RoboCupRescue 2006 - Robot League Team <NIIT-BLUE (Japan)>

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Robot-arm is effective in large places for searching, but obstacle in small places. So we install crawler at robot-arm and cover up whole robot by crawler for prevent to stranding.

1. Team Members and Their Contributions.

- Hitoshi Sato — Team leader, Mechanical design
- Yosuke Fujita — Sensor system design
- Takahiro Kobayashi — Operator, Mechanical design
- Tomoya Shioiri — Motor control design
- Katsuji Oogane — Advisor, Director

2. Operator Station Set-up and Break-Down (10 minutes)

Setup

1.Hardware
・Connection of battery
・Operation check of a robot
・Check of wireless camera and camera monitor

2.Software
・Boot computer
・Connection of wireless communication.
・Check of sensor information.

Break-down
We stop all systems and bring them back to staff room.

3. Communications

Rescue Robot League		
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Frequency	**Channel/Band**	**Power (mW)**
5.0 GHz - 802.11a	34ch	8000(mW)

Camera Frequency	Camera Channel
1.2GHz	7,4,1,3,10,16

4. Control Method and Human-Robot Interface

Control Method

The flow of the control method is shown in Fig.1. All sensor information and the motor control are controlled with the H8 microcomputer (Hereafter, it is assumed H8). Information controlled in H8 is fed back to building PC into. Serial communications are used for the means of communication with H8 used when feeding back. Camera information is sent directly to building PC into. It is a control method by which even here is done in the robot. The entire robot is controlled by control PC. As for the method, the operation by building PC into is output to information by top connecting a remote desk on control PC side. The robot is moved with the joy pad controller based on the information.

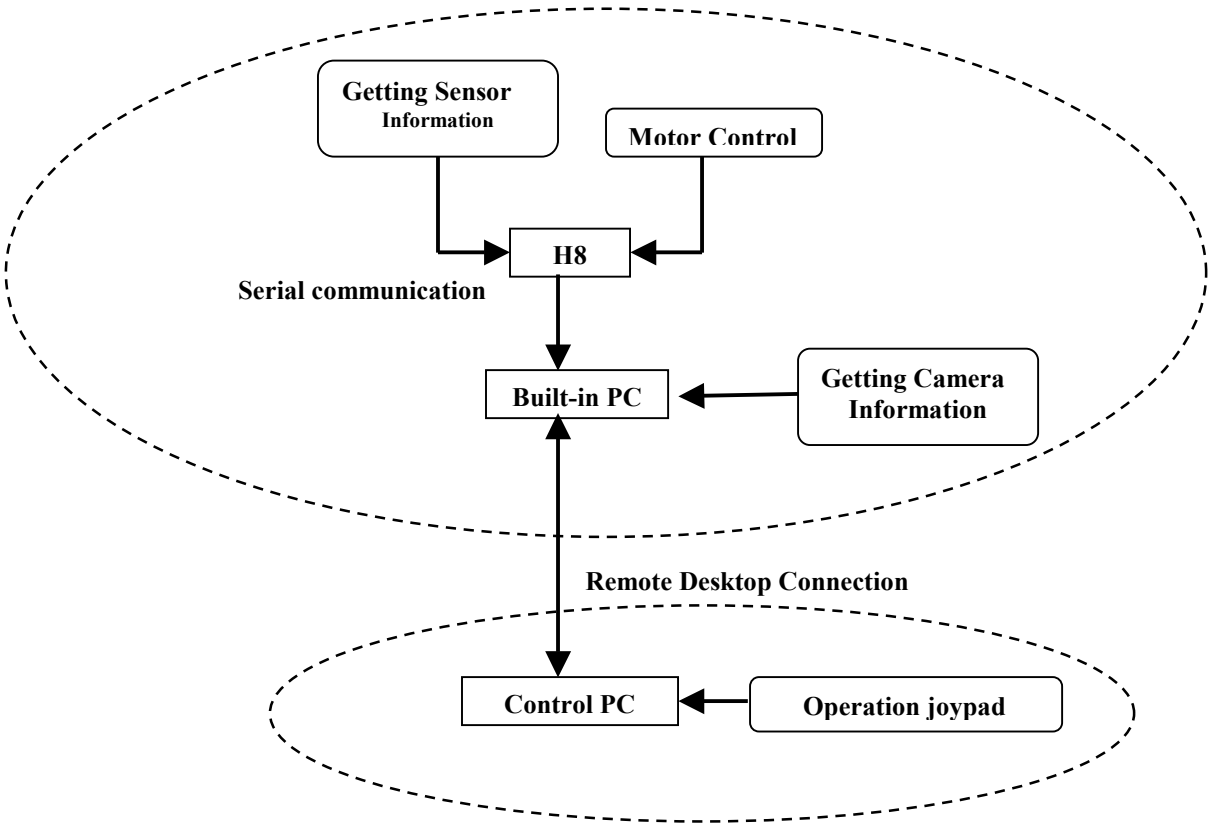

Fig.1 The Control Method

Human-Robot Interface

As for the rescue robot, it is thought that there are few used opportunities to use it at the time of disaster outbreak. Therefore it is thought that operation is difficult, and it is a burden because a vehicle driver is not an expert of operation of a robot at the time of disaster outbreak. Therefore I made operation interface to help a vehicle driver in this study. As for the structure of a system, a robot takes the information that has been sent as interface from a sensor. I tell the information that I visualized in interface to a vehicle driver and can put circumstantial judgment in a robot. When I get together if I use this operation interface, and a vehicle driver erred in operation, I can tell a vehicle driver about danger because the interface side displays a letter on a screen. Or that a robot stops movement; evade danger of a robot by taking action, and it is thought that can perform effective search activity by reducing a burden of a vehicle driver.

5. Map generation/printing

We use “handwriting” by information from wireless camera and sensor.

6. Sensors for Navigation and Localization

Distance sensor:

For find an object in a blind spot of a camera and warn it.

Fig.2 Distance sensor

Triaxiality acceleration sensor and geomagnetism sensor:

For know the situation of robot.

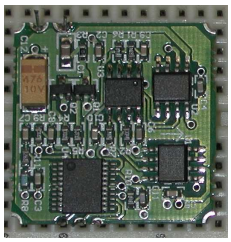

Fig.3Geomagnetism sensor

Fig.4 Triaxiality acceleration sensor

Wireless camera:

For grasp the situation by real time.

Fig.5 Wireless camera

7. Sensors for Victim Identification

Temperature sensor:

For measure the surface temperature of object or victim.

Fig.6 Temperature sensor

Microphone:

For catch a information of a victim such as groan, crying and tapping.

8. Robot Locomotion

Our robot have three unit, and connected by two joints.
The first joint can be connected by a joint of two degree of freedom of a turn and up-and-down motion, and the second joint is connected to the front part body by a joint of one degree of freedom of up-and-down motion.
It can get neighboring outlooks and a small radius of gyration by lifting the wide tread product and the second unit and the third unit by this.

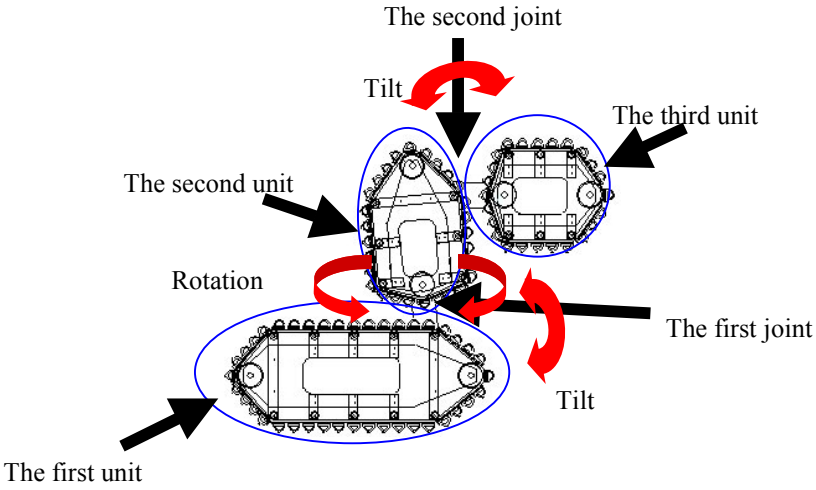

Fig.7 Each unit and the joint

It is possible to look around it from a high viewpoint by lifting the third unit and the second unit. When the robot get over random step it lengthening straight the body. Robot gets wide tread area and high run performance.

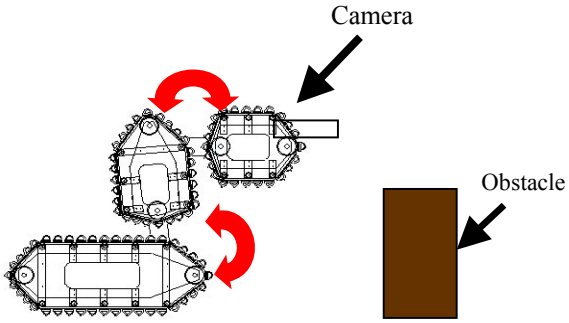

Fig.8 Normal form

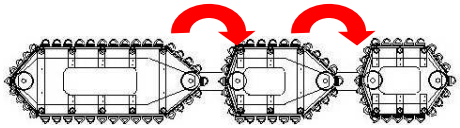

Fig.9 The robot extended.

When a robot rollover, it turn the first unit next turn the second unit and the third unit. Robot can return from a rollover by it. (Fig.10)

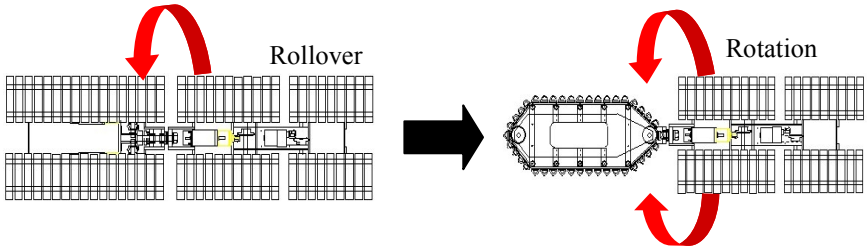

Fig.10 Measures after a rollover

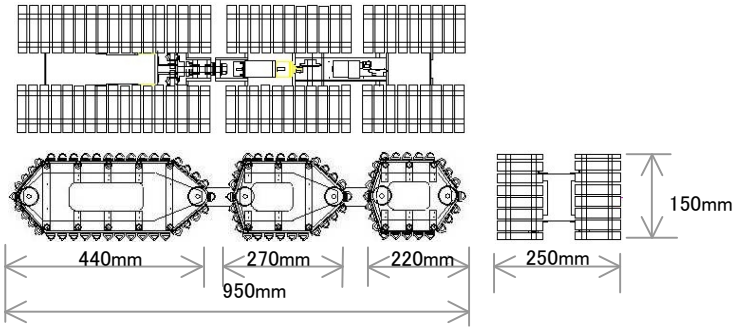

Fig.11 Robot design

9. Other Mechanisms

Our robot have a joint doing a pan tilt equipped with a camera and a temperature sensor on the body tip.

And other, we improve turning performance by inclining a tread of crawler.

10. Team Training for Operation (Human Factors)

It is difficult to operation because of the many joints.
Operator need to practice moving such as find a victim or object, climb over a stairs or slope and change the form.

11. Possibility for Practical Application to Real Disaster Site

Our robot is covered up the whole robot by crawler.
So good to climb over the rubble.

12. System Cost

The main body: Total cost is 400,000 Japanese Yen.
Sensor and PC: Total cost is 100,000 Japanese Yen.