Concept and Scenarios of Intelligent Robotic Systems for Social Safety

An MyungSeok*, HyunWoo Cho, Myungho Yoo

Imaging Division, Samsung Techwin Co., Ltd., SeongNam, KOREA
(e-mail:{myungseok.an, hw0808.cho, myungho.yoo}@samsung.com)

Abstract: In this paper, we will describe the development concept and scenarios of Intelligent Robotic System for Social Safety that includes the observation cameras, the mobile robots, and the monitoring system, etc. The system can observe specific wide areas with the concept and the scenarios that are for emergency as well as for normal situation.

1. INTRODUCTION

The fixed camera based surveillance system has limitation in terms of mobility. In case that the events, which may be the objects, are occurred in any place, the user can observe the event through the camera with pan/tilt/zoom function. However, the user can not observe the event in particular because of the circumscription about performance of the lens mounted to the camera and the PTZ controller for the moving camera.

For the reason, the requirement that users want to see the event as they watch near the event has been increasing [S.M.Lee]. In the viewpoint of the need related with the performance limitation of cameras, the mobility of the mobile robots is fascinated. Accordingly the system that the fixed cameras interact with the several mobile robots (vice versa) has been proposed, which is Intelligent Robotic Systems for Social Safety (IRSSS).

IRSSS, which is part of the social infrastructure, can effectively surveil and secure vast area to keep social security using multiple mobile robots and fixed surveillance cameras. This system uses existing camera surveillance system and swarm controlling function of multi robots called "guard robot" for carrying out security duty which protects properties and lives from various hazards through guard and surveillance activities.

IRSSS can be applied to not only the whole social part like surveillance, but also the military purposes like perimeter security system in the troubled areas. Therefore this system can provide more advanced security services than the previous surveillance system that used the fixed cameras and sensors only.

The robot system, as a more advanced system than existing system, has tremendous growth opportunity and potential demand. In this paper, we will briefly describe the concept and scenario of IRSSS.

2. Concept of IRSSS

2.1 Outline of IRSSS

IRSSS can be categorized into two parts; Main Control System (MCS) for surveillance activity, Security Robot (SR) part, which are interlocked to secure vast area effectively. The MCS part exchanges the data with the camera, robots, and outer systems like that of police. Each device and robot of the system communicates through wire/wireless networks. Fig. 1 shows the outline of the IRSSS.
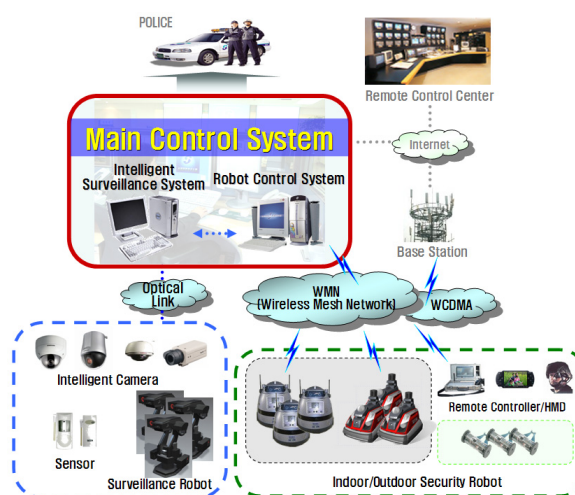

Fig. 1 System outline of IRSSS

2.2 Main Control System Part

The MCS part consists of two parts; Intelligent image surveillance system that controls and manages surveillance equipments, Robot control system that regulates and operates mobile robots. Fig.2 shows the equipments for the main control system like DVR, Intelligent Detection/Tracking System (IDTS), and In/Outdoor Sensing System (IOSS), etc.
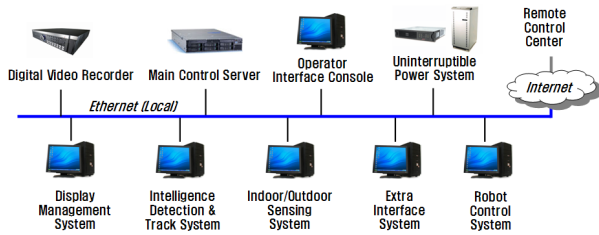
Fig. 2 Equipments for the main control system

2.2.1 Intelligent Surveillance System

Intelligent surveillance system takes a role to observe in/out the security zone, which can extend the observation area by connecting the existing security systems and intelligent surveillance cameras.

Intelligent surveillance system contains five parts; main control sever, user console, user display system, IDTS, and IOSS. The main control server and the user console are the main parts for configuring and managing the whole system.

The main control server exchanges the commands and status with local systems such as IDTS, and propagates the system status to a superior system such as that in National Police Agency. The user console provides interfaces for the user to handle the configurations and various statuses of the systems easily. IDTS controls the intelligent cameras, which have the functions to detect and track objects that the user is interested in, and transmits the processing results and the images to MCS.

Several intelligent cameras observe the pre-defined (preset) zones by periods. When there are moving objects in the zones, the camera detects them and tracks their trajectories. Moreover Display management system in Fig. 2 receives the real time image streams of detecting and tracking results from the cameras, and displays them to the user. Fig. 3 shows the relation of the display management system and IDTS.
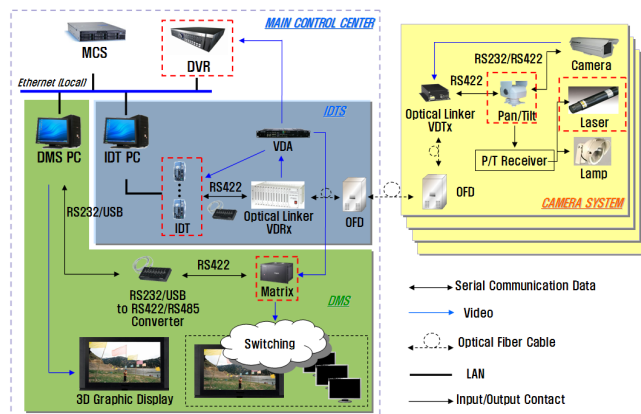

Fig. 3 Diagram of Display Management System and Intelligent Detection and Tracking System

IOSS gathers the signals from the sensors installed in/outdoors, and analyzes them for sending to MSC. The system provides some interfaces for many kinds of sensors which are the motion detection sensors, gas leak sensors, fire detection sensors, the radioactivity readings sensors, and electric wire cut detection sensors, etc.

2.2.2 Robot Control System

Robot control system manages security robots as one of the main control system with intelligent surveillance system. The main functions of the system are to display the images from the robots and to control them. The system displays real time images from robots and the statuses of robots, e.g. the position of them. The system makes some decisions for robot to move and act with the information from the robots. Finally sends commands for the robots to surveil and patrol.

2.3 Security Robot

SR is a mobile device that has intelligent patrol and self-defence function via communicating with the robot control system, which can move in/out environments like building, airport, etc. The robot has cameras for low illumination, which enables SR to capture and surveil the objects in the bad light condition.

SR has two kinds of the communication methods with the robot control system, one is seamless based WMN network, and the other is WCDMA based network in emergency.

This robot can move automatically as well as manually.

3. The scenario of IRSSS

There are two scenarios for IRSSS; normal patrol mode, emergency mode. In case of normal patrol mode, the robots patrol pre-defined areas according to the schedules. And the surveillance cameras watch out some places in periods. The information from robots and cameras which can be position of robots, direction of the cameras view, and images from all devices, is displayed by mean of the Display management system

In case of emergency mode, the mode is set when an intruder is in the restricted areas or crosses over the fences. The system gets the position of the event from sensing devices like cameras, sensors. Then the main control system sends the position to the robots, and drives the security robots to the position. After arriving there, the robots gather more detail information with cameras and sensors. Therefore this system can observe the places from wide rage to narrow range.

If the event is impossible for the user to handle, he can contact the police through MCS. Before they arrive, the robots will collect the information from the place that the event was occurred. Then send it to MCS for police to check the status of the position briefly.

REFERENCES

S.M. Lee, M.H.Back. and H.K.Lee (2006). Technical trend of security robot for social safety. IEEK, *Journal of IEEK*, **Vol.7**, pp.57-66.