CloudRidAR
A Cloud-based Architecture for Mobile Augmented Reality

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Introduction

- Mobile Augment Reality has exploded in popularity on mobile devices in various fields.

- Mobile Augment Reality enable users to interact with information without getting distract from the real world, it is a way to supplement the real world other than replace it.
Introduction

IKEA Furniture in your home
MAR Characteristics

- Most MAR applications are task-centred and well structured
  - These highly specialized applications often use specified architecture that are so much different. It is difficult to reuse the techniques in these architecture, although there are some same basic functional module.

- The performance for MAR application is still very limited due to the poor computing capability of mobile devices.
  - Computational intensive tasks are offloaded on cloud to accelerate computation in order to guarantee performance.
CloudRidAR Architecture Design

1. Easy to use for developer: it includes ready-to-use functional modules that provide uniform interfaces for developers.
CloudRidAR Architecture Design

2. real-time performance for user: based on cloud architecture, computational intensive tasks are offloaded to cloud.

Benefit: save computation time
   eliminates hash requirement of hardware and software on mobile devices.
   save power energy and prolong battery life.
3. Scalable across different mobile platforms: CloudRidAR introduces an abstract layer to encapsulate diverse hardware on mobile devices. Upper modules are built on hardware abstraction layer to make applications portable across various mobile platforms.
System Implementation
System Implementation

Hardware Abstraction

Traditional MAR applications built on specific hardware platform
- Difficult to reuse-

Solution:
- adopt a model for hardware with several common interfaces.
- Each hardware has a XML-based configuration file to describe characteristics and function
- a uniform interface to access various computing resources (CPU, Mobile GPU, cloud)
System Implementation

XML-based configuration file:

```xml
<hardware type = “ACCELERATOR” id=“accl” >
  <specification>
    <accuracy> “0.0015 0.0015 0.0015” </accuracy>
    <resolution> “0.001 0.001 0.001” </resolution>
    <update rate> “300” </update rate>
    <lag> “0.03” </lag>
  </specification>
  <output id = “velocity” type = “vector3” default = “0 0 0”>
  <output id = “acceleration” type = “vector3” default = “0 0 0”>
  <interface>
    <function name=“init” parameter = “void” output = “void”>
    </function>
  </interface>
</hardware>
```
System Implementation

Data-Driven Flow

1. Initialization: registered hardware will automatically recall the predefined function in the configuration file.
2. Task allocation mechanism decides which part to offload.
3. All tasks are synchronized.
4. Users can interact with the system in various way, such as gesture and voice control.
System Implementation

Application Container

-->a run-time context tightly coupled with the application logic.

- most MAR applications are task-driven

- can be abstract as a finite state machine (FSM)
System Implementation

Finite state machine (FSM)

→ users have several predefined sequences to finish tasks.

→ application switches from one state to a new state when transition condition is satisfied.

→ application logic is separate from execution and display

→ enables rapid development of application
Applications Using CloudRidAR

Most important part for these two application is feature tracking of pose estimation.
Questions?