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Editorial

Enabling Technologies for Smart Mobile Services 2020

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Mobility of people (users) plays an important role in day-to-day life, and currently these users are overwhelmed by a variety of services. Mobile services belong to an essential segment of modern communication services, and new trends in these consist of smart services, defined as a variety of context-aware services. Additionally, smart mobile devices (smartphones) can fulfil an astonishingly wide range of demands of users and providers. One of the reasons behind mobile development is the ever-growing computing power and communication capabilities of mobile devices. Furthermore, smart mobile devices offer new human-computer interfaces like speech recognition or touchscreens and employ powerful sensors, such as GNSS receivers, inertial sensors, or new communication platforms. The mentioned supporting technologies enable the provision of a completely new spectrum of context-aware, personalized, and intelligent services and applications. This raises device utilization issues, not only from the communication point of view but also for device smartness purposes. Smartphones, in fact, are very powerful devices with constantly increasing processing, communication, and sensing capabilities, and very recently, a large plethora of proposals have emerged to leverage those capabilities to contribute to the information production process. Smart mobile devices can be used in the health care sector and in the transportation sector, and in addition, multimedia services form a very interesting sector.

Because a variety of wireless telecommunication services need position information for real-time service operation, almost all modern devices are equipped with GNSS sensor. However, it cannot always be used due to the corresponding received signal strength level being too low or there is no signal present at all. In these cases, alternative positioning solutions are available or can be implemented. These alternative positioning solutions mainly utilize the improving mobile device performance such as increasing processing, communication, and sensing capabilities. A challenging wireless mobile environment impacts on the delivering of these services, as each service is sensitive to the immediate status of the radio channel in different ways, and these need to be considered in the services design.

Recently, we are witnessing a dynamic cloud computing evolution in nearly all areas of human activities exploiting information technologies. The implementation of solutions based on the idea of cloud services produces new challenges in areas such as management, security, technical solutions, infrastructure modelling, and mobile devices support.

This Special Issue aims at reporting on some of the recent research efforts on this increasingly important topic. The nine accepted papers in this issue cover interesting research topics: effective radio spectrum allocation, complex outdoor smart parking system based on IoT, utilization of IoT in education process, an effective and full-function palmprint authentication system regarding the application on an Android smartphone, smart chair system for sitting posture detection based on IoT, determination of behavioral intention to accept IoV (Internet of Vehicles) services, privacy issue in location-based services, analysis of mobile signal strength experienced by users, and the impact of the GPS interference caused by jamming and spoofing on the function of the DVB-T SFN network.

The paper entitled "Smart Radio Resource Management for Content Delivery Services in 5G and Beyond Networks" by D. Neznik et al. presents the idea, that effective spectrum allocation to devices is not an option but a requirement in a huge data flow environment of the wireless communications, if one wants to ensure acceptable speed and quality of the connection and to provide adequate quality of the services. Each of the selected methods for radio resource management has some advantages and disadvantages in the evaluation of results. The process of channel allocation with different methods for IEEE 802.11xx networks that are in the focus of our research in the sphere of wireless communication. The proposed and tested algorithms show the effective channel allocation by a method based on Fuzzy Logic, Game Theory, and the Smart Method.

The aim of the paper "A Smart Parking System Based on Mini PC Platform and Mobile Application for Parking Space Detection" by V. Sobeslav and J. Horalek is to propose a complex outdoor smart parking loT system based on the mini PC platform with the pilot implementation, which would provide a solution for the aforementioned problem. Current outdoor car park management is dependent on human personnel keeping track of the available parking lots or a sensor-based system that monitors the availability of each car. The proposed solution utilizes a modern IoT approach and technologies such as mini PC platform, sensors, and IQRF. When compared to a specialized and expensive system, it is a solution that is cost-effective and has the potential in its expansion and integration with other IoT services.

The purpose of the paper "A Method to Diagnose, Improve, and Evaluate Children's Learning Using Wearable Devices Such as Mobile Devices in the IoT Environment" by M. Moradi and K. Rahsepar is to transform the traditional classroom into a modern classroom in order to increase the ease and efficiency of the teaching process. The method includes phases of diagnosis and improvement. In the diagnose phase, the classroom is equipped with modern items such as Internet of Things (IoT) and game-based learning. In the improvement phase, the field method is used to extract and weight the effective criteria in improving the educational status. As a result, the proposed educational method can increase the learning performance of children.

The paper entitled "Research and Development of Palmprint Authentication System Based on Android Smartphones" by X. Zhang et al. presents the development an effective and full-function palmprint authentication system regarding the application on an Android smartphone, which bridges the algorithmic study and application of palmprint authentication. In more detail, an overall system framework is designed with complete functions, including palmprint acquisition, key points location, ROI segmentation, feature extraction, and feature coding. Basically, we develop a palmprint authentication system having user-friendly interfaces and good compatibility with the Android smartphone. Authors provide an open technology to extend the biometric methods to real-world applications. On the public PolyU databases, simulation results suggest that the improved algorithm outperforms the original one with a promising accuracy of 100% and a good speed of 0.041 seconds. In real-world authentication, the developed system achieves an accuracy of 98.40% and a speed of 0.051 seconds. All the results verify the accuracy and timeliness of the developed system.

The paper "A Smart System for Sitting Posture Detection Based on Force Sensors and Mobile Application" by S. Matuska et al. presents a smart system for sitting posture detection based on force sensors and mobile application. The major problem is the spinal pain caused by the poor sitting posture on the office chair. The smart chair has six flexible force sensors. The IoT node based on Arduino connects these sensors into the system. The system detects wrong seating positions and notifies the users. In advance, authors develop a mobile application to receive those notifications. The user gets feedback about sitting posture and additional statistical data. The data from smart chairs are collected by a private cloud solution from QNAP and are stored in the MongoDB database. The Node-RED application was used for the whole logic implementation.

The paper entitled "User Acceptance of Internet of Vehicles Services: Empirical Findings of Partial Least Square Structural Equation Modeling (PLS-SEM) and Fuzzy Sets Qualitative Comparative Analysis (fsQCA)" by Y. Liang et al. presents the study that identifies the determinants of behavioral intention to accept IoV (Internet of Vehicles) services by using an integrated model that combines UTAUT, perceived risk theory, and initial trust theory. The study uses Partial Least Square Structural Equation Modeling (PLS-SEM) and Fuzzy Sets Qualitative Comparative Analysis (fsQCA) methods to explore the role of determinants in consumers' intention to accept and purchase IoV-based services. Specifically, the net effects of each antecedent factor on intention are analyzed by conventional correlational techniques (PLS-SEM). The direct effects of performance expectancy, price value, habit, and initial trust on intention are found to be significant. Despite the determinants (e.g., effort expectancy, social influence, facilitating conditions, hedonic motivation, and perceived risk) are found to be nonsignificant effects on intention, however, it cannot be said they are not important to intention to accept IoV-based services, due to the existence of causal complexity. For the high levels of causal complexity, fsQCA provides a more nuanced understanding of how these antecedent conditions fit together to affect consumers' intention to accept and purchase IoV-based services. The results from fsQCA provide twelve different configurations to achieve high levels of behavioral intention to accept IoV services and eight causal paths equifinally to lead to the negation of behavioral intention to accept IoV services. The findings provide relevant insights and marketing suggestions for incentivizing consumers to accept IoV-based services.

For the growth of the location-based services, more accurate and various types of personal location data are required. However, concerns about privacy violations are a significant obstacle to obtain personal location data. In paper "An Adaptive Grid and Incentive Mechanism for Personalized Differentially Private Location Data in the Local Setting" by K. Jung and S. Park, authors propose a local

differential privacy scheme in an environment where there is no trusted third party to implement privacy protection techniques and incentive mechanisms to motivate users to provide more accurate location data. The proposed local differential privacy scheme allows a user to set a personalized safe region that he/she can disclose and then perturb the user's location within the safe region. It is the way to satisfy the user's various privacy requirements and improve data utility. The proposed incentive mechanism has two models, and both models pay the incentive differently according to the user's safe region size to motivate to set a more precise safe region. We verify the proposed local differential privacy algorithm and incentive mechanism can satisfy the privacy protection level while achieving the desirable utility through the experiment.

The paper titled "Mobile Coverage in Rural Sweden: Analysis of a Comparative Measurement Campaign" by P. G. Sudheesh and J. Beek presents a framework for analyzing mobile signal strength experienced by users. Based on measured signal strength, a coverage map has been made via IDW interpolation. Various analyses are carried out on signal strength over residential areas and roads of Norrbotten. Further, measurements are compared to those of Östergötland and it was found that both municipalities have almost similar measurements. By analyzing coverage across all 14 municipalities of Norrbotten, in contrast to the suspicion that rural areas have poor signal strength, we found that 2G and 4G provide satisfactory results. However, 3G fails to provide coverage in some areas. This is worse in some areas, resulting in more than 50% of areas to be outside coverage area at some places. These areas are mostly near the Finland border, which results in the fact that roaming and additional charges may be applicable to the 3G user in these areas.

In the paper titled "Impact of GPS Interference on Time Synchronization of DVB-T Transmitters" by J. Machaj et al., the impact of the GPS (Global Positioning System) interference caused by jamming and spoofing on the function of the DVB-T SFN network was investigated. The transmitters in DVB-T SFN use GPS signals for synchronization of data in the network, to avoid interference and sustain the quality of received signals. With an increased number of GPS interference caused by jammers, it is required to understand how DVB-T transmitters can cope with the affected GPS signals. We have performed experiments in two scenarios: in the first scenario, the GPS receiver at one of the transmitters was affected by jamming and in the second scenario by spoofing of GPS signals. Based on achieved results, it can be concluded that the DVB-T SFN network is able to cope with the jamming of GPS signals, in case that it does not last too long. From the results, it is obvious that the SNR of the received DVB-T signal was reduced, resulting in increased BER. However, the receiver was still able to decode the video stream without any significant decrease in quality.

Conflicts of Interest

The authors declare no conflict of interest.

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