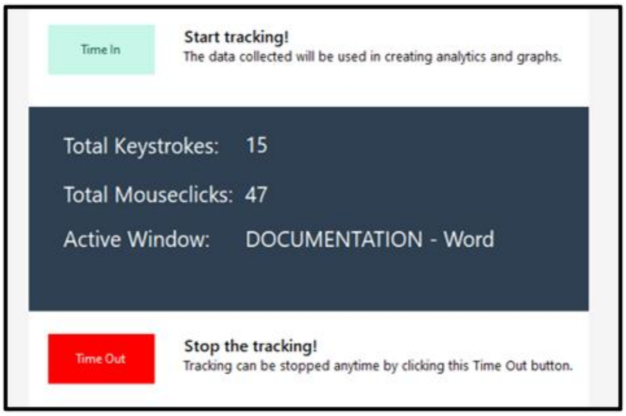


Figure 4
Real-time monitoring interface

The figure illustrates the real-time monitoring interface used in this study to capture workplace computer engagement, directly addressing one of the research objectives: tracking user activity during working hours. The interface records quantitative metrics such as total keystrokes, total mouse clicks, and the currently active application window. The "Time In" function initiates activity logging, while the "Time Out" function allows users to stop tracking at any point, ensuring flexibility and control over the monitoring process. These captured parameters enable the generation of detailed analytics and visualizations, providing empirical evidence of user interaction patterns and their alignment with work-related tasks.

RQ2. What engagement patterns emerge from computer activity data?

User engagement data was visualized through bar graphs and pie charts.

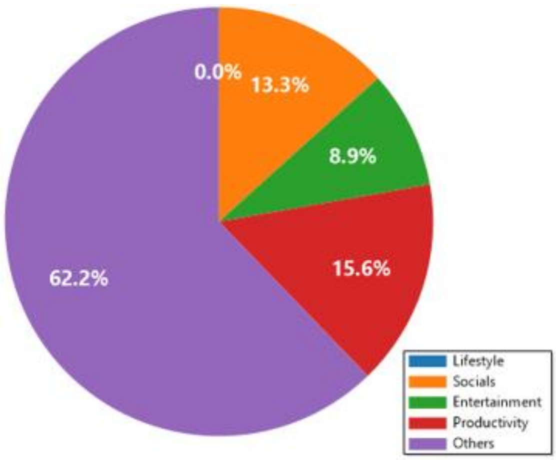


Figure 5
Sample pie chart categorization

The pie chart was categorized according to the name of the websites or software that has been visited by the user. The pie chart presents the proportion of websites and software visited by the user, categorized into five groups: Lifestyle, Socials, Entertainment, Productivity, and Others. The largest portion, 62.2%, falls under Others, indicating a wide range of miscellaneous activities. Productivity accounts for 15.6%, followed by Socials at 13.3%, and Entertainment at 8.9%. Interestingly, Lifestyle shows 0.0%, meaning no visits were recorded in that category.

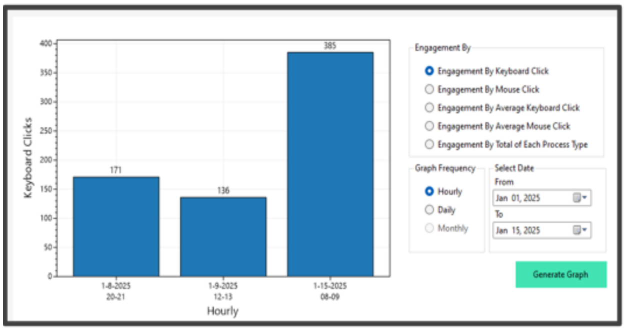


Figure 6
Bar graph depicting user engagement

The figure presents a bar graph depicting user engagement based on keyboard click activity, addressing the research objective of visualizing workplace computer interactions. The data collected between January 1 and January 15, 2025, is displayed with hourly granularity, showing variations in keyboard usage across different dates and times. This visualization, along with other bar and pie chart formats used in the study, enables clear identification of peak engagement periods and supports data-driven interpretation of user activity trends.

RQ3. How do stakeholders evaluate such monitoring systems?

The desktop application provides detailed tracking reports that were generated on an hourly, daily, and monthly basis as an option to monitor and evaluate the engagement of user.

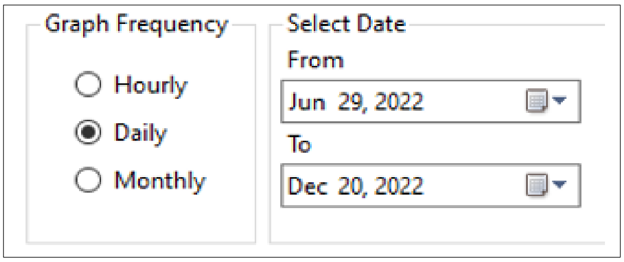


Figure 7
Graph Frequency

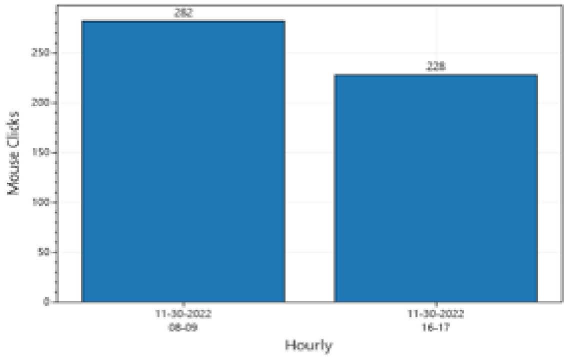


Figure 8
Tracking of hourly report

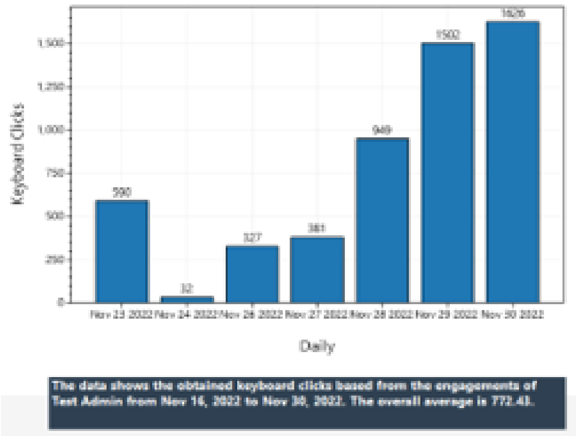


Figure 9
Tracking of daily report

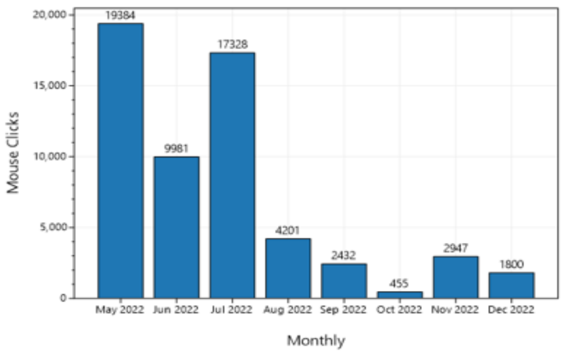


Figure 10
Tracking of monthly report

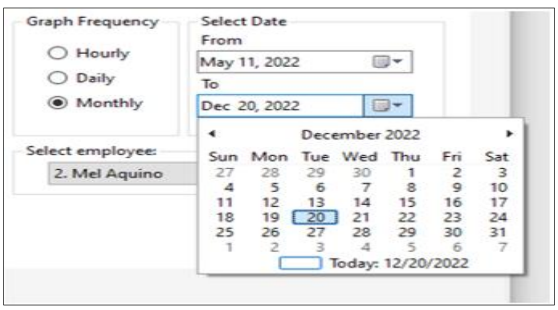


Figure 11
Date Range

The figures present the interface controls used for activity tracking, allowing stakeholders to select visualization frequency on an hourly, daily, or monthly basis. By enabling flexible views of keystroke and mouse click data within a specified date range, this tool supports precise monitoring of user engagement and productivity patterns. Such granularity facilitates the identification of peak performance periods and potential productivity gaps, aligning directly with the study's objective of evaluating workplace computer activity. Moreover, the generated activity report can be downloaded in different file formats, including attendance.

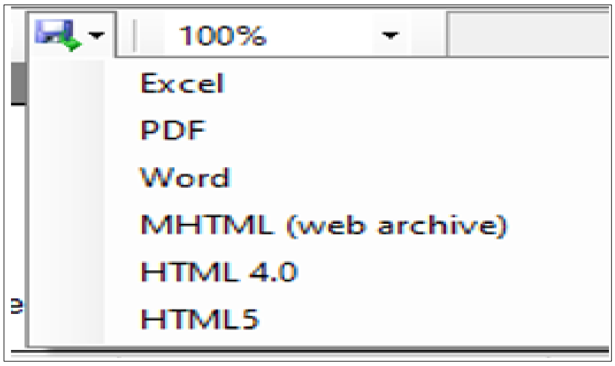
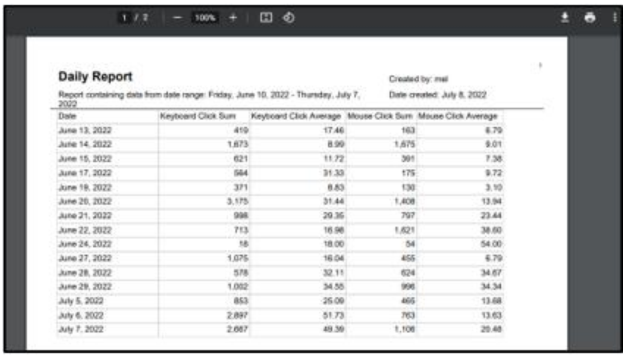


Figure 12
Downloadable file formats



Daily Report

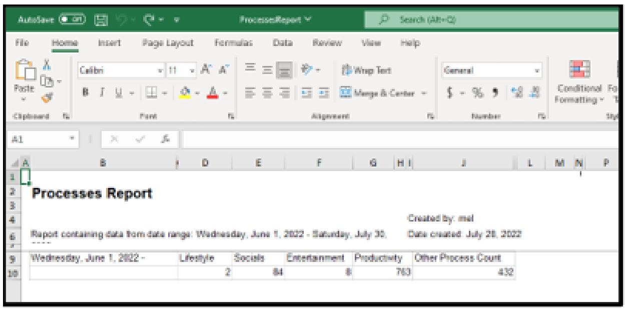
Created by: mel

Report containing data from date range: Friday, June 10, 2022 - Thursday, July 7, 2022

Date created: July 8, 2022

Date	Keyboard Click Sum	Keyboard Click Average	Mouse Click Sum	Mouse Click Average
June 13, 2022	419	17.46	163	6.79
June 14, 2022	1,673	8.99	1,675	9.01
June 15, 2022	621	11.72	391	7.38
June 17, 2022	584	31.33	175	9.72
June 18, 2022	371	8.83	130	3.10
June 20, 2022	3,175	31.44	1,408	13.94
June 21, 2022	998	29.35	797	23.44
June 22, 2022	713	16.98	1,621	38.60
June 24, 2022	18	18.00	54	54.00
June 27, 2022	1,075	16.04	455	6.79
June 28, 2022	578	32.11	624	34.67
June 29, 2022	1,002	34.55	996	34.34
July 5, 2022	853	25.09	465	13.68
July 6, 2022	2,897	51.73	763	13.63
July 7, 2022	2,687	49.39	1,108	20.48

Figure 13
Sample file format 1



Processes Report

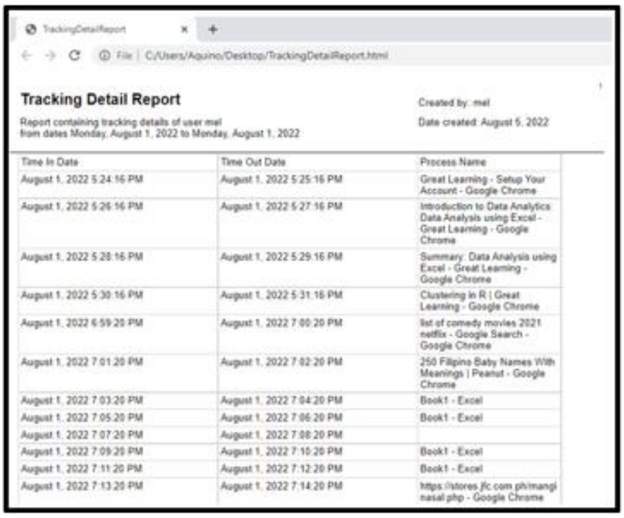
Created by: mel

Report containing data from date range: Wednesday, June 1, 2022 - Saturday, July 30,

Date created: July 28, 2022

Wednesday, June 1, 2022 -	Lifestyle	Socials	Entertainment	Productivity	Other Process Count
	2	84	8	763	432

Figure 14
Sample file format 2



Tracking Detail Report

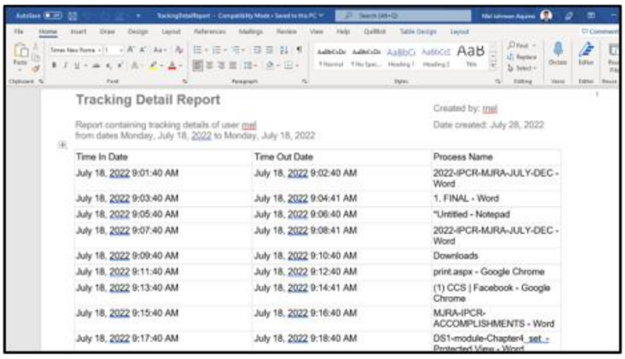
Report containing tracking details of user mel
from dates Monday, August 1, 2022 to Monday, August 1, 2022

Created by: mel

Date created: August 5, 2022

Time In Date	Time Out Date	Process Name
August 1, 2022 5:24:16 PM	August 1, 2022 5:25:16 PM	Great Learning - Setup Your Account - Google Chrome
August 1, 2022 5:26:16 PM	August 1, 2022 5:27:16 PM	Introduction to Data Analytics Data Analysis using Excel - Great Learning - Google Chrome
August 1, 2022 5:28:16 PM	August 1, 2022 5:29:16 PM	Summary: Data Analysis using Excel - Great Learning - Google Chrome
August 1, 2022 5:30:16 PM	August 1, 2022 5:31:16 PM	Clustering in R | Great Learning - Google Chrome
August 1, 2022 6:59:20 PM	August 1, 2022 7:00:20 PM	list of comedy movies 2021 netflix - Google Search - Google Chrome
August 1, 2022 7:01:20 PM	August 1, 2022 7:02:20 PM	250 Filipino Baby Names With Meanings | Peanut - Google Chrome
August 1, 2022 7:03:20 PM	August 1, 2022 7:04:20 PM	Book1 - Excel
August 1, 2022 7:05:20 PM	August 1, 2022 7:06:20 PM	Book1 - Excel
August 1, 2022 7:07:20 PM	August 1, 2022 7:08:20 PM	
August 1, 2022 7:09:20 PM	August 1, 2022 7:10:20 PM	Book1 - Excel
August 1, 2022 7:11:20 PM	August 1, 2022 7:12:20 PM	Book1 - Excel
August 1, 2022 7:13:20 PM	August 1, 2022 7:14:20 PM	https://stores.jfc.com.ph/mangi nasal.php - Google Chrome

Figure 15
Sample file format 3



Tracking Detail Report

Report containing tracking details of user mel
from dates Monday, July 18, 2022 to Monday, July 18, 2022

Created by: mel

Date created: July 28, 2022

Time In Date	Time Out Date	Process Name
July 18, 2022 9:01:40 AM	July 18, 2022 9:02:40 AM	2022-IPCR-MJRA-JULY-DEC - Word
July 18, 2022 9:03:40 AM	July 18, 2022 9:04:41 AM	1. FINAL - Word
July 18, 2022 9:05:40 AM	July 18, 2022 9:06:40 AM	*Untitled - Notepad
July 18, 2022 9:07:40 AM	July 18, 2022 9:08:41 AM	2022-IPCR-MJRA-JULY-DEC - Word
July 18, 2022 9:09:40 AM	July 18, 2022 9:10:40 AM	Downloads
July 18, 2022 9:11:40 AM	July 18, 2022 9:12:40 AM	print.aspx - Google Chrome
July 18, 2022 9:13:40 AM	July 18, 2022 9:14:41 AM	(1) CCS | Facebook - Google Chrome
July 18, 2022 9:15:40 AM	July 18, 2022 9:16:40 AM	MJRA-IPCR-ACCOMPLISHMENTS - Word
July 18, 2022 9:17:40 AM	July 18, 2022 9:18:40 AM	DS1-module-Chapter4_set - Protected View - Word

Figure 16
Sample file format 4

The figure above demonstrates the system's capability to generate and download comprehensive activity reports in multiple file formats, including PDF, Excel, HTML, and Word. These reports consolidate user engagement data such as keystrokes, mouse clicks, and active application usage alongside attendance records. By capturing both activity metrics and presence, the system provides a dual measure of engagement and productivity. Such reports can serve as a valuable instrument for monitoring work performance, identifying patterns of high and low productivity, and verifying user attendance for accountability purposes.

RQ3. How do stakeholders evaluate such monitoring systems?

To ensure the reliability and accuracy of the developed desktop application, a Black Box Testing approach was employed to evaluate its functionality across the system's major modules. Black Box Testing focuses on examining the software's output based on given inputs without consideration of the internal code structure, thereby simulating the perspective of an end-user. Each functionality was tested multiple times, with results recorded as the number of successful executions versus failed attempts.

Table 2
Result table for black box testing

Function	Input	Expected Output	Passed Test	Failed Test	Result
Sign-In	Account details	Enter the system	5/5	0/5	**Successful**
	Incomplete/incorrect details	Error message prompt	5/5	0/5	**Successful**
Analytics Tab	Engagement of the total number of keystroke and mouse click	The application successfully reflected the total number of captured keystrokes and mouse clicks at the top of the bar graph	5/5	0/5	**Successful**
	Category for the suers engagement	categories were successfully represented through a pie chart which is categorized in lifestyle, social, productivity, entertainment, and others	4/5	1/5	**Successful**
Graph Frequency	Hourly	User's engagements were successfully reflected in the analytics tab the engagement will depend on the decide graph frequency either early daily or monthly basis.	5/5	0/5	**Successful**
	Daily				**Successful**
	Monthly				**Successful**
Tracking Tab	Time in	Start capturing the current active window, keystroke, and Mouse clicks	5/5	0/5	**Successful**
	Tim out	Stop the tracing			**Successful**
Reports Tab	Reports content Attendance Tracking Detail report Category Keystroke and mouse click	The application generates reports in all the following reports content.	4/5	1/5	**Successful**
Reports Format	HTML PDF Word Excel	Reports were successfully downloaded based on the desired report format.	5/5	0/5	**Successful**

The table above presents a summary of the results. The testing covered key modules including Sign-In, Analytics, Graph Frequency, Tracking, and Reports, along with the different report formats supported by the system.

Sign-In Functionality. The system correctly validated both accurate and incomplete/incorrect credentials. For valid inputs, the user was able to access the application seamlessly, while invalid inputs triggered an appropriate error prompt. Both scenarios achieved a 100% success rate across five trials.

Analytics Tab. The application accurately reflected captured engagement metrics, including the total number of keystrokes and mouse clicks on a bar graph. User engagement categories (lifestyle, social, productivity, entertainment, and others) were represented using a pie chart. Four out of five trials fully met expectations, with one minor deviation noted, though the feature remained successful overall.

Graph Frequency. The system allowed engagement data to be displayed by hourly, daily, and monthly frequencies. In all cases, the application correctly adjusted and visualized the data on the analytics tab, showing 100% success across all test iterations.

Tracking Tab. The application successfully captured the active window, keystrokes, and mouse clicks when "Time In" was initiated and correctly terminated the tracking process when "Time Out" was triggered. This module passed all test cases.

Reports Tab. The system generated comprehensive reports containing attendance, tracking details, engagement categories, and keystroke/mouse click summaries. While one trial experienced a minor discrepancy, the module was still considered successful.

Reports Format. Exporting reports in multiple formats (HTML, PDF, Word, and Excel) was consistently successful across all test iterations, with the outputs downloaded accurately in the desired format.

Overall, the results confirm that the application performed effectively across all functional modules, with an overwhelmingly high success rate. Minor inconsistencies were observed in the Analytics Tab categorization and Report content generation, but they did not affect the overall operational reliability of the system. These findings demonstrate that the application has achieved functional correctness and robustness, fulfilling its intended purpose as a workplace computer engagement monitoring tool.

DISCUSSIONS

This pilot study demonstrates the feasibility of integrating visual analytics with workplace computer engagement monitoring, though several limitations constrain generalizability. This study successfully addressed its three primary research questions and achieved its overarching objective of demonstrating the application of visual analytics for monitoring workplace computer engagement.

In response to the first research question, the system proved capable of accurately recording real-time user activity through its "Time In" and "Time Out" functions. By tracking quantitative parameters such as keystrokes, mouse clicks, and active processes, the monitoring software provided a reliable and flexible method for capturing user engagement during working hours.

Regarding the second research question, the visualization of captured data through pie charts and bar graphs enabled the identification of clear usage patterns. The pie chart categorized visited websites and applications into distinct groups Lifestyle, Socials, Entertainment, Productivity, and Others while the bar graph displayed variations in keyboard activity across specific time intervals. These visual representations facilitated the detection of peak engagement periods and offered actionable insights into user behavior.

Finally, on the third research question, the study demonstrated the utility of downloadable engagement reports in multiple formats (PDF, Excel, Word, HTML). The system's capacity to generate detailed hourly, daily, and monthly summaries filterable by date range provided stakeholders with versatile tools for reviewing engagement levels, tracking attendance, and assessing productivity trends. Such reporting capabilities enable informed decision-making and support both performance evaluation and accountability measures.

The functional validation of the desktop application through Black Box Testing demonstrated that the system effectively performed its intended operations across all major modules, including Sign-In, Analytics, Graph Frequency, Tracking, and Reports generation. Test results showed a consistently high success rate, with all critical functions such as authentication, engagement visualization, data tracking, and multi-format report generation operating as expected. Minor inconsistencies were noted in the analytics categorization and report content, but these did not hinder the overall functionality or reliability of the system. The test confirmed that the application is functionally robust, reliable, and suitable for its purpose of monitoring and visualizing workplace computer engagement. Given the exploratory scope and absence of participant data, this pilot study emphasized functional validation of the developed system, and thus its findings are not intended for statistical generalization.

Overall, the findings confirm that the developed visual analytics system effectively captures, analyzes, and presents workplace engagement data in ways that are meaningful to both employees and stakeholders. By integrating real-time monitoring with intuitive visualizations and comprehensive reporting features, the system fulfills its intended purpose of transforming raw activity data into actionable workplace insight.

Recommendations. Despite these promising outcomes, several limitations must be acknowledged. For instance, privacy concerns and employee surveillance ethics require careful consideration before organizational implementation. It aims to support managers, supervisors, and business owners in making informed decisions based on employee engagement, especially in remote work scenarios. Furthermore, it promotes transparency among employees, fostering a commitment to organizational goals and objectives.

Future research should: (1) conduct randomized controlled trials with a larger sample size (n > 50) to improve generalizability. Also, (2) to compare engagement patterns with measurable productivity outcomes; and (3) incorporate robust privacy protection mechanisms to ensure ethical and transparent monitoring practices.

The researcher recommends extending the application's features to include video conferencing and location tracking to further enhance its usefulness. Future implementations of A Desktop Application for Workplace Computer Engagement Monitoring Using Visual Analytics are highly recommended for companies, businesses, and remote job setups seeking to monitor user activity effectively. To build on this system, future researchers are encouraged to develop functionality that can analyze and predict user behavior based on visual data, and to incorporate graphical elements such as scatter plots, histograms, and time series analyses to improve decision-making. Additional engagement categories, including educational and gaming applications, should be added to expand the system's scope. The attendance report should be enhanced to filter specific dates and display rendered hours per day for more detailed analysis. Finally, improving the software's compatibility with different operating systems beyond Windows will allow broader accessibility and adoption across diverse work environments.

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