Spatial service delivery system for smart licensing & enforcement management

N A Wahap1*, N M Ismail2, N M Nor1,3, N Ahmad1, M F Omar1, A A A Termizi1, D Zainal1, N M Noordin2 and S Mansor3

1 Agensi Angkasa Negara (ANGKASA), Pusat Angkasa Negara, 42700 Banting, Selangor, Malaysia
2 Geoinfo Services Sdn. Bhd. 31, Jalan Bandar 2, Taman Melawati, 53100 Kuala Lumpur, Wilayah Persekutuan Kuala Lumpur, Malaysia
3 Geospatial Information Science Research Centre (GISRC), Fakulti Kejuruteraan, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

E-mail: azawani@angkasa.gov.my

Abstract. Spatial information has introduced a new sense of urgency for a better understanding of the public needs in term of what, when and where they need services and through which devices, platform or physical locations they need them. The objective of this project is to value-add existing license management process for business premises which comes under the responsibility of Local Authority (PBT). Manipulation of geospatial and tracing technology via mobile platform allows enforcement officers to work in real-time, use a standardized system, improve service delivery, and optimize operation management. This paper will augment the scope and capabilities of proposed concept namely, Smart Licensing/Enforcement Management (SLEm). It will review the current licensing and enforcement practice of selected PBT in comparison to the enhanced method. As a result, the new enhanced system is expected to offer a total solution for licensing/enforcement management whilst increasing efficiency and transparency for smart city management and governance.

1. Smart city administration and service delivery
Spatial information has introduced a new sense of urgency for a better understanding of the public needs in term of what, when and where they need services and through which devices, platform or physical locations they need them. It has grown in popularity among government agencies to have an existing system to be incorporated with the Global Positioning Systems (GPS) and Geographic Information Systems (GIS), which allows them to visualize and map the complex spatial relationship. Generally, the use of technology in the advanced delivery system at all levels will relate to tracking and tracing capability to induce mobility and efficient administration of a city [1]. Sensors for tracking and tracing are tools to determine the current and past locations and extensive information of a unique item or property.

Radio-frequency identification (RFID) is synonymous with track-and-trace solutions and has a critical role to play in supply chains [2]. RFID is a code-carrying technology and can be used in place of a barcode to enable non-line of sight-reading. Deployment of RFID was earlier inhibited by cost limitations but the usage is now increasing. RFID has been used for maintenance applications, such as
an escalator maintenance called London Underground Step Tracking System developed by CoreRFID to protect passengers and reduces the risk of travel disruption [3]. The benefits of RFID includes of less contact, non-line-of-sight identification of objects over long distances, bulk or mass identification, insensitivity of the transponder against moisture, dirt and abrasion; possibility to store information directly at the item, and the possibility to write new data to the chip of the transponder [4].

An excellent city administration provides efficient service delivery to its citizens and stimulates commercial sector in the era of a service-based economy [5]. A smart government service is informed about its city’s condition and is able to reach its citizens effectively. The Smart Licensing/Enforcement Management (SLEm) application objective is to value-add existing license management process for business premises which comes under the responsibility of Local Authority (PBT).

By manipulating geospatial technology, SLEm can improve manual processes of enforcement activity by utilizing satellite-related technology with the integration of various sensors and mobile platform. This application allows enforcement officers to work in real-time, use a standardized process which can simultaneously improve service delivery and optimize operation cost and time. This application was tailored to the requirement of the selected PBT and in parallel to the project objective. By adopting Information and Communications Technology (ICT), SLEm offers a smart functional service delivery system by reducing waste of resources, hence resulting in cost and energy savings.

2. Smart Licensing and Enforcement management (SLEm) system approach
In order to achieve the objective, a user requirements study was conducted to identify a fitting smart concept for selected PBT. Figure 1 summarised the methodology stages of user requirements study for this project.

Figure 1. Methodology stages of user requirement study.

Series of meetings and site visits were carried out and questionnaires were distributed during stage one, to identify PBT’s current services and to understand the technology readiness, governance and organizational factors within PBT. A process mapping and analyses was conducted in stage two, to identify the requirement of devices, software and data for development of the track-and-trace module for each PBT. Process of designing the conceptual workflow and spatial smart service delivery system were done in stage three.

2.1. User Requirement Analyses
Based on the assessment made from the user requirements study, a theme of a smart conceptual model was developed including the interoperability of systems and data-sharing platform. From the analyses, there are four main services provided by the selected six PBTs. The four services are the licensing and enforcement management, waste management, amenities and facilities management and public complaint. Table 1 shows the summary of PBT descriptions and findings.
Table 1. PBT descriptions and findings.

| PBT                                      | Theme/Focus                      | Functional Smart Related Project                                                                 | Future Plans                                                                                     | Conceptual Smart Services                          |
|------------------------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------|
| Johor Bahru Municipal Council (MBJB)     | A City of International Standard by 2020 | Licensing to cater ISO 14001 for Low Carbon Society (under IRDA)                                       | Environment Management                                                                         | Smart Complaint                                    |
|                                          |                                  | Waste Management                                                                                  | Crime/disaster prevention and Social Management (crime hot spot).                                | Smart Licensing/Enforcement Management             |
|                                          |                                  | APK System                                                                                        |                                                                                                   |                                                   |
|                                          |                                  | e-COMPLAINT                                                                                       |                                                                                                   |                                                   |
|                                          |                                  | Tax System                                                                                        |                                                                                                   |                                                   |
| Melaka Historic City Council (MBMB)      | Focus: Green Technology City     | Real-time traffic control: CCTV/Real-Time Detection                                                | Traffic Management System                                                                        | Smart Complaint                                    |
|                                          | Theme: Melaka Historic City      | Speed Monitoring                                                                                  | Environment Management                                                                         | Smart Amenities/Facilities Management             |
|                                          |                                  | Traffic Information: LED MITCH                                                                    | Crime/disaster prevention.                                                                       |                                                   |
|                                          |                                  | IMap Melaka: Mineral piping BKI                                                                   |                                                                                                   |                                                   |
|                                          |                                  | Environment: Better Air Quality (BAQ)                                                             |                                                                                                   |                                                   |
|                                          |                                  | Air Pollutant Index                                                                               |                                                                                                   |                                                   |
|                                          |                                  | Scheduled Waste, Domestic Trash: PPSPPA                                                           |                                                                                                   |                                                   |
| Sepang Municipal Council (MPS)           | Green Environment, Green Energy, Bandar Selamat                                                  | OSC Online                                                                                        | GIS Based Waste Management System                                                                | Smart Complaint                                    |
|                                          |                                  | Compound System                                                                                   | GIS Based Complaint Management System for SJLR                                                   | Smart Waste Management                            |
|                                          |                                  | Assessment Tax System                                                                            |                                                                                                   |                                                   |
|                                          |                                  | Sistem Penerimaan Hasil                                                                           |                                                                                                   |                                                   |
|                                          |                                  | E-Complaint                                                                                       |                                                                                                   |                                                   |
|                                          |                                  | EIS & GIS Data Integration                                                                        |                                                                                                   |                                                   |
|                                          |                                  | GIS Data Management (offline – Map Info) Planning Department provides info to other departments. |                                                                                                   |                                                   |
|                                          |                                  | Crime Mapping (collaboration with PDRM)                                                           |                                                                                                   |                                                   |
| Langkawi Municipal Council (MPL)         | Langkawi City of Tourism          | GIS Data Management (offline – Map Info): not integrated and standalone.                          | Environment Management: Waste Management                                                          | Smart Complaint                                    |
|                                          |                                  | e-PBT                                                                                             | Crime/Disaster Prevention: Safe City                                                            | Smart Amenities/Facilities Management             |
|                                          |                                  | OSC Online                                                                                       | Facilities Management (Licensing): Mobile Workforce Management System.                           |                                                   |
|                                          |                                  | i-Plan (Land & Property)                                                                          |                                                                                                   |                                                   |
| Pekan District Council (MDP)             | Development Towards Vision 2020 | i-Plan                                                                                           | Facilities Management – GIS Based Licensing Monitoring System                                   | Smart Complaint                                    |
|                                          |                                  |                                                                                                   | Location based e-Aduan.                                                                          | Smart Licensing/Enforcement Management            |
| Kuala Langat District Council (MDKL)     |                                  | Sistem Aduan Rakyat Selangor (STARS)                                                              | Location based e-Aduan.                                                                          | Smart Complaint                                    |
|                                          |                                  |                                                                                                   | Contractor Management System.                                                                     | Smart Waste Management                            |

2.2. Licensing activity and workflow

Based on the assessment, Johor Bahru Municipal Council (MBJB) was elected to be the case study for this paper. The prototype development started by reviewing the current work practice of the Licensing and Enforcement Department for Business and Advertisement Premise Licensing in MBJB, followed by the development of enhanced workflow and the conceptual design of the track-and-trace module. Finally, a general system architecture of SLEm was designed based on the hardware and software
requirement and database design infrastructure. Figure 2 shows the current process workflow for licensing and enforcement activity of MBJB.

![Figure 2. Current process workflow for licensing and enforcement activity of MBJB.](image)

The workflow requires the enforcement officers to do an inspection in the premises of their task with a printed hardcopy of registered premises. On the site, enforcement officers will check premises license status and the license compliance with the registered license. This workflow allows enforcement officers to issue a compound letter and confiscation report if needed. All findings will be reported and submitted to the main office afterwards. The desk officers will update the system based on the reports from the enforcement officers.

3. Conceptual workflow & design

SLEm was designed with the consideration of having licensing and enforcement activity by using mobile devices with embedded Location Based Services (LBS) and RFID tracing capability. It promotes an efficient solution which provides a total mobility and real-time connectivity between the enforcement officers and the main office.

3.1. Conceptual workflow

This conceptual workflow was developed to tackle issues highlighted by MBJB regarding premise licensing and enforcement activity which fulfill the needs:

i. to monitor license status (premise license registration and renewal and its compliance with the registered license)
ii. to monitor licensing and enforcement officers on site
iii. to have an online reporting and submission hence avoiding missing reports
iv. to manage complaint effectively

By using SLEm, the enforcement officers can track and locate premises of his task by using map tracking. All information of premises will be stored in a spatial database so it can be presented in web-GIS applications. Therefore, enforcement officers can easily locate premises location as the premises were already been marked on the map. Figure 3 shows the conceptual flow of SLEm Application.
3.2. Conceptual system design
The system prototype comprises of the following components: Users, GPS service, operation, GSM/GPRS, SQL database, application server and Google map server. The user were citizens/premise owners, staffs (enforcement officers) and local authority (supervisor, management team). The sensor and satellite technology were incorporated in the track-and-trace module to locate and track the enforcement officers and licensed premises. Figure 4 demonstrates the conceptual system design for SLEm application.

i. Local Authority (PBT): Local authority is responsible for management of licensing, monitoring staff, and managing complaint and feedback from citizen

ii. Staff (Enforcement officers): Staff is local authority staffs who is responsible for monitoring premise licensing status in his authority
iii. Premise Owner: Premise owner is the building owner or license holder that registered under local authority
iv. Citizen: Citizen refers to public citizen that resides in the city

4. Spatial service delivery elements
The most important aspect of SLEm was the integration of the tracking and tracing technology in a mobile platform. SLEm presented an end-to-end concept in a comprehensible spatial representation of a map viewing via the web-GIS application of its three major components which are not being emphasized by other developers as observed in the study. Table 2 summarises the key element to support SLEm Application.

Table 2. Summary of the key element of SLEm Application.

| Actor                  | Spatial Element                                                                 | Instrument/Sensor               | Smarter Element                                                   |
|------------------------|---------------------------------------------------------------------------------|----------------------------------|-------------------------------------------------------------------|
| Management Supervisor  | Map: Geographic interface for viewing, analysing, and managing the complaint. Location Based Services (LBS) | PC, Laptop                       | • Multiple task delegation                                       |
|                        |                                                                                  |                                  | • Real-time monitoring map                                        |
|                        |                                                                                  |                                  | • Analyses and report                                             |
| Premise Owner Citizen  | Map: Geographic interface for Location Based Services (LBS)                      | PC, Laptop, Smart Phone, Tab     | • Online license renewal                                         |
|                        |                                                                                  |                                  | • Online license status                                          |
|                        |                                                                                  |                                  | • Online suggestion, complaint and feedback list                  |
| Enforcement Officers   | Map: Geographic interface for viewing the problem. Location Based Services (LBS) for Navigation: urgent corrective complaint about navigation | Smart Phone, Tab, RFID A-GPS, M-GNSS | • Locating premise location on map                                |
|                        |                                                                                  |                                  | • Tracing premise information                                    |
|                        |                                                                                  |                                  | • Automation of complaint notification                           |
|                        |                                                                                  |                                  | • Generating & submitting of report to PBT                       |

5. Conclusions
The objective of SLEm is to value-add existing license management process for business premises which comes under the responsibility of PBT. In this study, MBJB licensing and enforcement activity was reviewed and enhanced. By manipulating geospatial technology and RFID sensors via mobile devices, SLEm application has provided the PBT with a platform to work in mobile and real-time mode to improve the service delivery by optimizing operation time and cost. The new spatial smart service delivery system is expected to offer a total solution for licensing/enforcement management whilst increasing efficiency and transparency for smart city management and governance. By focusing on automation, the application is limiting human errors in data collection and reporting hence monitoring and decision making is made easy for the local authority.

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