Project Title :	Augmenting Physical Learning Spaces with Location-based Services Using iBeacon Technology for Engaging Learning Experiences
Leading University :	The Hong Kong Polytechnic University
Participating UGC-funded University(ies) :	City University of Hong Kong, Hong Kong Baptist University, Lingnan University, The Chinese University of Hong Kong, The Hong Kong University of Science and Technology, The University of Hong Kong
Project Leader(s) :	Dr Charles WONG Man-sing, Assistant Professor, Department of Land Surveying and Geo-Informatics, The Hong Kong Polytechnic University

Summary of Proposal

Students investing more time and effort in their learning and more efforts from the teachers and/or institutions on learning activities pose positive influences on students' academic outcomes. Despite the apparent positive values of student engagement, getting teachers and/or institutions to engage students more in learning in-class and out-of-class remains challenging and the higher education sector in Hong Kong is no exception. To address the challenges of better engaging university students for quality learning experiences and accordingly increasing teachers' chances of adopting the necessary changes, the Hong Kong Polytechnic University in collaboration with other partner institutions propose to make use of emerging iBeacon Technology as the innovative enabler for engaging learning experiences. In the current generation of Bring Your Own Device, the iBeacon Technology can be embedded to different existing physical learning spaces (e.g. lecture halls, seminar rooms, general teaching rooms, laboratories, libraries) with e-activities through the iBeacon transmitters and the companion mobile application developed for both Android and iOS systems such that students can become active explorers, not passive receivers, to access the e-materials. As iBeacon Technology is supported by both Android and iOS systems and these two systems are reported to cover 99.3% smartphone market shares all over the World by June 2016, the proposed iBeacon Technology is accessible to most students, if not all, in Hong Kong institutions. The objectives of the proposed project are to:

(i)   conduct a comprehensive implementation of iBeacon Technology that can augment various physical learning spaces with e-activities to explore how iBeacon Technology can support pedagogies of engagement and/or new pedagogies;

(ii)   develop discipline-specific materials for the e-activities in alignment with the intended learning outcomes of the wide range of subjects involved in this project, in the formats of low tech (e.g. video, audio and web information) and high tech (e.g. AR/MR contents) to transform teaching delivery to location-based enabled learning;

(iii)   design and develop a portable and holistic infrastructure for teachers to integrate AR/MR contents in addition to low tech contents effectively and efficiently for teaching delivery;

(iv)   investigate the potential Big Data collected from this project (e.g. class attendance, group formation, person-to-person interaction, classroom ecology) for students' behavioral study and any related issues resulting from this study;

(v)   make recommendations based on the findings of this project on the educational use of iBeacon Technology with various kinds of e-activities for the higher education sector and beyond as appropriate.

Summary of Final Report

Students investing more time and effort in their learning, and more efforts from the teachers and/or institutions on learning activities pose positive influences on students' academic outcomes. Despite the apparent positive values of student engagement, encouraging students to engage in in-class and out-of-class learning by teachers and/or institutions remains challenging and the higher education sector in Hong Kong is no exception.

To address the challenges of engaging university students for quality learning experiences, and accordingly increasing teachers' chances of adopting the necessary changes, the Hong Kong Polytechnic University had collaborated with other partner institutions. The institutions had employed the iBeacon technology and developed a multi-platform application system with Location-based Services named as Augmented

Teaching and Learning Advancement System ("ATLAS"), to utilize the iBeacon technology in the classroom for teaching, learning, and assessment. Two major components are included in ATLAS, which are 1) web portal for administrators and teachers, and 2) student/visitor mobile application for iOS and Android mobile phone. Compared with other iBeacon technology solutions, our ATLAS particularly employs the location-based service to allow the teacher to disseminate teaching, learning, and assessment materials under the active learning framework.

Diverse disciplines had been involved, including Nursing, Land Surveying, and Geo-Informatics, Civil and Environmental Engineering, Religion and Philosophy, Mechanical Engineering, Education, Management, and Geography. The System had been evaluated after the implementation and received positive feedback from students, which the mean scores of Perceived Usefulness, Perceived Ease of Use, and Intention to Use were 4.12, 4.76, and 3.84 on a 5-point Likert scale. The students' average engagement scores were 3.92, 3.34, 3.77, and 3.88 on a 5-point Likert scale for behavioural, agentic engagement, cognitive engagement, and emotional engagement respectively.

To date, the project team has published three SCI journal articles, one book chapter, and three conference proceedings, delivered four conference presentations, and conducted five workshops regarding the experience of implementation. The team had also finished the installation and deployment of iBeacons in more than 50 lecture theatres and the outdoor environment of the PolyU campus and other partner institutions. The development of ATLAS and the installation of iBeacon would create future opportunities for enhancing the teaching and learning even if our project has ended. Meanwhile, the PolyU Team has applied for the Teaching Development Grant in PolyU to encourage university-wide adoption of the System in the future. Further development can involve customization of contents towards specific environmental/scenario settings.