

CLOUD-BASED SMART ATTENDANCE FOR ENGAGEMENT ANALYTICS

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Highlights: Cloud-based smart attendance is a novel tool that integrates comprehensive student engagement in the attendance taking process. It is very simple and practical to be adopted by educators for blended learning strategy. It is designed to promote cognitive, emotional and behavioral engagement of the student in the class. With analytics-ready capability in this application, it is very practical for implementing engagement analytics. Since the application is hosted on the cloud platform, it is very potential for global-scale adoption to improve the quality of education in meeting the sustainable development goals (SDG) 4.

Keywords: Smart attendance, cloud services, engagement analytics, emoticon
Innovation Description

Cloud-based smart attendance (CBSA) is a simple online form created with cloud service and easily can be embedded in any web-based learning management system. The uniqueness of this innovation is the integration of learner profile, learner emotion, learner reflection and learner feedback (Figure 1).

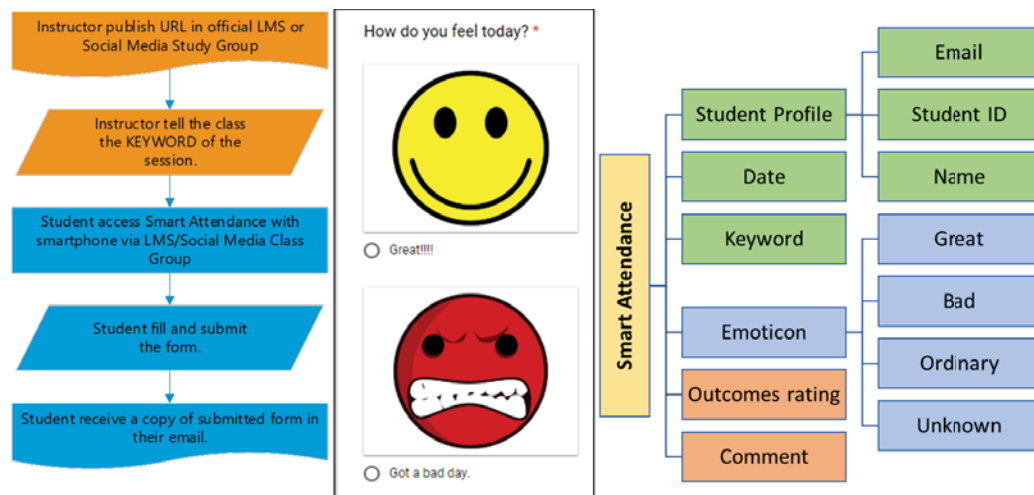


Figure 1: CBSA Process Model, Visual Model and Data Model

Since this application is hosted on the cloud platform, it is accessible from any Internet connected devices and in this study, students can easily access the application using their smartphone to sign in their attendance at the end of the class session.

Context of Innovation

Student attendance is a very important indicator in measuring blended learning approach since the approach still require physical presence of both teacher and student (R. Boelens, S. Van Laer, B. De Wever, 2015). Previous studies (Benyo, Sodor, Doktor, & Fordos, 2012; Bijsmans & Schakel, 2018) revealed that class attendance has strong relationships with class grades and Grade Point Average (GPA). These studies used attendance data as evidences to indicate student did attend or physically presence in class. However, it did not indicate student engagement in class. Student engagement can be categorized into three dimensions (Fredricks, Blumenfeld, & Paris, 2004) which are: - behavioral engagement: students' participation in education, including the academic, social and extracurricular activities of the school emotional engagement: students' emotional reactions in the classroom and in the school (a sense of belonging or connectedness to the school) cognitive engagement: students' investment in their learning (motivation and self-regulation).

Existing attendance system especially manual signature disturbed student's attention since student need to write down their initial by queuing. Technology based attendance system like QR-code (Masalha & Hirzallah, 2014), radio

frequency identification (RFID) (Al-Naima et. al., 2019) or even biometric technology (Shoewu, Makanjuola, & Olatinwo, 2014) mostly are designed with the goal not about student engagement especially on emotional engagement. Therefore, this study proposed a simple and practical attendance system that capable to capture student emotion in class using cloud technology.

Significance of Smart Attendance in Education

Although there are advanced systems (Islam, Hasan, Billah, & Uddin, 2018; Sunaryono, Siswanto, & Anggoro, 2019) for managing student attendance, the goal is to capture attendance data per se. It does not about promote student to do self-check, reflect and learn to provide feedback as proposed in this cloud-based smart attendance. Self-check and reflection are cognitive behavior that promotes deeper learning, more complex and integrated knowledge structure (Kori, Pedaste, Leijen, & Mäeots, 2014). Although there is literature claim that reflection does lead to an improvement in academic performance (Cavilla, 2017; Ndiwio, Raburu, & Aloka, 2016), reflection itself is essential for living with a growth mindset (Korstange, 2016). Therefore, this smart attendance is capable to promote cognitive engagement in a blended learning environment.

This smart attendance also integrates the capability to capture student emotional status. By using existing emotional icon or emoticon available over the Internet, instructors are free to choose a variety of graphics representing the type of emotion. This simple yet familiar approach to capture emotion in the blended learning settings has potential novelty since most of the study to assess emotional engagement typically measured using survey and interview (Gunuc & Kuzu, 2015; Manwaring, Larsen, Graham, Henrie, & Halverson, 2017; Wilson et al., 2015). Due to the dynamic nature of emotion, such assessment or data collection strategy could not provide contextual information to the learner and the instructor. Therefore, this smart attendance is capable to capture emotional engagement data in a contextual manner and potential to provide information or insight with data analytics by associating the emotion with the type of learning activity, time, venue and other parameters that available. This is a significant impact in advancing blended learning domain especially by adopting data analytics (Picciano, 2014).

Blended learning approach still requires a physical meeting of the instructor and learner. Attending physically the class session is the indicator of student behavior engagement. Like other existing digital and advance attendance system, the summary of student attendance can provide the level of student behavior engagement in class. Since the system is on the cloud and accessible through the Internet, there is the possibility of the student may sign in without attending physically in the class. To minimize the risk of a cheating case to happen, the system includes the phrase or keywords of the day which will be informed by the instructor at the end of the class. The keyword required in the system functions for two purposes; the first is to allow only those who physically attend the class can fill the form. The second is for an instructor to promote inspiring moments by using positive keywords or phrase. Although the risk of an unattended student to cheat is still there, it only could happen when those who attend disclose the keywords of the day. This is one of the situations where a student who attends are been tested with integrity values and this setting has been well informed to the student verbally as a class policy. Since the class scheduled student to attend the class in a weekly basis, this mechanism is quite effective in forming student's habit to self-govern on integrity value through repetition of behavior in a consistent context (Phillippa, M., W., & Jane, 2009). This is significant on behavior engagement of the student in blended learning.

Although this smart attendance capable to promote the whole context of student engagement, the success of the educational strategy lies in how simple it is for an educator to adopt. Cloud technology is meant to simplify the complicated issue or technical knowledge requirements in meeting the goal or purpose of the end-user. Since this smart attendance is using Google cloud services (Cahill, 2011) which is freely available for public education institution globally, that's mean this smart attendance model can be scale up and adopted by other educators globally. In short, this innovation has a big potential for large scale adoption in improving the quality of education in meeting sustainable development goals (SDG) 4.

Advantages to education and community

There are many advantages of adopting smart attendance on cloud services. The advantages of the cloud-based smart attendance system are as follow: -

Scalable: Smart attendance is hosted on the cloud and accessible with web browsers. This system can be accessed with any Internet devices with a web browser such as a computer, smartphone, smart TV or even in-car entertainment.

Reliable: Google's application and network architecture are designed for maximum reliability and uptime. This means the smart attendance can be accessed by a large number of users in a time which ensure zero interruption of a user to access.

Analytics ready: Smart attendance is using Google Form. The data captured is ready in spreadsheet and analysis can be made on a real-time basis. This cloud-based spreadsheet is also ready with external data integration where an educator can integrate the academic performance data in measuring the relationship between engagement and performance. The report can be fully customized and online dashboard or report can be shared with specific users or published on the web for public access.

Low-cost: The Free Google Suite EDU for institution comes with the benefit of unlimited storage for Google Drive. This means the cost of hosting the system to execute and storing attendance data with Google Suite EDU will not become an issue for the institution to adopt it.

Simple and practical: Smart attendance requires no special hardware like sensors or readers. It only requires a device that equips with web browsers and Internet access. To access the application, the link to the system can be embedded in existing Learning Management System (LMS), social networking sites like Facebook or through social networking apps like WhatsApp.

Fully customize: Smart attendance can be created as templates and shared with others. The template can be customized by other educator or community like changing the language, remove or add other items for the system.

Table 1: Advantage of Cloud Based Smart Attendance for Educator and Community

Advantages	Educator	Community
Increase productivity/saving time	X	X
Impactful attendee engagement strategy	X	X
Digital copy of attendance proof for attendee	X	X
Data driven decision making with data analytics	X	X
Efficient event organizing	X	X
Paperless working environment/save cost	X	X
Digital habit for Industrial Revolution 4.0	X	X
Convenience online access	X	X

Commercial Value

The commercial value of cloud-based smart attendance is not on the technology itself since Google cloud services can be freely registered by the education institution or community. The potential commercial value of smart attendance is the fees for professional and technical consultation should institution required major customization and integration with their existing information system or advanced functionality like designing a dedicated dashboard for decision making.

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