LUMOZ

Realtime AR Based Tool For Digital Media Production

2021-075

SLIIT FACULTY OF COMPUTING

Team Members

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Co Supervisor: Mr. Thusithanjana Thilakarathne

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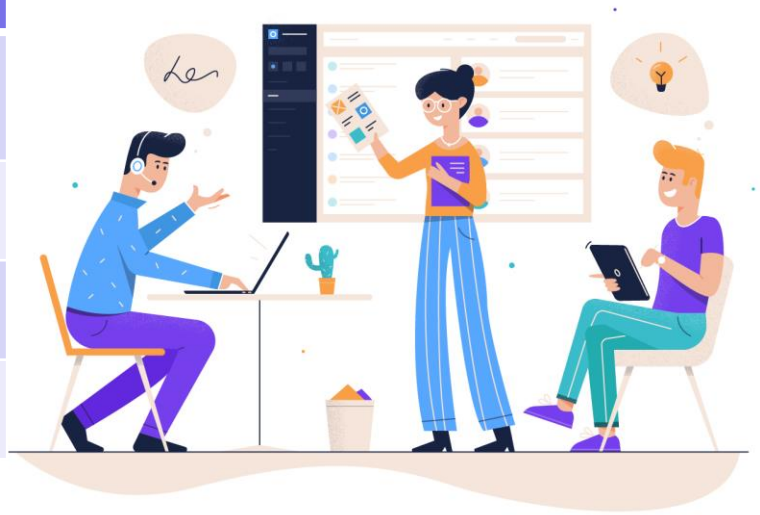

Introduction

What is media world?

Our research focus is to build a tool which helps digital media creators for creating their live content with high graphical effects like AR.

Research Problem

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Q. How to create easy graphics without

01 **Large production time**

02 **Large production cost**

03 **High employee training cost and time**

04 **High cost in outsourcing to 3rd party graphic companies**

Research Objectives

01 Object Placement

02 Point Tracking

03 Data Visualization

04 Gesture Detection

Overall Solution As A System Diagram

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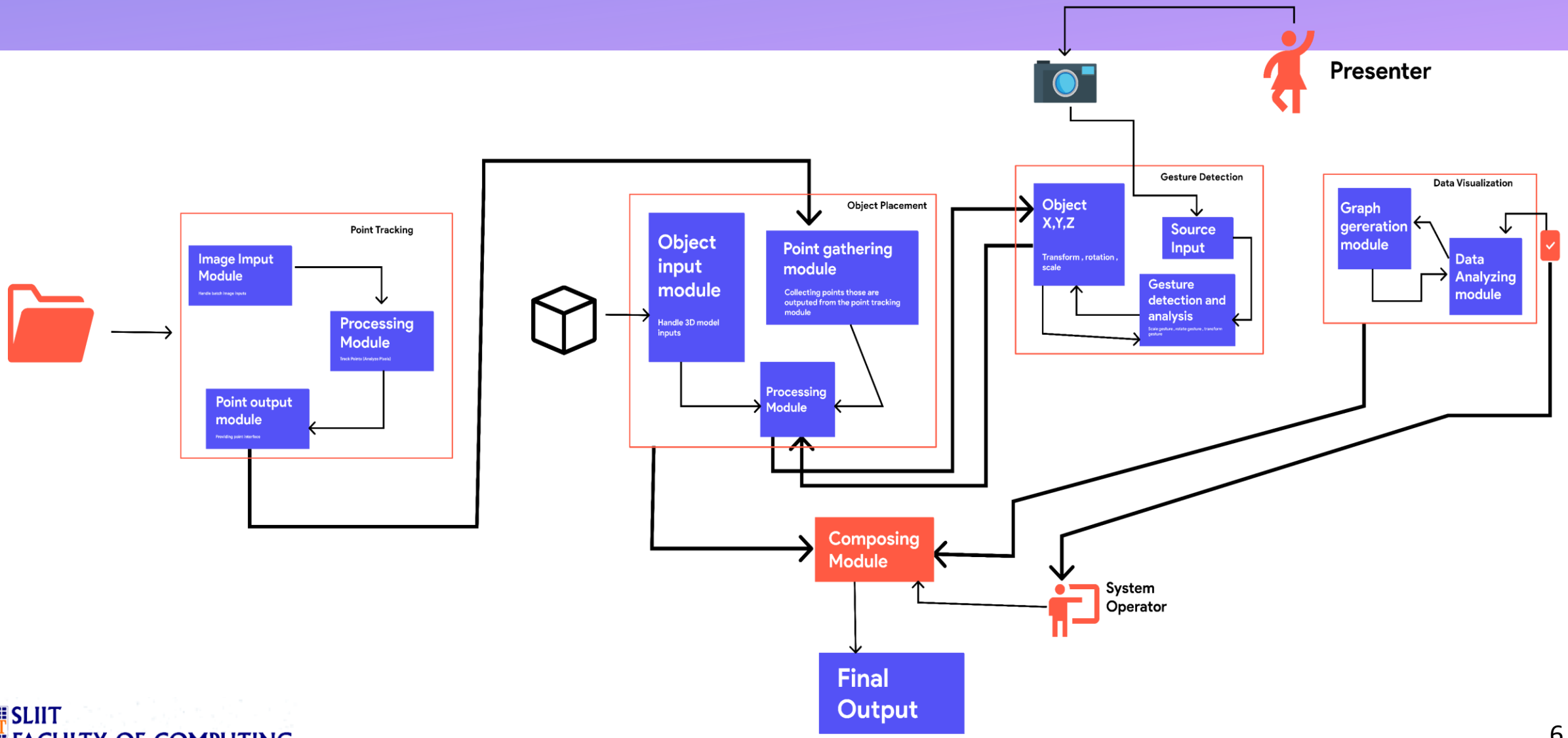

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Object Placement

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Information Technology

Research Questions

01 How can we bring a solution for representing objects which we cannot bring to the studio

02 What is object placement

03 How can we improve news attractiveness using object placement

04 Problems in the current use of this technology

Objectives

Show a three dimensional object or graphic 3D object represent the live broadcast

Placed right point to object

Maintain object in same marked point and auto scale

Analyze object in video and Live streaming

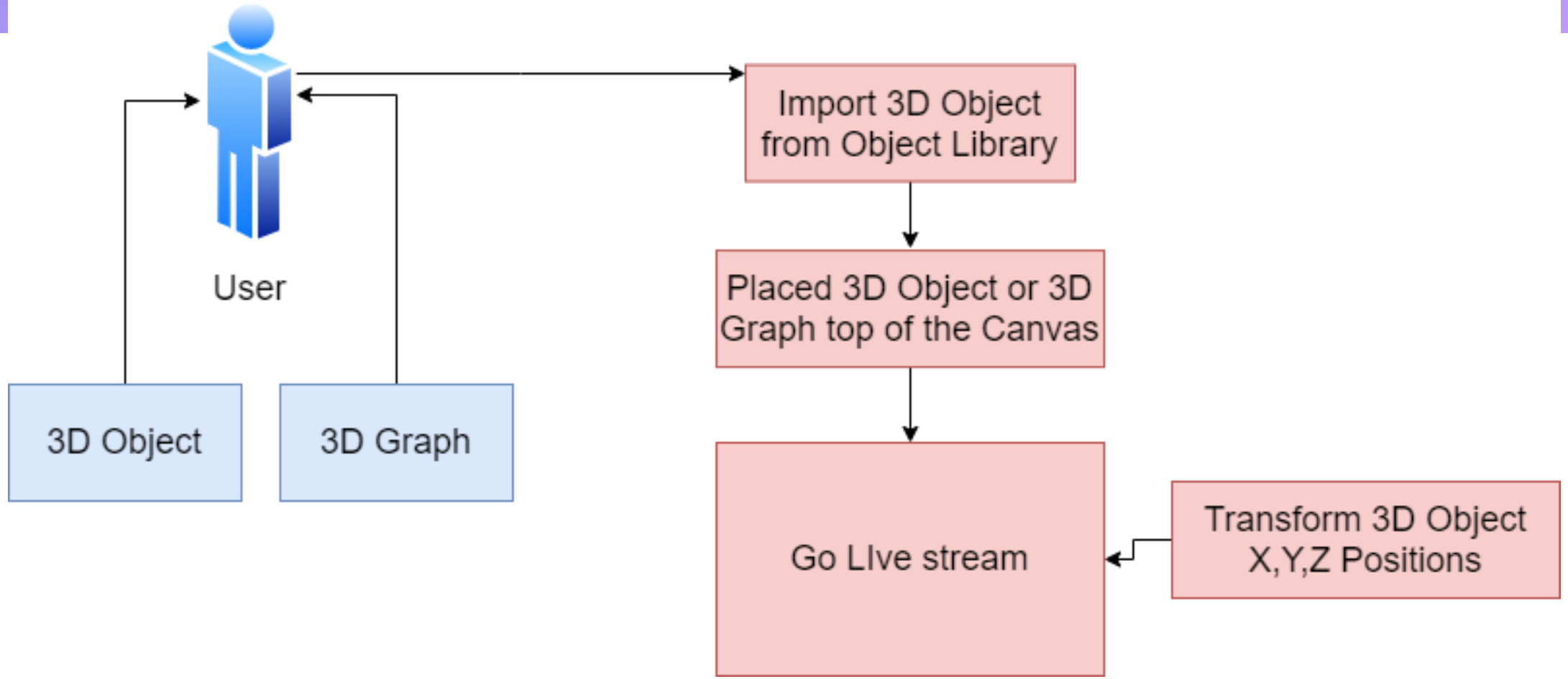
Methodology

01 System Diagram

02 Technology

03 Requirements

System Diagram

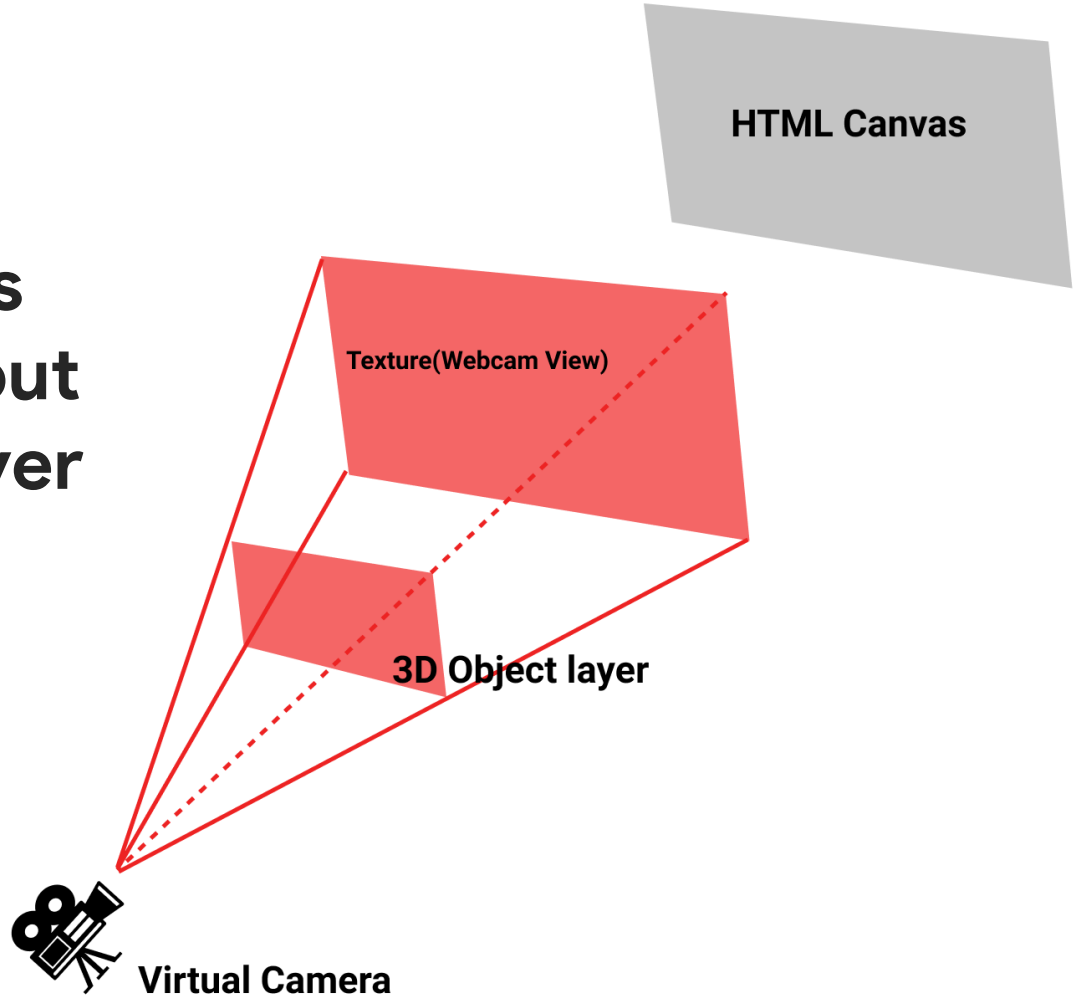


Technologies

- We used in React , JavaScript and ThreeJs
- Livestream server technology is NodeJS

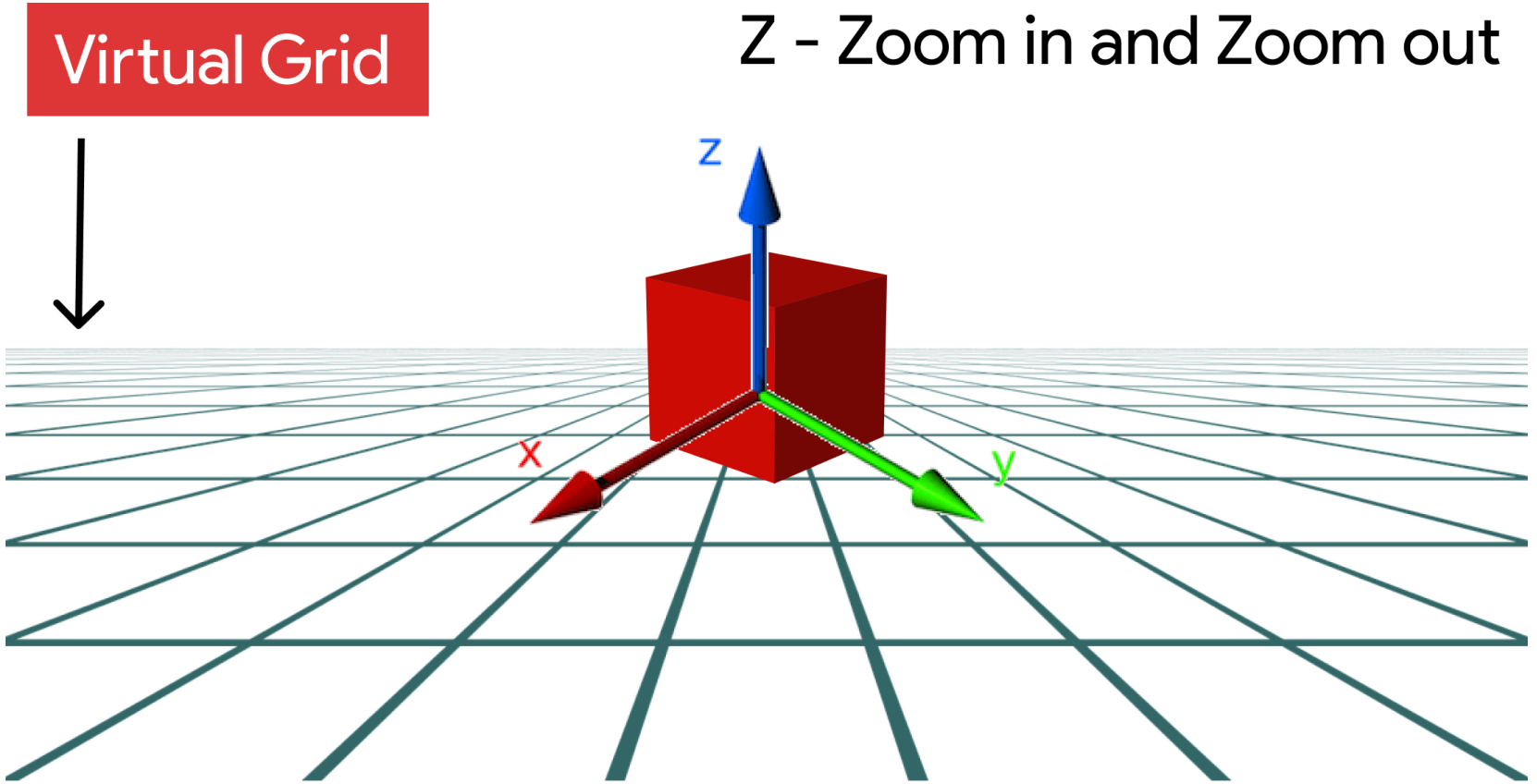
Canvas Layers

- Canvas divide 3 layers
- 1st layer – HTML Canvas
- 2nd Layer – Webcam input
- 3rd Layer – 3d object layer



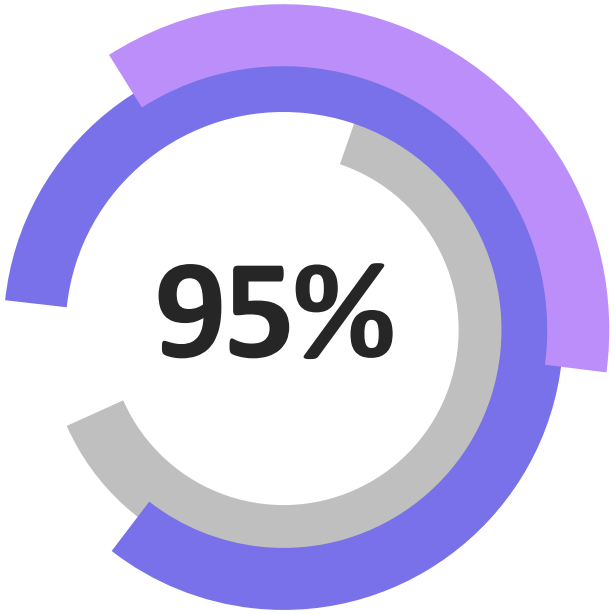
Virtual Grid

X - Left and Right
Y - Top and Bottom
Z - Zoom in and Zoom out



Current Progress – IT18175080 (95%)

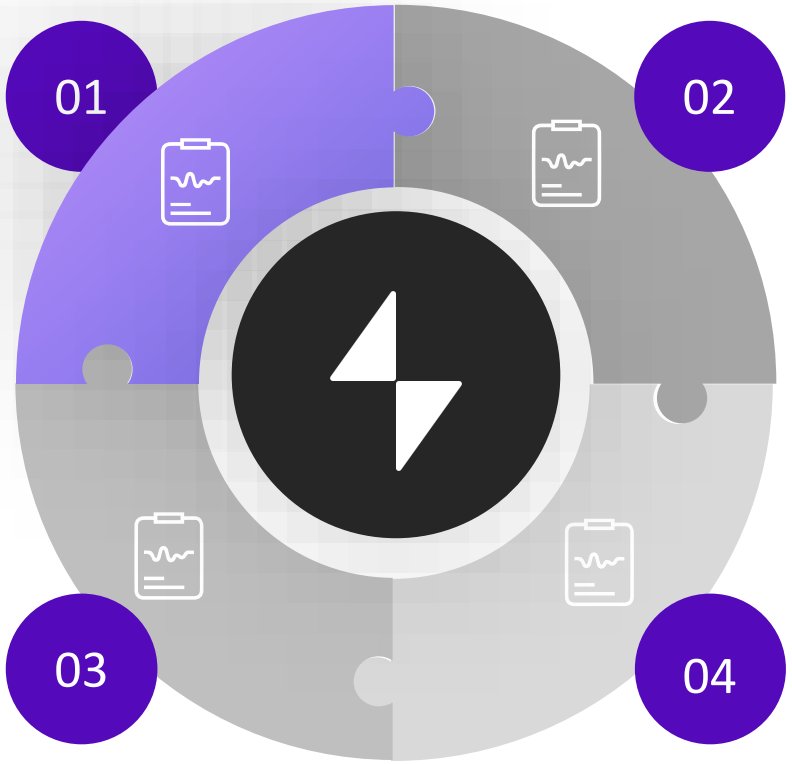
- 3D object placed on web camera input
- Support Different 3D Modals Type (glb , gltf)
- Auto scale object camera movement
- Model Replacement
- Integrate Facebook live stream API



Objectives and Project Completion

100%

Placed right point to object



100%

Integrate Live Stream API

100%

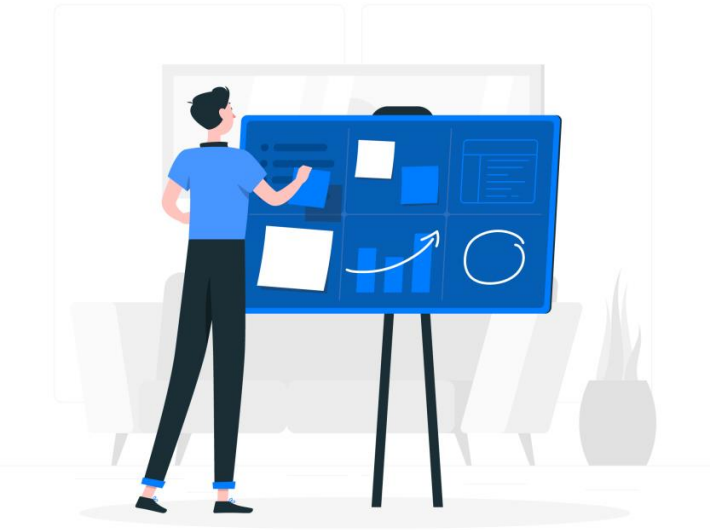
Object auto scale Moving camera

95%

Improve User Experience

Tasks To Be Completed – IT18175080

- Improve User experience



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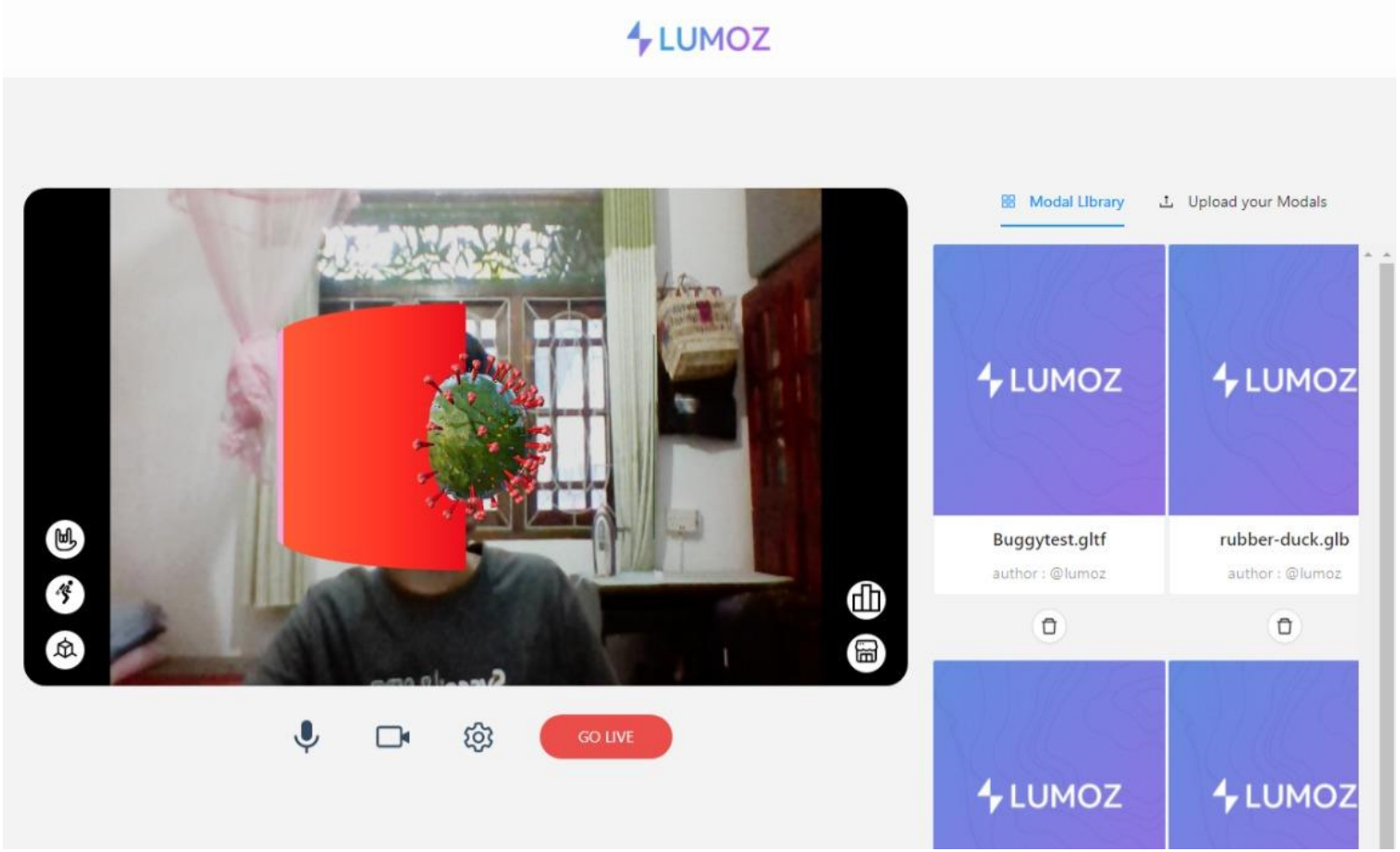
Screenshots of the current work

Project Evidence

IT18175080 | R.M.Bawantha Thilan | Project ID : 2021-075

Project Evidence – IT18175080

- Object Placing
- Modal Library
- Live Camera Input



Project Evidence – IT18175080

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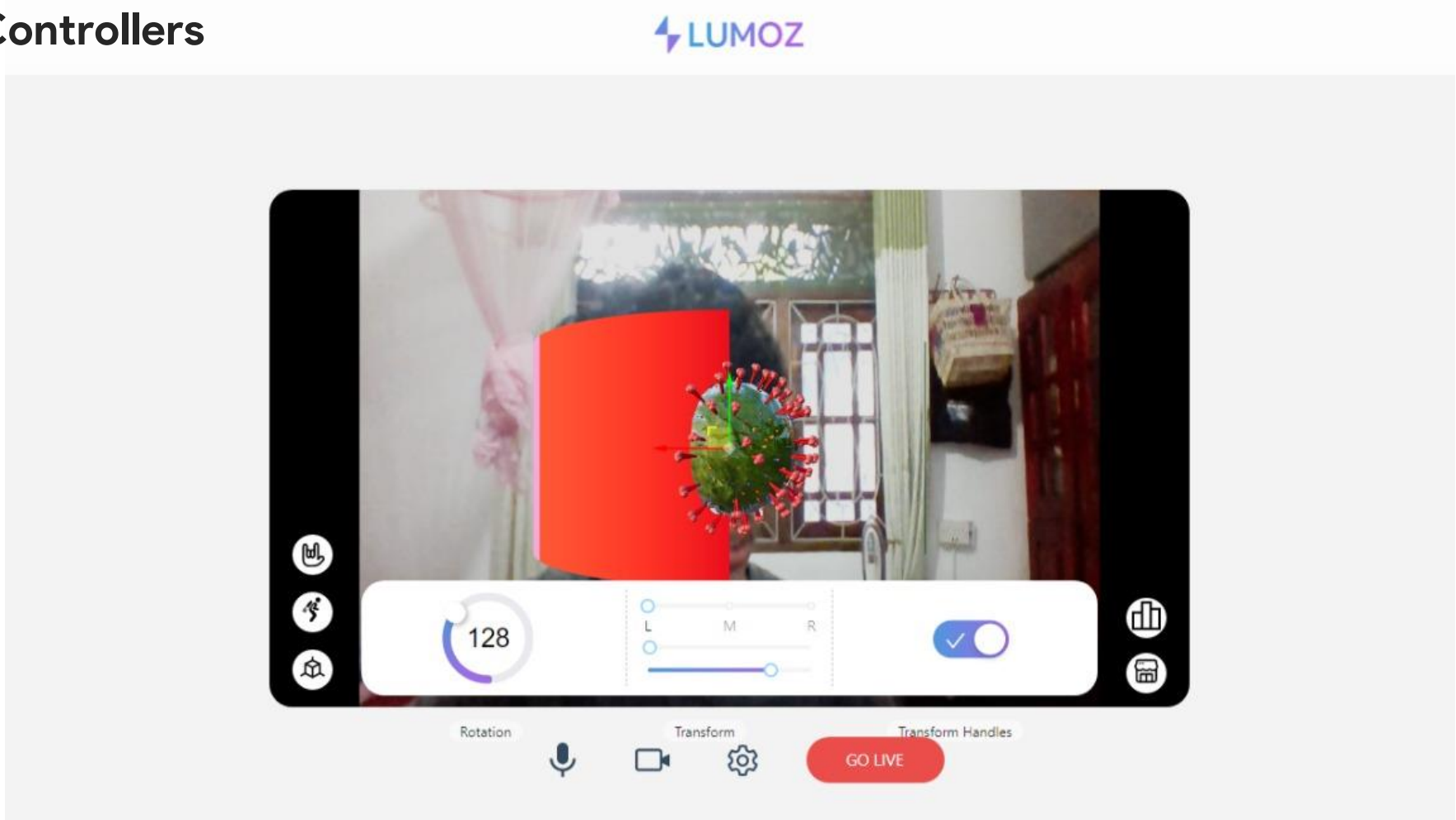
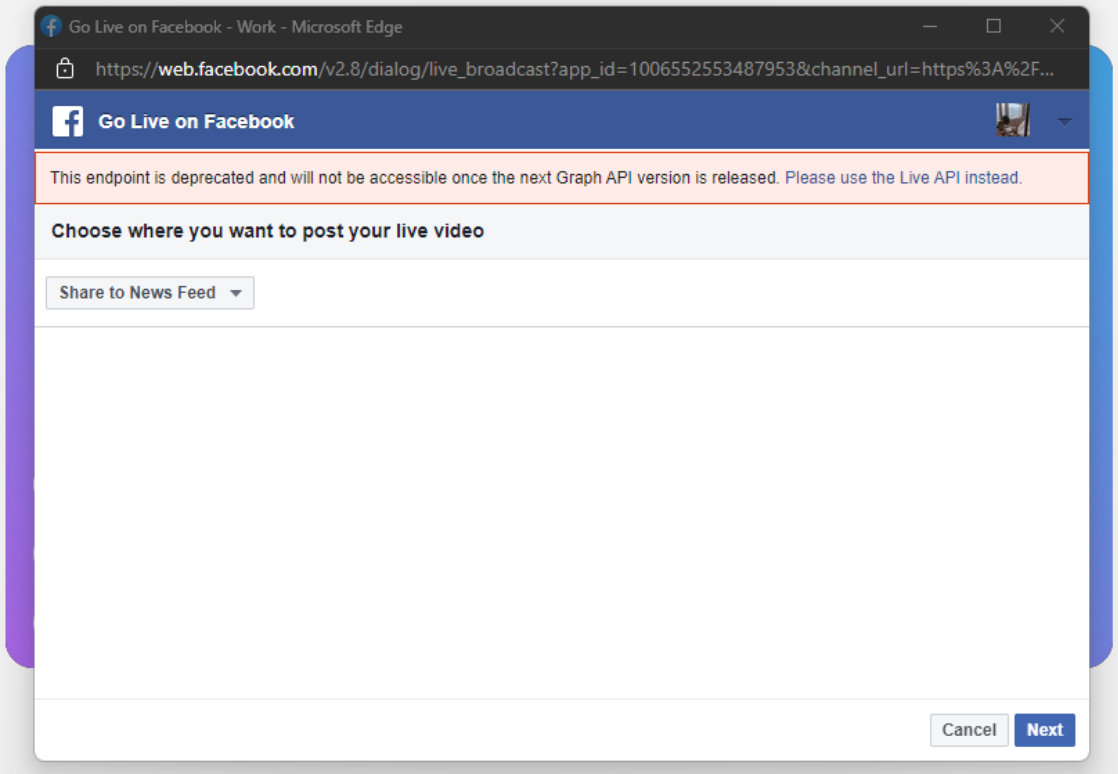
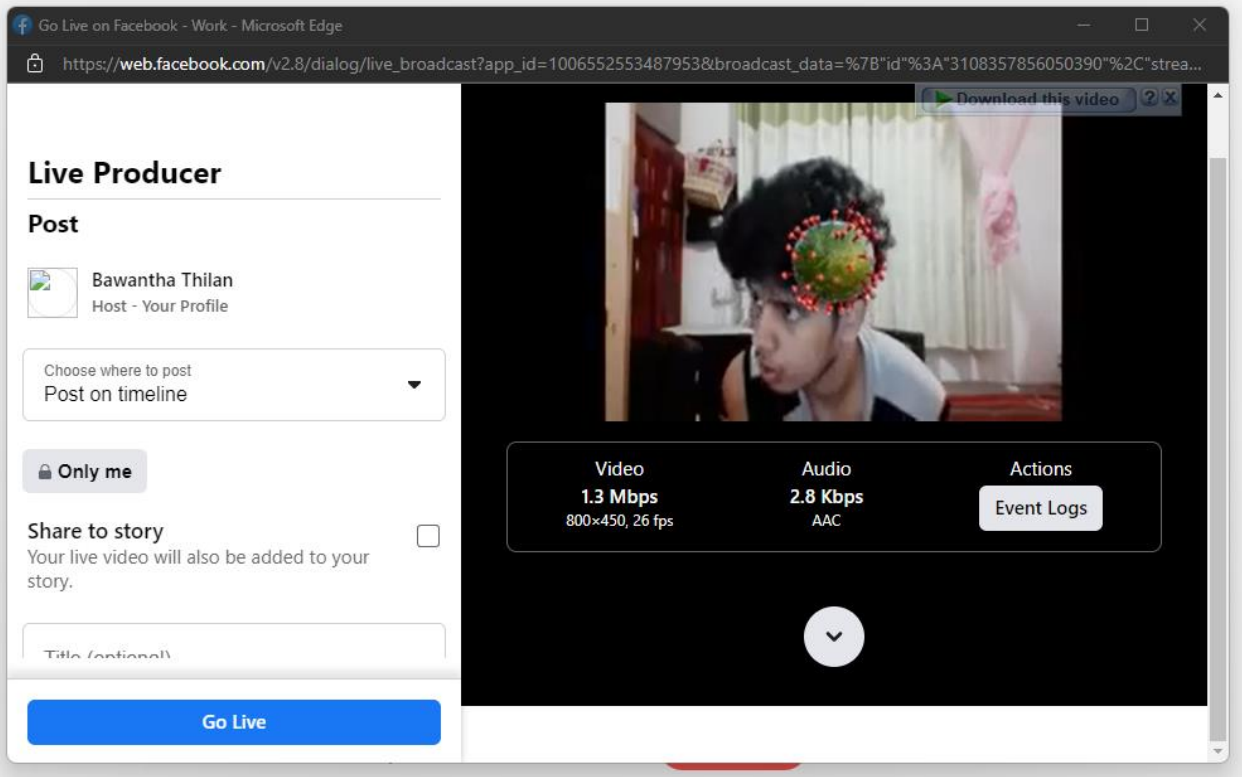
3D Object Controllers



Project Evidence – IT18175080

Live Stream API





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Point Tracking

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Information Technology

Research Questions

01 How to create a point tracking system that can be used by any non-technical person?

02 How to provide a low budget system for live point tracking ?

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Objectives

Develop a system that can deploy point tracking live broadcasts at minimal cost that can be easily used with minimal technical knowledge.

Providing a Simple user interface to the user

Providing a Realtime tracking feature through the sensor powered device

Mapping real time camera movements to the virtual camera

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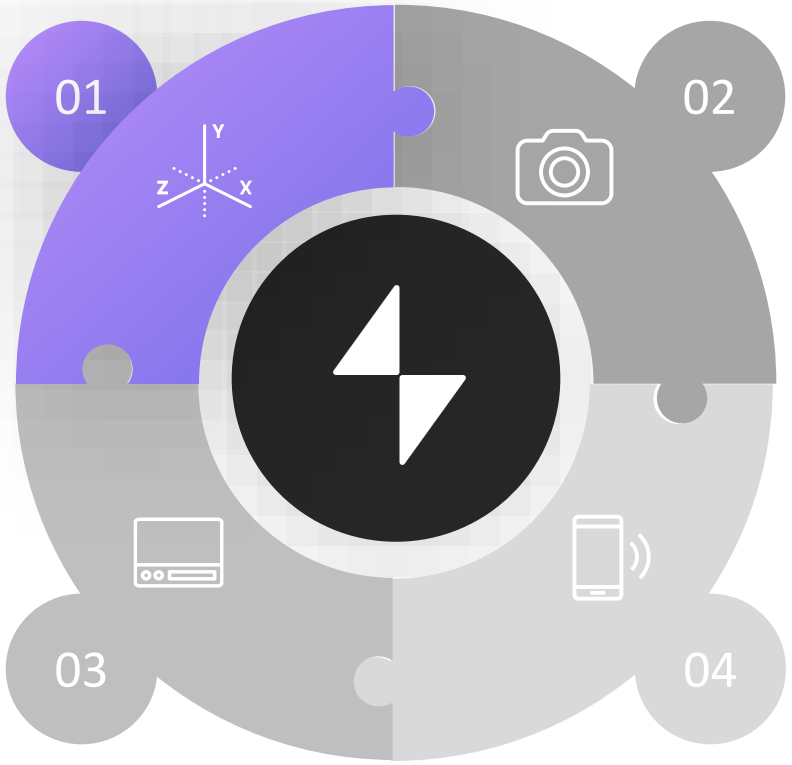
Objectives and project completion

95%

Model transform controllers



100%

Virtual camera

96%

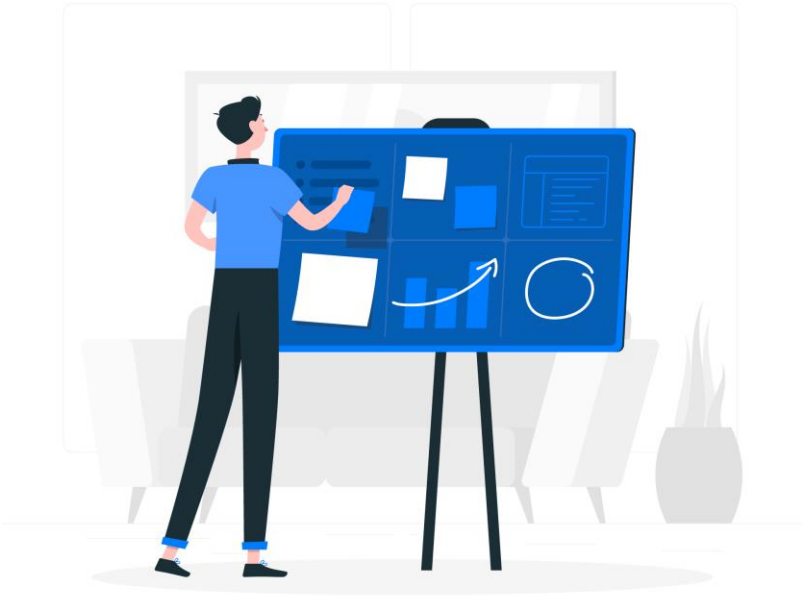
User interface

92%

Sensor powered device and App

Future Progress

- Sensor accuracy improvement in both device and mobile app



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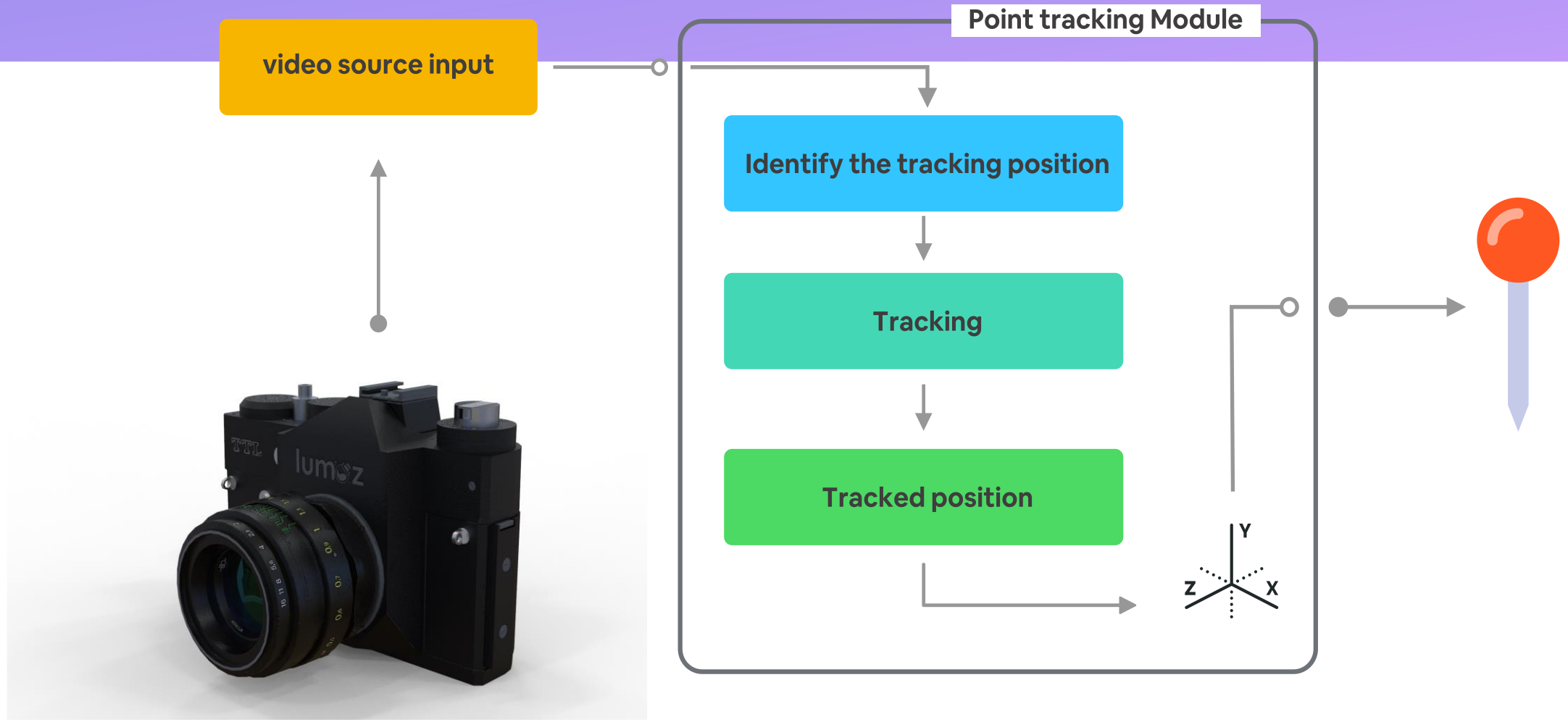
Methodology

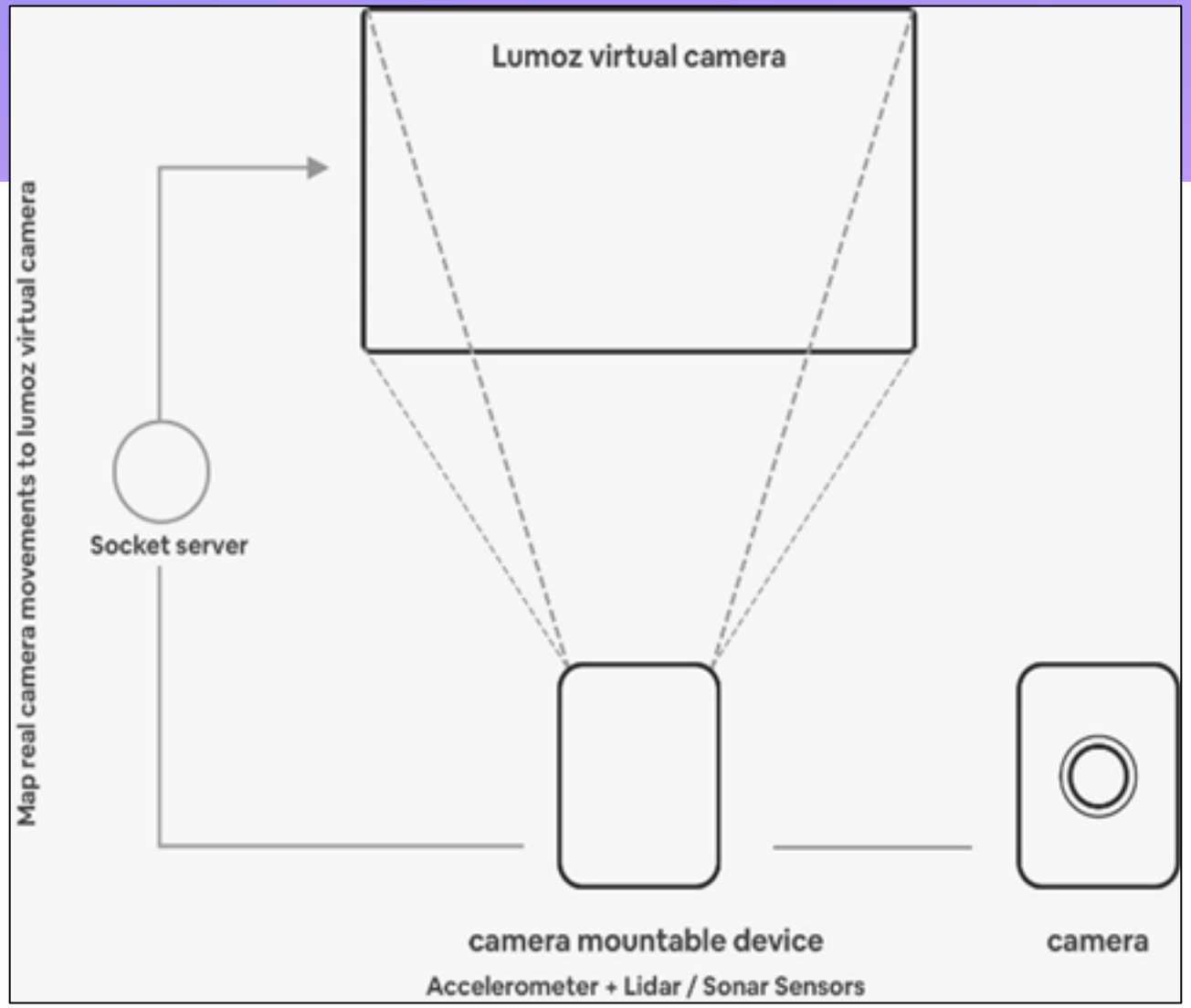
- System Diagram
- Technologies

System Diagram



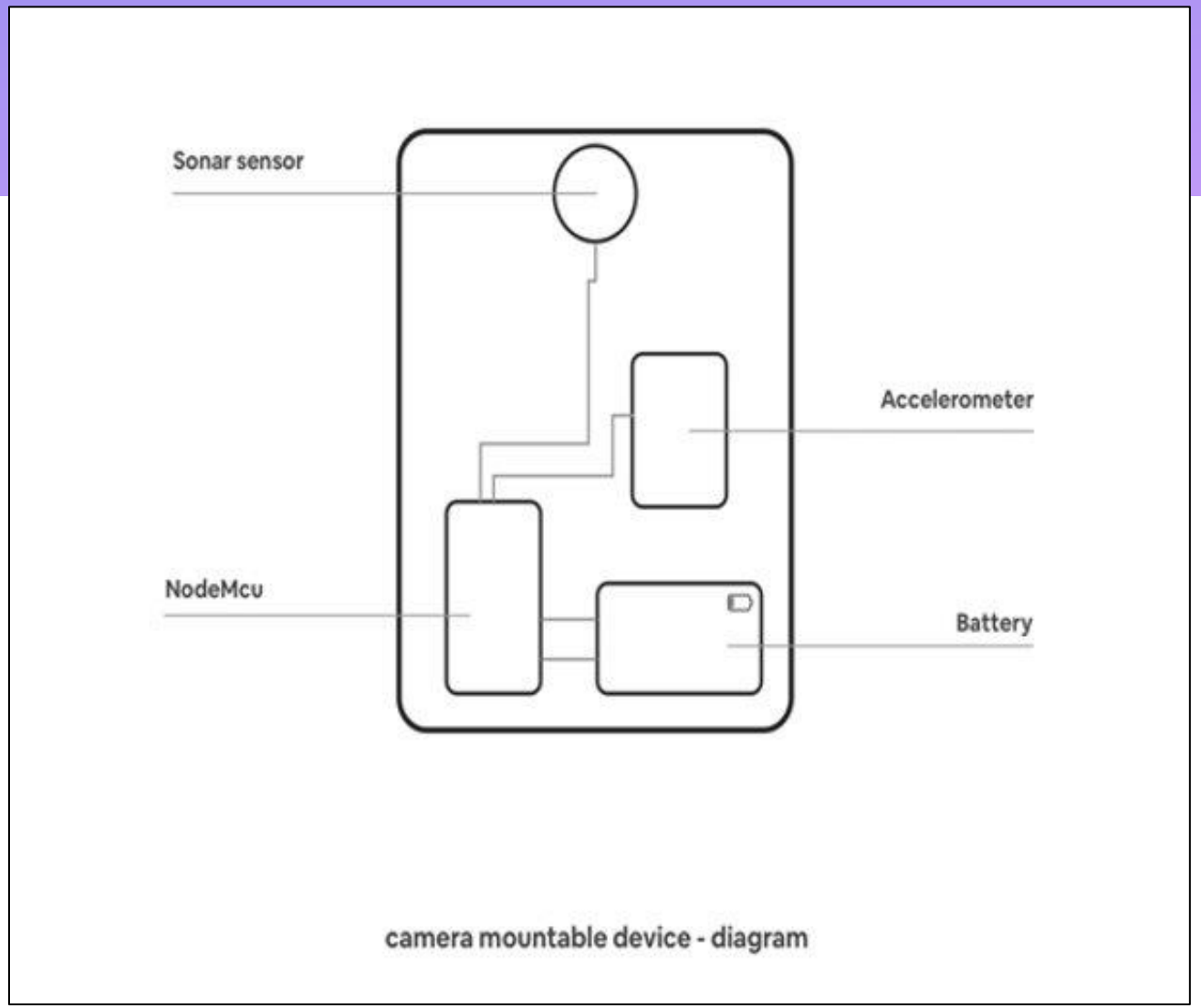
Methodology

IOT Device



Methodology

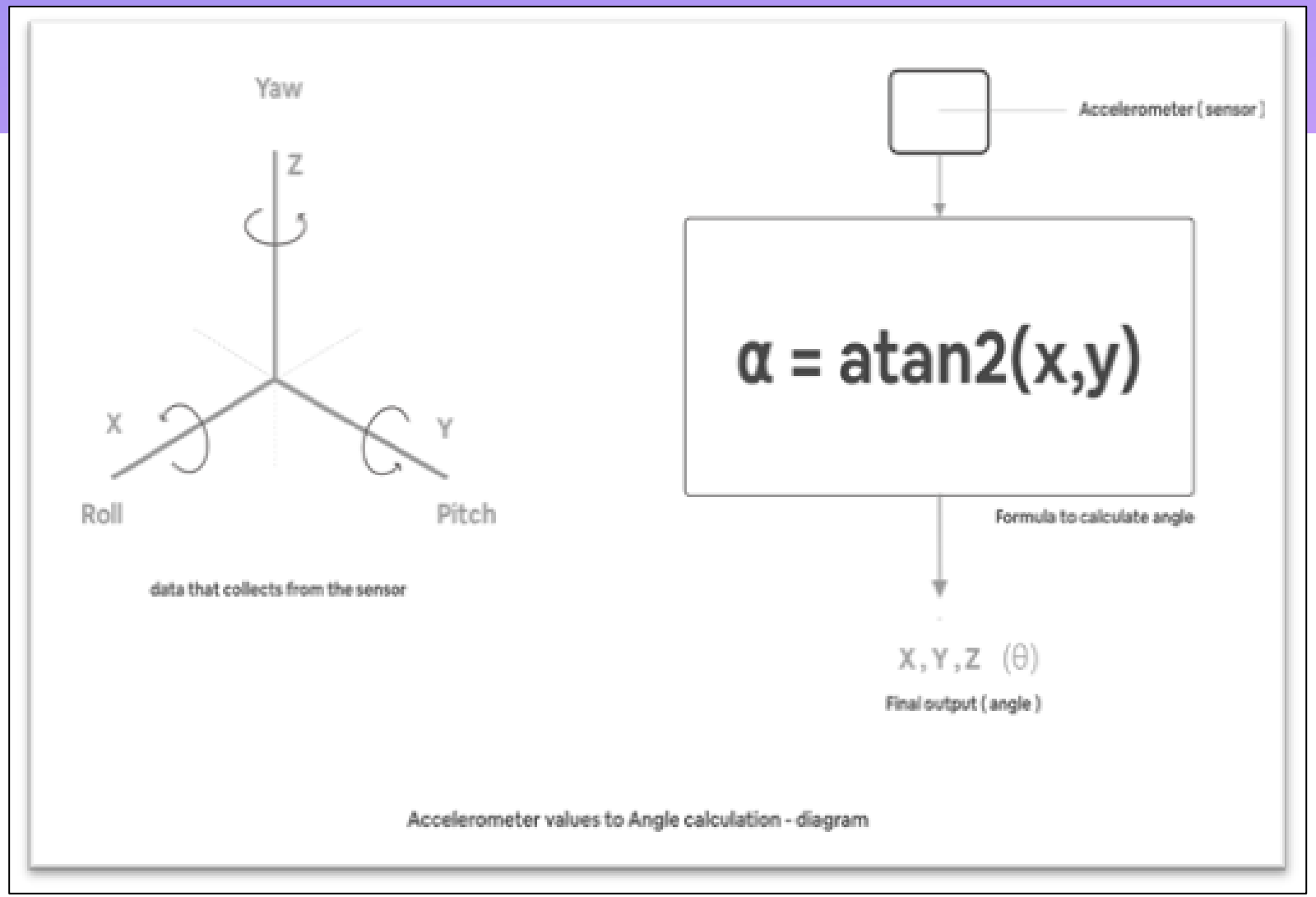
IOT Device



camera mountable device - diagram

Methodology

Angle calculation



Accelerometer values to Angle calculation - diagram

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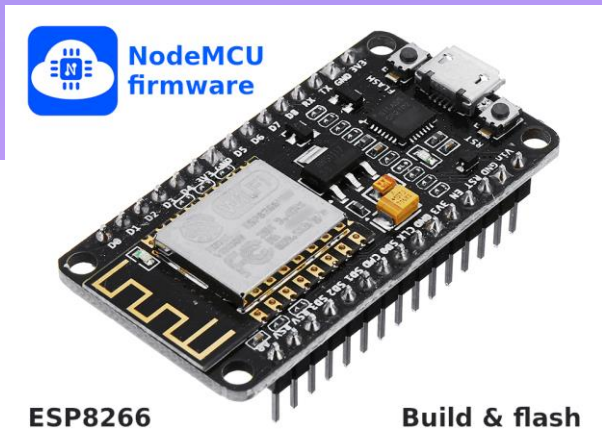
IoT Device

Technologies

- WebGL
- JavaScript
- WebRTC
- Express (framework)
- React.js (framework)
- Three.js (react-three-fiber)
- Arduino
- Nodemcu Firmware
- C language



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3D Data Visualization

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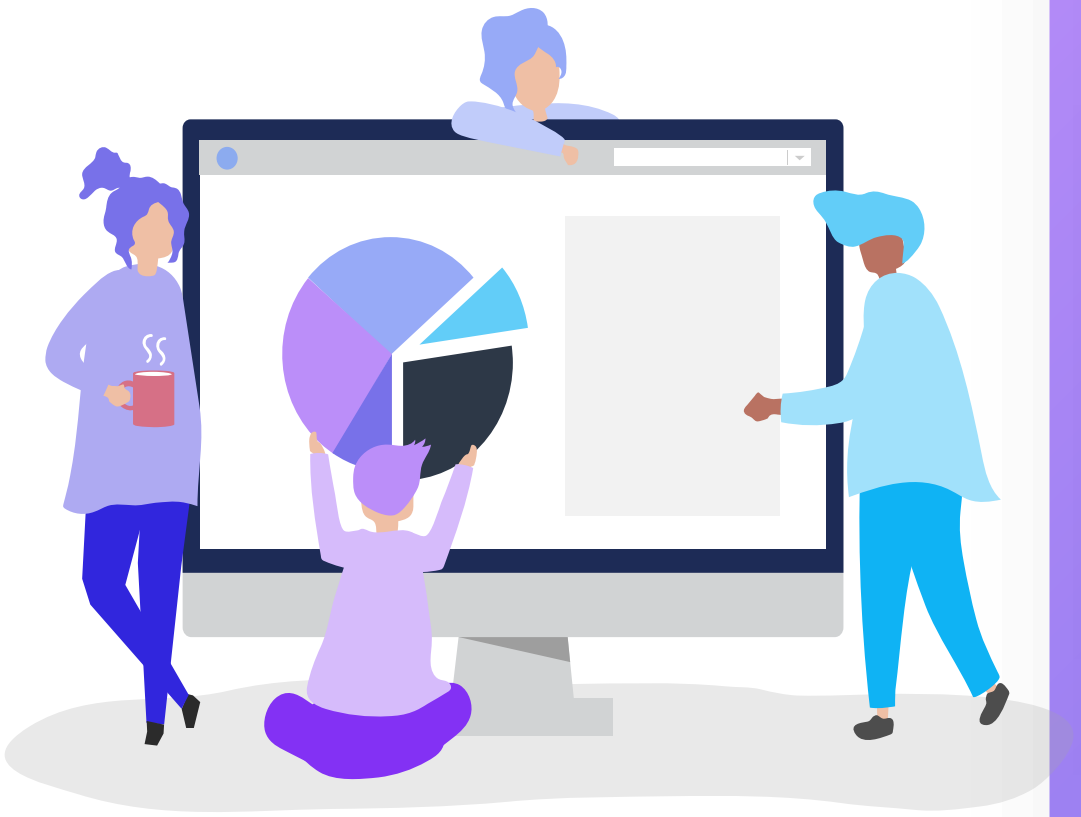
Interactive Media

Research Questions



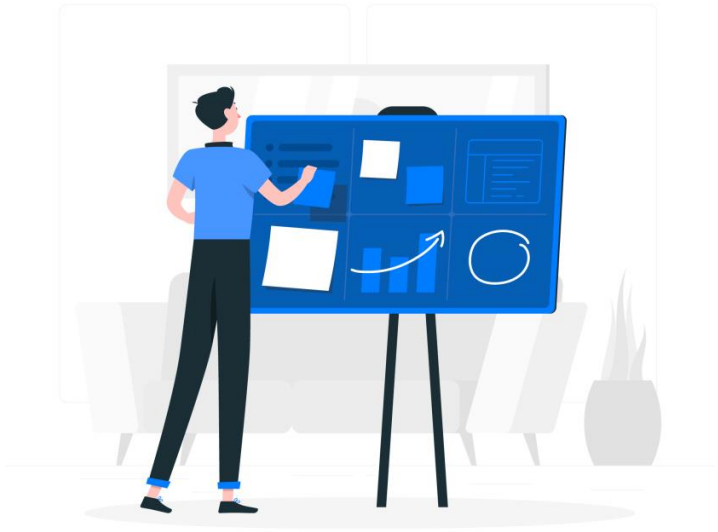
01 Can the user get 3D Graphs in live content?

02 Are there color suggestion technique in data visualization?

03 Can the user manipulate 3D graphs real-time with their live stream?

Objectives

Allowing the user to create and handle 3D graphs in a live session



Sub-Objectives

- ✓ Creating visual attractive 3D objects to represent statistics
- ✓ Real-time manipulation of the 3D graphs
- ✓ Creating color pallet according to the live performing surrounding

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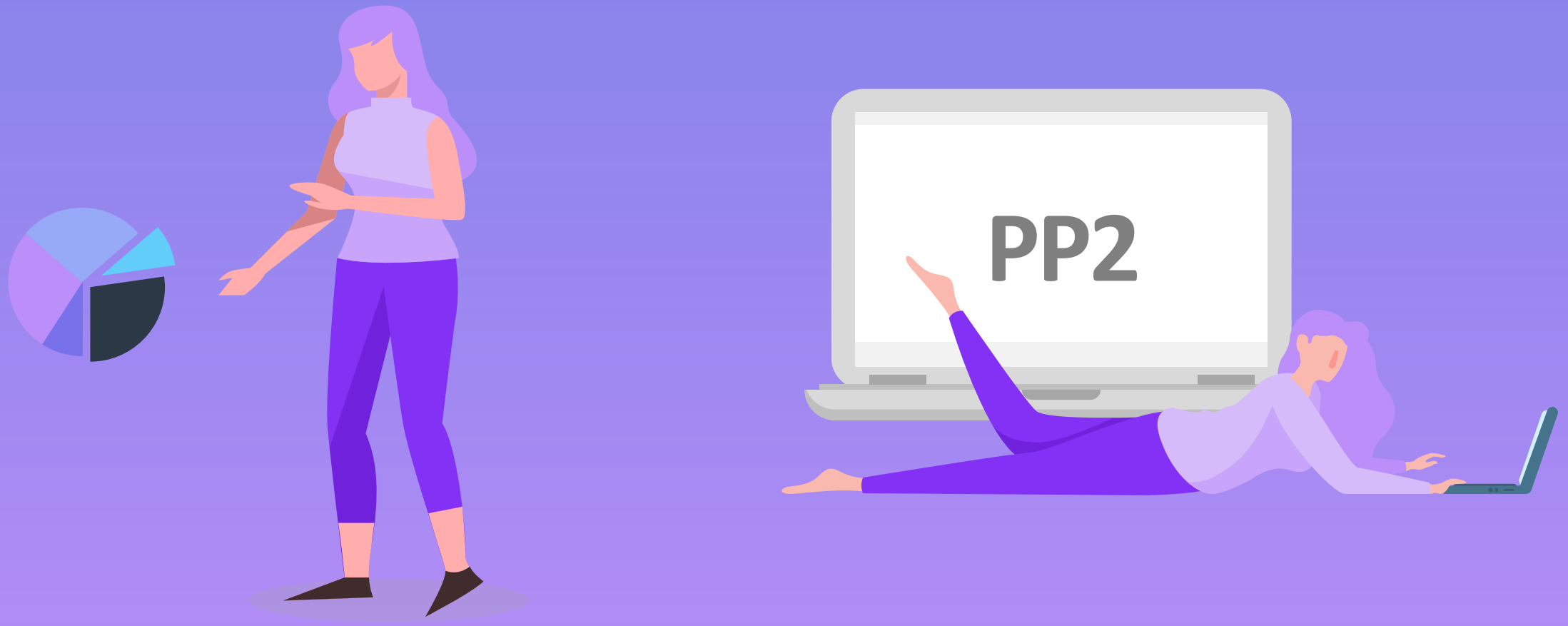
System diagrams and Algorithms

Methodology



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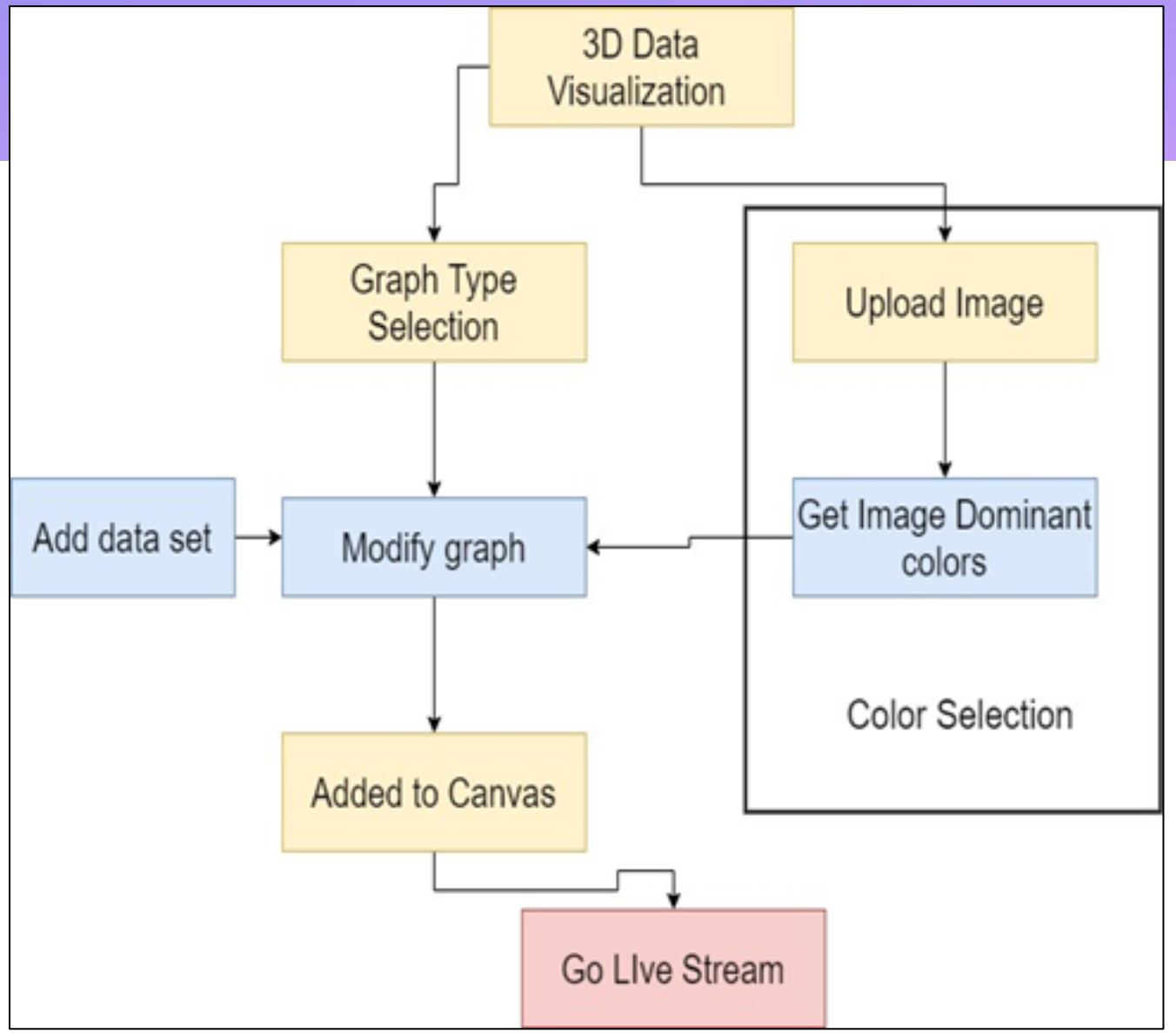
System Diagram

This is the system diagram it shows the overall process of the 3D data visualization component.

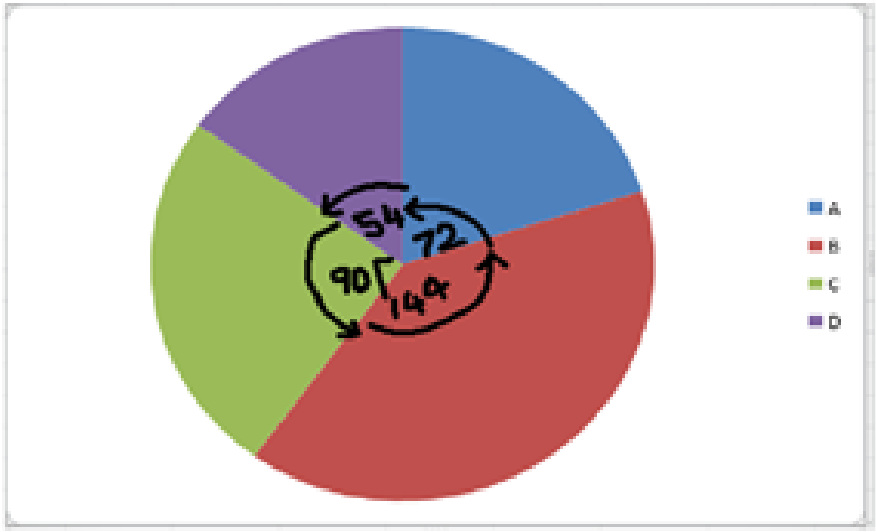


Pie Chart Formula

The formular is defined as the total number of pieces of data in a slice is multiplied with the percentage of the slice with the data set's total number and then the value is divided by 100.

Pie Chart Formular

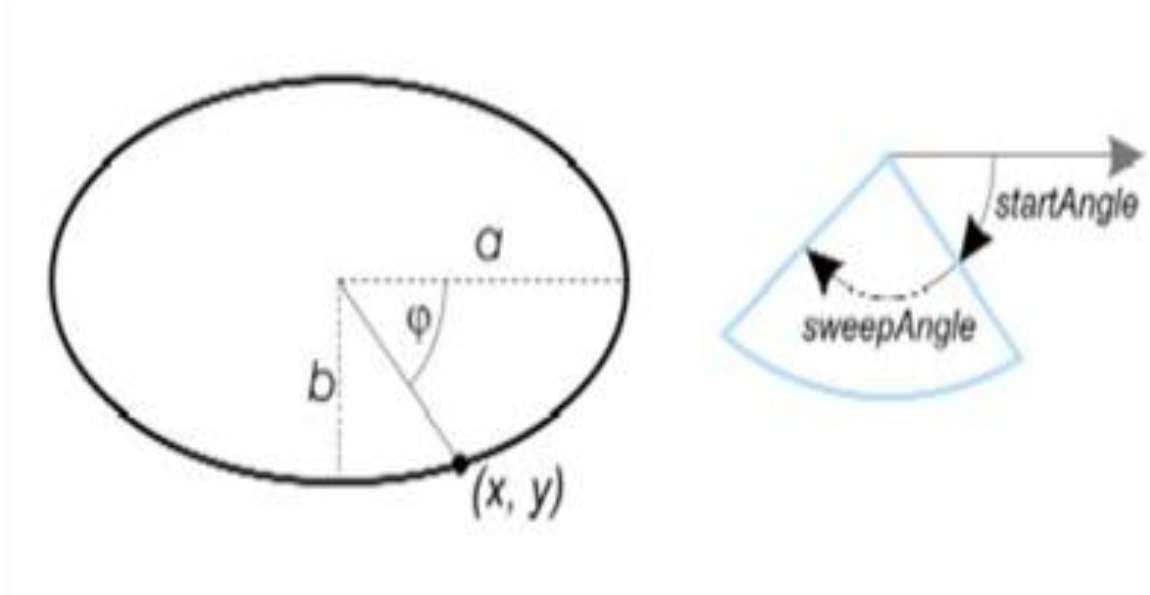
Item	Amount	Central angle
A	20	$\left(\frac{20}{100} \times 360\right)^{\circ} = 72^{\circ}$
B	40	$\left(\frac{40}{100} \times 360\right)^{\circ} = 144^{\circ}$
C	25	$\left(\frac{25}{100} \times 360\right)^{\circ} = 90^{\circ}$
D	15	$\left(\frac{15}{100} \times 360\right)^{\circ} = 54^{\circ}$



A + B+ C+ D = 100

Total Item (n) = 100
A = (Amount/ n)* 360
A = 72

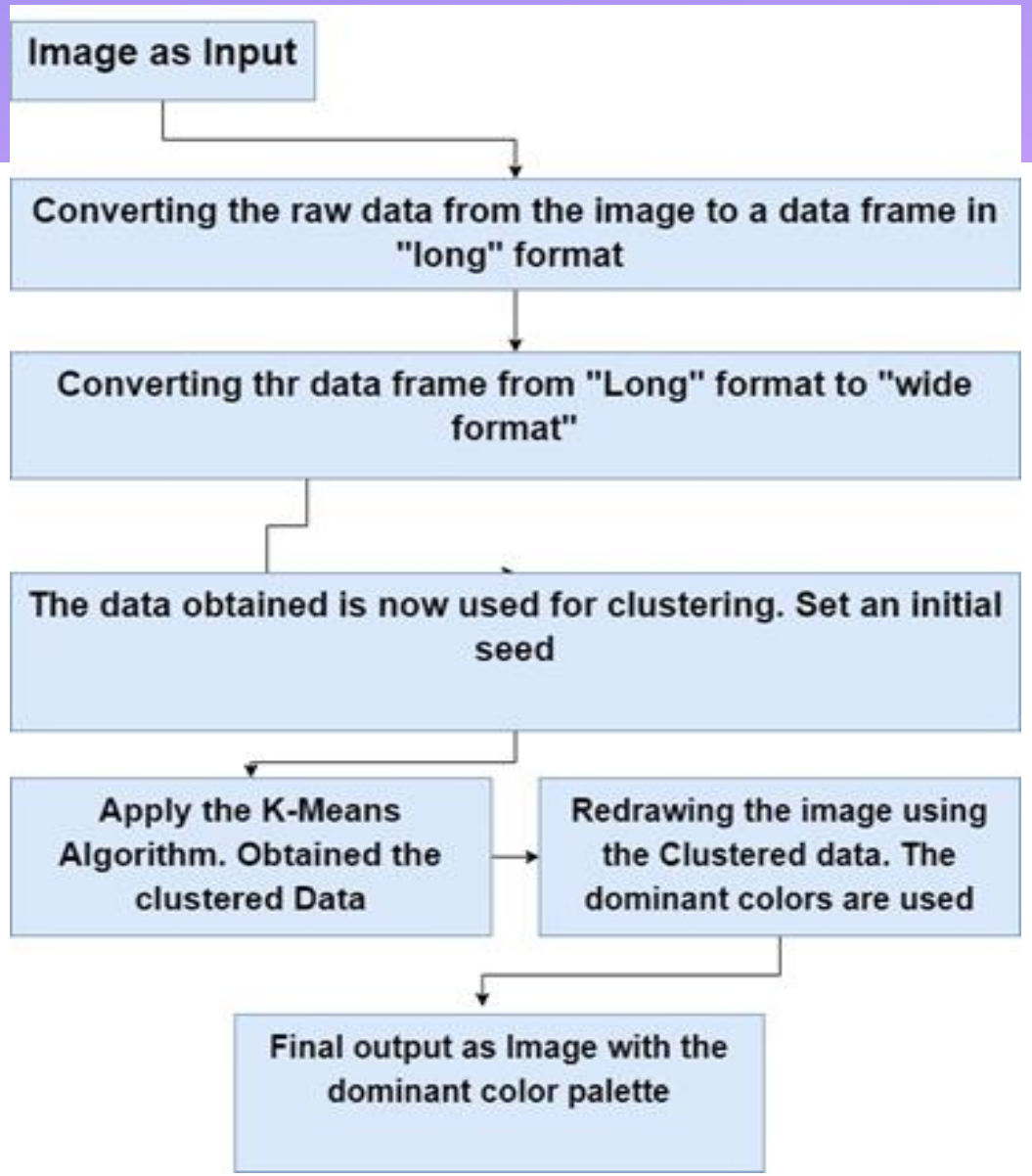
Pie Chart Formula



$$\text{Angle} = \tan^{-1}(y/x) = \tan^{-1}((b * \sin(t)) / (a * \cos(t)))$$

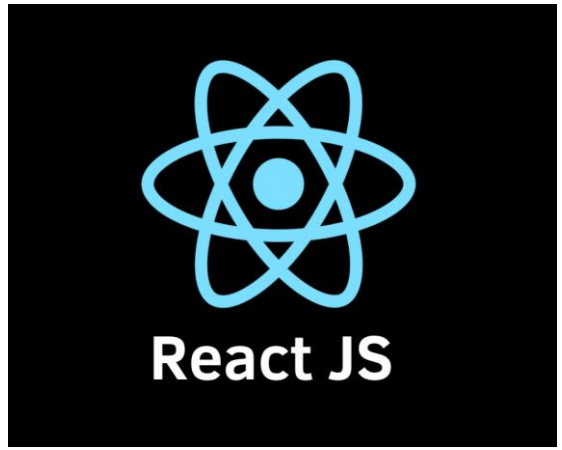
Color Suggestion Algorithm

- The color selection is automated to select the color which is suitable for the presenter's location.
- For that, an image can be given to the system and system will identify the most dominant colors of that image
- Output the dominant colors pallet



Technology

- JavaScript
- React JS
- Web GL



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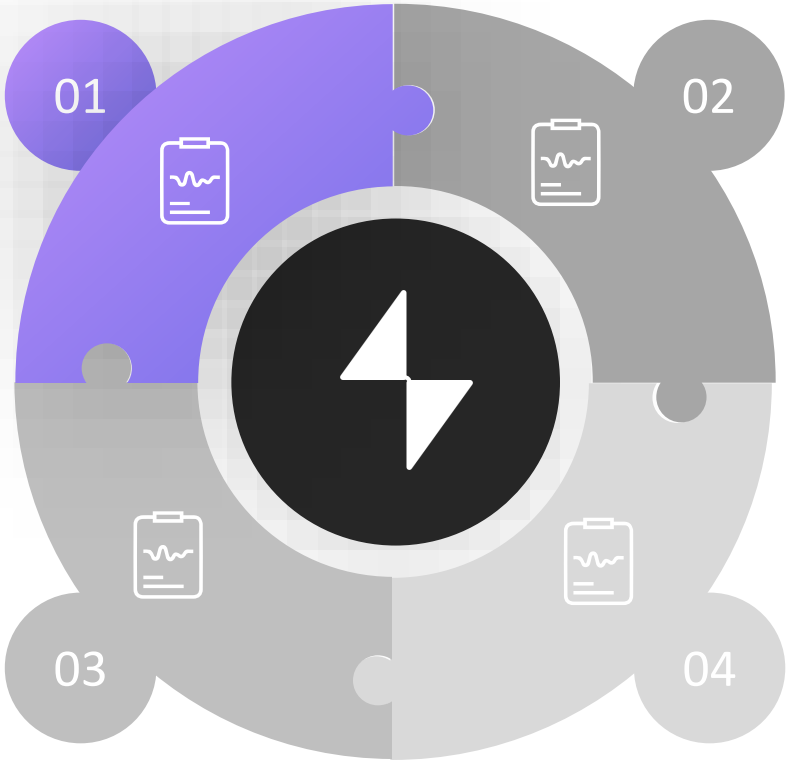
Objectives And Project Completion

90%

3D graph real-time manipulation in a live video



100%

Color pallet generation with image upload

90%

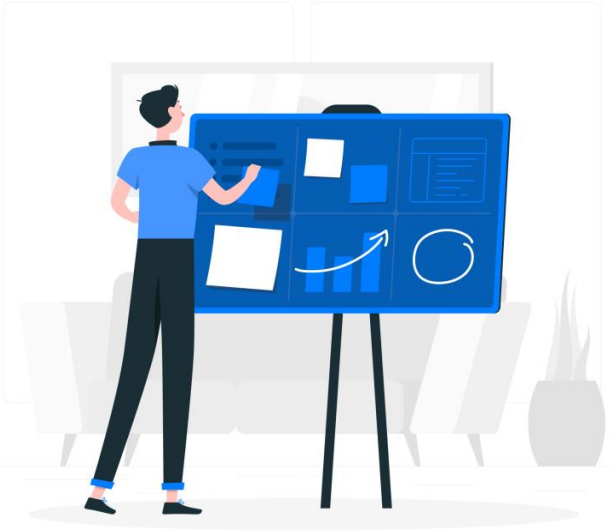
3D object creation for the live sessions

95%

Integration of the component

Future Progress

- Smooth the graphs and add more visual details to the 3D graph.
- Convert static data to dynamic data.



Why LUMOZ Need 3D Data Visualization?

- 3D models can be imported.
- To represent data and values we cannot use pre-made objects.
- User needs real-time data visualization.
- User needs to manipulate 3D graph real-time in a live session.

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Gesture Detection

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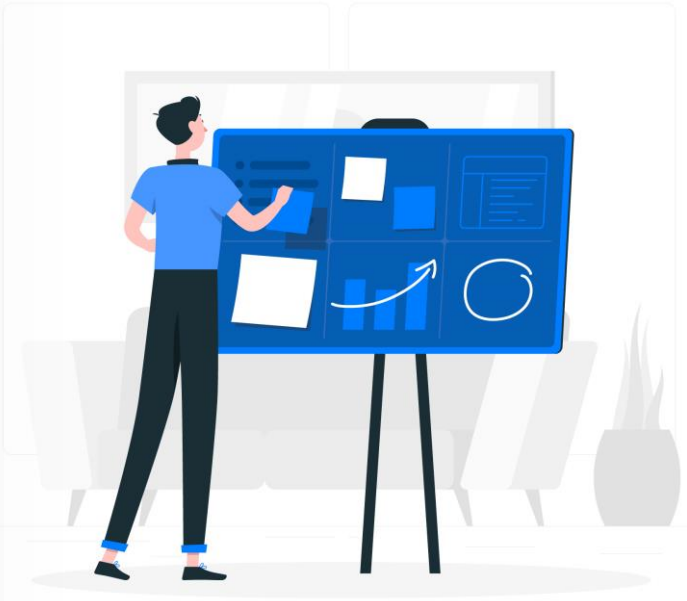
1. Research Questions
2. Objective
3. Methodology
    3.1 System Diagram
    3.2 Technology
    3.3 Switch Function
    3.4 Moving Function
    3.5 Zoom In/Out Function
    3.6 Rotate Function
4. Completion Percentage
5. References



Research Questions

Q. How the presenter interact with the 3D objects and data visualization when presenting?

1. Research Questions
2. Objective
3. Methodology
    3.1 System Diagram
    3.2 Technology
    3.3 Switch Function
    3.4 Moving Function
    3.5 Zoom In/Out Function
    3.6 Rotate Function
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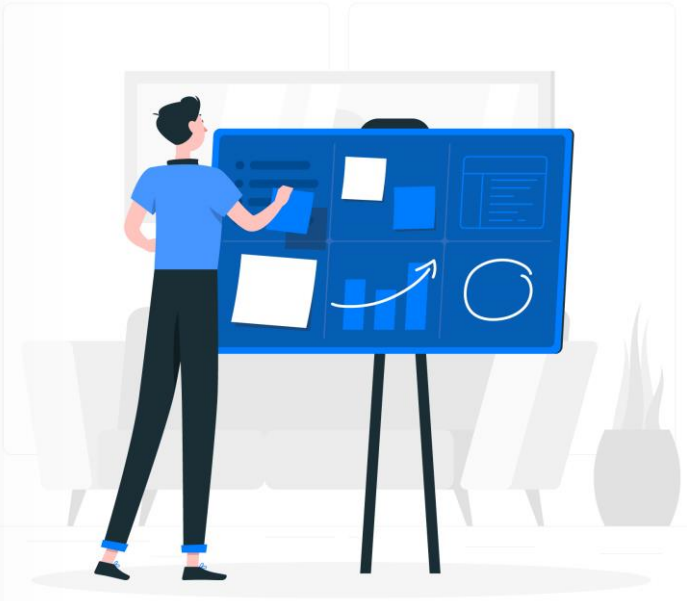
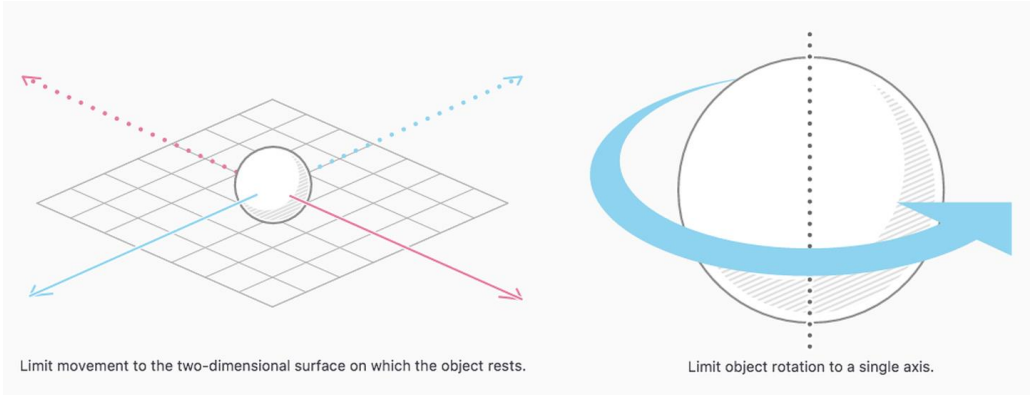
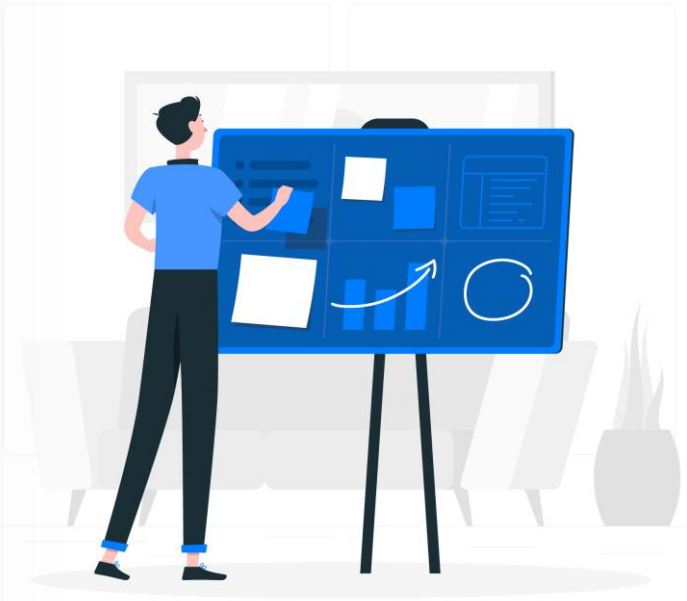


Objectives

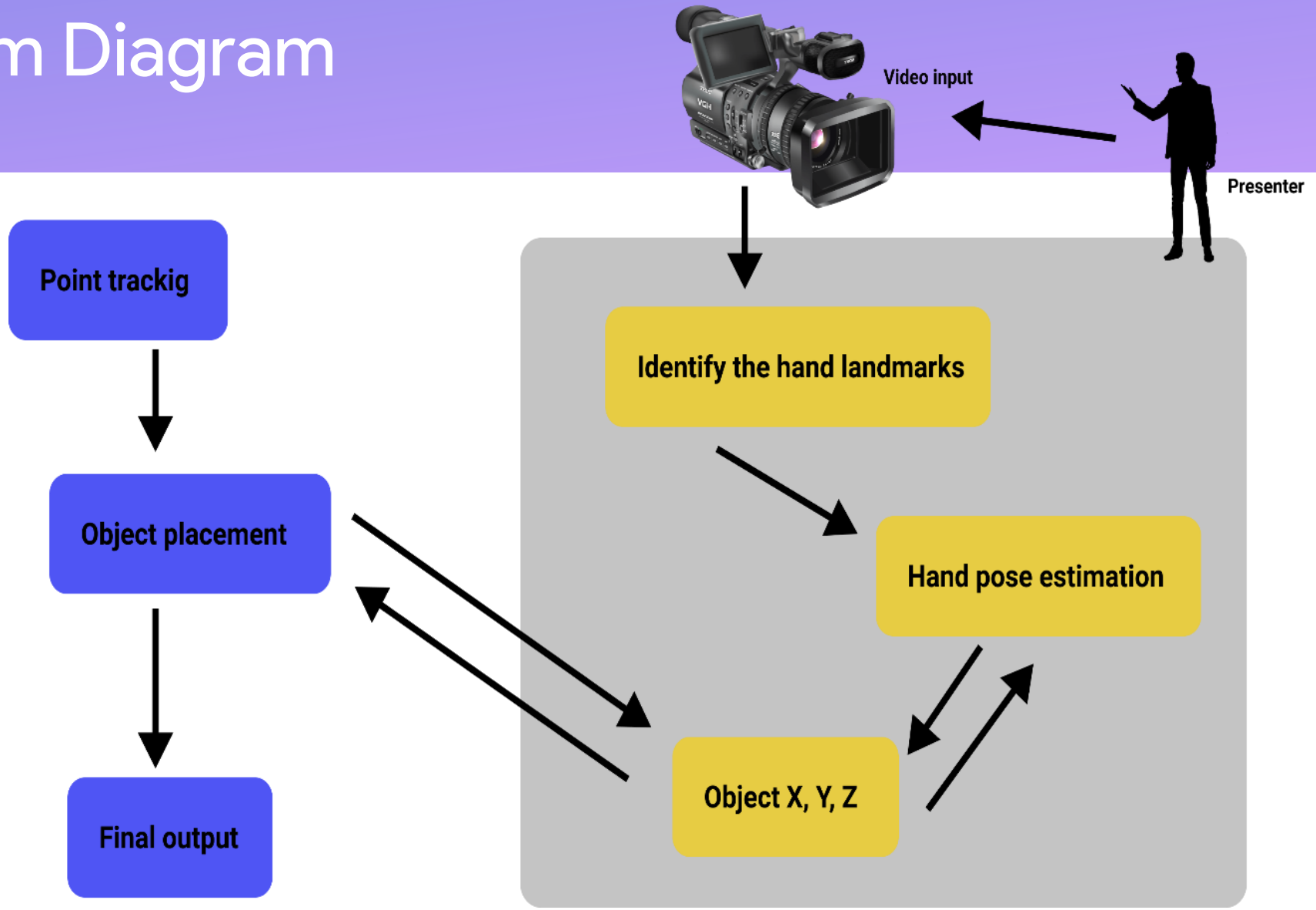
- ✓Communicate 3D object and 3D object movement in live



1. Research Questions
2. Objective
3. Methodology
    3.1 System Diagram
    3.2 Technology
    3.3 Switch Function
    3.4 Moving Function
    3.5 Zoom In/Out Function
    3.6 Rotate Function
4. Completion Percentage
5. References



System Diagram



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2. Objective
3. Methodology
    3.1 System Diagram
    3.2 Technology
    3.3 Switch Function
    3.4 Moving Function
    3.5 Zoom In/Out Function
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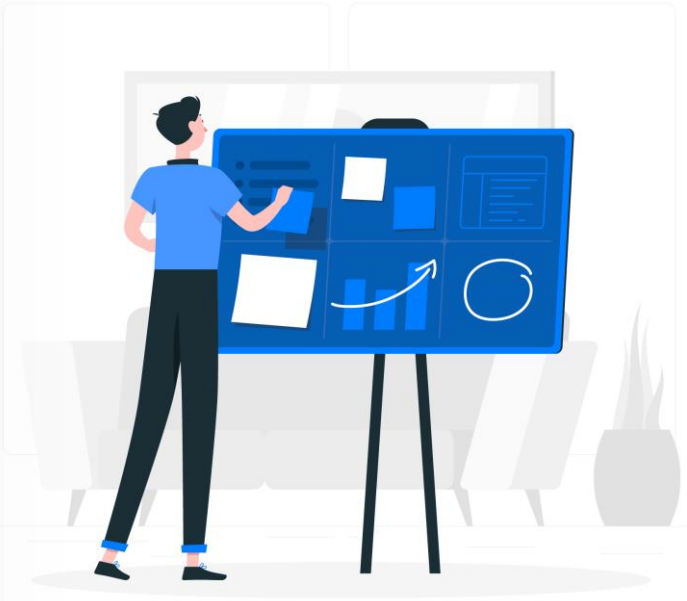


Which technologies to use ?

Java Script Benefits

- Light weight
- Cross platform support
- Availability of many libraries
- More open-source contribution

Reasons for selection

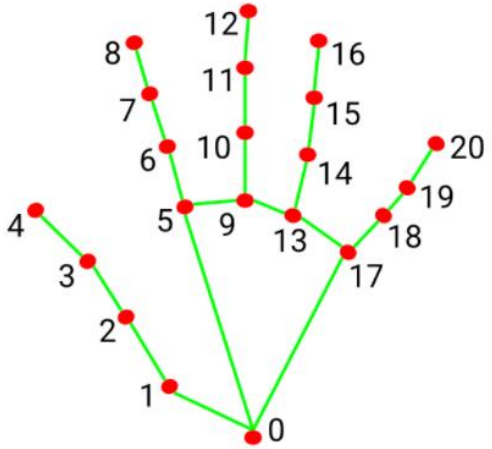
- ✓ Free and open source
- ✓ Build once, deploy anywhere
- ✓ End-to-end acceleration
- ✓ Powered by Google

TensorFlow

MediaPipe

Google

Detect Landmarks



0. WRIST
1. THUMB_CMC
2. THUMB_MCP
3. THUMB_IP
4. THUMB_TIP
5. INDEX_FINGER_MCP
6. INDEX_FINGER_PIP
7. INDEX_FINGER_DIP
8. INDEX_FINGER_TIP
9. MIDDLE_FINGER_MCP
10. MIDDLE_FINGER_PIP
11. MIDDLE_FINGER_DIP
12. MIDDLE_FINGER_TIP
13. RING_FINGER_MCP
14. RING_FINGER_PIP
15. RING_FINGER_DIP
16. RING_FINGER_TIP
17. PINKY_MCP
18. PINKY_PIP
19. PINKY_DIP
20. PINKY_TIP

Fig 2. 21 hand landmarks.

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2. Objective
3. Methodology
    3.1 System Diagram
    3.2 Technology
    3.3 Switch Function
    3.4 Moving Function
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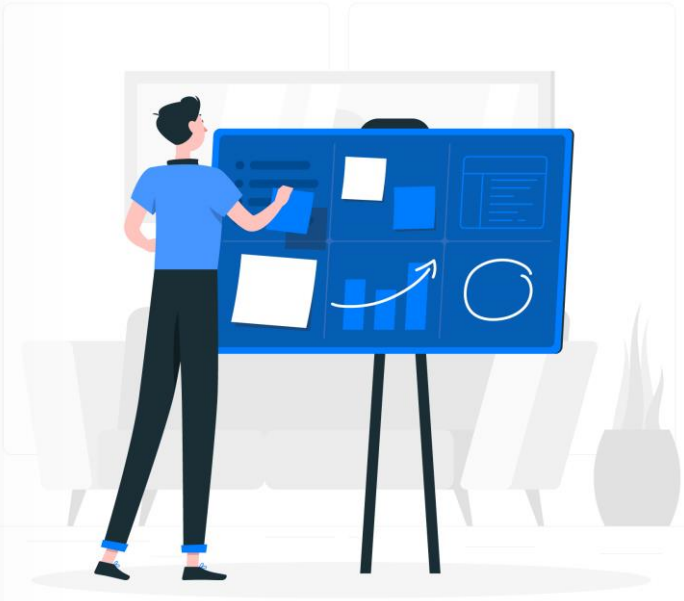
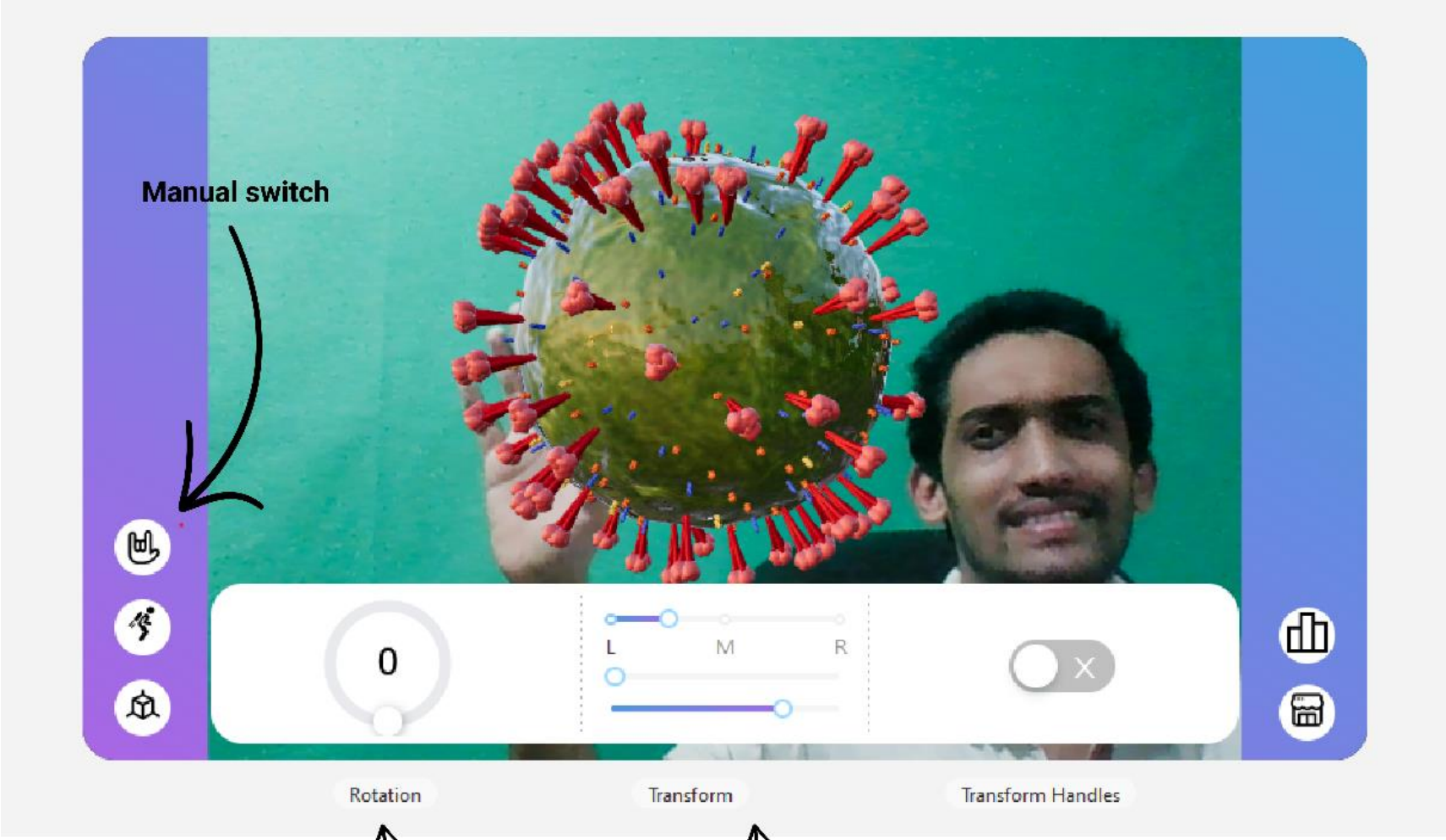
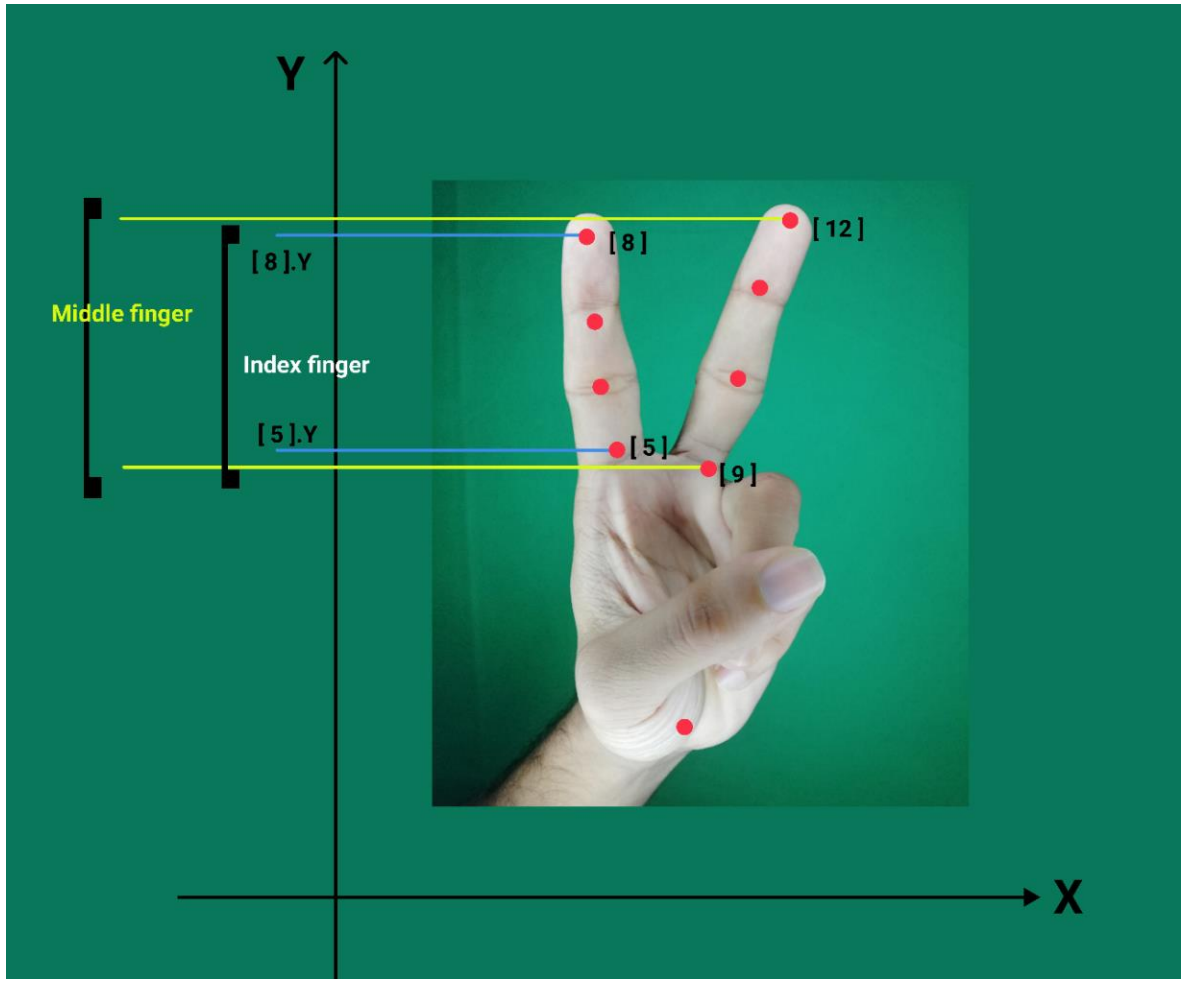
    3.6 Rotate Function
4. Completion Percentage
5. References



Manual switch



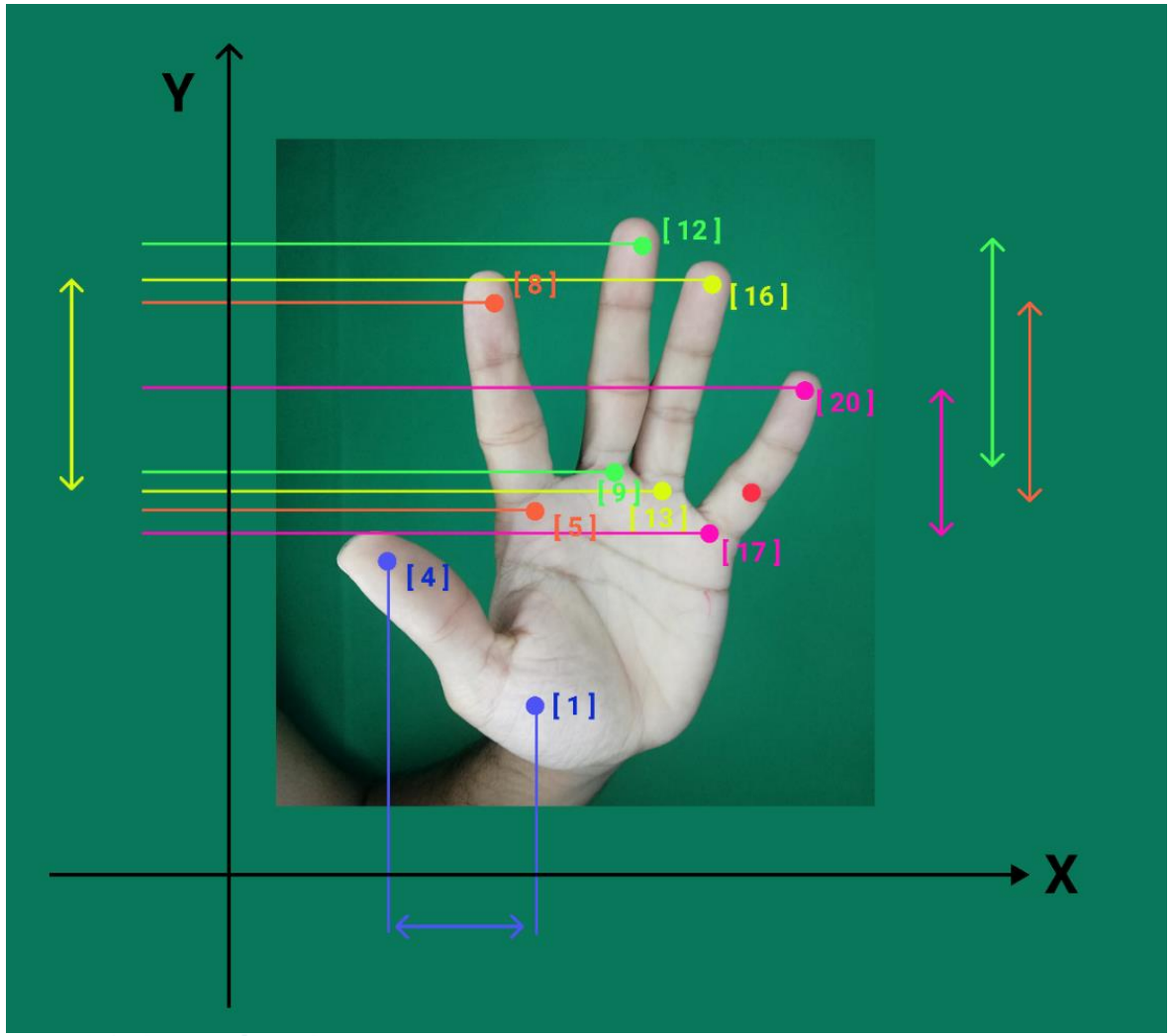
Automatic switch ON action




```
indexDown: predicted[8].y > predicted[5].y,
middleDown: predicted[12].y > predicted[9].y,
```

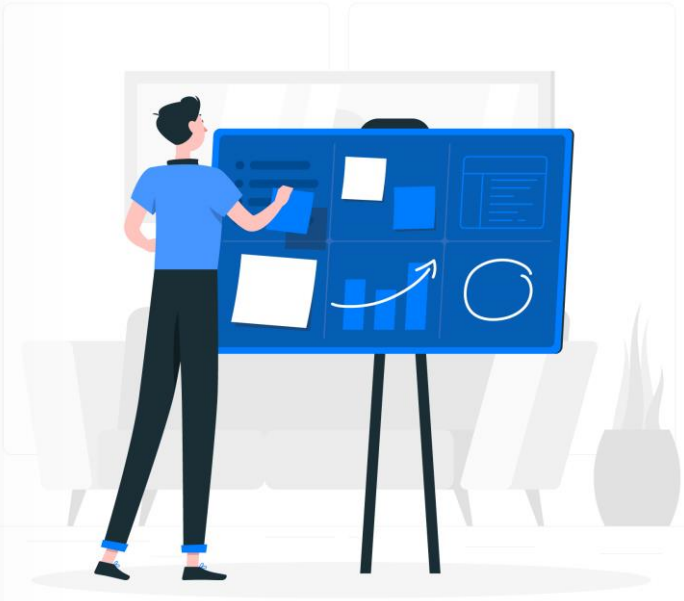
```
// ✌️ Hand follow start 🔥🔥🔥🔥
if (
  thumbIn &&
  !indexDown &&
  indexDown !== null &&
  !middleDown &&
  middleDown !== null &&
  ringDown &&
  pinkyDown
) {
  setFollowHand(true);
  setAction(true);
}
```

Automatic switch OFF action

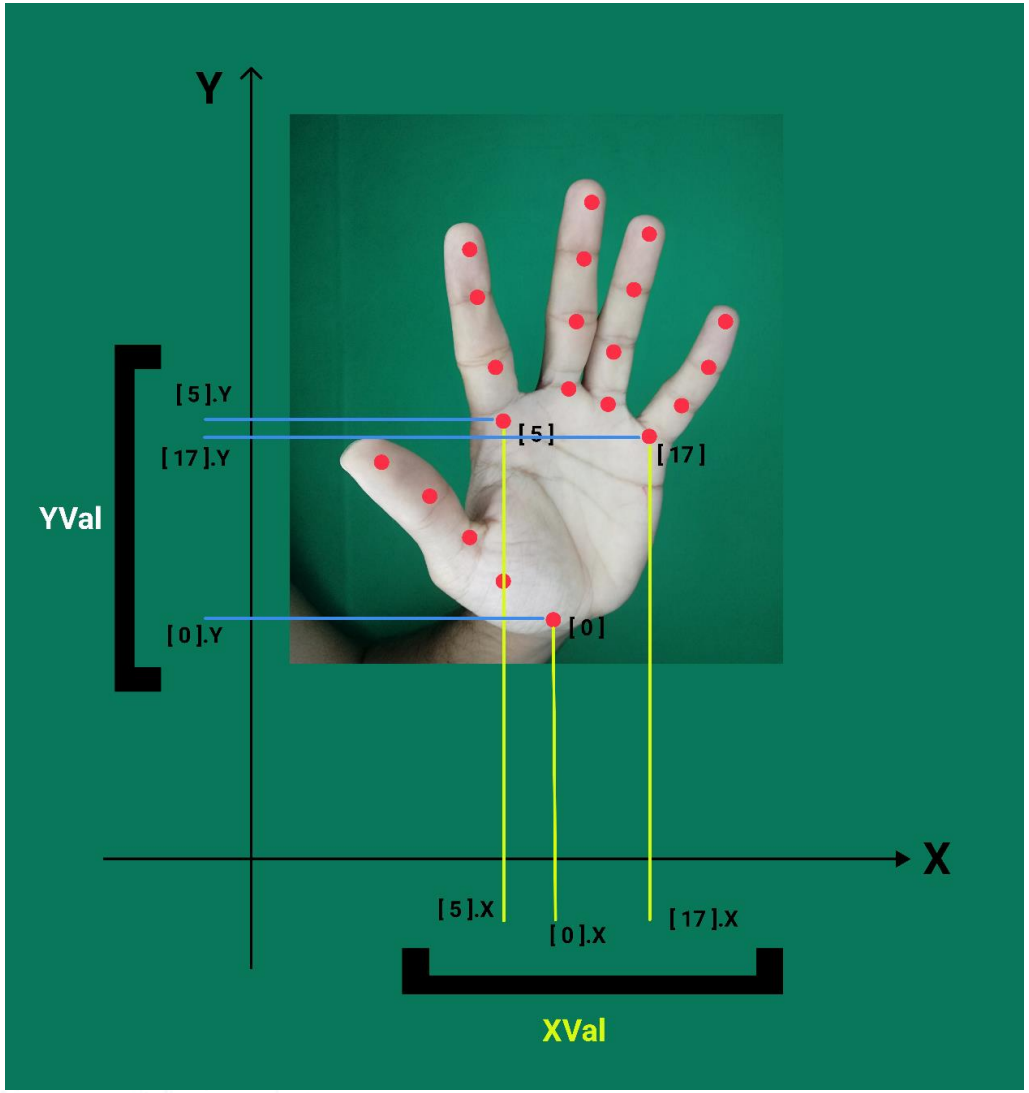



```
thumbIn: predicted[4].x < predicted[1].x,
indexDown: predicted[8].y > predicted[5].y,
middleDown: predicted[12].y > predicted[9].y,
ringDown: predicted[16].y > predicted[13].y,
pinkyDown: predicted[20].y > predicted[17].y,
```

1. Research Questions
2. Objective
3. Methodology
    3.1 System Diagram
    3.2 Technology
    3.3 Switch Function
    3.4 Moving Function
    3.5 Zoom In/Out Function
    3.6 Rotate Function
4. Completion Percentage
5. References



Moving Function




```
const xMidSum = predicted[0].x + predicted[5].x + predicted[17].x; // x
const yMidSum = predicted[0].y + predicted[5].y + predicted[17].y; // y

const xVal = parseFloat((xMidSum / 3).toFixed(4));
const yVal = parseFloat((yMidSum / 3).toFixed(4));
```

```
// 🏃 - 👋 X,Y Moving 🔥🔥🔥🔥
if (xVal !== null && yVal !== null) {
  setX((preXVal) => {
    const newX = xVal * videoWidth;
    left = preXVal - newX > 0 ? true : false;
    return newX;
  });
  setY((preYVal) => {
    const newY = yVal * videoHeight;
    up = preYVal - newY > 0 ? true : false;
    return newY;
  });
  if (followHandRef.current) {
    setHandX(xVal * 10 - 5);
    setHandY(5 - yVal * 10);
  }
}
```

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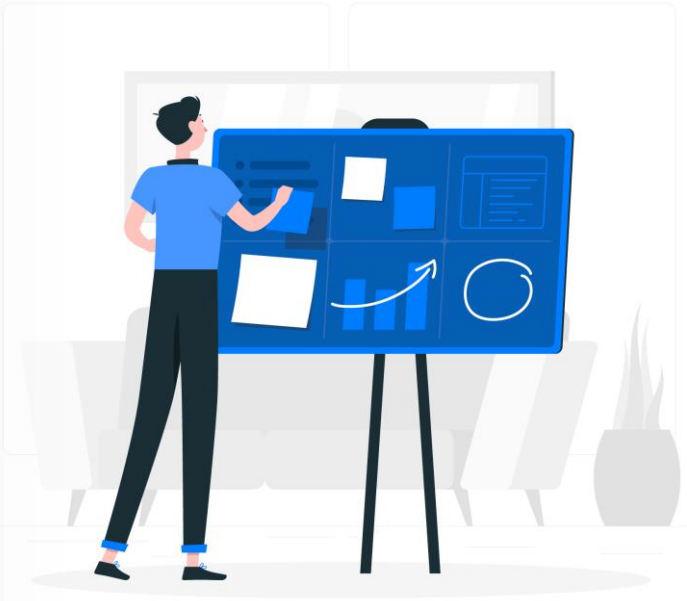
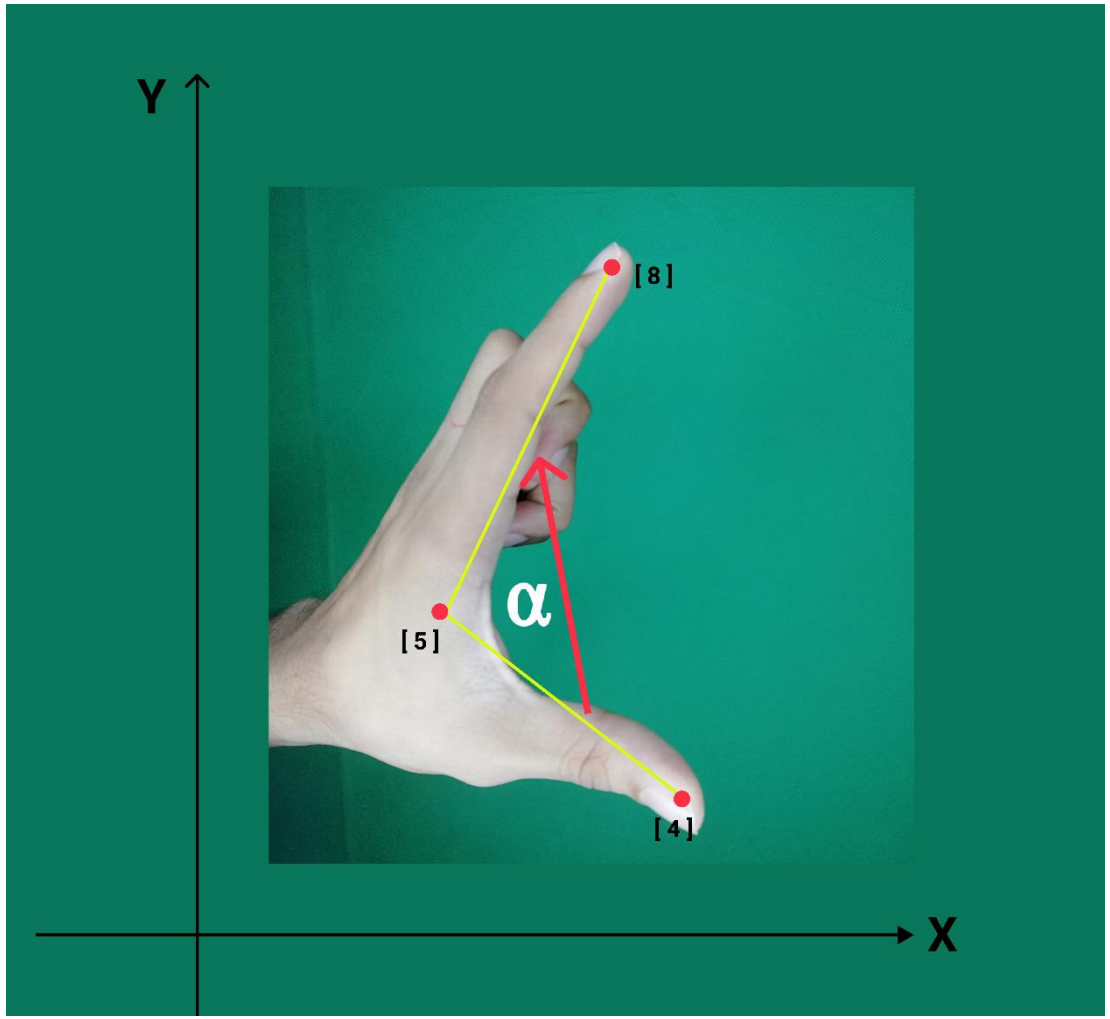
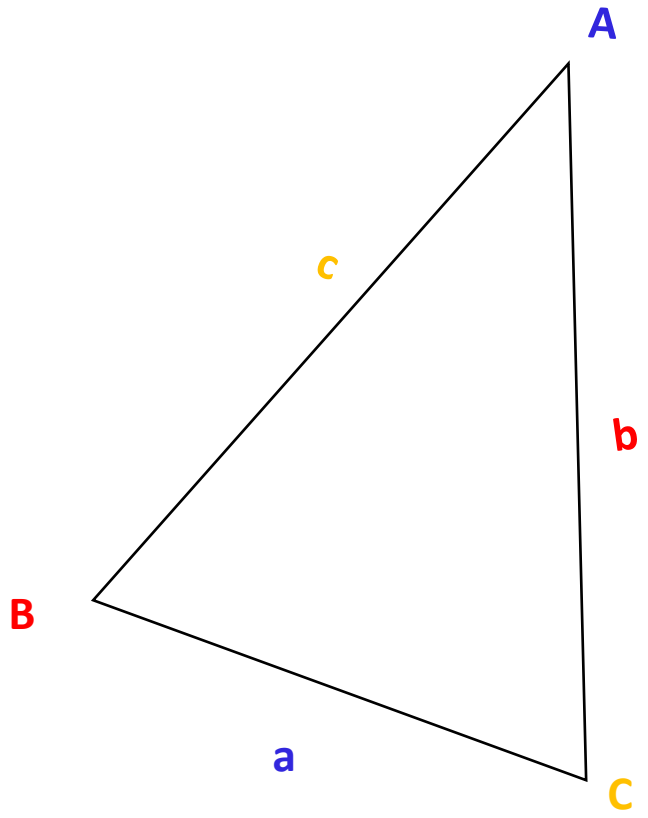
2. Objective
3. Methodology
    3.1 System Diagram
    3.2 Technology
    3.3 Switch Function
    3.4 Moving Function
    3.5 Zoom In/Out Function
    3.6 Rotate Function
4. Completion Percentage
5. References

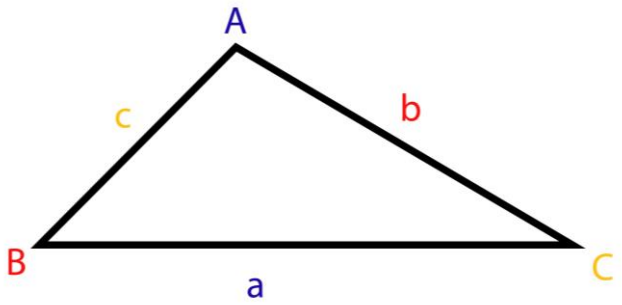


Zoom In/Out functions





Zoom in / Zoom out Signal Identification



law of cosine

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$b^2 = a^2 + c^2 - 2ac\cos B$$

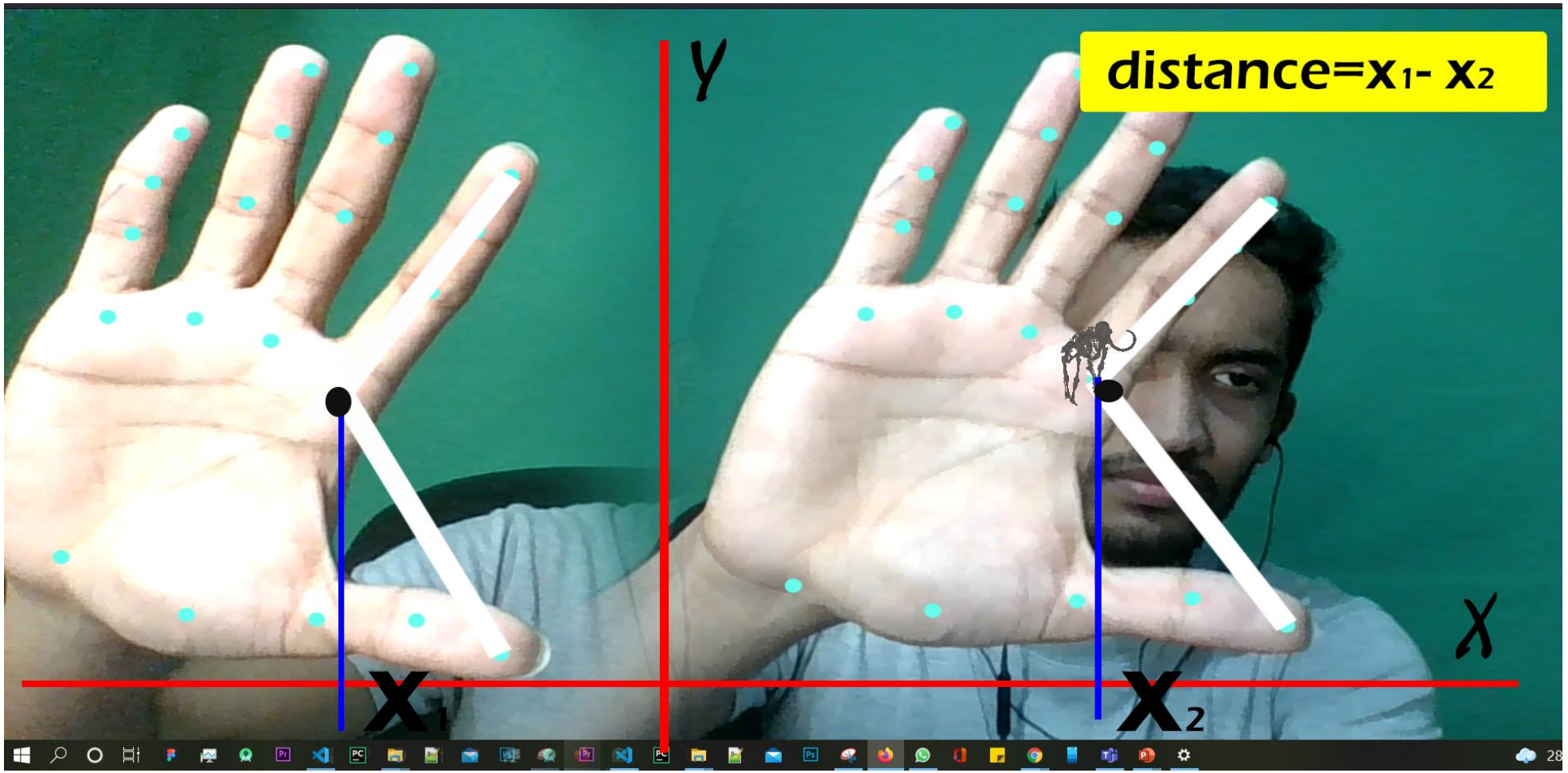
$$c^2 = b^2 + a^2 - 2ab\cos C$$

```
const find_angle = (A, B, C) => {
  const AB = Math.sqrt((B.x - A.x) ** 2 + (B.y - A.y) ** 2);
  const BC = Math.sqrt((B.x - C.x) ** 2 + (B.y - C.y) ** 2);
  const AC = Math.sqrt((C.x - A.x) ** 2 + (C.y - A.y) ** 2);
  return Math.acos((BC * BC + AB * AB - AC * AC) / (2 * BC * AB));
};
```

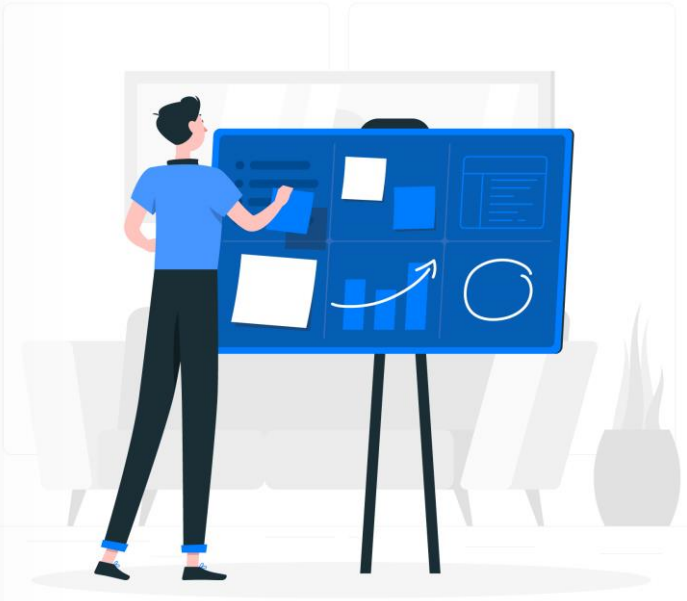
```
const indexThumbAngle =
  find_angle(predicted[8], predicted[5], predicted[4]) / Math.PI;
```

```
// 🔍 - 🤜 Zoom 🔥🔥🔥🔥
if (indexThumbAngle && indexThumbAngle > 0.7) {
  setZoom((zoom) => {
    if (left) {
      return zoom + 0.05;
    }
    return zoom - 0.05 > 1 ? zoom - 0.05 : 1;
  });
}
```

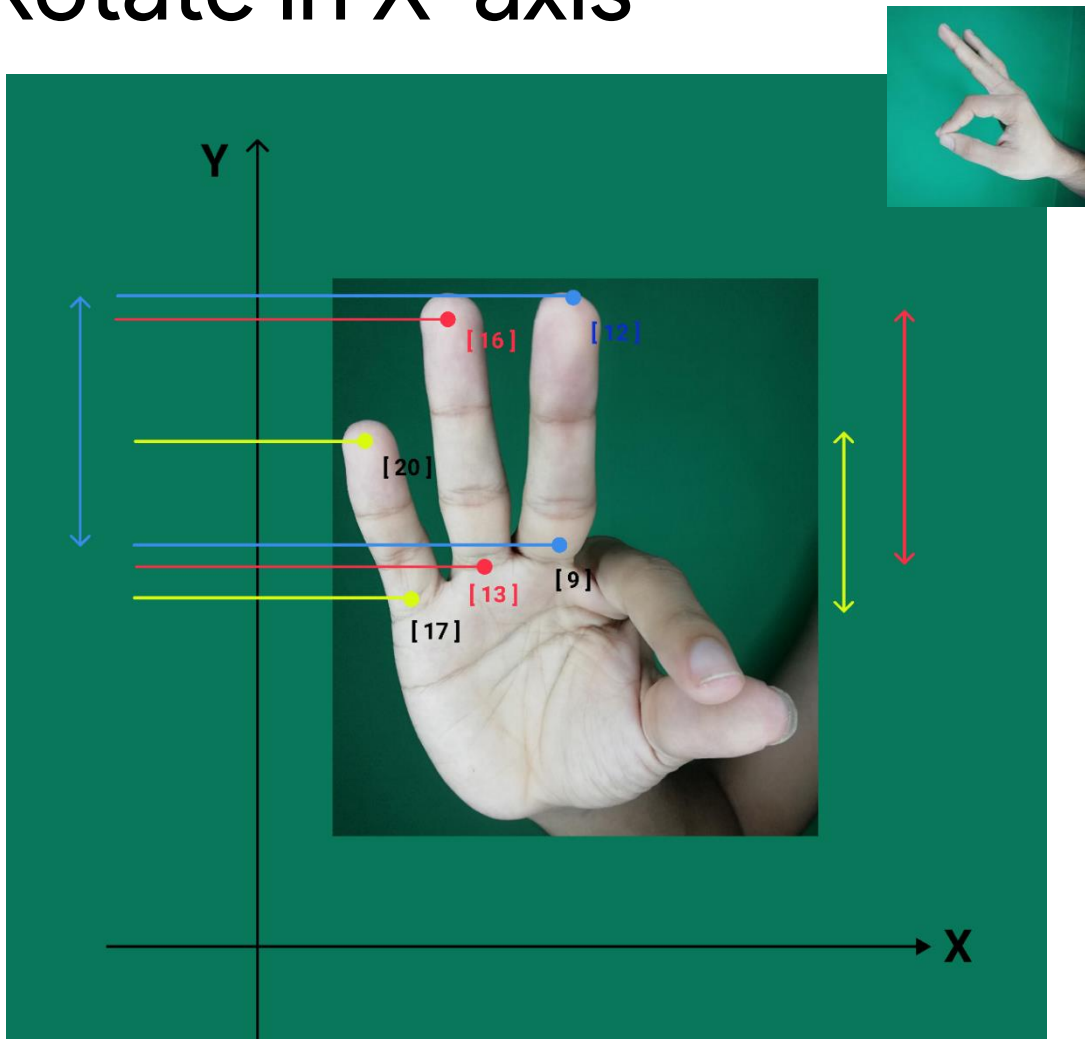
Zoom In/Out functions



1. Research Questions
2. Objective
3. Methodology
    3.1 System Diagram
    3.2 Technology
    3.3 Switch Function
    3.4 Moving Function
    3.5 Zoom In/Out Function
    3.6 Rotate Function
4. Completion Percentage
5. References



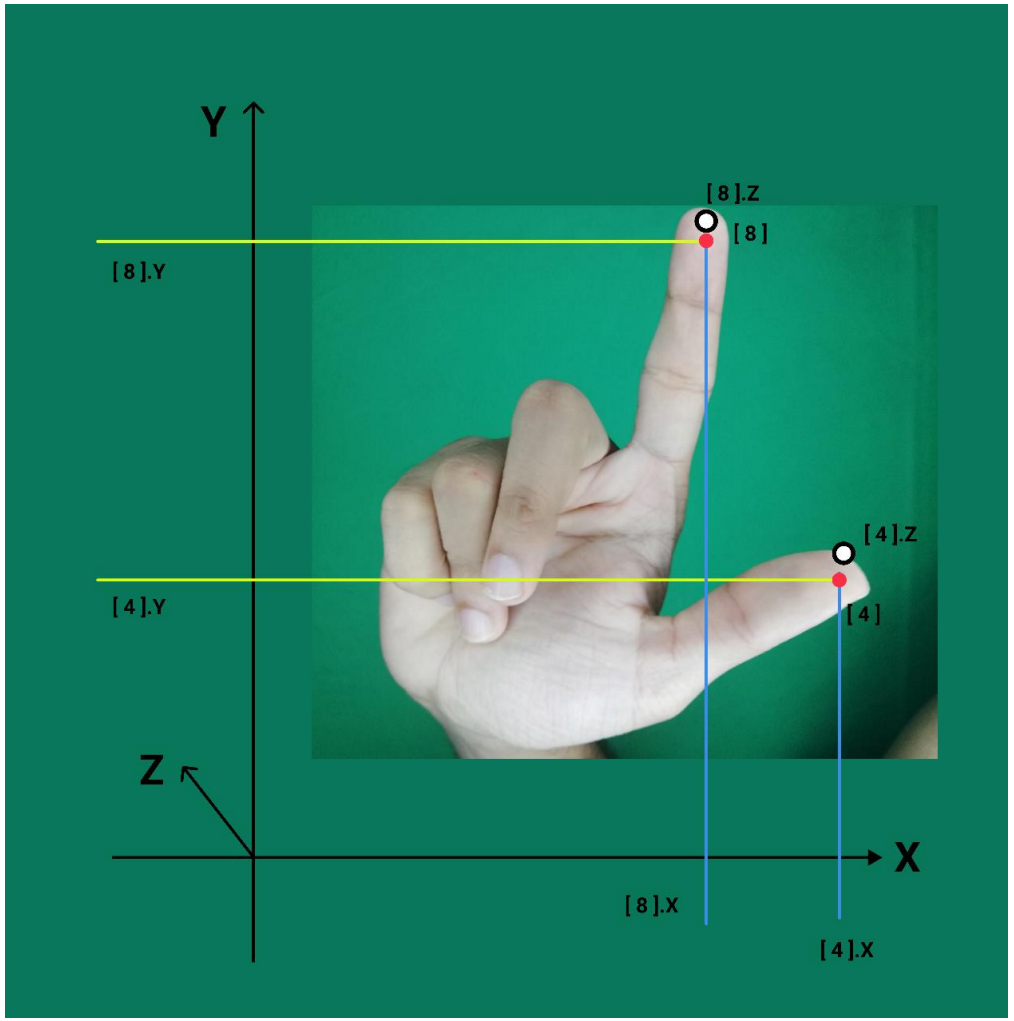
Rotate in X-axis




```
middleDown: predicted[12].y > predicted[9].y,
ringDown: predicted[16].y > predicted[13].y,
pinkyDown: predicted[20].y > predicted[17].y,
```

```
// 🔃 - 🤚 Rotate around X axis 🔥🔥🔥🔥
if (middleDown && ringDown && pinkyDown) {
  setRotateX((prevRX) => {
    if (up) {
      return prevRX - 0.05;
    }
    return prevRX + 0.05;
  });
}
```

Rotate in Y-axis




```
const distance = Math.sqrt(
  (predicted[8].x - predicted[4].x) ** 2 +
    (predicted[8].y - predicted[4].y) ** 2 +
    (predicted[8].z - predicted[4].z) ** 2
);
```

```
// 🔁 -👆 Rotate around Y axis 🔥🔥🔥🔥
if (distance && distance < 0.1) {
  setRotateY((prevRY) => {
    if (left) {
      return prevRY + 0.05;
    }
    return prevRY - 0.05;
  });
}
```

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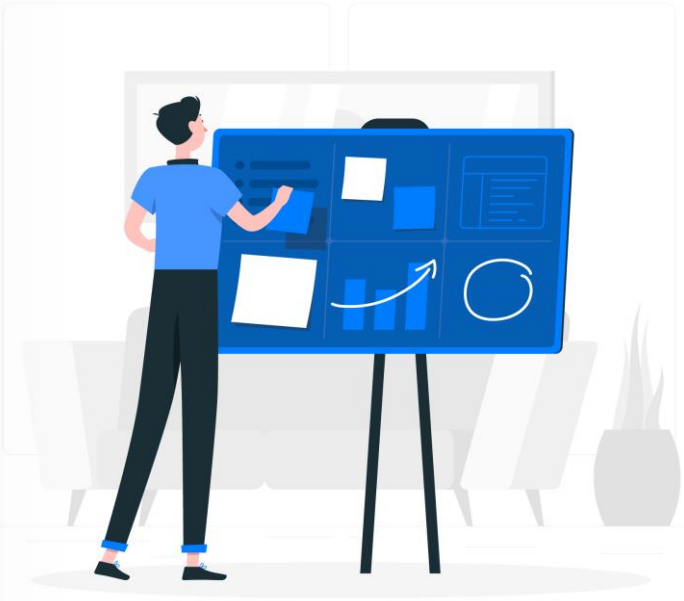
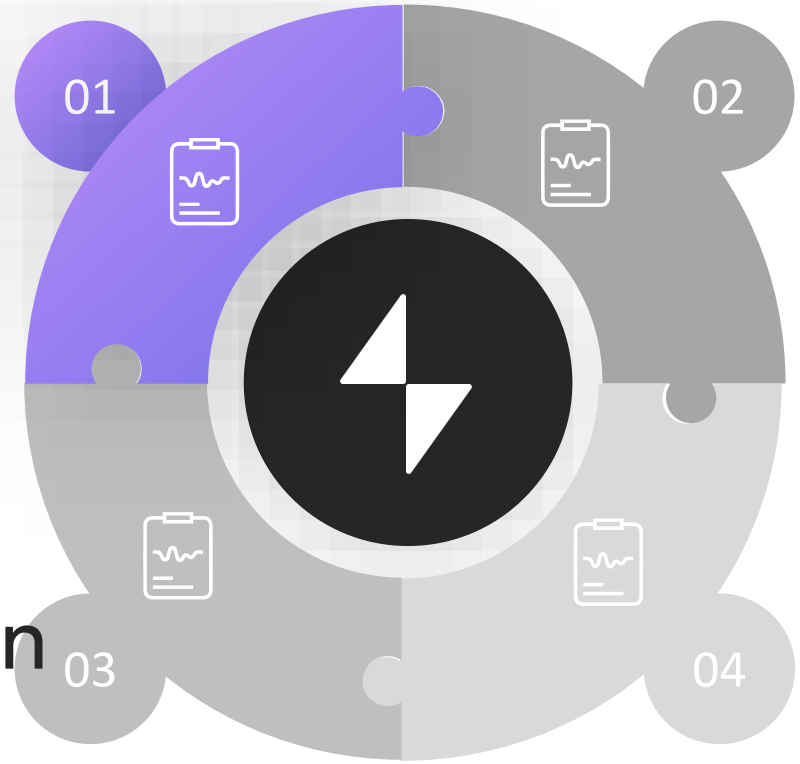
2. Objective
3. Methodology
    3.1 System Diagram
    3.2 Technology
    3.3 Switch Function
    3.4 Moving Function
    3.5 Zoom In/Out Function
    3.6 Rotate Function
4. Completion Percentage
5. References



Objectives and Project Completion

100%
Hand tracking



100%
Live 3D object controlling

100%
Hand pose estimation

90%
Integrate object placement and tracking

1. Research Questions
2. Objective
3. Methodology
    3.1 System Diagram
    3.2 Technology
    3.3 Switch Function
    3.4 Moving Function
    3.5 Zoom In/Out Function
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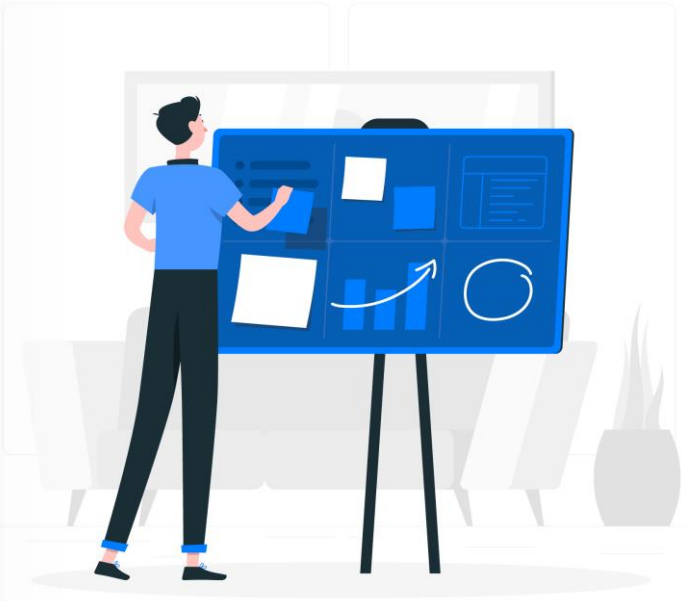

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Commercialization

01 Branding

02 Market Analysis

03 Business Model Canvas

04 Business Plan

Branding

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LUMOZ

- ✓ Create social media marketing plan.
- ✓ Already reserved custom social media domains.
- ✓ Recognizing target audience

LUMOZ

https://lumoz.studio

www.facebook.com/lumoz.studio

www.instagram.com/lumoz.studio

www.tiktok.com/@lumoz.studio

www.twitter.com/lumozstudio

www.linkedin.com/company/lumozstudio

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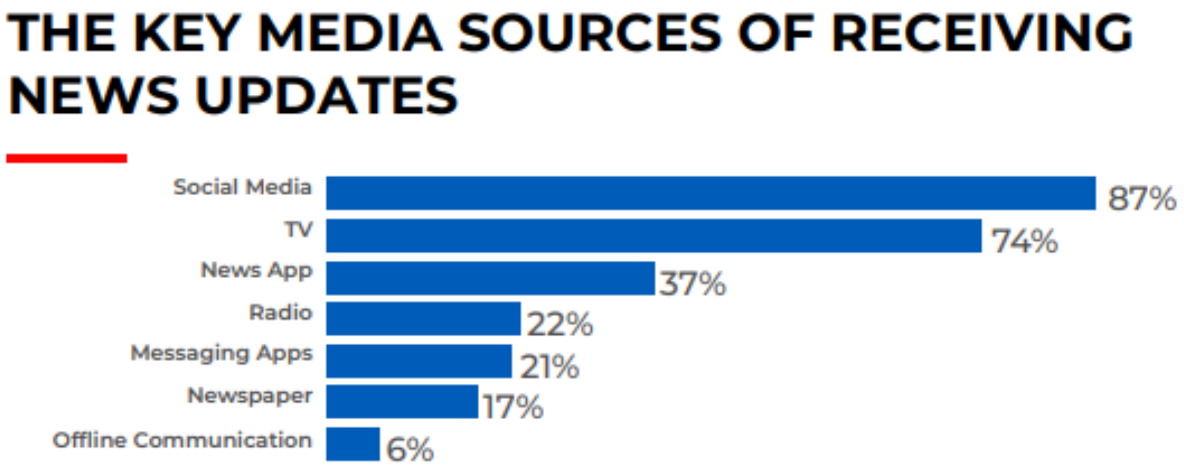
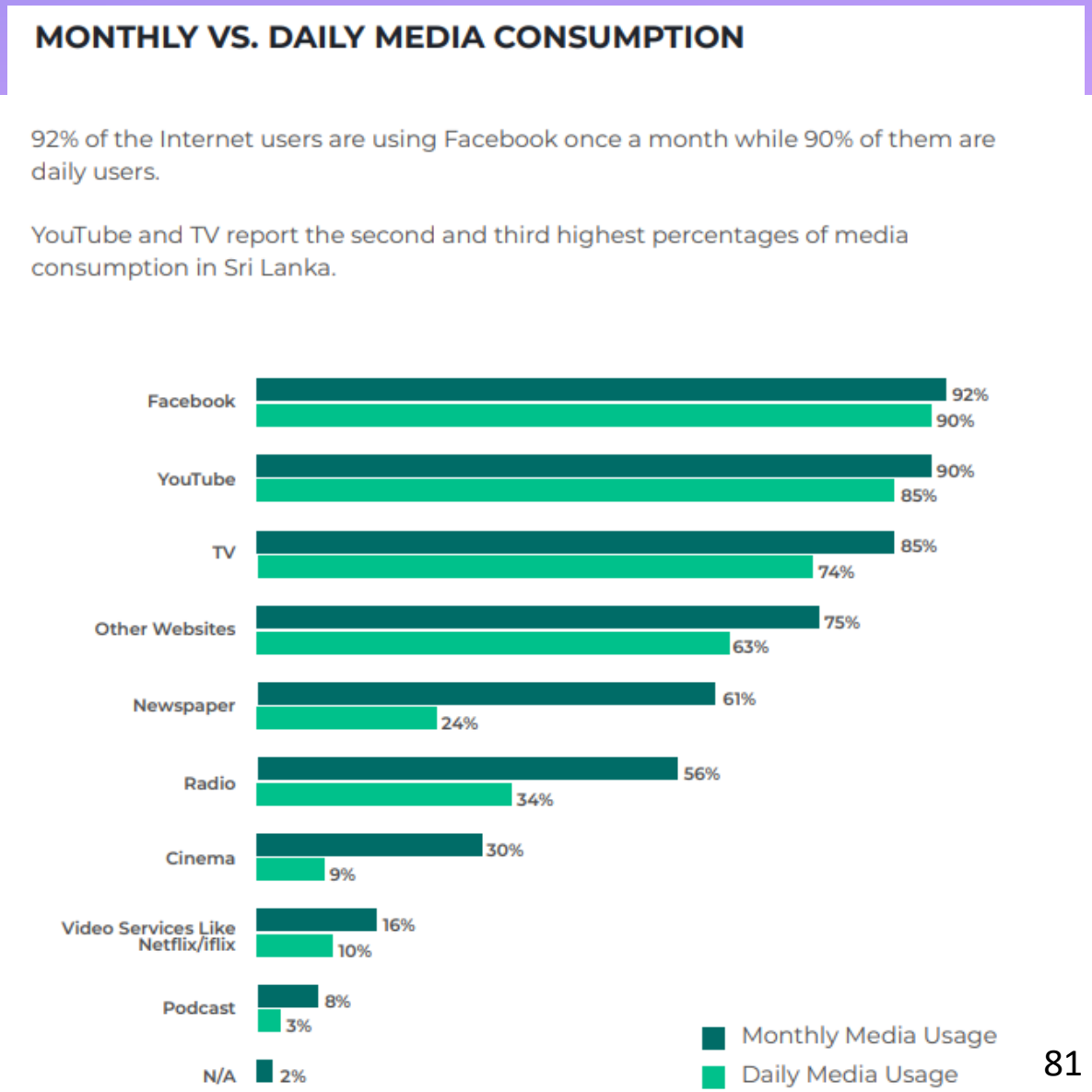
Market Analysis



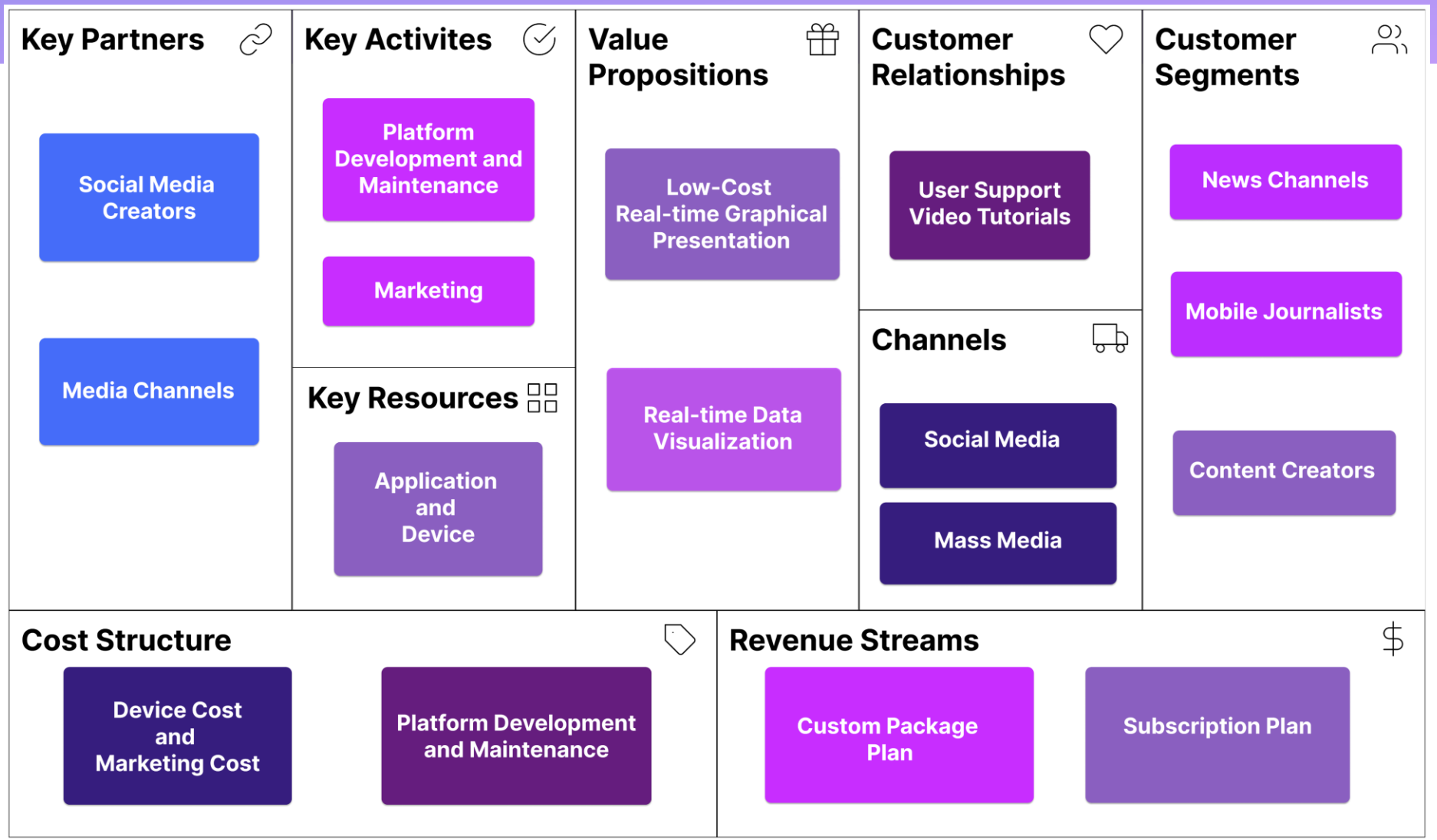
Sources : Digital outlook SriLanka 2021



Market Analysis

Business Model Canvas

LUMOZ



Business Plan

LUMOZ

Lumoz Studio

A comparison chart is a helpful tool in decision making. In one glance, the features and qualities

Free Trial

What You'll Get

- 40 min streaming time
- limited access model library
- Data visualization
- Social media streaming

$0/month

Try Now

Premium

What You'll Get

- Ultimate streaming
- Unlimited access model library
- Data visualization
- Social media streaming
- No watermark

$22/month

Buy Now

Thank you