Shale

Release Notes

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CU Craft Technology Group

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1 Introduction

CU Craft Technology Group is a part of the Center for Lifelong Learning and Design at the University of Colorado specializing in the integration of computation and craft materials to produce mathematical or educational toys and activities for children. The group consists of a small number of faculty members and students working on the Boulder Campus of the University.

Previously, CU Craft Technology collaborated with a team of undergraduate software engineers to develop a project entitled Laser Ball. This program created a combination of virtual and physical elements through the use of digital image recognition. Project Shale is an expansion upon this project, and will include wireless communication with the physical objects, in order to enable more advanced interactions such as movements, lights, and sound.

A conceptual diagram of the overall system is presented in **Figure 1**. The figure shows the software to be implemented, Shale (Levers Shadows & Wheels). Shale receives input from the web camera and outputs data to the projector, which projects virtual objects (e.g. falling spheres) onto a whiteboard or blank wall. Affixed to the wall are mechanical/physical objects and the beam of a green laser pointer, which are seen by the web camera, and interpreted by digital image processing software within Shale. Shale then combines the web camera's input and correlates the locations of the virtual objects to create an interactive environment. Shale will also interact with the physical objects through use of a wireless transmitter. It will send signals to these physical objects when they interact with virtual objects, triggering movement (through motors), lights (through LEDs), or sounds (through speakers).

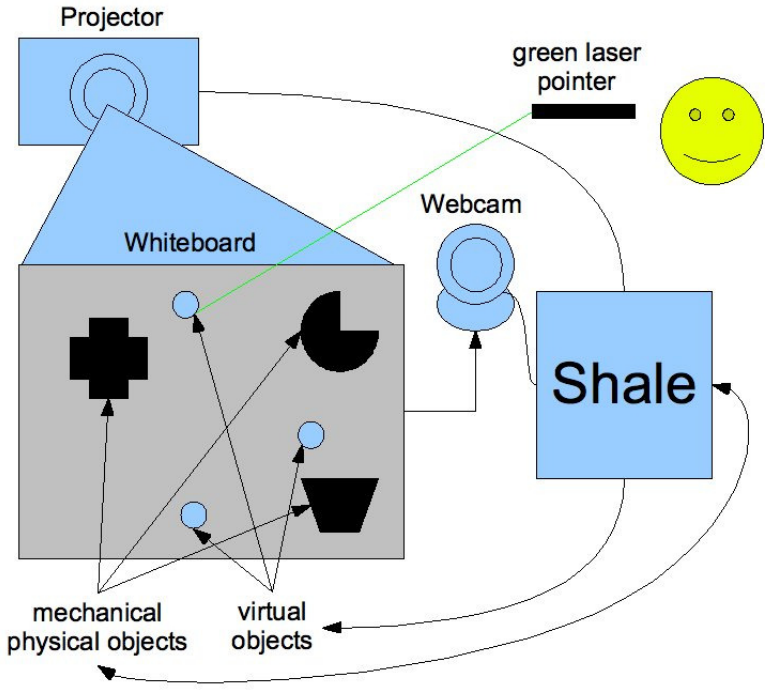

Figure 1: *Conceptual Overview of the Shale System*

This document, *Shale Release Notes*, is intended to be read by the person responsible for installing the Shale system, as well as by the person responsible for continuing development and maintenance of the software. It provides installation instructions, a very high-level view of the implementation and a list of useful references.

2 Shale Installation

2 Shale Installation

The Shale release includes access to all Shale documentation, along with direct access to the open source code of the Shale software, hosted with the GNU Public License on SourceForge. Installing Shale on a workstation is a relatively simple process. It involves the following four steps:

1. Determining if you have the proper hardware and software environment.
2. Downloading the Shale source from the project release website.
3. Building and installing the Shale files.
4. Making the Shale user documentation available to the users.

Each of these steps is described below in further detail.

2.1 Software and Hardware Requirements

While Shale will build and execute on a variety of systems, there are certain requirements that must be met to guarantee successful build and execution. These system requirements relate to the development environment, in addition to the software and hardware run time environment.

2.1.1 Software Runtime and Development Environment

Shale can be built and developed in the following software runtime and development environment:

- Windows XP SP3, Windows Vista SP1, or Mac OS X 10.4.11
- Processing PDE 135 Beta or later **[Processing]**
- Sun Java 6 JDK or later **[Sun Java 6 SDK]**

2.1.2 Hardware Runtime and Development Environment

Shale will execute correctly on a platform having the following minimum hardware runtime and development environment:

- 1GHz processor
- 1GB available disk space

- 256Mb of RAM
- 1024x768 pixel 24-bit color projection display
- 1 green laser pointer
- 1 functional webcam with appropriate drivers - we recommend Logitech® QuickCam Pro 9000™ **[Logitech QuickCam Pro 9000]**
- Arduino Diecimila **[Arduino Diecimila]** to control mechanical objects
- a wireless communication device adaptor for the Arduino Atmel (XBEE)
- a whiteboard or other surface on which to attach the mechanical objects

2.2 Downloading the Shale Source

Shale is distributed as a **zip** file on the project website **[Shale]**. Approximately 6.7MB of disk space will be required just to load the source files.

Perform the following steps to load the Shale source files:

1. Click on the link for Shale.jar as well as lib.zip from the project website. This initiates an automatic download from the web browser to the specified download location.
    a. Unzip the lib.zip file to create the *lib* directory in a specified location. This specified location is required later in the Building and Installing the Shale Source section as the *nativelibrarypath*.
2. For the entire source folder, click on the link for Shale.zip from the project website. This also initiates an automatic download from the web browser to the specified download location.
    a. Unzip the Shale.zip file to create the *Shale* directory in a specified location. This directory already contains the *Arduino*, the *lib*, the *IntelMacJMyron* and the *Shale* directories in addition to a README file that describes the contents of the directory intended to assist the user in the remaining two steps.

You are now ready to work with the Shale runtime files.

2.3 Building and Installing the Shale Source

There are two ways to build and run Shale – the first is designed for the end-user and involves the use of Shale.jar and the *lib* directory. The second is for the developer, which requires obtaining a distribution of Processing **[Processing]**, and it is recommended that you also obtain the Eclipse IDE for Java Developers **[Eclipse]** distribution in addition. For the instructions to build and run Shale as a development project please refer to the *Shale User Documentation* on the project site **[Shale]**.

For the end-user, there is a README file in the *lib* directory that explains extra steps necessary for Windows users to step through prior to running Shale, since Mac users do not require the use of the .dll files within the *lib* directory while Windows users do. Otherwise, you can just run the Shale.jar file via command line using the following:

shale.jar -Djava.library.path="*nativelibrarypath*"

where *nativelibrarypath* is replaced by the path name for the native library directory. The files should be accessed as part of the *lib* directory within the *Shale* directory that was created from the Shale.zip file.

2.4 User Documentation

There is currently one piece of documentation available to the Shale user. This is the *Shale User Documentation* – designed for developers to install and run Shale in a code modification environment, specifically through the use of Eclipse. Also includes attached resources for building the physical objects capable of interacting with the software, as well as simple instructions for the end-user to install and run Shale.

This can be found on the project website **[Shale]** under Documentation.

3 A Brief Look at the Shale Source

This section provides a brief insight into the implementation of Shale. It describes the organization of the Shale source code, and mentions known problems with the Shale system.

3.1 Shale Source Code Organization

To understand the Shale implementation, it is first necessary to understand the organization of the Shale source code. The Shale source directory structure is shown in **Figure 2** below.

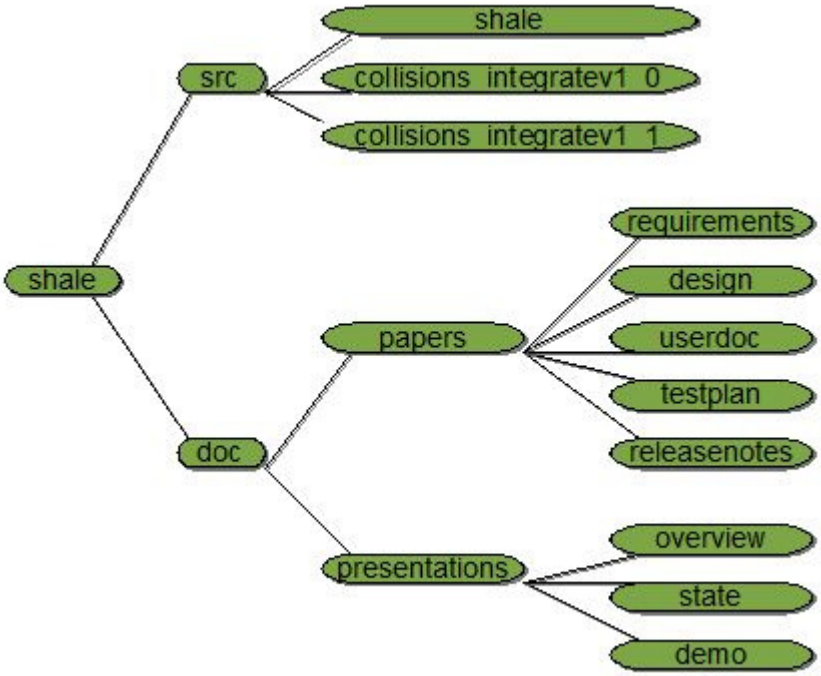

***Figure 2**. Shale Source Directory Structure*

A brief overview of the organization of the source files is given here.

src files and subdirectories for all Shale source code.

shale	source for the user interface process.
collisions_integratev1_0	source for the original collision detection.
collisions_integratev1_1	source for the revised collision detection.

doc subdirectories for papers written and presentations given for the Shale project.

- **papers** subdirectories for each paper written for the Shale project.
  - **requirements** source for the requirements specification.
  - **design** source for the design specification.
  - **userdoc** source for the user documentation.
  - **testplan** source for the test plan.
  - **releasenotes** source for the release notes.
- **presentations** subdirectories for each presentation given for the Shale project.
  - **overview** source for the overview presentation slides.
  - **state** source for the state of the project presentation slides.
  - **demo** source for the final demo presentation slides.

3.2 Known Problems

There are several minor problems that are known to exist in this release of Shale.

1. Collision detection has unusual behavior on virtual objects – this includes occasionally missed collisions and collisions that result into two or more virtual objects sticking together.

2. The physical objects are occasionally unresponsive to collision signals.

3. The image recognition is very sensitive to camera settings, lighting, and clarity of the projection surface.

4. Mechanical objects are design to only work on a whiteboard surface; mechanical objects are currently a prototype and are not meant to be completely durable.

4 SUMMARY

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This document has provided installation instructions, as well as a very high level view of the implementation. Together with the content of the release itself, developers should be able to easily continue with the development and maintenance of the Shale system.

5 References

There are a number of documents related to this paper that are useful for further reading.

[Shale]

"The Shale Project". March 2009. <http://projectshale.sourceforge.net/>

[Processing]

"Learning" *Learning\Processing 1.0 (BETA)*. Sept 2001. Processing (September 12, 2008) <http://processing.org/learning/index.html>

[Eclipse]

"Eclipse Downloads". Eclipse (February 5, 2009) <http://www.eclipse.org/downloads/ >

[Arduino Diecimila]

"Arduino Diecimila" *Arduino - ArduinoBoardDiecimila*. October 2008. Arduino (October 30, 2008) <http://arduino.cc/en/Main/ArduinoBoardDiecimila>

[Sun Java 6 SDK]

"Java SE Downloads" *Java SE Downloads*. Continuous. Sun Microsystems. (September 12, 2008) <http://java.sun.com/javase/downloads/index.jsp>

[Logitech QuickCam Pro 9000]

"QuickCam® Pro 9000" *QuickCam® Pro 9000*. Continuous. Logitech. (September 12, 2008) <http://www.logitech.com/index.cfm/webcam_communications/webcams/devices/3056&cl=us,en>