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Editorial

Visible Light Communication and Positioning: Present and Future

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1. Introduction

Future wireless communication may extend its spectrum to visible light due to its potential large bandwidth. It serves as a promising candidate for high-speed, line-of-sight communication. Besides, due to its lack of electromagnetic radiation and immunity to electromagnetic interference, the visible light spectrum can be deployed for the industrial Internet of Things. Its limited transmission range can alleviate the interference issue and can lead to ultra-dense transmitter and receiver deployment. Current research into visible light communication includes the experimental demonstration of high-speed communication systems [1,2], beamforming optimization [3], the physical-layer secrecy problem [4], and multi-user coverage [5].

Besides communication, the limited transmission range can lead to high positioning accuracy, especially for indoor visible light positioning (VLP). The received signal strength (RSS)-based VLP using photodiode and the angle of arrival (AOA)-based VLP using camera are two mainstream approaches. While the former approach can achieve a positioning accuracy of several centimeters, the latter one can achieve a positioning accuracy within one centimeter. A summary of current progress on indoor visible light positioning is shown in the Table 1.

Table 1. Summary of current progress on indoor visible light positioning. RSS: received signal strength; AOA: angle of arrival.

Ref.	Algorithm	Accuracy (cm)	Number of TX LEDs	Receiver Realization	LED Height (cm)	Note
[6]	RSS	2.4	3	Single PD	60	
[7]		1.66	3		100	Compensation of Positioning Error
[8]	Finger Print	5	2	Camera	167	Image Sensor Acceleration
[9]	AOA	1.53	4		72	Error Cancellation
[10]		6.6	3		180	
[11]	SVD	6	3		120	
[12]	Bayesian	0.86	4		190	Industrial Camera, Optical Compensation
[13]	Differential	4	3		100	Differential Detection
[14]	Image Processing	<10	24		300	Fisheye Camera
[15]		4.81	4		50	
[16]		1	3		231	Shift and Rotation based on a Reference Point
[17]	Differential AOA	<6	4		113	Unknown Tilting Angle

For a more comprehensive overview of visible light communication and positioning, the readers may refer to [18,19], respectively.

2. The Present Issue

The present issue, named "Visible Light Communication and Positioning", focuses on visible light communication and visible light positioning, in which four papers explore visible light communication and three papers investigate visible light positioning.

For visible light communication, the published works focus on the devices, the physical-layer techniques, and system work aspects. In [20], the light-to-frequency converter for VLC is characterized. In [21,22], the physical-layer non-orthogonal multiple access and multi-color VLC, respectively, are addressed. In [23], the system-level VLC based on the software-defined radio with intelligent transportation and indoor applications is addressed.

Besides VLC, in [24–26], visible light positioning is explored. A fingerprint-based indoor positioning system for multiple reflections is proposed in [24]. To address the issue of non-perfect LED deployment, in [25], the impact of LED tilt on visible light positioning accuracy is analyzed. Moreover, a mobile optoelectronic tracking system based on feedforward control is investigated in [26].

3. Future

While this special issue focuses on visible light communication and visible light positioning, more fundamental works into joint performance optimization need future work. For example, the impact of LED layout on the communication performance and the positioning accuracy, as well as the related joint optimization for both communication and positioning, remains to be investigated.

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