

# Realtime AR Based Tool For Digital Media Production

2021-075



# Team Members

Supervisor: Dr. Shyam Mehraaj

Co Supervisor: Mr. Thusithanjana Thilakarathne

Student Name	Student ID
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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 content with high graphical effects like AR.

# Research Problem



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 3<sup>rd</sup> party graphic companies**

# Research Objectives

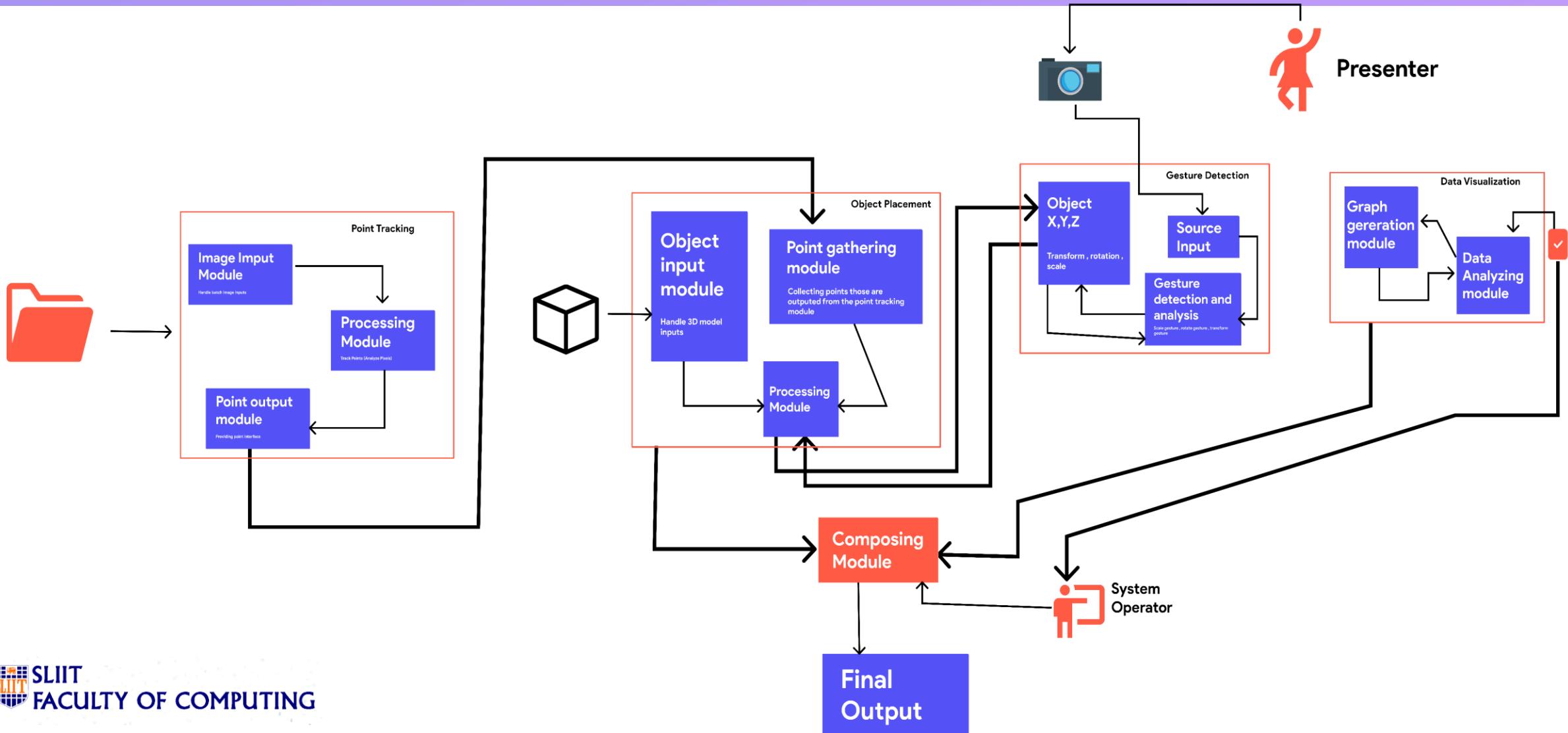
**01 Object Placement**

**03 Data Visualization**

**02 Point Tracking**

**04 Gesture Detection**

# Overall Solution as a System Diagram





# Object Placement

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# 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**

# Main Objectives

## Specific and Sub Objectives

### Main Objective

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**

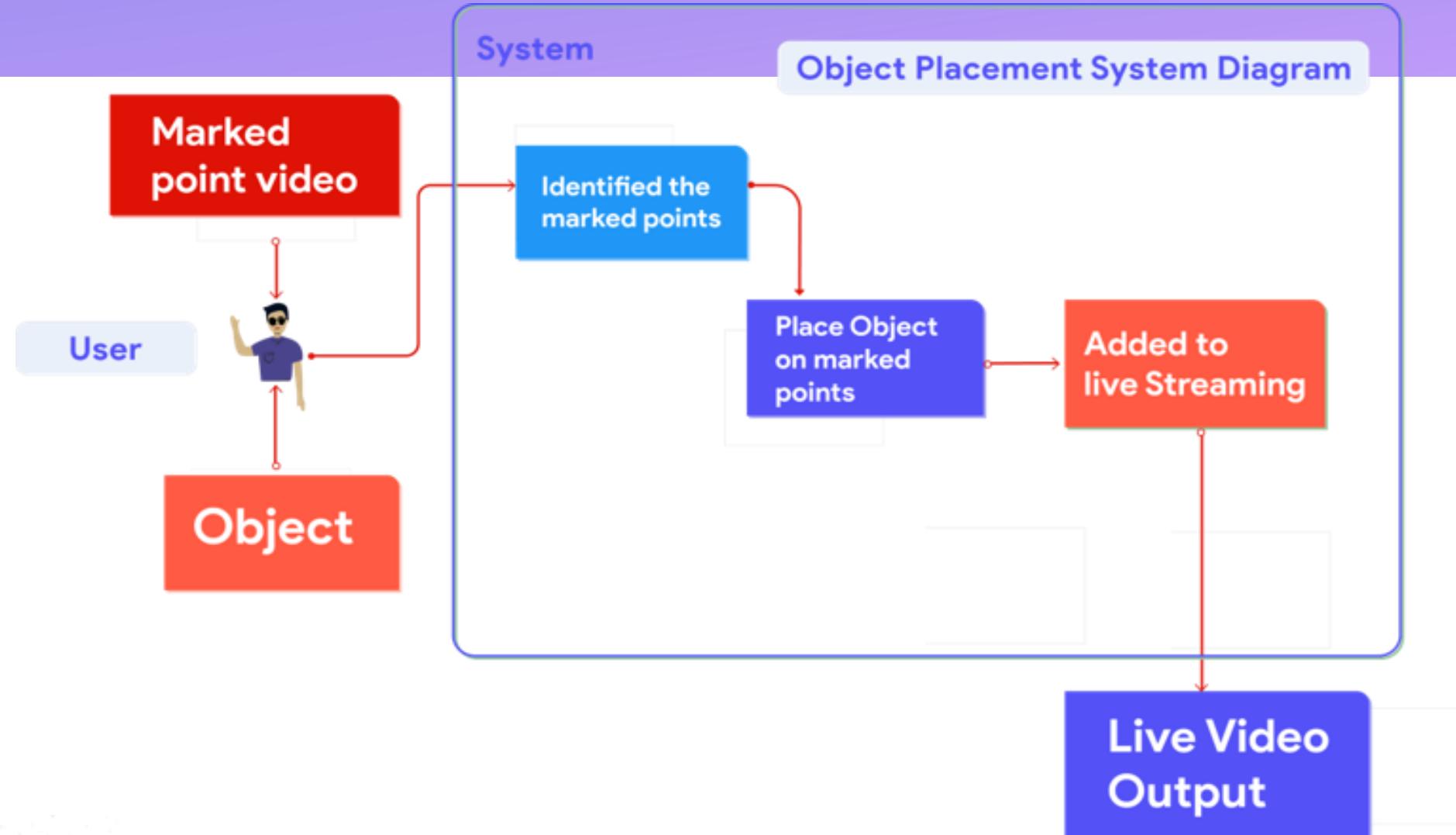
# Methodology

01 System Diagram

03 Requirements

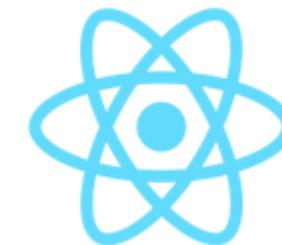
02 Technology

# System Diagram



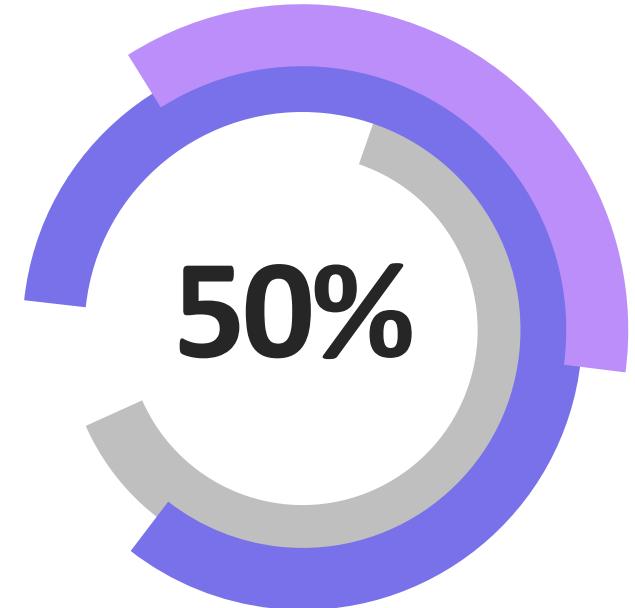
# Technologies

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



# Current Progress – IT18175080 (50%)

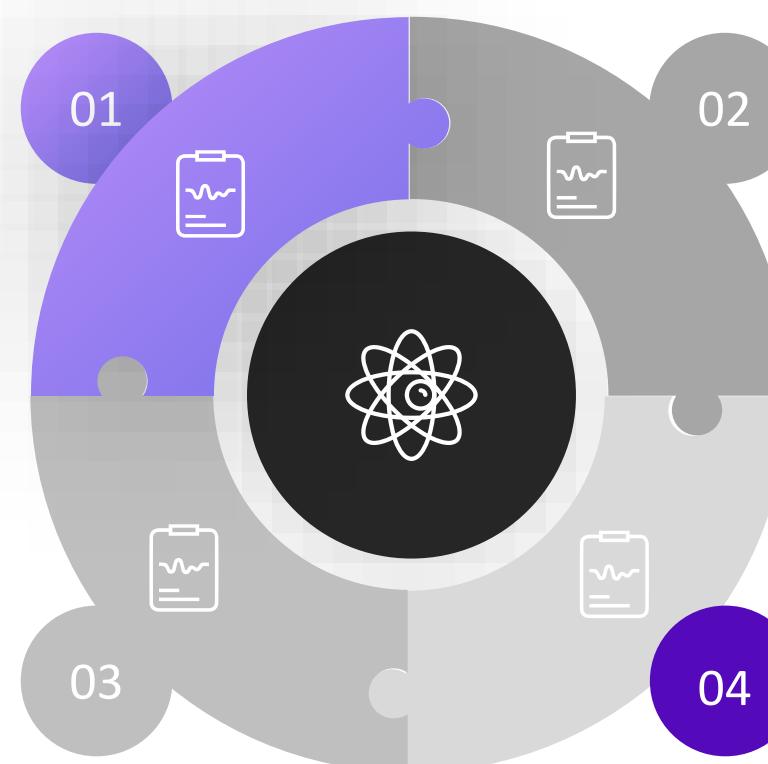
- **3D object placed on web camera input**
- **Auto scale object camera movement**
- **Model toggle**
- **Create low latency live stream API using Golang**



# Objectives and Project Completion

90%  
**Placed right point to object**

70%  
**Object auto scale  
Moving camera**



70%  
**Maintain object in same marked point**

50%  
**Frontend**

Screenshots of the current work

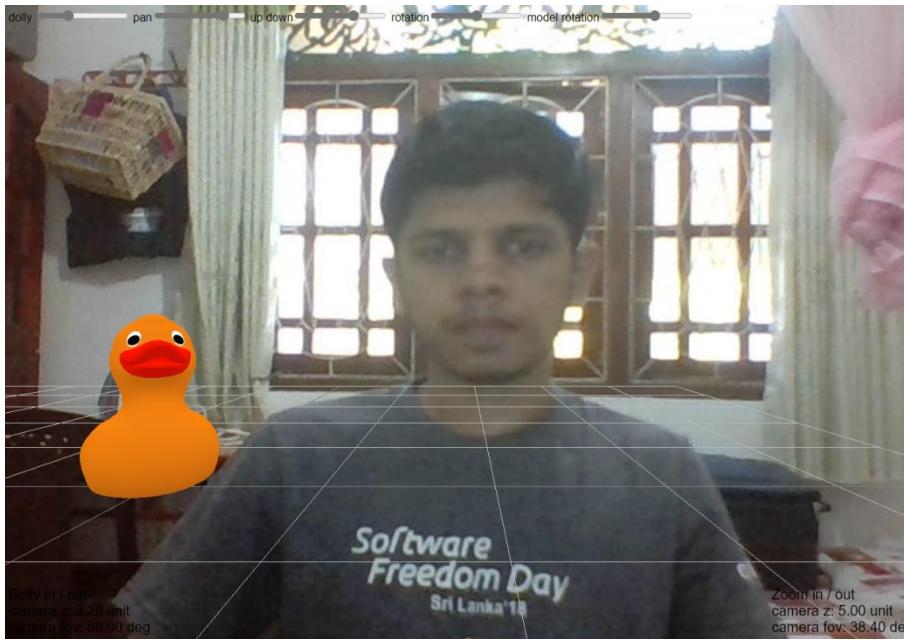
# Project Evidence



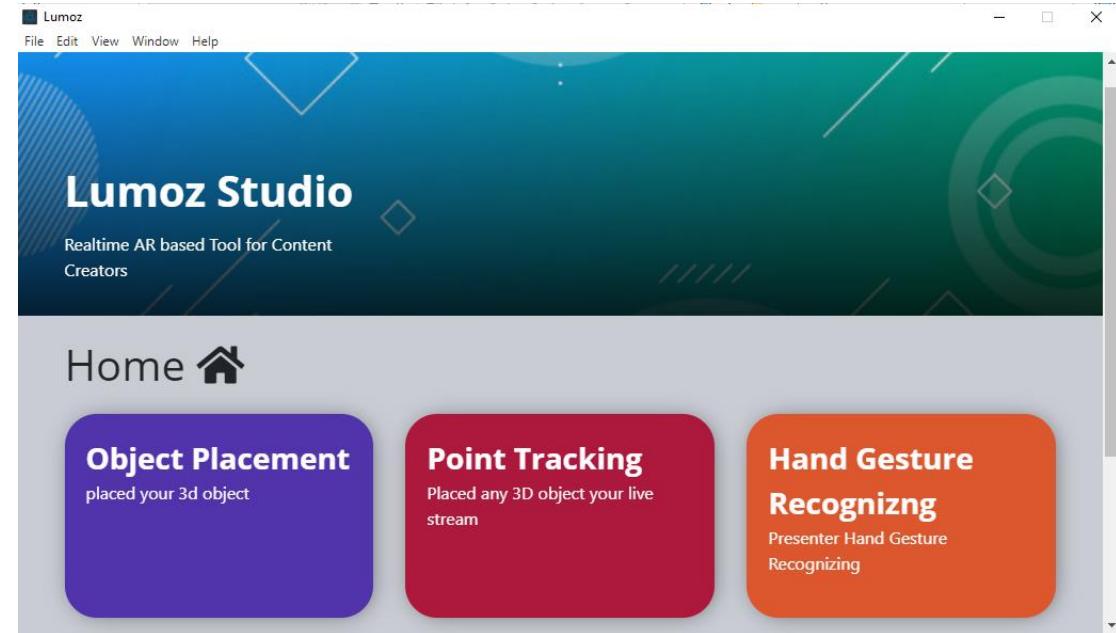
IT18175080 | R.M.Bawantha Thilan | Project ID : 2021-075

# Project Evidence – IT18175080

## Object Placing Live Camera Input

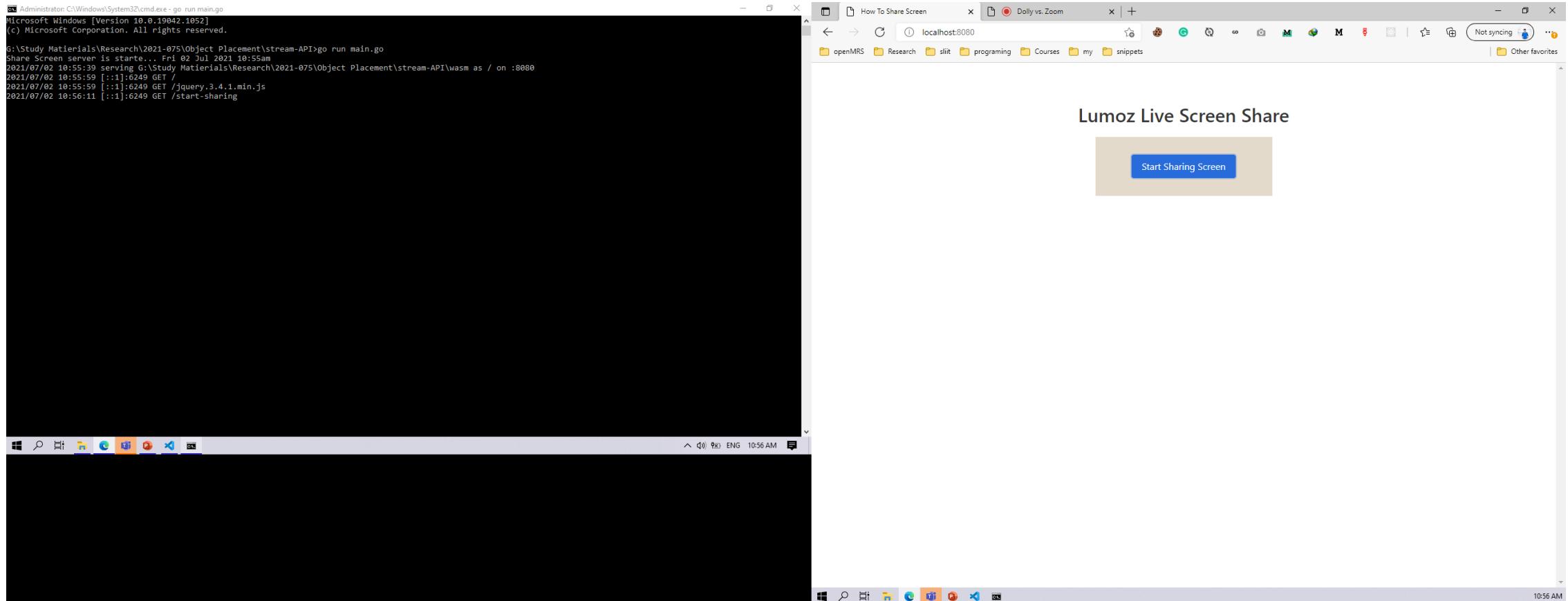


## Electron Frontend



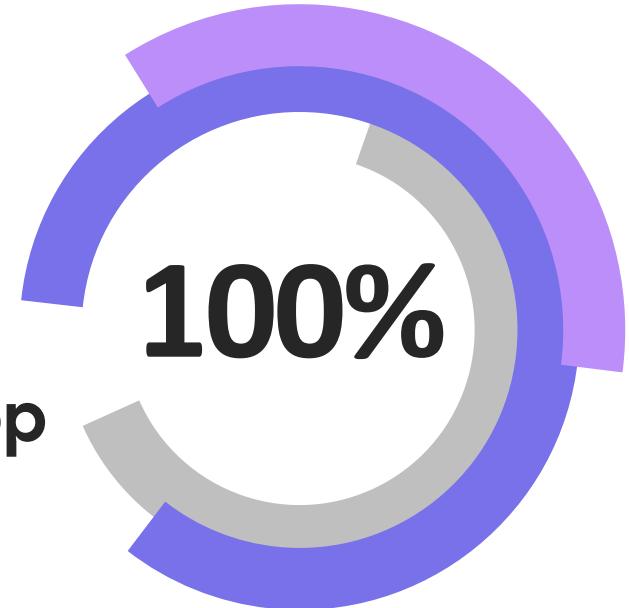
# Project Evidence – IT18175080

## LiveStream API



# Next Expected Progress- IT18175080 (100%)

- Importing various type 3d object via local machine and placed (.obj , .MTL)
- Placing a data visualization graph
- Convert to entire project into cross platform app using Electron framework
- Integrate LIVE Stream API with Main UI



# References

- [1] Park, J., Sung, M. and Noh, S., 2021. *Virtual Object Placement in Video for Augmented Reality*.
- [2] Druzhkov, P., Erukhimov, V., Zolotykh, N., Kozinov, E., Kustikova, V., Meerov, I. and Polovinkin, A., 2021. *New object detection features in the OpenCV library*.
- [3] Cho, H., 2021. *Vizrt Engine-Based Virtual Reality Graphics Algorithm A Study on the Basic Practical Training Method*. [online] Koreascience.or.kr. Available at: <<https://www.koreascience.or.kr/article/JAKO201925454133719.page>> [Accessed 24 February 2021].
- [4] Sri Lanka, N., 2020. වෙ ප්‍රමාණය අනුව පොල් මිලදී ගන්න, පාරිභෝගික සම්බන්ධතාව වෙළඳපෙනුව. [video] Available at: <<https://youtu.be/bmEKuHvCdmM?t=12>> [Accessed 22 January 2021].
- [5] DL.acm.org. 2021. *An online video placement policy based on bandwidth to space ratio (BSR) / Proceedings of the 1995 ACM SIGMOD international conference on Management of data*. [online] Available at: <<https://dl.acm.org/doi/abs/10.1145/223784.223853>> [Accessed 8 March 2021].
- [6] Bacher, I., Javidnia, H., Dev, S., Agrahari, R., Hossari, M., Nicholson, M., Conran, C., Tang, J., Song, P., Corrigan, D. and Pitié, F., 2021. *An Advert Creation System for 3D Product Placements*. [online] arXiv.org. Available at: <<https://arxiv.org/abs/2006.15131>> [Accessed 8 March 2021].



# Point Tracking

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# 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 ?**

# Objectives

## Main Objective

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**



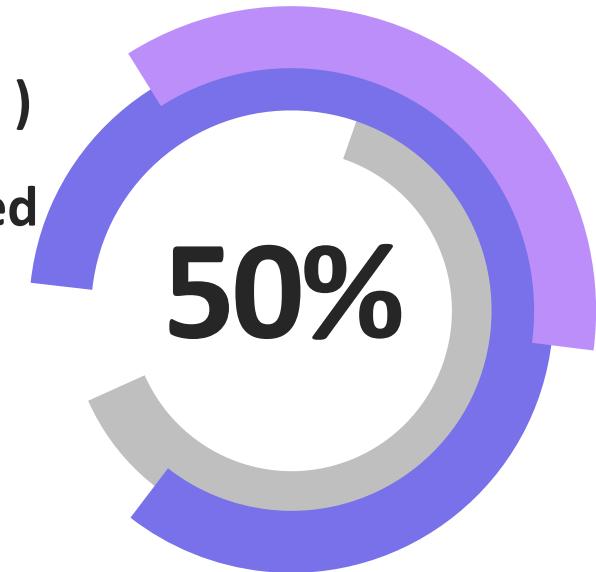
**Providing a Realtime tracking feature through the sensor powered device**



**Mapping real time camera movements to the virtual camera**

# Current Progress (50%)

- Created a transform controller for modal placement
- Created a virtual camera controller
- Created an User interface for the entire application (under development )
- Designed the PCB (Printed Circuit Board ) diagram for the sensor powered device
- Tested the livestream feature



# Objectives and project completion

95%  
**Model transform  
controllers**

75%  
**Virtual camera**

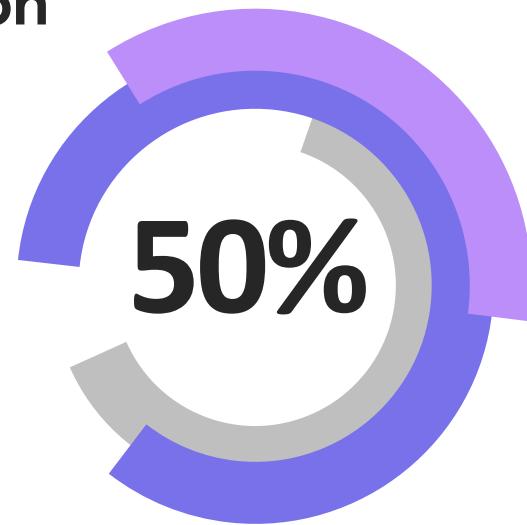
48%  
**User interface**

40%  
**Sensor powered  
device**



# Future Progress

- **Finalizing the sensor powered device**
- **Create and API for the Hardware and software communication**
- **Control virtual camera from the real camera data gathered by device**
- **Converting entire project into a cross-platform app using electron framework**
- **Implementing the user interface**



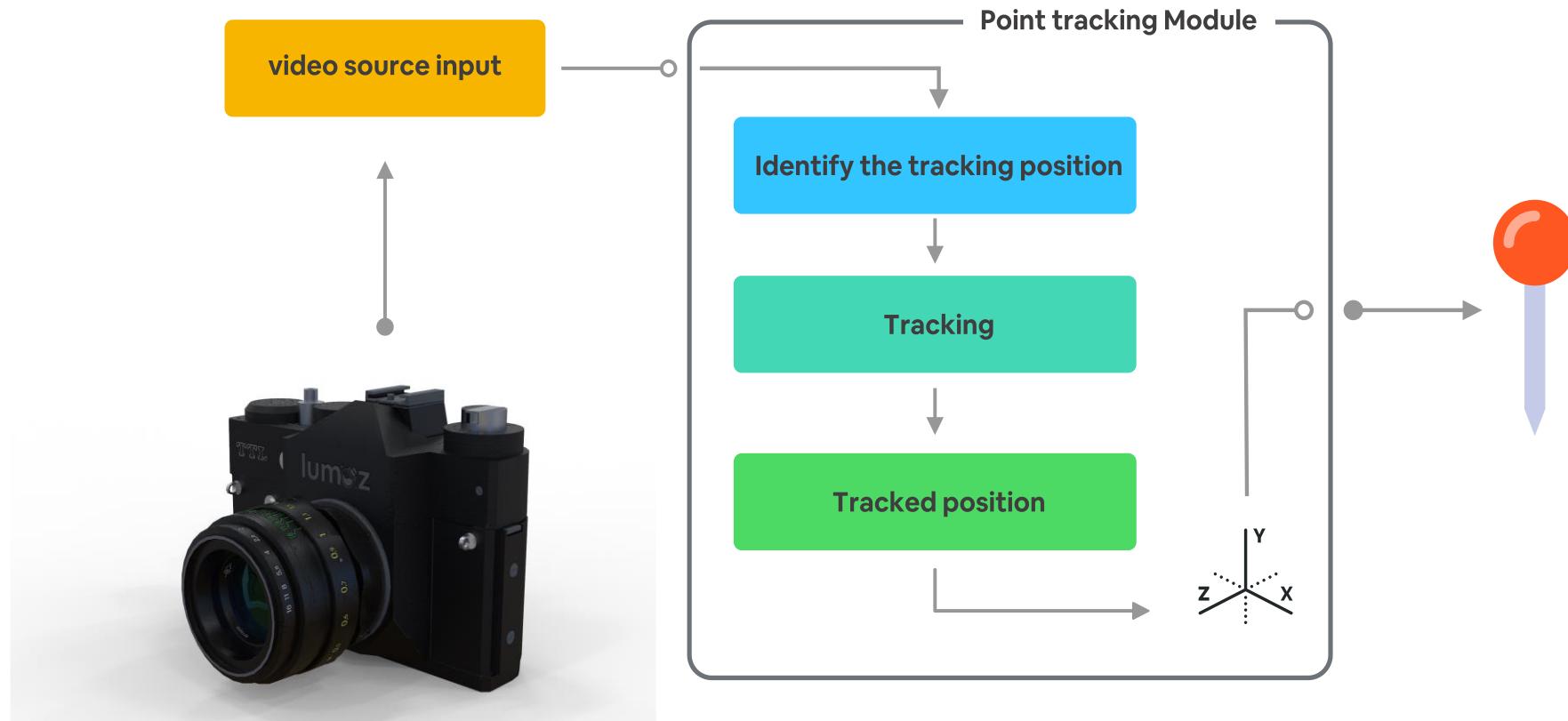
# Methodology

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- System Diagram
- Technologies
- Requirements

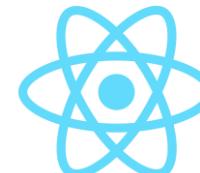


# System Diagram

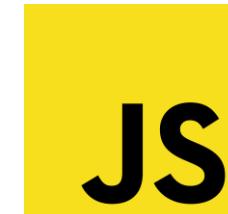


# Technologies

- WebGL
- JavaScript
- WebRTC
- Electron ( framework )
- Express ( framework )
- React.js (framework )
- Three.js ( react-three-fiber)
- Go lang



Golang



Express



# Project Evidence

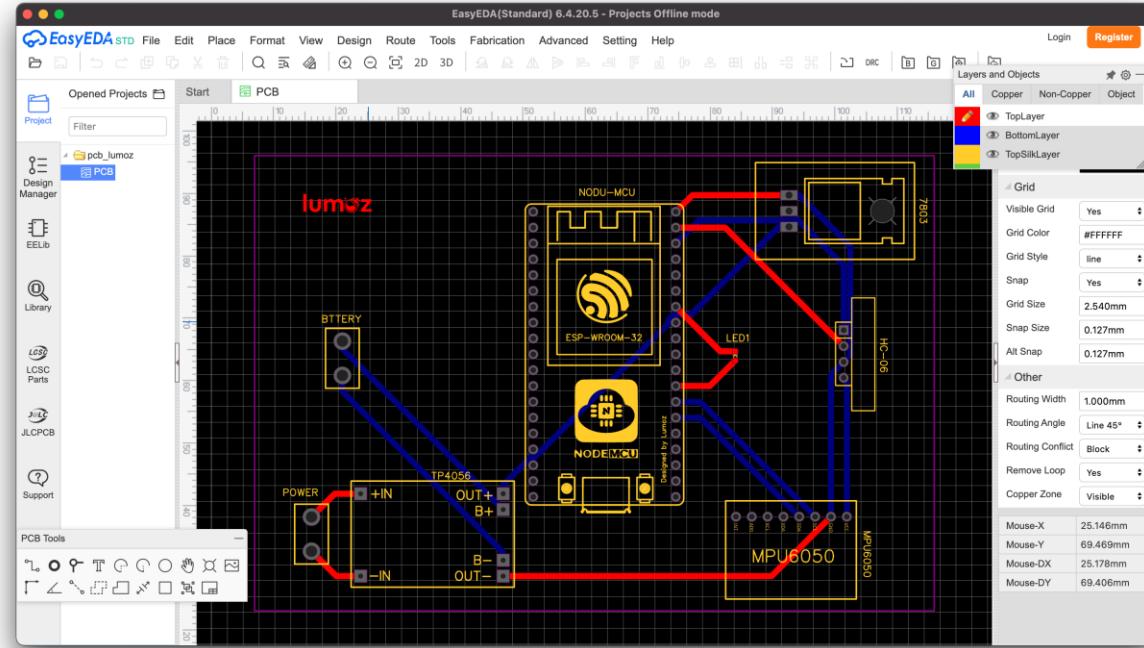
Modal 2

transform   
scale   
rotation



**Transform  
controller**

# Project Evidence

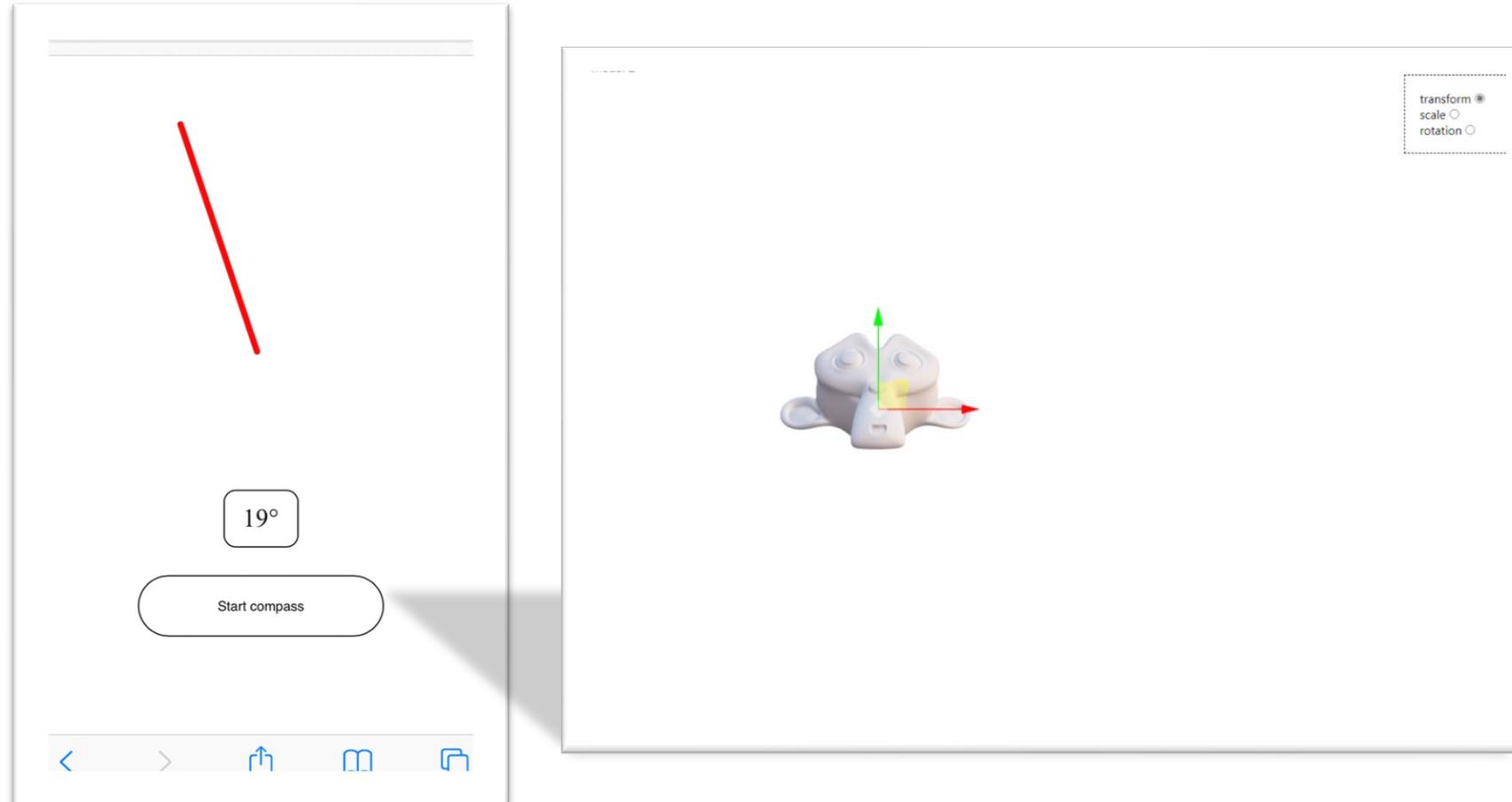


PCB Diagram



PCB diagram  
(expected view)

# Project Evidence



**Virtual camera  
controllers**

# References

- [1] Ying Kin Yu, Kin Hong Wong and Ming Yuen Chang, "Merging artificial objects with marker-less video sequences based on the interacting multiple model method", IEEE Transactions on Multimedia, vol. 8, no. 3, pp. 521-528, 2006. Available: 10.1109/tmm.2006.870734 [Accessed 24 February 2021].
- [2] Y. Genc, S. Riedel, F. Souvannavong, C. Akinlar and N. Navab, "Marker-less tracking for AR: a learning-based approach", Proceedings. International Symposium on Mixed and Augmented Reality. Available: 10.1109/ismar.2002.1115122 [Accessed 24 February 2021].
- [3] Ramesh Jain and Koji Wakimoto, "Machine dynamic selection of one video camera/image of a scene from multiple video cameras/images of the scene in accordance with a particular perspective on the scene, an object in the scene, or an event in the scene," 17-Mar-1998. [Accessed 24 February 2021].
- [4] Bilesan, A., Owlia, M., Behzadipour, S., Ogawa, S., Tsujita, T., Komizunai, S. and Konno, A., 2021. Marker-based motion tracking using Microsoft Kinect.
- [5] 2021. Markerless Tracking System for Augmented Reality in the Automotive Industry. [online] Available at: <<https://sci-hub.se/https://www.sciencedirect.com/science/article/abs/pii/S0957417417302221>> [Accessed 9 March 2021].
- [6] P. Karashchuk et al., "Anipose: a toolkit for robust markerless 3D pose estimation," bioRxiv, p. 2020.05.26.117325, 2020.
- [7] Y. Wang, S. Zhang, S. Yang, W. He, X. Bai, and Y. Zeng, "A LINE-MOD-based markerless tracking approachfor AR applications," Int. J. Adv. Manuf. Technol., vol. 89, no. 5–8, pp. 1699–1707, 2017.

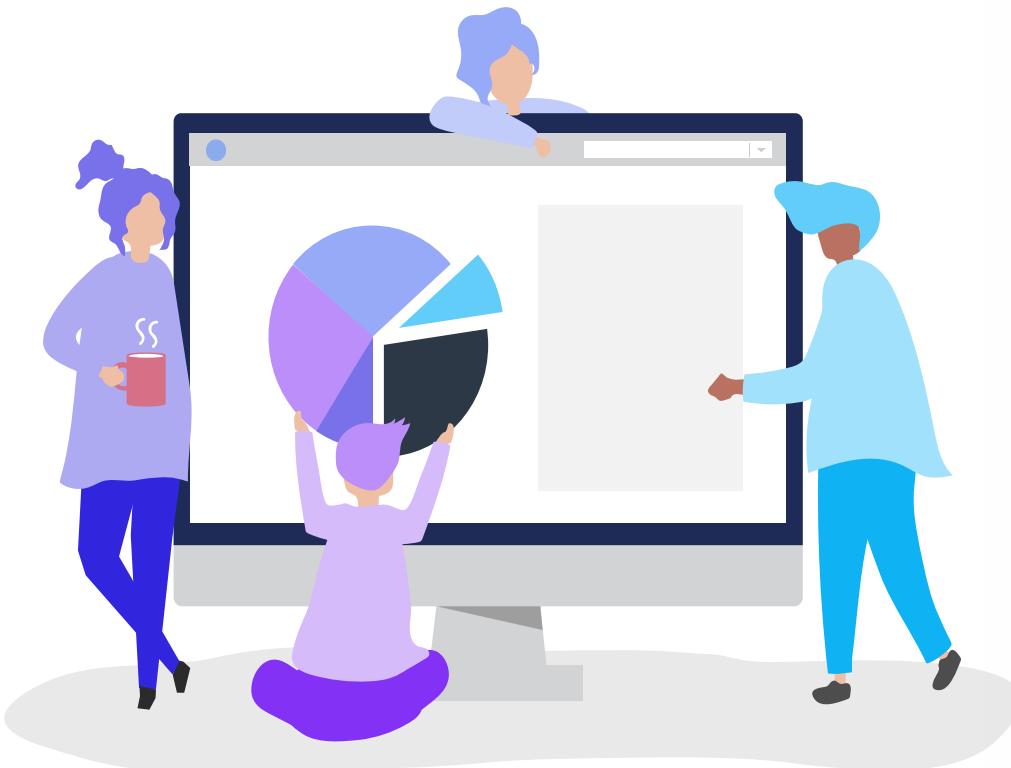


# Data Visualization

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Interactive Media

# Research Questions



- 01 Is there a tool with graph suggestions in data visualization?**
- 02 Are there color suggestion technique in data visualization?**
- 03 Is it possible to obtain 3D visual objects?**

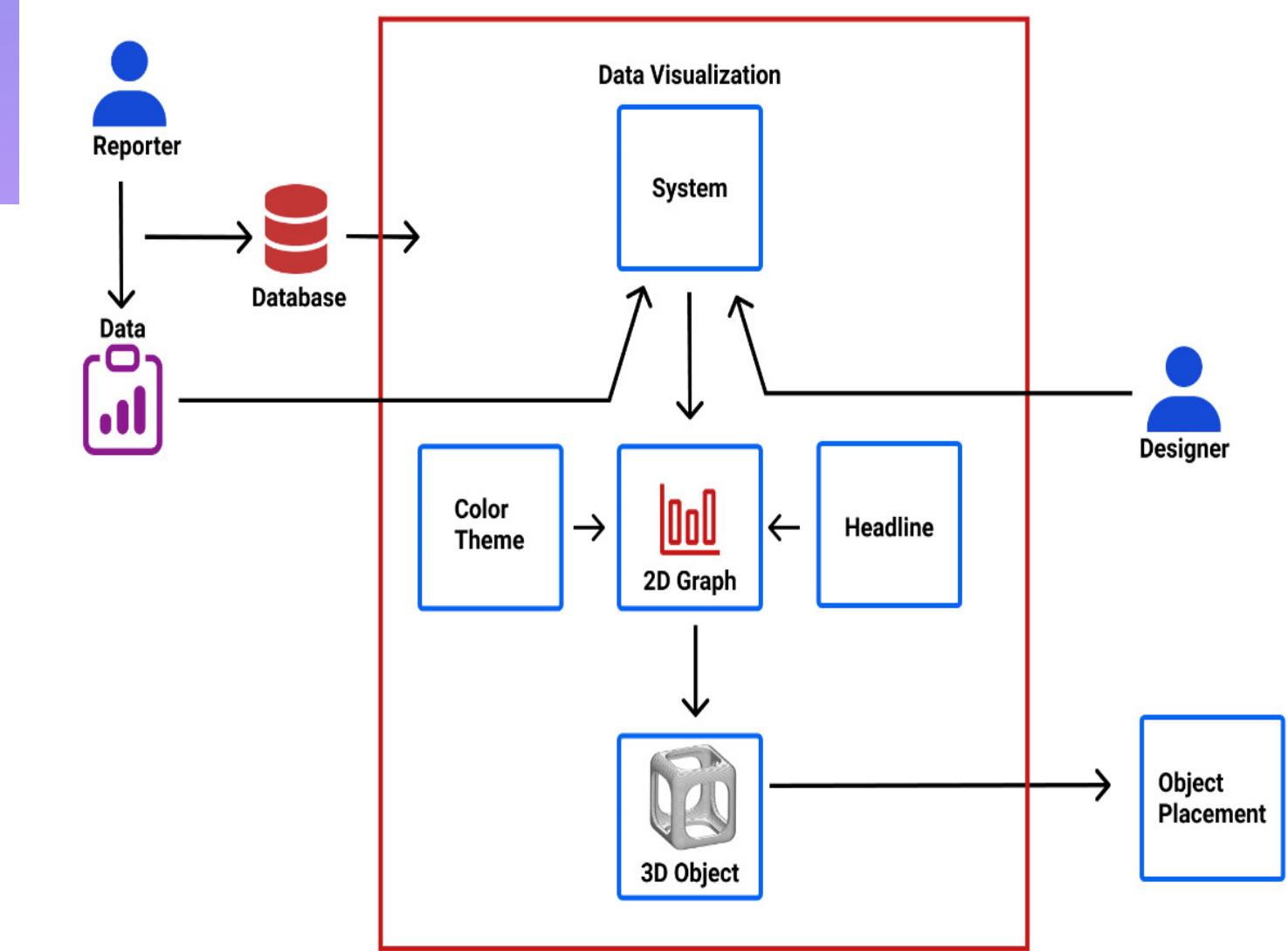
# Technology

Part	Technology
Creating the User Interface	Electron, React / java script
Visualizing Data as highly scalable graphs	SVG (Scalable Vector Graphics)

Part	Libraries/Frameworks
Chart creation	D3.js,chart.js,Three.js
Data cleaning	Data- cleaner (Java script)
CSS Framework	Bootstrap

# System Diagram

In this model of the system diagram shows the overall process of the data visualization tool that will be created in this project.



# Objectives and project completion

30%

**Graph selection  
(suggestion and manual)**

10%

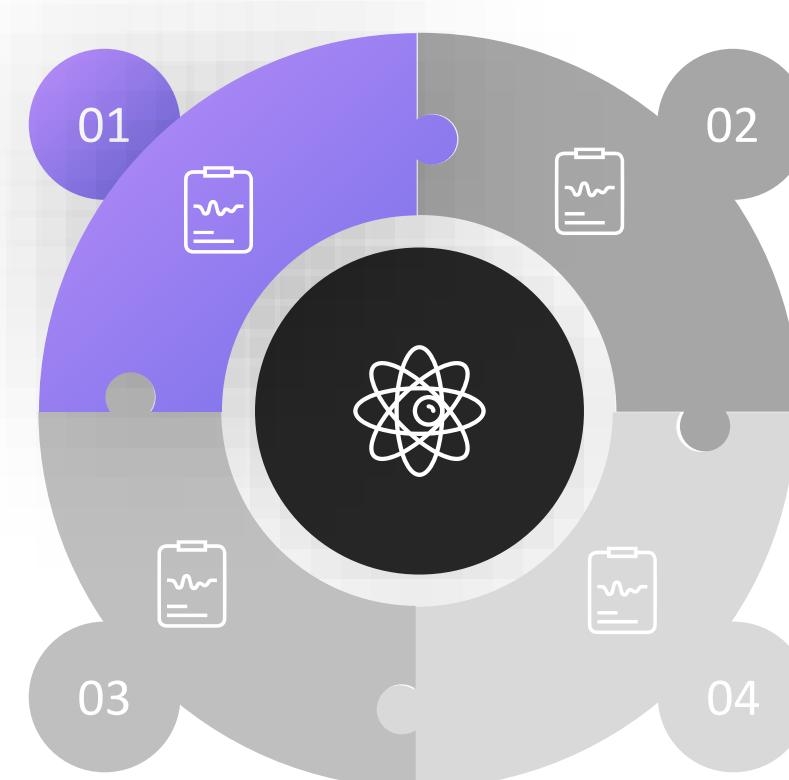
**Converting into 3D object**

80%

**Color suggestion**

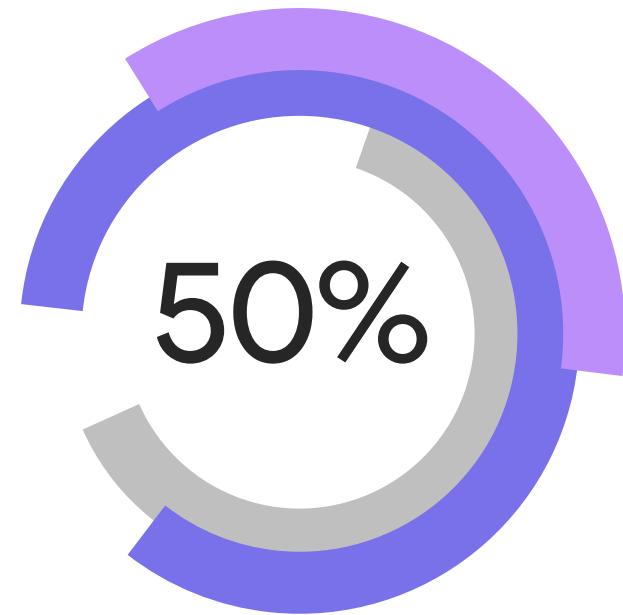
90%

**Color Pallet**



# Current Progress (50%)

- 2D graph data input (Tested with chart.js and d3.js)
- Color suggestion using java script algorithm.
- Manual color pallet created.
- UI designs created
- Image color identification



Screenshots of the current work

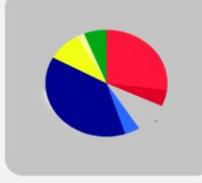
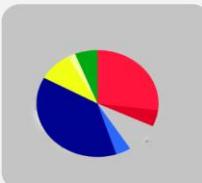
# Project Evidence



IT18063738 | Gankanda G.M.J.U | Project ID : 2021-075

# User Interface

lumoz

**Upload Sheet****Add data**

lumoz

## Graph Suggestions

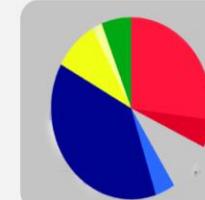
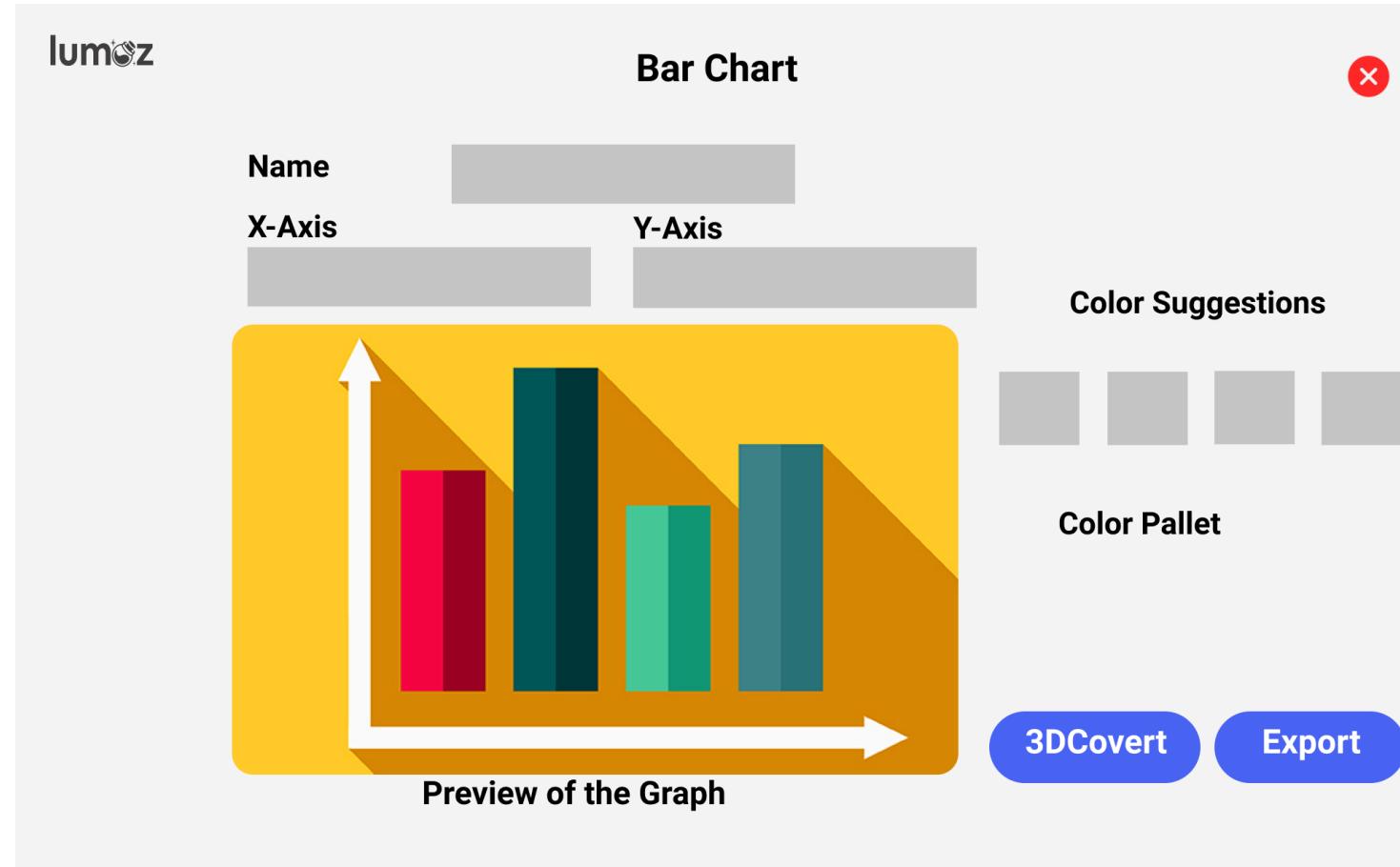
**Options****Next**

Figure 01

Figure 02

# User Interface



# Progress (50%) – Project Screenshots

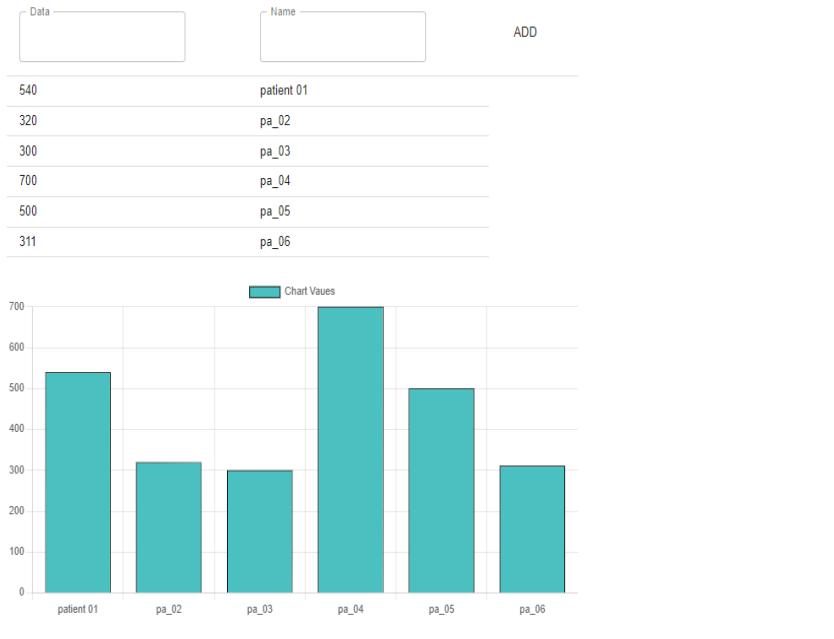


Chart created using chart.js

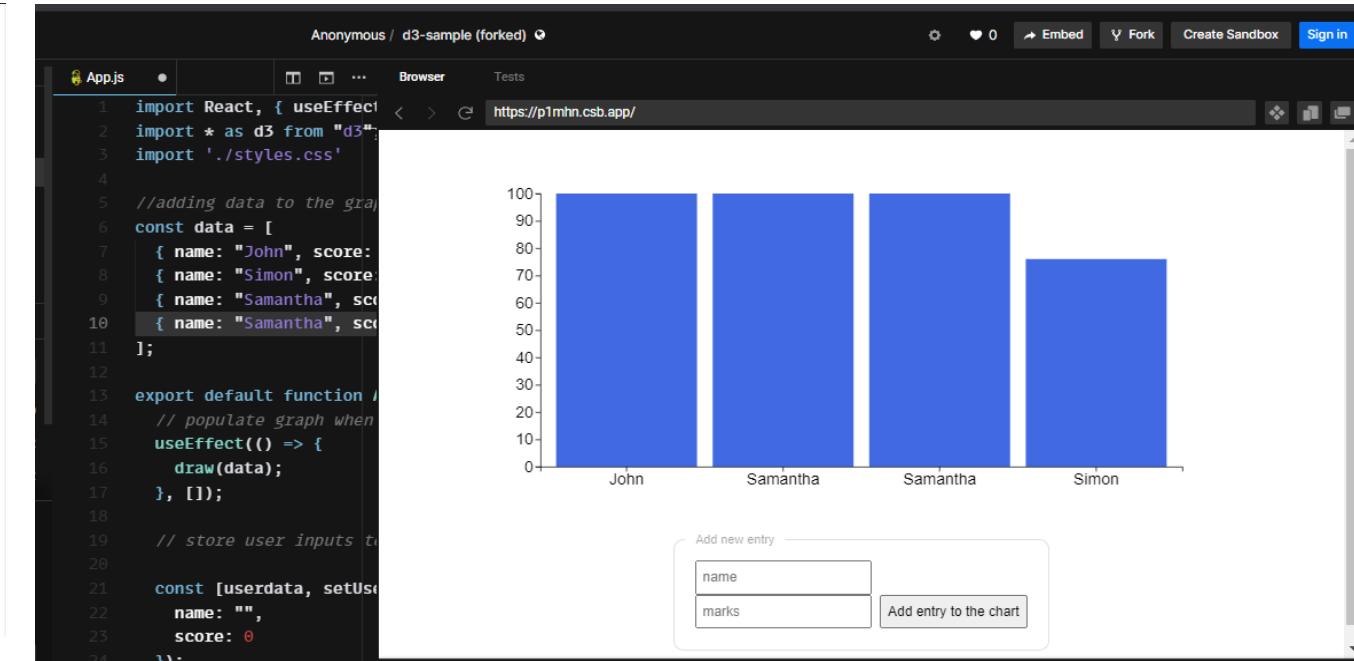
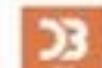


Chart created using d3.js

 Add Product


Chart.js

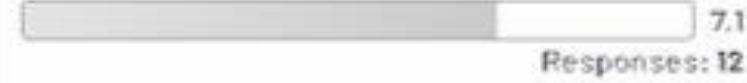
Request More Information



D3js

Request More Information

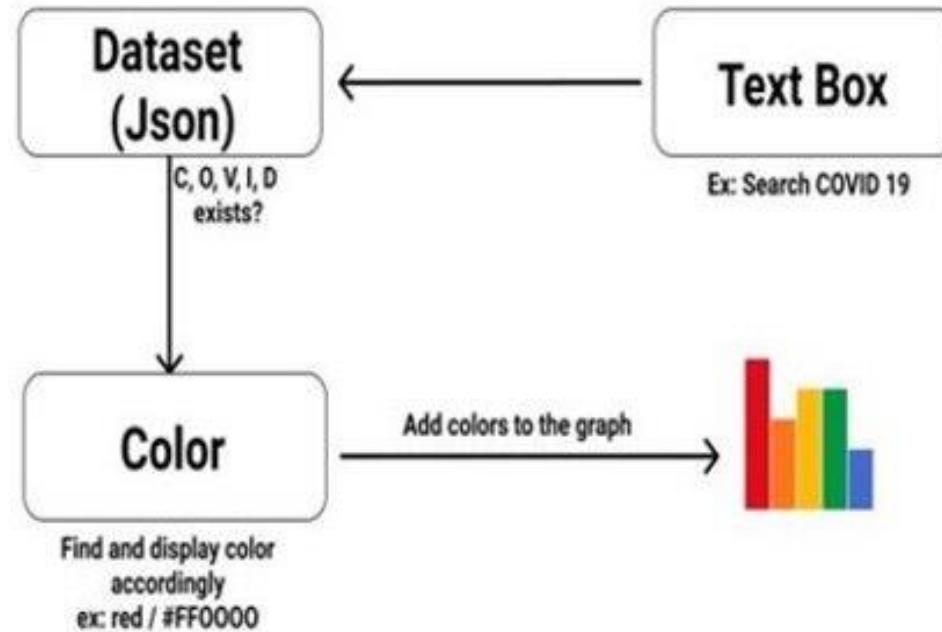
## Rating

**Meets Requirements****Ease of Use****Ease of Setup****Ease of Admin****Quality of Support****Ease of Doing Business With**

Not enough data available

**Product Direction (% positive)**

## Color selection Logic



Searchining for ' covid ' ? colors found

covid



Searchining for ' brain cancer ' ? colors found

bra

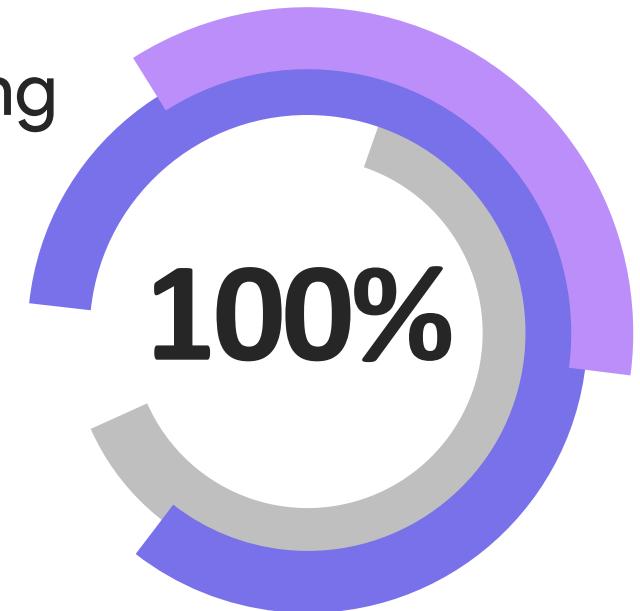


Color Selection Automation

This is the mythology of automating colors for the charts according to the name selection or the spread sheet title

# Future Progress

- Data adding using a spread sheet. And data clearing processes and preprocessing.
- Graph suggestion according to the given data.
- Converting 2D graph into 3D object



# References

- [1] Yang, B., Vargas Restrepo, C., Stanley, M. and Marsh, E., 2021. Truncating Bar Graphs Persistently Misleads Viewers.
- [2] Qin, X., Luo, Y., Tang, N. and Li, G., 2021. Making data visualization more efficient and effective: a survey.
- [3] [https://www.researchgate.net/profile/Martin-Theus/publication/5142809\\_Interactive\\_Data\\_Visualization\\_Using\\_Mondrian/links/0046353a45ba147e0b00000/Interactive-Data-Visualization-Using-Mondrian.pdf](https://www.researchgate.net/profile/Martin-Theus/publication/5142809_Interactive_Data_Visualization_Using_Mondrian/links/0046353a45ba147e0b00000/Interactive-Data-Visualization-Using-Mondrian.pdf)
- [4] D. Swayne, D. Temple, A. Buja, and D. Cook. Ggobi: Xgobi redesigned and extended. In Proceedings of the 33th Symposium on the Interface: Computing Science and Statistics, 2001
- [5] Luo, W., 2021. User choice of interactive data visualization format: The effects of cognitive style and spatial ability. [6] Library.oopen.org. 2021. [online] Available at: <<https://library.oopen.org/bitstream/handle/20.500.12657/22273/9789048543137.pdf?sequence=1#page=170>> [Accessed 26 February 2021].
- [7] Nadig, A., 2021. Visualization of social media data in disaster recovery. [online] Csus-dspace.calstate.edu. Available at: <<http://csus-dspace.calstate.edu/handle/10211.3/216042>> [Accessed 26 February 2021].

# References

- [8] <https://mediaweb.saintleo.edu/Courses/COM430/M2Readings/WATEERFALLVs%20V-MODEL%20Vs%20AGILE%20A%20COMPARATIVE%20STUDY%20ON%20SDLC.pdf>
- [9] S. Rose, “Return on Information : The New ROI Getting value from data.,” SAS Inst. Inc. U.S.A, 2014.
- [10] Toasa, R., Maximiano, M., Reis, C., & Guevara, D. (2018). Data visualization techniques for real-time information – A custom and dynamic dashboard for analyzing surveys’ results. 2018 13th Iberian Conference on Information Systems and Technologies (CISTI). doi:10.23919/cisti.2018.8398641
- [11] MICROSOFT CORPORATION, WASHINGTON, “Large scale data visualization with interactive chart ,” U.S. Patent 3 624 125, Jul. 16, 1990.
- [12] Jayaweera, D., 2020. Bad Graph !!! Hope This Will Be Corrected By Ada Derana With An Apology .. [image] Available at: <<https://www.facebook.com/dilith.jayaweera/posts/10157995591750977>> [Accessed 19 April 2020].
- [13] <https://onlinelibrary.wiley.com/doi/full/10.1046/j.1525-1497.2003.20703.x> (research Problem)
- [14] Channel Africa, e., 2020. The Race 2020 | Details From The US Presidential Election. [video] Available at: <<https://youtu.be/NL107fgpyH8?t=286>> [Accessed 22 January 2021].

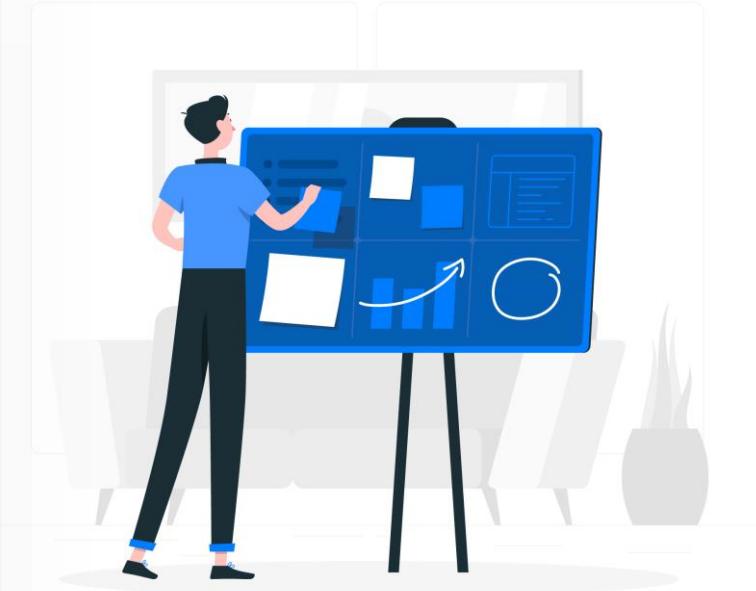


# Gesture Detection

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- 1. Research Questions**
- 2. Specific and Sub Objectives**
- 3. System Diagram**
- 4. Evidences for the Completion**
  - 4.1 Technology Stack Selection**
  - 4.2 Landmark Detection**
  - 4.3 Gesturer Detection**
  - 4.4 Rotate signal identification**
  - 4.5 Zoom in / Zoom out Signal Identification**
- 5. Objectives and Project Completion**
- 6. References**

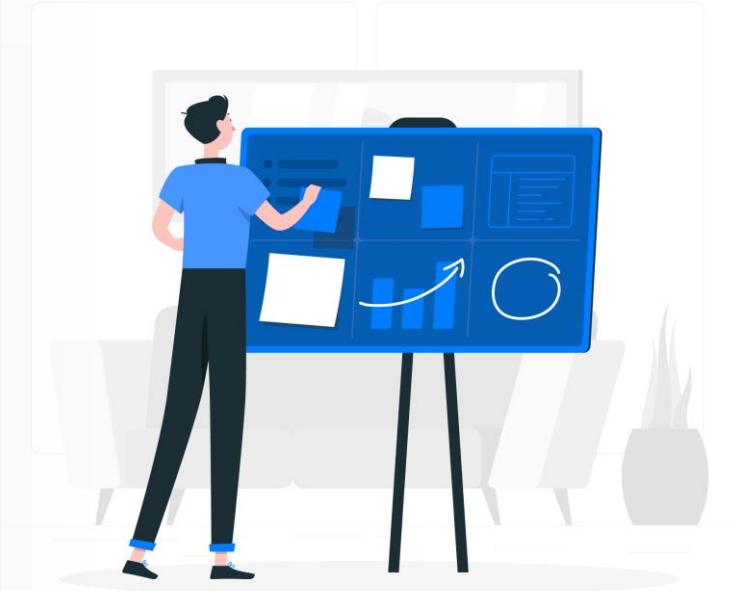


# Research Questions



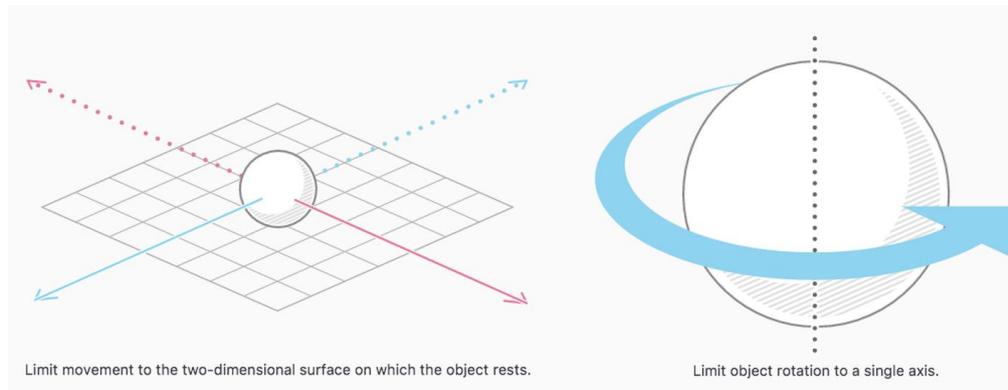
- 01 How the presenter interact with the 3D objects and data visualization when presenting?
- 02 How the presenter knows whether the object is in the space?

- 1. Research Questions**
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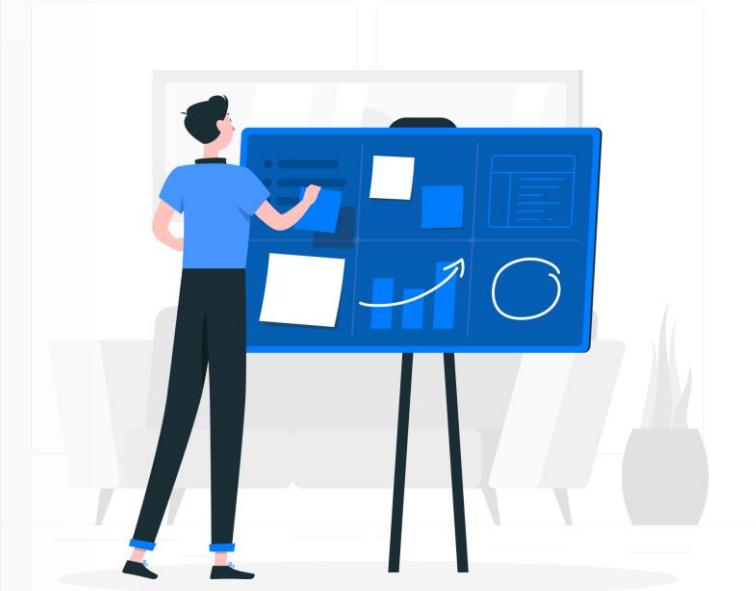


# Specific and Sub Objectives

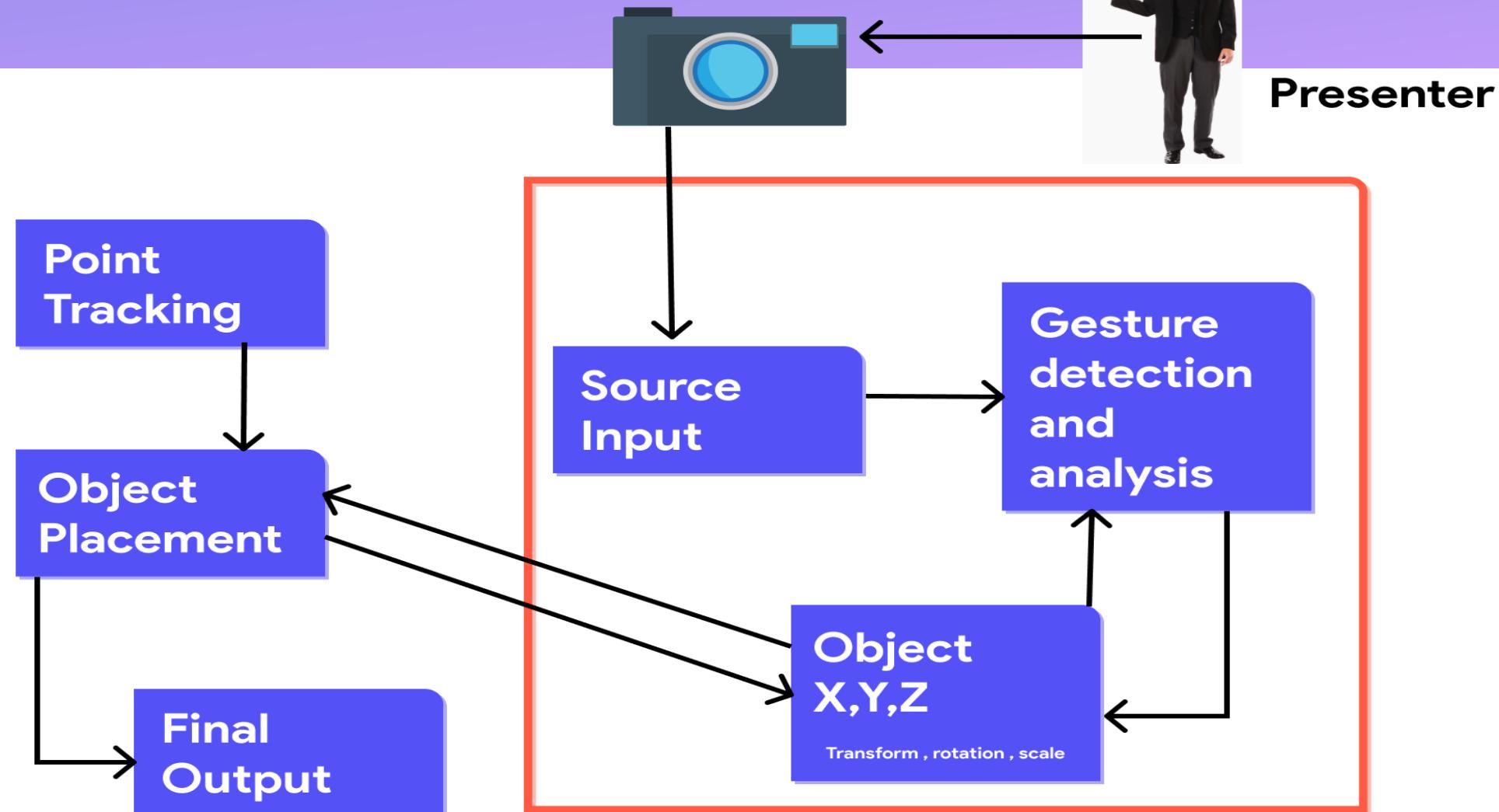
- ✓ Communicate 3D object and 3D object movement in live
- ✓ Presenter preview



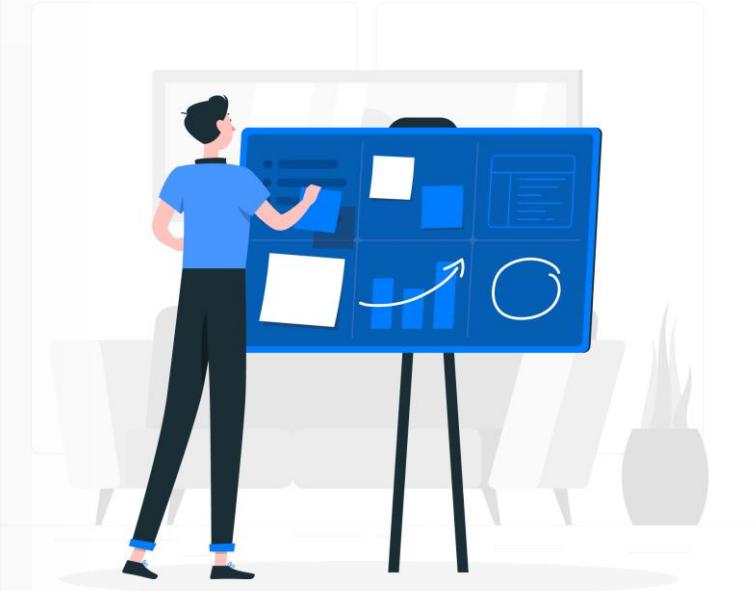
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- 5. Objectives and Project Completion**
- 6. References**



# System Diagram

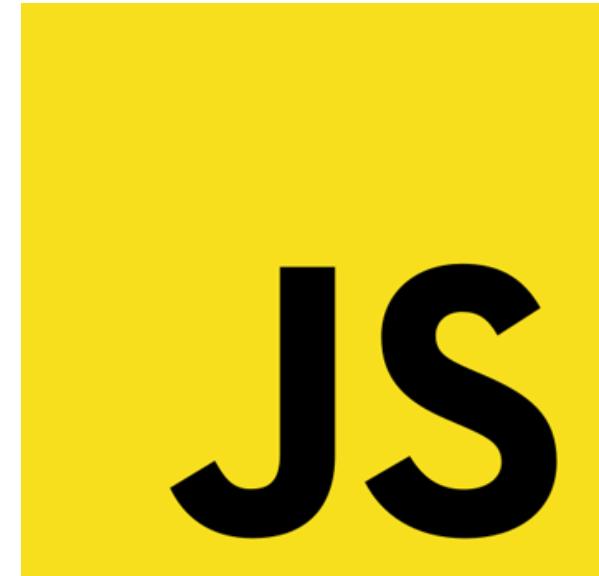


- 1. Research Questions**
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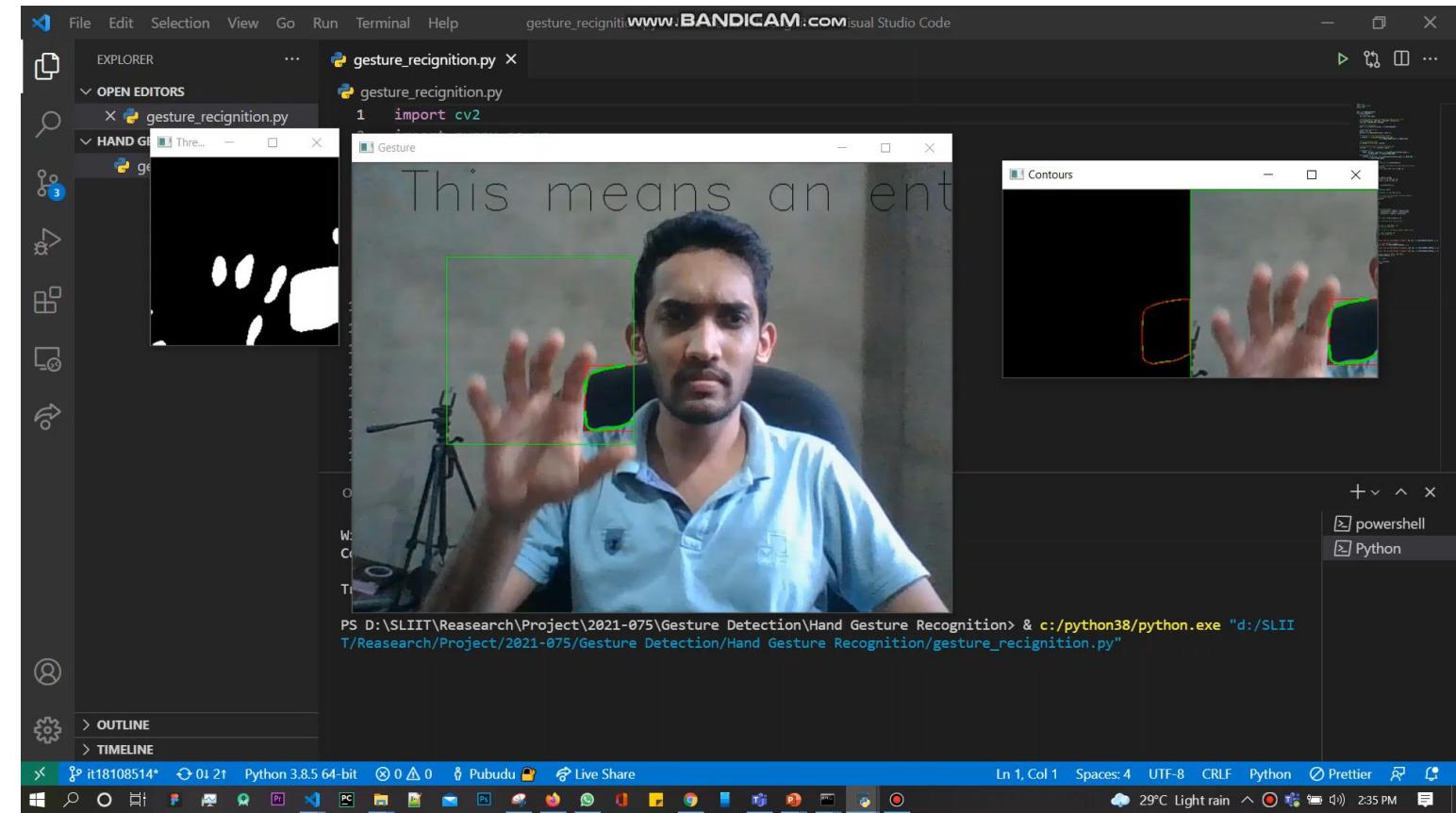


# Evidences for the completion

Which technologies  
to use ?



# Sample Hand Detection System



# Java Script Benefits

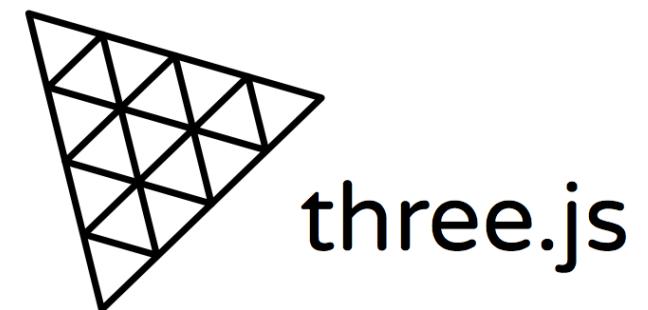


- Light weight
- Cross platform support
- Availability of many libraries
- More open-source contribution

# Java script libraries that I tried..



## TensorFlow



# Reasons for selection

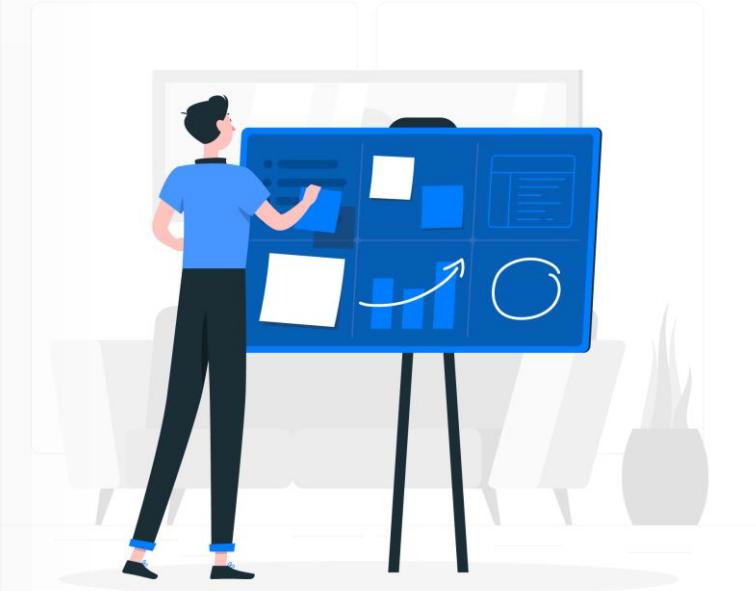
- ✓ Free and open source
- ✓ Build once, deploy anywhere
- ✓ End-to-end acceleration
- ✓ Powered by Google



# TensorFlow



- 1. Research Questions**
- 2. Specific and Sub Objectives**
- 3. System Diagram**
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- 6. References**



# Detect Landmarks

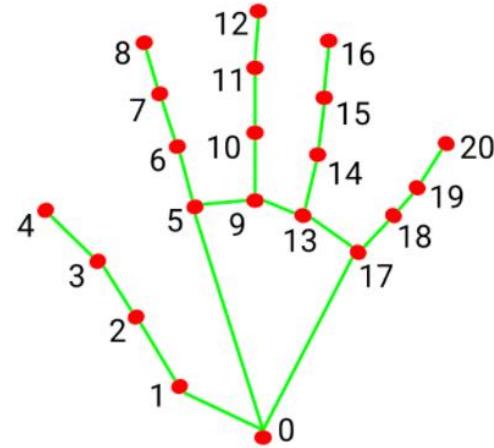
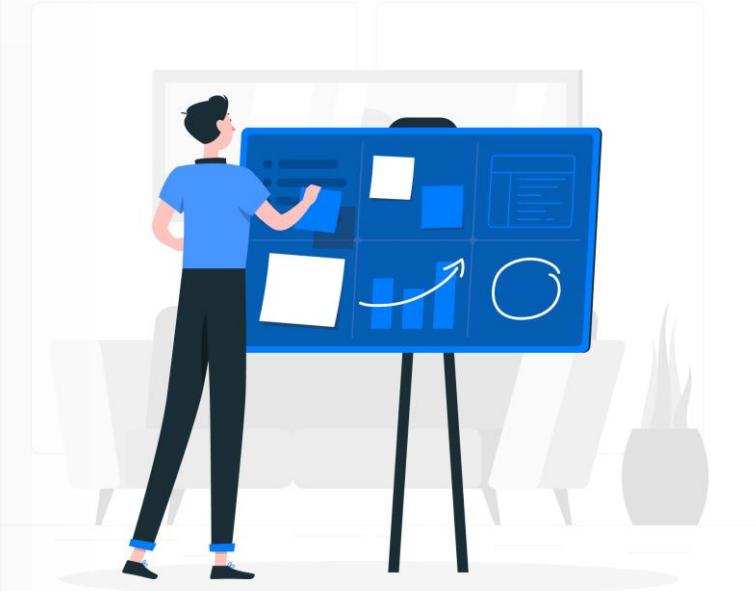


Fig 2. 21 hand landmarks.

- 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



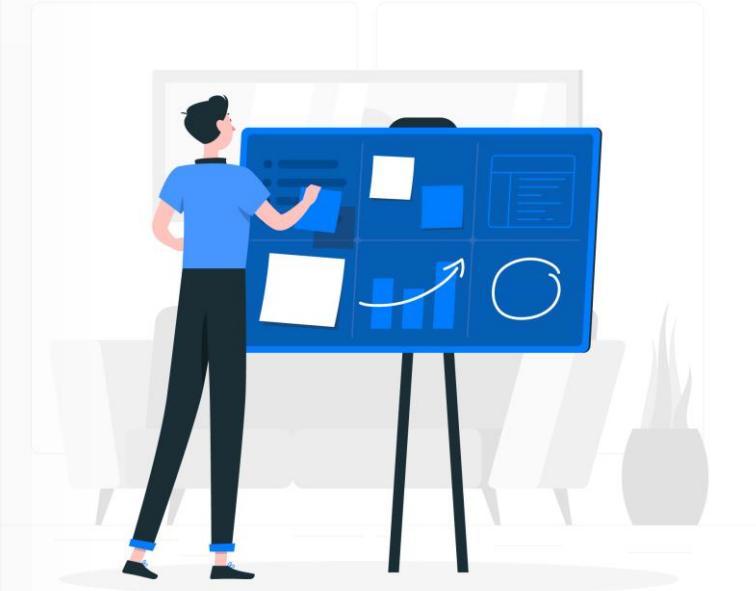
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  - 4.3 Gesturer Detection**
  - 4.4 Rotate signal identification**
  - 4.5 Zoom in / Zoom out Signal Identification**
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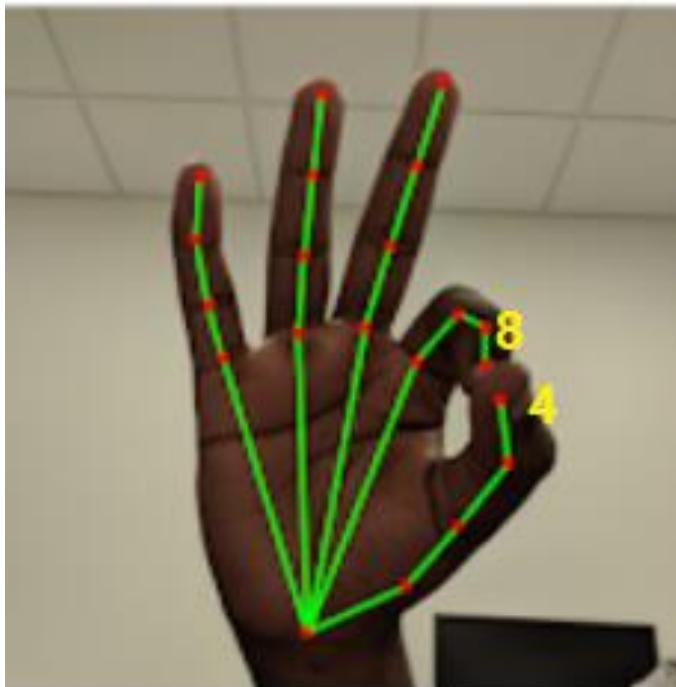
# Gesturer Detection Sample



- 1. Research Questions**
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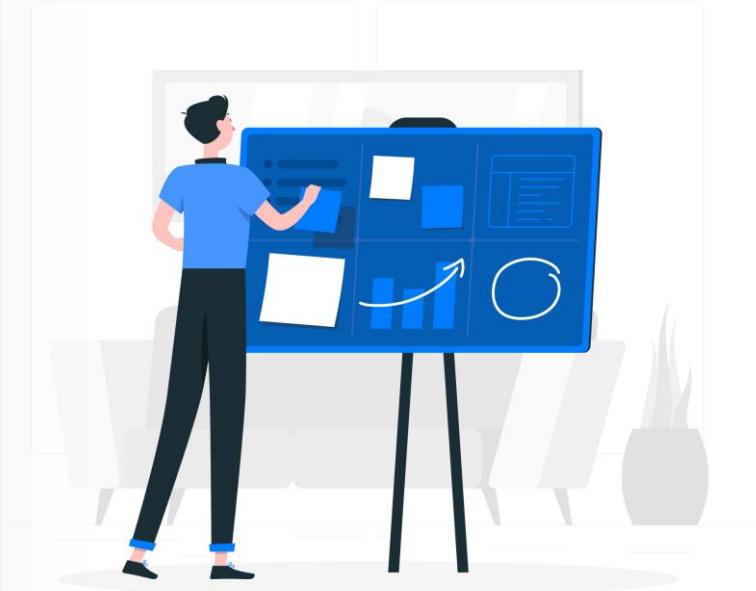


# Rotate Signal Identification

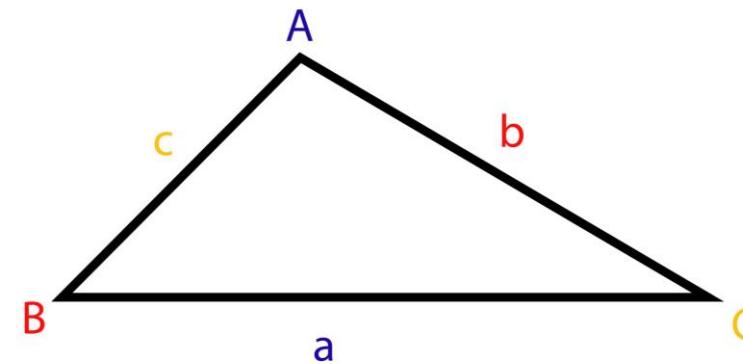
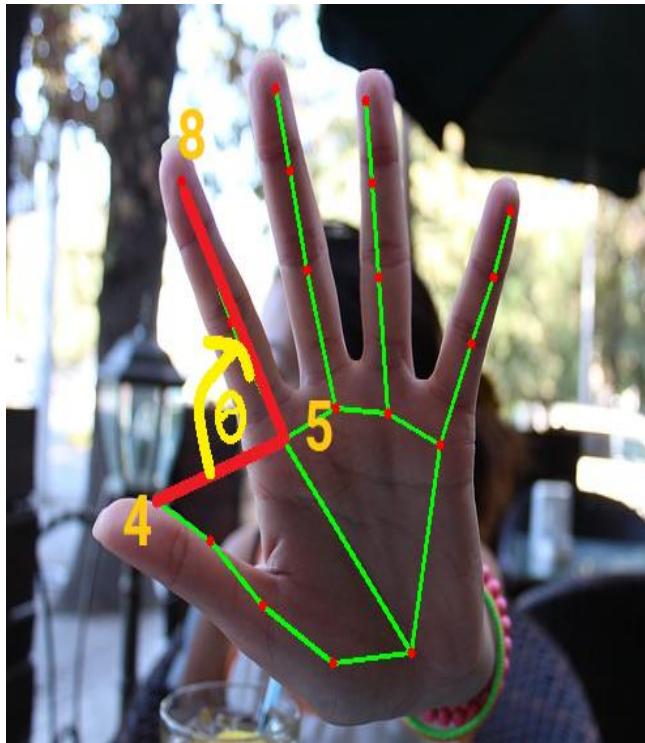


```
    }
    var shortG = [landmarks[8], landmarks[4]]
    var distance = Math.sqrt( Math.pow( shortG[0].x - shortG[1].x, 2 )
        + Math.pow( shortG[0].y - shortG[1].y, 2 )
        + Math.pow( shortG[0].z - shortG[1].z, 2 ) );
    var elem1 = document.getElementById("rot");
    if(distance < 0.1 ){
        drawLandmarks(canvasCtx, shortG, {color: '#FFFFFF', lineWidth: 30});
        elem1.style.color = 'red';
        s1 = s1 + 1;
```

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# Zoom in / Zoom out Signal Identification



law of cosine

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

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

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

# Zoom in / Zoom out

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

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

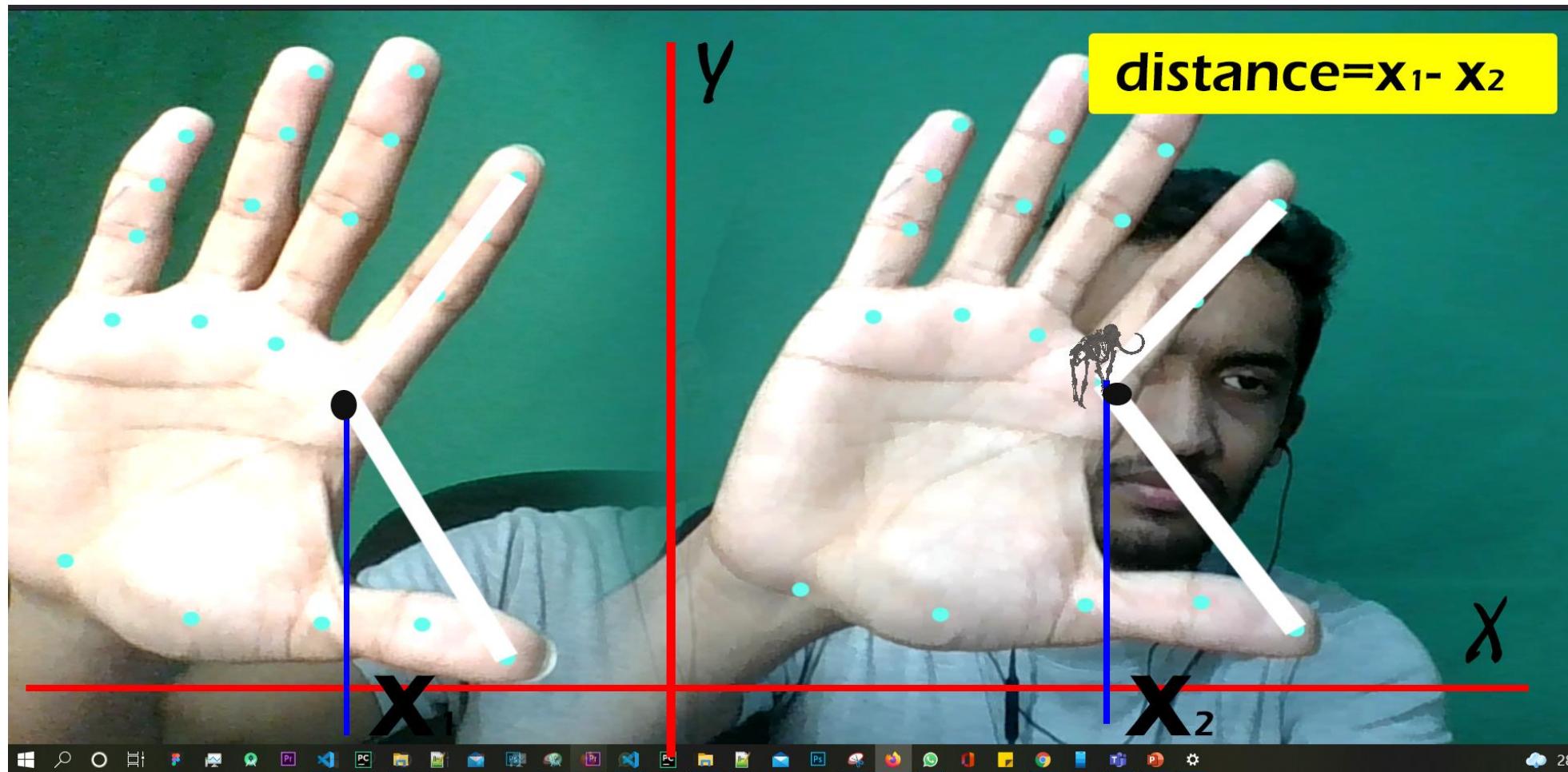
$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

```
//drawConnectors(canvasCtx, landmarks, HAND_CONNECTIONS,{color: '#00FF00', lineWidth: 5});
var longG = [landmarks[8],landmarks[5],landmarks[4]]
drawLandmarks(canvasCtx, landmarks, {color: '#66ffff', lineWidth: 2});
function find_angle(A,B,C) {
    var AB = Math.sqrt(Math.pow(B.x-A.x,2)+ Math.pow(B.y-A.y,2));
    var BC = Math.sqrt(Math.pow(B.x-C.x,2)+ Math.pow(B.y-C.y,2));
    var AC = Math.sqrt(Math.pow(C.x-A.x,2)+ Math.pow(C.y-A.y,2));
    return Math.acos((BC*BC+AB*AB-AC*AC)/(2*BC*AB));
}

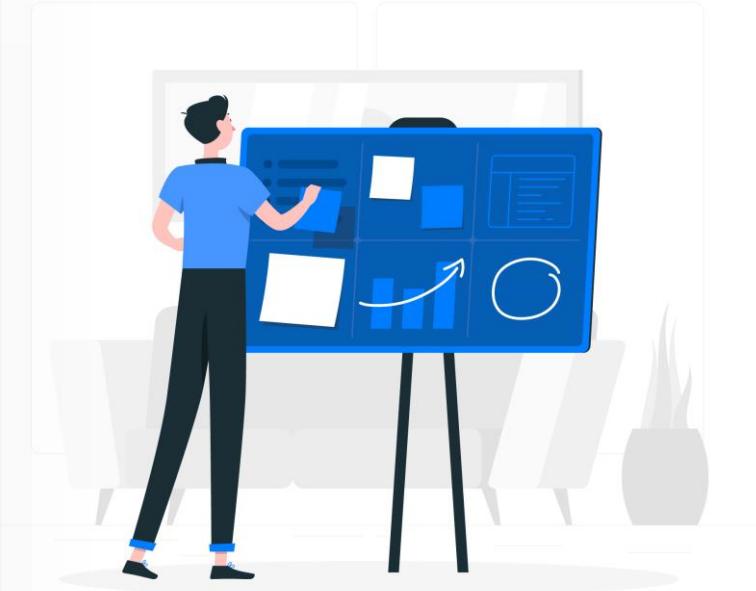
var angle = find_angle(longG[0], longG[1], longG[2]) / Math.PI
//console.log("angle"+ angle);
var es = Math.abs(landmarks[5].x - 0.5);
var elem2 = document.getElementById("zoin");
var elem3 = document.getElementById("zout");

if(angle > 0.7){
    drawConnectors(canvasCtx, longG, HAND_CONNECTIONS,{color: '#FFFFFF', lineWidth: 20});
    r = r + 1;
}
```

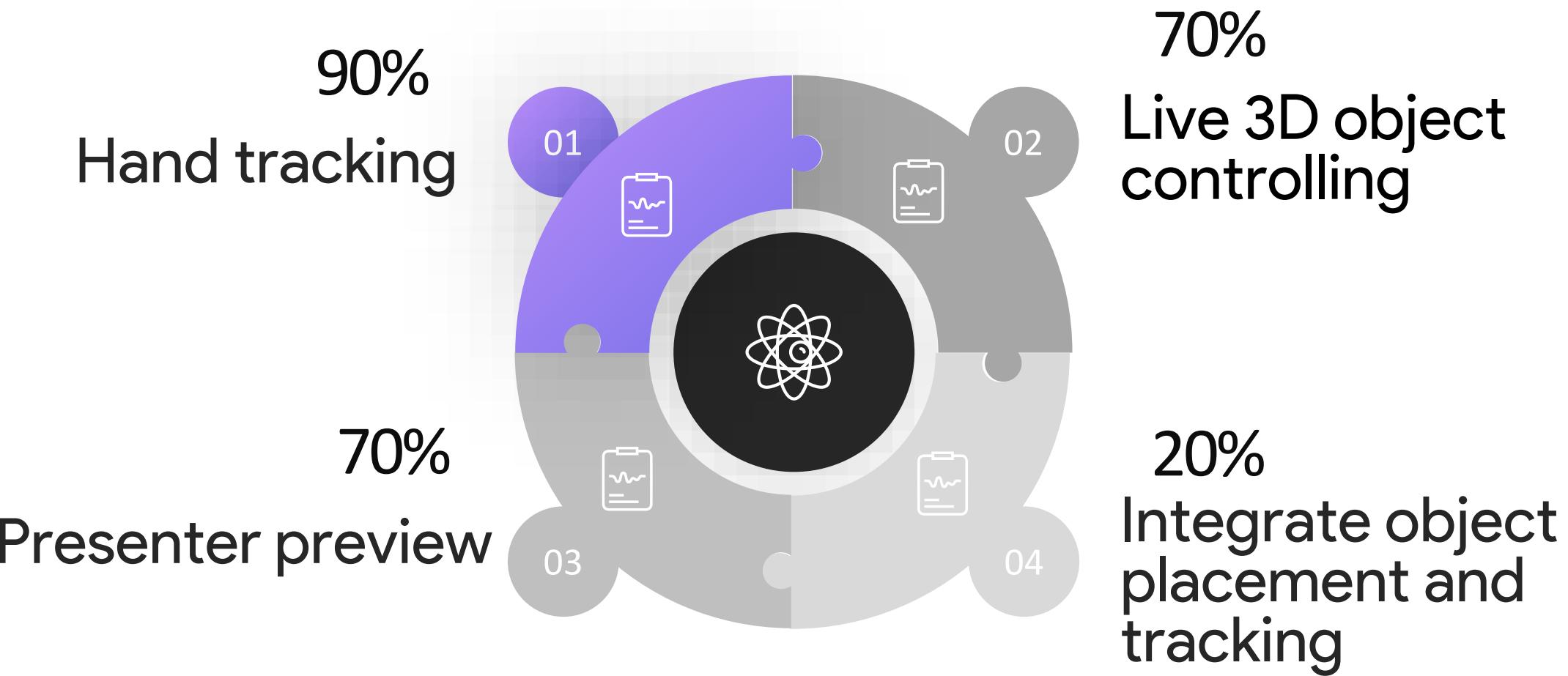
# Zoom in / Zoom out



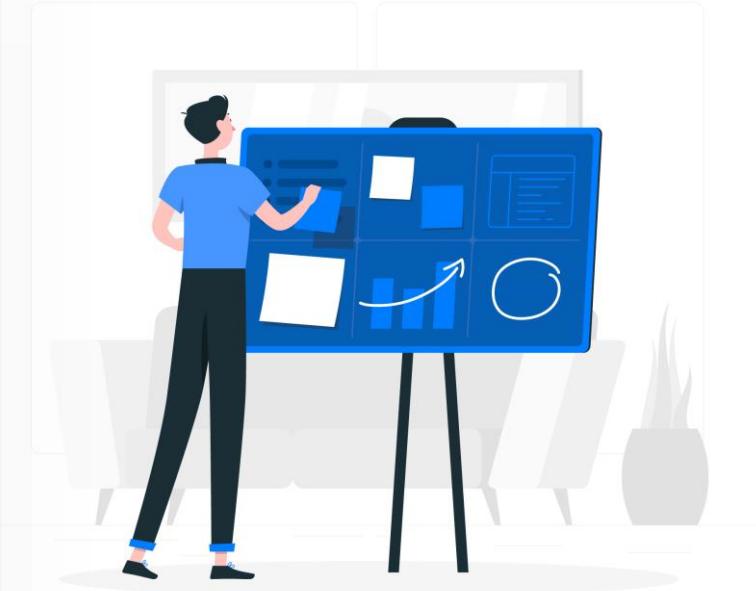
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# Objectives and Project Completion



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- 6. References**



# References

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# Commercialization

01 Branding

03 Business Model Canvas

02 Market Analysis

04 Business Plan

# Branding

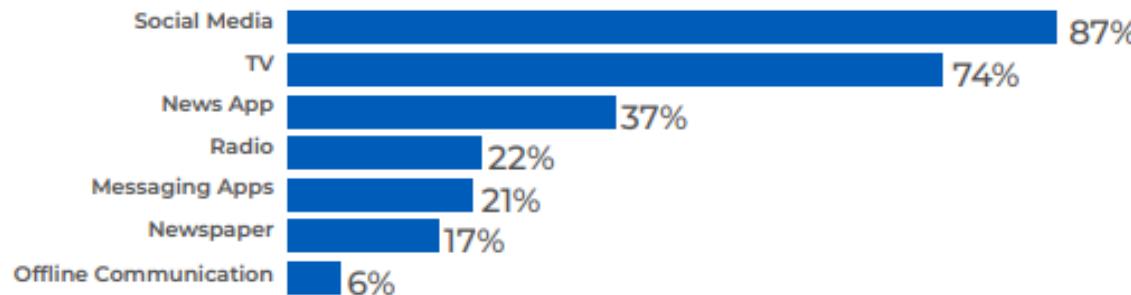


lumoz.studio

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

# Market Analysis

## THE KEY MEDIA SOURCES OF RECEIVING NEWS UPDATES

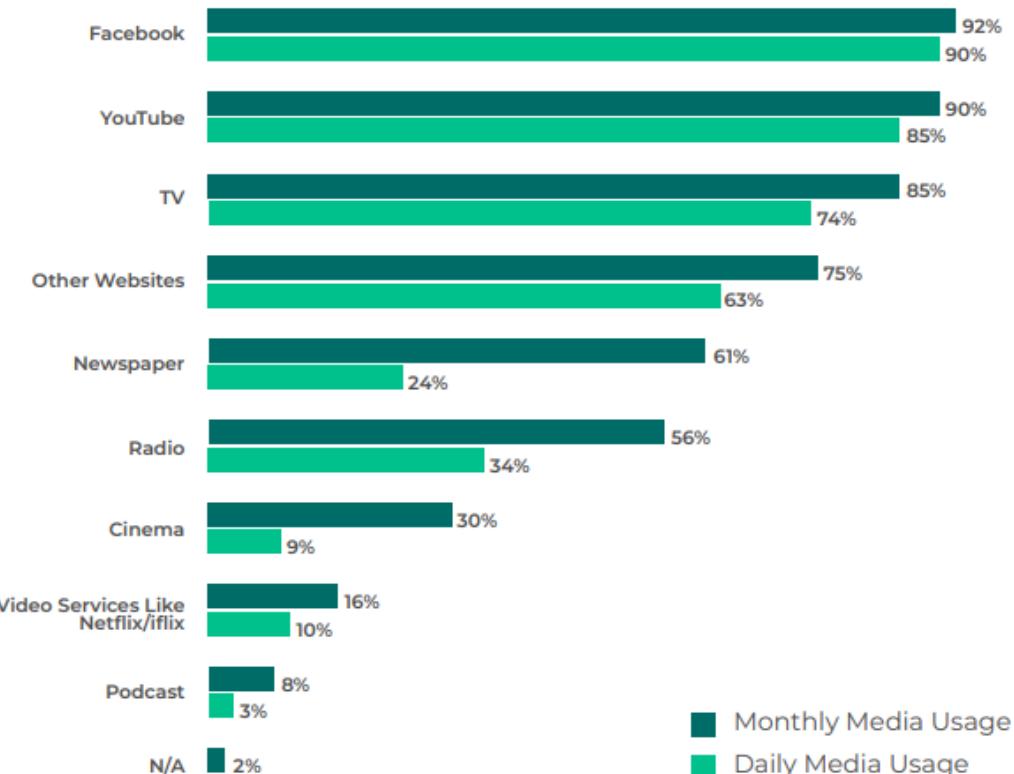


Sources : Digital outlook SriLanka 2021

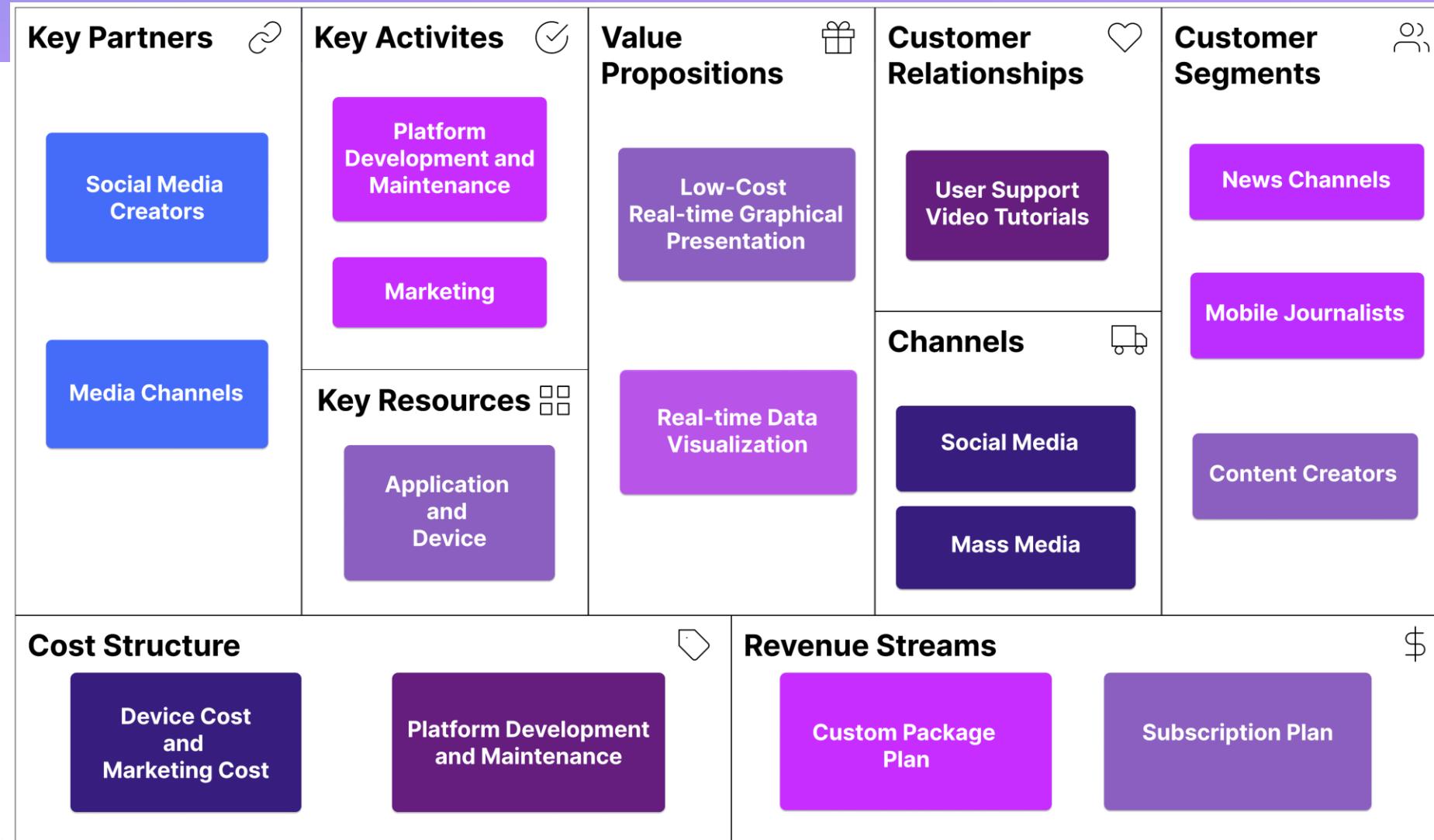
### MONTHLY VS. DAILY MEDIA CONSUMPTION

92% of the Internet users are using Facebook once a month while 90% of them are daily users.

YouTube and TV report the second and third highest percentages of media consumption in Sri Lanka.



# Business Model Canvas



# Business Plan

## Lumoz Studio

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



## Standard

### What You'll Get

- 24x7 Support
- Ultimate Streaming
- Social Media Streaming
- No Ads
- Access to our model library

\$9/month

Choose

## Premium

### What You'll Get

- 24x7 Support
- Ultimate Streaming
- Social Media Streaming
- No Ads
- Access to our model library

\$22/month

Choose

# Thank you