# MONITORING SYSTEM IN AUGMENTED REALITY (AR)


Avdhesh - 1521
Prateek Gupta - 1522
Rohit Kumar Shaw - 1523
Utkarsh Shrivastava - 1525
Khushi Kirit Akbari - 1526
Khyati Gaurana - 1527
Rajat Tanwar - 1528
Bhuvan Deep Sagar - 1529
Seelam Jaya Sidhu - 1530
Shikha - 1531

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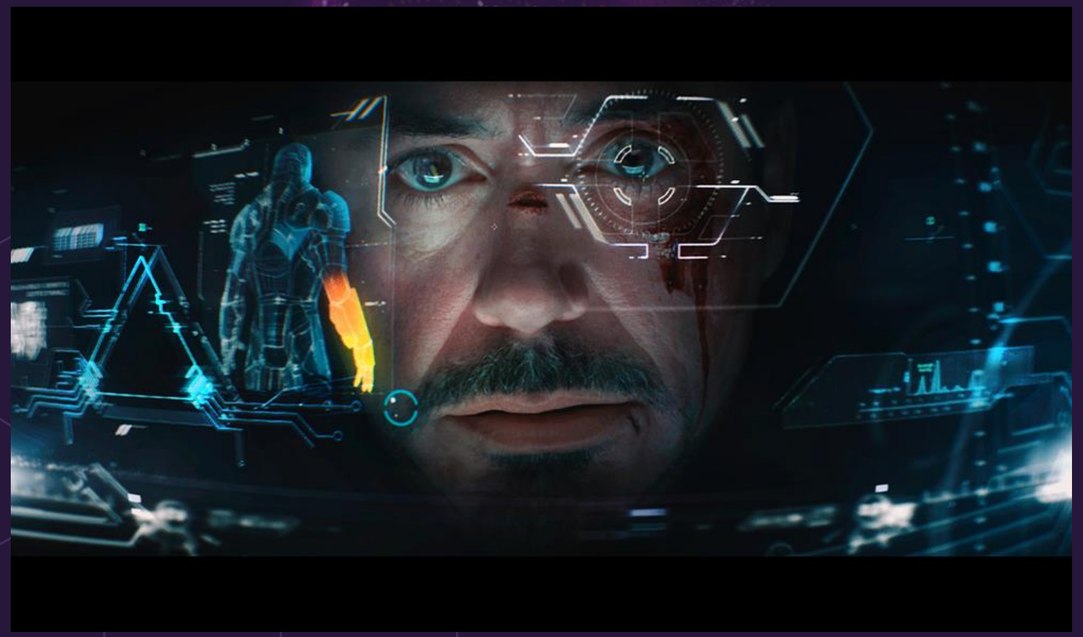
# 01 INTRODUCTION

Navigation overlaid directly onto your windshield, guiding you without distractions.

warehouse worker managing inventory with real-time data and instructions overlaid on their smart Device



AR monitoring systems provide real-time data and information in an augmented reality environment.

It uses sensors to collect data from user's surroundings and display useful information on user's view of reality.

Applicable in various fields such as:

- **Gaming:** Enhanced immersive experiences.
- **Healthcare**: Real-time patient data during surgeries.
- **Industrial maintenance:** Real-time diagnostics and manuals for technicians.

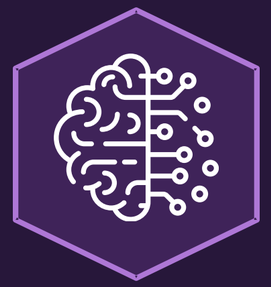
# 02

# KEY COMPONENTS

# HARDWARE COMPONENTS

## Sensors

- Detect user movement, gestures, and environmental changes.
- Eg.  Gyroscope and accelerometer



## Data Processing Unit

- Analyzes real-time data to adjust the AR environment.
- Eg. smartphone's processor analyzing sensor data to overlay virtual objects on the real world.

# HARDWARE COMPONENTS

## Communication Interface

- Allows data exchange between the AR system and external devices or networks.
- Example: AR devices communicating with cloud servers to access additional data or resources.

## Feedback Mechanism

- Provides real-time responses based on user actions or sensor data.
- Example: Haptic feedback in AR gloves when interacting with virtual objects.

# HARDWARE COMPONENTS

## Error Detection & Correction

- Ensures data accuracy and corrects any tracking errors.
- Example: An AR system recalibrating position when the virtual object drifts due to sensor inaccuracies.

# HARDWARE COMPONENTS

Microsoft HoloLens

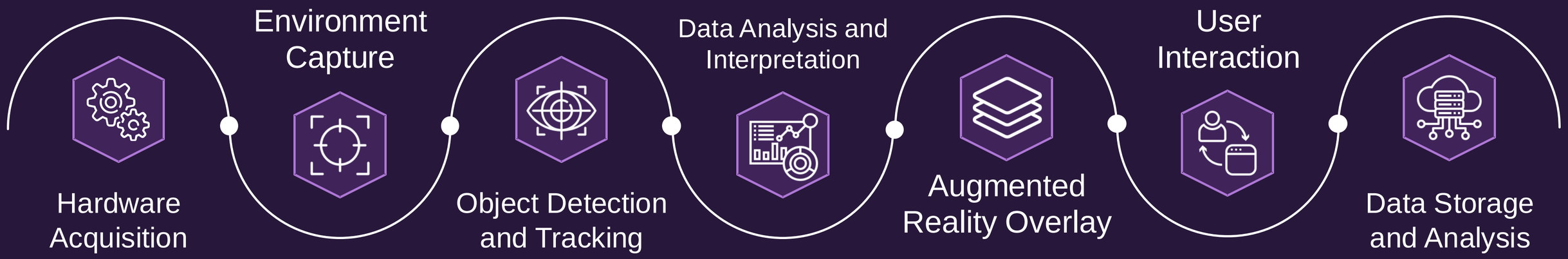
Magic Leap One

Smart Glasses

# 03

# WORKING

# WORKING PROCESS



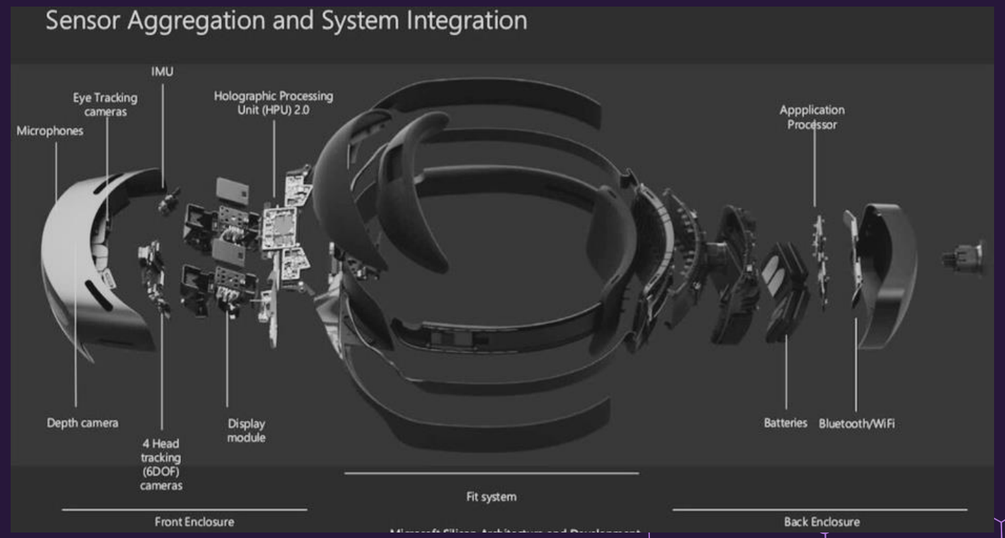
# HARDWARE ACQUISITION

Some necessary hardware components required to build AR monitoring systems are:

**Sensors:** AR systems uses a combination of sensors like cameras, inertial measurement units, depth sensors, etc

**Processing unit:** A powerful processor, such as a smartphone or dedicated AR headset, is required to handle the complex computations involved in AR.

**Display:** A screen to present the augmented reality view.



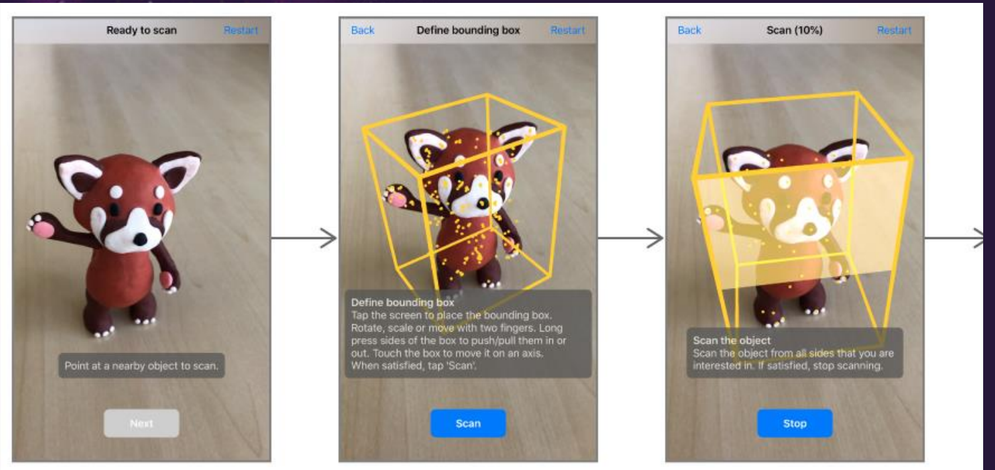
# ENVIRONMENT CAPTURE

Environment capture is the process of collecting and processing data about the real-world environment using the sensors integrated into an AR system. This includes sensor data collection, image processing and depth mapping.

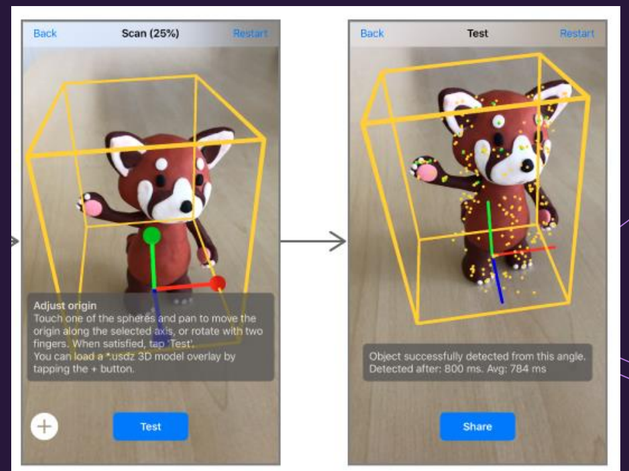
# OBJECT DETECTION AND TRACKING

**Object detection:** common methods of object detection are machine learning algorithms and computer vision techniques like edge detection, template matching, and color segmentation.

**Object tracking:** common methods of object tracking are Kalman filters to predict the object's future state based on its past behavior, Particle filters to represent the object's state as a probability distribution and updating it based on new measurements and optical flow to estimate the motion of image pixels to track objects.



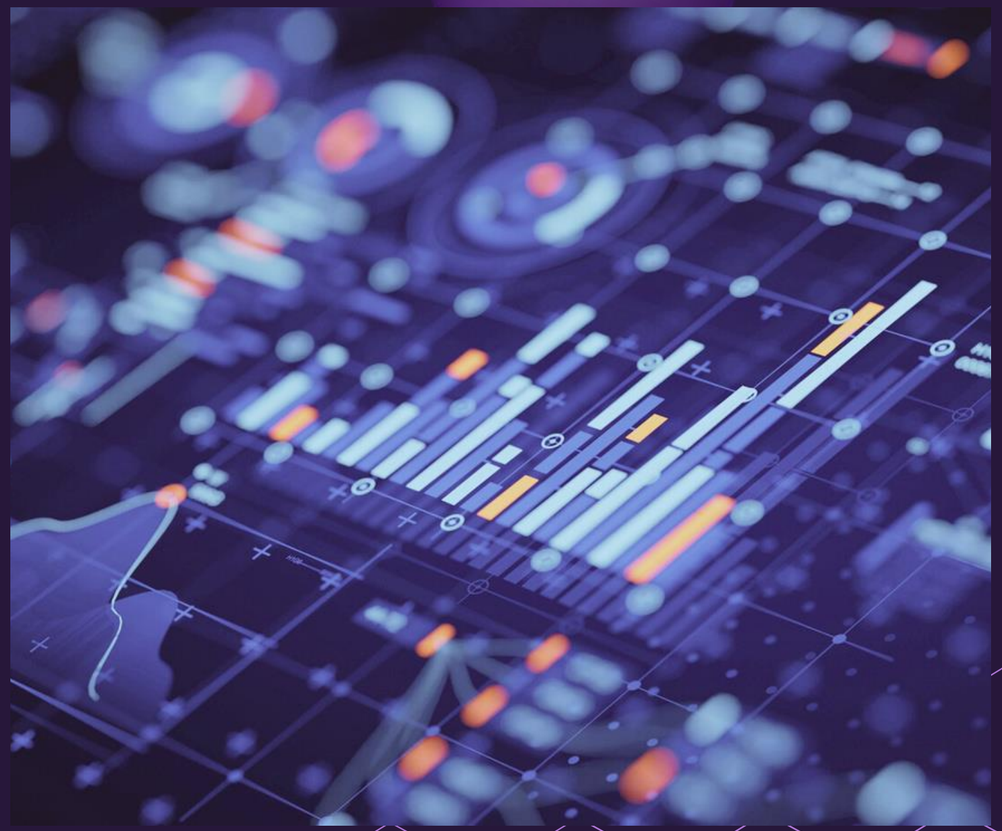

Prepare to scan | Define bounding box | Scan




Adjust origin | Test and Export

# DATA ANALYSIS AND INTERPRETATION

This step includes analysing real time data, making decisions or triggering actions based on analysed data and presenting relevant information on display.



# AUGMENTED REALITY OVERLAY

First virtual objects are rendered as 3D models, then they are aligned with the real-world environment based on the captured sensor data, this is followed by overlaying rendered virtual objects onto the captured scene, creating the augmented reality experience

# USER INTERACTION

The user interacts with the AR systems through various input devices, such as touchscreens, voice commands, or hand gestures.

The AR system provides visual, auditory or other sensory feedback to the user in response to their interactions.

# INFORMATION STORAGE AND ANALYSIS

The collected data is stored for further analysis and reference. Advanced analytics techniques can be applied to identify trends, patterns, or anomalies within this data.

# 04

# APPLICATIONS

# HEALTHCARE

AR monitoring systems in healthcare can assist doctors and medical professionals by overlaying crucial patient data onto their view during medical procedures.

**EX :**

- **Surgical Assistance:** HoloLens shows 3D anatomy overlays during surgery for better precision.
- **Vein Visualization:** AccuVein maps veins on the skin in real time.
- **Remote Assistance:** Proximie enables real-time expert guidance via AR.

# INDUSTRIAL MAINTAINENCE

AR monitoring systems in industrial maintenance help technicians by overlaying technical information onto equipment in real-time.

**EX :**

- **Equipment Repair:** AR headsets display step-by-step repair instructions, diagrams, and animations on the machinery.
- **Remote Assistance:** Vuforia Chalk enables remote expert guidance via live annotations.
- **Predictive Maintenance:** AR shows real-time sensor data to detect issues early reducing downtime and maintenance cost.

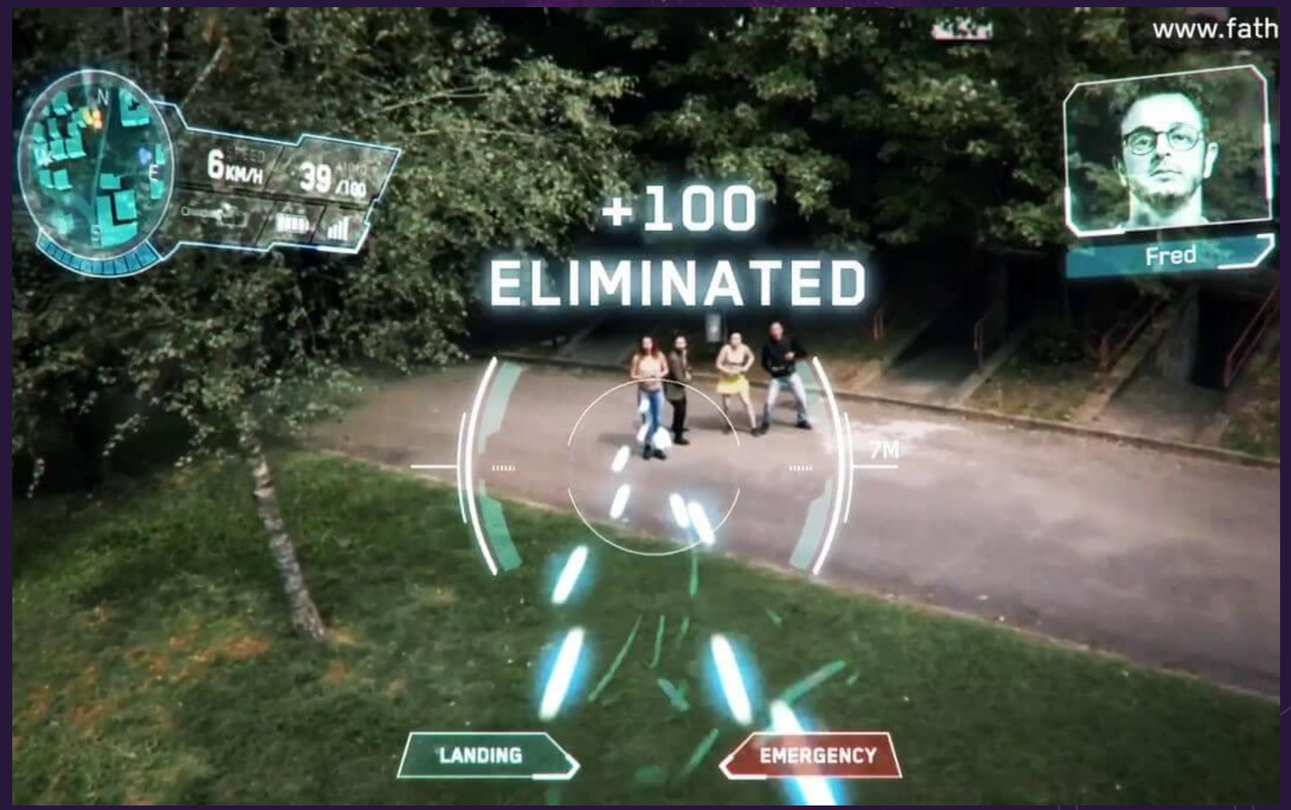
# GAMING INDUSTRY

**Immersive Gameplay:**

- AR monitoring systems create an engaging experience by blending digital elements with the real world.
- Example: Players can interact with virtual objects as if they are part of their physical environment, making games like Pokémon GO more immersive.

## Enhanced Motion Tracking:

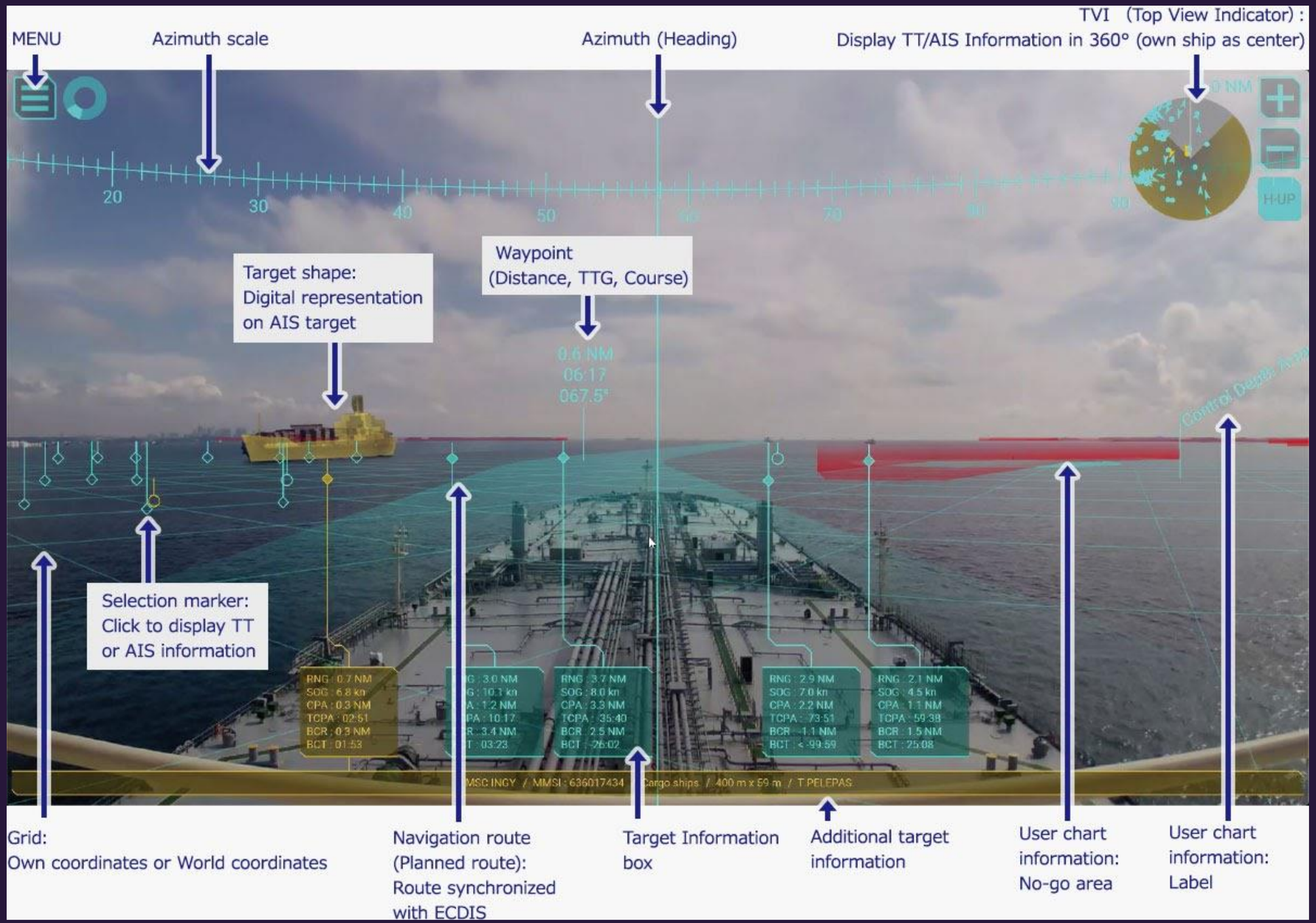
- Real-time tracking of players' gestures, movements, and surroundings allows for intuitive control and interaction.
- Example: AR-based sports games where players can mimic real-world actions (like swinging a bat or sword) to control gameplay.



# NAVIGATION

**Augmented Driving Assistance:**

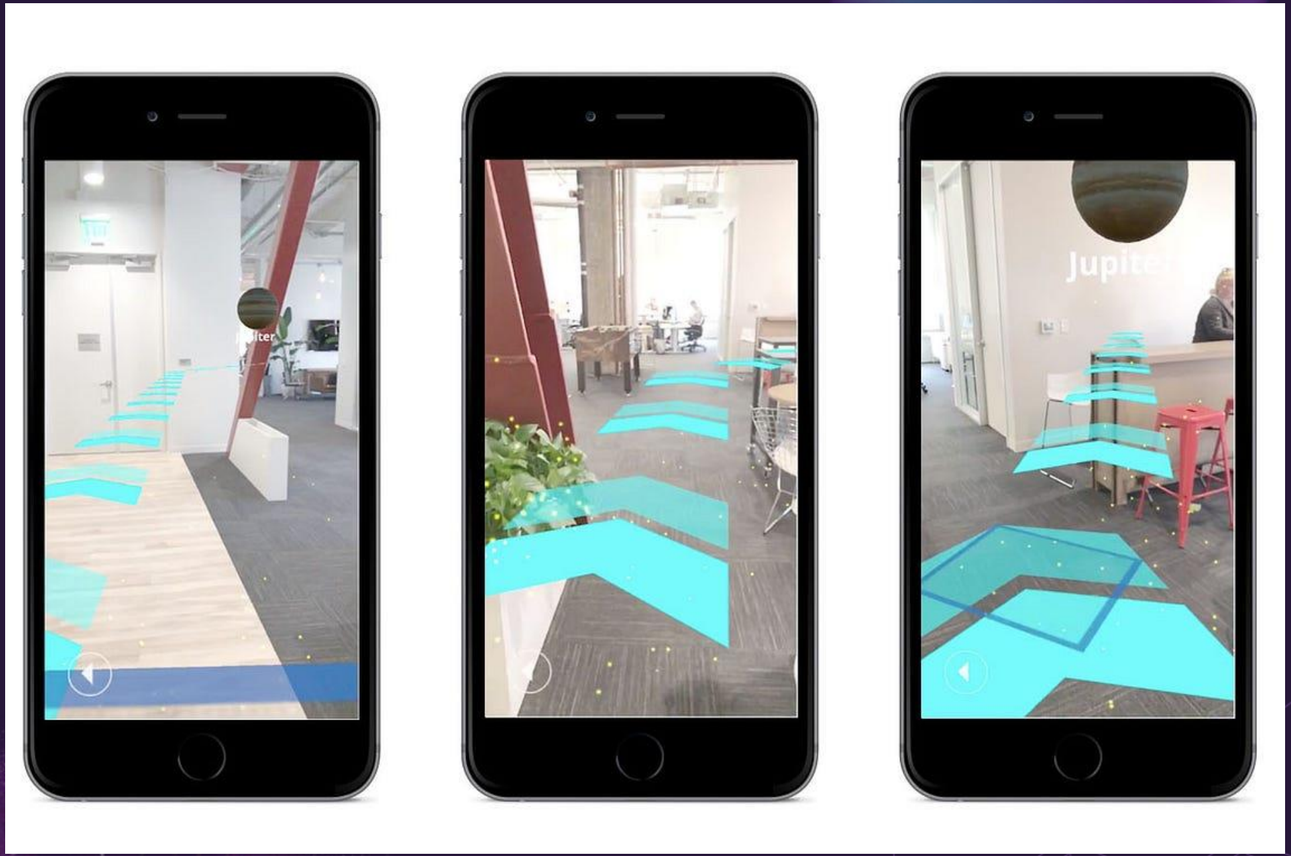
AR overlays critical information, such as route directions, speed, and alerts, directly onto the driver's windshield.


MENU
Azimuth scale
Azimuth (Heading)
TVI (Top View Indicator) :
Display TT/AIS Information in 360° (own ship as center)
20
30
40
50
60
70
80
90
H-UP
Waypoint
(Distance, TTG, Course)
0.6 NM
06:17
067.5°
Target shape:
Digital representation
on AIS target
Selection marker:
Click to display TT
or AIS information
RNG : 0.7 NM
SOG : 6.8 kn
CPA : 0.3 NM
TCPA : 02:51
BCR : 0.3 NM
BCT : 01:53
RNG : 3.7 NM
SOG : 8.0 kn
CPA : 3.3 NM
TCPA : 35:40
BCR : 2.5 NM
BCT : -26:02
RNG : 2.9 NM
SOG : 7.0 kn
CPA : 2.2 NM
TCPA : 73:51
BCR : 1.1 NM
BCT : < -99:59
RNG : 2.1 NM
SOG : 4.5 kn
CPA : 1.1 NM
TCPA : 59:38
BCR : 1.5 NM
BCT : 25:08
MSC INGY / MMSI : 636017434
Cargo ships / 400 m x 59 m / T PELEPAS
Grid:
Own coordinates or World coordinates
Navigation route
(Planned route):
Route synchronized
with ECDIS
Target Information
box
Additional target
information
User chart
information:
No-go area
User chart
information:
Label

**Indoor Navigation:**

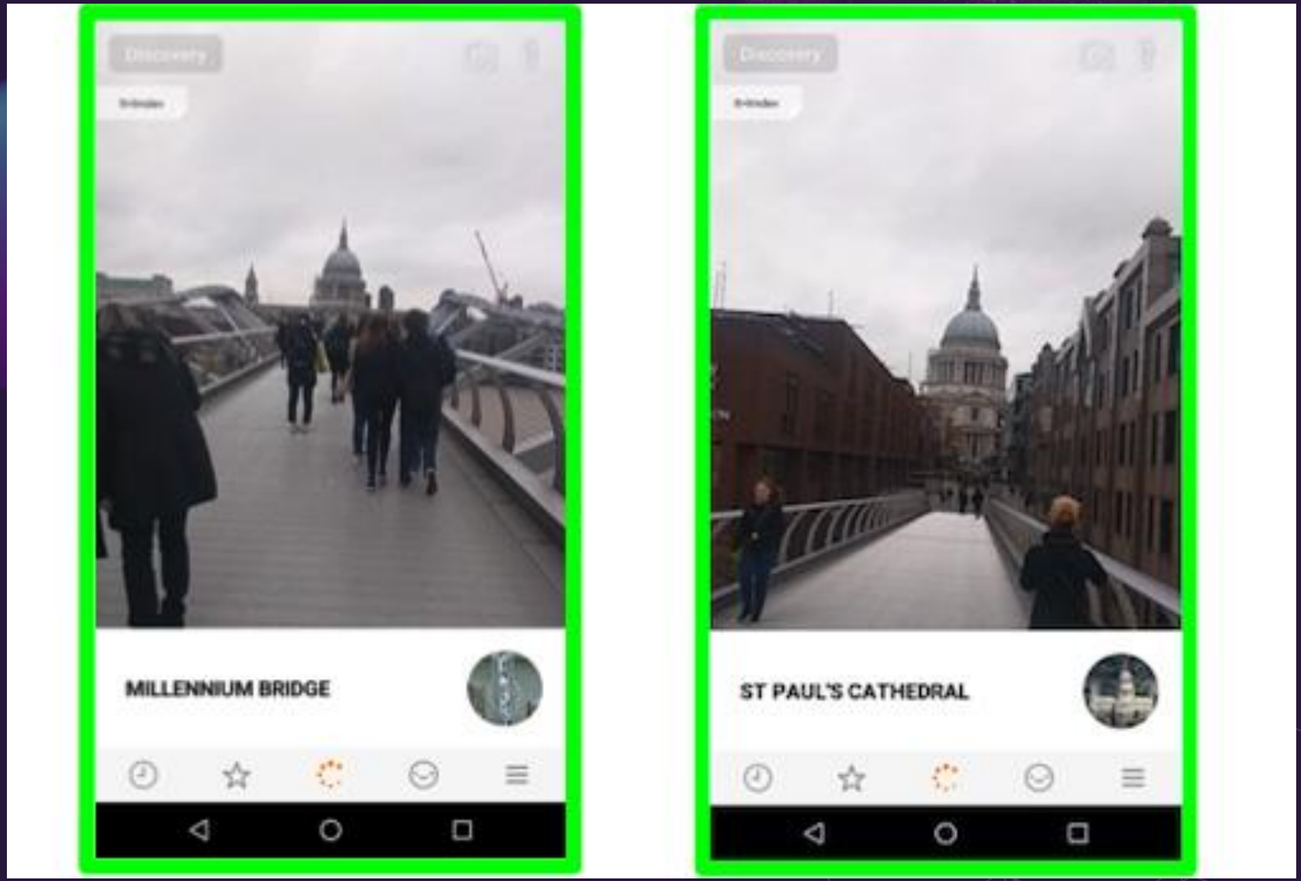
- Offers precise, real-time guidance in large or complex indoor spaces like malls, airports, and hospitals.

- Example: AR apps that display directional arrows and points of interest on the user’s smartphone screen or AR glasses, guiding them to their destination without confusion.



## Landmark Recognition and Information Display:

Identifies landmarks, buildings, and objects, providing relevant information overlaid on the user's view.
Example: Tourist applications that show historical facts, ratings, and details about monuments, restaurants, or stores when users point their devices at them.



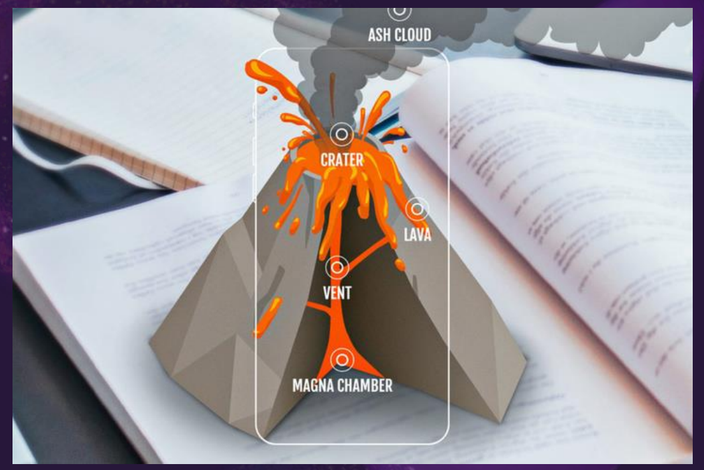
# EDUCATION

- AR systems can measure factors like eye gaze, facial expressions, and head movements to assess a student's level of engagement with the AR content.

- Students can receive instant feedback on their performance, helping them identify areas where they need to improve.

- AR can be adapted to meet the needs of students with disabilities, providing a more inclusive learning experience.
- AR systems can monitor group interactions and identify potential issues or challenges in collaboration.

Eg: Virtual Labs,Language Learning.



# TRAININ G

- AR systems can monitor trainees' performance on specific tasks, such as equipment operation or procedural steps, to identify areas for improvement.
- By tracking errors or mistakes made by trainees, trainers can provide targeted feedback and remediation.
- AR can be used to simulate hazardous situations and train trainees to identify and respond appropriately.
- EG: Surgical Simulations,Equipment Maintenance,Emergency Response.

05

# Challenges in AR Monitoring

# SECURITY AND PRIVACY CONCERNS IN AR MONITORING

## Securing Collected Data

- **Types of Data:** Personal Identifiable Information (PII), behavioral data, and environmental data.
- **Security Threat**s: unauthorized access, data interception, and malware attacks.
- **Best Practices:** Implement data encryption, access controls, regular security audits, and user education.

# Addressing Privacy Issues

- **Privacy Concern:** Informed consent, surveillance, and data retention.
- **Legal Considerations:** Compliance with GDPR and CCPA.
- **Privacy Protection:** Transparency, data minimization, user control, and anonymization.

# UPDATES AND MAINTENANCE

- Regular updates and maintenance require significant time, effort, and financial resources.

- Implementing updates and maintaining compatibility with changing technologies can be complex and challenging, especially for organizations with limited technical expertise.

# THANKS!