SGSEAM Assessment Guide for Lucid BuildingOS and BuildingDashboard

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1. Introduction

This document describes the proposed approach to assess the Lucid BuildingOS and BuildingDashboard using the Serious Game Stakeholder Experience Assessment Method (SGSEAM). The goal of SGSEAM assessment is to identify the major strengths and shortcomings of the software framework from the perspectives of user experiences of major stakeholders. The benefits of this assessment are for the developers of the framework to learn from the findings of the assessment and identify any actionable improvements.

Table 1.1 outlines the steps of the process of applying SGSEAM to a framework.

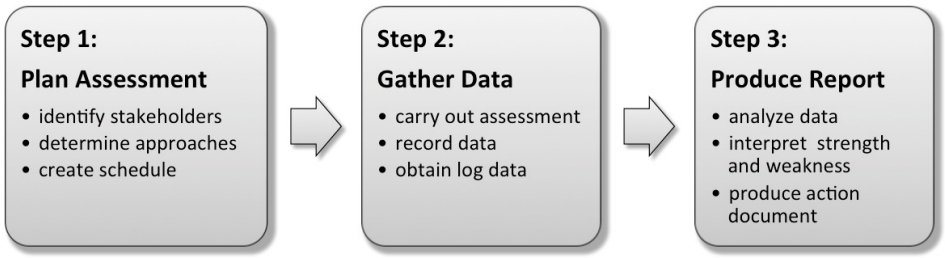

Table 1.1: Applying SGSEAM to a framework

There are three steps in the process of applying SGSEAM. Step one is to plan the assessment, including identifying the stakeholders, determining assessment approaches, and creating the assessment schedule. The deliverable for this step is the ***assessment plan*** document. Step two is to gather data by carrying out the assessment, recording and obtaining related data. The deliverable for this step is the assessment ***data repository***. Step three is to produce the strength and weakness report by analyzing the data and interpreting strengths and weaknesses. The deliverable for this step is the ***improvement action*** document.

The following chapters describe the steps in details.

2. Plan Assessment

2.1 Identify Stakeholders

Identify stakeholders of the framework and categorize them into SGSEAM stakeholder, identified their corresponding tasks.

The first step is to identify the SGSEAM stakeholders and their tasks for the Lucid BuildingOS and BuildingDashboard framework. SGSEAM stakeholders are defined in Table 2.1. They are the users of a serious game framework from different perspectives.

Stakeholder	**Definition**
Player	Residents living in the buildings that participate in the competition.
System admin	IT staffs who are responsible for setting up and maintain the software infrastructure for the competition.
Game designer	Competition organizers who design and configure the competition.
Game manager	Competition organizers who run and manage the competition.
Game developer	Software developers who use the framework to customize, extend and enhance the game.

Table 2.1: SGSEAM Stakeholders

According to Campus Conservation Nationals (CCN) Competition Planning Guide, a Competition Organizing Team (COT) is recommended to plan and execute the competition. Besides the residents of buildings participated in the competition, they are the users and stakeholders of the BuildingOS framework. We categorized the COT roles into SGSEAM stakeholders and identified their tasks related to BuildingOS and BuildingDashboard, as shown in Table 2.2. This table is included in the textbfLucid-SGSEAM-Assessment-Plan.xlsx document in the ***stakeholders*** worksheet. You could use the worksheet as the working document to plan the assessment and make changes as necessary.

SGSEAM Stakeholder	BuildingOS Users	Tasks
Player	Building resident	Use BuildingDashboard to view and participate.
System admin	Internal system admin or developer	Install software, backup, patch, monitor and scale the system.
Game designer	**Behavior Change Manager**, Technical Manager, Competition Director, Research Manager	• Decide on a competition format/structure • Set up buildings, meters, and competition in BuildingOS
Game manager	**Technical Manager**, Marketing Manager, Building Captain Manager, Events Manager	• Collect, verify baseline and competition data, enter into BuildingOS • Kick-off and other events • Coordinate competition prizes • Manage social media • Monitor competition status
Game developer	Internal or external Developer	• Develop interface to support other meters • Customize dashboard interface

Table 2.2: BuildingOS Stakeholders

2.2 Determine Assessment Approach

For each stakeholder, determine the appropriate assessment approaches.

There are several assessment approach for each stakeholders. Different assessment approaches have different levels of rigor which represents confident level of the assessment result. Different approaches also require different levels of implementation costs or efforts. Appendix A describes all the SGSEAM assessment approaches for each stakeholder.

Due to the efforts in recruiting testing subjects and set up the experiments, in-lab experiment assessment may be too expensive in the case of assessing BuildingOS and BuildingDashboard. We recommend the interview approaches for all the stakeholders except player. Table 2.3 shows the recommended assessment approaches for each stakeholders in BuildingOS and BuildingDashboard.

Stakeholder	Assessment Approaches	Expected Outcomes
Player	Pre-post effectiveness study	Determine effectiveness in resource usage reduction.
	Usability survey	identify problem areas in game interface
	Engagement metrics	determine the extent of engagement
System admin	Post-hoc admin interview	identify strengths and weaknesses in the installation and maintenance process.
Game designer	Post-hoc designer interview	Determine strengths and weaknesses in the game design interface.
Game manager	Post-hoc manager interview	Determine strengths and weaknesses in the game managing interface.
Game developer	Post-hoc developer interview	Determine strengths and weaknesses in developing enhancement.

Table 2.3: BuildingOS Assessment Approaches

The recommended approaches are included in the ***Approach*** worksheet in the **Lucid-SGSEAM-Assessment-Plan.xlsx** document. It is possible to modify the worksheet to choose a different approach or add more approaches for some of the stakeholder assessments.

Refer to the Appendix A for the detailed description of the recommended approaches.

2.3 Choose Assessment Participants

Select organizations and individuals who are willing to participate in the assessment, write down the contact info for each stakeholder.

We will contact a few organizations in the Campus Conservation National (CCN) 2014 asking them to participate in the assessment. With the agreement of these organizations, we will identify the persons for each stakeholder roles. Use the ***Participants*** worksheet in the textbfLucid-SGSEAM-Assessment-Plan.xlsx document to write down the stakeholders' names and contact info. Table 2.4 shows a sample of the ***Participants*** worksheet.

Stakeholder	Person name	Orgainization	Contact
Player			
System admin			
Game designer			
Game manager			
Game developer			

Table 2.4: Choose Participants

For each stakeholder, identify the population, the name and contact info. It is important to be able to contact the stakeholders in some way, either via email or phone, to get the feedback from their experiences with the framework.

2.4 Create Assessment Schedule

Create a schedule for each assessment approach, taking the competition period into consideration.

Once we decide what the assessment approaches and who the participants are, the next step is to create the assessment schedule. We created a sample schedule based on the sample planning timeline in the CCN Competition Planning Guide, as shown in Table 2.5. Depends on the competition period of each organization, the actual date of the assessment might be different. You can use the ***schedule*** worksheet in the **Lucid-SGSEAM-Assessment-Plan.xlsx** document to adjust the time line for the assessments.

Week	CCN Milestone	CCN Task	SGSEAM Task
Feb 3 - 7	CCN window starts		
Feb 10 - 14		Set up buildings, meters, and competition in BuildingOS	Finalize stakeholders and assessment approaches
Feb 17 - 21			Choose participants
Feb 24 - 28		Data collection dry run week, troubleshooting and resolve problems	Game developer Development using Lucid APIs
Mar 3 - 7			Finalize interview and survey questionnaires
Mar 10 - 14	Baseline	Collect & verify baseline data	Game developer post-hoc interview
Mar 17 - 21			System admin post-hoc interview
Mar 24 - 28	Competition	Verify baseline data, Collect and verify competition data, Enter data into BuildingOS; Kick-off and other events;	
Mar 31 - Apr 4			
Apr 7 - 11			
Apr 14 - 18		Collect, verify and enter final competition data into BuildingOS	Game designer post-hoc interview; Obtain log data
Apr 21 - 25			Player effectiveness study
Apr 28 - May 2			Player usability survey
May 5 - 9			Game manager post-hoc interview
May 12 - 16			Analyze the data; Interpret strength and weakness; Produce action document

Table 2.5: Assessment Schedule

3. Gather Data

This step carries out the assessment, record the data, obtain log data, and refine the assessment plan if necessary. The output of this step is a data repository contains all the assessment data that can be analyzed in the next step.

3.1 Carry Out Assessment

Carry out the assessment as described in the assessment plan.

For each assessment approach, complete the tasks outlined in the assessment plan, gather the data when carrying out the assessment. Store all the data into a central data repository.

3.2 Obtain Log Data

Obtain the log data from the framework, including all the interaction log from the each stakeholder.

Talk to the technical staffs of the framework to find out what kind of log data is available. Obtain the log data in a format that is easy to analyze. For example, if the log data is in a database table, ask for the access to the table, or the CSV export of the table data. If the log data is in a log file, ask for the access to the file. Store the log data into the central data repository.

4. Produce Strength and Weakness Report

This step analyzes all the data gathered from previous steps, interpret the strengths and weakness of the framework, and produce the action report regarding to what areas of the framework needs to improve on.

4.1 Analyze Data

Analyze the data from the data repository.

This step performs the data analysis from the data repository obtained from the previous step. Follow the assessment approaches described in section 2.2 for each stakeholder to carry out the data analysis. For example, for player assessment, calculate the engagement metrics from the game log; for game designer assessment, perform queries from user interaction log data to find out the completion time for a certain game designing task such as completing the configuration of global game settings.

4.2 Interpret Strength and Weakness

Interpret strengths and weaknesses of framework from the data analysis.

From the data analysis step, identified the problem areas which are indicated by having the most reported problems and the longest completion time.

4.3 Produce Reports with Actionable Steps

Produce the action reports for any improvement identified from the strength and weakness analysis.

Once the strength and weakness of the framework are identified from the data analysis, an action report should be produced. This report includes the weakness areas that can be improved and actionable steps on how to improve from each stakeholder's perspective. It also includes the strength areas that the framework needs to maintain.

By producing the report with actionable steps to improve the framework, the SGSEAM assessment is completed.

A. SGSEAM Assessment Approaches for BuildingOS

There are usually multiple assessment approaches for each stakeholder. Table A.1 provides an overview of the assessment method and the approaches. The appropriate assessment approaches should be determined according to the resource available. The approaches for a stakeholder is additive. The more approaches applied, the higher confidence of the assessment can be achieved.

Stakeholder	**Assessment goal**	**Assessment approaches**
Player	Determine the extent the framework affect and engage players.	Pre-post effectiveness study(A.1.1); Self-reported usability survey(A.1.2); Engagement metrics(A.1.3)
System admin	Determine strengths and weaknesses in system install and maintenance.	Post-hoc admin interview(A.2.1); In-lab system admin study(A.2.2)
Game designer	Determine strengths and weaknesses in facilitating the game design process.	Post-hoc designer interview(A.3.1); In-lab game design study(A.3.2)
Game manager	Determine strengths and weaknesses in managing the game.	Post-hoc manager interview(A.4.1); In-lab game management study(A.4.2)
Game developer	Determine strengths and weaknesses in developing system enhancement.	Post-hoc developer interview(A.5.1); In-lab game development study(A.5.2)

Table A.1: SGSEAM approaches

The following sections describe in detailed the different approaches for each stakeholder. Each assessment approach describes the goal of the assessment, what data to collect, how to collect the data and how to analyze the data to obtain insights about the strengths and weaknesses of the framework from each stakeholder's perspective.

A.1 Player Assessment

The goal of player assessment is to determine the effectiveness of the game framework from player's perspective as well as the usability of the game interface and the engagement level of the game. We proposes three approaches for assessing the player's experience with Lucid's framework.

A.1.1 Player Assessment Approach: Pre-post Effectiveness Study

One of the goals of the competition is (but not limited to) the reduction of resource such as energy and water consumption. To assess the effectiveness of this goal, we need to determine the metrics that may be measured before and after the competition (pre-post). Lucid BuildingOS and Dashboard calculates the percentage of reduction of energy and water consumption for each participated building, based on the baseline usage of the previous two weeks. We will use this metrics to measure the effect of the competition. The maximum, minimum and average percentage of reduction of all the buildings are calculated to determine the most, the least and average reduction of the resource usage.

This assessment reveals the extend of effectiveness of the game produced by the framework, regarding to the resource consumption reduction.

A.1.2 Player Assessment Approach: Self-reported Usability Survey

We will conduct a player usability survey at the final week or right after the competition to understand the strengths and weaknesses of the game user interface perceived by players. Minimum of 20 players (the more the better) are randomly selected to participate in this survey. The survey is administrated online via survey monkey or other survey tools. We design the survey questionnaire as shown in Table A.2.

1. What did you like most about the game?
2. What did you found confusing?
3. What issues did you have while using the game?
4. What was the thing you liked the least about the game?
5. What can we do to improve the game?
6. It was easy to find what I was looking for on the website.
   Strongly disagree - Disagree - Neutral - Agree - Strongly agree
7. The website was responsive.
   Strongly disagree - Disagree - Neutral - Agree - Strongly agree
8. The website provided adequate help in teaching me how to play.
   Strongly disagree - Disagree - Neutral - Agree - Strongly agree
9. I understood how to play.
   Strongly disagree - Disagree - Neutral - Agree - Strongly agree
10. this is something my friends should participate in.
    Strongly disagree - Disagree - Neutral - Agree - Strongly agree

Table A.2: Player self-reported usability survey questionnaires

Once the survey is created online, the survey administrator will email the selected players with the link and instruction to the online survey. After we received all the survey responses, we will code and analyze the response to understand the areas of usability problems in the game interface as well as the areas of strengths.

This assessment reveals the strengths and weaknesses of the framework regarding the usability of the game interface.

A.1.3 Player Assessment Approach: Engagement Metrics

This approach calculates the engagement metrics to assess the extent of engagement from players and the impact of the game. The more engaging the game is, the more potential impact could be to the players.

We will first obtain the detailed logs of user interaction with the game. These logging includes http web server logs and user action logs which identify every user click on the web page. Once the log data are available, we will calculate the engagement metrics as described in Table A.3. Calculate as many as possible the player engagement metrics. The more metrics obtained, the better understanding of the extent of player engagement.

Metric	**Definition**	**Mesure**
participation	percentage of players who participated in the game	the level of involvement from players
daily player	average percentage of players per day	the frequency of players interact with the game
daily play time	average play time of a player per day	the frequency of players interact with the game
submission	average submissions of a player	the rate of players' completion of game activities
social interaction	average social interaction of a player	the rate of in-game social interactions between players
game error	percentage of players who encountered errors	the rate of errors encountered by players during the game

Table A.3: Player engagement metrics

With the exception of the game error metric, the higher value these metrics are, the higher engagement level the game has. Distribution of the above metrics across of the period of the competition also provides insights on the extent of engagement in different time of the competition. For example, it may be typical that the first few days of the competition may have higher number of player and play time metrics because of the launch, or due to the announcement of an interesting real-world event.

This assessment reveals the extent of engagement of the players in the game.

A.2 System Admin Assessment

The goal of system admin assessment is to determine to what extent the framework facilitates the system administration tasks from system admin's perspective. SGSEAM assesses how much time is required to install and maintain an instance of a serious game using the framework and the problems encountered during the system admin process.

We consider the tasks of system admin interacting with Lucid's framework are:

1. install the software
2. configure smart meter connectivity
3. backup data
4. monitor performance
5. scaling the system

6. patching

We propose the post-hoc system admin interview approach to assess the system admin's experience for Lucid's framework.

A.2.1 System Admin Assessment Approach: Post-loc System Admin Interview

Once we identify the contact information of the system admins, the interview will be administrated by using an online questionnaire form followed by an optional phone interview if needed. We design the interview with the following questionnaire that is tailored to the specific tasks of the system admins of Lucid's framework:

1. How much time did you spend to install the system and the dependencies?
2. How much time did you spend to configure the meters?
3. How much time did you spend to maintain the system such as backup, patching, monitoring?
4. Did you need to scale the system? if Yes, how much time did you spend?
5. What problems did you encounter?
6. Did you find it difficult to admin the system? What was difficult?
7. Do you agree for us to call you for a short phone interview if we have more questions regarding your experience with the system?

Table A.4: System admin interview questionnaires

Once we receive the responses from the system admin, we will code (categorize) the time and problems encountered to find out what are the problem areas if there is any. if we need further explanation to the response, we will administrate a quick phone interview to address the specific response.

These assessment reveals the strengths, weaknesses and the areas of improvement regarding the system admin process for the framework.

A.2.2 System admin assessment approach: In-lab system admin study (Not Recommended for Lucid)

This approach assesses the system admin's experience using the in-lab experimental study. First identify a group of participants who have some levels of system administration experience. Second, provide instructions on each installation steps, ask the participants to install the system according to the instructions, and ask them to record the time spent and problems encountered as they complete each step.

Once the experiment data is collected, categorize the reported problems and correlated with the reported time data to identify the areas of strength (less time spent) and weakness (more time spent and problems or difficulties).

Due to the cost of in-lab assessment, this approach is not recommended to Lucid BuildingOS assessment.

A.3 Game Designer Assessment

The goal of SGSEAM game designer assessment is to determine the strengths and weaknesses of the framework regarding to the game design process. SGSEAM assesses how much time is required to design an instance of a serious game using the framework and the problems encountered during the design process.

We consider the tasks of game designer interacting with Lucid's framework are:

1. decide competition period
2. set up building occupancy, manual or automated meters
3. decide baseline period
4. monitor competition status during the competition

We propose the post-hoc game designer interview approach to assess the game designer's experience.

A.3.1 Game Designer Assessment Approach: Post-hoc Game Designer Interview

The interview is administrated by using an online questionnaire form followed by an optional phone interview if needed. We will interview several game designers of different competitions. The more data we collect, the more insights we get. The interview is designed with the following questionnaire that is tailored to the specific tasks of the game designers of Lucid's framework:

1. How much time did you spend to set up the buildings including meters? 2. How much time did you spend to setup the competition (competition periods, baseline period, participants)? 3. How much time did you spend to setup the homepage by deciding which widgets to include? 4. How much time did you spend to monitor analytical data to understand the state of the game 5. What problems did you encounter? 6. Did you find it difficult to use the interface? What was difficult? 7. Do you agree for us to call you for a short phone interview if we have more questions regarding your experience with the system?

Table A.5: Game designer interview questionnaires

After the interview, code and categorize the reported time and problems to identify the strengths and weaknesses. In addition, if possible, collect the system log data related to the game designing tasks, analyze the logs to find out the time spent and error encountered during the game designing tasks. Use the log data to verify the findings from the interview data.

These assessment reveals the strengths, weaknesses and the areas of improvement regarding the game design process for the framework.

A.3.2 Game designer assessment approach: In-lab game design study (Not Recommended for Lucid)

This approach assesses the game designer experience using the in-lab experimental study. First identify a group of participants who are somewhat familiar with the subject domain of the game. Second, provide instructions on each designing steps, ask the participants to design the game according to the instructions, ask them to record the time spent and problems encountered as they complete each step.

Once the experiment data is collected, categorize the reported problems and correlated with the reported time data to identify the areas of strength (less time spent) and weakness (more time spent and problems or difficulties).

Due to the cost of in-lab assessment, this approach is not recommended to Lucid BuildingOS assessment.

A.4 Game Manager Assessment

The goal of SGSEAM game manager assessment is to determine the strengths and weakness of the framework regarding to the game management process. Similar to the assessment of the game designer, SGSEAM assesses how much time it is required to manage an instance of a serious game using the framework and the problems encountered during the managing process.

We consider the tasks of game manager interacting with Lucid's framework are:

1. input data manually
2. manage events, marketing, handing out prizes
3. monitor competition status

we propose the post-hoc game manager interview approach for assessing game manager's experience.

A.4.1 Game Manager Assessment Approach: Post-hoc Game Manager Interview

The interview is administrated by using an online questionnaire form followed by an optional phone interview if needed. We will interview several game managers of different competitions. The more data we collect, the more insights we get. The interview is designed with the following questionnaire that is tailored to the specific tasks of the game managers of Lucid's framework:

1. How much time did you spend to enter the meter data manually for the baseline period?
2. How much time did you spend to enter the meter data manually for the competition period?
3. What problems did you encounter?
4. How much time did you spend to monitor analytical data to understand the state of the game
5. Did you find it difficult to manage? What was difficult?

Table A.6: Game manager interview questionnaires

After the interview, code and categorize the reported time and problems to identify the strengths and weaknesses in the game managing process. In addition, if possible, collect the system log data related to the game managing tasks, analyze the logs to find out the time spent and error encountered during the game managing tasks. Use the log data to verify the findings from the interview data.

These assessment reveals the strengths, weaknesses and the areas of improvement regarding the game managing process for the framework.

A.4.2 Game manager assessment approach: In-lab game management study (Not Recommended for Lucid)

This approach assess the game manager's experience using the in-lab game management study. First identify a group of participants who are somewhat familiar with the subject domain of the game. Second, provide instructions on each managing tasks, ask the participants to complete the tasks following the instructions, ask them to record the time spent and problems encountered as they complete each task.

Once the experiment data is collected, categorize the reported problems and correlated with the reported time data to identify the areas of strength (less time spent) and weakness (more time spent and problems or difficulties).

Due to the cost of in-lab assessment, this approach is not recommended to Lucid BuildingOS assessment.

A.5 Game Developer Assessment

To investigate how easy it is to understand, extend, and debug a serious game framework from a developer's perspective, SGSEAM assesses how much time it takes to develop an enhancement to the game framework, and how many errors are encountered during the development process.

We consider the tasks of game manager interacting with Lucid's framework are:

1. use API to get data in and/or out of the system
2. customize the interface
3. extend the system to support new meters
4. enhancement

We propose the post-hoc game developer interview approach to assess the game developer's experience.

A.5.1 Game Developer Assessment Approach: Post-hoc Game Developer Interview

BuildingOS and Dashboard have APIs for developing apps to tie into the framework. We will use the API to develop an extension or customization of the system. Here are the development tasks we proposed to perform using Lucid's API to extend the framework:

1. create a new widget to be available in the home page.
2. support the automated energy data collection from a new type of meter.

We will ask the identified game developers to perform the above development tasks using Lucid's framework. The developer could be Lucid internal developers or some one outside of Lucid. After the development tasks are completed, we will interview the developers to assess

his experience for these development tasks. The interview is designed with the questionnaire outlined in Table A.7.

1. How much time did you spend to implement the creation of a new widget?
2. How much time did you spend to implement adding a new type of meter?
3. What problem(s) did you encounter?
4. Did you find it difficult to understand, extend and debug the system? What was difficult?

Table A.7: Game developer interview questionnaires

Once the interview data is collected, categorize the reported problems and correlated with the reported time data to identify the areas of strength (less time spent) and weakness (more time spent and problems or difficulties) in the process of development.

These assessment reveals the strengths, weaknesses and the areas of improvement regarding the game development process for the framework.

A.5.2 Game developer assessment approach: In-lab game development study (Not Recommended for Lucid)

This approach assess the game developer's experience using the in-lab game development study. First identify the general development skills that the framework requires, such as the programming language. Second, identify a group of participants who have some levels of the required development skills. Third, provide requirement specification or instructions on how to develop a new enhancement to the system, ask the participants to complete the task, record the time spent and problems encountered as they works on the task.

Once the experiment data is collected, categorize the reported problems and correlated with the reported time data to identify the areas of strength (less time spent) and weakness (more time spent and problems or difficulties).

Due to the cost of in-lab assessment, this approach is not recommended to Lucid BuildingOS assessment.