AR GIS Technology for Smart Park Application

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What is Smart Park

Smart park refers to the use of a new generation of communication technology and digital technology deeply applied to park management and operation, with rapid information collection, high-speed information transmission, rapid information calculation comprehensive application capabilities

What To ACHIEVE in DIGITAL OPERATION for SMART PARK?

- ❑ equipment management
- ❑ asset management
- ❑ investment leasing
- ❑ property services
- ❑ other digital operations in the park,

Improve the competitiveness of the park, and promote the sustainable development of smart park of the

Goals for Smart Park Construction

Smart Coding

AI-based Geocoding

Smart Map

Efficient Integrated of Map Services

Intelligent Analysis

Rapid Processing & Analysis of Spatial Data based on Distributed Computing

Smart Decision

Geographic Cognition and Decision Making based on Multi Source Data Fusion

Control

Fully autonomous & Controllable

Safety

Comprehensive Security System

Type of Ecology

Microservice based on API Ecology

System

Intelligent Operation and Maintenance Monitoring System

Smart Park Conditions

Smart Park Application

- Data Timeliness is weak
- Heavy reliance on backend processing
- Expensive underground management
- Difficult to provide accurate positioning services
- High precision GIS fusion is weak
- Limited exposure and interaction

Difficulty to Operate

- The project results under construction/ planning is difficult to use it in practice
- ...

Data Island

- Monitoring, Supervision and Management

Homogenization

- Function without Highlights
- The Effect is unremarkable
- Weak GIS, Biased Display

Smart Park Application

Difficult to Achieve, precise, global, penetrating Management

Digital Status of Smart Park

Most of it are Virtual Reality (VR) + Smart Parks, and also Augmented Reality (AR) + Smart Parks are rarely implement.

1

AR GIS for Smart Park Planning

2

AR GIS for Park Property Management

3

Discover AR GIS for AR Park Navigation

4

AR Park for Map Development Practice

AR GIS for Smart Park Planning

AR GIS For Smart Park Planning

01 Field investigation of the Park

02 Park Planning and Design

03 Approval of Park Construction

04 Acceptance of Park Construction

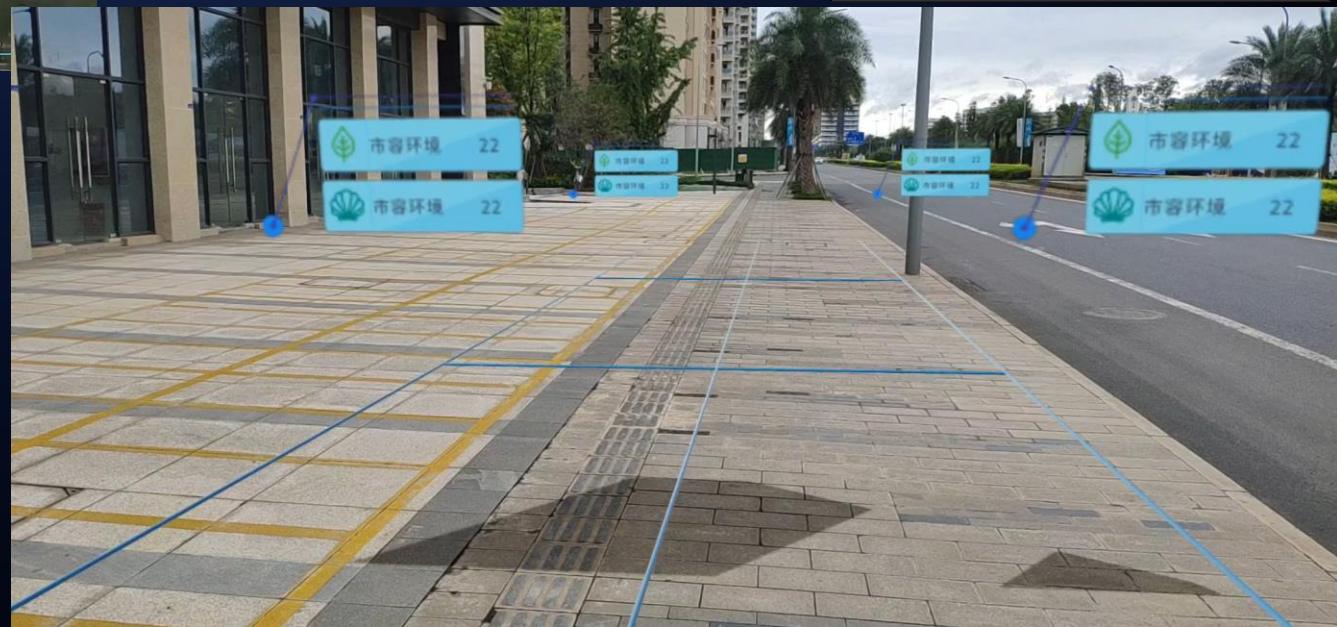
Park planning and acceptance, construction scene, virtual exhibition hall, electronic sand table...

What new experiences can be provided by combining AR GIS

Real Scene Survey of AR Park

Land Use Survey

Grid Law Enforcement



AR Park Planning and Design

Campus Greening

Factory Renovation Design

Scenic Route Design

Commercial Block Design

AR Park Design - Interior

Indoor AR Virtual Showroom Design

Indoor AR House Design

It is not only being applied on the internal planning of the park but it can also being applied to the planning of the bridge construction across the park.

Approval of AR Construction — Planning and Acceptance

Limitation

Planning Stage:

Mainly faced with the problem of time and space limitations during on-site investigation

Design Phase:

Unable to accurately adjust the design scheme according to the site conditions

Construction Stage:

There are obstacles such as construction progress control and comparison between construction and design plans

— A tablet device+ AR+GIS software, in the planning and design of construction acceptance phase helps to improve the traditional field work practice

Approval of AR Construction — Planning & Acceptance

AR Technology Route

Planning and Design Phase

- Design Scheme Mapping
- Feedback
- Feature View

Construction Stage

- Construction Progress Tracking
- Comparison of Design Scheme
- Progress Status Statistic Update

Acceptance Stage

- Acceptance Check
- Scheme Comparison
- On-site Investigation and Report

Keywords: AR Positioning, AR Map, AR Query, AR Analysis

Approval of AR Construction — Planning & Acceptance

Application Results

Planning and Design Phase

Construction Stage

Acceptance Stage

Acceptance of AR Construction

– Real Scene Section, Query, Comparison and Analysis of the Building

AR GIS for Park Property Management

AR GIS for Park Property Management

01 **Covert Facility Management**

02 **Park Component Management**

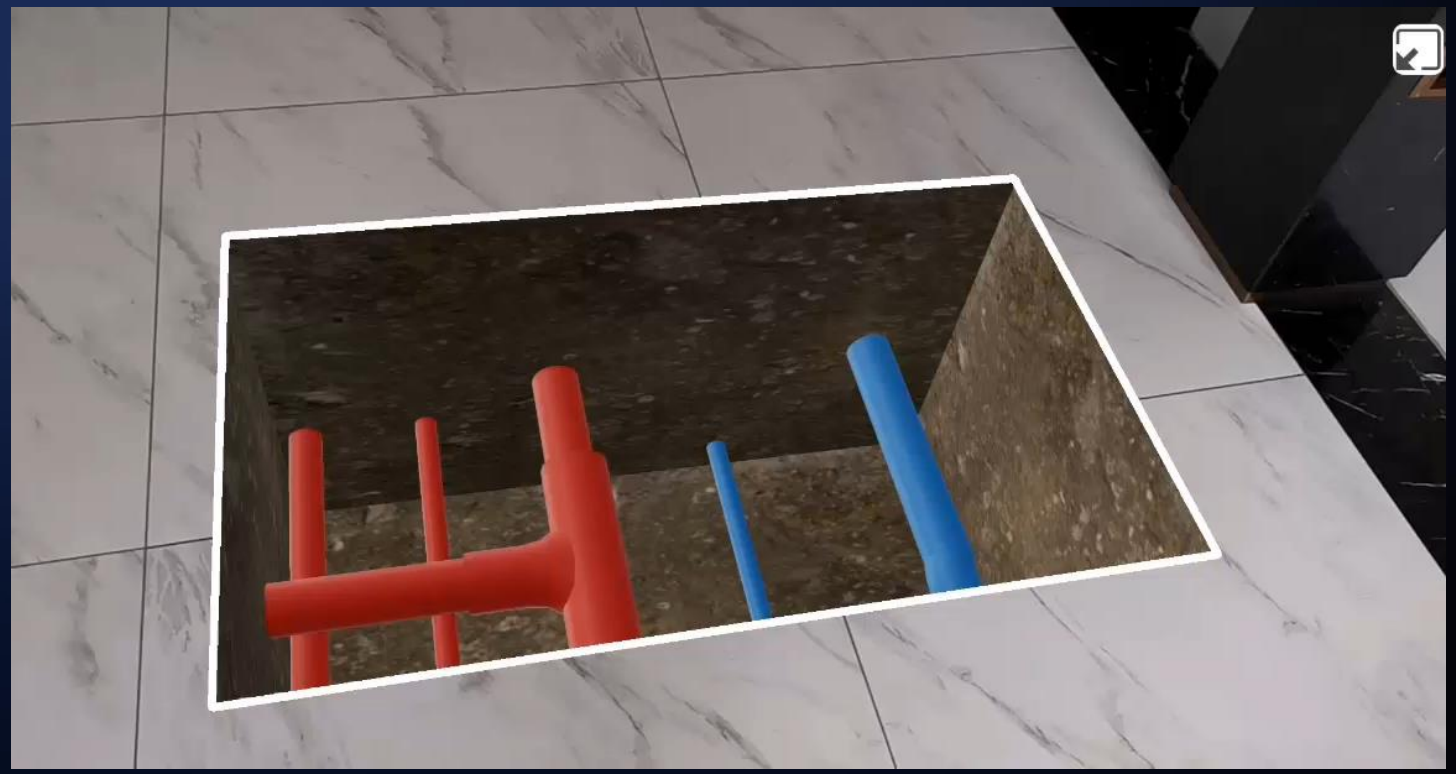
03 **Park civil air defense management**

04 **Park Vehicle Management**

05 **Park Facility Management**

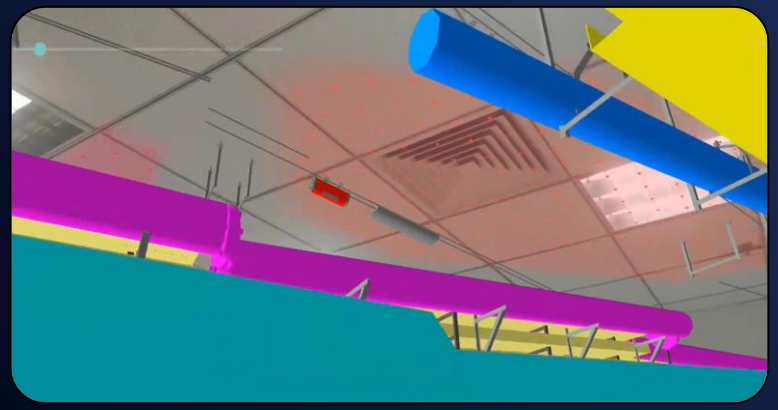
06 **Park Exhibition Hall Management**

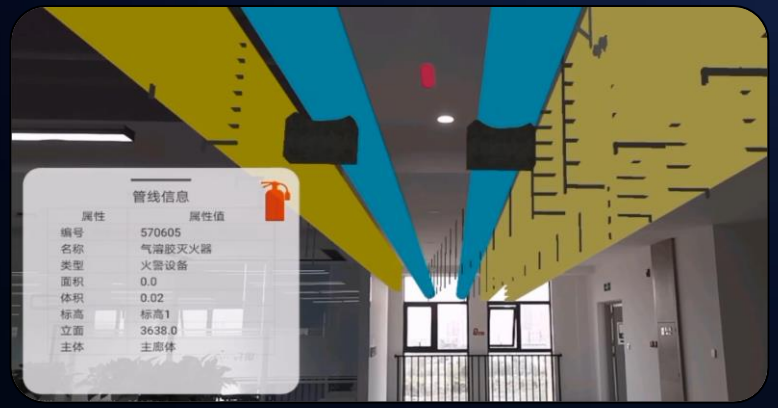
AR for Management of Hidden Facilities in Park

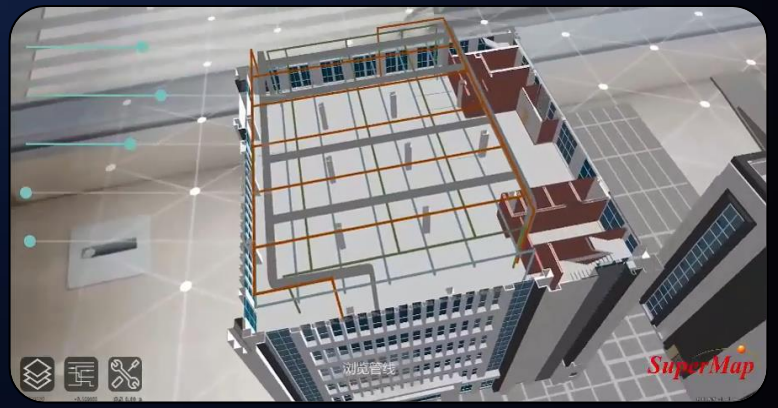


Virtual Excavation (Underground, Inside Walls, Roof)

AR for Management of Hidden Facilities in Park







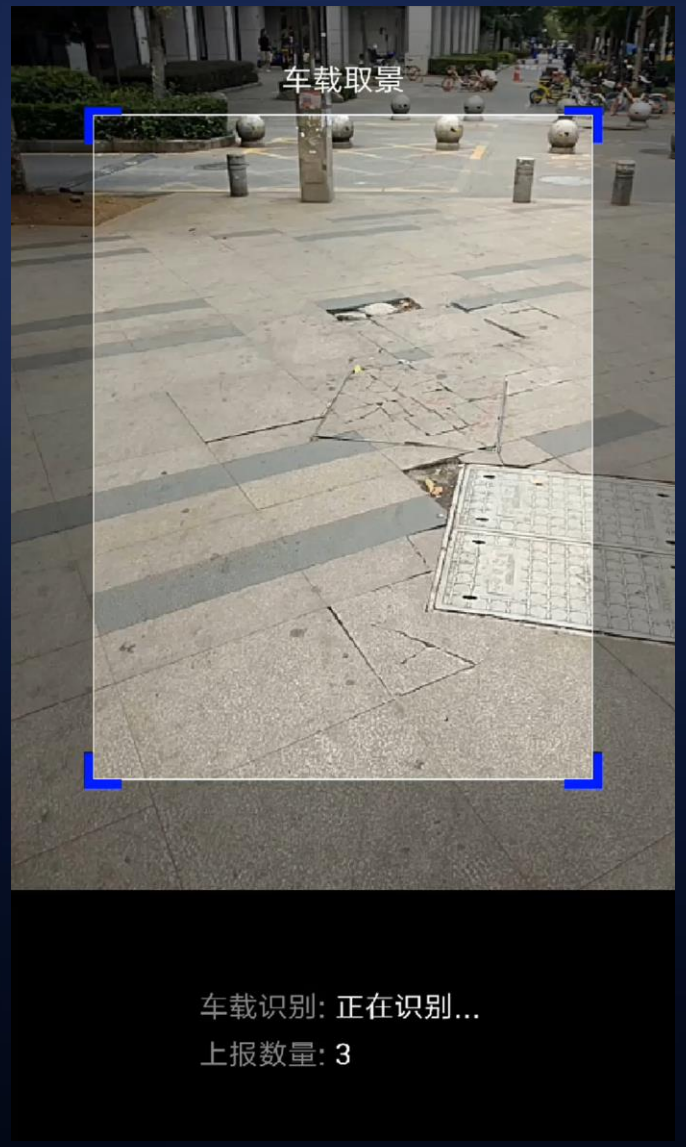
Indoor Concealment

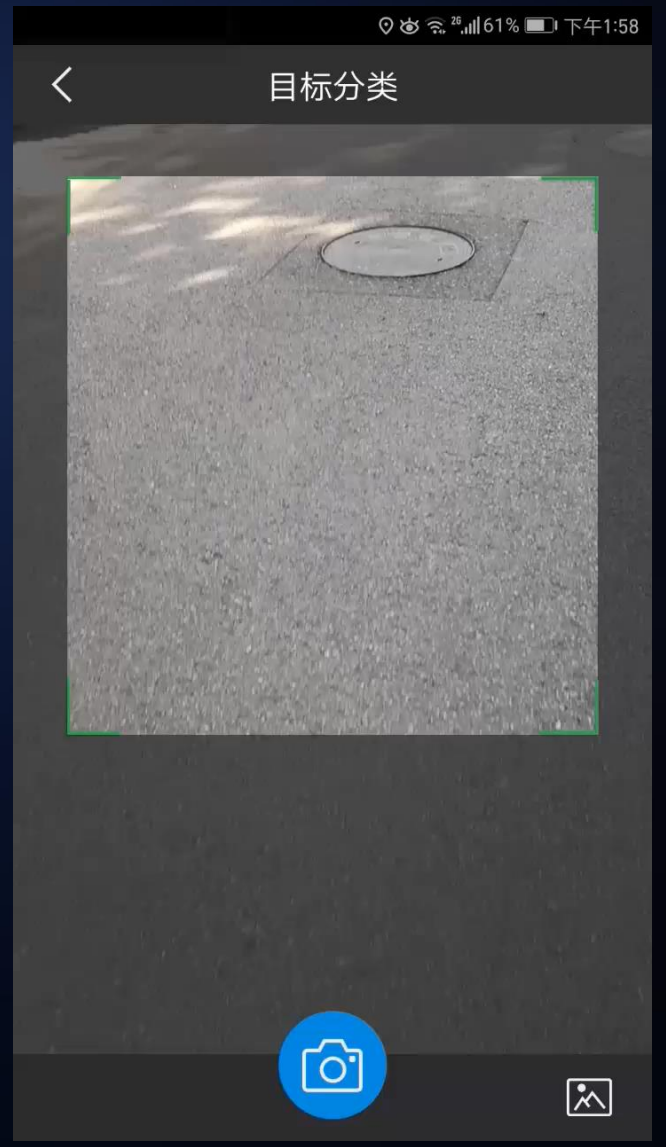
Outdoor Shelter

Hierarchical Management of BIM Hidden Facilities

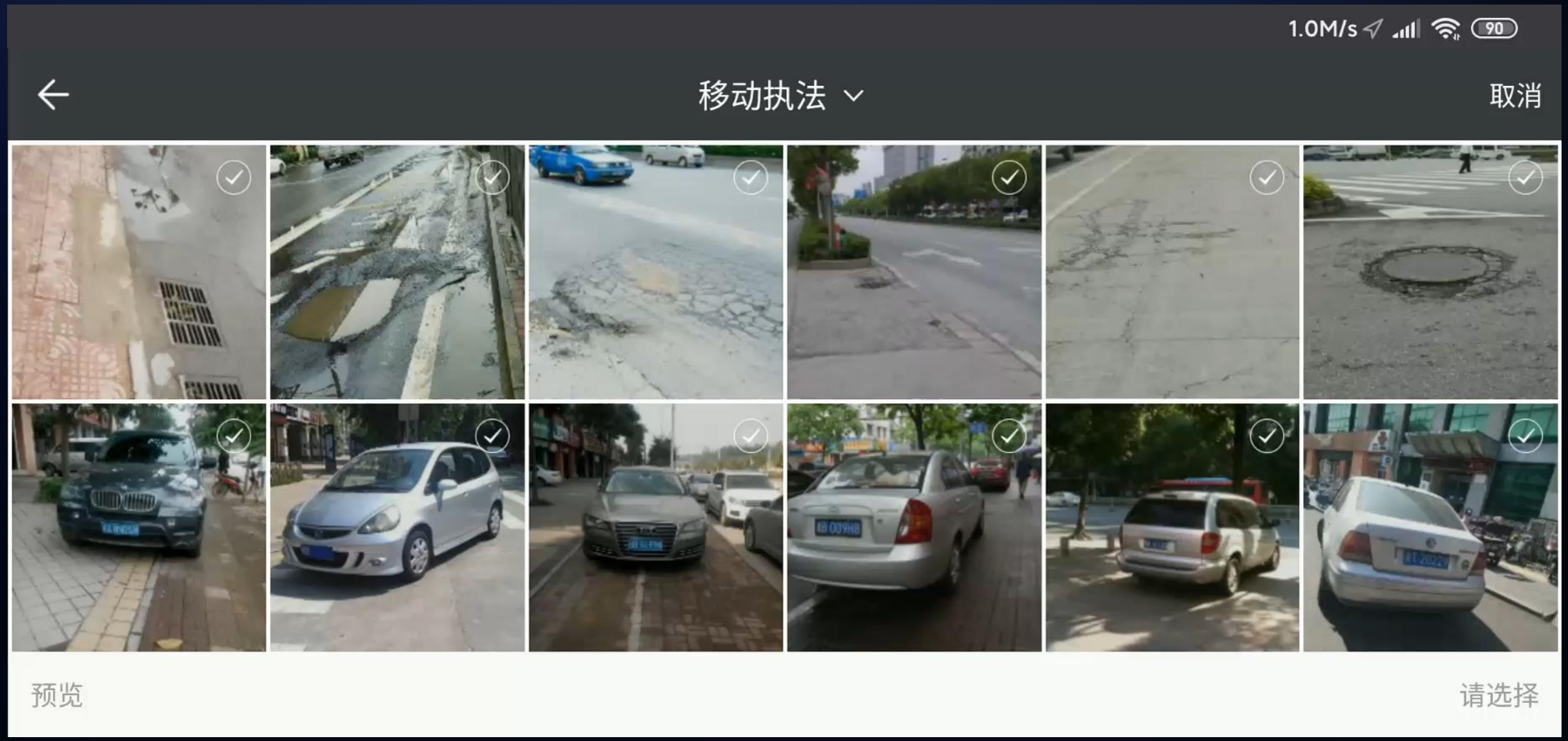
AR Park Management – Collection of Real Scene

AR Campus Management –
Business Components and Event Type Identification



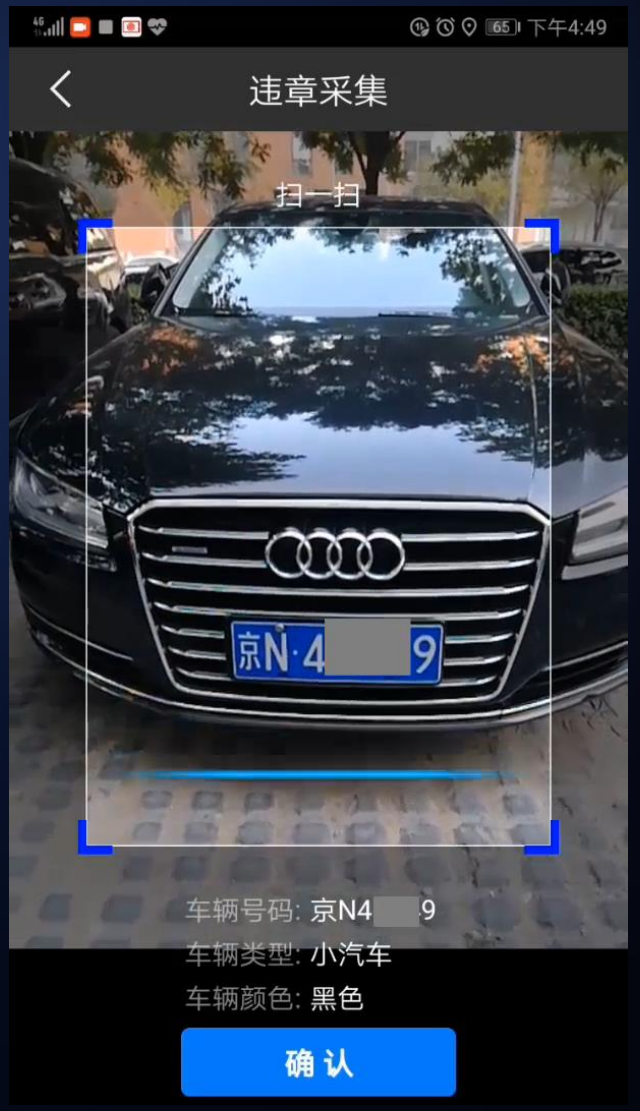


AR Park Components Management – Intelligent Identification and Results



AR Park Civil Air Defense Management – Monitoring of Key Personnel in the Park

AR Park Vehicle Management



AR Property Management

Building Management

Fire Facility Management

Greenfield Facility Management

Lighting Facility Management

AR Park Indoor Management – Virtual Exhibition Hall

Case: AR + AI Law Enforcement Application in Smart Park in xx City

Application Scenario

According to the business needs of rapid response to urban governance, combined with AI+AR to collect urban components and events, and quickly report daily inspections and abnormal situations in key areas.

Main Purpose

1.) AR Form Collection for Municipal Information

2.) Rapid report of Municipal Issues

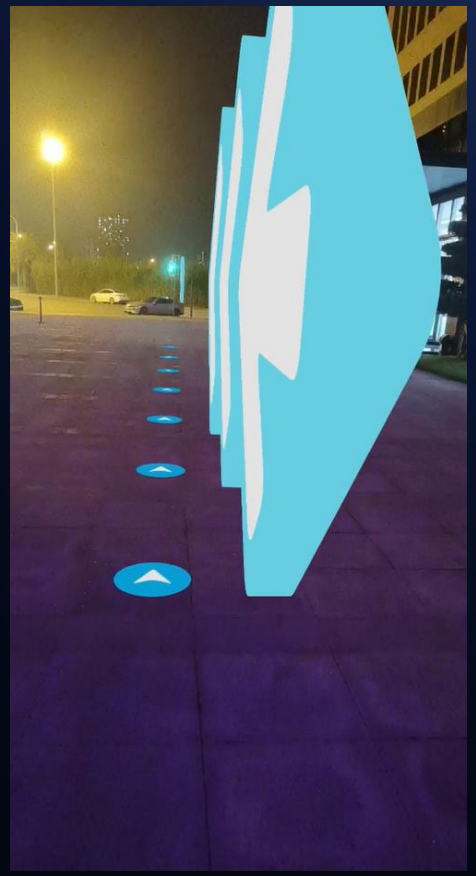
3.) Auto identification of urban governance problem

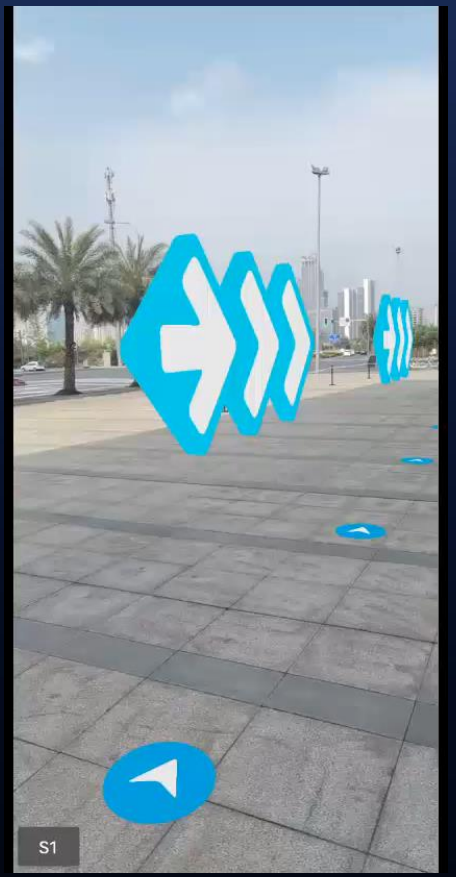
4.) Municipal geographic information display management

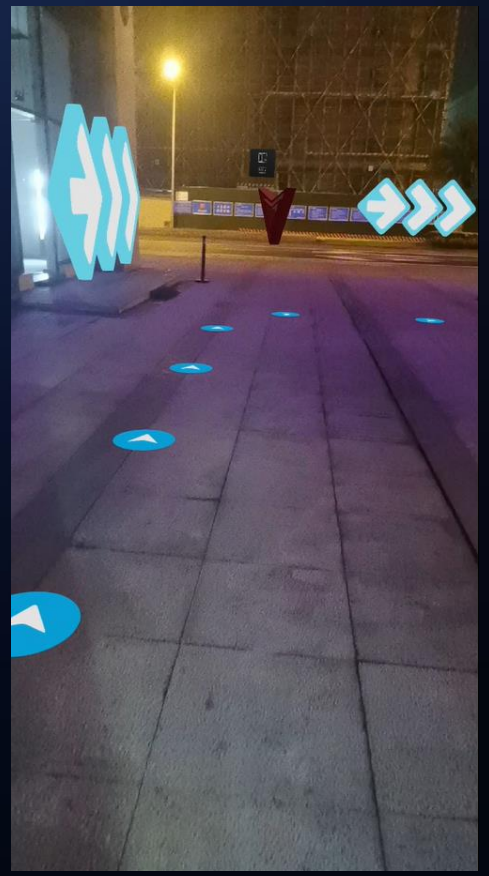
DISCOVER AR GIS for AR Park Navigation

High Precision, Large scale picture without real scene navigation

- AR Apps for Mobile Platforms
  - Support geographic coordinate system, planar and local coordinate system
  - Support mid to high end Android devices (Huawei, Xiaomi, Nova, Oppo, Vivo, Samsung)







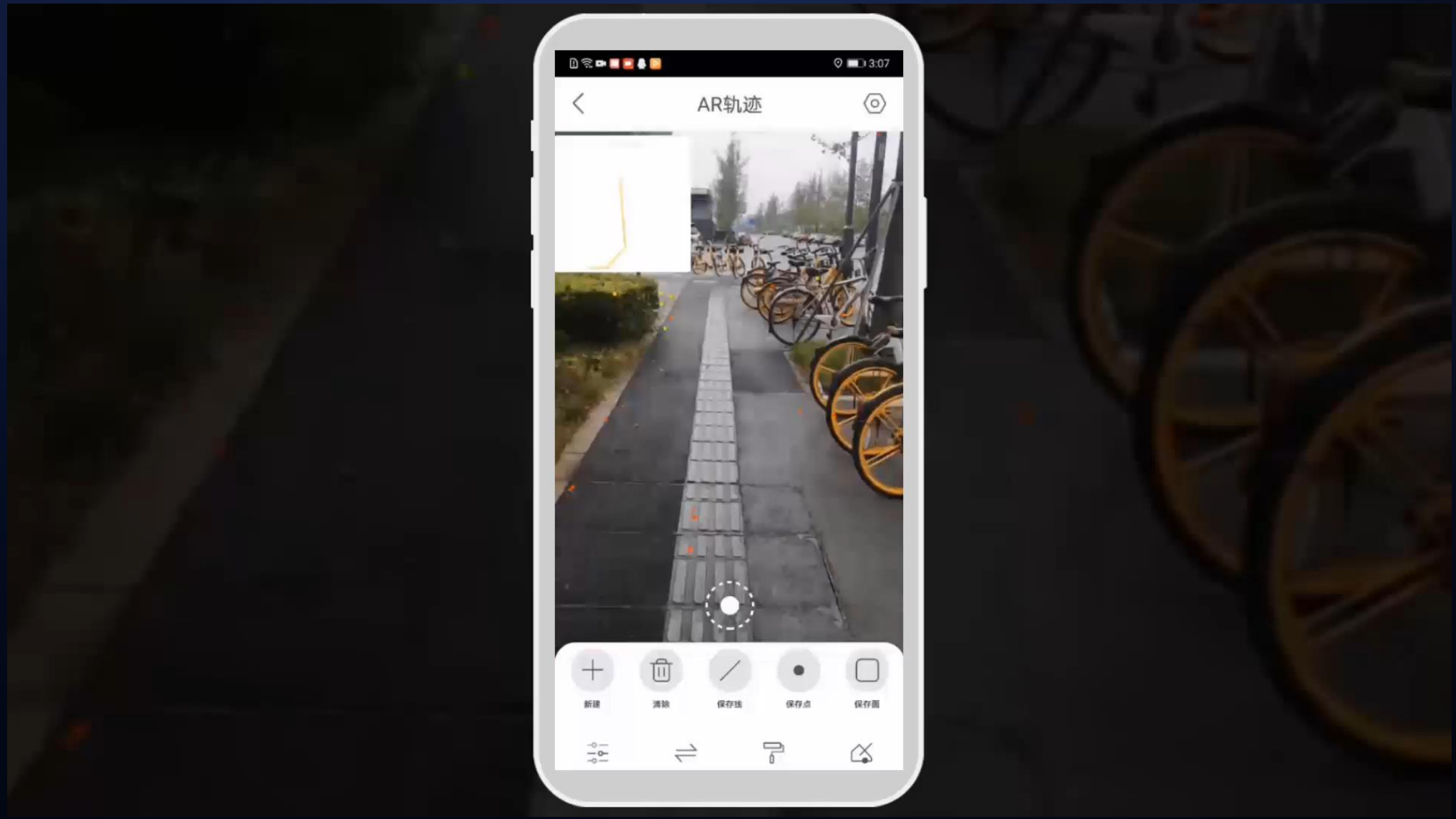
AR GIS Discovery for AR Park Navigation

01 Navigation route collection and compilation

02 Indoor and Outdoor Park Real Scene Navigation

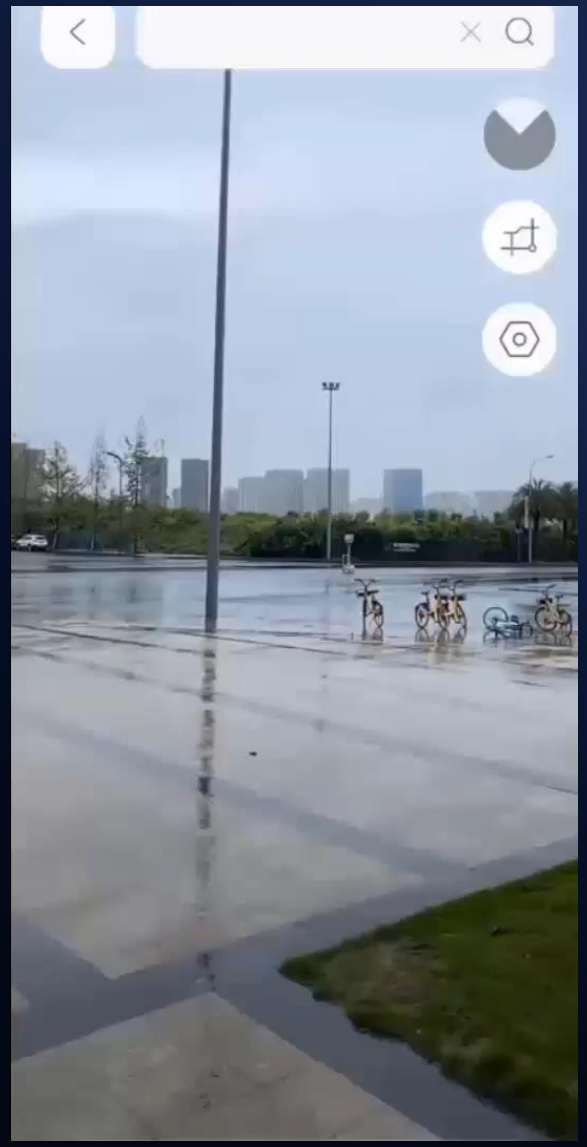
03 Logistic Distribution Navigation

AR Navigation Road Network Collection and Compilation



Indoor and Outdoor Park Real Scene Navigation

POI Retrieval and Planning



Indoor Park Navigation

Outdoor Campus Navigation

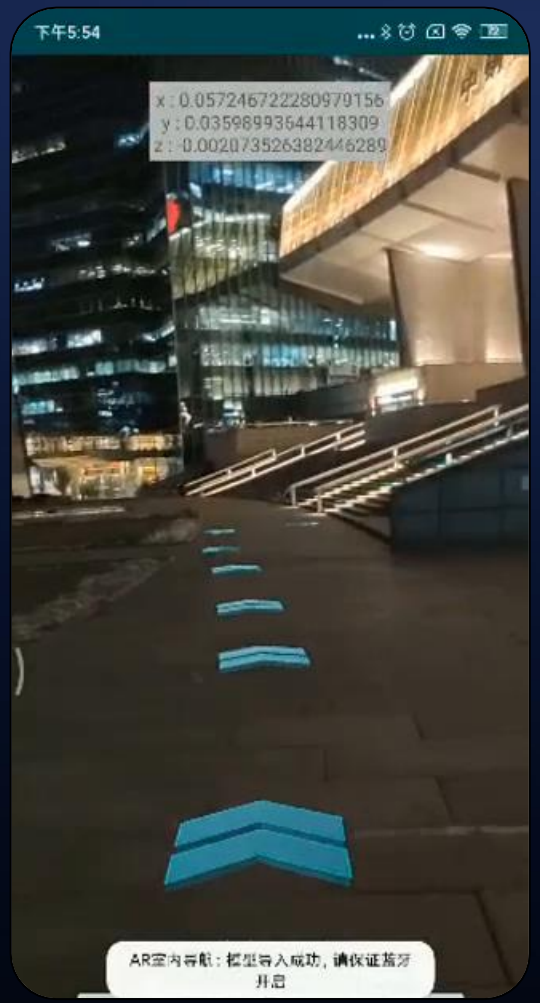
AR Park Navigation – Logistics Route Planning and Navigation

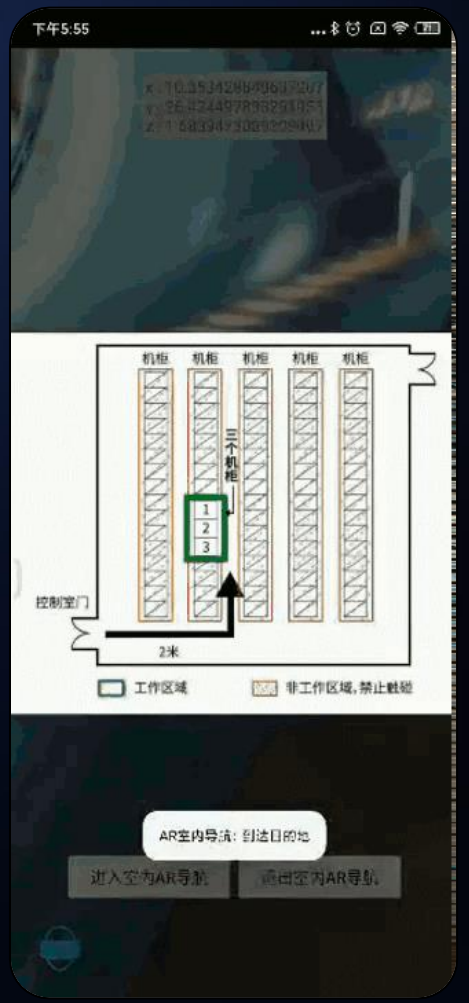
Based on 3D Scene Planning

Based on 2D Map Planning

Case: Application of indoor and outdoor AR venues in X Expo Park

Indoor and outdoor real-scene exhibitions in an exhibition hall park, combined with indoor and outdoor positioning, AR map placement and AR navigation for indoor and outdoor exhibition halls, target search and surrounding queries, guiding to the designated location。





AR Park for Map Development Practice

Development Steps of AR map for Park

Prepare Vector and Image Data

Product Support：SuperMap iDesktopX

Desktop-side AR Map Production

Product Support：SuperMap iDesktopX

AR Map Data Service/Analysis Service Publish)

Product Support：SuperMap iServer、SuperMap iPortal

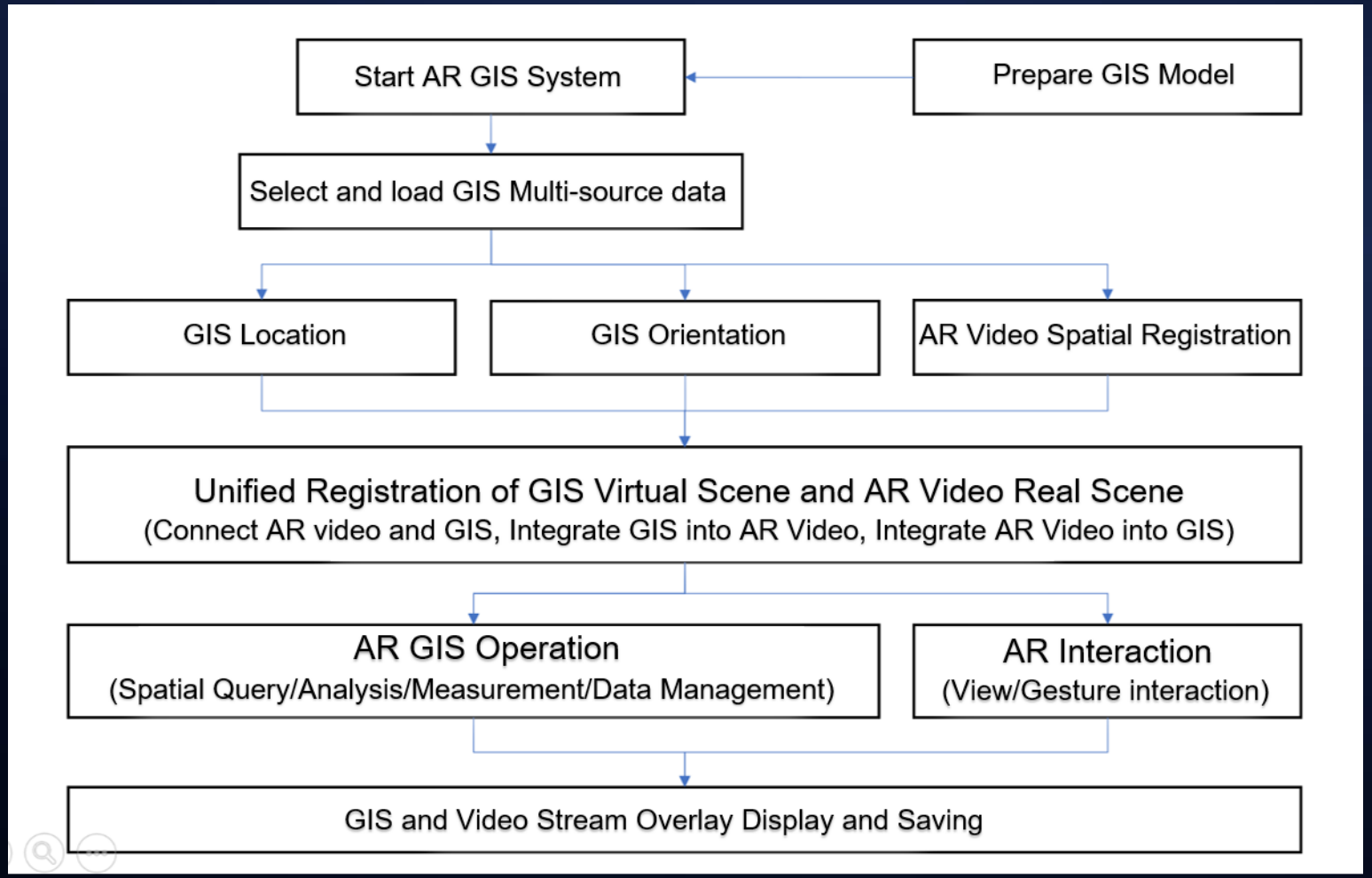
Configure AR Location and AR Resources on Mobile Terminal

Product Support：SuperMap iMobile 、SuperMap iTablet

Mobile Terminal Customized Map Application

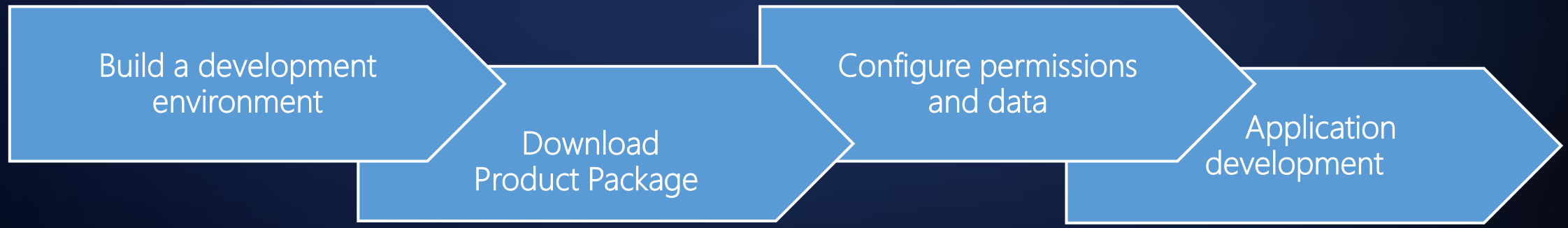
Product Support：SuperMap iMobile 、SuperMap iTablet

AR Reality Map Application – Key Technology Analysis



Cover Photography Equipment (Smartphones, Drone & CCTV)

AR Reality Map Development Process



Online：

http://support.supermap.com.cn/DataWarehouse/WebDocHelp/iMobileForAndroid/SuperMapObjectsEmbeddedHelp.htm

Offline：

Product Package/SuperMap iMobile 11i(2022) for Android.chm

Coordinate System in AR GIS

- **Camera World Coordinate System**
  - Origin: The real time position of the AR device relative to startup
  - Direction: X to the right, Y-axis upward, z-axis backward. In line with right handed coordinate system
  - Unit: (meter)

- **Geographic Coordinate System**
  - Origin: The position of AR device in the earth reference coordinate system
  - Direction: Always take geographic north as XY direction and Z direction points to the direction of the gravity vector of the AR device
  - Unit： Latitude and Longitude (B/L)

- **Camera Screen Coordinate System**
  - Origin: The real time position of the AR device on the 2D screen
  - Direction: Upper left or lower left corner is the starting point.
  - Unit: (pixel)

- **AR Device Pose**
  - Describe the transformation and update of the real time position of the AR device including the rotation matrix and translation vector
  - Rotation Matrix- When it multiplied by vector, it change the direction of vector and the size remain the same
  - Translation Vector- X/Y/Z translation components in three direction
  - Rotation quaternion- q=w+xi+yj+zk where w,x,y,z are real number; I,j,k are imaginary number

Requirement and Precaution

Requirement

- System Requirement：Android 7.0 above 64-bit (armv8)
- Product Package Requirement：SuperMap iMobile 10i for Android.chm and above
- Install ARCore/AREngine/ARKit on Android devices in advance
- Different devices may have slightly different results

Notes:

- It is recommended that the mobile phone should not have a black screen, and avoid multiple rotations, in-situ twisting, severe vibration, etc.
- Outdoor light and wind speed will interfere with the system, avoid interference from strong light and strong wind
- Indoor areas with weak textures may cause the system to get lost, avoid scenes like white


THANK YOU