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EMPROVE - AN EMPLOYEE PRODUCTIVITY SYSTEM USING MACHINE LEARNING

Alen George, Joel Raju, Roshan Roy, San Baby Francis

Department of Computer Science and Engineering

*Viswajyothi College of Engineering and Technology, APJ Abdul Kalam Technological University
Kerala, India*

alengeorge9526@gmail.com, joeljosephkutty101@gmail.com, roshan.thanickal@gmail.com,
san.baby.francis123@gmail.com

Project Guide: Mrs. Anju Markose, anjumarkose@vjcet.org

Abstract—Efficient employee productivity has become a crucial factor for organizations to maximize profits and ensure employee satisfaction. While managerial decisions have traditionally been relied upon to achieve this, the ever-evolving software industry and rise of remote work necessitate an alternative approach. This paper proposes a novel software system, Emprove, designed to increase employee productivity by providing timely short breaks using the Pomodoro technique, allowing for the setting of concentration or focus music of choice and enabling the setting and tracking of tasks and deadlines. Emprove also utilizes machine learning techniques to detect employee alertness levels in real-time, calculating Mouth Aspect Ratio (MAR) and Ear Aspect Ratio (EAR) from facial keypoints generated by the MediaPipe Face Mesh model. Additionally, employees can monitor their work stress levels using a metric jointly proposed by the American Institute of Stress and the Marlin Company. Furthermore, detailed reports can be generated for both the employee and their manager to view, providing actionable insights to increase productivity. Ultimately, Emprove provides a comprehensive approach to ensure employee productivity and promote optimal performance in the workplace.

Index Terms—productivity, software engineering, stress management, machine learning, image processing

I. INTRODUCTION

In today's fast-paced and rapidly-evolving software industry, employee productivity has become a key factor in determining the success of any organization. To address this need for a modern and reliable employee productivity system, we propose "Emprove," a web-based system designed to help employees manage their tasks, schedules and workload more efficiently. Emprove is an intuitive and feature-rich productivity management system that aims to increase employee productivity and job satisfaction while reducing stress.

The system includes a variety of features, such as task management, a Pomodoro timer, concentration music, drowsiness detection, work stress assessment and productivity reports. These features are all geared towards promoting a productive work environment, allowing employees to set short-term goals and take timely short breaks during work hours. Emprove uses the Pomodoro technique, a time-management strategy that divides work into focused intervals and regular short breaks, to assure employee focus and productivity.

One of the unique features of Emprove is its real-time detection of facial features to assess the employee's level

of alertness during work hours. This feature enables the employees to identify patterns and take appropriate measures to improve productivity. Emprove also generates a detailed report that highlights the employee's productivity level, time management skills and areas that need improvement.

Emprove also allows users to choose a concentration music of their choice to enhance their focus and create a positive work environment. This is a proven method to enhance productivity and attention of the employees. The Work Stress Assessment designed by the American Institute of Stress and the Marlin Company would help the employees to assess the stress they face in their workplace. The scale measures physical and emotional well-being, workload, communication, utilization of skills, recognition, job pressure, interference with personal life and control over work duties. Tips are provided for reducing stress levels and professional assistance is suggested if health is significantly affected. The system also includes a manager dashboard that enables managers to efficiently manage their employees, view their tasks and progress and assign tasks and deadlines.

Emprove is thus a comprehensive employee productivity system designed to increase employee productivity, job satisfaction and well-being while reducing stress. Its features are geared towards promoting a positive and productive work environment and helping employees manage their time and workload more efficiently. With Emprove, organizations can effectively manage their employees and maximize their productivity.

II. RELATED WORKS

Several techniques which help to detect drowsiness or lack of attention have been developed recently. Many such techniques are used to detect driver drowsiness as it poses a serious threat of road accidents. [1] proposes a system for driver drowsiness detection using a machine learning algorithm. To stop accidents brought on by driver inattention, a variety of techniques have been employed, including EEG, EOG, image processing, physiological & visual signal-based techniques and simulator-based detection techniques. The paper discusses the limitation of these techniques including the need for costly equipment and discomfort of drivers. The system proposed in

[1] utilizes a webcam to capture real-time video of the driver's face and calculates the drowsiness level based on factors like emotional activity and the type of distraction. It maps 68 points that identify the coordinates of the facial structure and uses the Eye Aspect Ratio (EAR) and Mouth Aspect Ratio (MAR) to determine eye and yawn activity of the driver. The system monitors the distraction level of the driver and emotional activity to alert the driver whenever they are feeling drowsy. The system aims to minimize the number of accidents caused by driver drowsiness and fatigue and the same concept has been applied to the employee productivity system to detect drowsiness and ensure employee productivity.

However, the model described in [1] could only map 68 facial keypoints. A newer face mesh detection model developed by Google Research uses an iterative procedure to predict the locations of 468 facial keypoints, which have either distinct semantics or participate in meaningful facial contours [2]. The model shows a high prediction quality that is comparable to the variance in manual annotations of the same image, as well as super-realtime inference speed on mobile GPUs. The authors suggest that to address the temporal jitter seen in the trajectories of individual landmarks as a result of differences in pixel-level picture representations across succeeding video frames, a one-dimensional temporal filter be applied individually to each predicted landmark coordinate. Although lighter variants of the model are also made to address CPU inference on mobile devices without proper GPU support, the model is developed for real-time mobile GPU inference. The model has been commercially released as MediaPipe Face Mesh under Apache License, Version 2.0 and has become very popular in entertainment domains. It uses a Convolutional Neural Network with customized blocks for real-time performance and is evaluated across representative groups and regions. The Mean Absolute Error normalized by Interocular Distance is used for quality and fairness evaluation.

The concept of "gamification," which refers to the employment of game design elements in non-game contexts to capitalise on the motivating power of video games, is covered by the authors in [3] as a new marketing tactic to monitor, regulate and reward consumer behaviour. The vast majority of studies demonstrate that gamification benefits people. The Pomodoro Technique, a time-management technique that enables people to work with their available time rather than rushing against it, is described in the paper. Using the Pomodoro Technique, one can manage their time by breaking up the workday into 25-minute focused periods. It encourages concentration, alertness and mental independence and serves as a timer and way for estimating effort. The Pomodoro timer, incentivization, peer influence and gamification are all combined in the authors' proposal for a straightforward mobile-based application called ProScore, which they claim will help people be more productive and less likely to procrastinate. The implementation of the ProScore framework can result in significant productivity gains and stress reduction even in small fields. The application of these productivity-enhancing techniques has shown promising results in reducing symptoms of anxiety, depression and stress.

[4] studies the relationship between software engineers' diverse physical work locations and their productivity and

satisfaction. It explains that because software development is highly collaborative and involves complicated issues on both a social and technical level, it necessitates a detailed analysis of work environments with a software engineering perspective. Today's software teams are increasingly global and use agile development and social coding tools. A mixed-methods study is presented in [4] that looks at workplace variables such as personalisation, social norms, space composition and atmosphere and explores how these variables affect reported productivity and employee satisfaction. According to studies, characteristics like customization, quiet workspaces and the capacity to minimise distractions have a good effect on software developers' productivity. According to the study, having a private office was associated with increased perceived productivity across all disciplines and being able to work in peace without interruptions while still being able to communicate with the team and leaders was crucial to satisfaction models.

In [5] a study to explore the impact of music on productivity during software development is presented. The study explores how music affects the productivity of software developers, based on elements like tempo and the existence of lyrics. Data were gathered for the study through observational studies, interviews and questionnaires. The study discovered that, when used properly, music can increase productivity and when played in the appropriate setting, can have a stimulating effect. However, the study acknowledged certain limitations such as the duration and the number of participants in the study and no consideration of the presence or absence of vocal components or music with varying tempo.

The Workplace Stress Scale [6] proposed by the American Institute of Stress and the Marlin Company is a survey tool that assesses an individual's stress levels in the workplace. The user rates eight assertions on a scale of 1 to 5 according to how frequently they experience those feelings at work. The statements relate to physical and emotional well-being, workload, communication, utilization of skills, recognition, job pressure, interference with personal life and control over work duties. The user can see how they rank in relation to others based on their demographic (gender and age) by summing up the scores for each statement to get the overall score. The total score is used to determine one's stress level and scores can range from "fairly low" to "severe." This scale helps individuals or organisations to assess the work stress experienced at their workplace and can take necessary steps to reduce stress levels or suggest professional assistance if health is significantly affected.

III. PROPOSED SYSTEM

In today's competitive business world, productivity is the key to success. New technology and approaches are being developed to help businesses realise their ongoing objective of increasing staff productivity and effectiveness. Hence we propose Emprove, an intelligent productivity tracker, which combines insights gained from modern systems and management strategies to provide a comprehensive tool for improving employee productivity.

The figure below shows the architecture diagram of the proposed system:

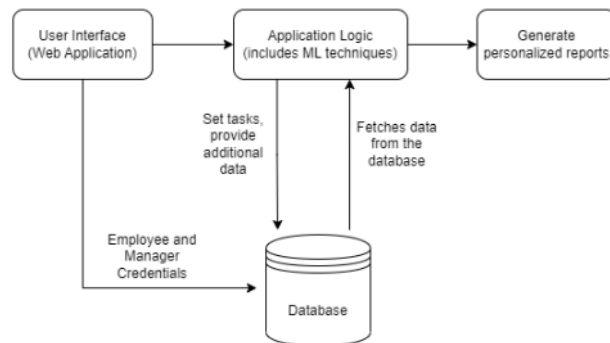


Fig 1. Architecture Diagram

The employee productivity system consists of several key processes that help employees manage their tasks and time effectively. These processes include:

- 1) **Task Management:** Employees can create and prioritise their tasks through our task management interface. The interface includes features such as the ability to add new tasks, set deadlines, edit existing tasks, delete existing tasks, etc. Employees can also view their task list and deadlines on the employee dashboard.
- 2) **Pomodoro Timer:** Employees can track their work sessions using the Pomodoro timer, which helps them stay focused and take breaks at regular intervals. The Pomodoro timer is based on the Pomodoro Technique, which recommends working for 25 minutes and then taking a 5-minute break. After four Pomodoros (or 100 minutes of work), the employee takes a longer break of 15-20 minutes. The Pomodoro timer helps employees stay on track and avoid burnout by encouraging regular breaks.
- 3) **Concentration Music:** During working hours or breaks, employees can choose to listen to concentration music to help them relax and refocus. The concentration music feature includes a selection of instrumental tracks designed to promote relaxation and focus. Employees can choose the track they want to listen to and adjust the volume as needed.
- 4) **Drowsiness Detection:** In the background, the system uses the MediaPipe Face Mesh model to determine if the employee is drowsy or alert by calculating the MAR and EAR from the 468 facial keypoints in realtime. If the system detects that the employee is drowsy, it can alert the employee. The pre-trained model achieves an accuracy of 95-98% with varying demographics. The system provides the drowsiness count as well as a detailed analysis in the productivity report.
- 5) **Work Stress Assessment:** The Workplace Stress Scale is a survey tool that assesses an individual's stress levels in the workplace. It consists of eight statements that the user rates on a scale of 1 to 5 based on how often they feel that way at work. The total score is used to determine one's stress level and scores can range from

"fairly low" to "severe."

- 6) **Productivity Report:** Employees and Managers can view reports on employee productivity to help them identify areas for improvement and track progress over time. The reports include metrics such as the number of pending tasks, Pomodoro count, drowsiness count, work stress score and the employee's overall productivity over a given time period.

The employee dashboard is designed in such a way that it provides no distraction to the user. The dashboard is implemented as a Single Page Application (SPA) using React, with each of the components like task management, concentration music, Pomodoro timer and drowsiness detection readily accessible within the interface. The following figure shows the employee dashboard of the proposed system:

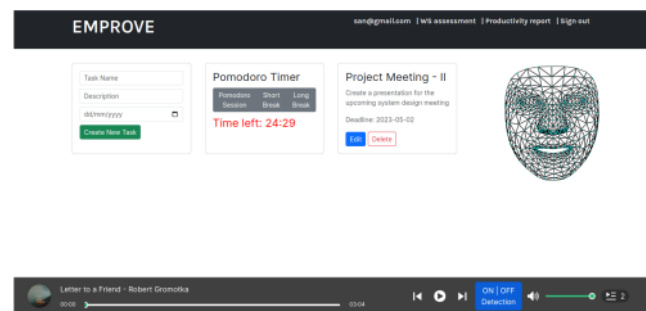


Fig 2. Employee Dashboard

IV. CONCLUSION

The employee productivity system is a powerful tool for helping employees track their tasks, manage their time and stay focused and productive throughout the workday. The software offers a number of advantages for both employees and managers with features like Pomodoro timer, task management, focus music, work stress assessment and drowsiness detection. For employees, the software helps them increase their productivity, manage their tasks more effectively and achieve a better work-life balance. The Pomodoro timer and concentration music features help employees take breaks and relax, improving their overall well-being. The drowsiness detection feature can help employees stay alert and avoid mistakes caused by fatigue. For managers, the software provides valuable insights into employee productivity and areas for improvement. They can assign tasks to those employees assigned to them. The reports feature allows managers to view metrics such as the number of assigned tasks, Pomodoro count, drowsiness count, work stress score and the employee's overall productivity over a given time period. This data can help managers identify areas where employees may be struggling and provide support to help them improve.

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