Application Notes

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# Smart Car

## Abstract

In contrast to a traditional mechanical car, the Smart Car is a highly computerized automobile featuring ubiquitous computing, intuitive human-computer interaction and an open application platform. In this paper, we propose an advanced Smart Car demonstration platform with a transparent windshield display and various motion sensors where drivers can manipulate a variety of car-appropriate applications in augmented reality. Similar to smartphones, drivers can customize their Smart Car through free downloads of car-appropriate applications according to their needs. Additionally, three potential car-appropriate applications related to computer vision are investigated and implemented in our platform for increased driving safety. The first and second car-appropriate applications aim to enhance the driving visual field by restoring the low-visibility scenes captured during inclement-weather or nighttime driving conditions to be high-visibility ones, respectively, and display them on a transparent windshield display. We also survey pedestrian tracking techniques that combine multiple driving recorders' information as a mobile surveillance network, including one proposed framework we have developed as the third car-appropriate application. By embedding these car-appropriate applications, the Smart Car has the potential to increase safety of driving conditions both in daytime and nighttime, even in bad weather.

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## I. Introduction

Ubiquitous sensors, devices, networks, and information are opening the door to a smart world in which smart devices have extended computational intelligence throughout the physical environment to provide reliable, relevant services to users [1]. These devices are getting smarter, more multi-functional, and more customizable to allow users to access and store comprehensive information via many downloadable applications.

In general, the smart devices are characterized by three important properties:

- ❏ Ubiquitous computing (ubicomp): assessing information or being assessed interactively and autonomously everywhere and anywhere via various sensors over different wireless protocols.
- ❏ Human computer interaction (HCI): the essential interfaces of smart devices that offer an interaction between human and computer.
- ❏ Applications platform: allowing users to download the third-party application (app) software for customizing their smart devices.

Thanks to these properties, smart devices can act as critical facilitator for the Internet of Things (IoT) through the use of recent information and communication technologies (ICT), such as mobile operating systems (e.g., Android, iOS, Windows Phone, etc.), multimedia interface, internet access (e.g., Bluetooth, NFC, Wi-Fi, 3G, 4G/LTE, etc.), mobile apps, digital cameras, global positioning system (GPS) sensors, motion sensors, and so on.

So what will the next generation devices be like? Let's take a look at the facts in terms of mobile phones and televisions. Mobile phones, which were truly the first pervasive transportable

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