Real World Geometry

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Outline

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- Problem Statement
- Related Works
- Need Finding
- Prototyping
- Implementation
- User Study
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Introduction

- Geometry is an essential area of mathematics but considered difficult by kids when they first access it in school.
- Kids know 3D shapes before going to school (everything around us is three-dimensional); they go to school learn to write and draw in 2D.
- Piaget’s theory: kids easily acquire new knowledge if learning occurs in a specific context and is embedded in a physical environment.
- Augmented Reality (AR): one of the most explored and successfully used technology.

Introduction

Use HCI design principles to design a game for kids (3-11 years old) to learn:

- Three basic geometry shapes model
- How those different geometry shapes look like in real
- world and do some simple calculations

Goals of the game

- Effectively Learning Geometry through an Augmented Reality Game
- Current App only have three geometry shapes to access
  - Expand the project to new Shapes
- Make the App widely applicable to more user interface
  - Expand it to support Android phones.
- Design details
  - More care about user experience, make it to a user-friendly game

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Problem Statement

This project aims at using AR technology to support teaching of geometry in K-3.

Build connection between 2D shapes drawing and 3D real objects

Help kids develop spatial imagination and the capacity for abstraction specific to geometry.

Geometry combines conceptual content (definitions and characteristics) with procedural content (applying formulae and calculus).

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Arloon Geometry

Arloon Education

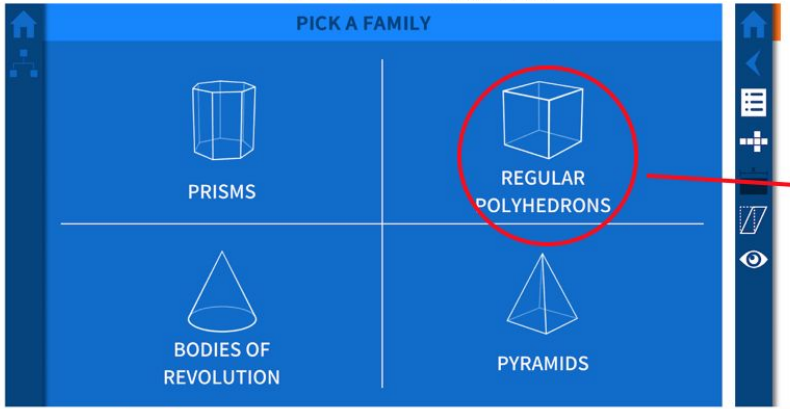
★★★★☆ 35

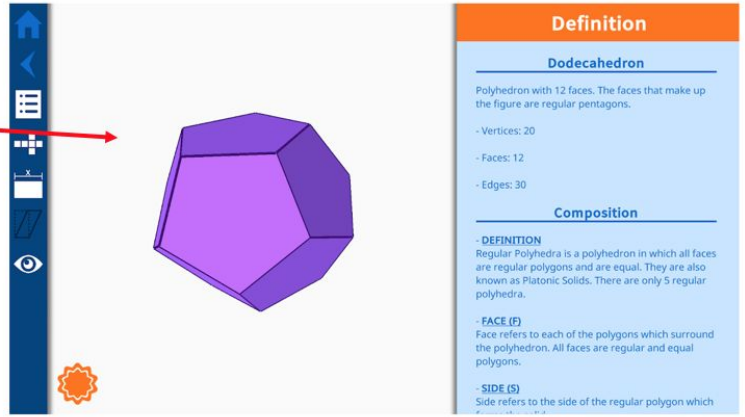
Everyone

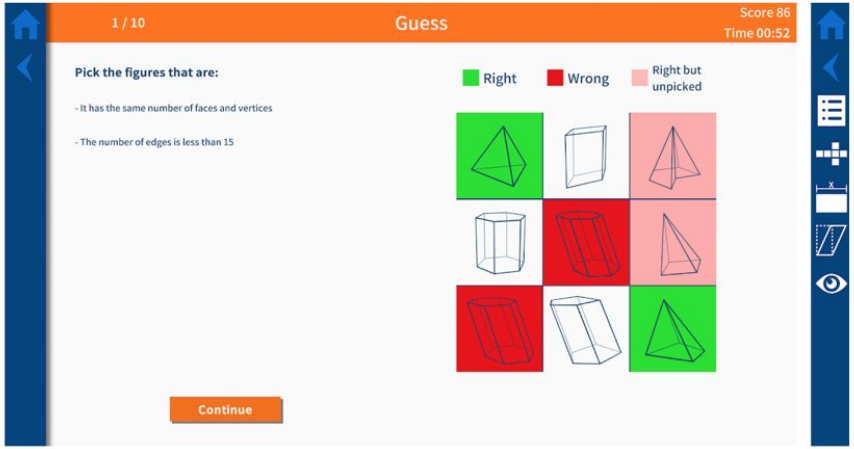
You don't have any devices

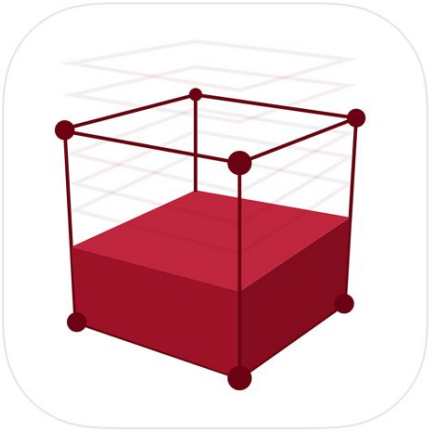
Add to Wishlist

$3.49 Buy









Shapes 3D - Create Geometry AR

4+

Measure & build 3D solid in AR

Learn Teach Explore Sp. z o.o.

Designed for iPad

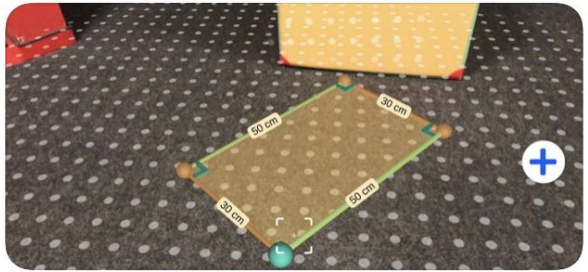
★★½☆☆ 2.5 • 11 Ratings

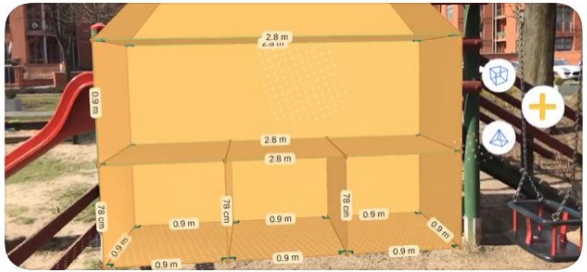
Free

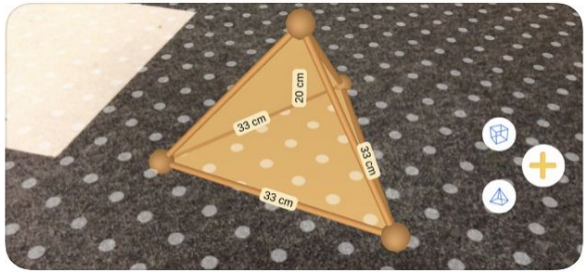
View in Mac App Store ↗

Screenshots

iPad iPhone



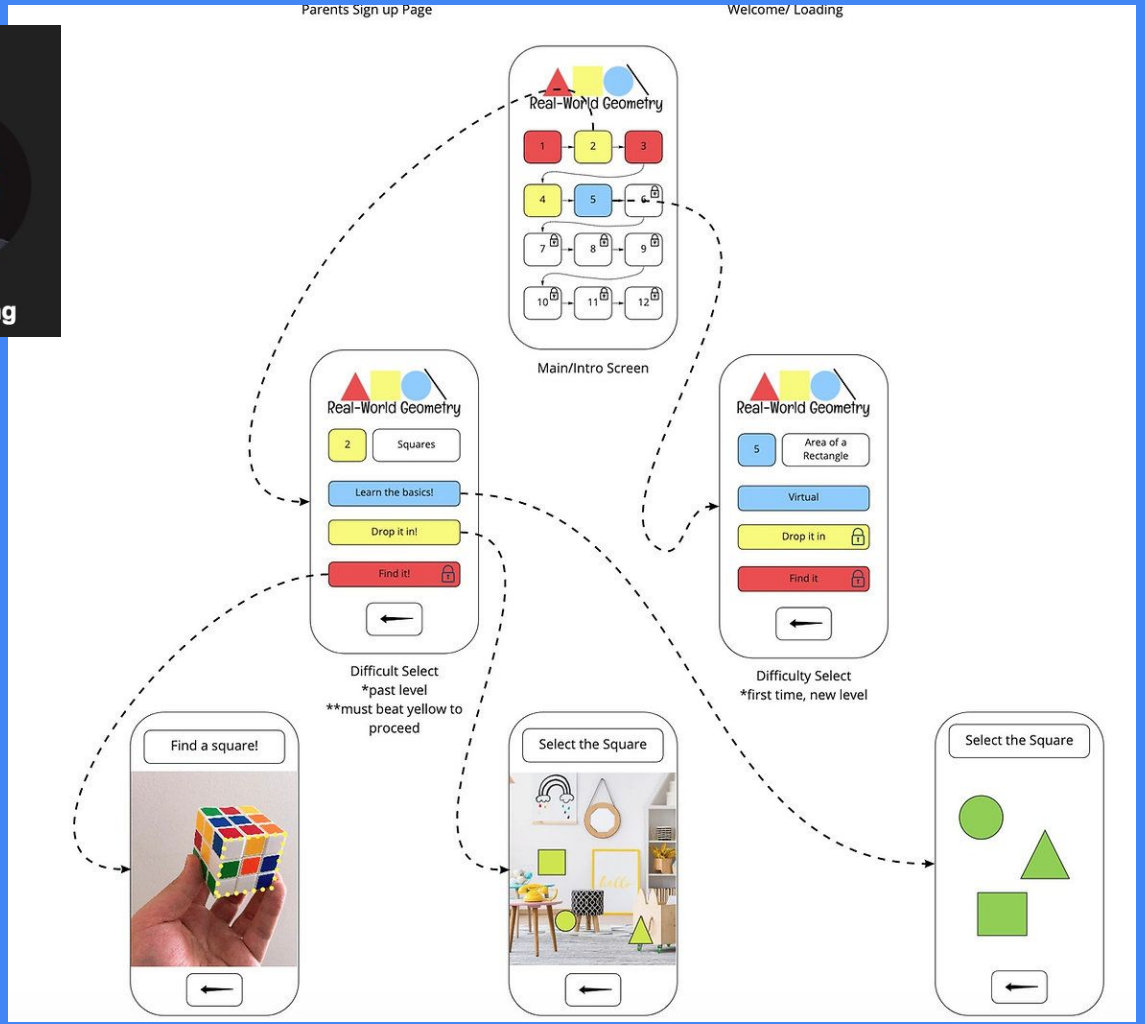




Geometry Augmentors

Ray Patt

Kyle Wang



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Who is our target user?

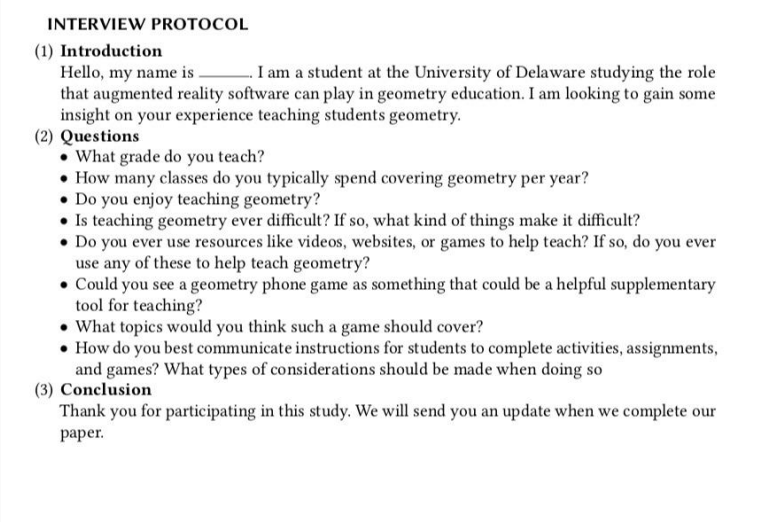
Elementary school (K-3) students learning about geometry

What we want to know

1. What material students struggle with the most
2. Can geometry games make an instructor’s job easier
3. How to best communicate instructions to students
4. How to keep students engaged

How we plan on collecting this information

Interviews with domain experts (k-3 teachers)



INTERVIEW PROTOCOL

(1) **Introduction**

Hello, my name is _____. I am a student at the University of Delaware studying the role that augmented reality software can play in geometry education. I am looking to gain some insight on your experience teaching students geometry.

(2) **Questions**

- What grade do you teach?
- How many classes do you typically spend covering geometry per year?
- Do you enjoy teaching geometry?
- Is teaching geometry ever difficult? If so, what kind of things make it difficult?
- Do you ever use resources like videos, websites, or games to help teach? If so, do you ever use any of these to help teach geometry?
- Could you see a geometry phone game as something that could be a helpful supplementary tool for teaching?
- What topics would you think such a game should cover?
- How do you best communicate instructions for students to complete activities, assignments, and games? What types of considerations should be made when doing so

(3) **Conclusion**

Thank you for participating in this study. We will send you an update when we complete our paper.

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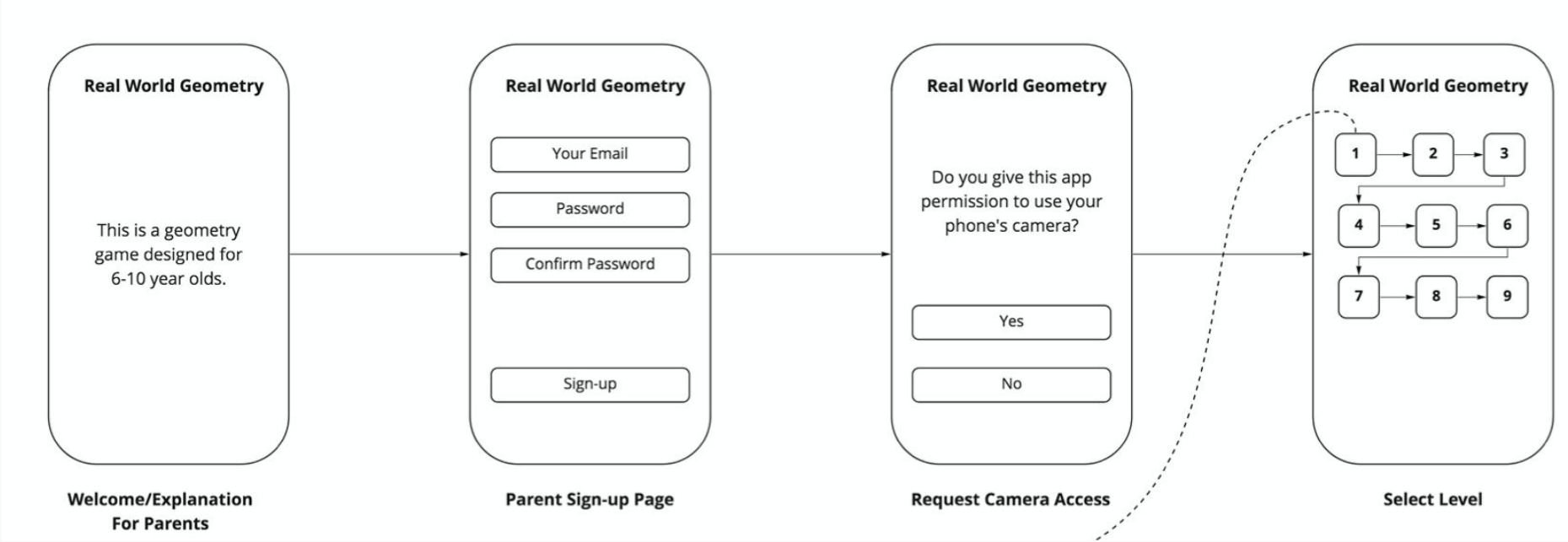
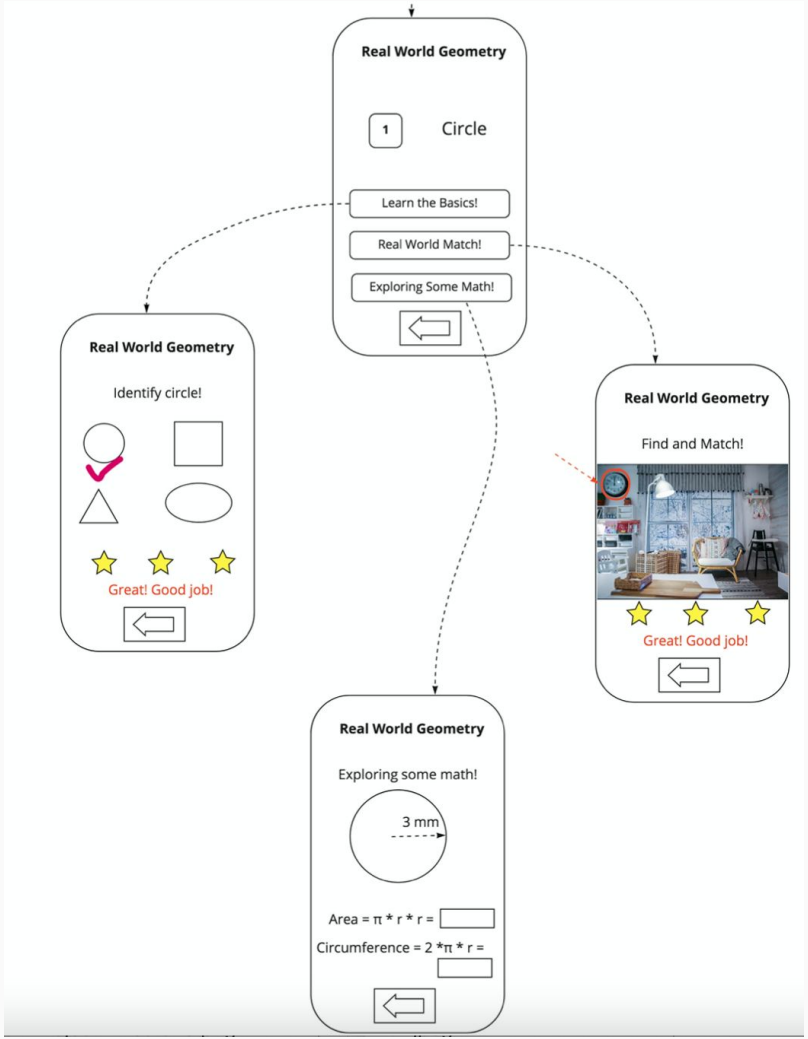

Real World Geometry
This is a geometry game designed for 6-10 year olds.
Welcome/Explanation For Parents
Real World Geometry
Your Email
Password
Confirm Password
Sign-up
Parent Sign-up Page
Real World Geometry
Do you give this app permission to use your phone's camera?
Yes
No
Request Camera Access
Real World Geometry
1
2
3
4
5
6
7
8
9
Select Level


Real World Geometry
1
Circle
Learn the Basics!
Real World Match!
Exploring Some Math!
Real World Geometry
Identify circle!
Great! Good job!
Real World Geometry
Find and Match!
Great! Good job!
Real World Geometry
Exploring some math!
3 mm
Area = π * r * r =
Circumference = 2 *π * r =

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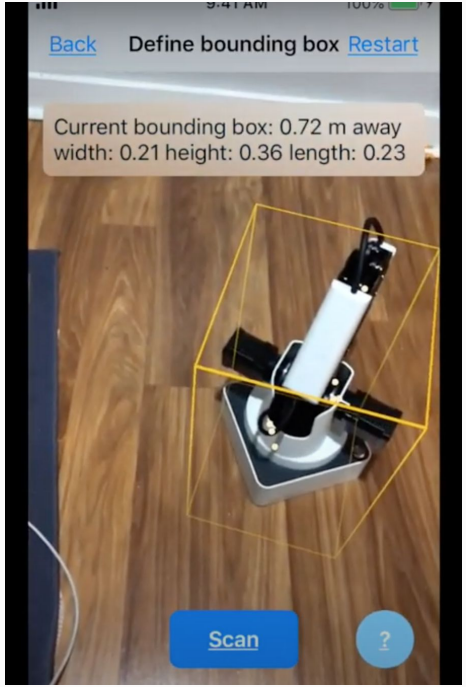
Implementation (iOS-ARKit 2)



https://developer.apple.com/videos/play/wwdc2021/10073/

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Hypotheses

- Can use of our application significantly improve student performance on geometry assessments?
- Is there a significant difference in geometry assessments performance between students who use our application and students in traditional learning environments?

High Level Details

- Between subjects experiment
- Collecting ratio data (as well as some qualitative data)
- 2 experimental conditions

Participants

Ideally we would recruit elementary school students, but this might not be feasible

Methodology

1. Students will take geometry pre-assessment
2. Students will undergo one of 2 experimental conditions:
    a. Watch a short pedagogical geometry video
    b. Use our app for 5-10 minutes
3. Students will then be reassessed
4. Students who use our application will answer a brief questionnaire about their experience

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Alternative Approaches

1. ARKit 2/Unity only support macOS/iOS.

Replaced plan: Vuforia/Unity or ARCore/Unity (support Android system)

2. Could not recruit elementary school students.

Replaced plan:

Let Neighbors' kids to use our app.

Ask UD Education Major friends try our app and provide feedbacks.

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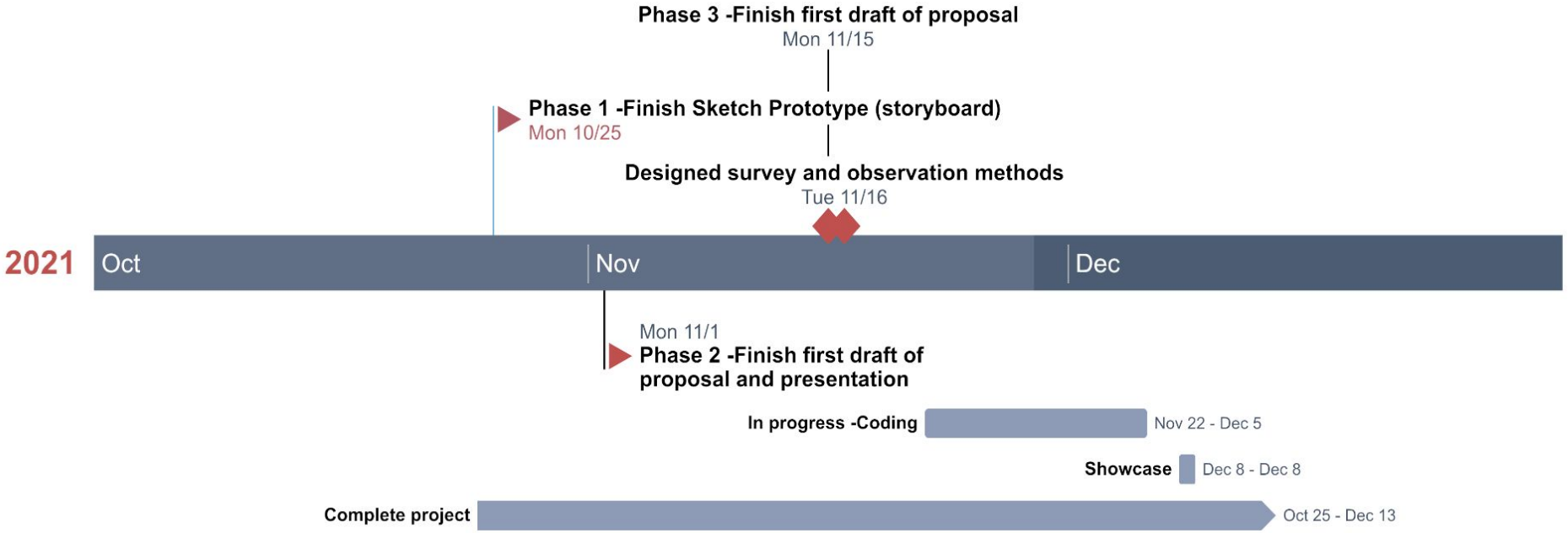
Phase 3 -Finish first draft of proposal
Mon 11/15
Phase 1 -Finish Sketch Prototype (storyboard)
Mon 10/25
Designed survey and observation methods
Tue 11/16
2021
Oct
Nov
Dec
Mon 11/1
Phase 2 -Finish first draft of proposal and presentation
In progress -Coding
Nov 22 - Dec 5
Showcase
Dec 8 - Dec 8
Complete project
Oct 25 - Dec 13

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