

Land Surveyors Checklist System (LSCS)

The project consists of designing the software architecture and implementing a Land Surveyor Checklist System, named LSCS application. The project will be performed in teams of 4-5 students; a single common report should be provided per team for each deliverable. There are three major deliverables: the architecture design planning, the software architecture design, and the implementation and demo of the application.

This document gives a summary of the LSCS application requirements and the required tasks for project teams.

1 Overview

The Association of BC Land Surveyors (ABCLS) is the governing body for land surveying in British Columbia. To perform surveying in BC a surveyor must meet the requirements set forward by ABCLS. The association is in charge of the education requirements, examinations and regulation surrounding land surveying in BC.

Land surveying is a highly regulated profession. It deals with surveying the surface of the earth for use in maps, plans and other legal documents. Surveying as a profession requires extensive knowledge of law, boundaries, geography, instruments and court precedents.

The work of land surveying is performed by trained professionals along with assistants. Since there is a large portion of the work that deals with legal requirements and precedents, the data must be accurate. Office and field work are both prevalent and necessary; it is not uncommon to have multiple members of a survey team working on a survey project.

While the field is well regulated and managed by ABCLS, there is always room for process and review improvements. Currently surveyors are personally responsible for an immense amount of regulation and legal material that must be adhered to without error. To assist land surveyors in their work ABCLS would like to develop an application, named the Land Surveyor Checklist System (LSCS), to ensure that the proper precautions, process and tasks have been performed.

ABCLS has contracted the task of developing LSCS to a spin-off company named ABC Inc. The primary mission of ABC Inc. is to develop the application, operate and market it as a service hosted on the cloud. Initially, the service will be targeted at and sold to ABCLS, and then progressively expand through subsequent releases to other Land Surveyors Associations in Canada and around the world.

LSCS is a checklist application for use by survey managers, supervisors, office employees and land surveyors over the course of their duties. The goal of LSCS is to aid the surveyors, managers and other support staff in adhering to the complex and strict rules surrounding several types of survey applications and processes.

The Checklist application is at its heart an application that will allow based on a certain type of surveys a land surveyor to ensure all information is properly gathered and reported. The application itself will not accept documents related to a land survey but acts as a tool prior to submission to ensure that all issues have been considered.

Since work takes place within the field and office, mobility is a key requirement. Land surveyors must be able to view and edit their surveys checklists from the field while managers must be able to edit and review information from the office.

1.1 Land Surveying Process Overview

Land surveying is a process of studying the details of the earth surface using measurements and information from legal and planning documents. The Land Surveyors collect their data using specific hardware. The data collected is paramount for reports, legal documents and recording purposes.

Currently while in the field land surveyors collect measurements pertaining to surface measurements, GPS location information, and other survey information. Once this information is collected it is recorded by a Land Surveyor and then submitted to their manager for review before being submitted to a government agency for use in land use applications, planning process and so forth.

The reports prepared by the Survey team are detailed and must follow a specific format, due to legal requirements. As a consequence the checklist application must ensure that Surveyors have the ability to select a type of report, and that they have considered all information with respect to the type of report chosen.

1.2 Data Overview

The data collected by the land surveyors is not used in the checklist application. What are in use are the types of data related to the type of report being produced by the land surveyor. The checklist will be created by a Manager, and based on the type of report created a checklist of specific items tailored to the type of report will be created that the land surveyor must review prior to submitting their report.

The checklist application will be responsible for managing data related to different types of survey reports, the requirements of each report, and the users that use the application.

A detailed overview of the specific data is listed in Appendix B.

1.3 System Overview

Figure 1 depicts a general overview of the proposed system workflow.

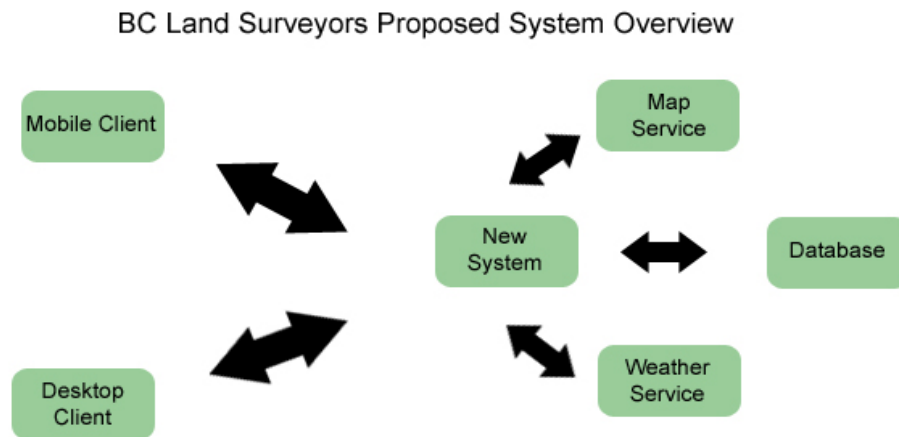


Figure 1: Proposed system overview.

The new checklist application is an online checklist to ensure Land Surveyors have covered off all the requirements for a specific type of survey. The new system should be able to CRUD data from a database to manage checklists, users, and other related information.

The system should also implement in the checklist application a set of Weather and Mapping services. These services should provide pertinent information based on weather and geography data to a checklist system user. The Map service should ideally display a map of the location of the survey as defined in the Checklist address field below. The weather service should provide a relevant weather forecast for the location as defined in the checklist.

Besides the external stakeholders, there are two main stakeholders in the project: The land surveyor, in charge of collecting data from the field and entering it into the new online system, and the manager or supervisor, who will be in charge of creating and reviewing a checklist.

The system is required to support a login to track data associated with each land survey project to a specific user. There should be different access control levels for Administrators or Land surveyors.

1.4 Checklist Overview

Checklists are lists that are created by a Manager for use by a Land surveyor in ensuring all requirements are met surrounding a land surveying project. A Checklist has several unique

components: Unique ID, File #, Survey Type, Land District and Date. This general information is entered by a Manager for use in creation of the proper checklist by the system. Once a checklist is created by a Manager, the system creates, based on the logic a resulting checklist that will be used by the Land surveyor.

The checklist that is used by the Land surveyor should comprise of seven distinct sections: Plan Title, Main Body, Scenery, Deposit Statement, Integrated Survey Area, Miscellaneous and Electronic Plan. These sections are described in detail in section 3.6.

2 Proposed Workflow

So how does the system actually work? In this section you will get an explanation of the proposed workflow of some of the users in the new system, while the details of the requirements and data are provided in section 3.

The first step in the system is initiated by a Manager or Survey supervisor who will create a checklist. A checklist is created with a number of special fields: Title, Description, Land District and so forth. The details of the data in this section are defined in section 3.6. Once a checklist is created it can be used by surveyors. Each time a surveyor or assistant creates a survey report, they will have a Checklist associated with this report. While completing the report, or after its completion the member of the Survey team will log into the system and perform the Checklist.

A Manager or supervisor will assign a checklist to their worker. This Checklist will then be sitting in a user's inbox when they log into the system. Once the Checklist is complete and submitted, it can again be viewed by a Manager. The Manager at any point in this process can access the Checklist and alter it. The Survey team member can only perform the checklist and view the status of their checklists.

3 Requirements

The key requirements of the system are based around the idea of the land surveyor, manager and the external stakeholders in the project.

3.1 Web Interface

It is your decision how you would like to program this web interface. You can do it in HTML/CSS or any other form of technology you like. The idea is to examine your technology choice when identifying architectural drivers, so as to justify your decisions.

The web interface will act as the main front end of the system. It must have the ability to accept data and input it into the database. It must support login, creation of checklists and all other

functions as defined in the following requirements. Key challenges to consider is how you will implement security; how the logging information will be transferred.

3.1.1 Interface Requirements

1. The system must support login via a web interface.
2. The system must display data related to checklists upon login.
3. The system must support the ability to create, modify and remove new checklists from the web interface.
4. The system must support the viewing of map and weather data for the location of the survey as defined in the checklist.

3.2 Checklist

- The system must support the creation and use of checklists. Checklists are defined as lists of information and checks that a land surveyor must complete prior to submitting a project for approval by their respective manager in support of land surveying activities.
- The system must support the creation of Checklists via the web interface by Managers. It must support the use of a Checklist by Surveyors.
- A Checklist is created by a Manager. There are several different requirements that a checklist itself must have associated with it as explained in the next section.

3.2.1 Checklist Requirements

1. A Checklist must have a unique identifier.
2. A Checklist must have a Title. When a Manager or Surveyor logs in to the system they must have the ability to view the title of the Checklist.
3. A Checklist must have a "Description" or General overview that the Manager or creator of the Checklist can use to give context and definition to the Checklist.
4. A checklist must have a File # field that is editable for entry by Managers.
5. A checklist must have a Land District field that is editable by Managers.
6. A checklist must have an address or location associated with it for Map and Weather Service information.
7. The system must log the date the checklist was created.

3.3 Weather and Map Services

As indicated in section 1.3, the system must support the display of a map, and weather information regarding the survey location defined in the checklist. This information is to be used by the Surveyor/Manager when working within the checklist system. There are several ways that this can be implemented. Below are some resources for you to consider when designing this feature:

- <https://developers.google.com/maps/documentation/business/geolocation/>
- <http://developer.yahoo.com/weather/>

You are not limited to these resources or web services API's. There is a sample view of the type of end result below:

Weather and Map data for: 975 Murray Street, Lillooet, BC V0K 1V0



Figure 4: Weather and Map Services provided by external API's through the Checklist application.

3.4 Security

The system must support authentication via username and password into the checklist application. You are expected to examine the features of such a system. Will you use SSL certificates? How will you store the information in the back-end database? Will you encrypt the passwords?

3.4.1 Security Requirements

1. The system must support user login by username and password.

2. The system must store the passwords in a secure way.
3. The system needs to allow the creation of users and their login credentials via the administration interface.
4. The users must be able to reset their usernames/passwords securely through the web interface.
5. The system must support different roles of users: Administrators, Managers and Land Surveyors at present.
6. The system must allow users to make changes to a checklist and store those changes according to their access capability.
7. The system must enforce access control such that Managers can create and update checklists, while Land Surveyors can read and update data in checklists.
8. The system must log all administrative activities which have been undertaken on the platform.

3.5 Dependability

The system is expected to have to respond to at most one thousand concurrent users during peak hours, and should be able to process any of the users' requests in no more than 10 seconds. At the same time, ABCLS wishes that the platform be available for at least 99.9% uptime during the service year. This requires the ability to run redundant copies of the system, and the ability for the system to detect and recover from failures. There are several issues that would need to be addressed if you were to implement this system in reality with actual servers. Therefore for the purpose of your report you are to document how you would mitigate down time? Replication? Self-hosted? What options are there? What are the benefits and downfalls of choosing a cloud-based approach?

3.6 Future Enhancements

Below is a list of possible future enhancements that have been discussed but are not included in the requirements of the original project. They are provided as a reference during your design and development. The system must be designed so as to facilitate those future changes.

3.6.1 Multiple Surveyors

ABCLS would in the future like to have the ability to support multiple surveyors on a single checklist. With this requirement there are several challenges. They wish to track what changes were made by which Surveyor during the review process. For this reason there is an overlap of data. What if two surveyors are accessing the same checklist at the same time? There may be conflicts involved in a new scheme.

3.6.2 History and Summary

ABCLS would also like to provide a secondary ability in addition to the normal Checklist application. It would like Managers of Surveyors to be able to track the submissions historically,

for record keeping and legal purposes. This would provide the client with the ability to export historical data such as past checklists, past users associated with the checklists, dates and other reporting features which are not well defined at this time.

3.6.3 Document Review Process

There is a possibility of the client ABCLS wanting to add in a new process in the system whereby Managers are able to review documents prior to submission. This new review process would have a Surveyor complete a *Checklist* and assign it to a Manager for review. From here the Manager is able to review and comment on the results, as well as re-assign the *Checklist* associated with a specific issue.

3.6.4 Mobile client

Since the system should ideally be available in a mobile environment, it is expected that in the short term a mobile client would be developed that supports major platforms such as Android, IOS, Window Phone, and Blackberry. Your design should consider and anticipate the challenges involved in implementing such requirements. You could discuss the challenges, compare and contrast using, for instance, CSS to create a mobile version of the site.

3.6.5 Report Generation

In the future ABCLS wishes to be able to generate reports surrounding the data that is available in the database. Both the options of implementing a custom reporting capability or integrating an external (existing) reporting engine will be considered.

3.7 Detailed Checklist Overview

Below are the checklists that should be implemented in the checklist application. The checklists are to be implemented with a couple of simple check-boxes appended to the end of each field. The values appended should be: Unanswered (the default option), Yes, N/A. Below is an example representation of each field. The fields must be able to be saved in the system so that the checklist can be saved.

B - Main Body of Plan	
Appropriate designation for Title or Interest parcels (eg Lot Number)	<input checked="" type="radio"/> unanswered <input type="radio"/> Yes <input type="radio"/> N/A
All essential dimensions given and closure calculated - GSI Rule 2-2	<input checked="" type="radio"/> unanswered <input type="radio"/> Yes <input type="radio"/> N/A
Title & Interest Parcel Area or Volume correct & to required precision-GSI Rule 3-4(1)(t), 9-27, and 10-17(m)	<input checked="" type="radio"/> unanswered <input type="radio"/> Yes <input type="radio"/> N/A

Figure 1. Example of how to represent checklist data, in a checklist. This is representative of section 3.7.2 below.

3.7.1 Plan Title

Type of Plan

Legal Description & registered plan no.
BCGS NO.
Appropriate Scale & Bar, including intended plot size
Legend explaining all symbols and non-standard abbreviations
Bearing derivation and reference
Notation: bearings to BTs are magnetic or planned bearings
North Point

3.7.2 Main Body of Plan

Appropriate designation for title or Interest parcels (e.g. Lot Number)
All essential dimensions given and closure calculated
Title & Interest Parcel Area or Volume correct & to required precision-GSI Rule 3
Boundaries reestablished and/or lots divided in accordance with Land Survey Act
Sufficient ties to evidence of previous surveys
Monumentation labelled and correct - GSI Rule 1-2 to 1-7
Read or "Lane" and name, when available, where road is being dedicated
Remember to check for hooked parcels, part parcels and remainders
New Dedicated Road or RW fully dimensioned with widths indicated-GSI Rule
No text less than 2mm
Plotting to scale and drafting legible - GSI Rule 3-2 & 3-3
Bold outline 1.0 - 1.5 mm centered on boundary (including any detail drawings)
Existing R/W, Easement or Covenant boundaries shown with broken lines - GSI Rule 3-4
Details of bearing trees and ancillary evidence found and made - GSI Rule 3-4
Radius, arc, radial bearings for each curve point - GSI Rule 3-4
Railway plan in un-surveyed land has district lot number assigned
Access to water body where applicable - LTA s75(1)
Label Un-surveyed Crown Land including theoretical or unsurveyed portions of townships

3.7.3 Scenery

Check status of adjacent roads. Have they all been dedicated?
Parcel boundaries (incl. highway, roads and railway) shown with solid lines - Rule 3-4(2)(g)
Description(s) given for all surrounding lands - GSI Rule 3-4(1)(r)
Primary parcel designations prominent in body of plan (use 'DL' not 'Lot') - Rule 10-14
Existing Road Names shown - GSI Rule 3-4
Roads, Trails, and Seismic Lines shown and labelled with width and posted as required
'Rem' added on lot and "portion of" or "part of" in title where appropriate

3.7.4 Deposit Statement

Plan lies within (Regional District) statement - GSI Rule 3-4

Leave 7 cm 12 cm clear space in top right corner for Registrar's notation pursuant to S 56 LTA

3.7.5 Integrated Survey Area

Grid bearing notation; ISA name and number, datum and bearing derivation - GSI Rule 5-7

Control monuments tied in accordance with GSI Rules 5-4(2)

Meets accuracy standards of integrated legal survey - GSI Rule 5-4 (3) & (4)

Control monuments shown on plan with required symbol and respective designation - GSI Rule 5-7(2)

3.7.6 Miscellaneous

Spelling check

Standard plan size - GSI Rule 3-1

If practical, top of plan orientated north - GSI Rule 3-3(5)

Notation regarding existing records that plan is compiled from.

3.7.7 Electronic Plan

Plan Image created with Adobe 6.0 or higher with minimum 600 dpi resolution - GSI Rule 3-1 (1)

All plan features black ink on white background with no ornate fonts - GSI Rule 3-3(1)

No signatures on plan - GSI Rule 3-3(7)

Plan complies with all standards for electronic submissions approved by S.G. GSI Rule 3-3 (12)

4 Required Tasks

To complete the project, you are required to perform the following tasks:

4.1 Part 1: Design Planning (8%; due May 30, 2014)

The goal of this part is to analyze the system requirements, identify architecturally significant requirements or drivers, and propose suitable design tactics and patterns to guide the architecture design. You can proceed as follows:

1. Analyze the functional requirements by identifying the use cases. Represent the use cases and actors using a use case diagram. Provide brief textual description (2-3

- lines maximum) for each use case. Prioritize the use cases and provide a brief rationale for your ranking.
2. Identify, organize, and prioritize the quality attribute requirements using a quality attribute utility tree. Describe each individual quality attribute scenario using stimulus-response table format.
 3. Based on the above analysis, identify the 5 topmost architectural drivers/requirements and propose suitable patterns and design tactics to address these drivers/requirements.

While identifying the architectural drivers, consider how you'll design such a system: mobility, security, risks, and future usages; how can you design this to be evolvable and address future needs? What trade-offs are associated with these decisions?

4.2 Architecture Design (12%; due June 27, 2014)

The goal of this part is to describe the views involved in the architecture design for the LSCS application. Based on the outcome and tactics of the design planning (i.e. Part I), describe in detail components structure, communications, and deployment:

1. For component structure, you need to refine the high-level component structure by determining composite components and their containing elements and simple components, as well as the relationships among them. For concurrent components, indicate using appropriate stereotypes whether you'll implement them as **threads** or **processes**, and provide appropriate justifications for why so.
2. For component communications, you need to describe component interactions using concurrent communication diagram. Explicitly identify **synchronous** and **asynchronous** communications among components, and provide appropriate justifications for why so.
3. Provide a deployment diagram describing the hardware topology and the allocation of key processes to main nodes.

Make appropriate use of structural and/or communication patterns in the above component structure and communications design. Appropriate use of patterns means not too many but not too few; just what is needed. Indicate which tactics and patterns (from Part I) were used and provide appropriate justifications for why so.

4.3 Implementation (15%; due August 1, 2014)

The LSCS application will be implemented using Web services technologies; you are free to use any programming language (C, C++, or Java) that you feel comfortable with. However, we recommend the use of Java because of the appealing features of the Java technology.

You are to implement the LSCS system (based on the above requirements) as a web application from front end user interface to back-end database interaction, including interaction with external web services.

The user interface must support login features for security and tracking purposes. You must implement the logic involved in logins, displaying information regarding plans, checklists and all other features defined. You are to implement a database interface to store the information regarding plans, checklists and other information as needed in a database. Along with a UI, control logic and database layers, you are to implement web services components that can deal with retrieving map and weather data from external sources.

The implementation of the checklist application leaves you with a couple choices. The specific technology stack you decide to use is up to you. The SENG 422 lab TA will provide you with group access to a machine where you will have the choice of running: Python, Ruby, Java, PHP or another proposed server side language. You can use any webserver or database that you like, provided it is supported by the computers. To implement the map and weather services, you are expected to use the external API's provided above. You are not limited to those API's, but they are available for your use.

The implementation must show your team ability to use the COTS components and how you manage the integration of different technologies such as Web services.

You need to provide a report briefly describing your implementation and conduct a demo of the application.

Evaluation Criteria

It is expected that your implementation will satisfy the above requirements. The following evaluation questions will help you to understand how your implementation will be evaluated:

1. You need to explain through one of the subsystems how your implementation is consistent with your architecture design for that subsystem and how it satisfies the system requirement. Particular emphasis should be placed on the 5 topmost quality attribute requirements considered in your design (in Part I).
2. It is expected that you can explain how appropriately the communications (synchronous and asynchronous) and data flows between components have been implemented.
3. In case where you miss any of the project requirements, you must be able to explain the reason why and how that could affect the system performance.
4. If your implementation does not match your architecture design you must provide a rationale for that and state what modifications in your design are needed to match your implementation.
5. You must use as much as possible all available COTS components and avoid re-implementing any ready-made component.

5 Appendix A

Below is a list of the requirements prioritized by the stakeholder.

Priority	Requirement
High	The system must support login via a web interface.
High	The system must support the ability to create, modify and remove new checklists from the web interface.
High	The system must support the creation and use of checklists. Checklists are defined as lists of information and checks that a land surveyor must complete prior to submitting a project for approval by their respective manager in support of land surveying activities.
High	The system must support the creation of Checklists via the web interface by Managers. It must support the use of a Checklist by Surveyors.
High	A Checklist must have a Title. When a Manager or Surveyor logs in to the system they must have the ability to view the title of the Checklist.
High	The system must support different roles of users: Managers and Land Surveyors at present.
High	The system must store the passwords in a secure way.
High	The system must support user login by username and password.
High	The system must enforce access control such that Managers can create and update checklists, while Land Surveyors can read and update data in checklists.
Medium	The system must allow users to make changes to a checklist and store those changes by supporting access control mechanisms.
Medium	The system must support the viewing of map and weather data for the location of the survey as defined in the checklist.
Medium	A Checklist must have a unique identifier.
Medium	The system must log the date the checklist was created.
Medium	The system must display data related to checklists upon login
Medium	A checklist must have an address or location associated with it for Map and Weather Service information.
Medium	A Checklist must have a "Description" or General overview that the Manager or creator of the Checklist can use to give context and definition to the Checklist.
Low	A checklist must have a File # field that is editable for entry by Managers.
Low	A checklist must have a Land District field that is editable by Managers. See Attached Appendix for information regarding the Land District type.
Low	The system needs to allow the creation of users and logins via the admin interface.

6 Appendix B

Example of a checklist that shows how to represent the data as defined above.

A - Plan Title		
Plan Title - Type of Plan - GSI Rule 9-26, 10-12 & 11-8	<input checked="" type="radio"/> unanswerd	<input type="radio"/> Yes <input type="radio"/> N/A
Plan Title - Legal Description & registered plan no. (if available) - GSI Rule 9-26, 10-12 & 11-8	<input checked="" type="radio"/> unanswerd	<input type="radio"/> Yes <input type="radio"/> N/A
BCGS NO. - GSI Rule 3-4(1)(e)	<input checked="" type="radio"/> unanswerd	<input type="radio"/> Yes <input type="radio"/> N/A
Appropriate Scale & Bar, including intended plot size notation - GSI Rule 3-2 & 3-4(1)(a)	<input checked="" type="radio"/> unanswerd	<input type="radio"/> Yes <input type="radio"/> N/A
Legend explaining all symbols and any non-standard abbreviations used - GSI Rule 3-4(1)(d) & 3-6	<input checked="" type="radio"/> unanswerd	<input type="radio"/> Yes <input type="radio"/> N/A
Bearing derivation and reference - GSI Rule 2-5 & 3-4(1)(c)&(f)	<input checked="" type="radio"/> unanswerd	<input type="radio"/> Yes <input type="radio"/> N/A
Notation: bearings to BTs are magnetic or plan bearings - GSI Rules 1-12(2)	<input checked="" type="radio"/> unanswerd	<input type="radio"/> Yes <input type="radio"/> N/A
North Point - GSI Rule 3-4(1)(b)	<input checked="" type="radio"/> unanswerd	<input type="radio"/> Yes <input type="radio"/> N/A

The data that will be used in the checklist system is a list of questions. These questions are prepared by the ABCLS for use when a member of a Survey project team is submitting a plan. The list of questions is to be shown as seen above. You may choose another format for the list or present them in a different way. The above serves as an example of a possible work-flow of questions that a user would go through the system with.