3D SCANNER PROJECT
3D IMAGE RECONSTRUCTION OF CULTURAL ARTIFACTS
NEEDS AND REQUIREMENT ANALYSIS

Date	Revision	Comments
9/16/14	0.1	Imported template
9/17/14	0.9	Rough Draft
9/18/14	1.0	Deliverable

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1.   Project Summary

The purpose of this project is to design a scanner that implements 3D digital images. This design will be used to preserve the artifacts in the *Slavery in the Old South* found in the Meek-Eaton Southeastern Regional Black Archives Research Center and Museum (Black Archives) at FAMU. Because of the easier virtual access to these artifacts, the museum hopes that it will increase the community's engagement in these historical findings.

2.   Design Team Positions and Responsibilities

Aubrey Tharpe
Project Leader

The Project Leader is the voice of the team. The Project Leader contacts and schedules meetings with the advisors and sponsors when needed. The Project Leader develops milestones for the project and   keeps the team focused on their individual tasks. The Project Lead takes responsibilities of other team members when they are not available (i.e. during a team meeting and times when a deadline needs to be met). The Project Leader guarantees that the project will meet the requirements of the budget and scope by the deadlines given.

Technical Area: C++, Java, VHDL, Assembly, Arduino, Microcontroller programming, some Blender Modeling.

Taylor Wagner
Lead Programmer

The Lead Programmer establishes guidelines for submodules including the interface to the modules as well as the general function of the module. The Lead Programmer also reviews code and ensures the submitted modules are in compliance with the provided guidelines as well as adherence to best programming practices.

Technical Area: C++, Python, Blender 3D modeling, VHDL, Assembly

Authors: Aubrey Tharpe, Rachelle Dauphin, Taylor Wagner, Nicolas Cardenas

Rachelle Dauphin
Secretary

The Secretary keeps records of project meetings (i.e. the meeting minutes and member attendance). The Secretary is responsible for recording the information discussed during each meeting and submitting the record on the team's Facebook group so available for the other members. The Secretary is also responsible for announcing any changes for meetings or schedules.

Technical Area: C++ programming, Microcontroller programming

Nicolas Cardenas
Financial Advisor

The financial advisor is required to keep tabs on all payments in order to ensure the group does not spend more money than what the budget allows. This could require planning future costs of hardware and software needed to complete this project and possibly think of alternate ways to save money where possible.

Technical Area: C++ programming, Microcontroller programming

3.   Need Analysis

3.1.   Problem Statement

The story behind the "Slavery on the Old South" collection is an important part of African-American history. It is well-documented and well-illustrated in a powerful collection on exhibit in the revered halls of the Black Archives. This collection has slavery memorabilia in relatively good condition from the 1600s-1800s time frame. Many visitors and esteemed guests can experience this powerful collection when they visit it at Carnegie Library on F AMU campus. However to increase global access of this snapshot in African- American history, we want to create a "virtual storybook" of the Slavery in the Old South collection so that a wider audience can experience the story and gain a deeper understanding of that period in our American history.

3.1.1.   Project Requirements

CAP-001: The Device must be capable of producing 3D mesh objects from artifacts that range in size from a small doll to a large room
CAP-002: The generated 3D objects must be in a format that can then be used on a webpage and interactive applications

3.1.2. Desirable Outcomes
CAP-003: A gallery is produced from the 3D objects
CAP-004: The 3D objects can be animated for interactive applications

3.2. Operational Description
The user should be able to place the artifact in a scanning environment, the output of which can then be analyzed and rendered into a 3D mesh object. The user then scans the object and obtains source data. The data is then input into software that will analyze the data and produce a 3D mesh object. The mesh object can then be used in animation software to produce videos or interactive learning software.

4. Requirements Specifications

4.1. Functional Requirements
REQF-001: The device must be capable of scanning small objects such as the size of a doll
REQF-002: The device must be capable of scanning large objects such as the size of a bed or a room

4.2. Non-Functional Requirements
REQN-0001: The mesh objects must be in a format that can be used in 3D modeling software

4.3. Constraints
These limit the development in some way, such as defining an operating system that the project must run on, which programming language must be used to implement the system, what drawing tools must be used, or specific vendors which must be used for manufacture. Constraints may also include regulatory constraints, environmental impact constraints, physical constraints, constraints for safety reasons, cost limits, time limits, etc.

CONS-001: The budget of the overall project must stay within 500 USD

CONS-002: The computational requirements must not exceed the capabilities of an average desktop and laptop computers

CONS-003: The system must be relatively simple to operate

CONS-004: The system must not require expert knowledge for maintenance

5.   Preliminary Test Plan

5.1.   Capabilities Test Plan

TESTC-0001: Render a 3D Image of a Small Object
Take multiple photos of a small object that is less than two cubic feet and construct a 3D model using photogrammetry techniques.

TESTC-0002: Render a 3D Image of a Medium Object
Take multiple photos of a medium object that is between two and seventy-five cubic feet and construct a 3D model using photogrammetry techniques.

TESTC-0003: Render a 3D Image of a Large Object
Take multiple photos of a large object that is more than seventy-five cubic feet and construct a 3D model using photogrammetry techniques.

5.2.   Requirement Test Plan

TESTR-001: 3D mesh is usable in 3D modeling software
Import mesh into industry standard modeling format such as .blend files

5.3.   Constraints Test Plan

TESTP-001: Render and analysis time
Generation of mesh takes less than 24 hours on conventional workstation hardware

TESTP-002: Simplicity
A user can complete the process with minimal instruction

TESTP-003: Maintenance
Device is used on all archive artifacts with no required servicing

6.   Deliverables

The final product of accessible virtual 3-dimensional (3D) models, "fly-by-movies" and animated reenactments of the artifacts' utilization that were converted from 2-dimensional (2D) images using 3D capturing software. The software (open-sourced or copyrighted) will fit within the budget of the project. The digital media created will be published on an online gallery.

As a one-year pilot case study project, the outcome will lead to building a potential research platform for constructing 3D virtual galleries that is focused on African-American culture. This can also lead to crossing liberal art and engineering majors into an undergraduate research curriculum.

7.   References

Project_Summary Tech It Up 2014.pdf