Software Requirements Specification (SRS)

for

Pile Driving Analyzer

Version 1.0

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1. Introduction

1.1. Purpose

The software's main purpose is to help the CEI inspector calculate the stroke of the hammer into the concrete pile by using an automatic system that is not affected by outside factors and provides more reliable readings, helping the inspector to provide accurate results to the clients. Such system would provide the inspector with a better understanding of whether the project has fulfilled the client's requirements, or it needs further inspection.

1.2. Scope

Product Name

Pile Driving Analyzer

Overview

The software will be equipped with Lobar (Unidirectional) microphone and listen to the strokes of the hammer every time it hits the pile, with this data, the software generates a report (pile log) which helps the inspector to decide whether the requirements have been accomplished.

Goals

- Software has to interface with a microphone and detect when a blow occurs by using a audio system that detects spikes when the initial prototype is released next Fall
- Precisely calculate height of the hammer using the saximeter formula provided by inspector manage within minutes of the start of the hammering process.
- Successfully generate a pile log report with all the data recorded during previous steps within two hours of the start of the hammering process

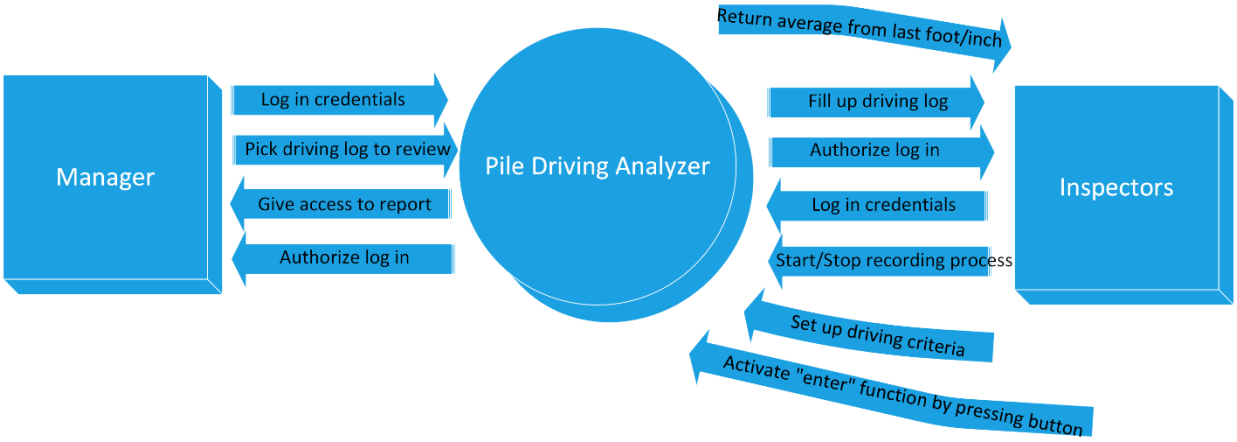
Out of scope

- Follow Meeting requirements set by head inspector (close to requirement---warning message)
- Writing a version of the software for Android devices (like tablets)

1.3. Product Overview

1.3.1 Product Perspective

Context Diagram



Constraint Issues

C3-22	All data recorded by the microphone shall be stored in the form of XML files in the database. [data constraint]	TO DO
C3-23	The system must run on a Microsoft Windows device [architecture constraint]	TO DO
C3-24	All calculations in the system will be made using the imperial system [design constraint]	TO DO
C3-25	System should be compatible with a mobile platform (laptop) [design constraint]	TO DO
C3-26	All the data included in pile driving log must follow guidelines stated in the Florida Department of Transportation (FDOT) [compliance constraint]	TO DO
C3-31	The systems implementations should be designed following the Smart Pile Software that already exists [design constraint]	TO DO
C3-38	The maximum allowed response time for the IT team is 24 hours [usability constraint]	TO DO
C3-39	The user clicks the arrow by the end of the screen to swap between different displays [specific user interface control imposed as a design constraint on ...	TO DO
C3-40	The user clicks the arrow on the top left to extend the navigation window. [specific user interface control imposed as a design constraint on a functional...	TO DO

1.3.2 Product Functions

- Use the microphone to provide reads on the hammer blows per minute (BPM) while not being affected by outside sources.
- Save data recorded by microphone and store it on a database.
- Create pile-driving logs that show the behavior of the Smart Pile using the information in the database.
- “Enter” button that calculate the average hammer stroke for that last foot/inches the pile has been dig.

1.3.3 User Characteristics

- Education level
  - All stakeholders have at minimum a bachelor’s degree in their field and are very used to each of its workforces.
- Experience

    - The stakeholders that will use the software have already used a system with similar features as the system being developed, so, the process will not be new for the construction engineering inspectors.
- Technical enterprise
    - The technical expertise of the Information technology manager, which in the case of this project, is also the sponsor and highest priority stakeholder is extent since he has been in the business for over 10 years.
- Disabilities
    - NA

1.3.4 Limitations

- Software should only be used by Construction engineering inspectors and staff.
- It has to be a mobile platform.
- Hardware must have a decent battery life.
- The system must run on a Microsoft Windows device

1.4. Definitions

- ***Practical refusal***: is defined as 20 blows per inch or less than one inch penetration, with the hammer operating at the highest setting determined by the DTE for driving piles without damage and less than 1/4 inches rebound per blow

2. References

- Ryan Grimm. Manager of IT department in HighSpans Inc.
- https://highspans.com/
- https://www.pile.com/products/esax/
- Smart Structures, The global leader in wireless Embedded Data Collector (EDC)
- solutions to improve the quality of bridge pilings and deep foundations. (smartstructures.com)
- https://fdotwww.blob.core.windows.net/sitefinity/docs/defaultsource/programmanagement/implemented/specbooks/january2021/1-
- 21ebook.pdf?sfvrsn=1c62cb58_2
- https://www.pm4dev.com/resources/docman/pm4dev-articles/14-the-projectconstraints/file.html
- https://www.americanexpress.com/en-us/business/trends-and-insights/articles/7-businessrisks-every-business-should-plan-for/

3. Specific Requirements

Requirements

Key	Summary	Description	T	Linked Issues	P	Labels
C3-37	When a field setting button is pressed, the system shall write comments on the driving pile report regarding the changes implied in the setting	Stakeholder (Head Inspector) ---> Information obtained during interviews			=	Functional
C3-36	The system shall start the stopwatch once the start recording button is pressed	Stakeholder (Head Inspector) ---> Information obtained during interviews			=	Functional
C3-35	The system shall have the function to display a graph that represents the hammer stroke per tip elevation (feet)	Stakeholder (Head Inspector) ---> Information obtained during interviews			^	Functional
C3-34	The system shall have the function to display a graph that represents the numbers of hammer blows per tip elevation (feet)	Stakeholder (Head Inspector) ---> Information obtained during interviews			^	Functional
C3-33	The inspector shall be allowed to send an email to the IT team to ask questions or report a problem about the system	Stakeholder (Head Inspector) ---> Information obtained during interviews			v	Functional
C3-32	The system shall provide an email address at which users can address issues or concerns	Stakeholder (Head Inspector) ---> Information obtained during interviews			v	Non-Functional
C3-30	Once signed in, the manager shall be able to see all the driving pile reports exported by the inspectors	Stakeholder (Head Inspector) ---> Information obtained during interviews			vv	Functional
C3-29	The manager shall be able to enter their credentials to have access to the system's tools	Stakeholder (Head Inspector) ---> Information obtained during interviews			vv	Functional
C3-28	The inspector shall possess unique credentials that will differentiate them from other inspectors	Stakeholder (Head Inspector) ---> Information obtained during interviews			vv	Functional
C3-27	The inspector shall be able to enter their credentials to have access to the system's tools	Stakeholder (Head Inspector) ---> Information obtained during interviews			vv	Functional
C3-20	The inspector shall be able to set the driving criteria in the pile log driving before the pile driving process begins	Stakeholder (Head Inspector) ---> Information obtained during interviews		C3-21	=	Functional
C3-19	The system shall provide different buttons that would serve as the different field settings set by the inspector	Stakeholder (Head Inspector) ---> Information obtained during interviews			vv	Functional
C3-17	The system shall contained an "enter" function that calculated the avg for that last foot/inches	Stakeholder (Head Inspector) ---> Information obtained during interviews		C3-18	^	Functional
C3-16	The system shall allow the inspector to press the "enter" button while recording BPM	Stakeholder (Head Inspector) ---> Information obtained during interviews		C3-18	^	Functional
C3-15	The system shall fill out the pile driving log using the information saved in the database	Stakeholder (Head Inspector) ---> Information obtained during interviews			=	Functional
C3-14	The system shall contain a template of a pile driving log approved by the State of Florida Department of Transportation	Stakeholder (Head Inspector) ---> Information obtained during interviews		C3-4	=	Non-Functional
C3-13	The system shall detect every hammer stroke by evaluating the audio spikes during the recording process	Stakeholder (Head Inspector) ---> Information obtained during interviews			^^	Non-Functional
C3-12	Using the saximeter formula, the system shall calculate the hammer stroke from the BPM recorded	Stakeholder (Head Inspector) ---> Information obtained during interviews			^^	Functional
C3-11	The system shall save and store the data recorded by the microphone in a database	Stakeholder (Head Inspector) ---> Information obtained during interviews			^	Functional
C3-10	The system shall accept input from a Lobar (Unidirectional) type of microphone that will record hammer blows per minute (BPM)	Stakeholder (Head Inspector) ---> Information obtained during interviews			^^	Functional

Use Cases

ID and Name:	**UC-1 Log in Platform**		
Created By:	Alejandro F	Date Created:	3/7/2022
Primary Actor:	Inspectors	Secondary Actors:	Manager
Trigger:	Opening the application		
Description:	Log in to software with unique credentials of every member of the company.		
Preconditions:	PRE-1. Software has internet connection		
Postconditions:	POST-1. Inspector has access to the system POST-2. Inspector can now begin working the pile driving analyzer		
Normal Flow:	**1.0 Login to software** 1. Make sure device has internet connection. 2. Type in credentials into system to gain access 3. Gain access to system's tools		
Alternative Flows:	**1.1 Log in being a new user** 1. Make sure device has internet connection. 2. Type in credentials into system to gain access 3. System will take you through a tutorial of how to use tools 4. Agree the system terms 4. Gain access to system's tools		

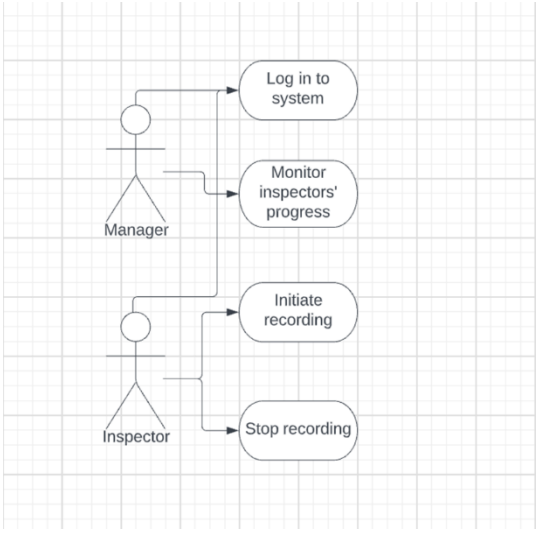
ID and Name:	**UC-2 Monitor the inspectors' progress**		
Created By:	Alejandro F	Date Created:	3/7/2022
Primary Actor:	Manager	Secondary Actors:	
Trigger:	Attempting to review a pile driving log report.		
Description:	Review a pile driving log report made by an inspector on certain date.		
Preconditions:	PRE-1. Report must be saved on the system's database		
Postconditions:	POST-1. Report denies any change on its data POST-2. Report gets a checkmark (approved by manager)		
Normal Flow:	**1.0 Review a report** 1. Manger logs in with credentials 2. Selects report wishing to review 3. Reports pops up as a PDF and gets checked 4. Manager reviews and saves report 5. Report gets a green check on the database		
Alternative Flows:	**1.1 Review an unfinished report** 1. Manger logs in with credentials 2. Selects report wishing to review 3. System throws a warning message about the file not being complete 4. Manager looks up inspector's name in charge of report 5. Manager ask for access of report 6. Reports pops up as a PDF and gets checked 7. Manager reviews and saves report 8. Report gets a green check on the database		

ID and Name:	**UC-4 Initiate the recording of hammer blows**		
Created By:	Alejandro F	Date Created:	3/7/2022
Primary Actor:	Inspector	Secondary Actors:	
Trigger:	Attempting to start recording the pile driving process		
Description:	Initiate the recording of data while the pile is being drive to the ground by using the microphone implemented in the system.		
Preconditions:	PRE-1. Microphone must be working properly PRE- 2. Diving Criteria has been set PRE-3. User's identity has been authenticated		
Postconditions:	POST-1. System starts recording data from blows POST-2. Inspector can see spikes of every time the hammer impacts the pile		
Normal Flow:	**1.0 Start Recording** 1. Inspector logs in into the system 2. Sets up driving criteria as an adjustment 3. Test that microphone is working properly 4. Starts recording BPM		
Alternative Flows:	**1.1 Start Recording without setting up criteria**		

	1. Inspector logs in into the system 2. Test that microphone is working properly 3. Starts recording BPM 4. System throws an error on unset driving criteria 5. Inspector goes back and check driving criteria 6. Sets up driving criteria as an adjustment 7. Starts recording

ID and Name:	**UC-5 Stop the recording of hammer blows**		
Created By:	Alejandro F	Date Created:	3/7/2022
Primary Actor:	Inspector	Secondary Actors:	
Trigger:	Attempting to stop recording the pile driving process		
Description:	Stop the recording of data so the system can save the data recorded and fill in the pile driving log report so further actions can be taken.		
Preconditions:	PRE-1. User's identity has been authenticated PRE-2. Recording has been started		
Postconditions:	POST-1. Data gets stored in system's database POST-2. Data is used to fill in driving log report POST-3 Data can be used to draw plots/graphs POST-4. System checks driving criteria		
Normal Flow:	**1.0 Stop Recording** 1. While system is running, inspector waits for the recording to be completed 2. Saves the data 3. Finishes the recording		
Alternative Flows:	**1.1 Stop Recording while pile driving still in process** 1. While system is running, inspector tries to shut down the system 2. System throws a message that recording has not finished 3. Inspector shuts down system 4. Data gets saved incomplete 5. System recognizes the reports as incomplete and notifies all users that try to access it		

Use Case Diagram



4. Verification

Key	Summary	Verification Approach(Es)
C3-37	When a field setting button is pressed, the system shall write comments on the driving pile report regarding the changes implied in the setting	Demonstration
C3-36	The system shall start the stopwatch once the start recording button is pressed	Demonstration
C3-35	The system shall have the function to display a graph that represents the hammer stroke per tip elevation (feet)	Demonstration
C3-34	The system shall have the function to display a graph that represents the numbers of hammer blows per tip elevation (feet)	Demonstration
C3-33	The inspector shall be allowed to send an email to the IT team to ask questions or report a problem about the system	Test
C3-32	The system shall provide an email address at which users can address issues or concerns	Inspection
C3-30	Once signed in, the manager shall be able to see all the driving pile reports exported by the inspectors	Inspection
C3-29	The manager shall be able to enter their credentials to have access to the system's tools	Test
C3-28	The inspector shall possess unique credentials that will differentiate them from other inspectors	Inspection
C3-27	The inspector shall be able to enter their credentials to have access to the system's tools	Test
C3-20	The inspector shall be able to set the driving criteria in the pile log driving before the pile driving process begins	Demonstration
C3-19	The system shall provide different buttons that would serve as the different field settings set by the inspector	Inspection
C3-17	The system shall contained an "enter" function that calculated the avg for that last foot/inches	Analysis
C3-16	The system shall allow the inspector to press the "enter" button while recording BPM	Test
C3-15	The system shall fill out the pile driving log using the information saved in the database	Inspection
C3-14	The system shall contain a template of a pile driving log approved by the State of Florida Department of Transportation	Inspection
C3-13	The system shall detect every hammer stroke by evaluating the audio spikes during the recording process	Demonstration
C3-12	Using the saximeter formula, the system shall calculate the hammer stroke from the BPM recorded	Test
C3-11	The system shall save and store the data recorded by the microphone in a database	Analysis
C3-10	The system shall accept input from a Lobar (Unidirectional) type of microphone that will record hammer blows per minute (BPM)	Inspection

5. Appendices

5.1. Assumptions and dependencies

- The lobar (Unidirectional) microphone will not be affected by outside noises
- The software is going to solve the issue.
- There is going to be financial support with this project
- The company will benefit from the usage of the system

5.2. Acronyms and abbreviations

- ***FDOT***: Florida Department of Transportation
- ***FSS***: Federal Specification Standard
- ***CEI***: Construction Engineering Inspection

- ***FS#***: Field Setting number