OPTIMIZE: PILOT USABILITY EVALUATION OF AN EMPLOYEE PRODUCTIVITY MONITORING SYSTEM

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Lack of productivity is a widespread problem that impacts on all working environments. This study introduces an innovative integrated system, Optimize, focused on enhancing employee productivity and data loss prevention within a company by actively monitoring activities and interactions across multiple communication channels. The developed system consolidates various data sources, including email messages, instant messaging conversations, online resource access, and workstation activities, to monitor employee activity and generate statistics targeting the optimization of employee interactions, task execution, and information security. A pilot evaluation conducted with 26 employees is presented, highlighting perceptions related to the system's functionality and employee productivity monitoring.

Keywords: employee, productivity, monitoring, software, workplace

1. Introduction

Lack of productivity is a widespread problem, considering the study of De Smet et al. [1], which showed that approximately half of employees believe they are not productive at work. Thus, a system measuring employee productivity is a first step toward finding strategies to manage and enhance employee productivity.

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This can contribute not only to the employees' satisfaction but also to better results within the company.

A system for monitoring and assisting in increasing employee productivity can bring both advantages and disadvantages. As such, understanding both the positive and negative perspectives is important to have a complete view, and several articles tackle this issue [2, 3]. Such solutions can ensure fairness in evaluating employee performance, clarify individual or team contributions to projects, and highlight valuable employees. However, they may also raise privacy concerns, affect employee trust and well-being, and pose GDPR compliance challenges.

On the other hand, it is a well-known fact that the volume of workplace data available has grown exponentially [4], thereby increasing the opportunities for theft and the accidental disclosure of sensitive information. Consequently, interest in Data Loss Prevention (DLP) techniques has grown [5]. With the help of DLP solutions, a level of protection is added against both mistakes that lead to information leaks and intentional misuse by internal personnel, as well as against external attacks on the company s IT infrastructure. Moreover, many companies fall under the jurisdiction of GDPR, running the risk of not fully complying with its requirements, possibly without the responsible individuals even realizing it. As such, DLP solutions can ensure data governance policies, including GDPR compliance.

Considering the elements discussed, the primary advantages of a DLP system include its ability to detect threats, prevent the unauthorized handling of sensitive data, enhance visibility into data flows, and educate users about compliance policies. Additionally, when integrated within an employee productivity monitoring component, such a system can significantly benefit the organization and its employees.

The primary aim of this paper is to present the pilot usability evaluation of such an employee productivity monitoring system, Optimize. Our system enhances performance management and data loss prevention by closely examining how employees interact with the organizational environment through their workstations. The following section briefly overviews existing employee monitoring and productivity solutions. Next, an overview of the Optimize system and details of the pilot usability procedure conducted in real organizational environments are presented. The survey results are then presented in a separate section, followed by a discussion that highlights the lessons learned during the evaluation process, outlined as directions for improvement.

2. Existing solutions

The development of Optimize started with a market analysis of existing solutions. The following section details the most relevant solutions, focusing on employee monitoring and productivity. The existing solutions are selected from the top employee monitoring software rankings compiled by McAllister [6].

Teramind [7] offers a comprehensive suite of tracking tools, allowing organizations to monitor user behavior through keystroke tracking, live session viewing, and video recording. Its intuitive user interface and dashboard make it easy to navigate, while flexible deployment options, whether in the cloud or on-premises, accommodate diverse business needs. Privacy compliance measures and robust access controls help ensure sensitive data is handled responsibly, maintaining trust and transparency. However, the breadth and depth of its monitoring capabilities can also present a learning curve, potentially complicating setup and ongoing management.

Variato Cerebral [8] provides visibility into employee activities and communications, giving organizations a comprehensive understanding of workforce dynamics. Its risk score dashboard is beneficial for identifying a range of threats, while its powerful insider-threat detection alerts ensure timely intervention before problems escalate. Measuring and analyzing employee engagement supports security and productivity goals, blending robust monitoring and insightful analytics in one interface. On the downside, the platform can become expensive as teams grow, and storing the massive data files it generates may require additional infrastructure. Additionally, implementing remote or covert installations can be complex, which may present challenges for some organizations.

ActivTrak [9] stands out for its quick and intuitive user interface, making it easy for administrators to set up and manage. The agent installation is straightforward, and the tool effectively identifies leading apps and websites employees use, enabling more informed decision-making. By tracking productivity per project, ActivTrak s insights help managers understand performance and serve as a foundation for more targeted employee coaching. However, some fine-tuning is required to define productivity metrics accurately at both the user and group levels. Additionally, the lack of optical character recognition (OCR) for keyword searches within screenshots, the lack of keystroke logging features, and the inability to customize dashboard widgets may limit its versatility for some organizations.

Controlio [10] focuses on productivity by monitoring both productive and distracting activities, providing organizations with valuable insights into employee performance. Its productivity scoring system can be applied at user and departmental levels. At the same time, video snapshots from multiple displays and synchronized keylogging with video recordings give administrators a clear, contextualized view of time spent. However, Controlio s video capture lacks AI or

OCR capabilities, which could limit the depth of analysis for certain types of tasks. Additionally, the absence of a universal search function may slow the locating of specific events or interactions within the recorded data.

Hubstaff [11] provides various features that help organizations manage remote teams more effectively, including screenshots and keystroke monitoring, which offers valuable insights into employee activity. Its productivity tracking tools are well-suited for distributed workforces, and including job site and geolocation functionality enables better oversight of field-based tasks. Additionally, scheduling employee shifts is straightforward, simplifying administrative responsibilities. However, Hubstaff s capabilities are limited by the lack of advanced tracking options, and the requirement of a separate stopwatch app on the desktop can be inconvenient. Furthermore, its reporting features are relatively basic, potentially requiring supplemental tools for more in-depth analysis.

3. Method

3.1. System description

Optimize underwent multiple iterations and can be deployed in various configurations, each incorporating various features and components. This paper focuses on the first configuration evaluated in a real-world environment. In this configuration, the user interface consists of a desktop application, a browser add-on (see Fig. 1), and a web application. It collects data on the applications, processes, and resources accessed via desktop or mobile workstations (laptops). The data is collected using third-party APIs, local software agents, and browser add-ons installed on employees' computers. The collected data is further processed on the backend to assist employees in streamlining their workflows, improving efficiency, and enhancing DLP practices. The system's architecture can be visualized in Fig. 2. Part of the system components have been open-sourced [12, 13].

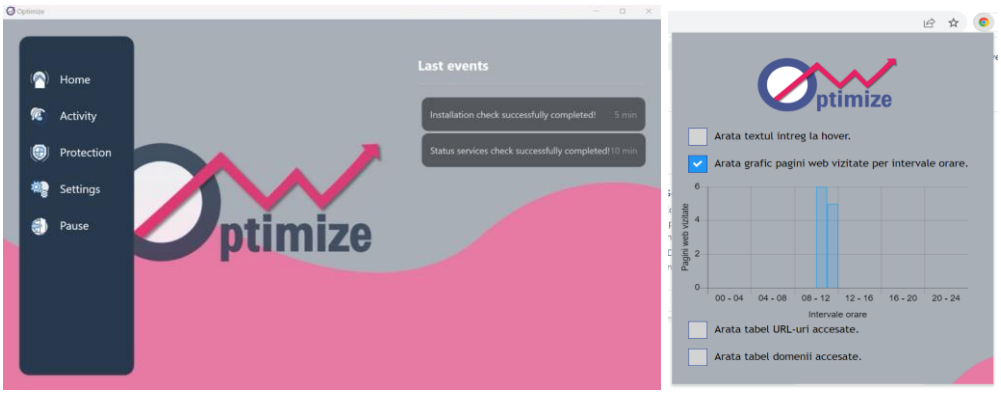

Fig. 1. The Overview page of the desktop application (left) and the browser add-on (right).

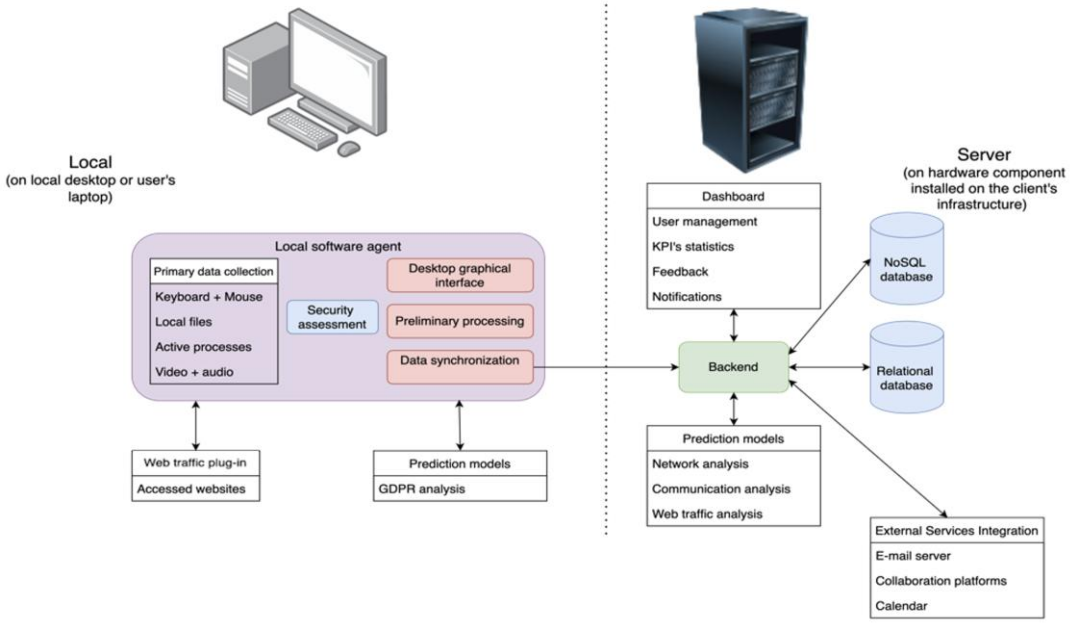

Fig. 2. Optimize architecture.

The browser add-on component acts as an interface service between the user and the providers of the websites they access (i.e., Google Chrome). Designed as a plug-in, it collects data about web pages and sends it to a specialized analysis model. The model enables the application of methods for processing and analyzing the linguistic content of web pages to classify them effectively. If a page still needs to be classified, techniques such as scraping and crawling are applied, followed by pre-processing and text analysis. The analysis component is multilingual, although the prototype primarily uses Romanian-language data. The analysis results are displayed on the user's page (see Fig. 3) and are accessible to both the manager (identified through the organizational chart) and the administrator.

The web application enables managers to define and monitor Key Performance Indicators (KPIs) for employees, providing a comprehensive and dynamic tool for performance management. KPIs are calculated and monitored in the back-end service, which aggregates information from the local software agent, APIs, and prediction models. The system’s continuous analysis capabilities allow for identifying trends and patterns in KPI achievement, enabling actionable insights to be derived. The system presents the analyzed information through an intuitive interface tailored to employees and managers. Employees can view personalized dashboards (Fig. 4) that provide real-time feedback on their performance, empowering them to self-regulate and improve. Conversely, managers gain access to detailed overviews and comparative analyses that help identify high performers,

address underperformance, and make informed decisions about resource allocation and team dynamics.

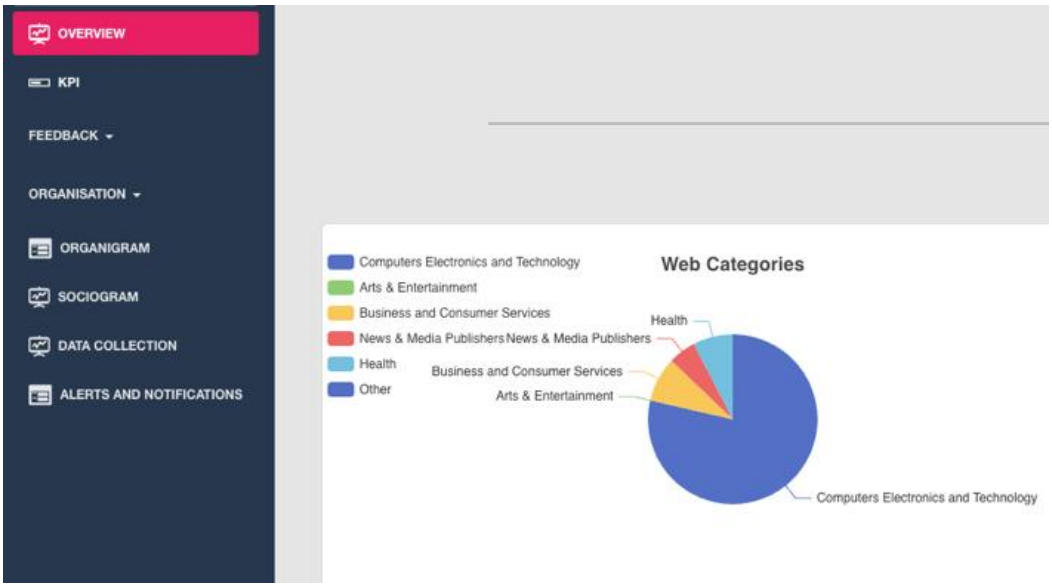

Fig. 3. The web application showing categories of browser pages accessed by the user.

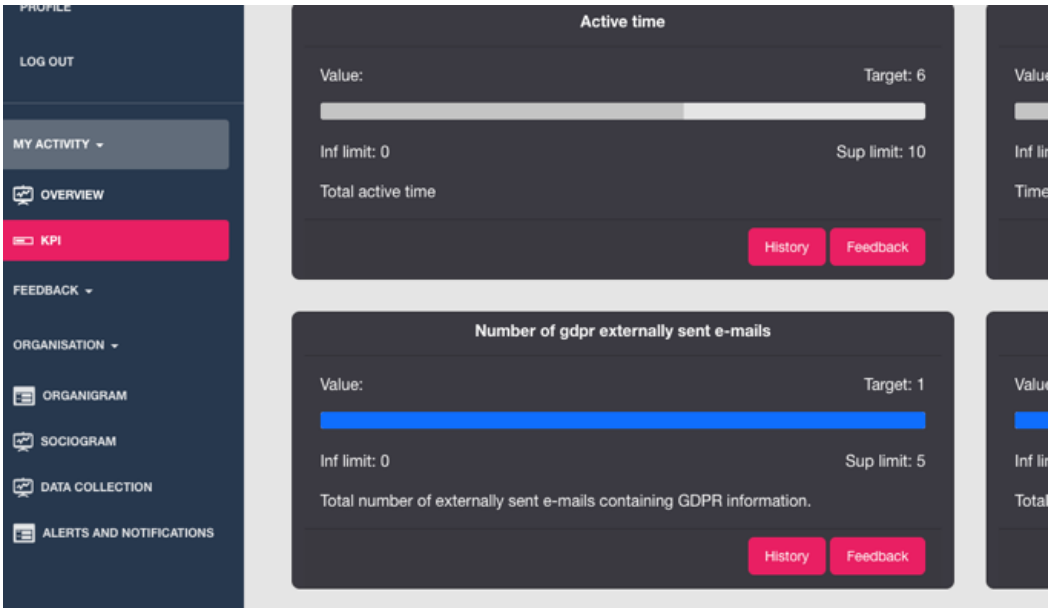

Fig. 4. The KPI page of the web application.

The web application also includes a feedback system that allows employees to share their opinions on the system's usefulness (see Fig. 5). A second system

offers a way for employees to send feedback between themselves, and each user's interface displays the aggregation of all received feedback while safeguarding the sender's anonymity.

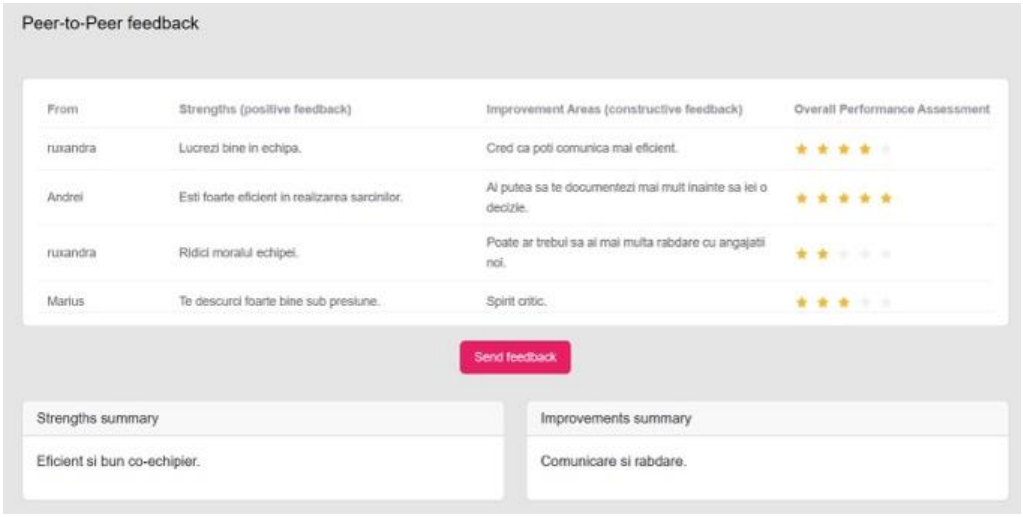

Fig. 5. Web aggregation page of received feedback.

Furthermore, the system also identifies bottlenecks in the communicational workflow between departments and teams by analyzing data collected via tertiary applications (e-mail server, chat, and online meet applications). These issues are visualized through a social network (see Fig. 6), highlighting critical nodes with distinct colors. Identifying such connections provides insights into which departments or teams could benefit most from interventions.

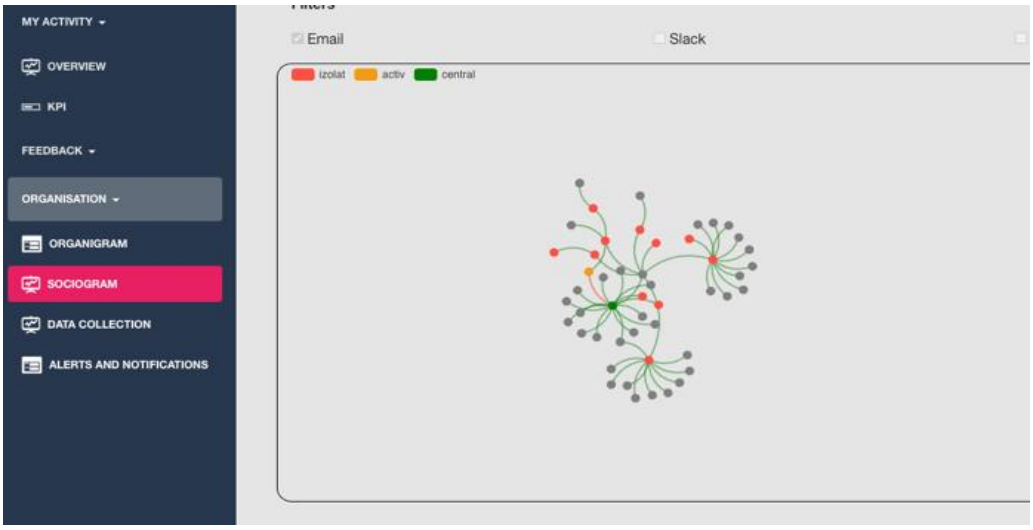

Fig. 6. Social network page of the web application.

Considering DLP, the desktop application provides a security verification mechanism (see Fig. 7). It generates contextual alerts to prevent the loss of sensitive information through malicious applications. The system also processes all information transmitted both inside and outside the company through monitored communication channels (e-mail, chat, local documents). It uses predefined rules and text patterns to identify personally identifiable information (PII), such as national identification numbers, phone numbers, and bank account details.

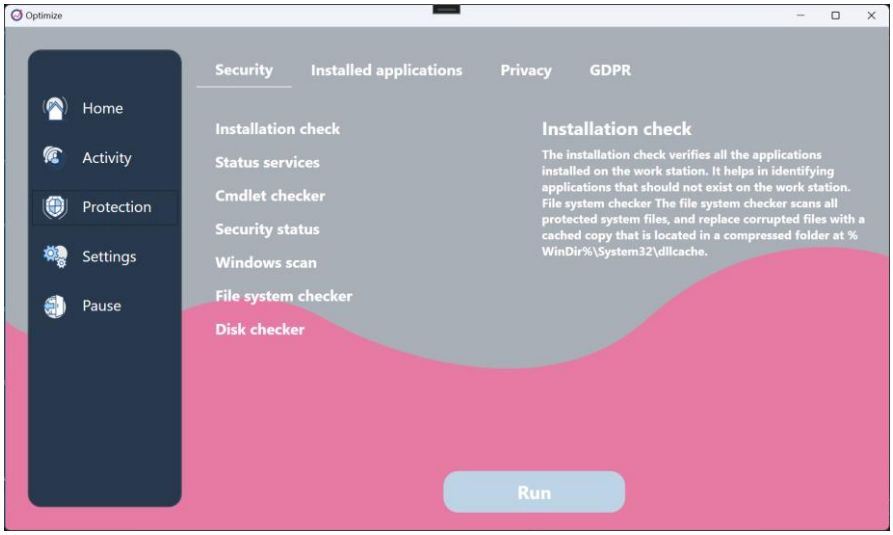

Fig. 7. Security alerts displayed on desktop application.

When PII is detected, the system generates visible alerts within the local and central visualization components (Fig. 8). These alerts are visible to both the administrator and other users. Users can define rules for delivering these alerts based on the type of source or the type of information sought using filter-type options.

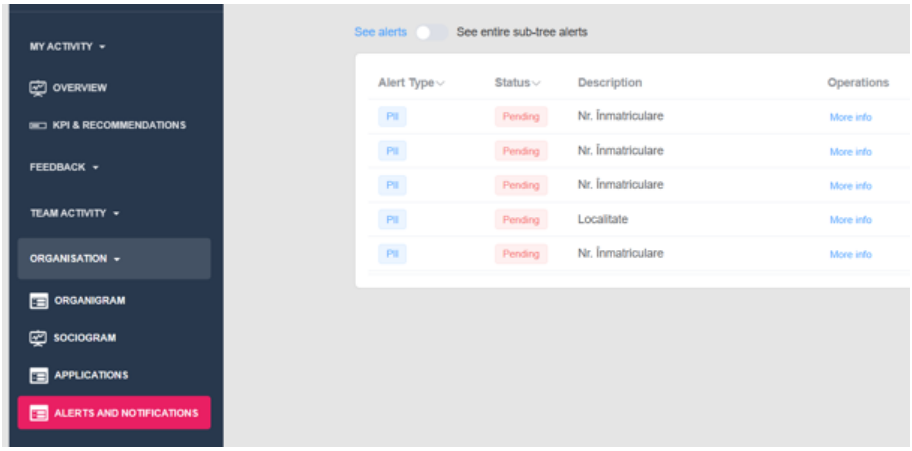

Fig. 8. Alerts and Notifications web page.

The implementation workflow of the Optimize system follows a structured sequence. First, a dedicated server is set up to host the backend and web application, with the necessary connections to third-party APIs established at this stage. Subsequently, the desktop application and browser add-on are installed on employee workstations. This installation process can be carried out either remotely or on-site. On-site installations typically involve discussions with employees to explain the system and its functionalities. Following installation, the accommodation phase begins, which includes providing users with relevant documentation and offering support to facilitate the system's adoption.

3.2. Usability Testing Procedure

Usability measurements can be qualitative or quantitative and depend on the chosen testing procedure as well as factors like cost and user motivation. Regardless of the measurements selected, they should cover at least the three dimensions of usability: efficiency, effectiveness, and satisfaction. Barnum [14] defines efficiency and effectiveness as the extent to which a product helps users achieve a given goal accurately and quickly. On the other hand, satisfaction is an overarching term describing system or product properties such as engaging, pleasant, or aesthetically pleasing. Hornbæk [15] provides a comprehensive analysis of specific metrics that can be used.

Regarding the design of measurements for survey-based questionnaires, both Riihiaho [16] and Dumas & Salzman [17] advocate for using existing tools whose reliability and validity have been tested. In this regard, three useful alternatives for this research are identified: the System Usability Scale (SUS), the Computer System Usability Questionnaire (CSUQ), and the Software Usability Measurement Inventory (SUMI). Additionally, the Usability Metric for User Experience (UMUX), proposed by Finstad [18], and its short version, UMUX-LITE, proposed by Lewis et al. [19], are noteworthy. Based on Stetson & Tullis [20], Dumas & Salzman [17] argue that a minimum of 12 respondents is sufficient to differentiate between a usable and a less usable system for any of the three tools.

Following the implementation of the system across multiple organizations, users were asked to use Optimize and explore its functionalities. The evaluation methodology required users to interact with the Optimize system for at least two weeks. Documentation was provided to facilitate familiarity with the system, outlining tasks involving the use of the system's components (desktop application, browser add-on, dashboard). At the end of the period, a questionnaire inspired by the tools described in the previous paragraphs was administered, containing the following affirmations with a response scale from 1 to 5:

1. The functionalities of Optimize meet my needs and preferences.
2. I think I would like to use the Optimize system frequently.
3. I consider the Optimize system to be straightforward.

4. I found the Optimize system easy to use.
5. I believe I can use the Optimize system without assistance from a technical specialist.
6. I find that the various functionalities of the Optimize system (e.g., KPI monitoring and statistics visualization, providing feedback, software agent, Email plug-in, Web plug-in) work well together.
7. I think the Optimize system is very coherent.
8. Most people could probably learn to use the Optimize system very quickly.
9. I find the Optimize system comfortable to use.
10. I felt very confident while using the Optimize system.
11. I was able to use the Optimize system without spending too much time figuring out how it works.
12. Overall, the predictions, classifications, statistics, and/or recommendations provided by the Optimize system are useful.

The system was installed on 54 workstations across 4 distinct organizations, resulting in 26 responses for system evaluation. Of the respondents, 73% were female, and 76% came from the same organization. The responses were not anonymized, which introduces the risk of desirable answers.

Additionally, a question regarding how comfortable users feel with the idea of productivity monitoring was included in the survey. This question aimed to explore the extent to which the system's implementation might influence employees' perceptions of surveillance, privacy, and autonomy in the workplace. By examining users' comfort levels, the study sought to understand the potential challenges related to employee acceptance of monitoring tools and how such systems could impact their daily work experience. However, it is important to note that this question was addressed only to a subset of employees, precisely 16 individuals from a single organization. As such, the results may only partially capture the broader attitudes of all employees within the participating organizations.

4. Results

The respondents evaluated the alignment between the functionalities provided by the Optimize system and their individual needs relatively positively. An average score of 3.42 indicates a moderately positive system-needs fit, with a standard deviation of 1.17 reflecting moderate consistency among participants' responses. Additionally, the system's utility is demonstrated by an average score of 3.23 and a standard deviation of 1.06 for the usefulness of its predictions, classifications, and recommendations.

However, a relatively negative perception regarding the desire to use the system frequently is evident, with an average score of 2.96 and a standard deviation of 1.28. This suggests a low intention to adopt the Optimize regularly.

The simplicity of the Optimize system received a relatively positive evaluation, with an average score of 3.74 and a standard deviation of 1.17. This suggests that most users find the system easy to understand, with moderate variation in their experiences. This is further supported by the average score of 3.6 and a standard deviation of 1.20 for ease of use.

Confidence in using the Optimize system without technical support was rated relatively positive, with an average score of 3.61 and a standard deviation of 1.32. This conclusion is further supported by responses to usage comfort and usability concerning the time spent figuring out functionalities, which received average scores of 3.57 (standard deviation 1.17) and 3.46 (standard deviation 1.30).

The interoperability of the system s functionalities was rated with an average score of 3.30 and a standard deviation of 1.25, indicating a moderately positive perception of how well the system's various components work together. Similarly, the coherence of the system was rated with an average score of 3.42 and a standard deviation of 1.23.

Finally, the comfort and confidence levels experienced while using Optimize received relatively positive scores. Comfort was rated with an average score of 3.5 and a standard deviation of 1.17, while confidence was rated with an average score of 3.2 and a standard deviation of 1.33. Confidence levels were lower than comfort, suggesting the need to identify strategies for enhancing user trust in the system.

Fig. 9 provides a visual representation of the average scores. Using the SUS methodology to calculate an aggregate score for the 10 specific questions on this scale, a score of 61.73 was obtained.

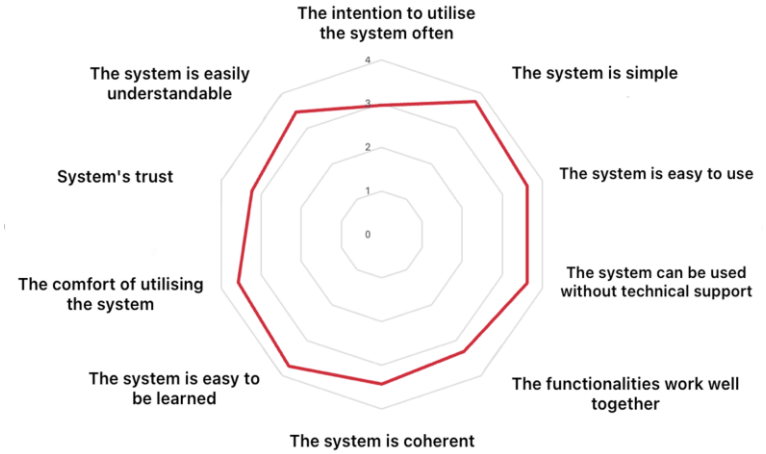

Fig. 9. Visual representation of the evaluation scores (n=26).

This score, ranging from 0 to 100, illustrates the overall usability of Optimize and provides a baseline metric for measuring progress in future development of the system.

As shown in Fig. 10, at least three distinct typologies of employees can be defined based on their perceptions of workstation monitoring for collecting productivity statistics: employees who are relatively comfortable with the idea, those who hold a neutral stance, and those who express discomfort. With an average score of 3.12 on the comfort level scale, the overall perception leans towards a neutral to somewhat positive attitude. This suggests that while some employees are open to a monitoring tool for improving productivity, others still need to become more open-minded and cautious about its implications.

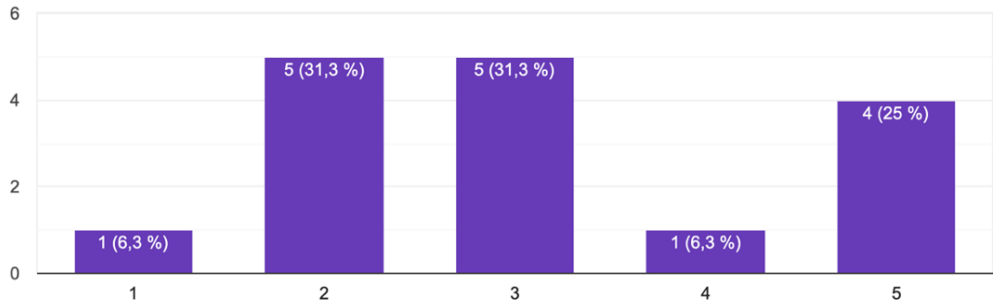

Fig. 10. Answers to the statement “I feel comfortable with the idea of workstation monitoring to collect productivity statistics.” (n=16)

5. Discussion

The implementation and evaluation of the Optimize system reveales several critical areas for improvement. These insights emerge from the usability survey assessment, including subsequent collaborative analysis of the results conducted with the implementation team and the management of the organizations where the system was deployed. The findings highlight technical and organizational dimensions requiring attention to ensure the system's effectiveness and acceptance.

One significant dimension involves developing a robust methodology for setting KPIs. This methodology should account for the dynamic nature of organizational workflows, including their weekly and monthly fluctuations, to provide a more nuanced and accurate representation of employee performance and organizational outcomes. Organizations can better align measurement practices with actual work patterns by tailoring KPIs to these temporal dynamics.

The current system enables managers associated with an employee to define and redefine that employee’s indicators, determining which actions are monitored while specifying the monitoring procedure (such as the time interval and the arithmetic operation used for aggregating indicators). Although this approach

provides flexibility and customization, it also places additional demands on managers. In this regard, external expertise may be considered to ensure continuous monitoring that adapts to organizational changes. Alternatively, automated systems for the same purpose may also be developed.

Another worthwhile area of focus that emerged during the implementation of the pilot solution in real environments is developing a "light version" of the prototype, designed to operate efficiently on low-performance workstations. This adaptation is essential for extending the system's accessibility and usability across a broader range of organizational contexts, particularly those with limited technological resources. Addressing this technical constraint will enhance adoption and ensure equitable functionality.

Additionally, the research identifies the need to explore strategies for increasing employees' intention to use the system more frequently. Understanding the behavioral factors that influence system adoption, such as privacy concerns, fear of micromanagement, technical difficulties, or a perceived lack of value from the system, is crucial for fostering sustained engagement and maximizing the benefits of monitoring tools. This requires targeted studies to uncover employee perceptions and provide solutions, such as improving communication about the system's goals, involving employees in defining KPIs, or enhancing usability.

Establishing clear and transparent monitoring objectives is also essential to further enhance the system's effectiveness. These objectives may include assessing the impact of organizational policy changes, identifying and rewarding high-performing employees, spotting opportunities for automation, and detecting communication inefficiencies. Articulating these goals explicitly will provide both management and employees with a shared understanding of the system's purpose and value.

Another key improvement area is transparency in communicating the rationale behind performance measurement. Employees should be informed about why specific indicators are monitored and the rewards or penalties associated with KPI outcomes. Such communication fosters trust and helps mitigate potential resistance to the system. Moreover, involving employees in defining KPIs and measuring them weekly can enhance their acceptance and engagement. Collaborative approaches to KPI setting ensure that the metrics are perceived as fair and relevant.

Regarding perceptions related to employee productivity monitoring, the division in employee attitudes highlights the need for organizations to carefully consider communication strategies and transparency when implementing such systems. Understanding these varying perspectives can guide the development of tailored approaches to increase comfort levels, such as emphasizing the system's benefits, addressing concerns, and fostering a more collaborative environment for feedback.

Similarly, incorporating iterative testing with diverse employee groups will be essential for ongoing refinement. By using user-centered design practices, we can ensure that future versions of the system continuously align with the needs and expectations of all user types. The Optimize system can evolve through regular feedback and adjustments to provide a more intuitive and efficient user experience.

One potential area for improvement is the user interface (UI). Future iterations of the system could focus on refining the UI to enhance usability and user satisfaction. This could involve simplifying workflows, streamlining navigation, and improving the overall visual hierarchy. For instance, by incorporating user feedback on pain points related to accessibility and ease of use, we can design more intuitive layouts that minimize cognitive load. Additionally, clearer labeling and more consistent iconography could improve the user experience, ensuring that individuals can quickly and easily navigate the system, even with limited technical knowledge.

Another area for enhancement considers increasing the platform's attractiveness by integrating a reward system. The system can increase user engagement and motivation by introducing gamification elements, such as badges, leaderboards, and rewards. These features would make the platform more enjoyable and encourage consistent use and data entry, which can improve overall system effectiveness. A well-designed reward system can further boost user satisfaction by providing immediate positive feedback, fostering a sense of accomplishment, and making the system more interactive and engaging.

5. Conclusions and Future Work

The primary aim of this paper was to present the pilot usability evaluation of the developed employee productivity monitoring system, Optimize. This system enhances performance management and data loss prevention by examining how employees interact with the organizational environment through their workstations. The findings from implementing and evaluating the Optimize system provide valuable insights for organizations considering similar productivity monitoring solutions.

One of the most critical takeaways is the importance of designing systems that align with the dynamic nature of organizational workflows and the existence of three distinct typologies of employees who interact with such systems: detractors, neutrals, and promoters. Further research will focus on exploring these typologies in greater depth, examining the factors contributing to these differing attitudes, and identifying strategies to mitigate concerns, enhance acceptance, and promote positive engagement with monitoring systems across all employee groups. Further studies with larger and more diverse samples that include employees from

different sectors, positions, and seniority levels would also better validate the results.

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