

# REMOTE CONTROL FOR SMART CLASSROOM WITH BLUETOOTH NETWORKS

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## ABSTRACT

*On 21st Century, it is the rising up generation of smartphone. Smartphone is become indispensable in people's lives. It is whether in social network, e-learning or entertainment. For examples, you want to chat with other peoples, search information, playing electronic games or listen to music. Now, all can have done on the phone by one click, APPs (Applications) makes life be more convenient and excellent. In this project, I decided to build up a smart classroom model. This classroom operation is different to the tradition classroom. Traditionally classroom is facilitated with different type of electrical equipment or accessories to help teachers in the classroom. In the past, most of control devices and facilities in classroom are using mechanical on/off switch and wiring system. Sometimes, teacher often forgot to turn off the electrical device when he/she left the room. It is resulted waste energy as well. The electrical installation works in the classroom are very complicated. My designed system is a set of control through wireless system. It contained with an Apps, Bluetooth, Arduino and PLC. The first part is use smartphone platform, the second is signal transfer through Bluetooth transmit to Arduino. And the last is hard model with PLC control. Simply said, it use and Android platform to control all devices in the classroom. I hope, I can use this system in the classroom.*

## KEYWORDS

*Smartphone, PLC Control, Bluetooth, Android, Arduino.*

## 1. INTRODUCTION

A Smart classroom system is use wireless to connect between smartphone and devices and classroom facilities. This system can let teacher be more convenience when he/she are teaching in the class. Because teachers did not wait and go in front of the traditional switch to turn on and off the light or projector. He / She just use his/her smartphone devices to control. The advantage of wireless system made lessons more effectively and run smoothly. It does not only flexible, it is cost saving and it can reduce energy losses.

The traditional smart classroom systems are controlled and communicated through kinds of wiring works. They are very difficult to expand or upgrade the system compliant with some new appliances or devices.

The Wireless network not only can provide much more flexibility, mobility, save cost and less energy spent in synthesizing wiring. It can also correspond to communication to others classroom network.

It can make teaching in classroom:

1. Processing more effectively and
2. Running more smoothly

3. And it also saving energy and more safety.

Energy saving and safety

Teacher often forgot to power off devices when he/she left the classroom. It will make energy wasting and sometimes an overheat or temperature rise in electric device (i.e. Projector, computer, AV system etc.).

1. This system can reduce the power waste and eliminate the overheat harm.
2. All the electrical devices in classroom will be POWER OFF automatically within 10 minutes while Bluetooth disconnected.



Figure: 1-1.

## 2. DESIGN TENDENCE

### 2.1. Aim and objective

In this work, I aim to build up an Android APK [1-3] via Bluetooth [4] to control four kinds of electrical devices in the classroom. But Bluetooth cannot operate devices. It is transmitting data only. It cannot control the devices on or off, up or down. That means a microcontroller is necessary to install. There are lot of different kinds of Micro-controller. The first choice is Arduino [5]. Arduino is easy to learn and program. There had lot of example of wireless control. For example is intelligent home. It is most common in the market. But I through, the using times and frequency of teacher is larger than in home. But there is no one to design classroom for teacher. At the final, the topic of a smart classroom is decided.

The main parts are the Android, Bluetooth, Arduino and PLC platform [6-9]. All of them need to develop their relative programs. In part of software, they are Android application package, Bluetooth encoding program and decoding program, Arduino instruction program and PLC ladder program. For the hardware, an Android phone, Bluetooth transmitter and receiver, Arduino main board, PLC, a relay PCB board and led test board were necessary. After built up, connected and testing and commissioning of completed above parts, this project will be finished.

The remote technology for class is through electronics and wireless. Used classroom hold electronic appliances was matured. Based on the Android application and through Bluetooth technology, this item on remote control classroom hold electronic appliances was put forward. Using the Bluetooth transmission of the Bluetooth module, devices of the control network were well managed so that can plug and play. The functions of the control network devices and the interior commands were standardized. A set of classroom control which used Android device to transfer control data, decode control data and the port serial communication were designed in this item. Designed drive applications to operate the Bluetooth, thus the control system can be easily operated.

### 2.2. Research will be cover

1. Learning and develop Android App

2. Bluetooth module application.
3. PLC program design and application

### 2.3 Android

The Android application package files (APKs) are program binaries for distributing and installing Android applications onto the Android operating system. Here, we will see the making of an Android Apps [15-17] file step by step to install on a smartphone.

The tools & software used in this article:

- i/ JDK1.6
- ii/ Eclipse3.7.2
- iii/ Android\_SDK

It had two methods to export application packages in Eclipse using the tools of Android. The tutorial of making a simple APK as below shown:

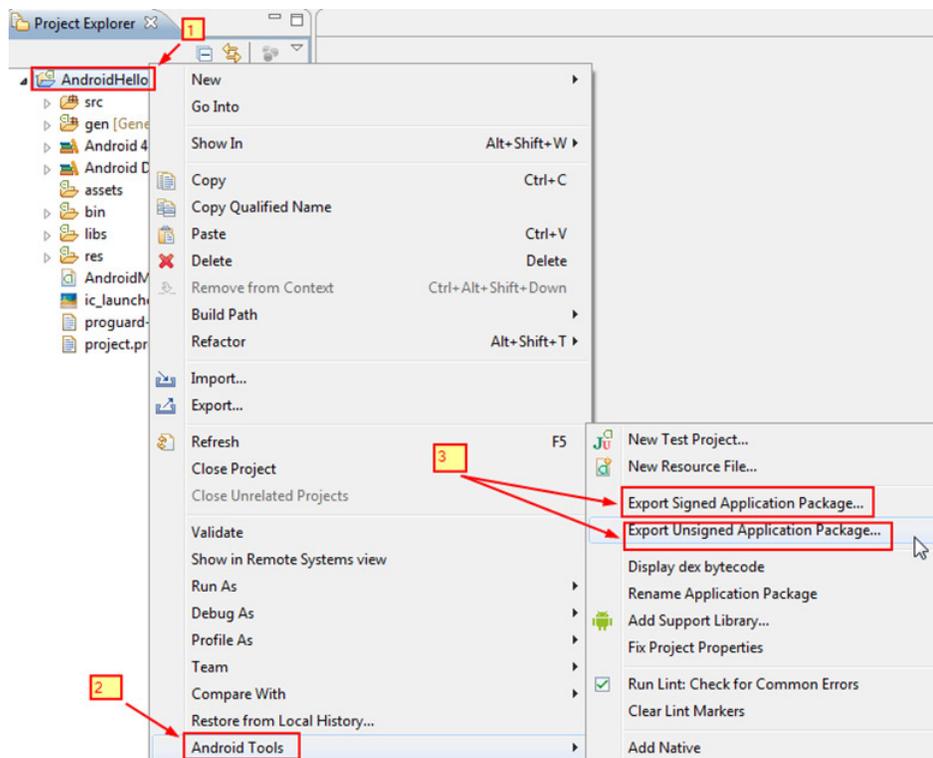


Figure: 2.3-1

1. Export Unsigned Application Package
2. Use right click on a mouse in an Android project (any file name you want), choice Android\_Tools>Export\_Unsigned\_Application\_Package from contextual menu. Browse Location\_Save\_APK and click the save button. Then click OK in the below window:

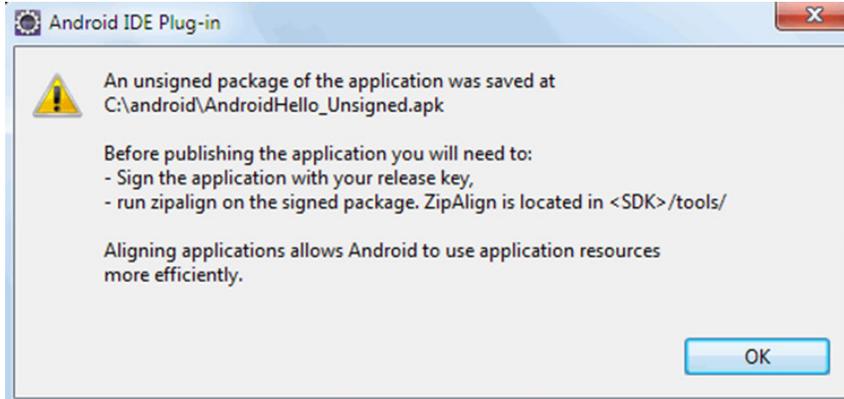


Figure: 2.3-2

### 3. Export\_Signed\_Application\_Package

Click Right\_click in the Android project, choice Android\_Tools> Export\_Signed\_ Appliaction\_Package from the context menu. Choice the project to export it and then in Project blank input the name of a new Android project(for example `AndroidHello`). Then click `Next`.

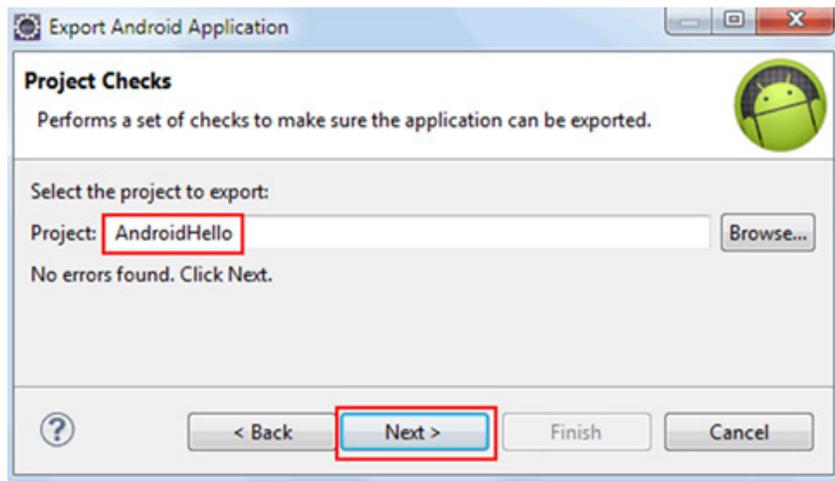


Figure: 2.3-3

### 4. Keystore\_selection

To create and post an APK. Create a digitally signed apk.

1. The first step is to create a selfsigned\_certificate/keystore. And then choice the Create\_new\_keystore, input the expected file location and password in this part.
2. Click Next.

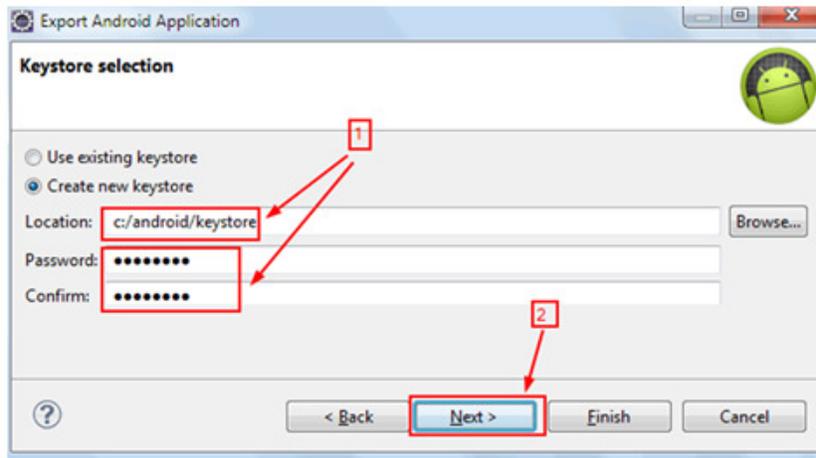


Figure: 2.3-4

### 3. Key\_Creation

Fill up the Key\_Creation form starting from the first line `Alias` to create a key, password. And then click Next.

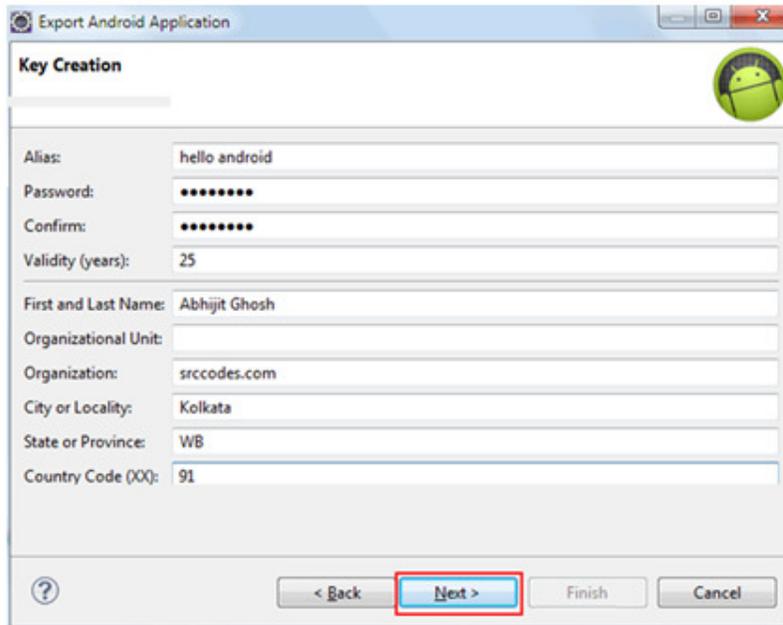


Figure: 2.3-5

4. Finally, the first APK file is created. It is ready for installation in android device.

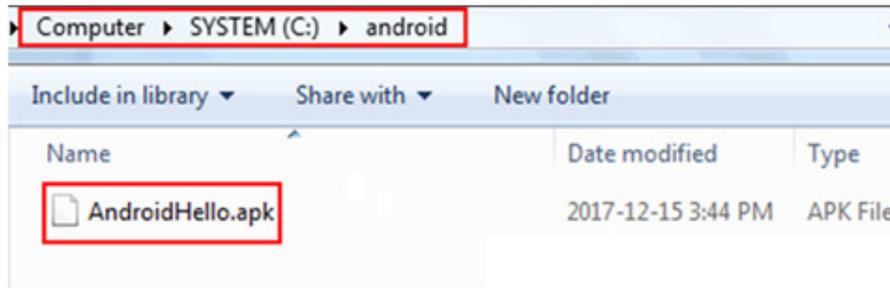


Figure: 2.3-6

title is to be written in 20 pt. Garamond font, centred and using the bold and “Small Caps” formats. There should be 24 pt. (paragraph) spacing after the last line.

#### 2.4. Objective of Work

A The Android system has most mobile users using in the world. Build-up a modern remote classroom device system combinative with:

1. Android mobile,
2. Wireless Bluetooth Technology and
3. Programmable Logic Controller.

Android Smart Classroom via Bluetooth and PLC



Figure: 2.4-1

It is easily using in any Android devices, such as:  
Using in Difference kind of Devices



Figure: 2.4-2

## 2.5. Design and Developing an APK

An APK (Android\_application\_ package) file are for installing or distributing applications. The file included application code, manifest, resources and assets files. In following figure shown the apk icon.



Figure: 2.5-1

### 2.6.1. Turn on the Bluetooth function



Figure: 2.6.1-1

### 2.6.2. Touching APP Icon on the Android device

Design the key of different function on screen.



Figure: 2.6.2-2

### 2.7. Touch to control classroom device



Figure: 2.7-1

### 2.8. Apply Bluetooth module and PLC



Figure: 2.8-1

### 2.9. To control Classroom Device

The system can control the electrical devices such as Lighting system, Projector screen, Microphone system and Air conditioning system inside the classroom.



Figure: 2.9.1

### 2.10. Control Schematic

The control schematic is shown below:



Figure: 2.10-1

1. Create an Android Application program (App).
2. Edit the Bluetooth Module
3. Draw a relay circuit
4. Draw a PLC control circuit
5. Make a simulation test

### 2.11. Button design of classroom for electrical devices

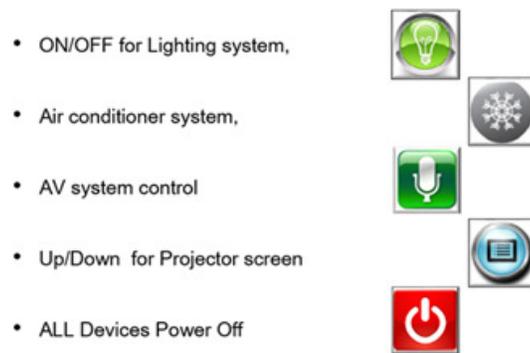


Figure: 2.11-1

## 2.12. Software development

I will build-up a remote classroom device system combinative with

1. Android mobile:

Eclipse - To write programming for Android Application

2. Bluetooth Technology:

Adrunio 022 – To translate function between Android and Bluetooth receiver to access class room code

3. Programmable Logical Controller:

PLC program - To design PLC program for control hardware and future extension development

## 2.13. Looking Youtube for Mobile Apps

In the Video, I learnt

i/ The design of initial contact to Android system;

ii/ Know the background of writing the Android programming language. It is JAVA

iii/ Some concept of OOP

iv/ Doing some practical training guided by instructor.

## 2.14. Build up the Hardware

1. Android Device

2. Bluetooth Module

3. Arduino Body

4. Relay board

5. Mitsubishi FX2N PLC (wiring works on next semester)

6. Model of Classroom (works on next semester)

## 3. PERFORMANCE TEST AND ANALYSIS

### 3.1. Performance Test

The Remote classroom can operate in the classroom. The control distance about 20m. The Remote classroom can control nine functions. There are on/off up and down for difference electrical devices. Also, it can turn off all the power at the same time in Power off function.

To testing the Remote classroom without Android, it used the access port (figure 4.29) to send the character to the Arduino. The access port can download on internet free. It can connect the COM of the windows and send the data via Bluetooth.

To testing the Android apps output data, it can use the SSCOM. Plug-in the Bluetooth module to USB adapter, and then Plug-in the USB adapter to computer, then Run SSCOM. Ensure the Bluetooth module connected to the smartphone. Next run the Remote classroom apps and then press the button.

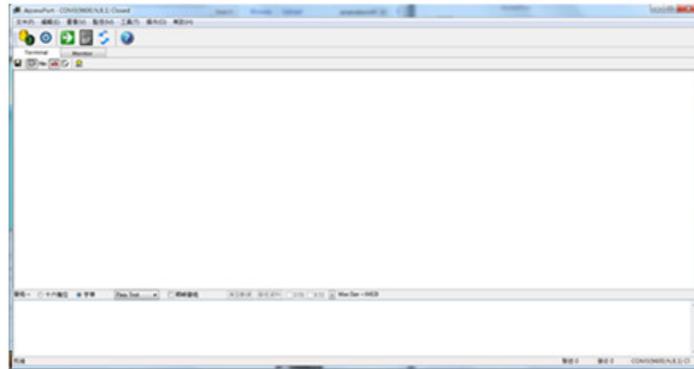


Figure: 3.1-1

### 3.2. Final Test

1. Select Manual mode at the model
2. Testing the manual individual function
3. Turn on/off for all electrical devices by manual switch
4. Select Auto mode
5. Turn on the Smartphone icon and Bluetooth function
6. Searching and matching Bluetooth Devices
7. Press the button on the Smartphone icon for testing the function of each electrical devices.

### 3.3. Test the setting

1. We use the phone or computer to scan the Bluetooth module
2. Test the name and password

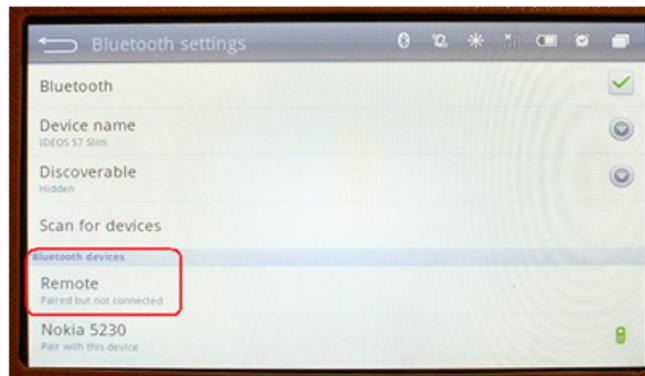


Figure: 3.3-1

### 3.4. Operation Manual

1. Turn on the Arduino
2. Activity the Bluetooth function on smartphone
3. Scan the Bluetooth Module (vtc1234)
4. Connect the Bluetooth module
5. Type the key to connect (pin: 1234)
6. Open the Remote classroom apps
7. Select the menu button on smartphone
8. Click connect device
9. Waiting the text message (“connected”)
10. Start to Control the Remote classroom

Details:

1. Plug in the 5V battery to the socket. The Arduino will turn on immediately. The Arduino nano has a power led (blue). When the power led (blue) is on, it means the power of Arduino is switched on. The Bluetooth module also has signal led (red). The led (red) will flash in normal situation. The normal situation means not connected to any device. When the Bluetooth module had connected to the device, the led will light on instead of
2. Using the smartphone, click into Bluetooth device manager. Click the Bluetooth function to on.
3. Scan the Bluetooth module of Remote class room.
4. Then, click and connect
5. The message box will show on. It provides a text box for user to type in the key.
6. Click the ‘Remote classroom’ icon to run the apps
7. Click the ‘menu’ on the smartphone. After that, the apps will show on the option menu on the below
8. Click ‘connect device’, the list of Bluetooth device will show on.
9. If the connection was success. The text message will show the below.
10. After above step, starting to control the Remote classroom.

### 3.4. My design layout for the Smart Classroom with remote control using AutoCAD

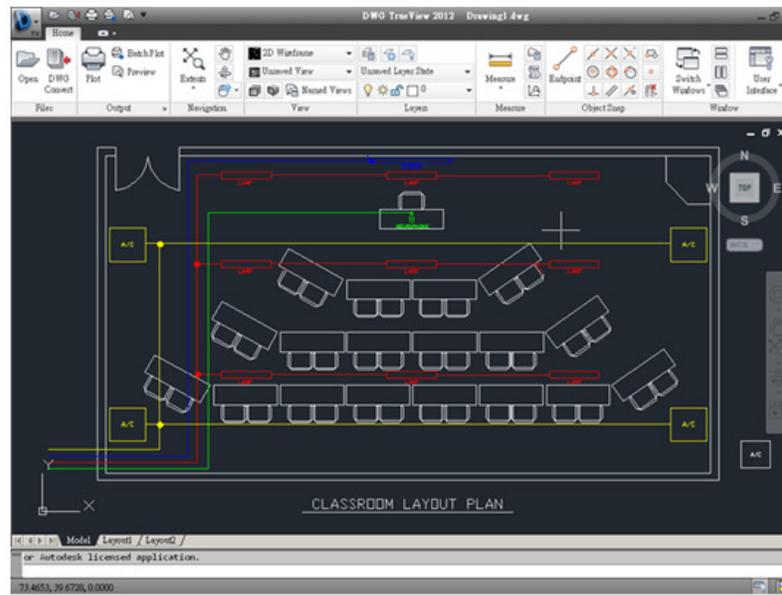


Figure: 3.4-1

#### 4. CONCLUSIONS

In the process of my study, I bought two books because I was accustomed to reading books. One is the basic introduction to Google! This is an introduction to Android mobile apps. This book is written by Gasoline and it is very easy to understand. For beginners will be a great help, even if there is no Java basis can easily read this book, it also has some of the teaching can be found here, another is a more advanced Google Android SDK development examples. And, I search from the internet and found out a most useful tutorial video. They contain many the program examples will be helpful for writing programs.

The process of my study is based on the paradigm of the introductory book. Once done one by one, it is recommended that you must play the code yourself, because you can get familiar with the process of developing the program more quickly, and you may encounter many problems. When we solve, we will make a lot of progress. We can also know what kind of mistakes we are likely to make. After learning the basic programming, we must improve our programming capabilities. So, we should start developing a bigger program.

In the process of writing, many problems encountered, of course, is to rely on Google God to find answers, there will be many resources on the Internet can refer to, such as the Android official technical documents, in addition to an SDK inside API Demo. This example has many APIs to learn and it is also known what Android can do. It is highly recommended to learn from this paradigm. In this work, it had Four mains hardware was important for Remote classroom system. There are including body of Classroom, Arduino, electrical devices and relay circuit. For the software, the Android apps and Arduino program was needed. The main difficult is editing the Android program. It was never done before. To learn the Android, develop environment was hard for this project. All things were strange. Fortunately, it can finish on time. That is one of greatness on the project. The Remote could control by any Android smartphone via Bluetooth. The control distance is about 10m. It is enough length for control inside and classroom.

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Tony Tsang (MIEEEE'2000) received the BEng degree in Electronics & Electrical Engineering with First Class Honours in U.K., in 1992. He studied the Maste Degree in Computation from Oxford University (U.K.) in 1995. He received the Ph.D from the La Trobe University (Australia) in 2000. He was awarded the La Trobe University Post-graduation Scholarship in 1998. Prior to joining the Hong Kong Polytechnic University, Dr. Tsang earned several years of teaching and researching experience in the Department of Computer Science and Computer Engineering, La Trobe University. He works in Hong Kong Polytechnic University as Lecturer since 2001. He works in Hong Kong College of Technology in 2014. He has numerous publications (more than 110 articles) in international journals and conferences and is a technical reviewer for several international journals and conferences. His research interests include mobile computing, networking, protocol engineering and formal methods. Dr. Tsang is a member of the IET and the IEEE.

