# CHAPTER 7

# Conclusion

Nowadays, the water quality has been declining severely and water pollution has increasingly affected public health and welfare. As it is crucial to monitor water quality closely, various methods have been employed so far. For example, a conventional method involving standard water analysis in laboratory offers an easy, inexpensive approach but takes quite a long time. Many new methods exploit latest technology to provide quick analysis, however the procedures are complicated and expensive. In recent years, modern IT in everyday life has been developed rapidly, especially smart devices have become smaller and multi-functional. The smart device contains built-in camera, GPS and internet connection. It also includes many free, user-friendly software and mobile applications. As a result, the use of modern IT devices has been increasingly popular and the technology has become a part of everyday life.

In this research, the water quality monitoring system has been developed using rapid water analysis devices with modern IT, not only hardware (Smart device, Notebook, Digital camera, GPS Navigator), but also software and mobile application (Skype, TeamViewer, Google Earth, Google Maps, Google Street View, Google Docs, Google Site, Google Drive, Picasa Web Album, Line, Viber, WhatApp). The developed system called "water quality monitoring system employing modern information technology", consists of 5 steps; First, planning an operation by remote survey and sampling point assignment using Google Earth / Google Maps / Google Street View. Second, water quality monitoring and data recording (photography) for traceable information. Third, uploading data to a cloud system (photograph, VDO and numerical data) which is free, easy to access and secured. Forth, evaluating data using developed method for colorimetric test. Fifth, displaying data on the website (https://sites.google.com/site/waterqualitymonitoringbyfbacmu/mapping).

The developed system was applied for water quality monitoring at 4 different study areas; First, the system was tested at Chiang Mai Moat (Chapter 3), as a standing water study area. The water quality at 8 sampling points in Chiang Mai Moat were examined by 6 teams (10 people) within 3 hours. The outliers were determined and all data were displayed in real-time on the website (https://sites.google.com/site/chiangmaimoat waterquality/). Second, the system was demonstrated at Mae Ping River in city area of Chiang Mai (Chapter 4). The study area was divided into 6 zones along the river, with one sampling point each. The water quality in 6 zones and a reference point on Mae Ping River were examined by 3 people in one day. Data were displayed in real-time on the website (https://sites.google.com/site/waterqualitymonitoringbyfbacmu). Also, point sources in the area were determined within a day. Third, the system was applied on Phayao Lake (Chapter 5). The lake area was divided into 10 zones. The water quality monitoring at all zones were completed within a day and data were reported in semi real-time on the website (https://sites.google.com/site/waterqualitymonitoringbyfbacmu/). This study was the first to report such data from Phayao Lake. Moreover, the system was used to determine the location of point source, the time when wastewater was drained in to the lake and the distribution of pollutant in the lake. Last, the system was adopted to monitor water quality in a specific event, Big flooding in Thailand, from the end of 2011 to early 2012. The study area was divided into 3 zones, consisting of zone 1 Mae Ping River from Chiang Mai to Nakhon Sawan and Wang River in Lampang; zone 2 Chao Phraya River from Nakhon Sawan to Ayutthaya including irrigation canals, Khlong Lamthadang and Khlong Phraya Bunleu; and zone 3 Chao Phraya River from Phathum Thani to the Gulf of Thailand including some irrigation canals. The water quality monitoring was carried out by 3 people and completed within a week. The data was displayed in real-time on the website (https://sites.google.com/site/waterqualitymonitoring byfbacmu). The system was also able to determine a point source in a short time.

Apart from application in water quality monitoring at various study areas, modern IT was used for communication among the team, such as TeamViewer, Skype, Line, WhatApp, Viber, Face time and VDO Conference. This allows the teams at different place or other country to work together in real-time. In the planning process, Google Earth, Google Maps and Google Street View were used to survey an area and assign a sampling point. A modern IT device could be used for navigation to reduce travel time to

each sampling point. Furthermore, water quality data were stored on the cloud system which is free and easy to access from anywhere. In addition, the system was developed mainly based on Google service which provided free platform and good security. It is a familiar system for most modern IT user. This helps to reduce time and cost for monitoring.

However, the developed water quality monitoring system employing modern IT has a few limitations. For example, the system required internet connection and specific equipment for a quick water analysis. Free-version software and mobile applications had some limitations like limited cloud storage space. Modern IT devices have various quality including resolution of built-in camera and precision of GPS navigator. Some applications are not supported on some OS, etc.