

GEOGRAPHIC INFORMATION SYSTEM FOR WATER QUALITY WORK: “WATER QUALITY ON YOUR CLICK” BY MWA, THAILAND

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ABSTRACT

Metropolitan Waterworks Authority (MWA), Thailand, is a state enterprise formally established to provide proper quality water supply throughout the service area covering Bangkok, Nonthaburi and Samutprakarn. In addition to meeting customer demand, the organization aims to serve quality products and service. In 2014, the MWA Water Quality Integrated Centre was founded to serve as a controlling centre of quality data presented in water quality map with real-time online reports. With 24-hour access, customers can access water quality information including residual chlorine, turbidity, pH and conductivity transmitted from 50 online stations. In 2016, MWA consequently integrates the water quality system with Geographic Information System (GIS) as an application officially called “Water Quality on Your Click” in order to improve data presentation with more channels and added locations. The application includes a real-time database from 50 online stations and laboratory databases from more than 10,000 samples per year. With easy access and user friendly options, 5 sets of nearby location data will appear after dropping a pin on the desire location and can be switched into a residual chlorine contour map covering the service area. Water Quality on Your Click is not only a channel for water quality information but also a key that drives accountability starting with customers themselves and elevates customer satisfaction according to MWA 2017 vision to provide quality water for quality life.

Keywords: Metropolitan Waterworks Authority (MWA), water supply, water quality, Geographic Information System (GIS).

1 INTRODUCTION

Metropolitan Waterworks Authority (MWA) is a state enterprise established in 1967 with a purpose to provide water supply for Bangkok, Nontaburi and Samutprakarn [1]. MWA customers include government offices, airports, industrial factories and houses. With a standardized process and management, tap water is safe and complied with World Health Organization (WHO) guideline for drinking water 2011. MWA keeps improving not only qualified water, but also its services are satisfaction and accountability for customers. Nowadays, with a developed communication technology, people easily access to the information via personal computer, tablet and mobile phone. The knowledge that received most attention, is the health information. The awareness of health leads customers to pay more attention to water and food. According to the change of health concerned, MWA has to improve data management to satisfy customers.

Geographic Information System (GIS) is a system designed to capture, retrieve, store, manage, display and analyse geographic data [2]. It has been widely used in many fields such as population dispersal, epidemic study, forest management and water resource management. MWA has started using GIS since 2000. The first time, the data applied by GIS include registered customer data, loss water management, water pressure and distribution line map. And later in 2016, water quality data have been integrated into the system and presented in the application officially called “Water Quality on Your Click”. The integrated data consist of real-time water quality data from 50 online stations, laboratory test data of more than



10,000 samples, residual chlorine contour map, serving area zoning and pipeline map. This user-friendly application is designed to display water quality data which is easy to access and understand via personal devices. This article mainly focuses on the application development and user-friendly function that provides instant water quality data to the customer which will further lead to uplift customer satisfaction and accountability.

2 WATER QUALITY ON YOUR CLICK DEVELOPMENT

Water Quality on Your Click has been developed since 2016 with a purpose to present water quality data in the form of instant data which the customer can reach and understand effortlessly. SCADA, GIS, tap water quality laboratories database and real time database are integrated in this application and displayed via geographic aspect that can be used to support efficiently water quality prediction and overall water quality management. The data used in Water Quality on Your Click consists of the following (Fig. 1).

2.1 Geographic Information Systems

Geographic information system or GIS is a computer system basically performed with spatial data to examine data and area like address and location on map, latitude and longitude. Patterns and spatial data relations are analysed by GIS and then resulted in change and time relation such as disease epidemic, migration, invasion, land using, etc. The data applied by GIS are displayed on the map and can be used instantly [2].

In 2000, MWA started apply GIS with registered customer data, water loss management, water pressure and pipeline map. At present, MWA GIS data consist of various complicated data. It also provides web service which can be used by any department within the organization. Water Quality on Your Click connects to GIS through web service and consequently displays map and location data kept in MWA database, including area zoning, serving area by branches, registered customer data and distributing pumping stations.

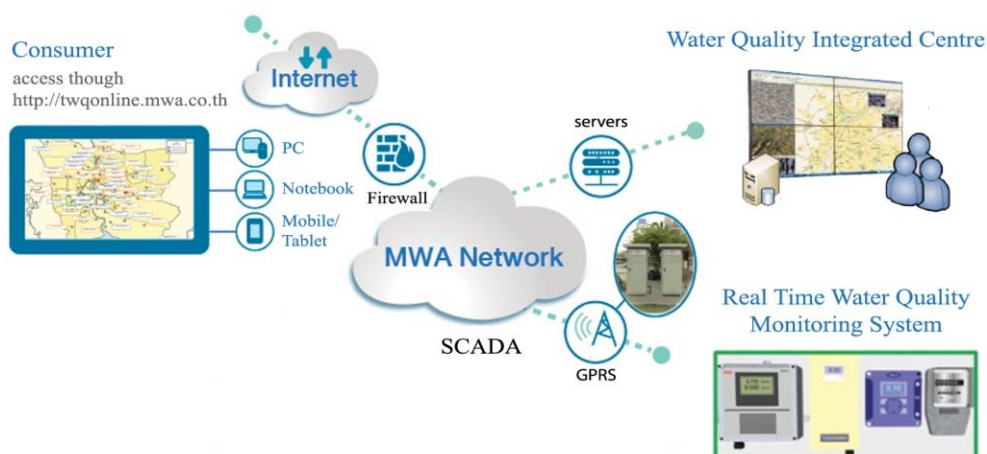


Figure 1: Data connection diagram of MWA Water Quality Integrated Centre.

2.2 Real-time water quality monitoring system

Real-time water quality data; free residual chlorine, turbidity, pH and conductivity, from 50 online stations are transmitted to the MWA Water Quality Integrated Centre. The data are sent via SCADA and kept in the real-time database server. Real time water quality database links to an XML file which is generated every 3-5 minutes by web server. XML is then recorded in MWA GIS Temp data and displayed in any other form.

2.3 Tap water quality laboratories data

MWA water supply quality is complied with WHO guideline for drinking water quality. The WHO recommendation of minimum sample numbers for faecal indicator testing in distribution systems is 12 samples per 100,000 heads of population plus an additional 120 samples [3]. In 2015, population in the MWA service area reaches 10 million therefor there are more than 3000 samples [4]. They are analysed in physical, chemical and biological aspects and recorded in tap water quality laboratories database.

The Water Quality on Your Click application has connected to tap water quality database through GIS web service. Afterward, the web service is recorded in the Temp data of Water Quality on Your Click to be further used. The data are composed of the sampling location name, road, date of sampling, residual chlorine, turbidity, *E. coli*, conductivity, dissolved solids, iron and apparent colours.

3 WATER QUALITY ON YOUR CLICK APPLICATION

The Water Quality on Your Click application works similar to Google map. The GPRS on the device is used as a navigator to display water quality for users. The systems of Water Quality on Your Click application consists of the following (Fig. 2).

3.1 Geo Server

The Geo Server tasks to service all clients. It installs as follows.

3.1.1 OS: Linux CentOS 6.7

3.1.2 Program

- PostgreSQL 9.4.5: Database Management System.
- PostGIS: The extension helps Postgresql database support GIS and its spatial.
- Node.JS.
- Web service (lamp, Apache Tomcat, PHP).

3.2 Geo Broker

The Geo Broker tasks to receive data from other servers in MWA network and send to the Geo Server. It installs as follows.



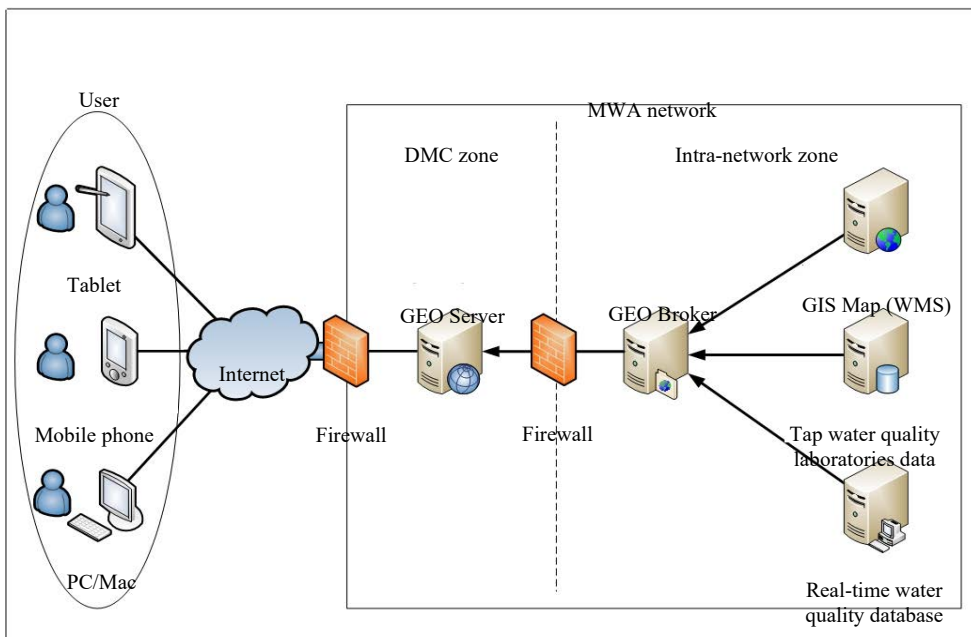


Figure 2: Diagram of “Water Quality on Your Click”.

3.2.1 OS: Linux CentOS 6.7

3.2.2 Library

3.3 Geo Map (WMS)

GIS Map (WMS) is the system providing GIS service in MWA. Geo Broker shows data (WMS) on Geo server as layer on Map. ArcGIS ESRI is installed on Geo Map.

3.4 Water Quality laboratories data

Water Quality laboratories data is the system that compose of web service and database of laboratories data. The web services of the Geo Broker receive data as JSOM file. It installs as follows.

3.4.1 Xampp (PHP, Apache)

3.4.2 MySQL

3.5 Real-time water quality database

Real-time water quality database has 2 systems; SCADA and web service. The Geo Broker uses XML file on those systems. It is installed as follows.

3.5.1 SCADA

3.5.2 Lampp (PHP, SQL)

The main page shows the base layer from the Google internet service and the MWA map service as background. In addition, it displays MWA service area and tap water quality monitoring station. The user can turn on/off on demand. The main display is composed of;

- 18 branches of MWA service area;
- 50 tap water quality monitoring stations with free residual chlorine;
- Search function which allows user to put some part of a place name into it. It supports both the Google service and the MWA service.

As for water quality, it displays according to coordinates. The system connects to SCADA, GIS, real-time water quality monitoring system and tap water quality database in order to display the data on a map (Fig. 3). The map shows at least 5 points of water quality near user location or the user defined area. Furthermore, turbidity is displayed as a symbol which changes automatically in accordance with its value and the residual chlorine is shown as a contour map. The other parameters can be displayed by clicking the turbidity symbol (Fig. 4).

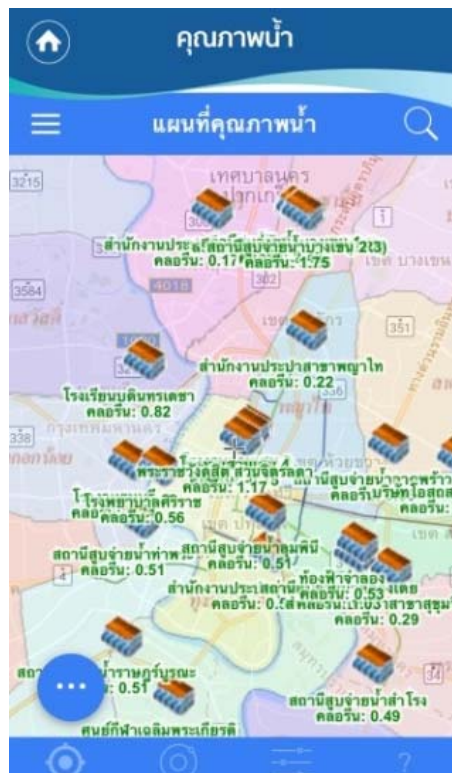


Figure 3: Main display of Water Quality on Your Click.

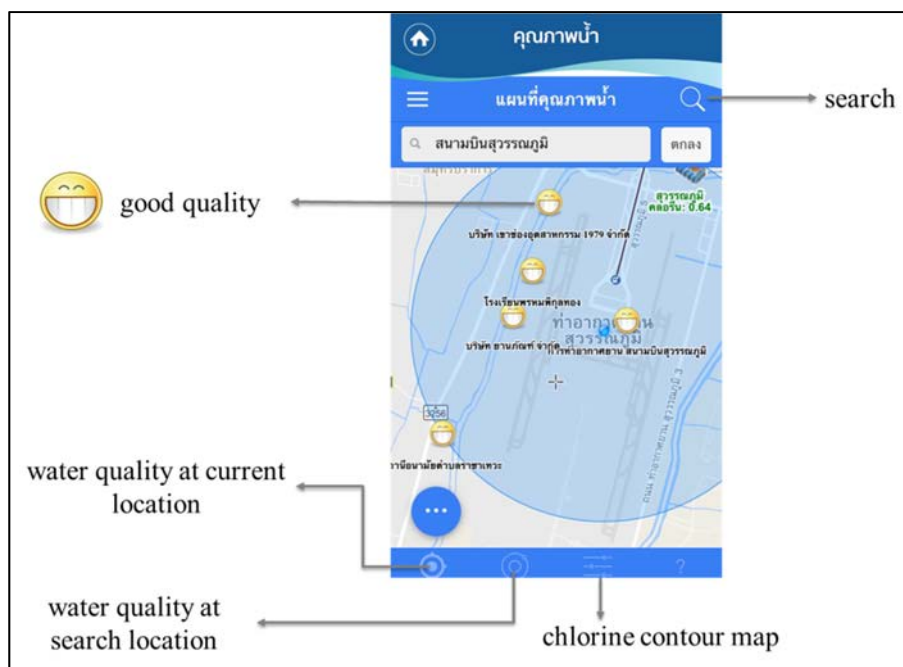


Figure 4: Water Quality on Your Click applications.

Water Quality on Your Click results from the development of MWA water integrated centre. It is more modern, easier accessible and simpler to understand than the old system. The consumers can easily access to the application via a website (<http://gisonline.mwa.co.th/wq/mobile/#/app/map>) and “MWA on Mobile” smartphone application which is already used. The improvement of water Quality on Your Click is information management to be concise data in one place. In the future, the application will continually develop to be the information centre that serves consumers 24/7. This leads to raise consumer confidence in water quality and satisfaction on MWA services according to MWA vision, “provide quality water for quality life”.

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