Date of Submission	31 March 2021

IPL Project (IPL - 227) Annual Report Form 2021

1 January 2019 to 31 December 2020

1. **Project Number (approved year) and Title**,

   (IPL-227 (2017), Title: Development of a web based landslide information system for the landslides in Sri Lanka

2. **Main Project Fields**: Technology Development (database and hazard assessment)

3. **Name of Project leader:**

   Eng. K. M. Weerasinghe, B.Sc. (Civil Engineering), M.Sc. (Geotechnical Engineering)

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   Core members of the Project: Names/Affiliations: (4 individuals maximum)

   Ms. J. M. K. Herath; B.Sc. (Geology Special), M.Sc. (Water Resources Management)/Engineering Geologist (CECB)

   Mr. K. B. Attapattu – B.Sc (Town and Country Planning)/Planner (CECB)

   Mr. A. A. Virajh Dias – B.Sc(Civil Eng); CEng, PG.Dip; MASCE,MIESL/ AGM (CECB)

4. **Objectives:** The objective of this research is to develop a web based database on landslides for Sri Lanka by collecting information through online tools such as 'Google alert' (https:/www.google.com/alerts), other available databases (www.desinventar.lk) and field verification, and organizing the data in an user friendly manner.

5. **Study Area:** Mountainous area of Sri Lanka covering the Central, Sabaragamuwa, Uva, Western and Southern administrative provinces.

6. **Project Duration**: Three years (September 2017 –August 2020)

7. **Report**

   7.1 Progress in the Project

Year 2019

Data collection: Data on past landslides were successfully collected through online tools, other digital and printed media, and technical reports. Collected data were organized into data tables for input into the database.

Designing backend database architecture on a Mysql server:

Considering the requirements of the potential users, both the back and front ends of the LIS were designed as per the use case diagrams shown in the Figure 1.
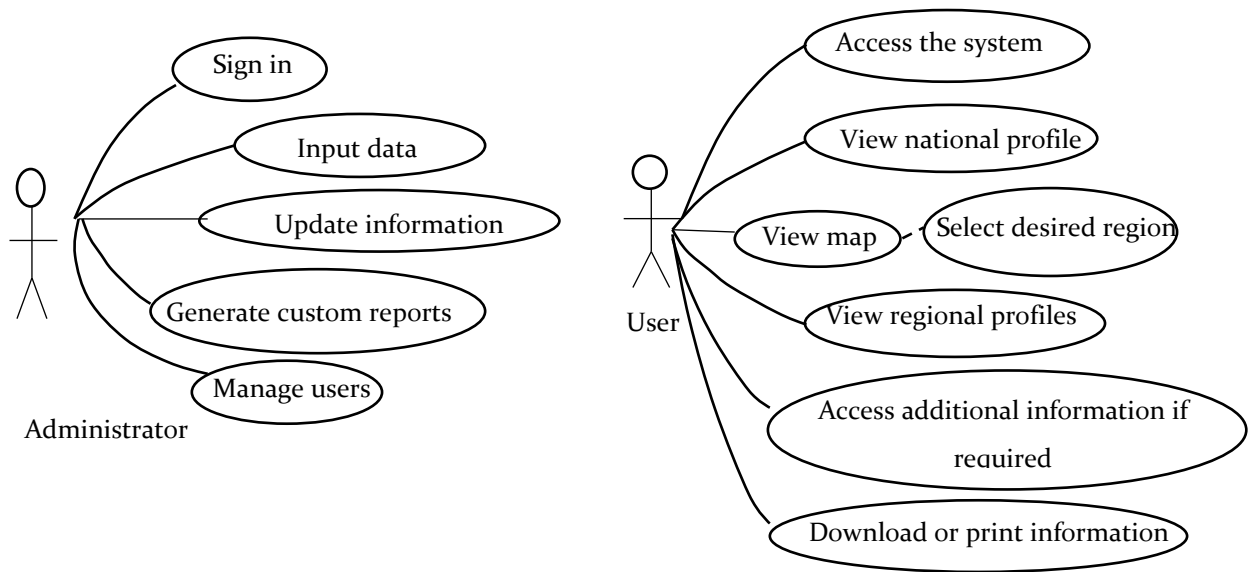

Figure 1: Use case diagrams for the design of LIS

Data were stored in relational tables avoiding redundancies. Each landslide was assigned a unique identification number (ID) (Figure 2), and a calling name for minimizing ambiguities about the information retrieved on landslides occurred in the same village and/or very close to each other. The type of landslide, i.e. whether it is a landslide, rockfall, debris flow, cut slope failure etc, have also been input into the respective tables (Figure 2 and Figure 3).

Where available, the location information of landslides have been stored in the form of Latitude and Longitude. Information on Sri Lankan administrative units where the landslides were located have also been input and linked with the landslide data. The location of landslides in a particular administrative district (Figure 4) were input into the google map and linked to LIS for user's viewing (Figure 5).

Ls_id	Landslide	Dist_id	DS_id	GND_id	Type_id
24178150001	Hapugoda	24	178	150	1
3031135001	Pahiyangala (Jayalathgoda)	3	31	135	1
3031145001	Thibbottawakanda	3	31	145	1
3039146001	Diganna	3	39	146	1
3039140001	Athwelthota	3	39	140	1
3039140002	Murapolawatta	3	39	140	4
3039140003	Morapitiya	3	39	140	4
3039005001	Kosgulana (twin slides)	3	39	5	1
24177086001	Munhinkanda	24	177	86	1
3031205001	Morawakakanda	3	31	205	1
3039085001	Mawathawaththa	3	39	85	1
3031065001	Kobawaka (in Kobowila estate)	3	31	65	1
3031105001	Bambarakele kanda	3	31	105	2
3031105002	Galketikanda	3	31	105	1
3031135001	Dematapitiya	3	31	135	1
3031180001	Bogahawatta (Delpawatta)	3	31	180	1
3031235001	Gallaka (Weyangalla)	3	31	235	1
3040170001	Weerakanda	3	40	170	1

Figure 2: Relational data table on landslides

Type_id	Ls_Type
1	Landslide
2	Rock fall
3	Debris flow
4	Cut/Fill slope failure
5	Subsidence

Figure 3: Relational data table on landslide types

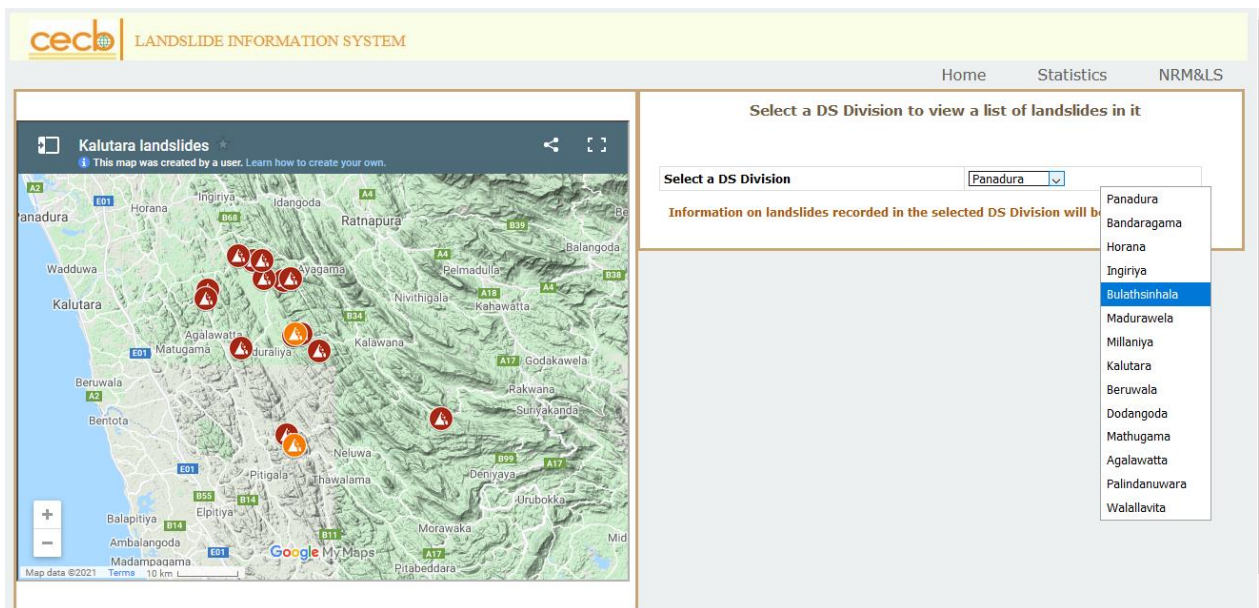| DS_id	Dist_id	Provincial_code	District_code	DS_code	DSD
51	4	2	1	33	Harispattuwa
52	4	2	1	34	Hatharaliyadda
53	4	2	1	36	Yatinuwara
54	4	2	1	39	Udunuwara
55	4	2	1	42	Doluwa
56	4	2	1	45	Pathahewaheta
57	4	2	1	48	Delthota
58	4	2	1	51	Udapalatha
59	4	2	1	54	Ganga Ihala Korale

Figure 4: Relational data table on DSD Divisions

Figure 5: Locations of landslides linked to a google map

Designing front end (user interface) of the Information System:

The home page of the LIS shows a map of Sri Lanka in which the landslide prone districts have been highlighted. The country profile and the district profiles of past landslides are also shown on this first page for a quick glance (Figure 6). The users can access district level information by clicking on a desired landslide prone district on the map.
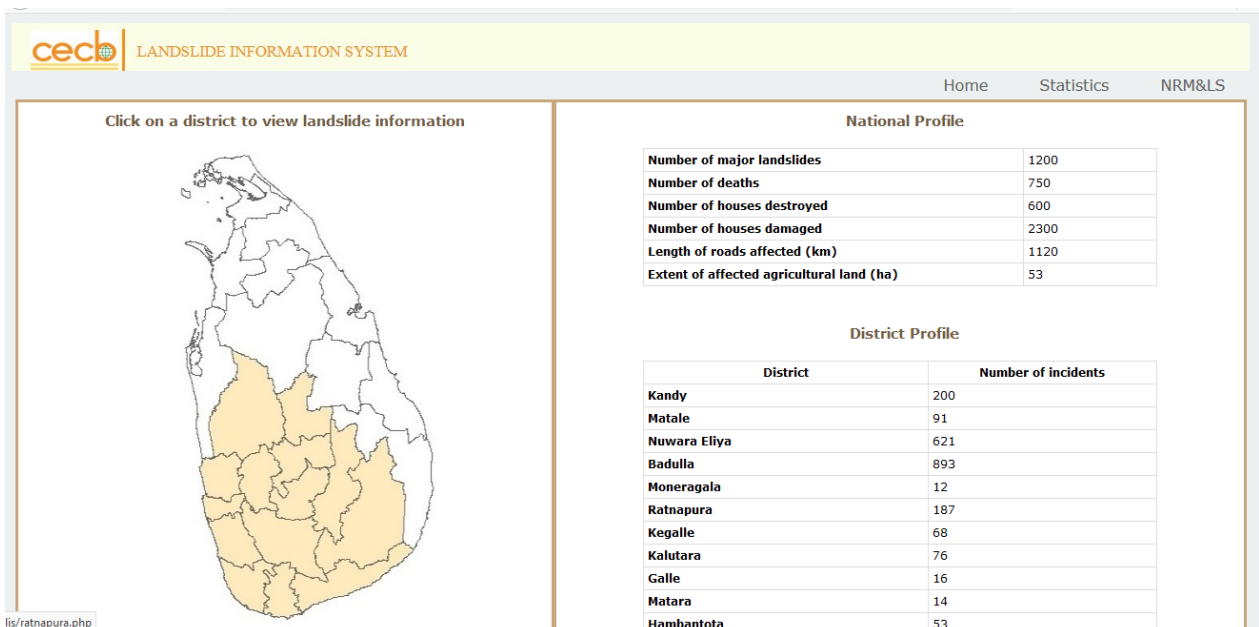

Figure 6: Home page of designed user interface

A district consists several DS Divisions, and a DS Division consists several GN Divisions. Once a district is selected by clicking on it, users are prompted to a second page, through which, the

information at DS divisional level can be accessed (Figure 7). Users can retrieve statistics on the number of landslides, social losses and damages, impacts on roads, river, and streams, and property damages at DS Divisional level.
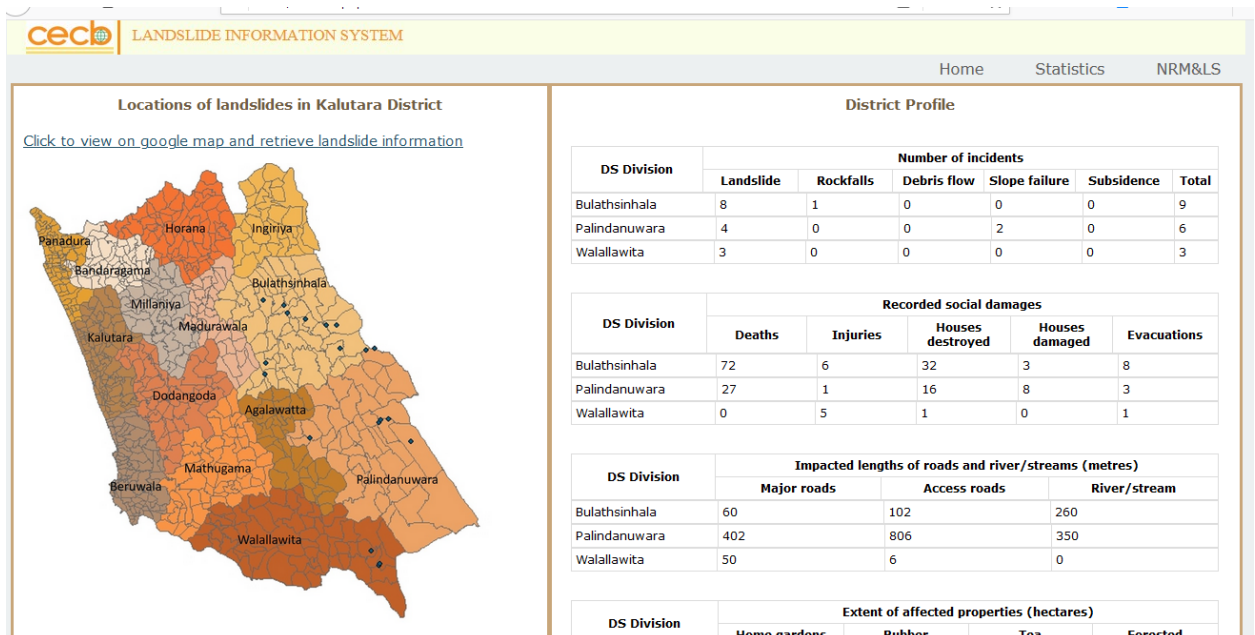

Figure 7: Divisional level landslide events, social damage, infrastructure damage etc. within the selected district

Further, as shown in the Figure 5, the user can select a particular DS Division for accessing a list of landslides within it, through which the information on GN Divisions where landslides have been occurred can be learned.
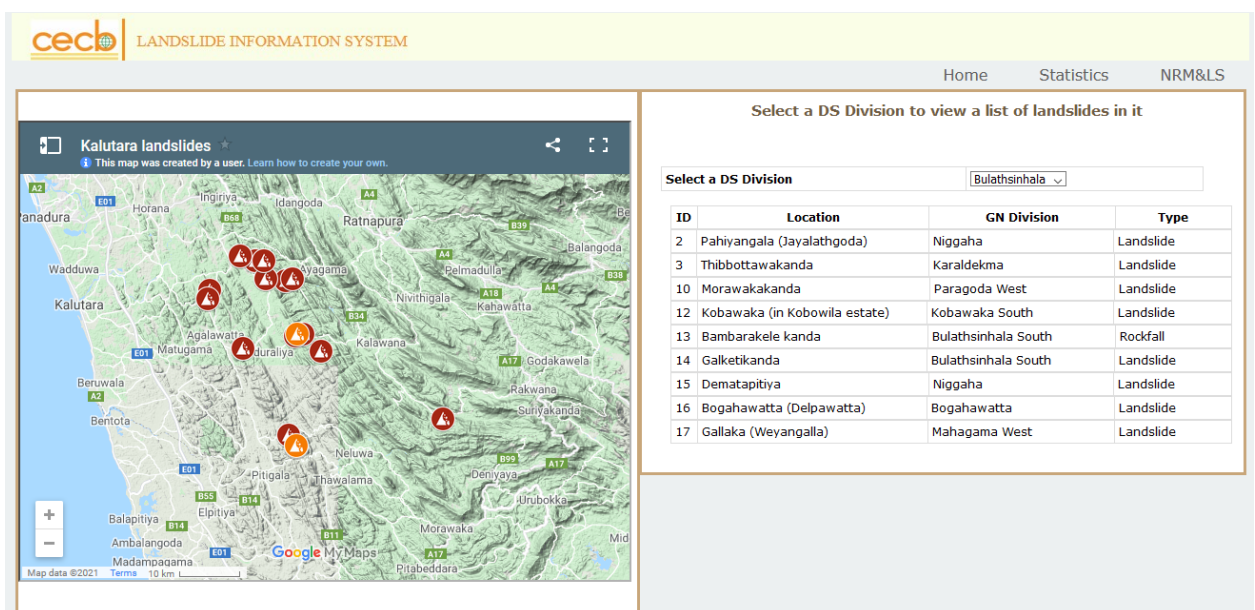
Figure 8: List of landslides occurred within a selected DS Division

A report is being prepared for each landslide event and the technical information and photographs have been included in those reports. Those reports shall be linked to the database for user's retrieval.

Database Management

The database can be continuously updated with the occurrences of new landslides, and when the field data verification prompts for changing the previously entered data. This feature is password protected and accessible only by the administrator and editors. A form has been created enabling entering/updating of data collected for a particular landslide event (Figure 9).

Figure 9: Data input/update form

Year 2020

Only a small progress could be achieved during the year 2020, due to the prevailing pandemic and subsequent closure of work places. Even though the most of the work were desk studies, the sudden closures of work places limited the accessibility to data and inputs from supporting staff. Further due to travel restrictions, the field verifications could not be performed for verifying data collected through online tools and other digital and printed media.

Even though the project was expected to be ended in August 2020, due to above reasons, it could not be completed. Therefore, an extension of the project is kindly requested until December 2021. The proposed work plan for the year 2021is listed below.

7.2 Planned future activities or Statement of completion of the Project

January 2021- December 2021:

(a) Continuing collection of landslide information, if new landslides occur

(b) Where possible, field data verification on landslide information collected via digital media,

(c) Continue entering of collected data into the relevant databases,

(d) Updating the front and back end system architecture, as and when necessary.

(e) Continue performing unit testing, sub system testing and integration testing.

(f) Launching the Beta version of the comprehensive landslide information system.

(g) Performing performance testing and acceptance testing.

7.3 Beneficiaries of Project for Science, Education and/or Society

The landslide professionals, academics, researchers, planners and people residing in landslide prone areas in Sri Lanka are the beneficiaries of this project.

8. Results: (15 line maximum, e.g. publications)

a. Mysql database on landslides

b. Mysql database on losses and damages caused by landslides

c. Report on each landslide including technical information and photographs/images

d. User interface for retrieving landslide information based on national, district, and DS divisional level.

e. User interface for retrieving statistics on landslide incidents, social damages, infrastructure damages, and property damages based on national, district, and DS divisional level.

f. Locations of landslides on google map

Publication:

"A Landslide Information System for Sri Lanka: A tool for Decision Making", Kumari M. Weerasinghe , A.A.V. Dias , H.M.J.M.K. Herath , A.M.K.B. Atapattu, Proceedings of the CECB Symposium – 2018, Colombo, November 2018, PP 219-223,

References:

Devoli G., Strauch W., Chávez G., Høeg K., (2007), A landslide database for Nicaragua: a tool for landslide-hazard management, Journal on Landslides (Springer).

Des Inventar Disaster Information System, https:/www.desinventar.lk.

Innocenzi, E., Greggio, L., Frattini P and Amicis M.de.,(2017), A Web-based Inventory of Landslides Occurred in Italy in the Period of 2012-2015, In: Advancing Culture of Living with Landslides, Vol 2, 1127 -1133.

Weerasinghe, K.M., (2014),Utilization of Inferred Landslide Hazard Information as a Web Based Decision Making Tool for Landslide Disaster Risk Reduction and Early Warning, In: Landslide Science for a Safer Environment, Vol. 3, 319 - 332.