



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: **An Intelligent Real-time Classroom Visualization and Notification System**

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SHORT ABSTRACT

Traditional classrooms are now required to satisfy the demands of teachers and students to fulfill their ever-increasing expectations to provide quality teaching-learning experiences and outcomes. The classroom system uses technology to enrich the students and teachers in classroom teaching and learning. It gives birth to a blended learning platform based on the usage of Information and Communications Technology (ICT), while researchers are also looking for new ways to teach in the classroom. The purpose of a blended learning platform is to incorporate new opportunities like the Bring Your Own Device (BYOD) paradigm and mobile computing into classroom teaching-learning.

In a classroom, teachers face difficulties in monitoring and caring for individual students. Technology-enabled on-demand classroom monitoring can assist the teachers. In real-time classroom status visualization, the major challenges are showing the status and location of a large number of students in a limited display area such as that of a smartphone with minimum additional cognitive load on the teacher working in a time-constrained environment. Here, cognitive load means the mental effort teachers need to understand classroom monitoring information. Researchers are also facing challenges in notifying teachers and students about the students' pitfalls. The notification improves teacher-student interaction and engagement. Usually, receiving notifications about weaknesses or pitfalls requires the teachers' and students' focused attention to comprehend in a real-time classroom environment. This makes it really challenging to design notification systems for in-class use. In addition, classroom visualization and notification demand academic performance metrics (APMs) in tracking student performance. However, performance assessment and prediction depend on the challenges of selecting metrics.

To address the challenges of classroom visualization and notification, this thesis contributes to determine metrics, and define academic performance state, and introduces the concepts of a classroom visualization including notification techniques. We provide an up-to-date literature survey to use the APMs and strengthen the state-of-the-

art. This survey helps in defining and predicting student performance states for real-time classroom visualization and notification. In addition, we determine the APMs through a field study to validate and compare the metrics in the Indian context. The aim of our classroom visualization is to display the large data on students' performance state in a limited available display. A two-level visualization scheme is developed to display the state of one hundred or more students on a desktop and/or smartphone screen the teacher might have. Our goal is to display the status of the entire class, location of the student, and detailed state information of the in-class students. In order to prevent disruptions to the usual flow of instruction, it should also be simple for the teacher to check student performance state. We propose an intelligent notification system for real-time classroom use. The system generates automatic notifications to the user depending on students' performance status in real-time. The challenge here is ensuring the teacher's primary task (lecture delivery) should not be hampered. The notification also makes sure that instructors and students are aware and focused throughout lectures, even in the face of the busy schedule in the classroom. In this scenario, we developed a peripheral notification technique, which helps to reduce the cognitive load and time to get the feedback of a teacher working in busy everyday classroom activities. The system is designed to deliver notifications to students to analyze and understand their performance at an early stage and on time.

We developed Android applications for implementing visual monitoring and notification systems to evaluate usability. The high System Usability Scale (SUS) scores, perceived usability, and the positive feedback from the users (teachers and students) point to the fact that the proposed visual monitoring and notification system are likely to result in higher learning outcomes.