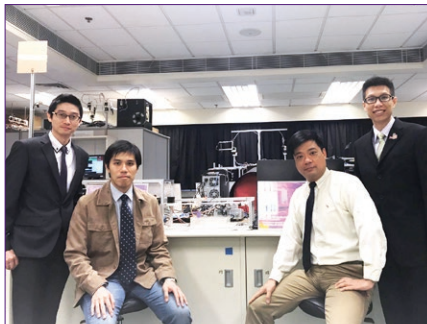


# Technology Frontier

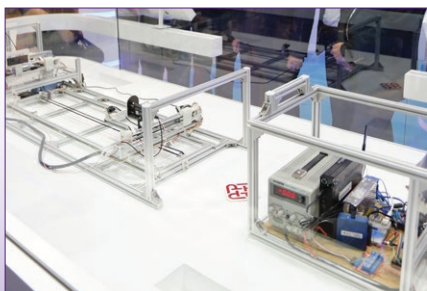
News Bite on PolyU's Innovation

## RemoteLab and AP-Sensor Making science experiments accessible anytime anywhere

Hands-on learning is the best way to understand the world around us and experiments are essential to science education. However, due to limited resources, distance or other limitations, not every student has access to a traditional lab. The researchers from the Department of Applied Physics thus developed RemoteLab that lets students conduct experiments from a distance on a real-time basis, and AP-Sensor app that turns modern smartphones into lab instruments. The former is especially useful for experiments not practicable in typical secondary school labs while the latter arouses students' interest in learning by correlating physics with their daily life.



Dr Chee-leung Mak (2nd from right),  
Dr Kwok-lung Jim (left) and their project team



Experiment equipment of RemoteLab

Science is the study of facts. Experiments play a pivotal role in science education because they encourage exploration and discovery. Hands-on learning is the best way to grasp the world around us and learning doesn't happen in classrooms alone. If students have access to scientific experiments whenever and wherever they feel like, they tend to take pleasure in thinking and contemplating how things work. Along the same line of thought, Dr Chee-leung Mak, Associate professor, and Dr Kwok-lung Jim, teaching fellow, Department of Applied Physics, led research teams in developing RemoteLab for conducting real-time experiments via the internet and AP-Sensor that turns any smartphone into a tool for physics experiments. Both projects are extremely well received by local

university and secondary school students. The scholars are also exploring the possibility of collaborating with educators from around the world to enable students to conduct experiments anytime anywhere.

### RemoteLab: accessible 24-7

"We got the idea to develop RemoteLab in 2011 in anticipation of the double cohort of students enrolled in the university in the following year due to the implementation of the 3-3-4 education system," said Dr Mak. As there were twice as many students accessing lab facilities, they figured out a way to expand the capacity by making lab equipment remotely controllable real-time while allowing users to change parameters and observe results via video transmission from webcam or in



User interface of AP-Sensor

graphical charts. The experiment results are also fully downloadable. As it was well received by PolyU students, he broadened the user base to 10-plus pilot secondary schools in 2014 and to Lingnan University later on.

RemoteLab has obvious advantages for students unable to access a traditional lab because of time constraints, distance or physical disabilities. It is available 24 hours a day, 7 days a week, accessible from anywhere in the world with internet connection. Dr Mak said, "It is especially useful for experiments that are too dangerous to set up in a typical secondary school lab (such as those involving radioactive substances) or entail high-precision equipment too expensive for every school to acquire. RemoteLab is not a virtual lab that simulates experiments with animation or computer graphics. It is a real physical lab with real instruments. The results show the same level of randomness as doing an experiment in person. This is also an important fact about science that every student should know." Apart from physics experiments, students also once grew bacteria on petri dishes. Instead of coming to the lab a few times a day to count the bacteria colonies, they can see the petri dishes via webcam from a distance. Similarly, it is also applicable to other biology or chemistry experiments. Dr Mak is currently liaising with schools in Germany, as a first step to let students from around the world learn via RemoteLab and he wishes to collaborate with more schools in

Hong Kong and the Chinese mainland soon.

## **AP-Sensor: turning smartphone into lab tool**

On the other hand, Dr Jim believes correlating science with everyday contexts is a useful way to arouse students' interest in learning. Inspired by the various sensors that come with modern smartphones, he got the idea to take lab experiments out of the classrooms. "Most advanced smartphones have built-in accelerometer, magnetometer, GPS, gyroscope, and even proximity and light sensors. That's why we develop an app called AP-Sensor, which stands for Applied Physics Sensor, to convert a smartphone into a lab instrument with multiple capabilities," said Dr Jim. After downloading the app, you can conduct a few interesting experiments with your smartphone – measuring the change of apparent weight in an elevator, the speed of sound and the behaviour of simple pendulum motion. Detailed instructions are available in the app and students can learn from their personal daily experience instead of memorizing the theories on textbooks. AP-Sensor will be available for the public to download later this year (stay tuned to the Facebook fanpage of PolyU House of Innovation), and Dr Jim looks forward to collaborating with interested parties on this project.

The RemoteLab project won the Asia Gold Award in the Wharton-QS Stars Reimagine Education Competition 2016.