INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: वेदिन्-कक्ष (Vedinkaksha): A Computational Framework for a 'Sensitive' Blended Learning Platform.

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Thesis Submitted to the Department/ Center	:	Department of Computer Science and Engineering
Date of completion of Thesis Viva-Voce Exam	:	25/01/2021
Key words for description of Thesis Work	:	Affective Computing, Blended Learning Platform, Learning Technology, Sensitive Classroom, Students' Mental State Detection.

SHORT ABSTRACT

Advanced technologies are being utilized in the field of education for an improved teaching-learning experience. Modern technologies and equipment such as smartboard, projector, and sound amplifier are being adapted in the traditional chalkboard duster classroom system. With the advent of ICT, a new type of learning system, called e-learning, has also been popularized. In order to achieve the benefits of both the face-to-face classroom and e-learning systems, recently scholars have started to blend e-learning with the traditional classroom system, which is termed as a blended learning platform. Although the use of modern technologies and devices in the educational setting seems to lead to an improvement in the teaching-learning experience and outcome to a significant extent, the mere use of them does not ensure fulfillment of all the important requirements for effective teaching and learning. One of such important requirements is the detection of mental states of the students. Consideration of mental states in a classroom is very important as it directly and/or indirectly affect many critical aspects of students' present and future life such as school dropout rate, learning progress, thinking capability, and future career expectations.

Identifying the mental states is therefore very important. However, it is challenging for a teacher to detect these states in real-time, especially when the classroom is large (having a hundred to a few hundred students). In this thesis, we propose a novel computational framework for a sensitive classroom system, which is able to automatically sense (or detect) the mental states of the students based on their emotion, involvement, and level of classroom activities, and at the same time take some actions as per the identified states. Additionally, the system is also able to quantify the learning and understanding level of the students on the learning platform. We have assumed a blended learning platform in the BYOD paradigm as the basis of the framework.

The proposed framework incorporates four novel machine learning-based computational models, which are the key research contributions of the thesis. We have built three models namely, the Touch-Affect, the Type-Affect, and the Smart-Affect, which detect the affective states of the students from basic user-smartphone interaction data, i.e.,

users' touch and typing patterns. We have validated the models with the EEG data of the students. The adaptability of the models in a blended learning platform has also been tested by using the EEG data. The fourth computational model, called the In-Activity, detects the involvement of the students in study-related activities in the blended learning platform. We utilized these four models as the key components of the framework for a sensitive blended learning platform.

In order to validate the proposed framework, we have built a high-fidelity working prototype for a sensitive blended learning system. We have observed that the system is able to detect the mental states of the students and take some actions based on the identified states, such as alerting the students and teacher and presenting a visualization dashboard to the teacher to perceive the status of the classroom based on the detected states. Based on our findings, we believe that a sensitive classroom system built following our proposed framework will help in motivating the students and teacher for greater engagement in the teaching-learning process, and in improving the learning outcome.