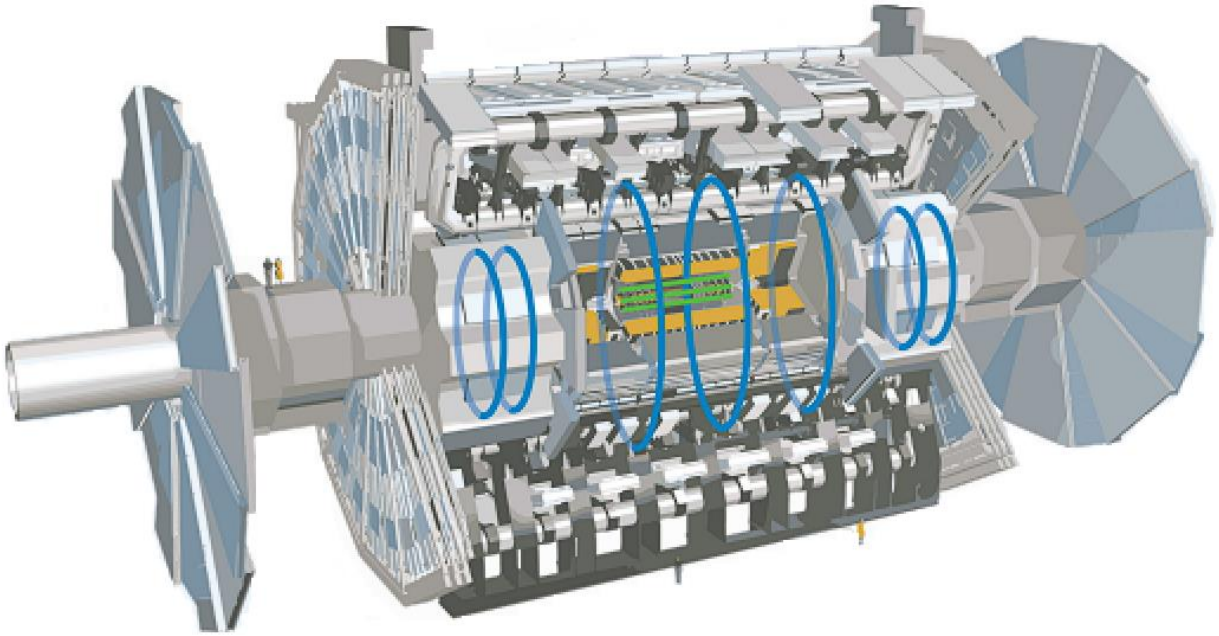
AR BOOK

Project to demonstrate a 3D Scene in AR Foundation



Research and Development stage presentation

Draft presentation with QR code scanner

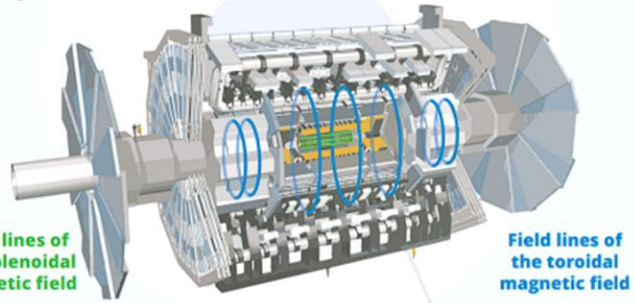
ATLAS-GTU TAI Agreement Workshop

Georgian Team: Vladimir Dolinski
Responsible: Lasha Sharmazanashvili

PROJECT HIGHLIGHT

MAGNET SYSTEM

ATLAS uses two different types of superconducting magnet systems – solenoidal and toroidal. When cooled to about 4.5 K (–268°C), these are able to provide strong magnetic fields that bend the trajectories of charged particles. This allows physicists to measure their momentum and charge.



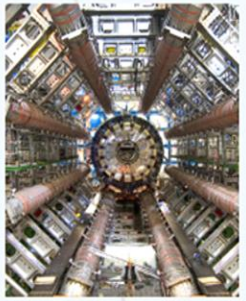
CENTRAL SOLENOID MAGNET

The ATLAS solenoid surrounds the inner detector at the core of the experiment. This powerful magnet is 5.6 m long, 2.56 m in diameter and weighs over 5 tonnes. **It provides a 2 Tesla magnetic field in just 4.5 cm thickness.** This is achieved by embedding over 9 km of niobium-titanium superconductor wires into strengthened, pure aluminum strips, thus minimising possible interactions between the magnet and the particles being studied.

TOROID MAGNET

The ATLAS toroids use a series of eight coils to provide a magnetic field of up to 3.5 Tesla, used to measure the momentum of muons. There are **three toroid magnets** in ATLAS: two at the ends of the experiment, and one massive toroid surrounding the centre of the experiment.

At 25.3 m in length, the central toroid is the **largest toroidal magnet ever constructed** and is an iconic element of ATLAS. It uses over 56 km of superconducting wire and weighs about 830 tonnes. The end-cap toroids extend the magnetic field to particles leaving the detector close to the beam pipe. Each end-cap is 10.7 m in diameter and weighs 240 tonnes.



https://atlas.cern

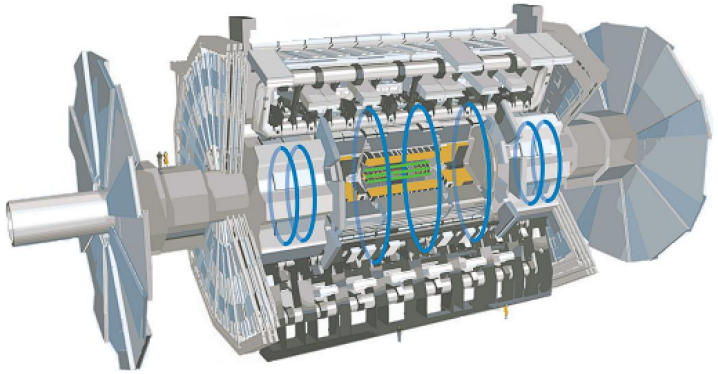
ATLAS EXPERIMENT

AGENDA

1. Introduction
2. Main purpose
3. Project basis
4. Research
5. Development
6. Roadmap
7. Draft presentation

MAIN PURPOSE

SHOW ATLAS DETECTOR GEOMETRY IN AR



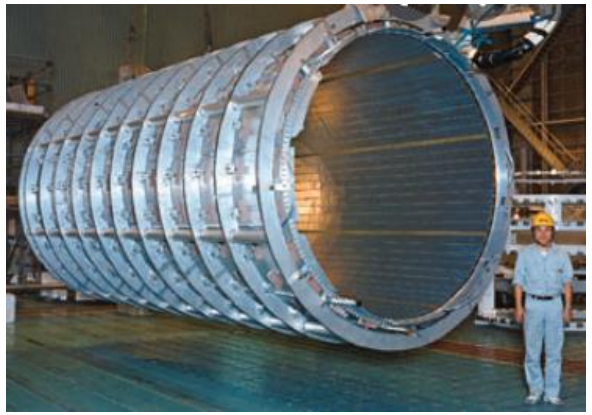
We need to show:

1. Geometry
2. Scale
3. Magnetic fields

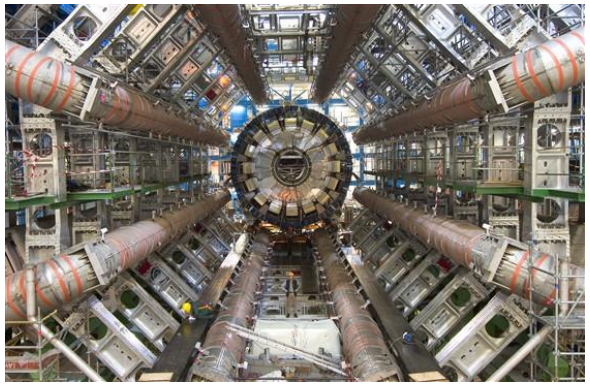
of Central solenoid and Toroid magnet

And application must be controllable

CENTRAL SOLENOID

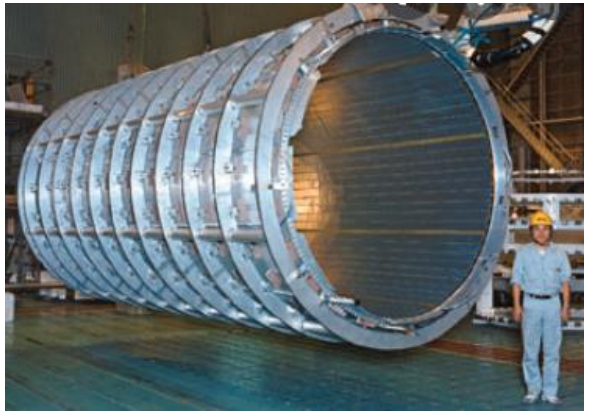


TOROID MAGNET



MAIN PURPOSE

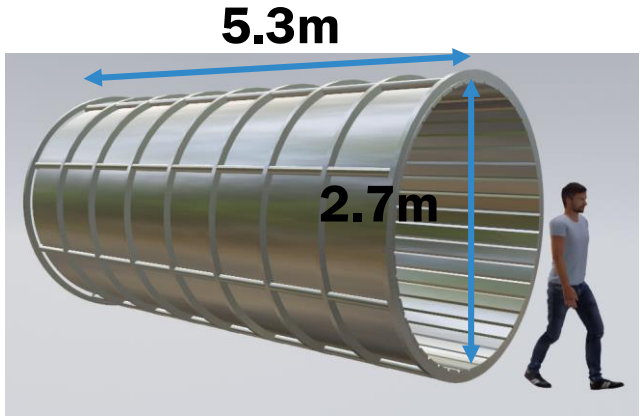
CENTRAL SOLENOID SECTION



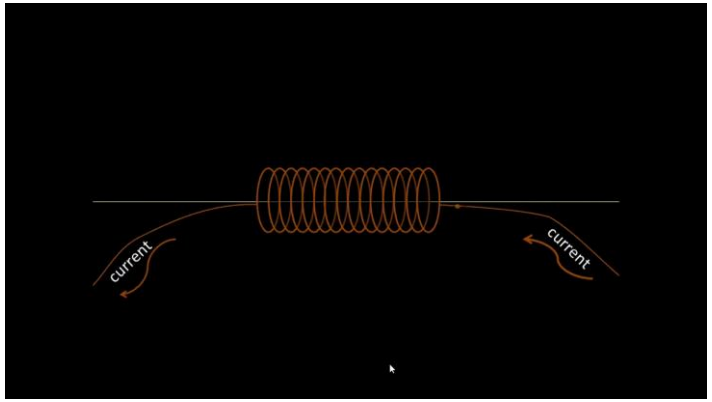
Scene with Central solenoid contains:

1. geometry (Hight 2.7m, Length 5.3m)
2. human for scale (Hight 1.8m)
3. magnetic field

GEOMETRY AND SCALE

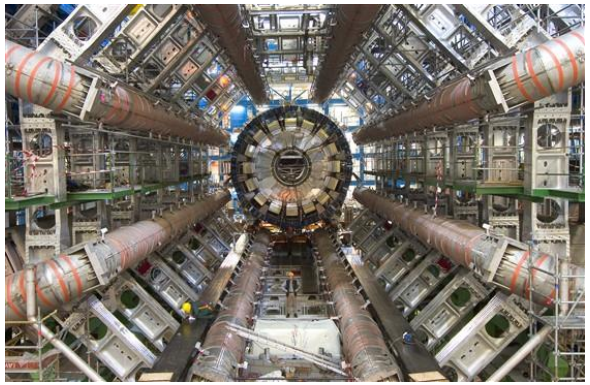


MAGNETIC FIELD



MAIN PURPOSE

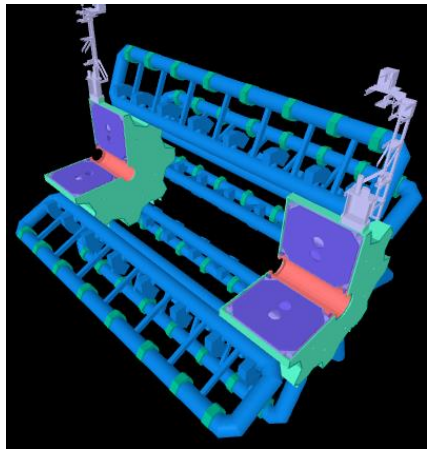
TOROID MAGNET SECTION

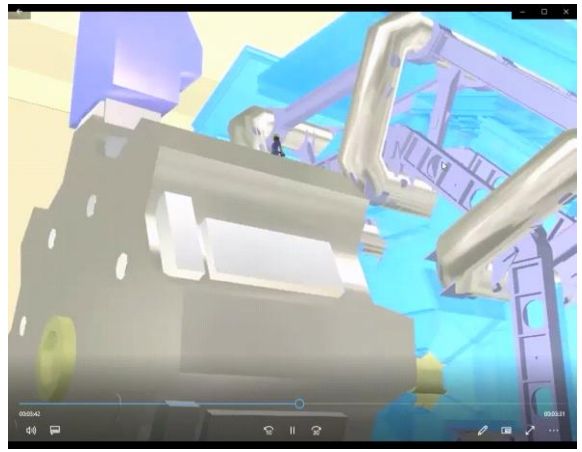


Scene with Toroid magnet contains:

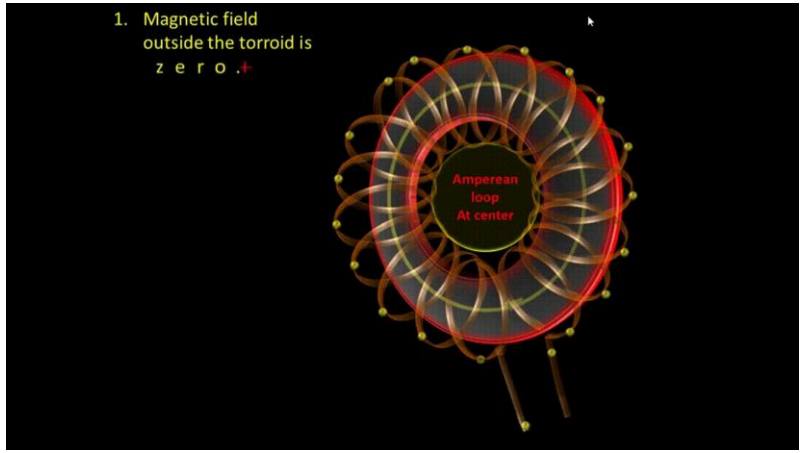
1. geometry (Barrel and Endcap)
2. human for scale
3. magnetic field

GEOMETRY AND SCALE





MAGNETIC FIELD



MAIN PURPOSE

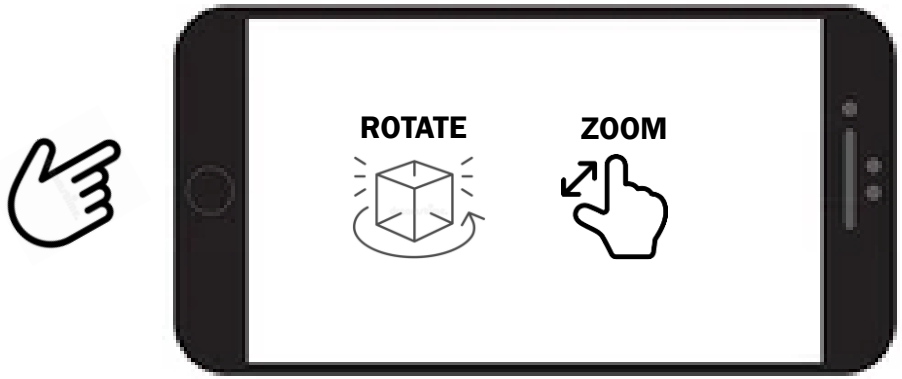
BACKEND SECTION

1. WHOLE SCENE HIDE/SHOW
2. ONLY GEOMETRY HIDE/SHOW
3. MAGNETIC FIELD HIDE/SHOW

APPLICATION MUST BE CONTROLLABLE BOTH WITH BUTTONS AND GESTURE CONTROLS

BUTTON-BOUND FUNCTIONS

GESTURE CONTROL FUNCTIONS



PROJECT BASIS

Research

I. understand what AR is
II. finding a way for the application to work
III. find out the requirements
IV. find tools with which we can create an application
V. define pros and cons of of the chosen decisions

Development

A. visualization stage:
   I. geometry creation
   II. adding animation
   III. exporting scene
B. coding stage:
   I. importing scene
   II. adding image targeting
   III. code writing

RESEARCH

What is AR?

AUGMENTED REALITY – PART OF XR

AR is Reality Extension which adds layer of virtuality in real world.

It needs:

- **touchscreen**
- **camera**
- **Image/marker or anchor in real world**
- **App or browser**

RESEARCH

Requirements

Software requirements to start work with AR

3D software for:

- geometry
- Rigging & animation
- Export tools for standardized AR format

Backend for:

- Code writing
- IDE for build
- Server hosting or 3rd party service with tools

RESEARCH

FRONTEND – 3D SOFTWARE

BLENDER

- Price
- Modeling
- Rigging
- Animation
- Learning Curve
- Good for everything
- Average

3ds MAX

- Price
- Modeling
- Rigging
- Animation
- Learning Curve
- Good for visualization
- Bad in C animation

MAYA

- Price
- Modeling
- Rigging
- Animation
- Learning Curve
- Excellent for everything
- For pro users

Cinema4D

- Price
- Modeling
- Rigging
- Animation
- Learning Curve
- Easy to use
- Bad in C animation

RESEARCH

BACKEND – JavaScript

Three.JS

- Widely used; works in every browser
- Support for mobile & desktop
- Good for games & apps with 3D scenes
- Complicated functions is hard to use

A-FRAME

- Works only on mobile
- More functions for AR
- Easy to use tools for AR
- New and still in development

Babylon.JS

- Works mostly in desktop
- Best for games and heavy apps
- information on AR is hardly available

+

AR FRAMEWORK

AR.JS

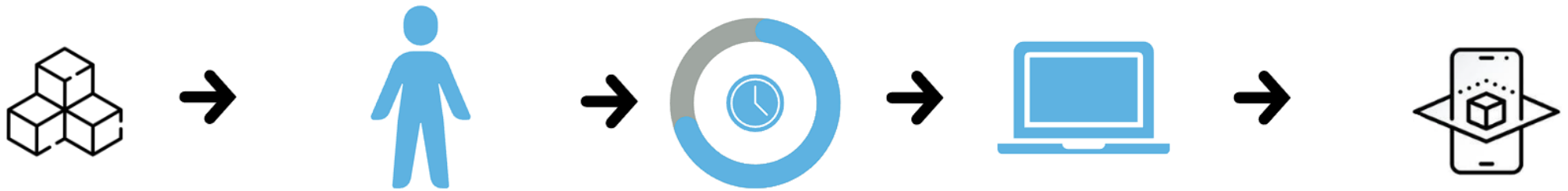
- Works in every browser
- Fast
- Needs marker with border
- Documentation is not very informative
- Not all AR functions works perfect
- harder to learn

AFRAME AR

- only some browsers have support
- Medium latency
- Works with any image/point in world
- Documentation hardly available
- More specific AR tools and easy code writing

DEVELOPMENT

LIFECYCLE



1 2 3 4 5

GEOMETRY CREATION & TEXTURING

RIGGING & ANIMATION

EXPORT

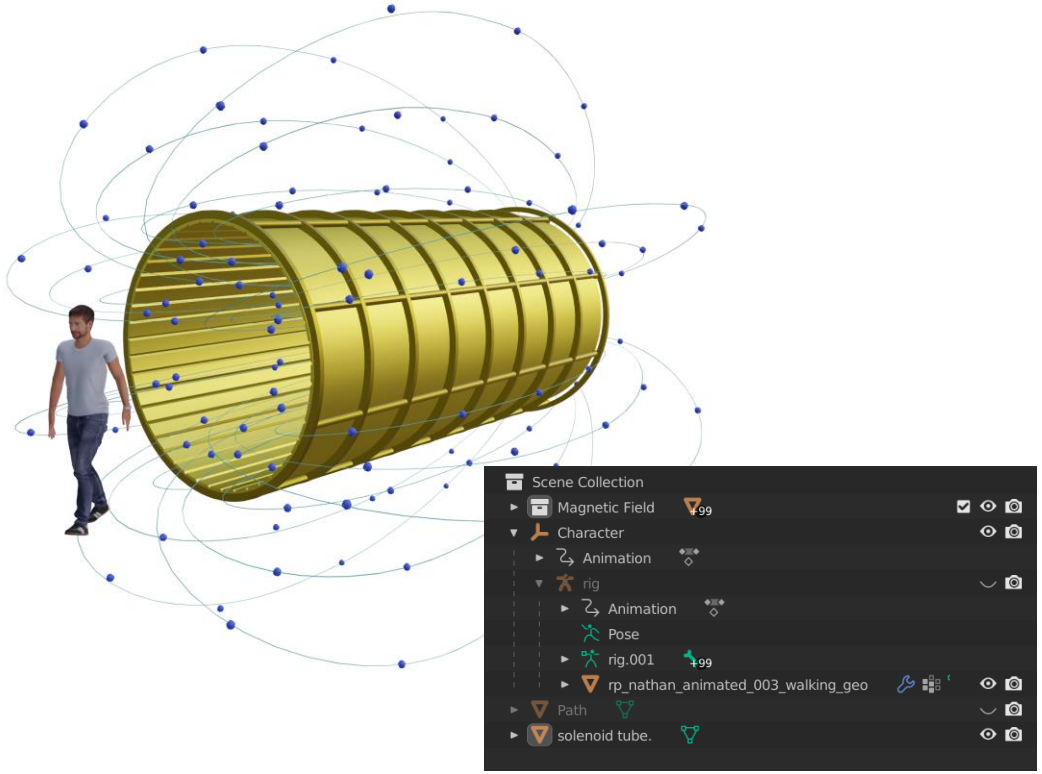
ASSETS IMPORT & CODE WRITING

BUILD AND TEST

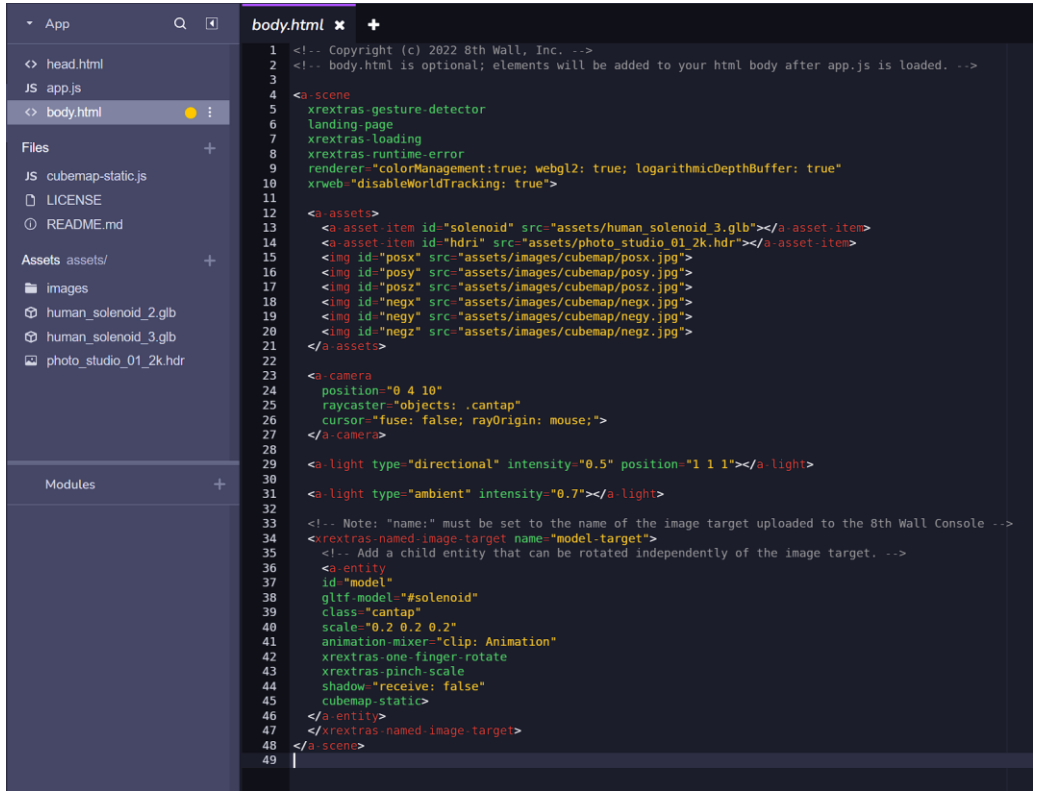
DEVELOPMENT

Development

FRONTEND



BACKEND



ROADMAP

	COMPLETED	IN PROGRESS	IN DESIGN
FRONTEND	SOLENOID GEOMETRY	SOLENOID ENHANCEMENT	2D ICONS FOR APP
	HUMAN ANIMATION	ANIMATION ENHANCEMENT	TOROID GEOMETRY
	MAGNETIC FIELD GEOMETRY&ANIMATION		REALISTIC MAGNETIC FIELD
BACKEND	JS CODE	TRANSITION TO A-FRAME	MULTIPLE SCENES UPLOAD
	SCENE & ANIMATION IMPORT	SCENE UPDATE	CONTROL WITH BUTTONS
	GESTURE CONTROLS	TESTING DIFFERENT FRAMEWORK	

DRAFT PRESENTATION

QR Code

Image Target

END OF PRESENTATION

THANK YOU

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