Combined RFID with sensor of motion detect for Security system

Byungkwan Ju, Kyoungkeun Kim, Youngwoog Yoon, Yeongseog Lim
Dept. of Electronics Engineering
Chonnam National University
300, Yongbong-Dong, Buk-gu, Gwangju
Korea

Abstract : -   In this paper, we designed advance RFID system that combined RFID with motion detect sensor. RFID Interrogator had problem radiate electromagnetic wave always. This problem is that provided the setting for electromagnetic interference in the whole frequency. The proposed system present solution of this problem that restrict radiation of electromagnetic wave limitedly. This system is based on sensor of motion detect to moving object. It is predict that motion sensor is able to detect moving object in cover area and operate RFID interrogator for identify RFID Tags. Additionally web camera take a picture of moving object. This system had first benefit that reduced consumption power of RFID interrogator and source of electromagnetic interference(EMI). This system had add-one Bluetooth interface for between RFID interrogator and host computer. It has expanded coverage of interrogator at extremely low cost. This interface provide long range of communication in comparison with wired.

Key-word: RFID, Motion sensor, Bluetooth, Ad-Hoc network, web-camera

1. Introduction

The potential application of RFID technology is limited only to one's imagination. Although a popular belief holds that RFID is best suited to supply-chain management or consumer packaged goods (CPG) industries, the range of current RFID applications goes far beyond these areas. In fact, a variety of established RFID application types have already been deployed successfully in real-world environments.   RFID is an emerging technology, and as such, tremendous potential lies ahead to apply it to areas that can utilize the benefits of the technology [1].

Recent advances in RFID(Radio Frequency IDentification) technology and USN (Ubiquitous Sensor Network) technology is a highly reliable way to electronically control, detect and track a variety of items using FM transmission methods [2].

RFID's low level of recognition may be simply a reflection of the technology's current state of limited penetration in most consumers' daily lives. If this is the case, the more systems and controls are powered by RFID, the more users will understand and discuss the technology. Alternatively, RFID may develop as another technology that we use in a multitude of ways

and eventually take for granted, with only the slightest understanding of either its potential or its limits. In either case, a balance will have to be struck between providing as much information disclosure as possible to protect consumers and retaining the convenience benefits that will drive adoption of RFID systems in the first place [3].

RFID technology make up for weak point to add USN(Ubiquitous Sensor Network) Technology. We will make a corporate body with RFID interrogator and motion sensor of microwave frequency. This body is consist of two part. One part is motion detect sensor that is used to doppler effect in microwave 10.525 GHz. the other part is RFID interrogator that is used to inductively coupled type in VHF 13.56 MHz. This body added Bluetooth module for interface between interrogator and host computer. This add-on module make up to limit range of coverage. It is expected to increasing variety applications in use. This improve functions of a corporate body had a good point that is reduce to electromagnetic radiation in use time. In during, RFID interrogator devide a activation of timing into two parts. The first timing is the term of waiting for empty in a search area. This timing is not radiate of electromagnetic wave.

This function obtain the same effect in the other RF band. The other timing is a stationary state that get a information data of RFID tags and take a picture of object in detect moving object.

2. Structure of proposed system
2.1. Description of complex RFID system

The proposed system make a corporate body that combine sensor of motion detect with RFID interrogator and web-camera for capture image of moving object. This system have four block of parts that divides blocks into motion sensor, web camera, RFID interrogator and Bluetooth interface between corporate body and host computer.

Fig 1. advance complex RFID system

The used sensor based on principle of Doppler effect that used to radiate microwave signal from sensor to object. This signal is low power that is affected object in line of sight. They are benefit of sensor that have low consumption power of operating and flexibility of environment. It detect moving object that compared radiation wave with return wave. The difference between radiation wave and return wave is linear variance in the whole frequency.

Sensor of motion detect is consist of two piece of function block. one piece block has radiation microwave, the other piece block is received to return wave. In case, frequency have increase a small frequency. This frequency reckon by distance for measure velocity of moving object. It attaches the Microwave motion detect sensor which uses a 10.525 GHz RF(Radio Frequency). The up-to-date sense, which uses Doppler effect in principle, Microwave phase has difference between transmit wave and receive wave.
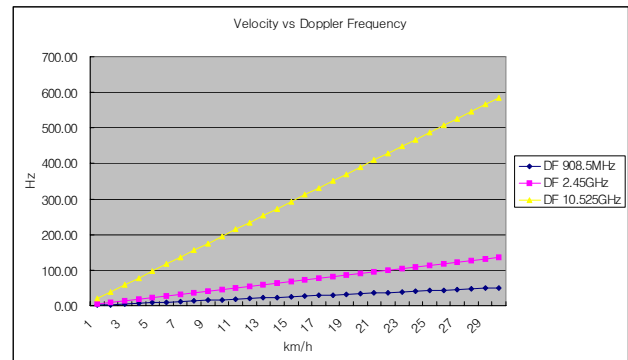

Fig 2. Velocity vs Doppler frequency

When motion detect sensor enable to system active state, in same time, camera module has recording that status is activate DVR(Digital Video Record) in host Computer. This Function is separate to two states, in standby state alone to used monitoring device and in active state to used record device. In addition, it is enable to function that has control signal Video alarm output that are both provided along with VCR and alarm unit. This piece is Motion detect sensor part that used frequency is 10.525 GHz RF.

RFID interrogator is able to replace frequency band using 13.56 MHz, 860~ 960 MHz, 2.45 GHz. This system has interconnection between RFID interrogator and host computer to use Bluetooth module. It is necessary to dual band antenna that used to 2.45 GHz frequency and the other band frequency. This system expected to door lock, service robot in home automation, security system in limited area etc. It is in addition to extension function that take a picture object in security area. It's very useful that operates web-based monitoring for remote control system.

The adopted interface between RFID Interrogator and host computer is Bluetooth interface that is responsible for overall end to end validity and integrity of the transmission. It is very useful characteristic that furnish a wide-range of coverage for Ad-Hoc networks.

2.2. Description of operation scenario

Motion detector can be used to perform system control roles which is sequence control flow. It is scenario that is system control flow.

First step is motion detect state that is recognize object to moving.

Second step is initialized RFID interrogator and identify RFID Tag. It was RFID interrogator wake-up state, when power wave being transmit or supply inductive current. to antenna.

Third step is that identification data transmit to host computer. This step is RFID interrogator active state, when it is recognize Host computer to RFID Tag information data.

Four step explain to DVR state when motion detect to object. This step is recording state that motion detect and active CMOS web camera at the same time. it is necessary for DVR function to capture image of moving objects for human and package.

In time recording, host computer cut down capacity of memory of HDD for recording data. This system make use CMOS Camera. CMOS image sensors can switch modes on the fly between still photography and video. However, video generates huge files so initially these cameras will have to be tethered to the mothership (the PC) when used in this mode for all but a few seconds of video.

This system has detect distance that microwave detect range 150 degrees with 20 meters. it is very useful function that expanded distance of detect range for motion sensor service area.

The host interface is normally an application program that is running on a computer system. The program communicates with the interrogator and makes sense of the data that is obtained from the tag. Tags can be read-only or read-writable. If the tags can also be written to, then the application sends out the required data to the interrogator through, for instance an RS-232C serial port of the computer [6].

This system have two functions of Bluetooth module for the host interface that first function use to recognize for Tags data from RFID interrogator to host computer and second function use to capture for image data from motion detect to host computer. It make the best use Bluetooth Ad-Hoc Network for WLAN (Wireless Local Area Network). In Ad-Hoc networks there is no fixed network infrastructure and therefore they can be deployed and adapted much more rapidly.

We have present example system for flexible security system that focus use basic functions of propose system. This proposed system is an useful advanced RFID system for Multiple wireless environment.

This system is expected to increasing variety applications. In particular important functions reduce Electromagnetic Radiation in result to decrease Electromagnetic Radiation time.

Electromagnetic radiation is a combination of oscillating electric and magnetic fields moving through a medium perpendicular to each other through space and carries energy from one place to another.

RFID interrogator State Standby state prevent to Electro magnetic Radiation, active status Emit to Electromagnetic Radiation. This sequence of control is reduced to unnecessary Electromagnetic Radiation in RF environment.

The other benefit, it is necessary for active type RFID Tags that prevent to repeating recognition of Tags after approve to one time. Unnecessarily repeating recognized tags data that have the use of consumption of power battery in the Tags. The exciting state of repeat recognize tags will be shorten life time of battery in RFID Tags. This characteristic is very useful function for active type Tags in application system.

3. Specification

3.1. Sensor of motion detect

Sensor of motion detect combine Doppler effect sensor with web-camera. The sensor range of detect that is about 20m between motion detector and object. This motion detector has features that operate frequency 10.525 GHz and

main frequency band 50 ~ 60 Hz. In state of motion detect, It is indicate to LED sway. LED sway period time delay is 0.5 ~ 9.0 sec that difference level 8 degree. The following detection distance is shown considering when the detector is fixed at 90 °. Range of detect decision that height up 2 m under 3 m on the walls.

3.2. RFID Interrogator

Relatively RFID interrogator can low power Motion Sensor. This paper has use RFID interrogator that frequency is 13.56 MHz. This RFID interrogator consume power that compare interrogator active state to consumption power 5V 200mA and motion sensor operate state consumption DC 5V max 50mA. This proposed system result to motion sensor using low power consumption. This proposed system has operated in accordance with control flow that reduced electromagnetic radiation and Power consumption

If this system will have application to passive tags in the UHF(868 ~ 870, 902 ~ 928 MHz), Micro wave (2.45 GHz) frequency RFID system, RFID interrogator would prevent unnecessary radiation for EMI. In time of activation, RF power wave permit to RFID Tag for interrogator active state. Because UHF band RFID interrogator has radiation power rating about EIRP 1W, established RFID system is possible EMI.

3.3. Web camera

The web camera consist of single-chip back end processor to pair with a CMOS image sensor. It reads a 9 or 8 bits input raw image data (RGB Bayer pattern) from an image capturing device and outputs through a USB port into the PC. This chip includes a simply color processing engine, an image compression engine, a dark calibration, a hardware image windowing with random image size selection, panning and scaling functions. The single-chip processor can directly transmit the compressed or un-compressed image data to the USB port

without any extra memory support. Its multi-powerful functions and special designed architecture make this chip suitable for extra low cost USB PC camera application.

3.4. Bluetooth Module

The Bluetooth module is replaced to RS232C serial communication for wireless communication. This module has specification that is operate voltage DC 3.3 V. In use frequency band 2.4GHz, Data rate is 1200 ~ 115200 baud rate. Communication network is based on pico-net point-to-point communication and extend scatter-net for application. This module has characteristics that output interface support UART (Universal Asynchronous Receiver Transmitter). This compliant Bluetooth Speci fication version 1.1 support. This module have consume transmission power mode is Class 2 (max +4 dBm). communication distance recognit -ion receiving sensitivity is -84 dBm. The module interconnection distance maximum range is 30 m in LOS(Line of Sight) between RFID interrogator and host computer.

4. Application Case

The most prominent RFID applications are as follows : item tracking and tracing, inventory monitoring and control, asset monitoring and management, anti-theft, electronic payment, acc -ess control, and anti-tampering [4].

When RFID interrogator scan RFID Tags, the interrogator in informed of a user's proximity and at least one of the user's possessions. But with current technology, this information flow is only one way.

However, a solution to this problem can be developed with the addition of two mandatory feature to the technology. All reading devices should be required to broadcast two pieces of data in the read field: Their own unique ID number, and their location data [5]. This propose system presents advanced RFID interrogator as conventional RFID interrogator has a weak point which disclosure at read that get together unique

ID number and location data.

This function is information of location data that recognize to entering object. This function is in addition to RFID interrogator we are simply providing function of detection of motion detector. It is very a small and quick reaction as against existing. This location data is very useful information that object position data replace GPS data as location information of object.

This system has application to wireless security system. it can be adopted to the new scenarios that is motion sensor to detection active and detection signal of motion sensor enable RFID interrogator to reading operation RFID Tag. This motion sensor use microwave frequency to detect when enter Human or Package. The RFID interrogator not always operate to active reading status until motion detector enable to recognize.

Altogether, this system will have application of vast commercial system. This proposed system combine with individual function for advance RFID system.

4.1. Security system in limited Areas

This system consist of Motion detect sensor and RFID interrogator for management of coming and going to limit areas. It is use to RFID coming and going system for Total Security Maintenance system that is speed gate system.

First section is speed gate that recognize RFID Tags in ID-Card. It is always radiation Radio Frequency in active state for recognition of RFID Tags. This system make up for the weak points that reduce unnecessary radiation power. Applying this system may have reduce unnecessary radiation power and simplify entrance procedure. Motion detect sensor is recognition to entrance human and material to request for entrance permission.

In case, this system consist of a simple entrance management system for low cost.

5. Conclusion

We desire to advance RFID equipment that can used USN equipment for wireless communi -cation environment. This proposed system redu -ced electromagnetic wave radiation to separate status of standby and active. In case, state of idle permit to reduced power consumption.

This proposed system has reduced unnece -ssary Electromagnetic Radiation and operating time in multiple RFID interrogator. It is nece -ssary to that EMI prevent to wireless communi -cation environment. The design is evaluated for cost, future flexibility, efficient of RFID.

Reference

[1] Sandip Lahiri, RFID Sourcebook IBM press, pp. 63, 2005

[2] Anthony Sabetti, Texas Instruments

[3] Simson Garfinkel, Beth Rosenberg, RFID Applications, Security, and privacy, Addison Wesley, 2005, pp.166-167

[4] Sandip Lahiri, RFID Sourcebook, IBM press, pp-64, 2005

[5] Simson Garfinkel, Beth Rosenberg, RFID Applications, Security, and privacy, Addison Wesley, 2005, pp.172-173

[6] S.C.Q. Chen and V. Thomas, Optimization of inductive RFID technology, Proceeding of the 2001 IEEE International Symposium on Electronics and the Environment, 2001, pp. 82-87