Near Field Distance Awareness Algorithm using Bluetooth for Device Sociality Service

Joonyoung Jung*, Dong-oh Kang*, Jang-ho Choi*, Okgee Min*

*Human Computing Research Section,
Electronics and Telecommunications Research Institute, Deajeon, Korea
jyjung21@etri.re.kr, dongoh@etri.re.kr, janghochoi@etri.re.kr, ogmin@etri.re.kr

Abstract— The use of Device-to-Device (D2D) communication in various networks is expected to grow in the coming years. The D2D distance-based device sociality service is affected by distance awareness between the D2D devices. Thus, the wireless distance awareness between smart devices should be accomplished easily, accurately, and immediately. When smart devices are used in the distance-based distance sociality service, the smart device needs to know the distance to other smart devices in order to aware the space sociality. Several methods, such as receive signal strength indication (RSSI), time of arrival (ToA), and time difference of arrival (TDoA), can be used to aware the distance between D2D devices. Among these methods, the RSSI system can aware the D2D distance easily and inexpensively because most smart devices can estimate the received signal strength. However, estimating the distance using a RSSI is difficult due to inaccuracies. We conducted a preliminary test to discover the relationship between the actual distance and a Bluetooth RSSI under near field environment. Through the results of this test, we realize that the near field distance is hard to be classified due to the inaccuracy of Bluetooth RSSI. Therefore, in this paper, the near field distance awareness algorithm is proposed to reduce measurement errors by alleviating fluctuations in a Bluetooth signal. To evaluate the effectiveness of the proposed algorithm, the distance awareness is compared using different filtering algorithms, such as, a low-pass filer (LPF), a Kalman filter, and a particle filter under a meeting room environment. The proposed algorithm showed the best results in terms of the coefficient of determination, standard deviation, and measurement range.

Keyword— Near field awareness, Device to Device (D2D), Distance awareness, Filtering algorithm, Wireless signal

Joon-young Jung received the B.S. and M.S. degrees in Computer Network Engineering from Soongsil University, Republic of Korea, in 1996 and 2000, respectively. And, he received his Ph.D. degrees in Chungnam National University, Korea, in 2015. Since 2000, he has been working at Electronics and Telecommunications Research Institute. His research interests include wireless communication, Internet of Things, cloud computing, virtualization system, and home multimedia network service.

Dong-oh Kang received his B.S. degree in electronic engineering from Yonsei University, Korea, in 1994. And, he received his M.S. and Ph.D. degrees in electronic engineering from Korea Advanced Institute of Science and Technology, Korea, in 1996 and 2001 respectively. Since 2001, he has been working at Electronics and Telecommunications Research Institute. His research interests include home network middleware, distributed control, and server cluster power management.

Jang-ho Choi received his B.S. degree in computer science and business administration in 2010 from the University of Southern California, USA, and his M.S. degree in computer science from Korea Advanced Institute of Science and Technology, Korea, in 2013. He has been with the Human Computing Research Section of the Electronics and Telecommunications Research Institute (ETRI) as a researcher since 2013. His research interests include Internet/Web of Things, End-user Software Engineering, and HCI.

Ok-gee Min received her B.S., M.S., and Ph.D. degrees in computer science from Chungnam National University, Korea, in 1988, 1992 and 2010 respectively. Since 1988, she has been working at Electronics and Telecommunications Research Institute. Her research interests include big data system, IoT system, and artificial intelligence.