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University of Moratuwa
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**Abbreviations**

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<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESMIS</td>
<td>Environmental Sanitation Management Information System</td>
</tr>
<tr>
<td>LA</td>
<td>Local Authority</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographical Information System</td>
</tr>
<tr>
<td>UoM</td>
<td>University of Moratuwa</td>
</tr>
<tr>
<td>MC</td>
<td>Municipal Council</td>
</tr>
<tr>
<td>QGIS</td>
<td>Quantum Geographical Information System</td>
</tr>
<tr>
<td>SLT</td>
<td>Sri Lanka Telecom</td>
</tr>
<tr>
<td>GPS</td>
<td>Geographical Positioning System</td>
</tr>
<tr>
<td>K-Hub</td>
<td>Knowledge Hub</td>
</tr>
</tbody>
</table>
1. **What is an ESMIS?**

Environmental Sanitation Management Information System (ESMIS) is a web-based information management system, through which most of the existing environmental sanitation and development information related to the services provided by the Local Authorities (LAs) is included. The proposed ESMIS is expected to provide a tri-partied interactive base for the system operators, and activity managers (officials of the LA) and the service receivers (citizens) of the selected LA areas. The information will be provided, retrieved, updated and verified by both the service providers and the receivers.

In the Initial stage, the system will be developed as a Geographic Information System (GIS) database which will include basically the road inventory of the pilot area.

![Figure 1: Conceptual diagram of how ESMIS works](image)

This system inherits the capacity of upgrading it as a more comprehensive system with the advancement and improvement of the capacities of the institution. Accordingly, the system will provide the facilities for online transactions, reservations of facilities, e-voting, etc…

As per the figure 1, the local authority system in Sri Lanka has manual system where the preparedness for having a digital information system for local authorities is lacking due to insufficient capacity in terms of knowledge, financing and willingness among the many other reasons.
2. Who are the partners and their roles in preparation of ESMIS?

There are four key partners for developing the ESMIS. The close interaction between these parties including the fifth party (other third party institutions) will enable the smooth implementation of ESMIS.

<table>
<thead>
<tr>
<th>No</th>
<th>Partners</th>
<th>Roles</th>
</tr>
</thead>
</table>
| 01 | University of Moratuwa (UoM) | - Development of ESMIS  
- Test Run of the ESMIS  
- Training the LA staff for the using and maintaining the ESMIS  
- Troubleshooting and  
- Assist to Maintenance of ESMIS |
| 02 | Ministry of Urban Development, Water Supply and Drainage | - Peer review and giving feedbacks/ comments |
| 03 | Urban Development Authority | - Peer review and giving feedbacks/ comments  
- Implementation of ESMIS in collaboration with the University of Moratuwa |
| 04 | Gampaha and Moratuwa Municipal Councils | - Assist the UoM team by providing available information  
- Appointment of a working group to assist the developing of the ESMIS  
- Allocation of resources for the implementation of ESMIS  
- Implementation of ESMIS  
- Maintaining the ESMIS |
| 05 | Other third party institutions | - Assist the UoM team and Municipal Councils (MCs) by providing available information  
- Peer review and giving feedbacks/ comments |
### 3. **What are the key components?**

The following are the integral parts that should be there to develop the ESMIS.

<table>
<thead>
<tr>
<th>01</th>
<th>Software</th>
<th>GIS Interface</th>
<th>Quantum GIS (QGIS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Web Interface</td>
<td>OpenLayers, Geo Server, Ubuntu Server</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Database Development</td>
<td>SQL, HTML, PHP</td>
</tr>
<tr>
<td>02</td>
<td>Hardware</td>
<td>Web Server</td>
<td>Sri Lanka Telecom(SLT) server Space</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Personal Computers</td>
<td>Computers with internet connection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mobiles/ Tablets</td>
<td>The access to update and refer to the ESMIS will be configured</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GPS/Smart Phones</td>
<td>Data collection devices</td>
</tr>
</tbody>
</table>
| 03 | Data | GIS Layers | - Polylines (roads, waterways, distribution lines, drainages, etc…)
| | | | - Polygons (land use, building footprints, zones, administrative boundaries, etc…)
| | | | - Points (solid waste collection locations, dumping sites, places of public interest, etc…)
| | | Image Data | - Satellite images (04 bands/ 08 bands)
| | | | - Google images (03 bands)
| | | | - Arial photographs
| | | | - 1:10,000 survey maps
| | | Photographs | Geo-tagged photographs |
| | | Other data layers prepared in the different software | SQL databases
| | | | AutoCAD Layers (maps) |
| 04 | Human resources | Trained Technical Officers of MCs | As key persons to carry out further developments and maintenance work of the ESMIS |
| | | Trained focus group of people among general public | To aware others about the system and to update data |
4. Present Situation of Local Authorities and Project Approach

Although both local authorities have identified the need of having a comprehensive citizen’s information system, none of them has no proper information system other than piece by piece works undertaken by local authority and under different government projects. Most of the local authority information available in the manual ledgers in tabular form and some information only available in the minds of officers who handle the particular subject.

**Moratuwa MC:** There is no computerized information system at Moratuwa MC. There was a website for Moratuwa MC, but it is not functioning at the present.

**Gampaha MC:** Street map with road names and widths available; a computerized tax collection system is available.

Accordingly, the Sri Lankan K-Hub team developed a flexible approach to develop ESMIS for Moratuwa and Gampaha Municipal Councils.

4.1. Consultation Meetings

A series of consultation meetings with the local authority officers and politicians including the Mayors, Council Members, Commissioners, Municipal Engineers, Technical Officers were carried out in both local authorities (Figure 2).

As a product of those consulting meetings, working groups were formed in order to ease the project activities within the LAs.

*Figure 2:* Caption of a consultative meeting held at Gampaha MC

An introductory presentation made at the first consultative meeting is attached in the annex 1.
4.2. Training of Local Authority Staff

Five (05) number of local authority officers who were nominated from municipalities were selected for a basic GIS training. Accordingly, introductory and essential training that required for ESMIS preparation process was designed. Initially the training was conducted at the municipal council premises, but the attempt was not fully succeeded. Hence, in house workshop for both municipal councils was proposed. The QGIS training manual is provided in the annex 2.

4.3. Lessons Learnt

a. When fixing the dates for consulting meeting with government offices specially with the local authorities, it is more efficient to select a date other than Wednesday since it is the public day.

b. It is always needed to contact high ranking officers at the institution to introduce and implement the project activities since the blessing of the politicians and administrators are the lubricant for smooth project implementation.

c. Each and every officer at the institution have their own duties and responsibilities. This project work is additional work for them. Hence, it is not possible to expect full time engagement of any of the officer for this kind of research work. Hence, Motivation of local authority staff for the project activities is essential. Honorarium payments, study tours or visits, in house workshops can be used as means of motivation.

d. Team has to take precautions to fulfil the aspirations of both politicians and administrators in the LAs who have their own interest within the institution.
5. The ESMIS development process

- **Collection of Available Data from LA**
- **Identifying lacking information in the field of sanitation**
- **Awareness workshop with LA offices regarding information and data collection**
- **Preparation of Base map for the ESMIS**
- **Preparation of field survey sheets and other required documents**
- **Collect equipment and tools for data collection**
- **Initial field visit to selected pilot area**
- **Data sorting and preparation**
  - Spatial Data to be prepared as shape files in QGIS
  - Tabular Data enter Spread Sheets and attribute tables
  - Secondary Data enter into Spread Sheets
- **Upload to web server**
- **Spatial Database**

**Figure 3**: ESMIS development process
5.1. Data Collection

A Survey team consisting of trained Technical Officers from the Municipal Councils monitored by the university staff will be sent to the field with necessary equipment for data collection. Data will be recorded in a specific format as the team is trained to collect the data in an effective way to be stored in a database. Team will aware about data types and database before they go to the field. At the end of every day GPX data in the GPS Handheld receiver and photographs in Digital camera will be copied to laptop computer and saved inside separate folders named using GPS/Digital camera unique code and date.

Equipment/Tools

- Geographical Positioning System (GPS) Handheld Receiver(Unique code will be given to each receiver)
- Laptop Computer
- Digital Camera(Unique code will be given to each camera)
- Field data collection sheets
- Location map with approximate project locations

The initial data collection covers only sample areas in both LA’s whereas the Sri Lankan K-Hub team expects the transfer of knowledge to the local authorities to continue the task on their own with improved capacity of the staff in the long run.

Figure 4: A field survey map
A most recent satellite images for both local authorities were purchased and the buildings and roads were digitized in order to prepare field survey maps. Accordingly, base maps were prepared with buildings and roads as shown in figure 4.

Two types of inventory forms were prepared in order to collect road and building information at the field (see annex 3 and 4).

5.2. GIS Data

Following GIS data will be collected from the field

<table>
<thead>
<tr>
<th>Structure</th>
<th>Geometry</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road section of a main</td>
<td>Point</td>
<td>Mark GPS position of starting point of the main road (Road Inventory form –Start Way point No).</td>
</tr>
<tr>
<td>road</td>
<td>Line</td>
<td>Start GPS track and continue till the end of the road section and record Track No (Road Inventory Form-Track No)</td>
</tr>
<tr>
<td></td>
<td>Point</td>
<td>Mark GPS position of end point of the main road and record Waypoint No (Road Inventory form –End Way Point No).</td>
</tr>
<tr>
<td>Road section of by roads</td>
<td>Point</td>
<td>Mark GPS position of starting point from the main road (Road Inventory form –Start Way point No referencing to the track no of the main road).</td>
</tr>
<tr>
<td></td>
<td>Line</td>
<td>Start GPS track and continue till the end of the by road section and record Track No (Road Inventory Form-Track No)</td>
</tr>
<tr>
<td></td>
<td>Point</td>
<td>Mark GPS position of end of the road section and record Waypoint No (Road Inventory form –End Way Point No).</td>
</tr>
<tr>
<td>Bridge</td>
<td>Point</td>
<td>Mark GPS position of the Approach point of the Bridge and record Way point No (Bridge Inventory form-Approach Way Point No)</td>
</tr>
<tr>
<td></td>
<td>Point</td>
<td>Mark GPS position of the Departure point of the Bridge and record Way point No (Bridge Inventory form-Departure Way point no)</td>
</tr>
<tr>
<td>Culvert</td>
<td>Point</td>
<td>Mark GPS position of the center point of the Culvert and record Way point No (Culvert Inventory form-Way point no)</td>
</tr>
</tbody>
</table>

5.3. Map data

Points, polygons, poly lines are the features of shape files that will be used as map data. Downloaded Google images, 3 band aerial photographs from Google or updated multi spectral satellite images, geo-tagged photographs are included in the database as base
maps according to different purposes. Output map types will be in .shp format and it will be converted into different other formats according to the requirements.

5.4. Database development

Collected spatial and other data will enter using different software packages and converted into various formats in order to create interactive maps. Q-GIS platform will be used to enter spatial data and create maps. Non spatial data will be entered to the database using Spread Sheets, MySQL etc.. For this purpose, few members from LA will be given a training by the staff of the University of Moratuwa and in the first phase it will be monitored by the university staff.

All the citizens are eligible to retrieve data from the system but there will be authorized people who can only enter and edit data.

LA officers can log into system and they are authorized to prepare maps and use information for different purposes and if they have legal powers they can share those thematic information with general public. There will be two different user interfaces for these users as login pages.

User can load different shape files such as roads, buildings, land use etc(figure-3.) Once the layers are loaded in to the interface it looks like as follows (figure-4).

Figure 5: Available shape files list
6. **How it works?**

System includes a sever consists of large number of data which will act as a bridge to link the public and municipal officers. In the user's end they will connect with the server via Web Interface or a Mobile App. Users can feed data if they are authorized and all citizens can refer information back. Online transactions for tax payments will also expected to include into the system in further steps. Different ways citizens can access the information is divided into four major categories; Interactive Map, Application Forms, Payment Gateway and Complaints/ Inquiries/ Suggestions.

There should be a separate server for installed and maintained for this and first proposal is to obtain a server space from University server and to maintain it by university staff since it is easy for the team to handle when it is installed within the university. The other option is to reserving a server space from SLT (Sri Lanka Telecom) Server system and annual fee will be paid for them for maintenance. Considering the convenience and effectiveness second option is selected after having a discussion with LA staff.

Server consists of spatial data stored in the database. This spatial database will be maintained using QGIS and MySQL.

Data that users feed will refer, updated and analyzed by the municipal officers. It will also be dome through the same user interface (Web Interface or a Mobile App). They will use spatial data in the database for map preparation using different analysis tools for required purposes.
### 7. Implementation

#### 7.1. Test run and troubleshooting
Formulation of the ESMIS is carrying out by the staff of University of Moratuwa with the feedback of the stakeholder working group of municipalities. After the formulation, a test run will be carried out at the end of August to a period of two months. Feedback from the stakeholders and troubleshooting will be noted and the system will be developed accordingly.

#### 7.2. Maintenance and Monitoring
- As the server space will be provided by a network provider, an annual rental will be paid by the local authorities for the continuation of the system.
- A simultaneous and intermittent training will be provided for the local authority staffs who are engaged with data entering, validating and system updating by the staff of University Moratuwa.
- Maintenance of the system will be carried out by the University of Moratuwa at the initial stage where the local authority staff will be trained for the long term maintenance.
- The ESMIS will be monitored periodically by the Urban Development Authority and the University of Moratuwa.

8. User manual

User manual for the ESMIS is guidance, generally for municipal council officers to use the system at the first stage. This will helpful to enter and update data in this stage.

Two target groups of officers from MCs will be identified; first group as general users of the system for data entering and updating, second group as the officers with good technical knowledge and, officers with web and programming based knowledge. Hence there are two types of user manuals for two groups. The first user training manual (annex 5) gives the guidance for ESMIS interface, Features and functions. The second user training manual (annex 6) is expected to be introduced for the second target group of officers after handing over the entire system to the MC in order to maintain it and to give a comprehensive knowledge on how the system has developed, how to customize it according to their changing requirements and regarding troubleshooting.
Annexure

Annex 1: Introductory presentation for ESMIS for Local Authorities

Urban Knowledge Hub Sri Lanka

Department of Town & Country Planning
University of Moratuwa

Introduction – South Asia Urban Knowledge Hub

Aim
- To increase the influence of evidence-based advocacy for urban policy and practice in South Asia.

Objectives
- The main objective of the K-Hub is to build capacity to generate and apply knowledge to city management according to principles of sustainable development and to influence policy and decision-makers in this direction.

- K-Hub activities will facilitate sharing of best practices in urban management, infrastructure and services delivery in South Asia and other regions; and develop capacity for outcome-oriented research in the urban sector.
Although Sri Lanka has met with targets of sanitation, commitment is needed to meet universal targets.

Due to lack of effective technologies and improper selection of technologies and faulty designs, pollution occurring due to improper collection and disposal of sewage is alarming.

Most of the sanitation issues can be identified as an outcome of the limited capacities of the local authorities in planning and implementation.

Several needs have been identified including a mechanism for local authorities to measure the effectiveness of the technology option in terms of level of treatment and method of effluent disposal; and local authorities need capacity building in proper evaluation of sanitation standards, guidelines and designs.
Therefore, the Sri Lanka National Centre proposes to initiate a programme to support local authorities to have improved capacities for development planning and service delivery in the area of environmental sanitation and physical development.

**Goal and Impact**

**Goal**
- Improved service delivery in the area of environmental sanitation in Moratuwa and Kandy Municipal Council areas of Sri Lanka by the year 2020.

**Impact**
- All residents of Moratuwa and Kandy Municipal Councils get access to improved environmental sanitation services by the year 2020.
Objectives

Objective 1
- To influence the selected two Municipal Councils (Moratuwa and Kandy) to employ the newly developed Environmental Sanitation Management Information System (ESMIS) for their planning, development and environment management activities by 2017

Objective 2
- To support the Moratuwa and Kandy Municipal Councils to enhance their capacities in Strategic Planning and Implementation by 2016

Performance Targets

Objective 1
- KP1: Model on Environmental Sanitation Management Information Systems (ESMIS) (30 April 2015)
- Policy Brief on transformation into information technology based local authority information management policy (30 June 2015)
- Technical Brief for policy makers on adopting sustainable sanitation practices (communicating user manual) (September 2016)
- Case study 1 on EMS at Sri Kotte- Sri Jayawardenapura MC and on the best practices of Environmental Management Systems in K-Hub and other countries (01 December 2014)
- Case study 2 on how ESMIS is improving the Municipal Council in their decision making (October 2015- March 2016)
Performance Targets

**Objective 2**
- KP3 - Sector specific recommendations on plan preparation and implementation *(30 May 2016)*
- Policy Brief on relevance and use of plan preparation and implementation *(July - September 2016)*
- Twinning partnership completion report on best practices of two MCs *(December 2016)*

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**Environmental Sanitation Management Information System (ESMIS)**

Urban Development Authority
Moratuwa Municipal Council
Gampaha Municipal Council

Department of Town & Country Planning
University of Moratuwa
**Project Brief**

**Objective 1**

To influence the selected two Municipal Councils (Moratuwa and Kandy) to employ the newly developed Environmental Sanitation Management Information System (ESMIS) by 2017.

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**Project Brief**

University of Moratuwa is involved to improve service delivery in the area of environmental sanitation in Moratuwa and Kandy Municipal Council areas by the year 2020 with collaboration of Asian Development Bank.

**Key Partners:**
- University of Moratuwa
- Ministry of Defense and Urban Development
- Urban Development Authority
- Local Authorities
- Divisional Secretariat
- Sri Lanka Institute of Local Governance
- Mayors Forum
- Chamber of Commerce
Project Brief

Ultimate Product of the project

A web-based Environmental Sanitation Management Information System (ESMIS) - Most of the existing environmental sanitation and development information related to the services provided by the local authority could be accessed and monitored.

Rationale

- Management of water, solid waste, and industrial waste, as well as the pollution control is regarded as environmental sanitation. It is a fundamental requirement to all citizens and increased coverage of this essential service will significantly contribute to population welfare as well as to improve the quality of life.

- Economic return on sanitation projects are highly favorable as the cost of impact resulting from poor sanitation and hygiene reflects the adverse health effects associated with poor sanitation, cost on treating health issues, loss of productivity results due to poor health condition, adverse impacts on the environment of the country etc.

- At present sanitation related issues such as solid waste management, provision of proper drainage systems etc. has reached up to an alarming stage.
Rationale

- As the sanitation issues are outcomes of limitations in planning, implementation, and capacities of the local authorities, a holistic approach with a range of interventions and a long-term programme is needed that covers the entire island.

- Reliable and accurate information is a crucial factor in the field of planning and management.

- The problem is; to determine what type of data and information is required for the purpose in hand; to find out if it exists and where; how to get hold of it if it exists and how to collect it if it does not; how to store this information in easily accessible and referenced form; how to interpret the data, contradictions and incompleteness; to determine who needs the information, when and in what form(s).

- Development of a web-based Environmental Sanitation Management Information System (ESMIS) is helpful as information could be accessed and be monitored. It gives easy access to all relevant information for managing, operating and optimizing in the field of sanitation management of the municipality.

Methodology

1. Conceptualization
   1.a Development of Draft framework of the ESMIS.
   1.b Stakeholder Meetings
   1.c Development of the ESMIS infrastructure.

2. Actualization
   2.a Forming Working Groups
   2.b Training for the working groups on handling of the ESMIS
   2.c Monthly Meeting of working groups and the Project Team
   2.d Updating the ESMIS

3. Institutionalization
   3.1 GIS training on map preparation GIS database management
   3.2 Influencing the LAs to use the ESMIS
   3.3 Incorporating the ESMIS into MC annual budgets
Benefits

- Web-based information system which gives easy access to all relevant information for managing, operating and optimizing.
- Valuable tool for operating as well as managing collection, treatment and disposal information.
- Possible to obtain the water supply and sanitation coverage very accurately corresponding to relevant GND, District, Local Authority, and Province and finally for entire country as a whole to all sector partners.
- Helpful to identify areas where there is a lack of water supply as well as sanitation facilities.
- Can be integrated with other service providers such as revenue collection, statistical data, management.
- Improve public participation
- Capacity building for officers at local authorities.

How the ESMIS Works ???
Environmental Sanitation Management Information System (ESMIS)

Septage Management
- Household wise Septic facilities
- Public Toilet Facilities

Solid Waste Management
- Waste Collecting: Date/Time Schedule
- Waste Collecting: Route
- Dumping Sites/Collection Centers

ESMIS
- Public Information
- Waste Collection
- Existing Projects
Waste Collection Centers

<table>
<thead>
<tr>
<th>Venue</th>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wenu</td>
<td>Wednesday</td>
<td>6.45 a.m.</td>
</tr>
</tbody>
</table>

Collection Centers
- Monday
- Tuesday
- Wednesday
- Thursday
- Friday
- Dumping Site
Waste Collection Route
## Existing Drainage Projects

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Completion Date</th>
<th>Funding Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 1</td>
<td>04/03/2001</td>
<td>xxxx</td>
</tr>
<tr>
<td>Project 2</td>
<td>28/08/2004</td>
<td>xxxx</td>
</tr>
<tr>
<td>Project 3</td>
<td>30/04/2005</td>
<td>xxxx</td>
</tr>
<tr>
<td>Project 4</td>
<td>18/11/2009</td>
<td>xxxx</td>
</tr>
<tr>
<td>Project 5</td>
<td>05/03/2011</td>
<td>xxxx</td>
</tr>
<tr>
<td>Project 6</td>
<td>24/06/2014</td>
<td>xxxx</td>
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</tbody>
</table>