Internet of Things and BDS Application

Bo Wang · Xiangsheng Liu · Yaqi Zhang

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Preface

With the continuous development of the new generation of information technology, the combination of the Internet of things (IoT), which provides perceptual information, and the satellite navigation system, which is the spatiotemporal benchmark, is becoming closer and closer. As China's independent and controllable spatiotemporal benchmark, Beidou satellite navigation system (BDS) provides complete global services from 2020. The key of technology lies in the application. The close combination of precise spatiotemporal information with the interconnection of all things not only empowers a variety of industries, but also leads the reform of more industries. According to the statistics of GNSS and LBS Association of China (GLAC), the total output value of Chinese satellite navigation and location-based services industry has exceeded 400 billion Yuan in 2020, of which BDS has contributed more than 80% to the core output value of the industry. Therefore, the continuous development of IoT and BDS application is not only related to the national security of China, but also greatly promotes economic development of China. With the development of 5G, cloud computing, big data, artificial intelligence, and a series of emerging technologies, the IoT and BDS application will bring more vigorous vitality to the development of the industry.

BDS is a global satellite navigation system built and operated independently by China and compatible with other satellite navigation systems in the world. Since the 1990s, China has completed the construction of BDS-1, BDS-2, and BDS-3 systems in accordance with the "three-step" strategy, "First active and then passive, first regional and then global," and has blazed a road of satellite navigation system construction with Chinese characteristics.

Guided by the BDS spirit of "Independent innovation, unity and cooperation, overcoming difficulties and pursuing excellence," BDS system provides global service capability through high-density networking, ensures stable service with high operation speed, creates new highlights of international cooperation with high standards, and drives new breakthroughs in application with high precision. The BDS system has reached the level of 10 m at 95% confidence level, the positioning accuracy of 10 m height, the speed of 0.2 m/s, the timing accuracy of 20 ns, and the availability of system services more than 95%. In the Asia-Pacific region, the positioning accuracy

of 5 m is achieved at 95% confidence level. People all over the world can enjoy the service of BDS system. Through the BDS ground-based augmentation system, the precision of the spatiotemporal information provided by BDS can be improved to the centimeter level of real time and millimeter level of post-processing. The accurate spatiotemporal information can be widely used in various industries with extremely low cost and convenient way.

IoT is a network based on perception, which achieves the full interconnection of people and things. At present, the IoT industry has developed from the stage of technology improvement to the stage of application popularization. With the continuous improvement of all kinds of near-field communication technology and low-power communication technology, artificial intelligence technology continues to emerge. Under the dual promotion of supply-side reform and demand-side reform, the IoT industry has set off the third development wave represented by basic industries and scale consumption. Relevant data show that the scale of the global IoT industry has increased from $50 billion in 2008 to $151 billion in 2018. By 2022, IoT market of China is expected to reach $255.23 billion, accounting for 24.3% of the global total expenditure in the same period, after 25.2% of the USA, ranking second in the world, and the vision of IoT is being realized.

The key of technology development lies in application. Only the stage of popularization of application is the stage of value creation of various technologies. Driven by technologies such as precise spatiotemporal information and interconnection of all things, popularization of industrial applications has become the top priority of technology development. Technology not only empowers the industry, but also leads the change of the industry.

Under the new situation, the industry application of BDS should change from focusing on platform construction to focusing on platform capability, deeply combining the precise spatiotemporal information provided by the ground-based augmentation system with the industry application, improving the platform capability and enabling the industry, and changing from focusing on scale and quantity to focusing on quality and connotation. The scale effect of the BDS has been highlighted. More importantly, the application quality must be upgraded to a certain level. From the traditional division to the integration of innovation, the development of innovative applications is carried out in line with the traditional application fields such as transportation, logistics, safety and emergency, and other industries. The business information provided by IoT sensors is closely combined, so that the application of BDS is no longer limited to positioning, navigation, and timing. Instead, it takes spatiotemporal information as the starting point, perception as the basis, and information transmission as the link to improve the application level of the industry in an all-round way. It changes from focusing on advantages to focusing on sharing, sharing the advantages formed in a certain industry with more industries, and sharing BDS spatiotemporal information to more and more industries. We continue to practice the concept of “Good in the sky, good on the ground” by academician Sun Jiadong, the first chief designer of BDS.

Dr. Wang Chenglong, Dr. Jia Jingyuan, Dr. Ma Zixuan, Master Liu Jingyang, and Master Chen Jiaqi gave great efforts in the process of compiling this book.

The industry application analysis contents in this book are supported by GNSS and LBS Association of China and its precision application professional committee and Shenzhen Beidou Industrial Internet Institute. The publication of this book is also supported by Beijing Science and Technology Plan (Z181100003518003) and Beijing Jinqiao Project Seed Fund (ZZ19018). Chapters 1–5, 7, Sects. 6.2–6.4, and 6.7–6.9 are written by Bo Wang, Sects. 6.1, 6.5, and 6.6 are written by Xiangsheng Liu, and the whole book is translated by Yaqi Zhang. After the completion of the first draft of this book, Dr. Miao Qianjun, Prof. Cao Chong, and Prof. Zhang Quande reviewed it and put forward very valuable opinions and suggestions. We would like to express special thanks to them.

IoT and BDS, as developing high tech, are not only involving the intersection of various disciplines, but also highly engineering application technology. Limited to the author's knowledge level and the scope of data access, omissions in the book are inevitable. It would be grateful if readers criticize and correct them.

Beijing, China
2021

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