

Pomodoro Timer with ML-based Motion Detection

Introduction

In today's world, students rely heavily on mobile phones due to technological advancements; however, these devices often distract them from their studies. The Pomodoro Technique helps manage time by dividing study sessions into intervals with short breaks. However, students still get distracted by phones while using the timer. To address this, a machine learning–integrated Pomodoro timer is proposed, which utilizes accelerometer data to monitor phone usage and help Students stay focused

Machine learning model

The Study Focus App uses a machine learning model to detect whether the phone is stationary or has been picked up, based solely on accelerometer data. This helps monitor distractions during Pomodoro focus sessions. Data was collected from the phone's accelerometer at 62.5 Hz, capturing 2-second windows labeled as either stationary or pick-up. A total of 112 samples were gathered, with 66% used for training and 34% for validation.

Using the Edge Impulse platform, spectral analysis was applied to extract frequency-domain features from the accelerometer signals, making the model robust to different phone orientations. A neural network classifier was trained on these features to distinguish between the two states effectively. The trained model was then converted into a TensorFlow Lite (.tflite) file for efficient on-device inference, allowing real-time motion detection without cloud dependency. This integration helps ensure users stay focused by detecting phone movements indicative of distraction during study interval.

Model implementation of Mobile App

The Study Focus App was developed using Android Studio, leveraging Kotlin/Java for the app logic and UI components. The trained TensorFlow Lite (.tflite) model file is included in the app's assets folder, allowing efficient on-device inference without internet access. To enable TensorFlow Lite integration, necessary dependencies were added to the project, including the TensorFlow Lite runtime library. This setup facilitates loading and running the ML model directly within the app.

The app consists of two main activities:

- Main Activity (Timer Page): Features the Pomodoro timer with “Start” and “Reset” buttons, allowing users to control focus and break sessions easily. During active focus periods, the app continuously monitors phone motion using accelerometer data and the embedded ML model to detect distractions.
- Settings Activity: Provides users with options to customize focus and break durations.

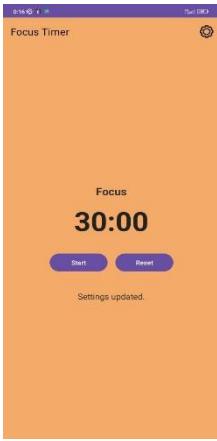


Figure 1: Simple UI of the app with the pomodoro timer

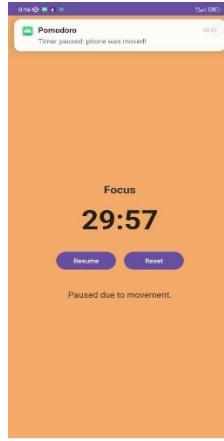


Figure 2: Mobile phone detects the motion and stop the timer with the notification

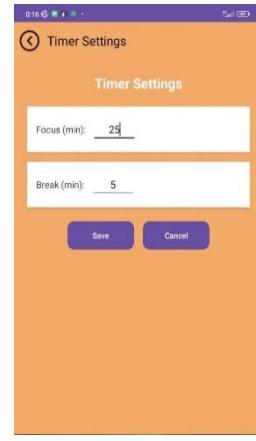


Figure 3: User can customize the focusing/studying time and break time

Results and Future Improvements

This study addresses the challenge of student distraction caused by mobile phones during study sessions using the Pomodoro Technique. Although many smartphones provide accelerometer data, this information alone is often underutilized for real-time decision-making. By integrating a machine learning-based motion detection model into the Pomodoro timer app, we offer an effective solution to monitor phone movements and detect distractions in real-time.

While the current dataset is limited and not all mobile devices may have accelerometer sensors—or may have varying sensor quality and current model support only stationary and pick-up states—this approach demonstrates the potential of leveraging on-device sensors to support student focus. Future improvements could include multi-sensor fusion, personalized models, and adaptive thresholds customizable by users to enhance detection accuracy and user experience.

Conclusion

The integration of ML-driven motion detection empowers students to stay motivated by setting target focus times and achieving self-satisfaction from completing their tasks. Even when distractions occur, the app encourages users to refocus, ultimately promoting better productivity and study habits.

Reference

- Jordan, E. (2025) Getting started with Android Studio and Edge Impulse, Edge Impulse. Available at: <https://www.edgeimpulse.com/blog/getting-started-with-android-studio-and-edge-impulse/> (Accessed: 14 July 2025).
- Mobile phone (no date) Edge Impulse Documentation. Available at: <https://docs.edgeimpulse.com/docs/edge-ai-hardware/using-your-mobile-phone> (Accessed: 12 July 2025).