Fusion of a RFID Reader and UWB Module Applicable to Smart Devices

Youngjae Lee, Dongyeop Kang and Kiyoung Moon
Regional Industry IT Convergence Research Section, Daegu-Gyeongbuk Research Institute, ETRI
Daegu, Korea
{lyj4295, kang, kymoon}@etri.re.kr

Jaeheon Lee and Jinho Ko
RFID Team
Phychips
Daejeon, Korea
{jhlee, jhko}@phychips.com

Abstract—The fusion module of RFID reader and UWB mobile tag is presented for the connection with the smart devices. The small module is attached to the smart devices like smart phone and tap through the micro-USB interface. Previously, a RFID and UWB are used and applied with no relation with each other. As the smart device is developed to integrate the other sensors, a RFID and UWB can be included and utilized as the inner sensors. To meet this proposition, a fusion module is designed and applied using the several functions and techniques inside the smart device. The RFID reader which was already developed shows its performance while the UWB technology is matured to make the fusion module without the degradation of its performance.

Keywords—RFID reader; UWB; Fusion; Tag; smart device

I. INTRODUCTION

A RFID and UWB technology have been developed and made to the products for a long period, respectively. There was some attempt to merge them trying to use the UWB frequency band in the operation of a RFID reader [1-3]. As the smart devices and technologies are matured and grown, several sensors and devices are needed to be integrated and fused to cover many functions appropriate to the application areas. Particularly, indoor localization using Pedestrian Dead Reckoning (PDR) systems was an interesting theme and smartphone-based tracking algorithm was developed using the IMU sensors in smart devices [4-6].

A RFID and UWB module isn’t currently included into the smart device because they don’t find the way to the application area and market volume. Therefore, it is better to connect them with smart device using the external interface such as micro-USB. It has several merits like easy-using, portability and small sizing. By fusing them, it makes the cooperation of several functions and addition of new functions as shown in Fig. 1. A RFID has the ability of the item management, item level tagging and short range positioning and an UWB has the item searching, ranging and middle range positioning. They can have the additional function of map indication, wireless transmission and direction information with connecting into the smart device. A smart device has several sensors and communication module to extend and support the RFID and UWB module and app is needed to display the measuring results on the screen.

II. SYSTEM DESIGN

A RFID system was already established as a product in an immature market. Especially, a RFID reader IC was developed to integrate RF, MCU and DSP in single chip. An UWB system has been known as the accurate provider to inform the ranging distance and positioning. A CMOS UWB IC was recently supplied to the market substituting the UWB module that has large area, high power consumption and cost. At present, an UWB IC did not integrate the RF and MCU on single chip. There are some environment and situation to use a RFID and UWB system at the same time as shown in Fig. 2 and it is needed to unite the two chips on board.

III. RFID DEMONSTRATION

Before we design the fusion module, a RFID reader module that is interconnected with smartphone through the USB was developed as shown in Fig. 3.
Thanks to the USB interface, the RFID module can get the power from the phone and transfer signal to the phone. The app that is working under the android environment was operating to express the RFID tag data on the smartphone. It is good to examine the goods portably and easily.

The UHF RFID reader has the UHF antenna that is located on the back side and a RFID reader chip that integrates the RF block and MCU digital block. The module size that is dependent on the antenna performance is about 25mm by 25mm. It is sealed with a case to guarantee the external protection and reliable operation.

IV. SYSTEM IMPLEMENTATION

A RFID reader and UWB module are put together to make a fusion module and their block diagram is shown in Fig. 4(a). They consist of two main chips. A RFID reader is PR9200 and UWB is DW1000. DW1000 only has RF block. Therefore, a MCU block should be connected but to reduce the module size and power consumption, UWB commonly uses the MCU block of PR9200 chip. To access the USB port, USB-to-UART converter is added. A DC power source is supplied from the USB port of smart device and regulated to 3.3V. Fig. 4(b) shows the outline of case to fill the module and its features. A case design should consider the USB port and antenna location to sustain the stable performance.

Because two technologies are using one MCU simultaneously, two functions are not operating at one time. It is necessary to make scenario that a RFID reader is assigned the tag reading time less than 400ms and when it is sleeping, UWB is starting to work and inform the current positioning at the given time. The switching time is too short to recognize the timing interval between the RFID reader and UWB tag.

V. CONCLUSION

The fusion of RFID reader and UWB module is proposed to be connected with the smart device by allowing their functions to operate and cooperating with the sensors and communication module in smart device. They merge the MCU block to reduce the area and power consumption and have scenario to work under the assigned time.

ACKNOWLEDGMENT

This work (C0503918) was supported by Business for Cooperative R&D between Industry, Academy, and Research Institute funded Korea Small and Medium Business Administration in 2017.

REFERENCES