An Intent-Based Management Framework for On-Device Artificial Intelligence Devices

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***Abstract*—This paper proposes an intent-based framework for On-Device Artificial Intelligence (AI) called On-Device AI (shortly ODAI). ODAI is a technology trend to open user-friendly intelligent services in living domains. ODAI devices need to collaborate with a cloud system with computing resources. In an ODAI framework, an ODAI user can give a command to the cloud system with either voice or text in a natural language. The cloud system understands the command by a Large Language Model (LLM) and translates it into a policy that is enforceable by ODAI devices.**

I. Introduction

Recently, Internet of Things (IoT) has opened a new door to On-Device Artificial Intelligence (AI) called On-Device AI (shortly ODAI) for intelligent IoT services. In this paper, an Intelligent IoT Device is equivalent to an ODAI Device. This ODAI device can autonomously and intelligently observe its environment with various sensors and respond to events and conditions in the environment with its actuators according to an intent from its user. Note that an intent is a declarative configuration for a required goal, and a policy is an imperative configuration to specify steps to achieve the goal.

This papers proposes a software framework for an intent-based management system for ODAI devices. That is, this framework is an Intent-Based Management Framework for ODAI devices. This ODAI framework consists of an ODAI cloud (e.g., a central cloud and an edge cloud) and ODAI devices. ODAI devices includes robots, Software-Defined Vehicles (SDV), Unmanned Aerial Vehicles (UAV). Service Functions (SF) in an ODAI device can have a cloud-native platform like Kubernetes [1] to manage its containers for SFs for network, security, and AI applications.

II. Intent-Based ODAI Framework

For autonomous and intelligent management of various SFs in an ODAI device, an intent-based management framework is required between an ODAI Cloud and an ODAI Device. Fig. 1 shows an Intent-Based ODAI Framework for ODAI devices. This framework consists of an ODAI Cloud and ODAI Devices. The ODAI Cloud consists of ODAI User (as a system administrator), ODAI Controller (as an orchestrator for the ODAI Cloud), Knowledge Graph (as a main repository for ODAI management and monitoring), ODAI Analyzer (as a monitoring data analyzer for ODAI devices), and ODAI Vendor's Management System (as a vendor system to provide cloud-native containers). An ODAI Device is composed of IoT

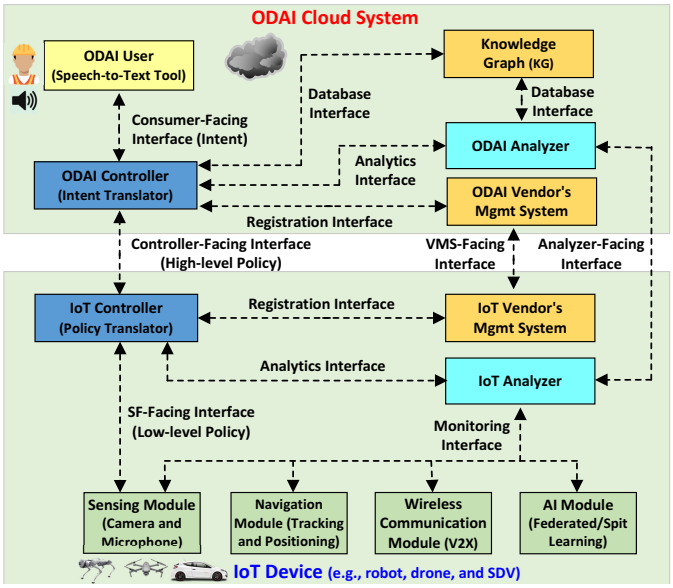

Fig. 1. Intent-Based Management Framework for Intelligent ODAI Devices

Controller (as a manager for an ODAI device), IoT Analyzer, IoT Vendor's Management System, and SFs such as sensing module, navigation module, wireless communication module, and AI module for autonomous ODAI services.

In Fig. 1, an interface exist between each pair of system components in the ODAI framework. An intent, a high-level policy, and a low-level policy can be expressed in XML documents based on YANG data models [2]. They can be delivered to the SFs via a message delivery protocol such as NETCONF [3] and RESTCONF [4].

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