



State of the Project

Shale

*(**SH**adows **LE**vers & **W**heels)*

Paul Gerhardt
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Tomas Ramirez
Jessa Rothenberg
Kaiti Trimble



The Shale Team



. . . Paul Gerhardt



. . . Amanda Orin



. . . Tomas Ramirez



. . . Jessa Rothenberg

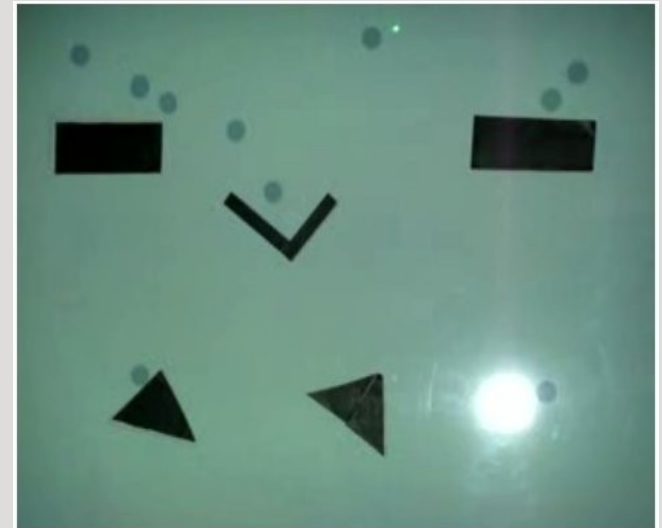


. . . Kaiti Trimble



Presentation Focus

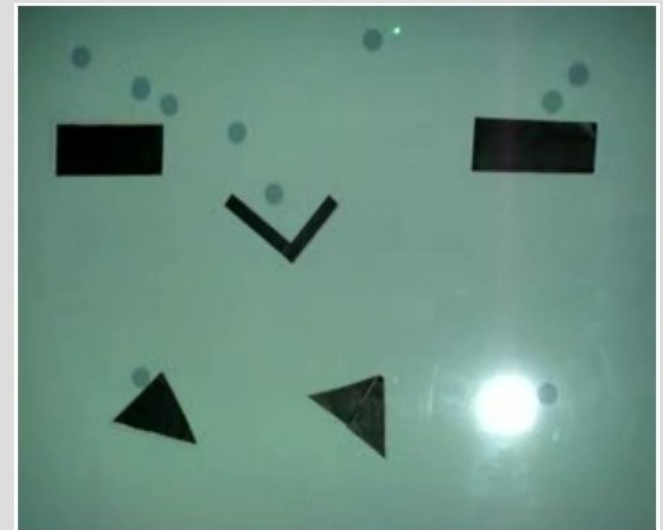
- Project Overview
- Requirements
- User Interface Design
- Architecture
- Software Demo





Presentation Focus

- Project Overview
 - The Class
 - The Problem
 - The Solution
- Requirements
- User Interface Design
- Architecture
- Software Demo





The Class

- Computer Science Capstone
- 49 Students... 10 Teams
- Industry Projects
 - Game Creation Game for the Nintendo Wii
 - AgentSheets, Inc. (Boulder, CO)
 - Auto-Categorization of Content Publishers
 - Lijit Networks, Inc. (Boulder, CO)
 - MyJinji – Social Networking Portal
 - MyJinji (San Francisco, CA)





Problem

- Interactions between virtual and physical objects
 - Virtual: balls, balloons, bubbles?
 - Physical: bumper, see saw, waterwheel
- User input
 - move physical objects
 - create virtual objects
- Expand LaserBall idea



Problem

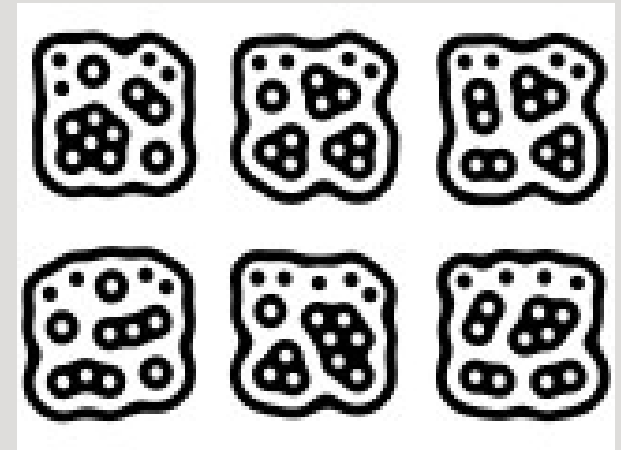
- Laserball...
 - Virtual objects
 - “Dumb” physical objects
- Needed:
 - Incorporate reactive physical objects
 - Wireless communication





The Solution: Shale

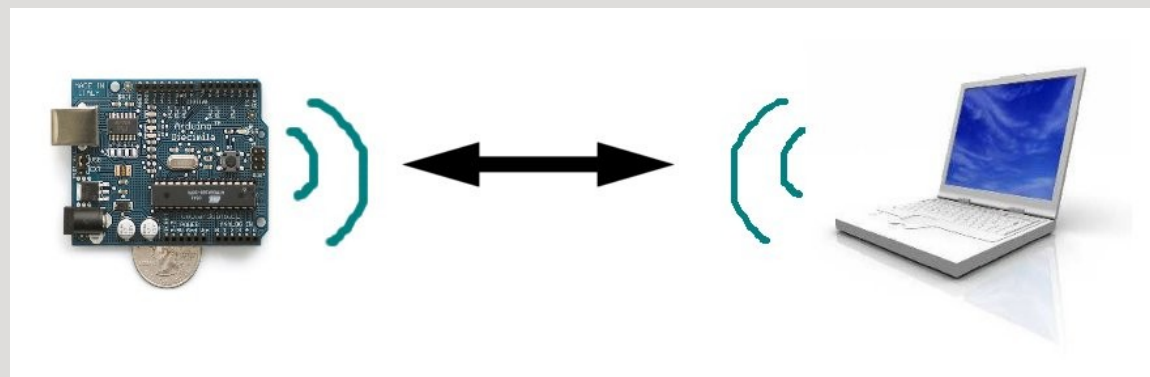
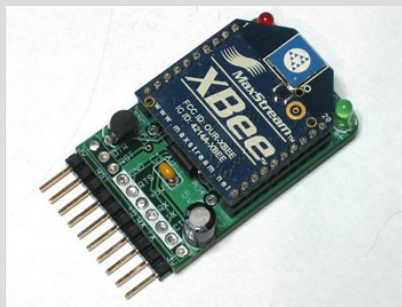
- Uses of Shale
- Major Requirements
 - Development
 - Environment
 - Functional
- Conceptual View of Shale





Solution: Shale

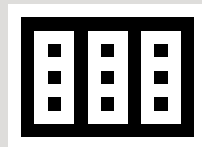
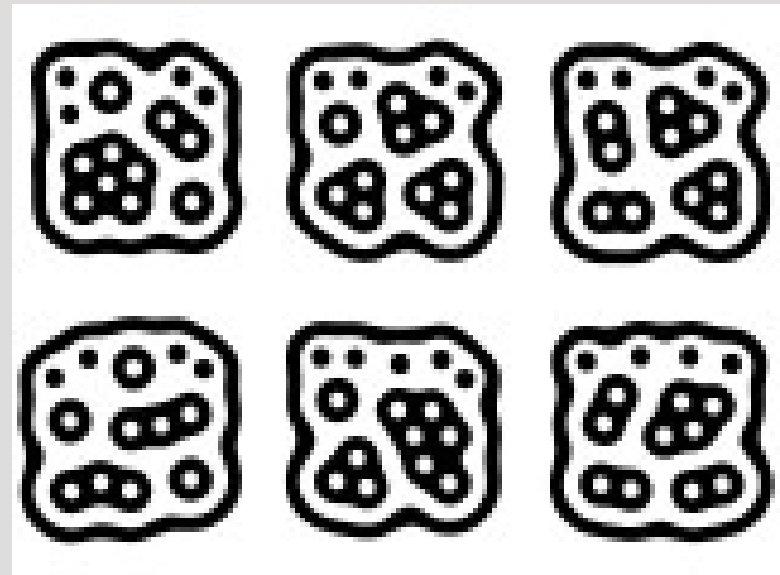
- Extend the LaserBall project with reactive physical components
 - See-saw, Bumper, Sound Emitter
- Wireless communication with components
 - Xbee (Zigbee 802.15.4 mesh networking)





Solution: Shale

- Recognize Physical Objects
 - Topological fiducial markers

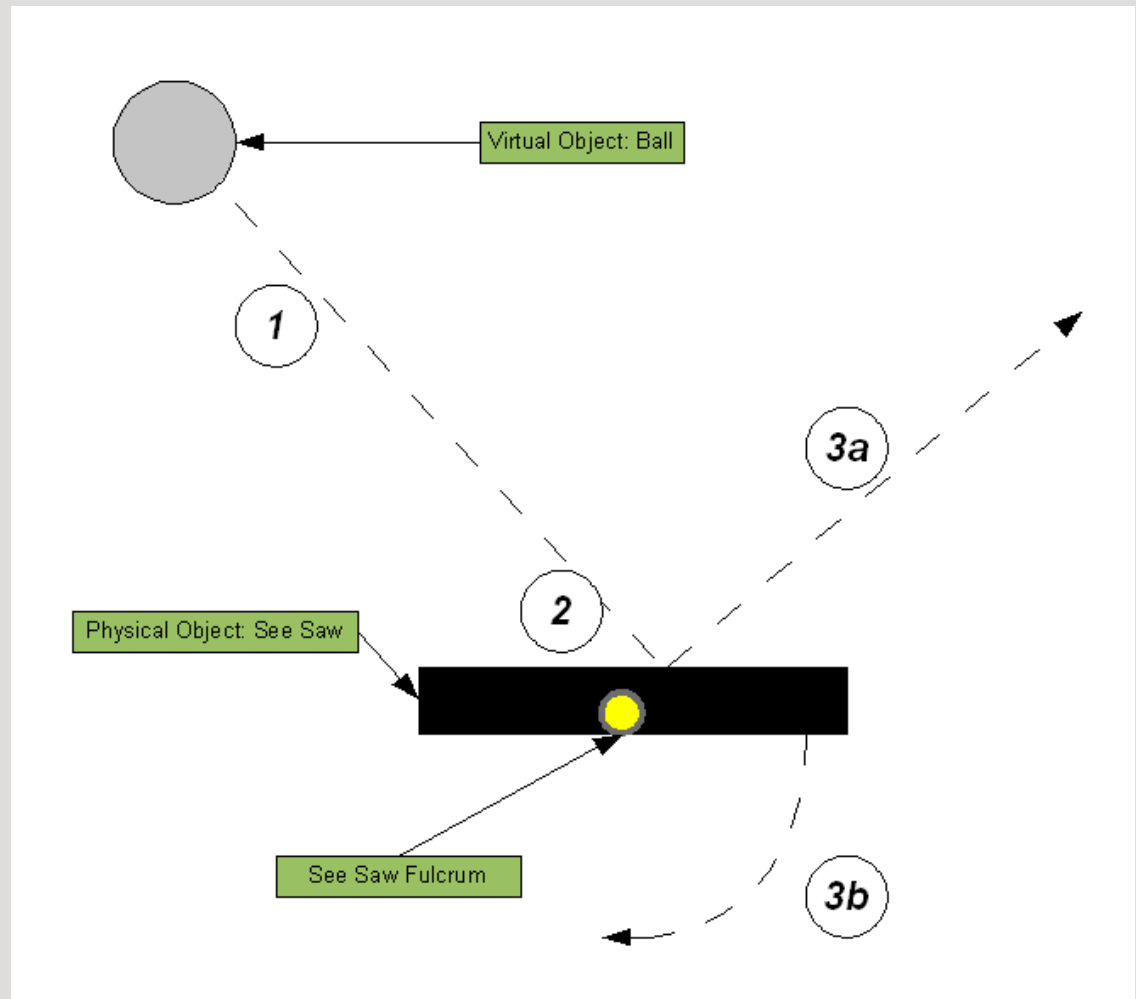




Shale: An Example

Steps:

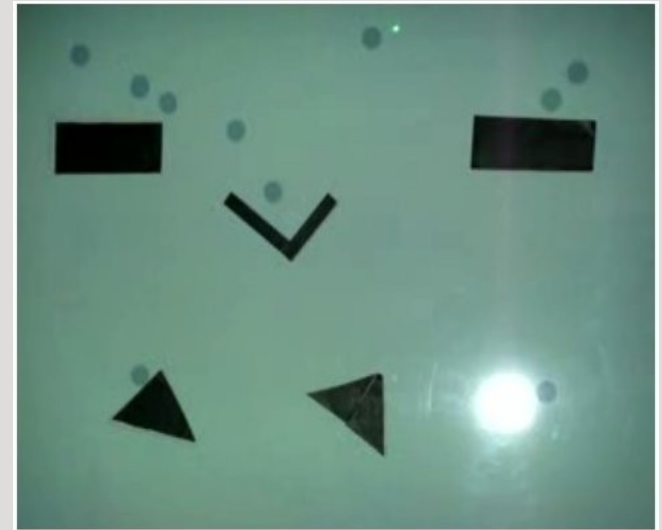
1. Virtual Object (the ball) moves towards the Physical Object (the see saw)
2. Virtual Object and Physical Object collide
3. Virtual Object (ball) ricochets off in a different direction AND Physical Object (see saw) turns in reaction to the collision





Presentation Focus

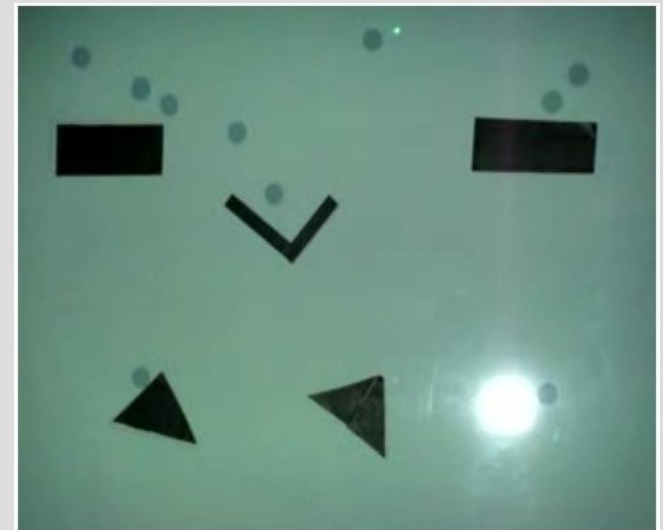
- Project Overview
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Presentation Focus

- Project Overview
- Requirements
 - Development Requirements
 - Environment Requirements
 - Hardware Requirements
 - Functional Requirements
- User Interface Design
- Architecture
- Software Demo





Development Requirements

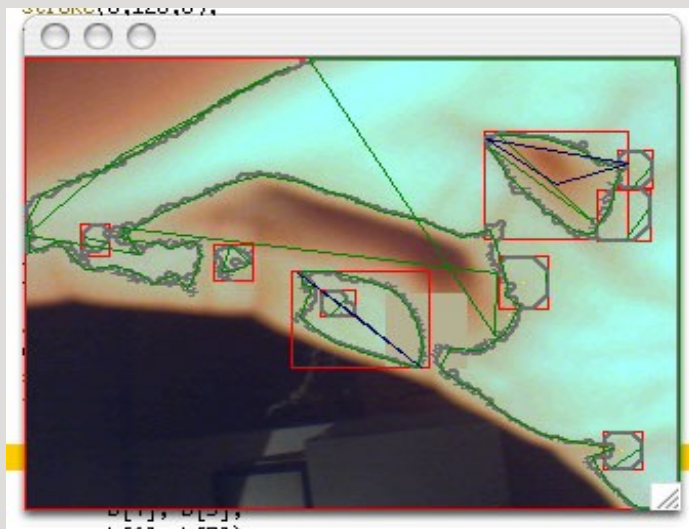
- Processing PDE 1.0
 - LaserBall
 - Easy graphical content
 - Cross-platform
 - Compatible with hardware





Development Requirements

- JMyron Image Processing Library
 - Compatible with Processing
 - Easy to use





Environment Requirements

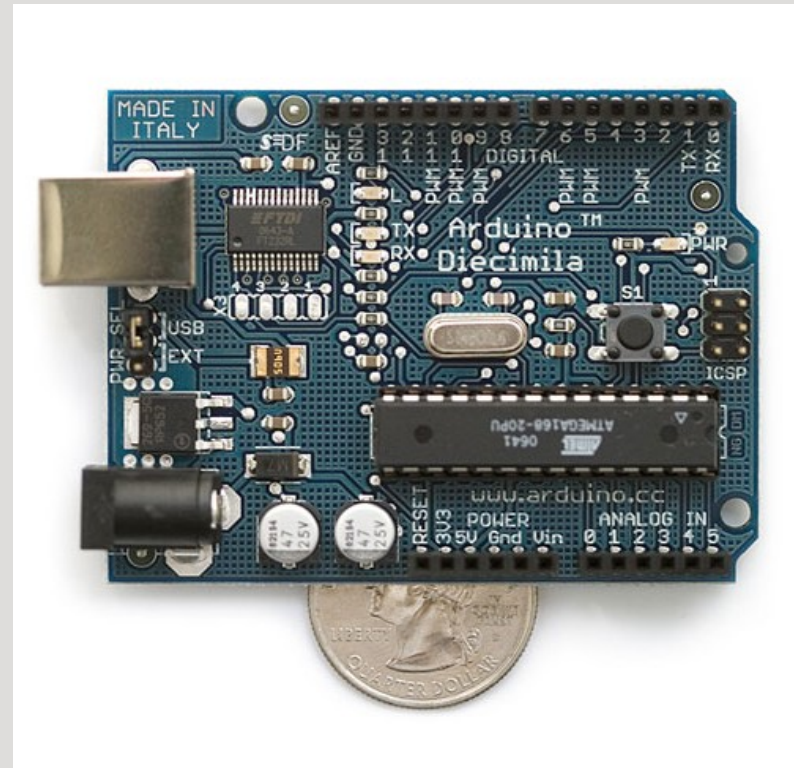
- Windows XP or Vista
- Mac OS 10.5 Intel Chip
- JRE 1.5 or better





Hardware Requirements

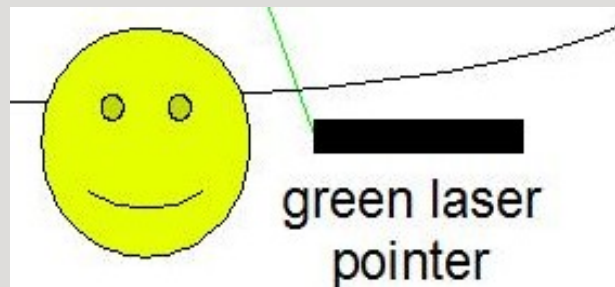
- Projector
- Web camera
- Projection Surface
- Laser Pointer
- Arduino micro-controllers





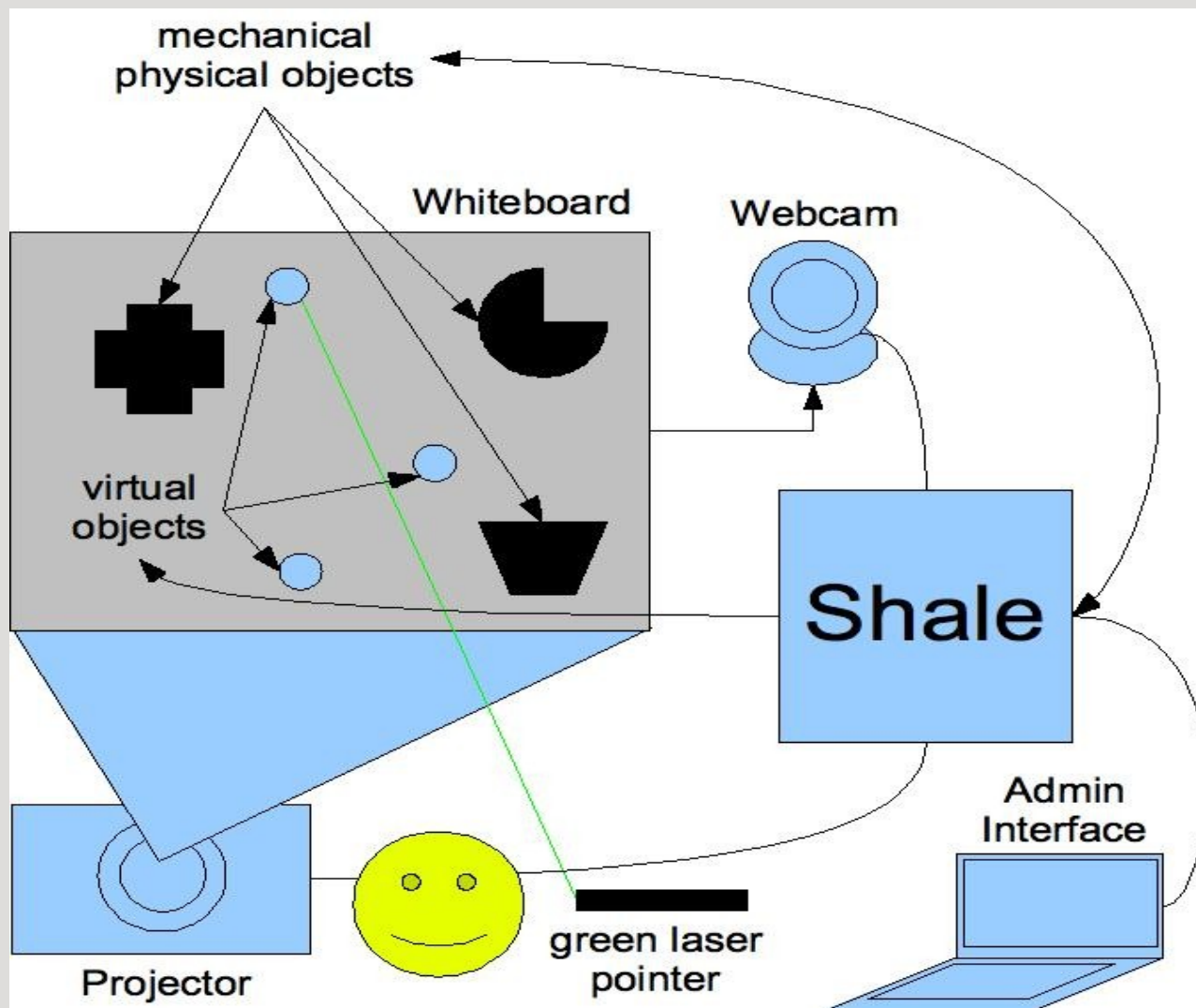
Functional Requirements

- Interactions between physical and virtual objects
 - Project virtual objects
 - Screen Update Interval
 - Detect and control physical objects
 - Respond to user actions



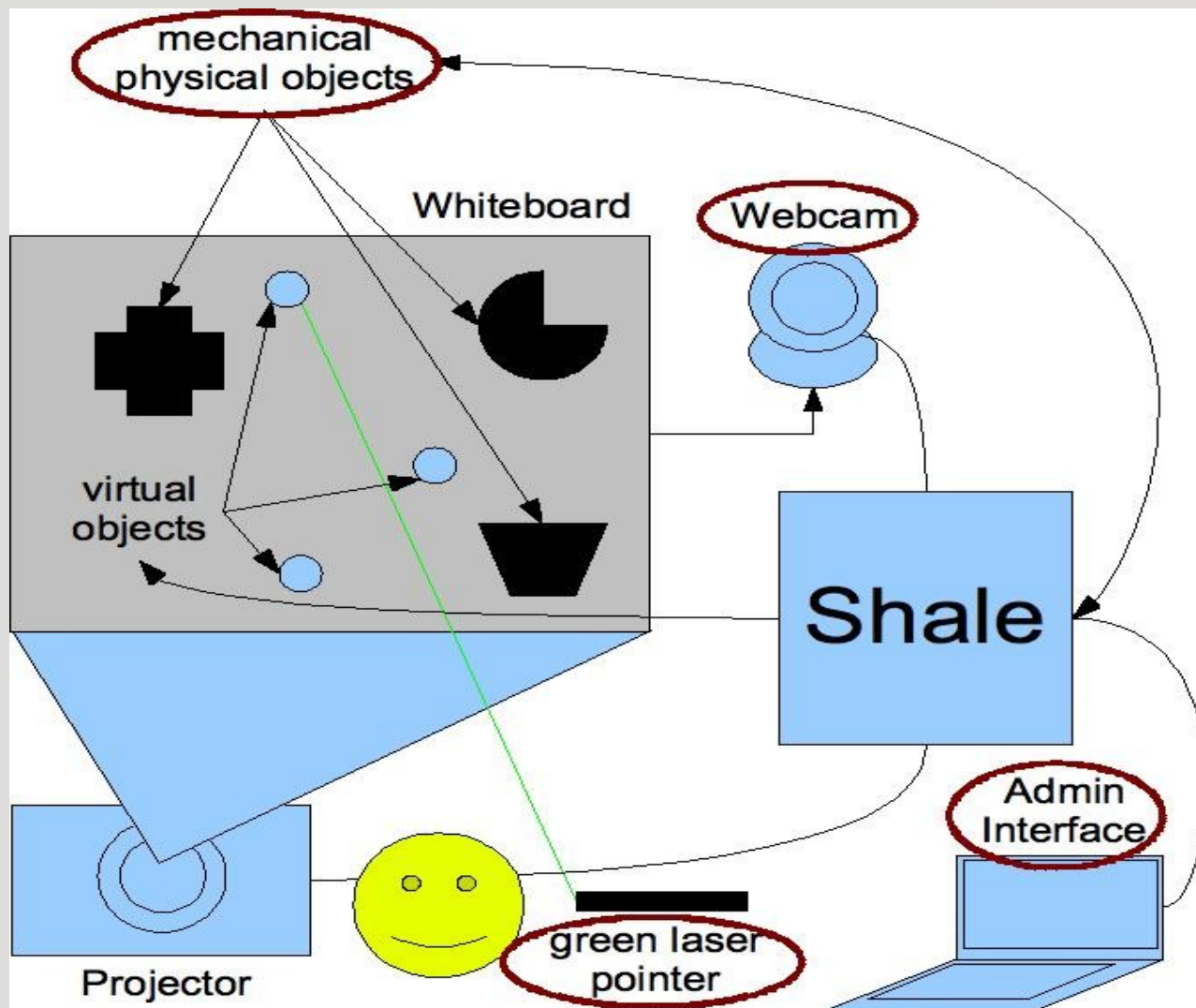


Conceptual Overview



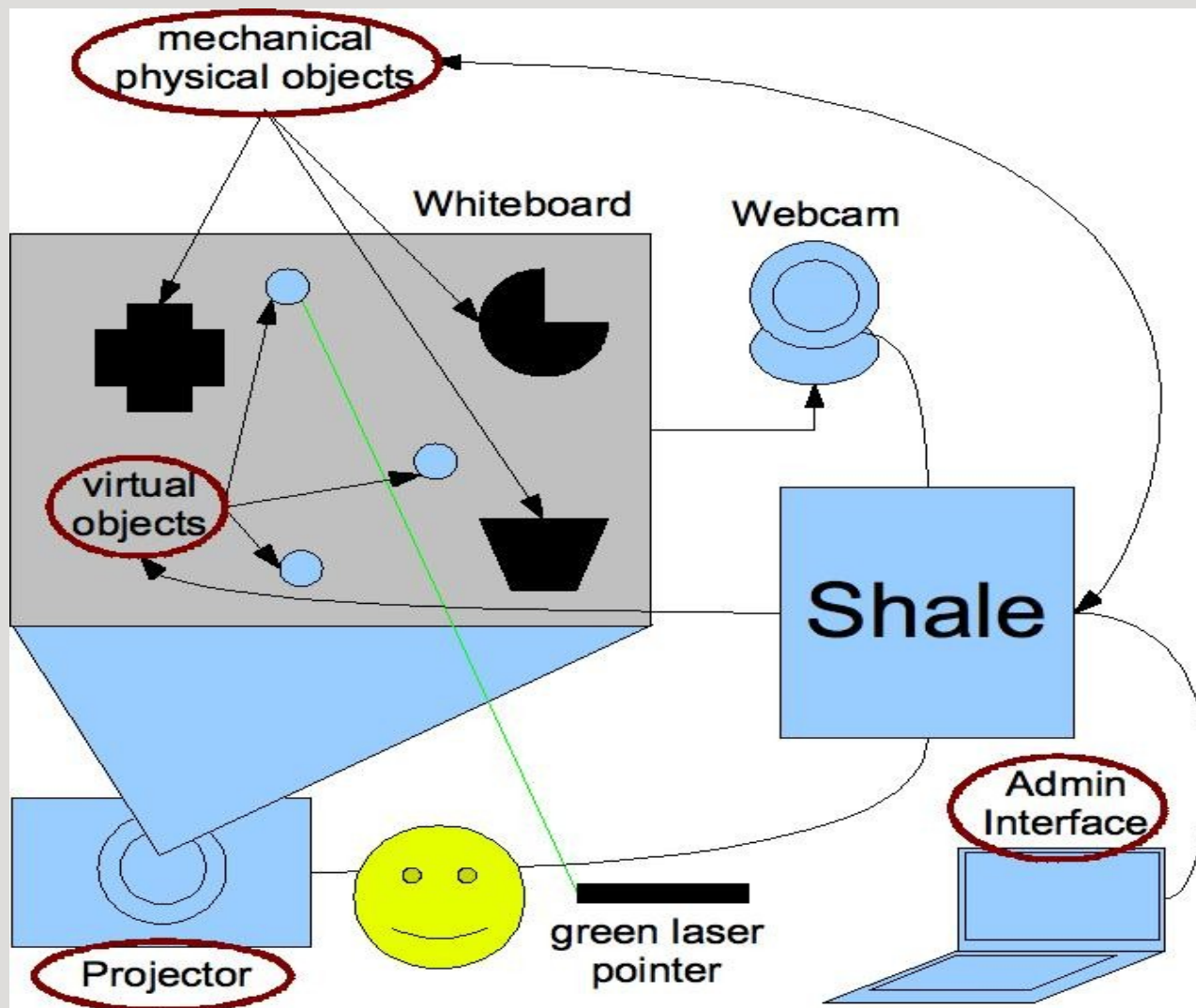


Conceptual Overview





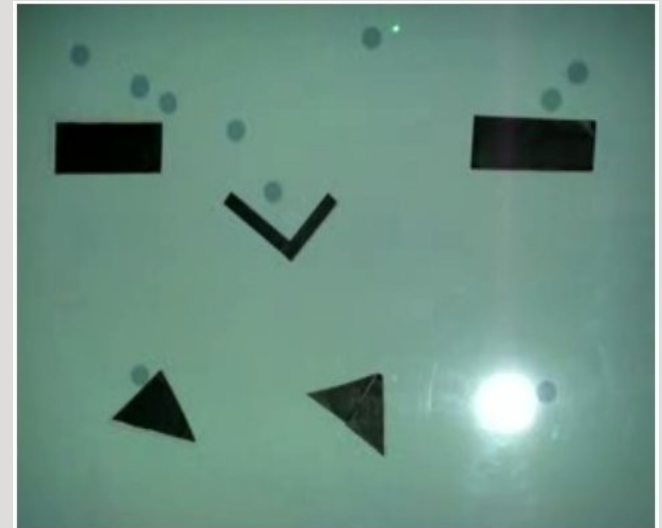
Conceptual Overview





Presentation Focus

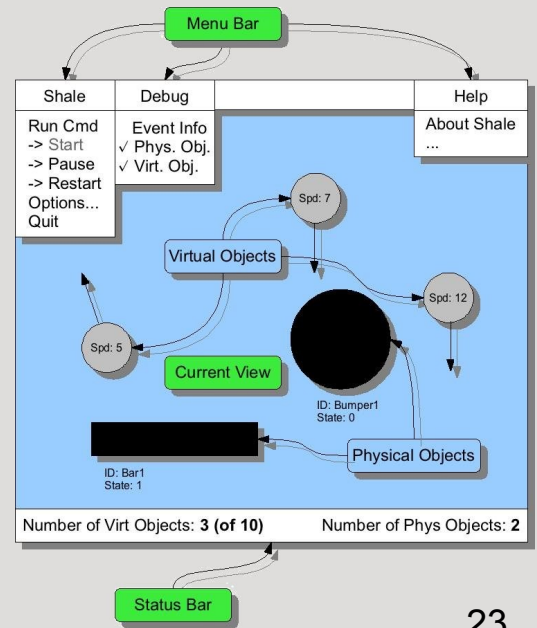
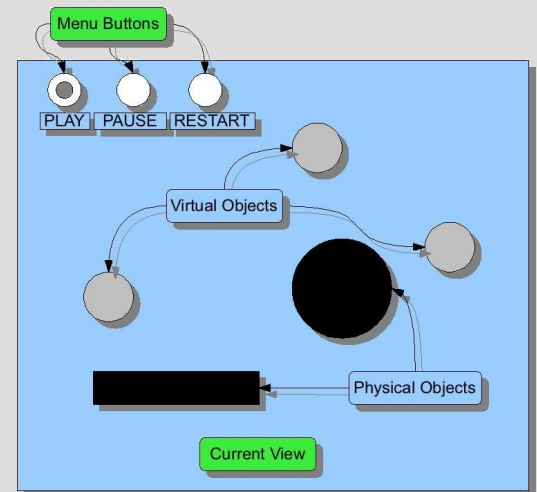
- Project Overview
- Requirements
- **User Interface Design**
- Architecture
- Software Demo





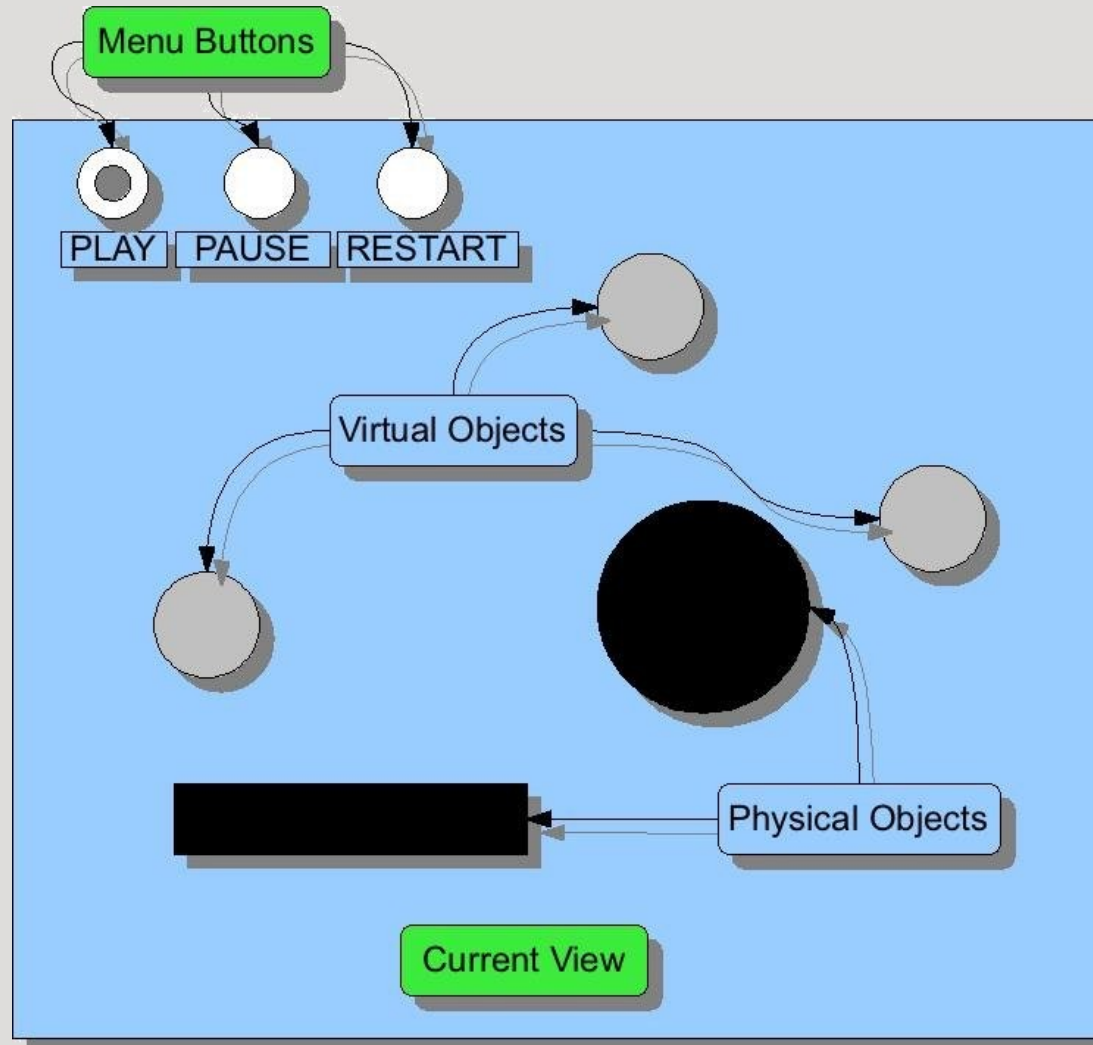
Presentation Focus

- Project Overview
- Requirements
- User Interface Design
 - Standard User Interface
 - Administrative Interface
- Architecture
- Software Demo





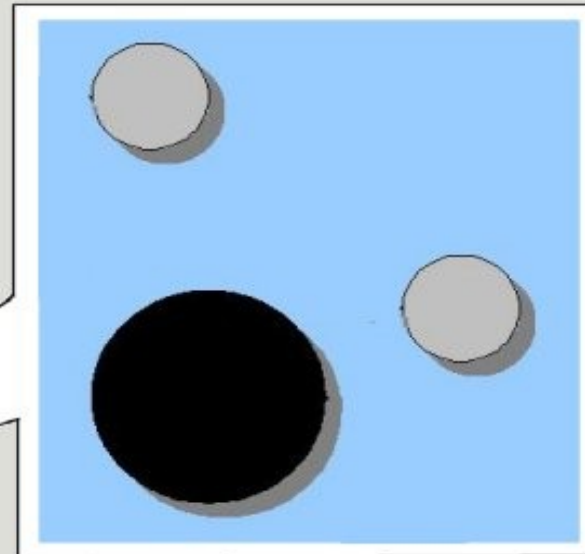
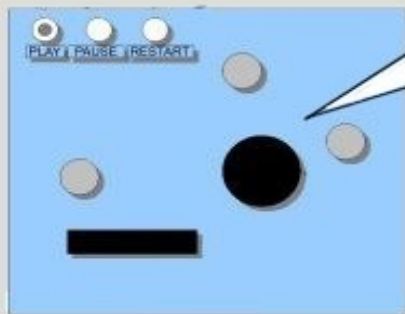
Shale: The Standard Interface





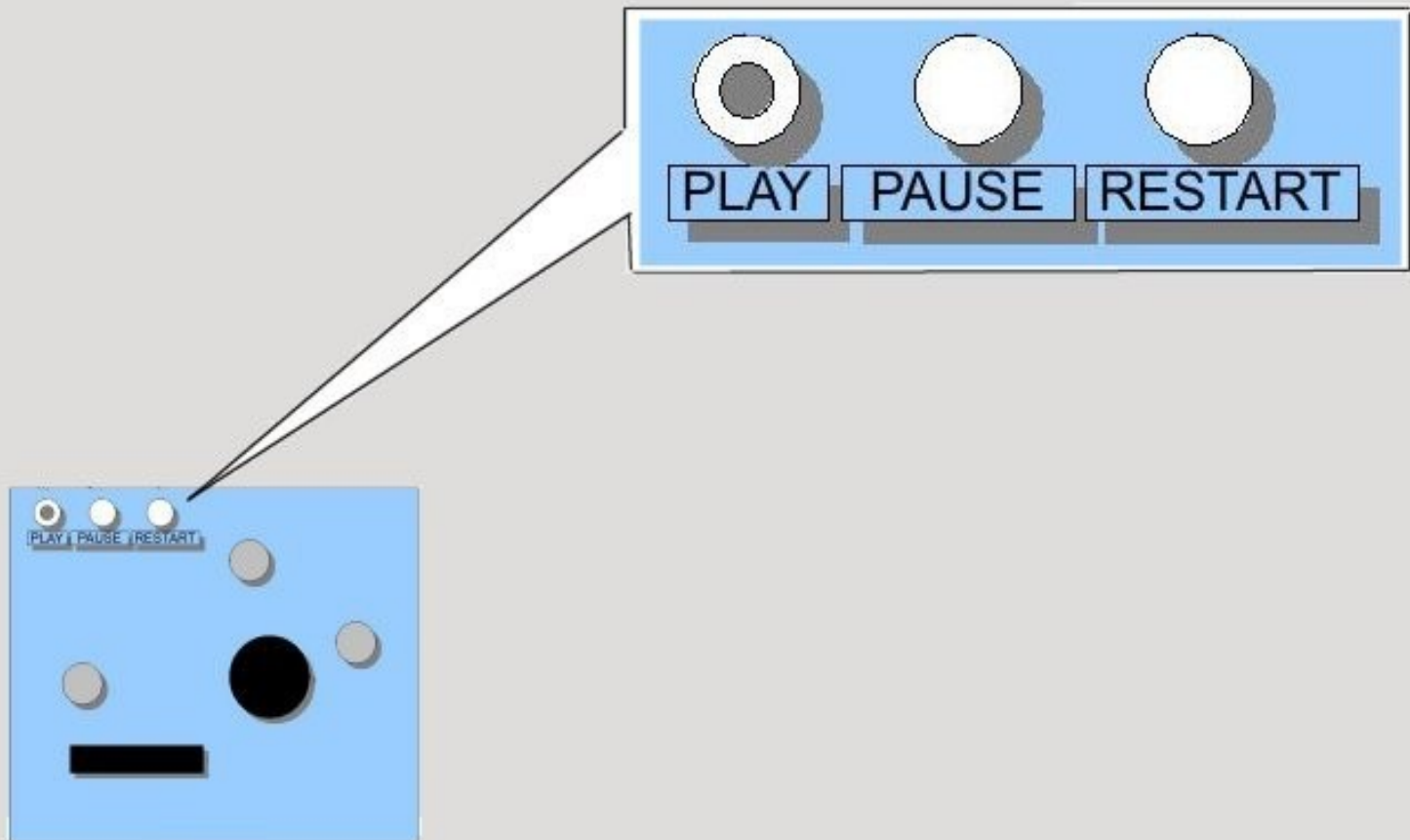
Current View

- **Simple display onto the Stage**
 - Physical Objects (black)
 - Virtual Objects (gray)

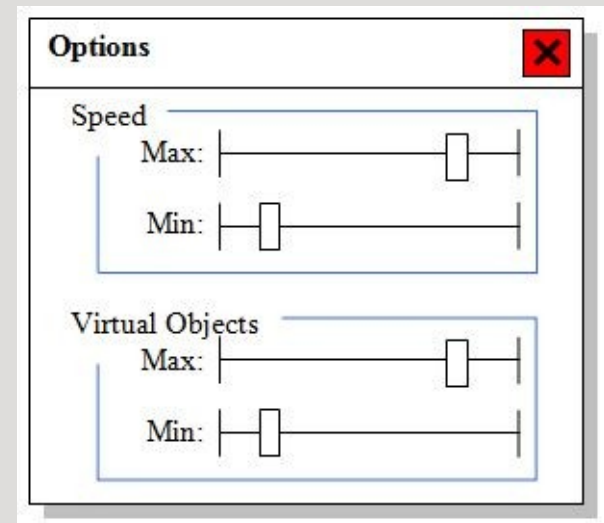
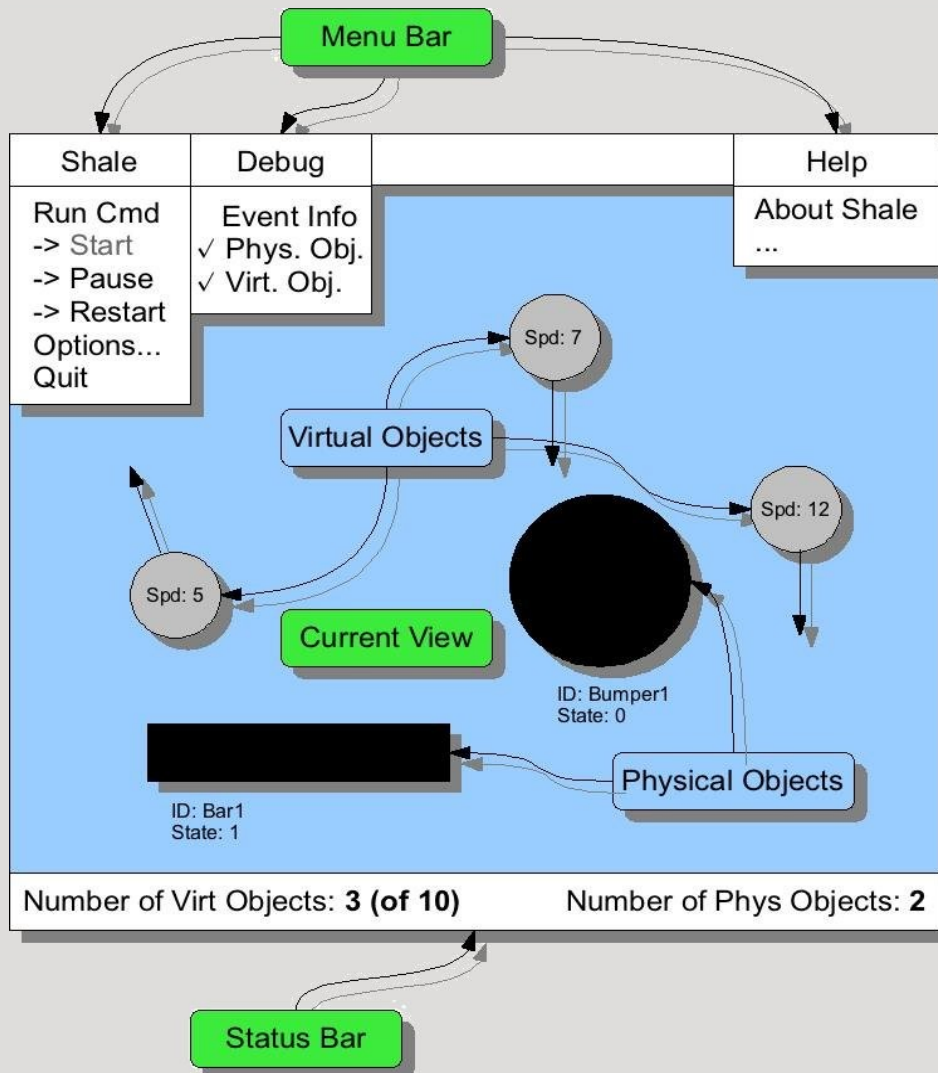




Menu Buttons



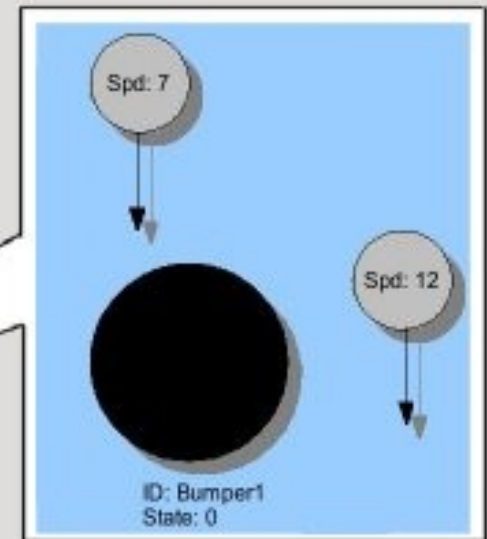
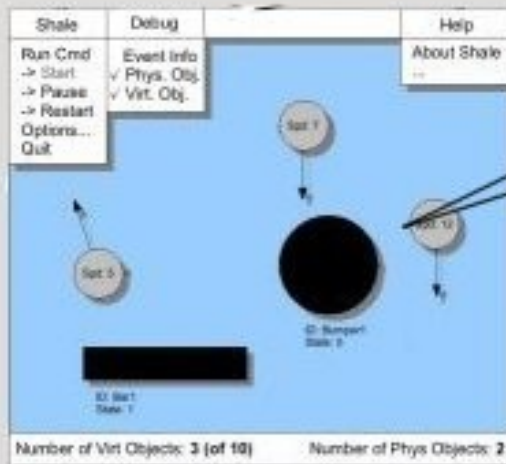
Administrative Interface





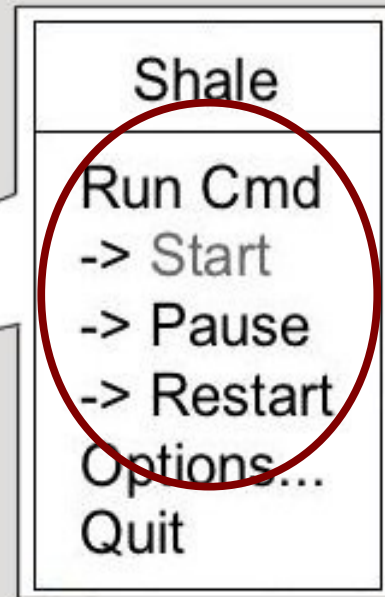
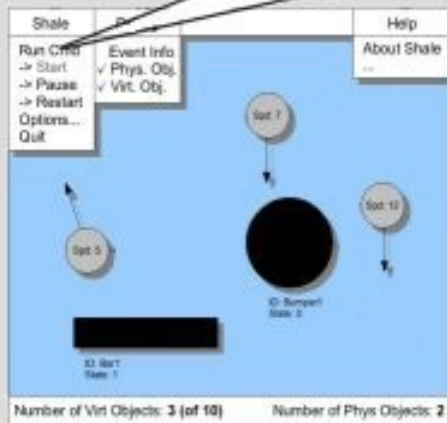
Current View

- **Physical Objects**
 - Can (un)display debugging features
- **Virtual Objects**
 - Can (un)display debugging features





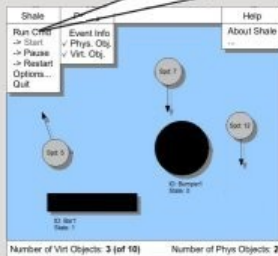
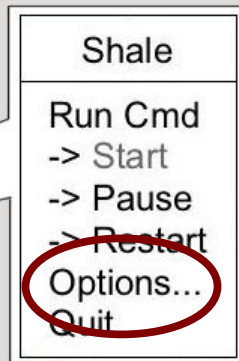
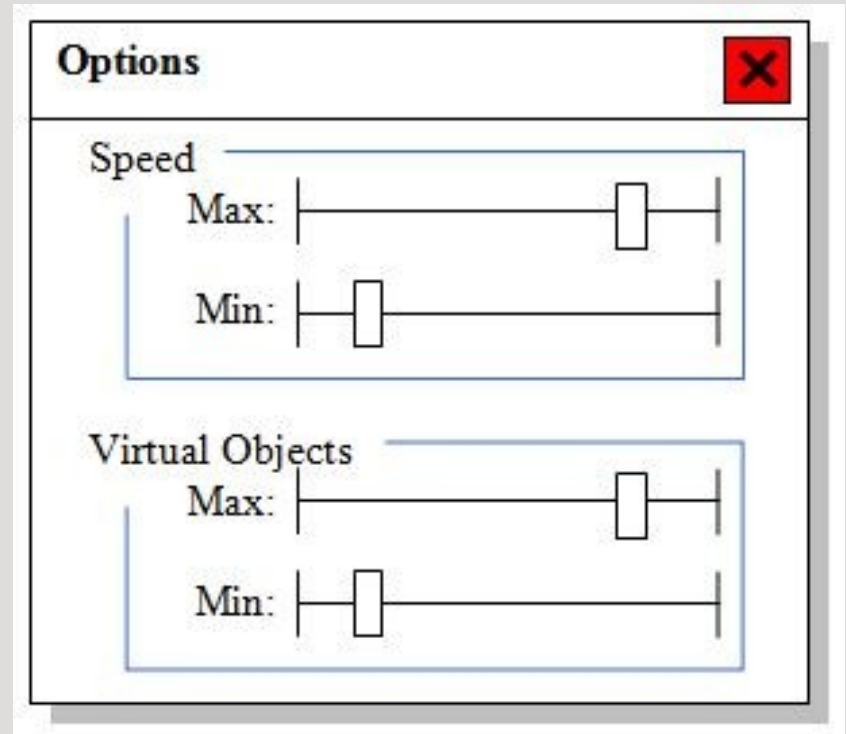
Menu Bar: Shale – Run Cmd





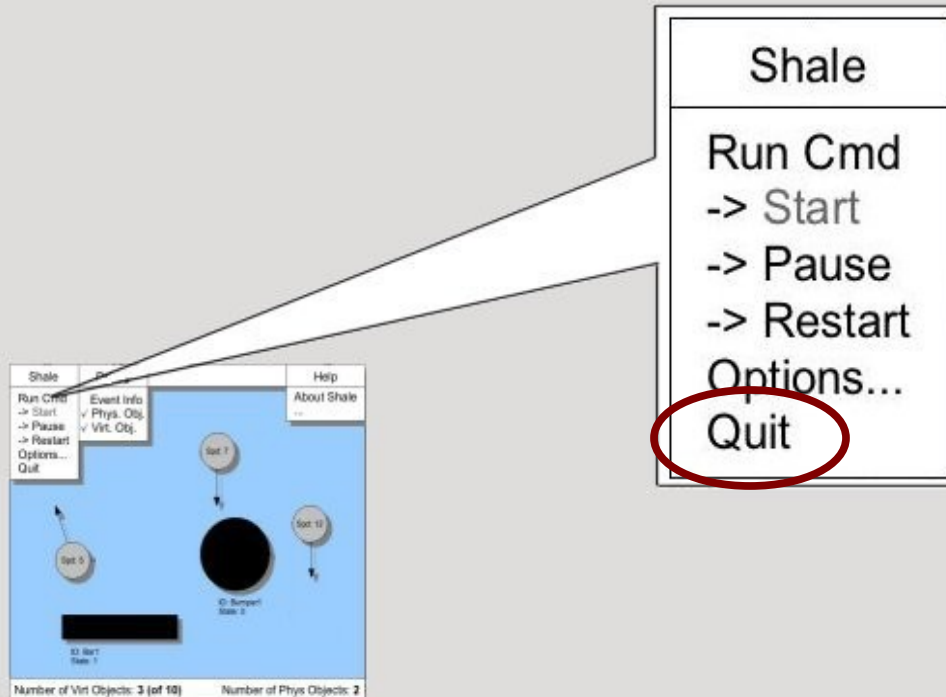
Menu Bar: Shale – Options

- Options...
 - Opens dialog box to modify user preferences:
 - Virtual Object Speed
 - Virtual Object Quantity





Menu Bar: Shale - Quit

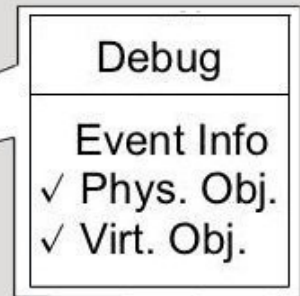
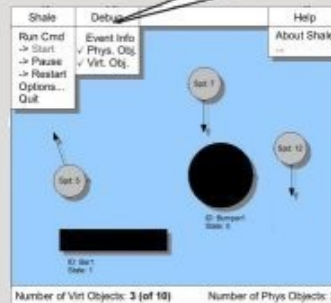




Menu Bar: Debug

- **Event Information**

- log file
 - collision event information
 - change in state for virtual/physical objects

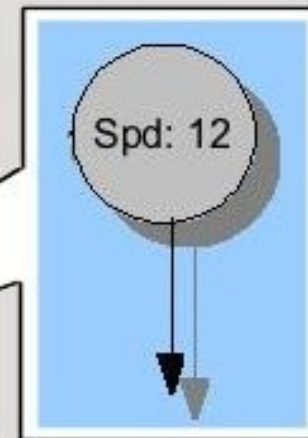
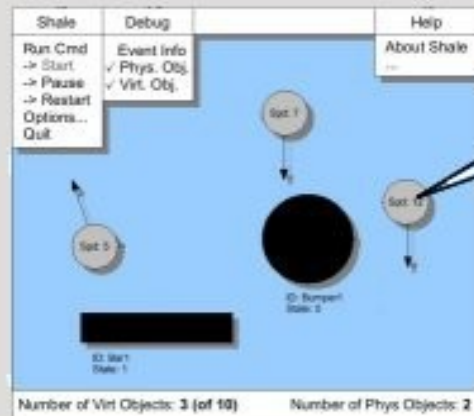




Debug: Virtual Objects

- **Virtual Objects**

- current speed
- directional arrow for movement

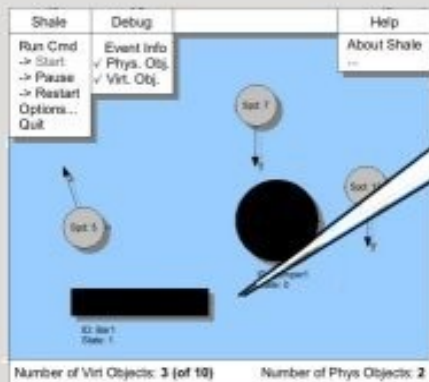




Debug: Physical Objects

- **Physical Objects**

- Display the ID of each object
- Display the current state of each object



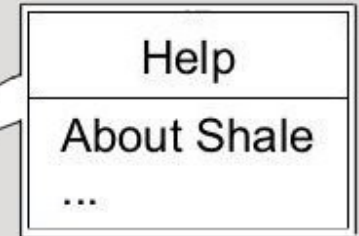
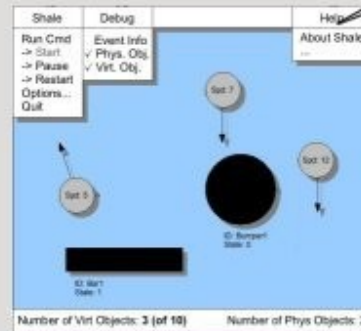
ID: Bar1
State: 1



Menu Bar: Help

- **About Shale**

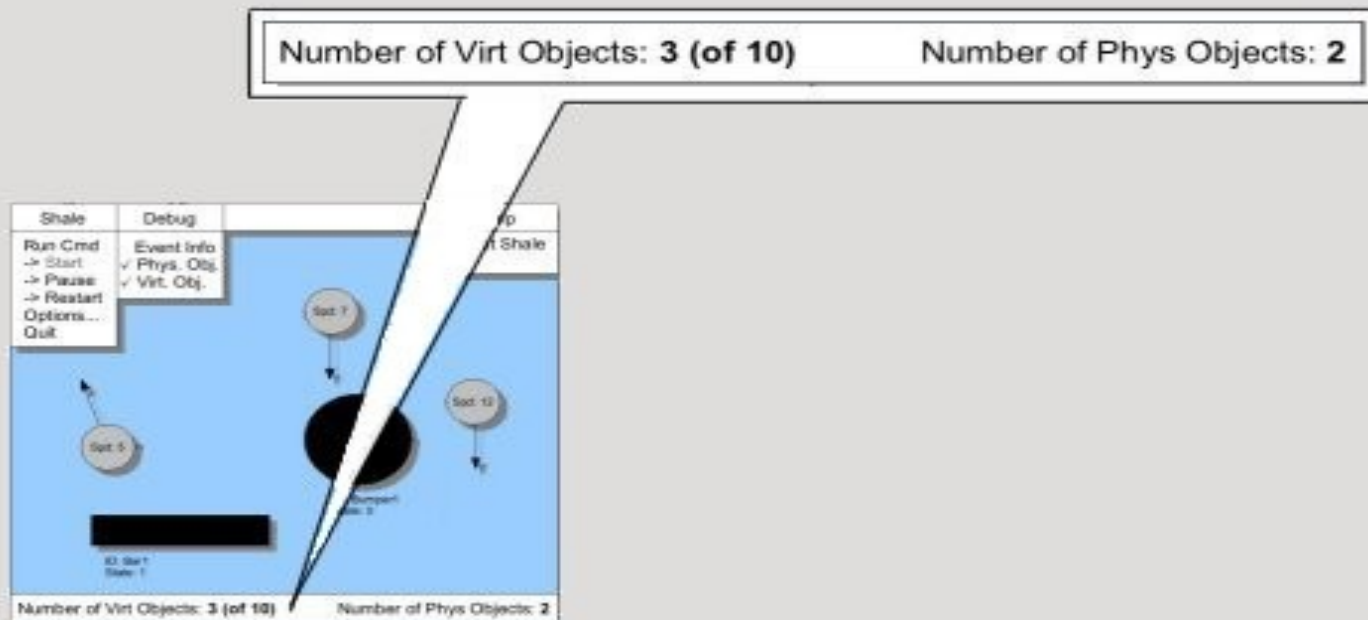
- information about the Shale software
- brief background
- link to the project website
- ...
- Other useful topics





Status Bar

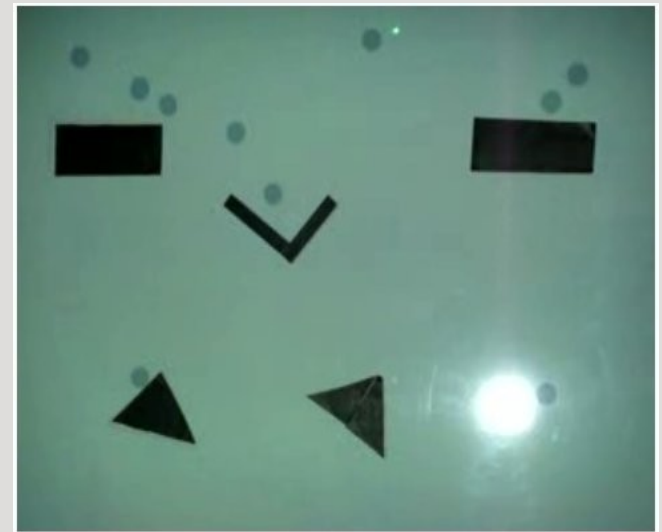
- **Number of Virtual Objects**
 - current number of virtual objects
 - maximum number allowed
- **Number of Physical Objects**
 - current number of physical objects





Presentation Focus

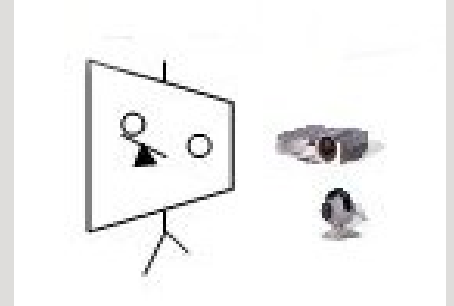
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- **Architecture**
- Software Demo





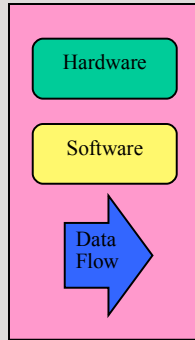
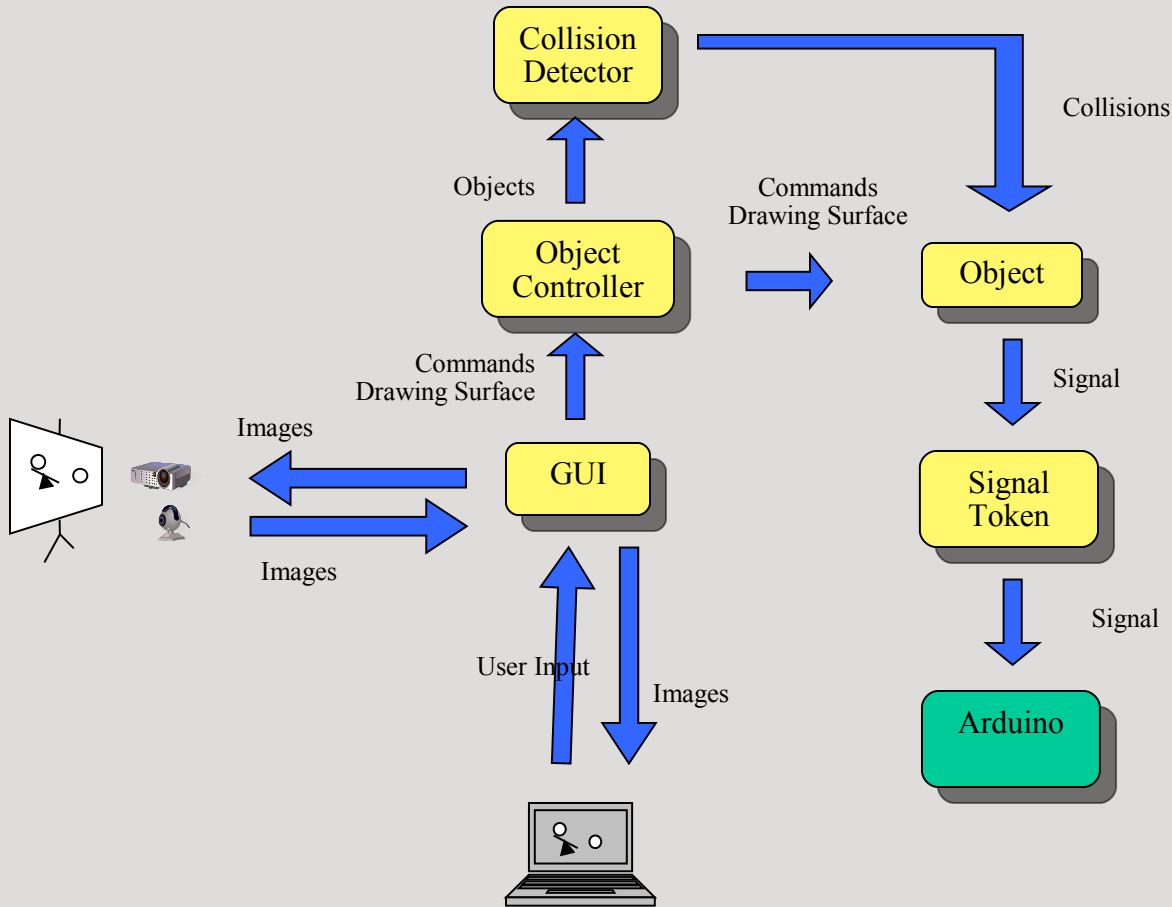
Presentation Focus

- Project Overview
- User Interface Design
- Architecture
 - Overview
 - Shale Classes
- Software Demo

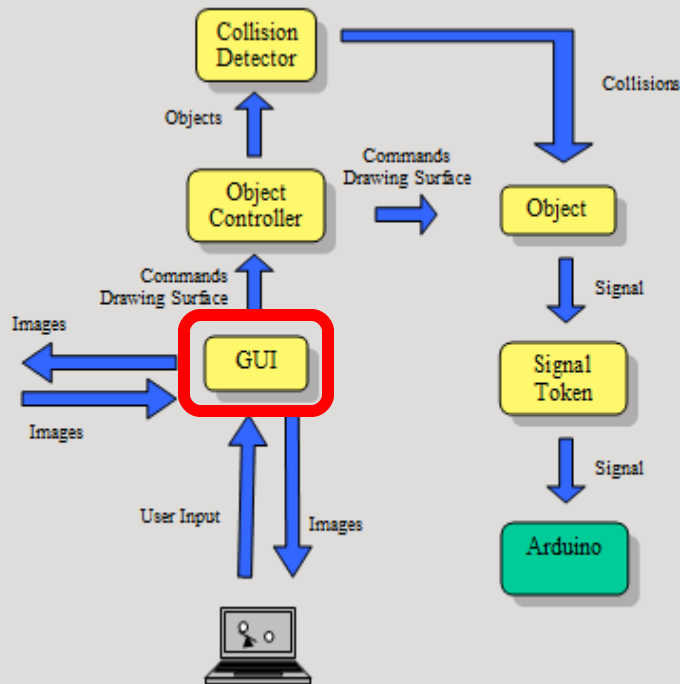




Shale Architecture

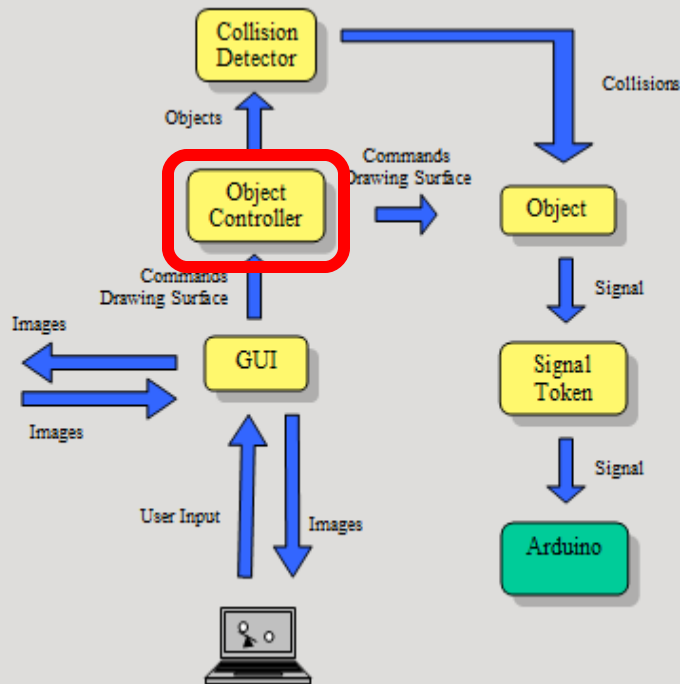


The Graphical User Interface



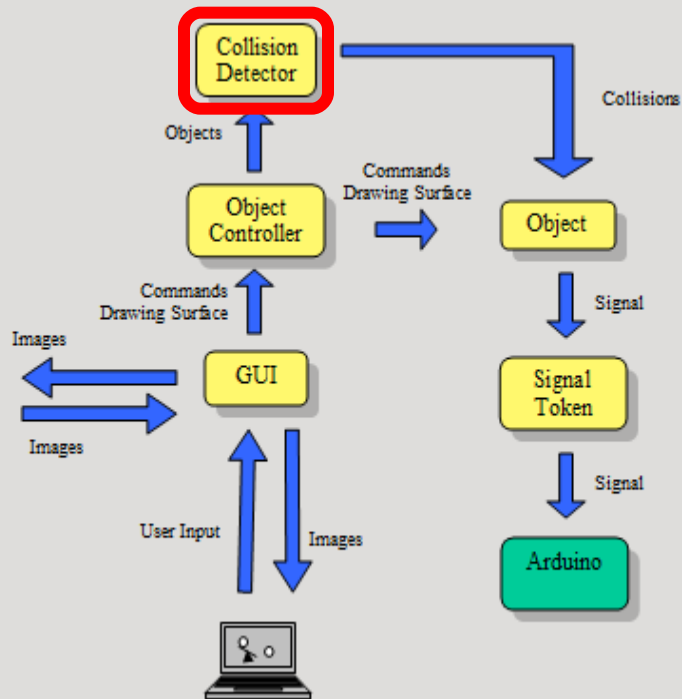
- Handle user input
- Process images
- Direct Object Controller

The Object Controller



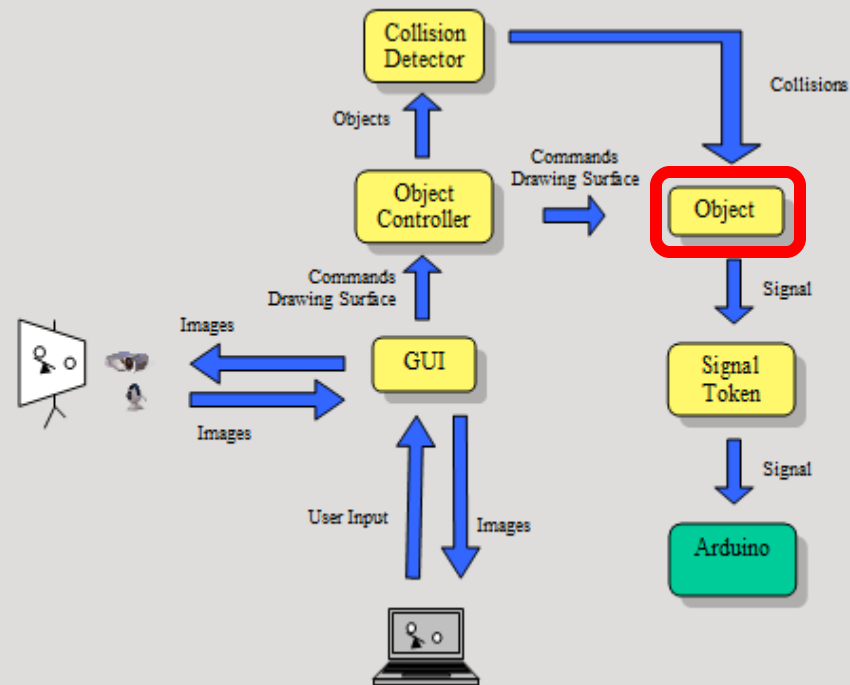
- Maintain Objects
- Move Objects
- Get Signal Tokens

The Collision Detector



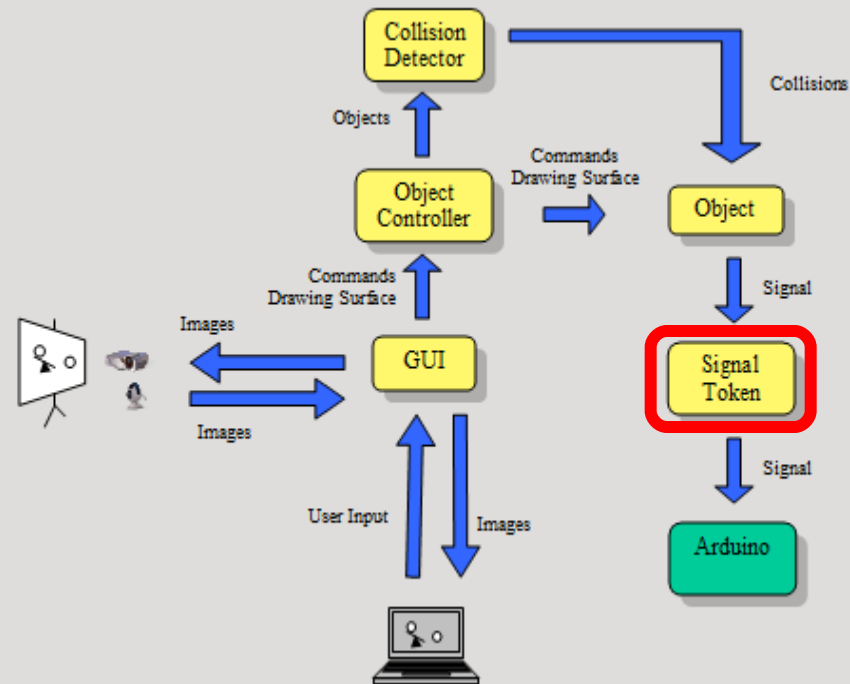
- Identify collisions
- Calculate velocities
- Activate Objects

The Objects



- Position, speed, size
- Implement collision

The Signal Tokens

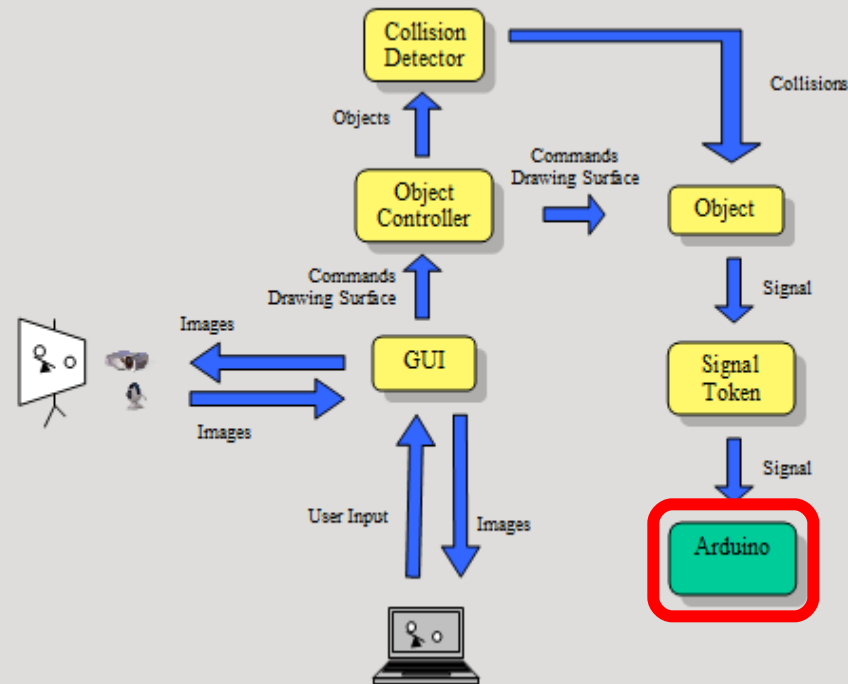


- Unique Arduino signal
- Send signals



The Arduinos

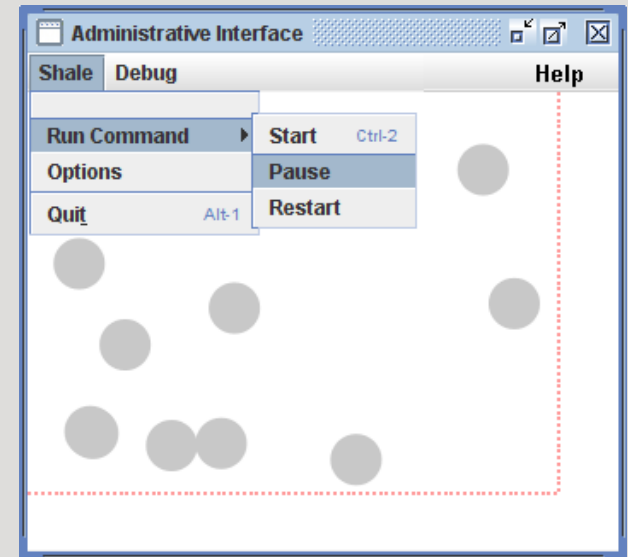
- Receive signals
- Do collision behavior





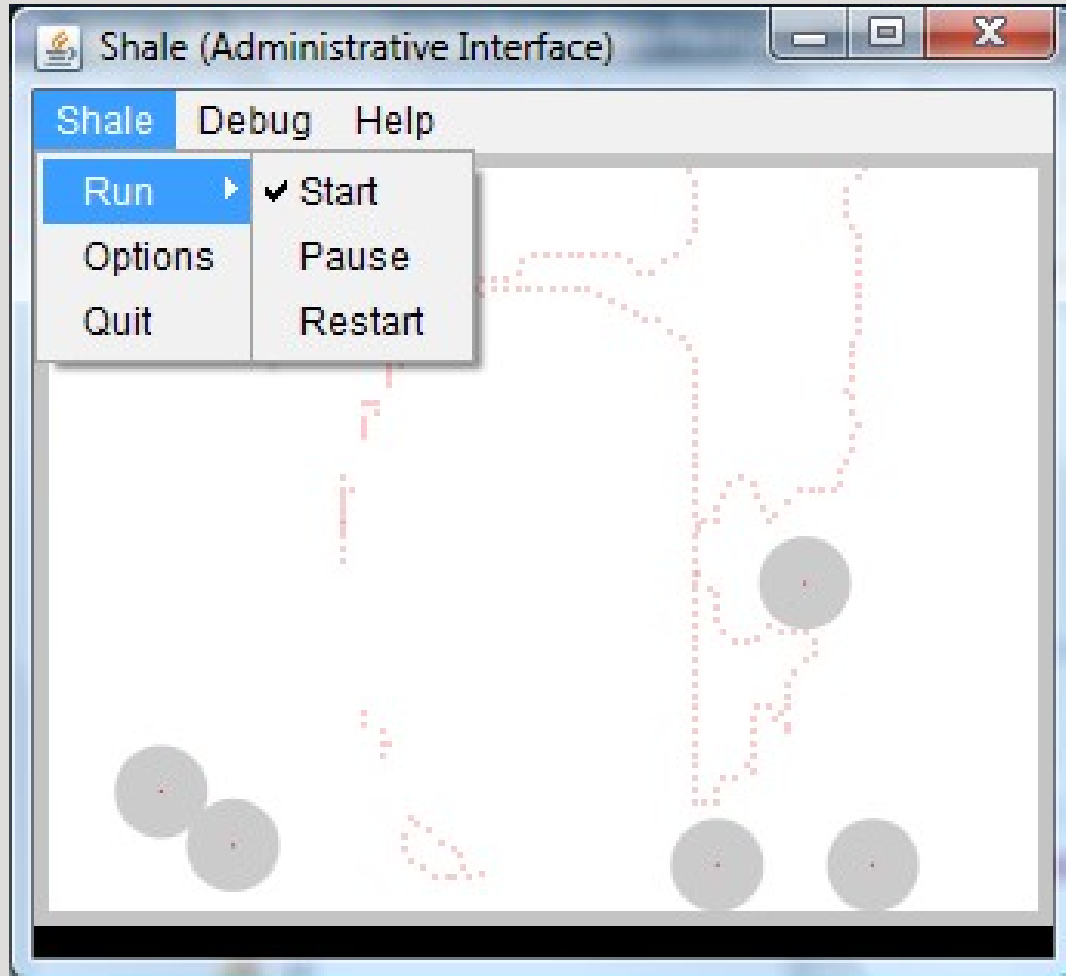
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- **Software Demo**





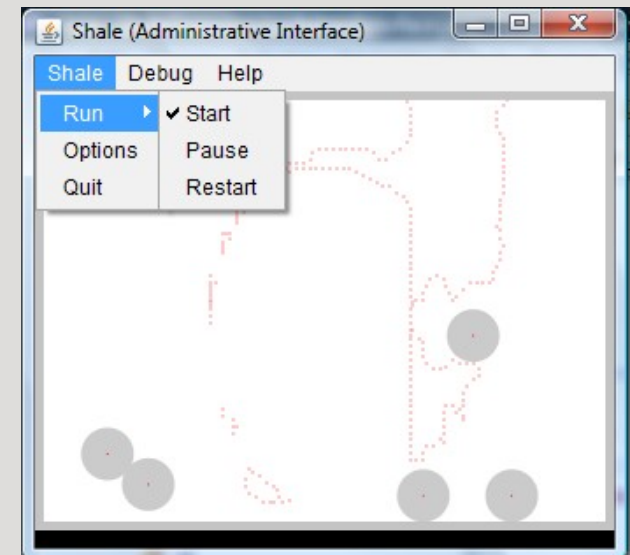
Demonstration





Summary

- **Project Overview**
 - The Class
 - The Problem
 - The Solution
- **User Interface Design**
 - Standard User Interface
 - Administrative User Interface
- **Architecture**
 - Overview
 - Shale Classes
- **Software Demo**





Q & A

The presentation is over...
But before we go, are there any
QUESTIONS?