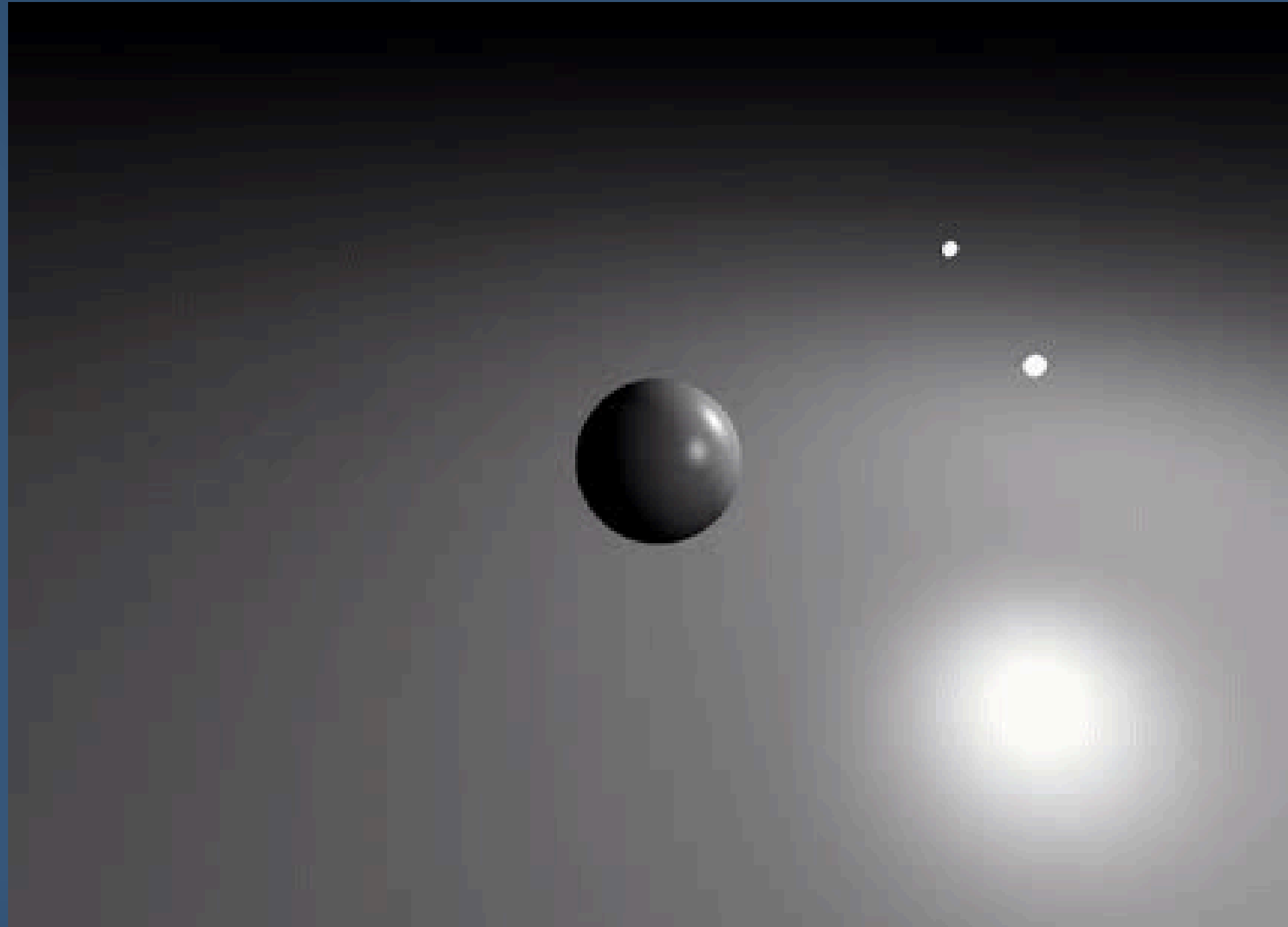




# **PORTING AN EDUCATIONAL GRAPHICS ENGINE TO A WEB PLATFORM USING WEBGL**

**Eldar Satyndiev**

# INTRODUCTION



- **OpenGL ES 2.0 (C++)**
- **Educational tool for Computer Graphics**
- **Core principles (Shaders, Vertex, Fragment, Transformations)**

# PROBLEM

## Development Environment

Prepare the development environment at home.

- Install the latest drivers for your GPU.
- Install Git VCS <https://git-scm.com>.
- Install Conan Package Manager <https://conan.io>.
- Install CMake Build System <https://cmake.org>.
- On macOS, install Xcode IDE <https://developer.apple.com/xcode>.
- On Windows, install Visual Studio 2022 Community IDE <https://visualstudio.microsoft.com> legally.

You can use any other IDEs (like CLion) or code editors (like VS Code, Vim, Emacs) that you like. They all provide support for Visual Studio 2022 on Windows and Xcode on macOS.

You can also work on Linux, but you must figure out the driver/tools/editor-installation process on your own.

## Installation

! Debug

```
/Applications/CLion.app/Contents/bin/cmake/mac/aarch64/bin/cmake -DCMAKE_BUILD_TYPE=Debug -DCMAKE_CXX_COMPILER=clang++ -DCMAKE_CXX_FLAGS=-std=c++11 -DCMAKE_CXX_STANDARD=11 -DCMAKE_CXX_STANDARD_LIBRARIES=-lc++ -DCMAKE_CXX_FLAGS_DEBUG=-g -DCMAKE_CXX_FLAGS_RELEASE=-O3 -DCMAKE_CXX_FLAGS_MINSIZEREL=-Os -DCMAKE_CXX_FLAGS_RELWITHDEBINFO=-O2 -g -DCMAKE_CXX_FLAGS_DEBUG=-g -DCMAKE_CXX_FLAGS_RELEASE=-O3 -DCMAKE_CXX_FLAGS_MINSIZEREL=-Os -DCMAKE_CXX_FLAGS_RELWITHDEBINFO=-O2 -g
```

```
CMake Error: CMAKE_PROJECT_TOP_LEVEL_INCLUDES file does not exist: conan_provider.cmake Debug
```

```
CMake Error: CMAKE_C_COMPILER not set, after EnableLanguage Debug
```

```
CMake Error: CMAKE_CXX_COMPILER not set, after EnableLanguage Debug
```

```
CMake Error at CMakeLists.txt:10 (find_package): Debug
```

```
By not providing "FindSDL2.cmake" in CMAKE_MODULE_PATH this project has asked CMake to find a package configuration file provided by "SDL2", but CMake did not find one.
```

```
Could not find a package configuration file provided by "SDL2" with any of the following names:
```

```
SDL2Config.cmake
```

```
sdl2-config.cmake
```

```
Add the installation prefix of "SDL2" to CMAKE_PREFIX_PATH or set "SDL2_DIR" to a directory containing one of the above files. If "SDL2" provides a separate development package or SDK, be sure it has been
```

## Errors

# SOLUTION

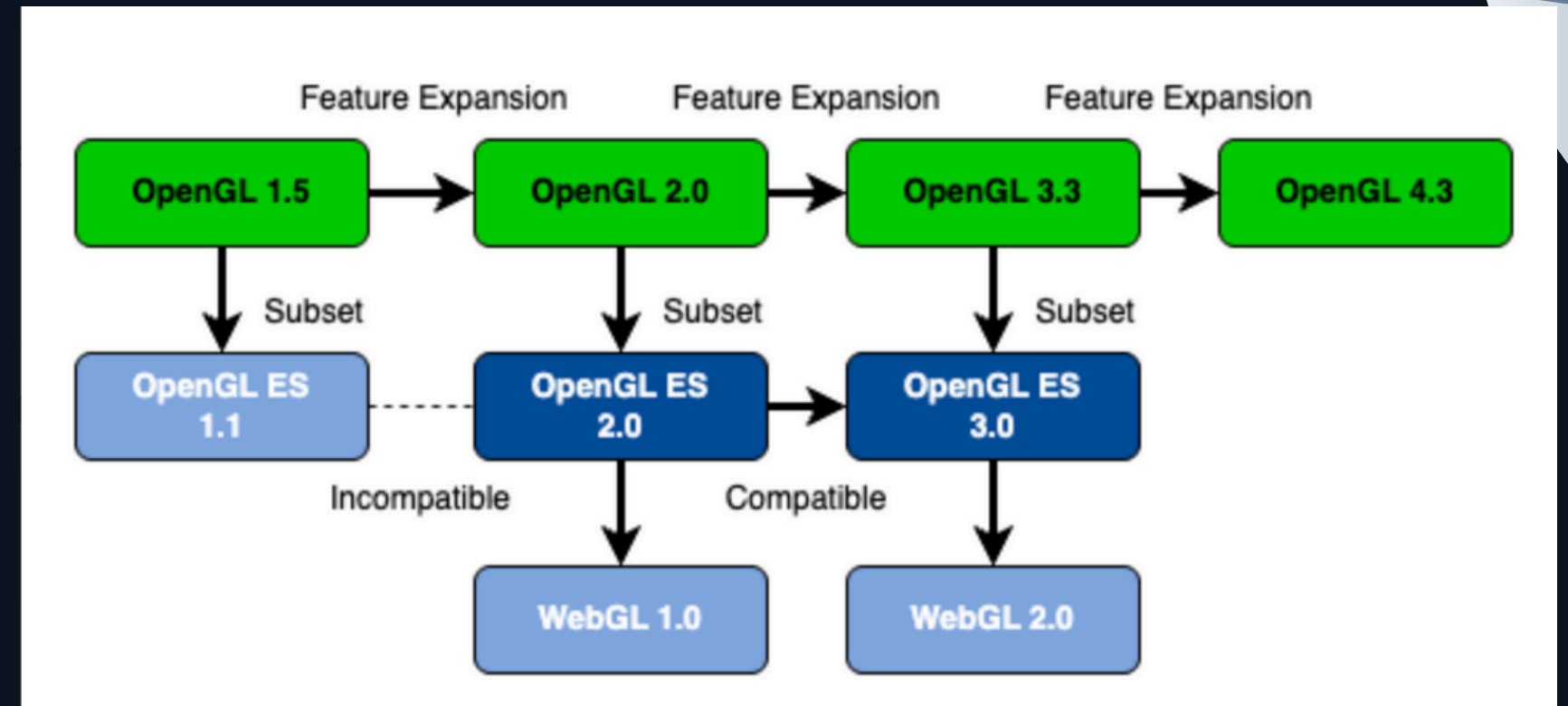
**Simplify the engine by porting it to Web platform, allowing students to run it directly in a browser with no installations.**



# LITERATURE REVIEW

## Main Objective:

- No installation required
- Full browser compatibility
- Easy setup for students



**Vulkan**

**Three.js**

**WebGL**

**Metal**

**Babylon.js**

**WebGPU**

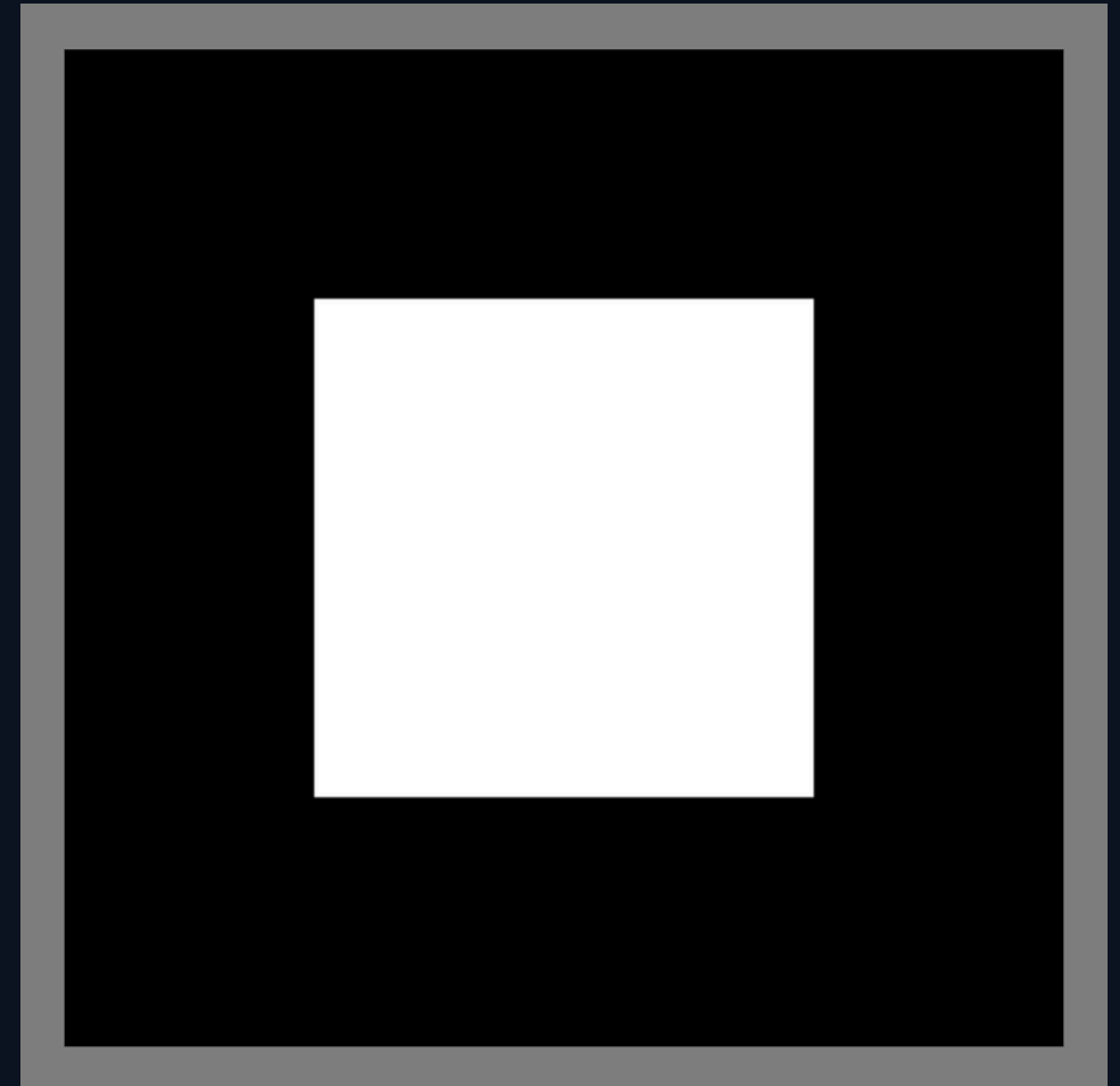
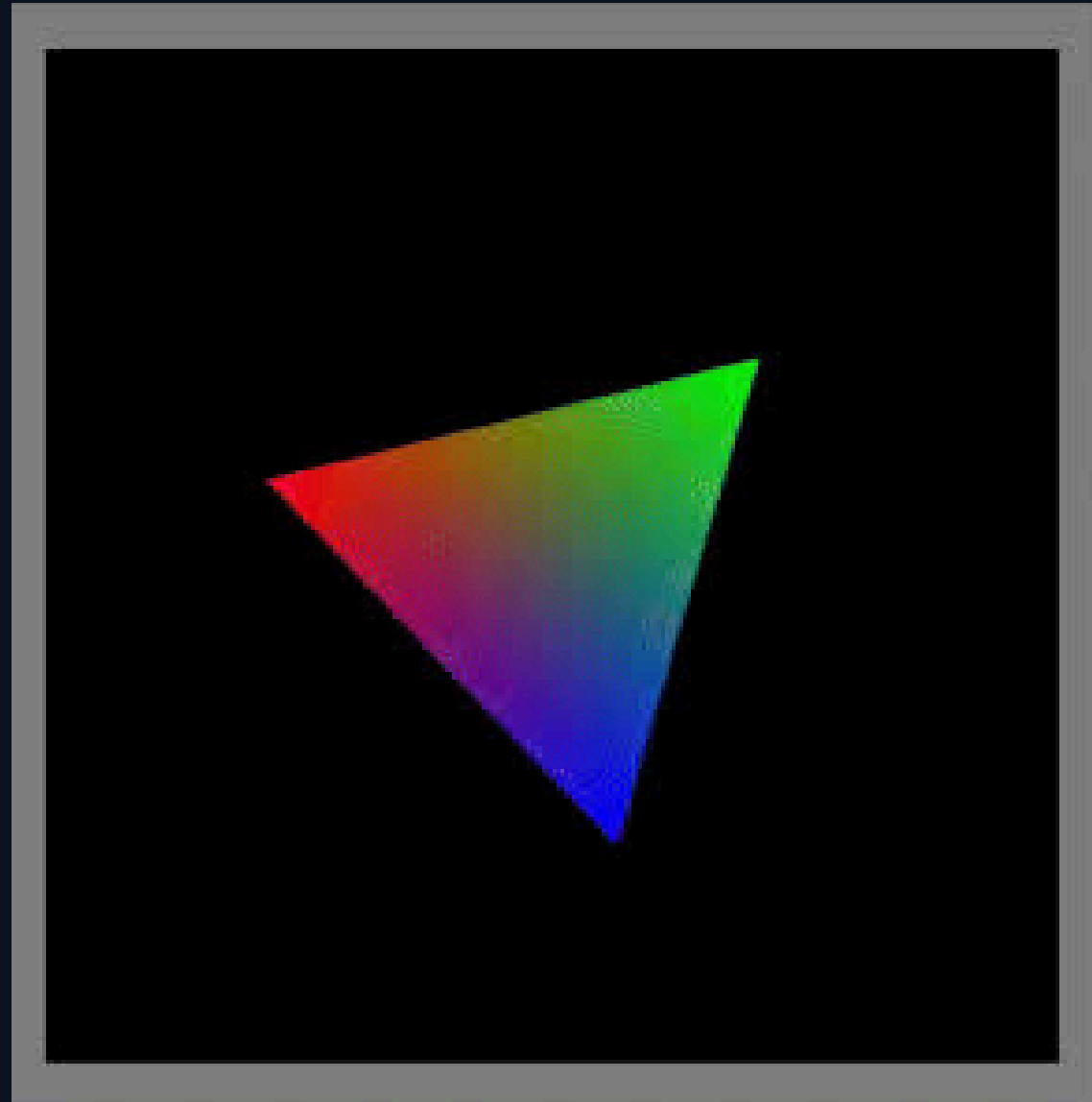
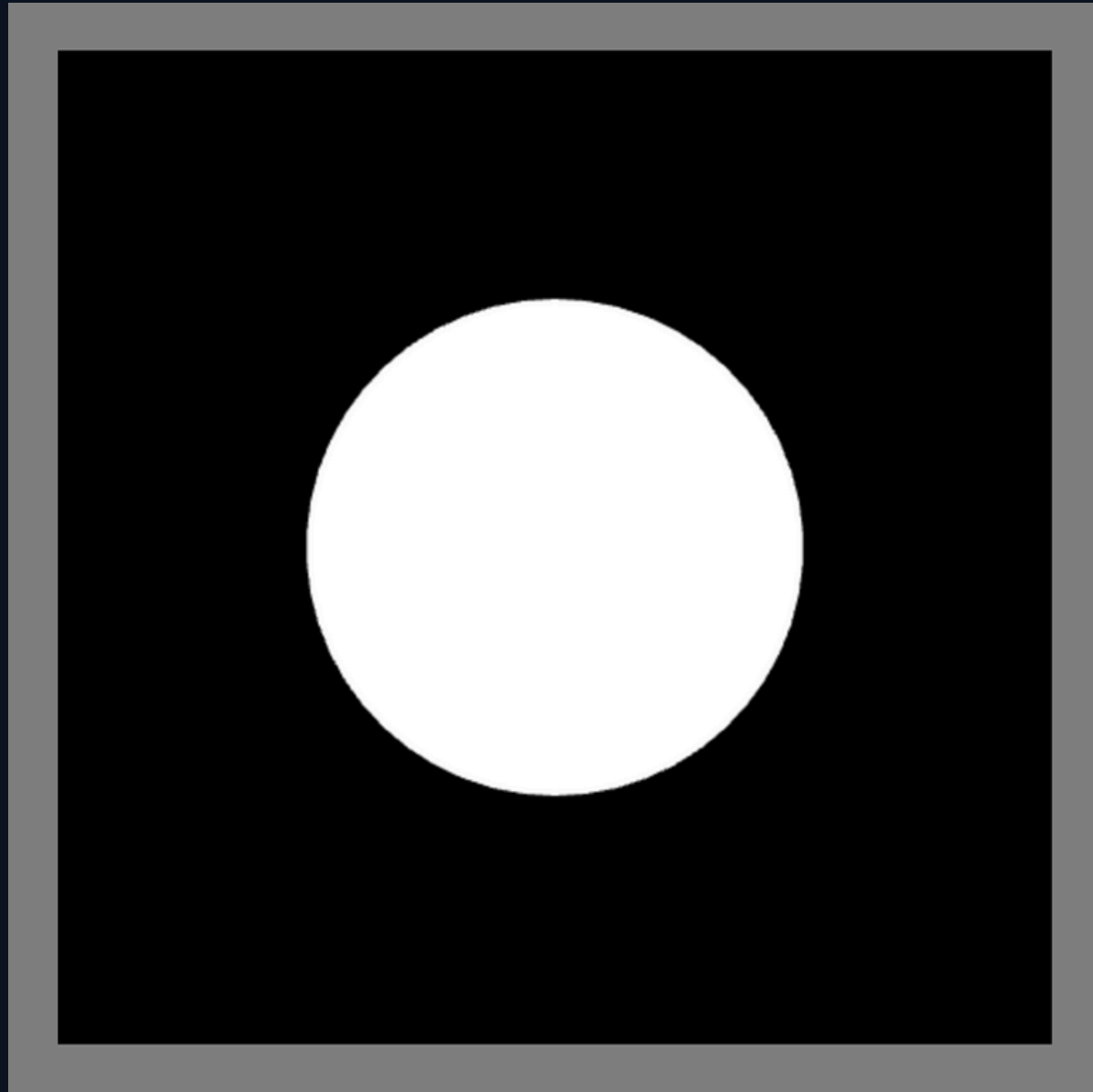
# ENGINE STRUCTURE

## Versions:

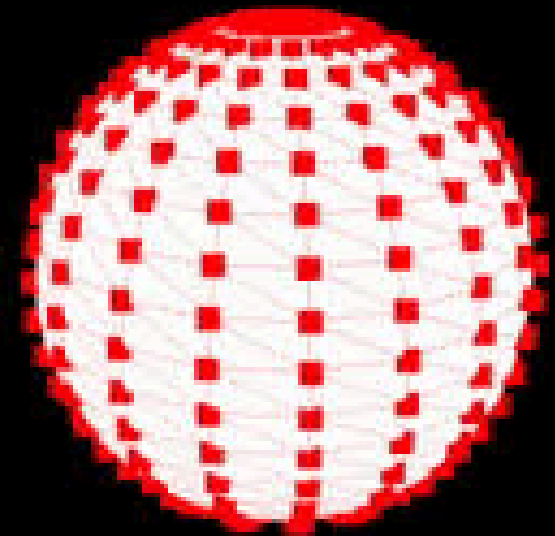
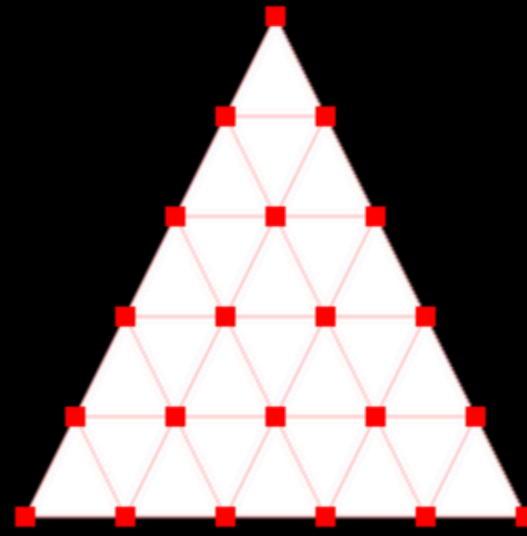
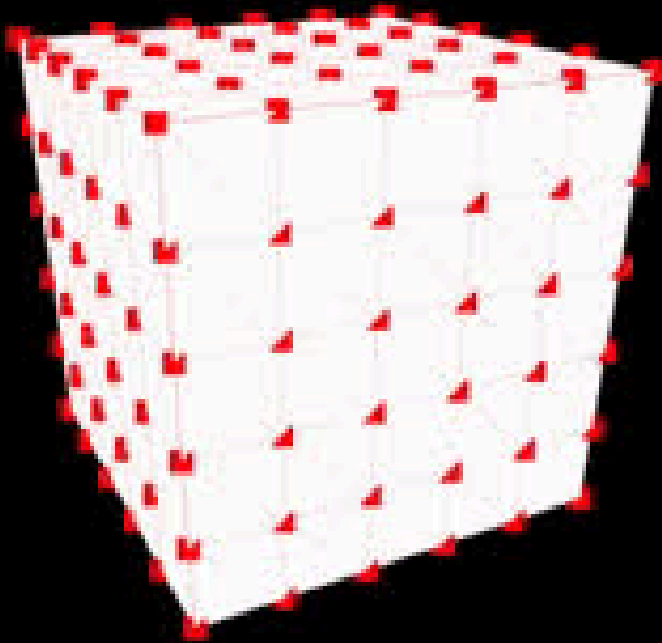
**Incremental builds, each adding new features:**

- **asr-1.0 – Basic 2D rendering**
- **asr-1.1 – 3D geometry + indexing + keyboard handling + matrix usage support**
- **asr-1.2 – Texture support**
- **asr-1.3 – Instancing and lighting**

# VERSION 1.0

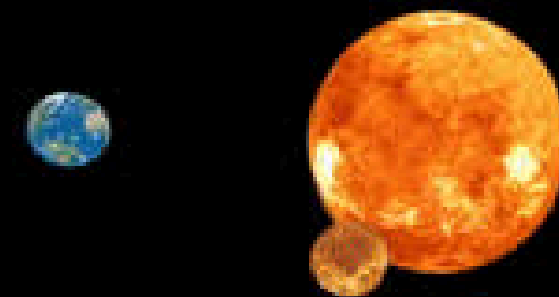
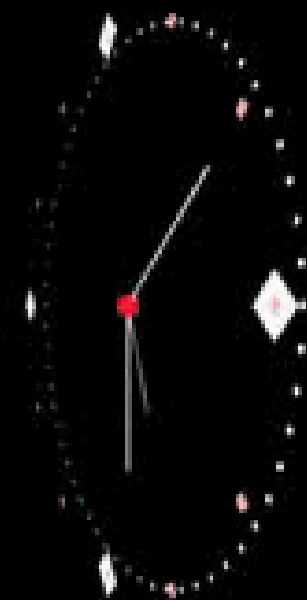
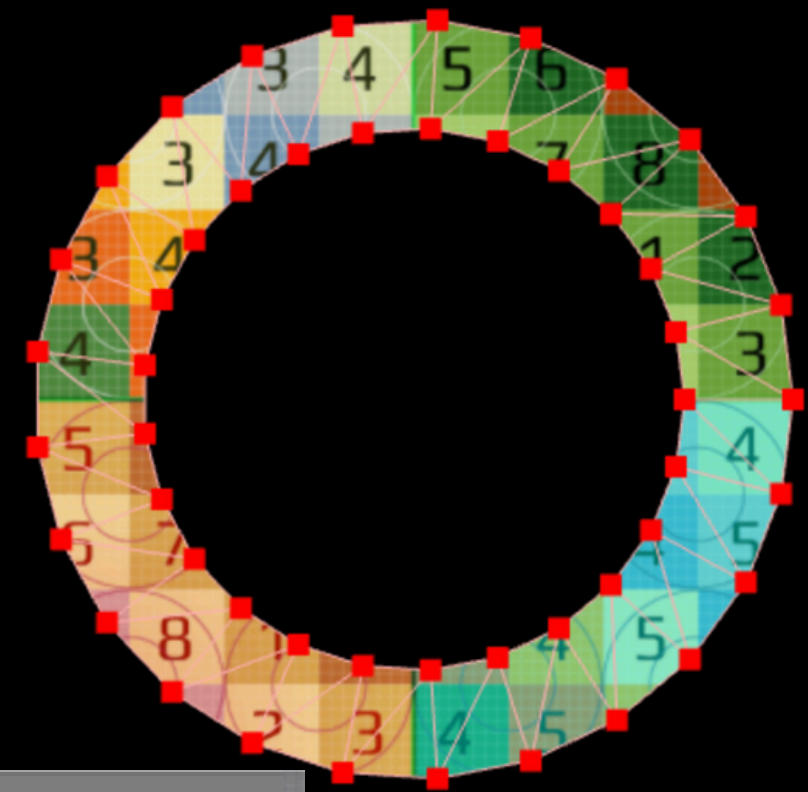
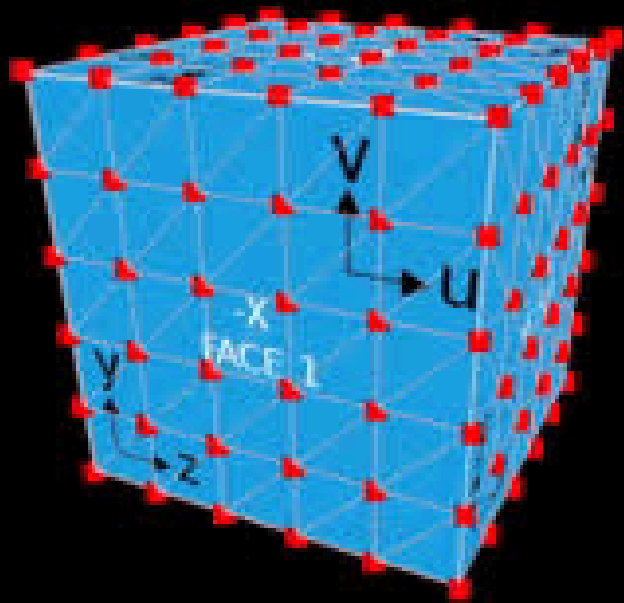


# VERSION 1.1

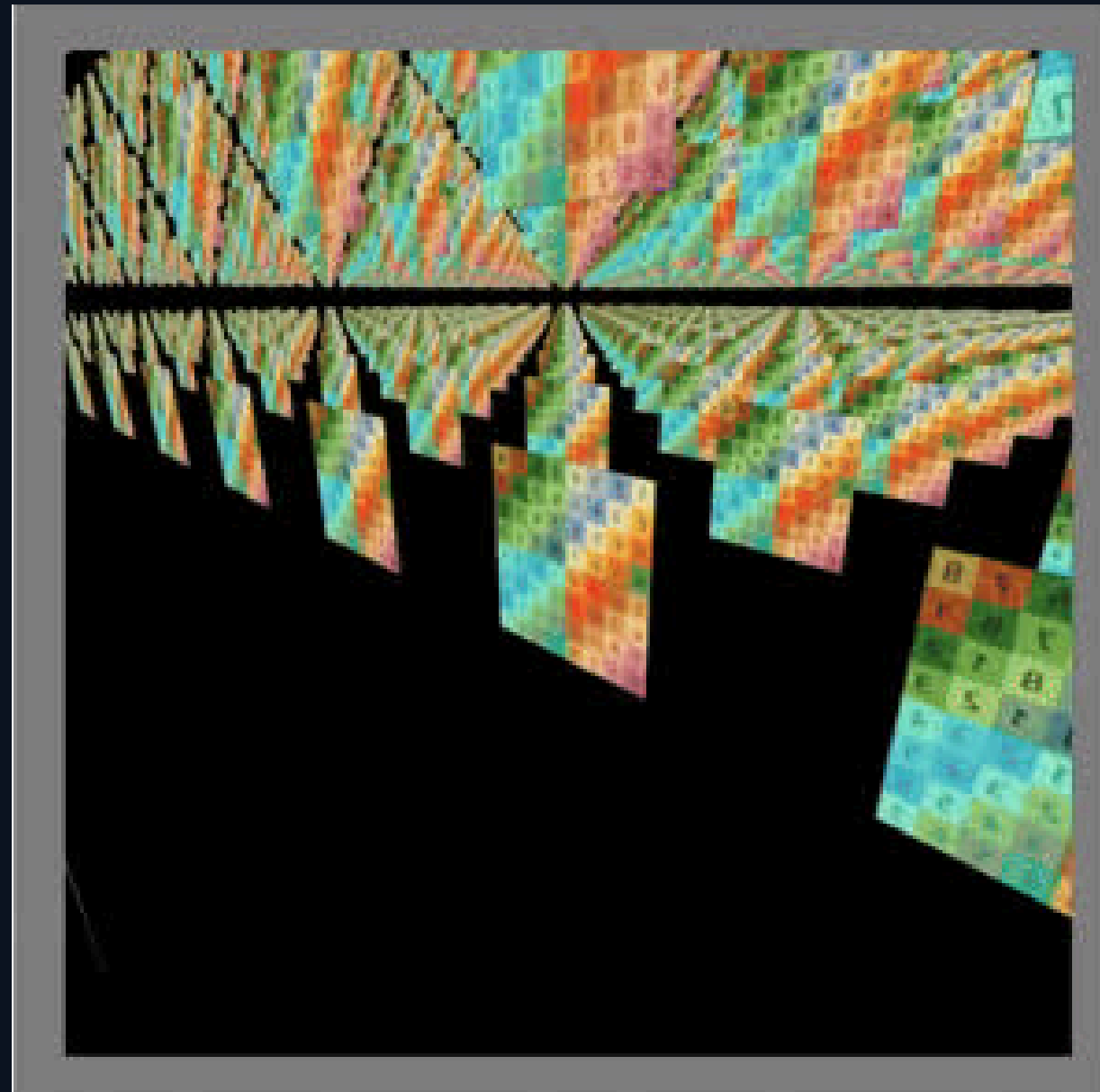
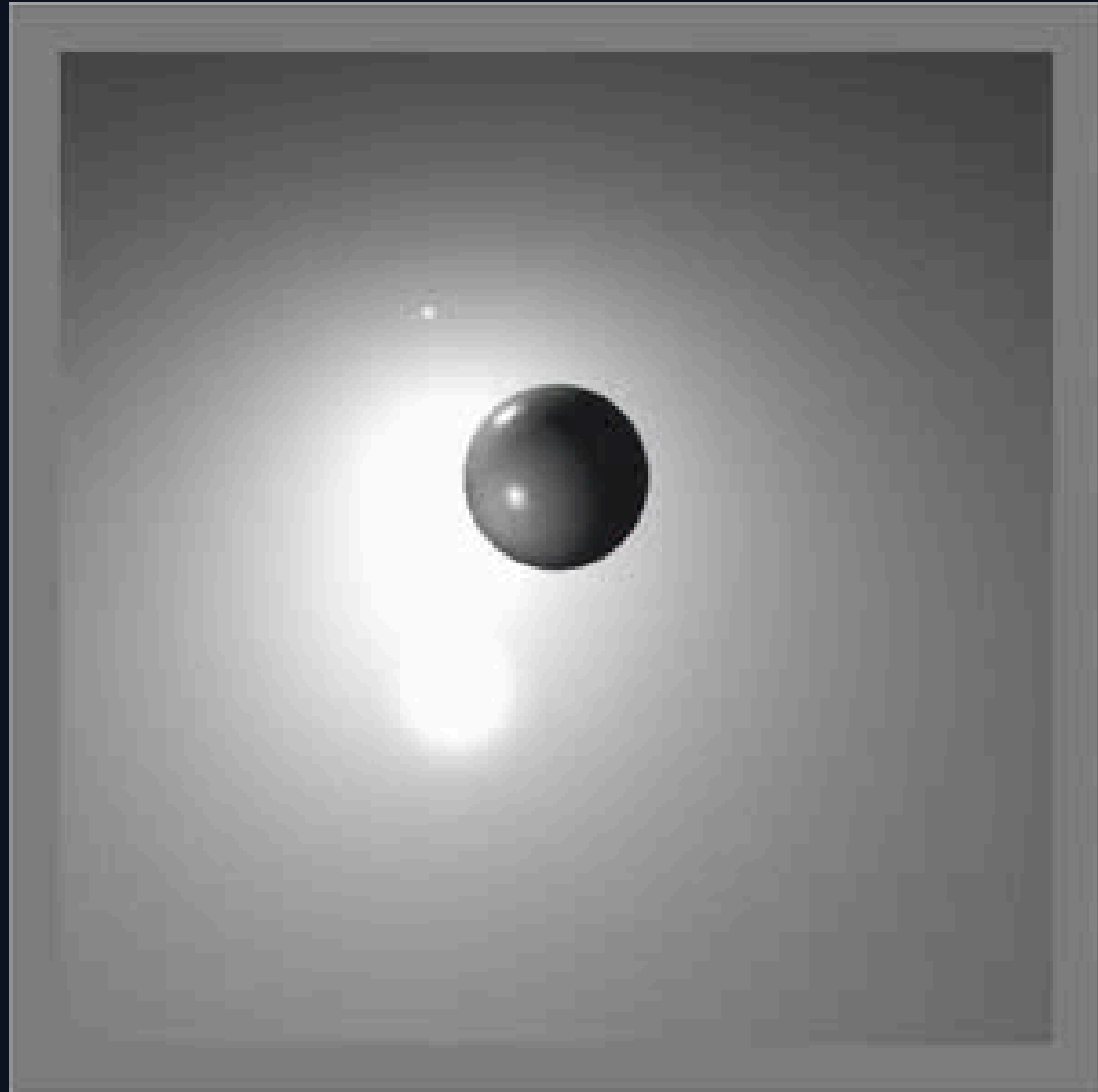




# VERSION 1.2



# VERSION 1.3



# MAJOR CHALLENGES

- **JavaScript lacks built-in support for GL-style math**
- **Complex handling of various uniform types**
- **Keyboard handling**
- **Browsers restrict file access (CORS issues)**

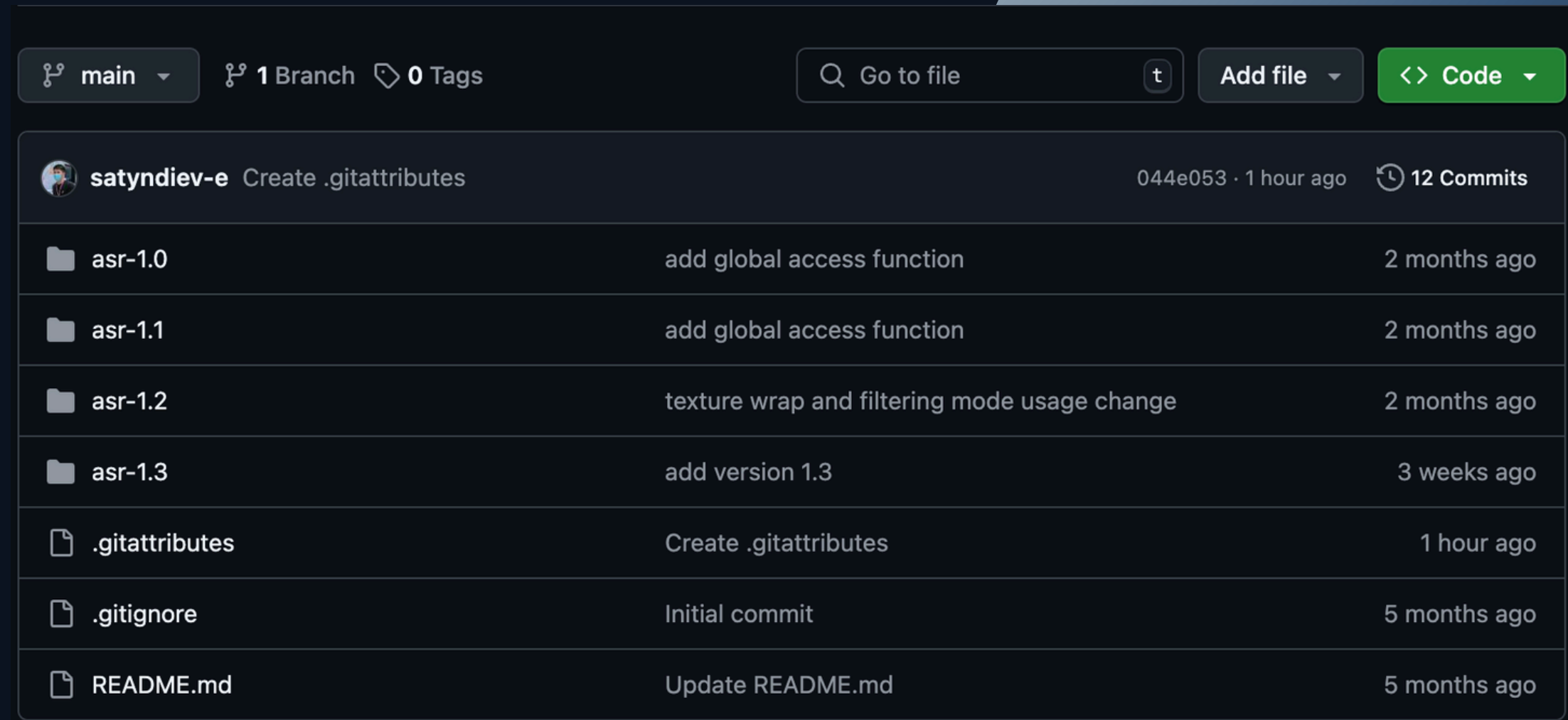
# RESULTS

## Fully Functional WebGL Engine

- All versions migrated, ready for educational use

### Runs Without Server

- Students can launch the engine by simply opening the HTML file in a browser
- No setup or local server needed



The screenshot shows a GitHub repository page for user 'satyndiev-e'. At the top, it indicates the 'main' branch with 1 branch and 0 tags. A search bar and buttons for 'Add file' and 'Code' are visible. The commit history table lists several commits, including the creation of '.gitattributes' and updates to 'asr-1.0' through 'asr-1.3'.

Commit Hash	Commit Message	Time Ago
044e053	Create .gitattributes	1 hour ago
044e053	add global access function	2 months ago
044e053	add global access function	2 months ago
044e053	texture wrap and filtering mode usage change	2 months ago
044e053	add version 1.3	3 weeks ago
044e053	Create .gitattributes	1 hour ago
044e053	Initial commit	5 months ago
044e053	Update README.md	5 months ago

# FUTURE WORK

## **Modular Expansion of the Engine**

- Future versions could include UI panels, object manipulation tools, or real-time editors

## **Exploring Libraries like Three.js**

- It could be used for creating a more complex visual version of the engine in future iterations



**DEMONSTRATION**

# THANK YOU FOR YOUR ATTENTION



satyndiev\_e@auca.kg