

# Tempus – A Facial Recognition Technology in Attendance Monitoring

Melanie M. Reynoso<sup>1</sup> and Ariane M. Torres<sup>2</sup>

<sup>1</sup>Carlos Hilado Memorial State College–Alijis Campus, Bacolod City, Philippines

<sup>2</sup>University of Negros Occidental–Recoletos, Bacolod City, Philippines

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**Introduction.** Attendance monitoring has strategic importance for every organization. It has shifted from utilizing paper-based attendance monitoring to biometrics, radio-frequency identification, Bluetooth and smart technologies, Internet of Things (IoT), cloud computing, or face recognition technology. Tempus is an automated attendance monitoring system that uses face recognition technology for input, real-time IoT capabilities for processing, and portability of mobile platforms for output. It has hardware and software components. The core of the hardware component is Raspberry Pi 3, which serves as a communication medium between the camera sensor and the information system. Tempus uses Haar Cascade for facial detection and Linear Binary Pattern Histogram (LBPH) for facial recognition. The software component is further divided into two: 1) the information system for administrators, an attendance monitoring which allows encoding of data, creating new user accounts, managing schedules, recording attendance, and generating reports; and 2) mobile platform for end-users, the teachers,

that is provided for communication and notification purposes only.

**Methods.** Agile developmental model is a system development approach intended to improve software quality and responsiveness to customer requirements. After developing the minimum valuable product, integration testing was performed on the hardware and software components, simulated all possible use cases on the system from account creation to reporting generation. An emulator was used to test the mobile application to ensure that all links and actions were functional. The sensors were tested using case scenarios to present the readiness of the system. The Lowell Jay Arthur's instrument was employed to measure the performance of the system. Out of 24 measures, only 11 measures were considered relevant to the system features like accuracy, completeness, consistency and understandability, controllability, error tolerance, execution efficiency, expandability, hardware independence, observability, operability, and simplicity. The five main features of Tempus were mapped to a specified group of measures. During the alpha testing, twenty-two respondents were selected to test the system, four of whom were administrators, six were professionals, and twelve were teachers. The instrument used a five-point Likert scale: 5 = Very Good, 4 = Good, 3 = Average, 2 = Fair, and 1 = Poor.

**Results.** The results that were collated and interpreted showed all five features of the Tempus system, such as integrated computer vision, mobile support, user-friendly interface, real-time, and customizable time settings, scored between 4.20 and 5.00. These marks showed that the performance and quality of its hardware and software components, based on the measures, were rated excellent. The integration of face recognition technology with the mobile platform made Tempus stand out from other existing attendance management systems. The system is known for its simplicity and operability because its interface design's transparency allowed the administrator to receive attendance reports, and teachers received notifications as well. The real-time feature dynamically checked the schedule of teachers and events added into the system then notified the target end-users on a real-time basis. The customizable time setting allowed the administrators to modify conditions for grace periods, monitor tardiness, enable and disable notifications for late in, early out, early in, late out, and absence. Trials on its face recognition component were conducted. The system was found to be capable of detecting and recognizing faces. It had an acceptable performance and an average accuracy of 83% that was achieved in real-time.

**Conclusion.** The final system is considered effective and efficient based on software performance evaluation. It combines the real-time processing power of the IoT and task efficiency of information systems. The inclusion of a mobile platform ensures fast information dissemination. It allows both admin and teachers to receive relevant logs and updates due to its automated notification functions. Tempus is an addition to the growing list of smart systems that promotes the integration of smart technologies into the daily processes of institutions, serves as an encouragement for researchers, developers, and students to consider the advantages of IoT technologies and use them as catalysts to produce technologies that will help improve society.

**Practical Value of the Paper.** Tempus' generated reports related to attendance, leaves, schedules, status, and feedback can help the institutions, specifically the human resource department, and direct supervisors in carrying out further the next appropriate action concerning the teachers' tardiness, absences, and performance evaluation. The majority of famous web applications have also released a mobile version of their applications because mobile devices tend to have longer battery life in terms of availability.

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## Correspondence:

Melanie M. Reynoso [melanie.reynoso@chmsc.edu.ph]  
<https://orcid.org/0000-0003-2273-0365>