Blockchain-based Data Management System Exploiting Consistent Hashing for Data Privacy in Urban Computing

Gabin Heo*, Inshil Doh**

* *Division of Artificial Intelligence and Software, Ewha Womans University, Seoul, Korea*

** *Department of Cyber Security, Ewha Womans University, Seoul, Korea*

gjrkqls@ewhain.net isdoh1@ewha.ac.kr

***Abstract*— With the advancement of artificial intelligence, the importance of data has been increasing, leading to a growing demand for intelligent systems that can utilize various types of data in real time. Although data sharing is essential for such systems, traditional centralized data sharing architectures face several limitations, including a Single Point of Failure (SPoF), issues related to data ownership and trust, and privacy violations caused by large-scale data leaks. To address these issues, various studies have explored the integration of additional security mechanisms. However, in systems that require real-time processing, these mechanisms often result in performance degradation. Therefore, a lightweight data protection method is needed to ensure privacy while maintaining performance. In this paper, we propose a blockchain-based data management system designed to enable secure data sharing. The proposed system classifies data into general data and sensitive data, applying a stepwise privacy-preserving approach. General data is randomly distributed through similarity-based shuffling among base stations within the same shard, preventing any specific group from inferring users' behavior patterns. In contrast, sensitive data is stored across shards in a distributed manner without shuffling to minimize pattern exposure during communication. Furthermore, the system leverages consistent hashing to efficiently manage data, reducing the overhead caused by node additions or removals during system scaling. Through this design, our system demonstrates that it is possible to achieve a balance between security, privacy protection, and performance in a real-time data sharing environment.**

***Keyword*— Blockchain, Data management, Privacy, Consistent hashing, IoT**

Gabin Heo received her M.S. degree in Computer Science and Engineering from Ewha Womans University in 2020. She is currently pursuing a Ph.D. degree in the Division of Artificial Intelligence and Software at Ewha Womans University, Seoul, Korea. Her research interests include blockchain, authentication, digital content security, data privacy, and IoT securit.

Inshil Doh received her B.S. and M.S. in Computer Science at Ewha Womans University, Korea, in 1993 and 1995, respectively. She received her Ph.D. degree in Computer Science and Engineering from Ewha Womans University in 2007. From 1995 to 1998, She worked at Samsung SDS of Korea. She was a research professor at Ewha Womans University in 2009, 2010, and at Sungkyunkwan University in 2011. She is currently an associate professor of the Department of Cyber Security at Ewha Womans University, Seoul, Korea. Her research interests include wireless network security, sensor network security, and IoT network security.