RoboCup Rescue 2010 - Robot League Team SUCCESS (Thailand)

Anusorn Tangpok, Chanyut Siriphitakchai, Chaiwat Sawatdee, Wittaya Kaewesuriyawong, Chunhawut Pathomkanokpong, Waraporn Bubpamala and Kittiphong Poomphochana

Faculty of Engineering
Rajamangala University of Technology Rattanakosin (RMUTR)
96 Phuttamonthon 5 Road, Salaya, Nakhon Pathom 73170, THAILAND
wb_rmutr@hormail.com

Abstract. SUCCESS team the best mobility award winner in national competition 2009. The Team has two teleoperative robots, rear and back arms help to movement. Including gripper and camera unit sensor arms which monitoring and creating the 2-D automatic mapping. The conveyer belts help the robots excellent movable on a variety location. The driving system consists of high-torque DC motor for the moving on the steep or dangerous procession. The high strength materials used to construct the main robot body to protect the inside unit. The rubber used as components of a mobile system help to support and adhesion. The team is prepared for show the ability in the RoboCupRescue 2010

Introduction

Rescue robot competition is very popular in various groups of Thai student. In 2009, both secondary and vocational education has entered the competition more than 104 teams and 7 foreign teams competed in the Thailand National Rescue Robot Contest, sponsored by Siam Cement Group (SCG) and organized by Thailand Robotic Society (TRS). The SUCCESS team has joined four times competition in Thailand Rescue Robot Championship (2006-2009) and can pass through the 8 team last 4 consecutive years. In 2008 and 2009 teams from Japan, Iran, Australasia, and Germany joy to the contest. The design of robots competing in the last contest shows very high level of diversity (please referred to http://www.thailandrescuerobot.org). Our team won the Best Mobility category in the competition.

It time of opportunity to rising experience and developing skill in the international competition. RoboCupRescue, recognized as the international competition and a very high honor for the team to join. The Rajamakala University of Technology Ratanakosin, RMUTR decided send team to participate in RoboCup Rescue 2010 competition in Singapore

Fig. 1. SUCCESS won The Best Mobility award in 2009

1. Team Members and Their Contributions

The SUCCESS has seven members. The names and contribution of each member are listed as follows:

- Anusorn Tangpok — Electronics design, software development
- Chanyut Siriphitakchai — Mechanical design and control robot
- Chaiwat Sawatdee — Mechanical design
- Wittaya Kaewesuriyawong — Mechanical design
- Chunhawut Pathomkanokpong — Software and controller development
- Kittiphong Poomphochana — Team advisor
- Waraporn Bubpamala — Team co-advisor

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

Fig. 2. Set up unit before the competition

Need for speed and reduce errors in the competition, the installing equipment and control systems unit was set before. When fight just plug and switch on the unit can used immediately. The system installation will consist of access point, UPS (for computer backup power) and plug into the base aluminum.

3. Communications

The communication systems used between the SUCCESS operator and robots. The wireless LAN based on IEEE 802.11a standard, the main communication system: for controlling robots, receiving video streaming from cameras on robots, and getting sensors feedback for locating the status of robots on computer monitor as well as for the automatic map generation. The range of the working distance is within 200 m for outdoor and 100 m in the building.

Rescue Robot League		
SUCCESS (THAILAND)		
Frequency	**Channel/Band**	**Power (mW)**
5.0 GHz - 802.11a	Adjustable	50

4. Control Method and Human-Robot Interface

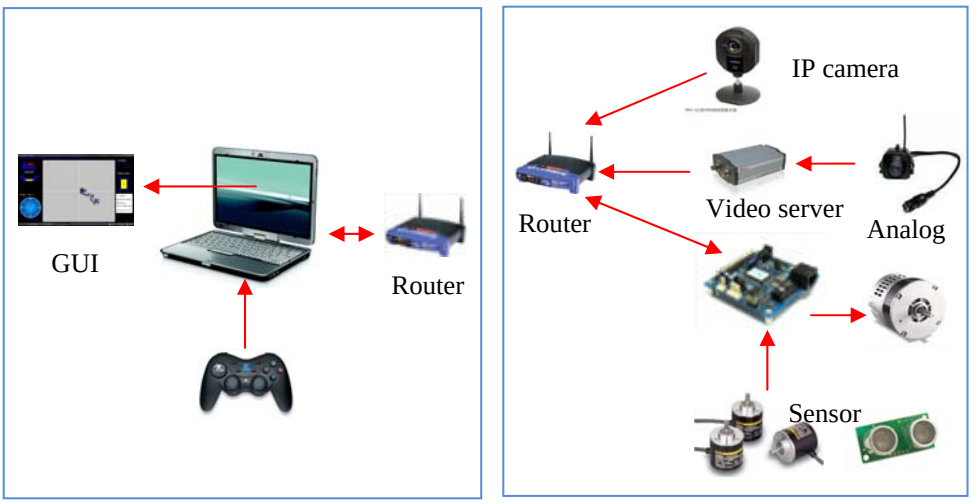

Fig. 3. The control system used by SUCCESS

The robots main control is based on one CPU (PIC microcontroller (16F877) 40 pins). **Fig. 3.** depicts the schematic of the control system which has two main tasks as follows:

4.1 Used for receiving data for identifying status of the robots and create map automatically as shown in Figure 2 This information will be shown to the robot operator via a computer monitor.

4.2 Used for sending data for controlling the movement by sending the signal to the drive control for controlling DC motor at various locations on the robots

5. Map generation/printing

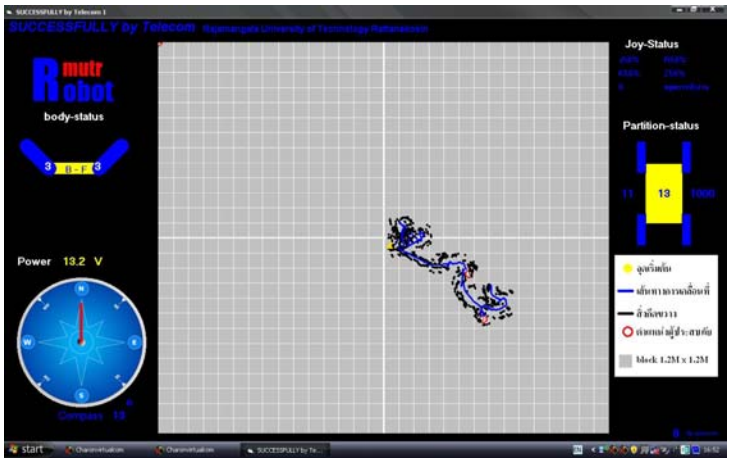

Fig. 4. Display of the robot status and the automatic mapping

The several of sensors are installed on each robot in order to get the data for monitoring and creating the 2-D map. The robot direction and location for searching victims was created automatically shown on the computer monitor (**Fig. 4**). The map is generated by using the information from the distance the robot moved from encoders, direction of the robot sensed by digital compass, and distance between the robot and obstacles from Ultrasonic sensors.

.

6. Sensors for Navigation and Localization

Sensors, used for guiding the robot movement and identifying the location of the robots, shown in **Fig.3** in the part of robot side and described as follows:

6.1 Encoders: Use to measure the distance that the robot moved and use this information to plot on the software along with other type of sensors.

6.2 Digital compass module[1]: Use to measure the direction of the robot and use this data to plot along with the distance measured from the encoders.

6.3 Ultrasonic sensors [2]: Use to measure the distance between the robot and obstacles and use this information to plot on the software.

7. Sensors for Victim Identification

Fig. 5. SUCCESS's searching and identifying victim

On each robot, many types of sensors used for checking and analyzing the victim found by the robot. These sensors are listed as follows:

7.1 IR temperature sensor [3]: Use for checking the temperature of victim found for further analyzing whether the victim still alive or not. The temperature value measured by this kind of sensor will be sent back to computer monitor of the operator.

7.2 CO_2 sensor [4]: Use for measure CO_2 of victim found for checking the aspiration of the victim.

7.3 Microphone: Use for detecting sound of the victim found.

Real-time video cameras: Use for investigating of the victim found and send pictures back to the operator for further analyzing the victim.

8. Robot Locomotion

Fig. 6. Success can be up-down stairs and in the roughly area.

SUCCESS Team has two teleoperative robots like shown as **Fig. 6**. The driving system, use the conveyer belt for movable on a variety of areas such as the rugged, slope ramp, the different step and stairs. Each drive system consists of high-torque DC motor for the moving. The high strength materials used to construct the main body. The rubber used as components of a mobile system to help support and help in the adhesion. The robots have two arms (front and back), can be free rotated more than 360 degree.

9. Other Mechanisms

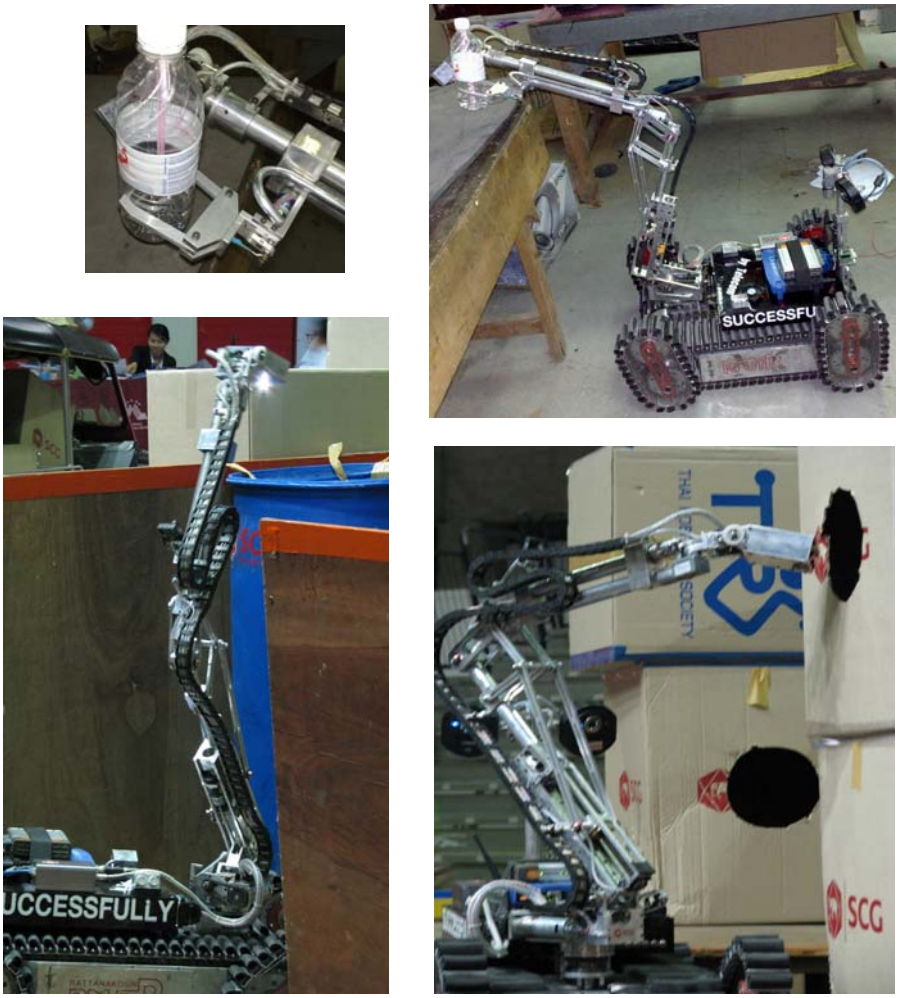

Fig. 7. Success's gripper and camera arm

6 join robot mechanical arms, extendible length 1.2 meter, with camera access to check the victim. The broader views obtain from twin-camera at the rear side help to identifying the direction and location of victims. The gripper (as show in the picture before) captures and moves some items such as bottled water which weight not more than 1 kg.

10. Team Training for Operation (Human Factors)

The SUCCESS team has competed in Thailand Rescue Robot since 2006. We have learned and continuously developed our skills from 2006. We received the best training through the experiences from real competition round in round out since in each task given in the competition requires not only skills of robot operator but the operator has also to withstand the pressure in the competition environment.

11. Possibility for Practical Application to Real Disaster Site

The problem of unrest in the southern hemisphere is the main problem of Thailand. Since the terrorist bomb, burn or destroy all such construction. The threat to operational staff, life interest or injured during the mission. The development of the Thai Rescue Robot can actually use to take a significant help the performance of the staff. The security talent motion of SUCCESS Robots, strength and durability, in a practical implementation.

12. System Cost

SUCCESS team has three robots. Two of which are teleoperative robots. The cost of parts on each robot is listed as follows:

Structure of robot and drive train	
$ 1,500	
Sensors	
- Encoders x 2	$ 120
- Digital compass module	$ 100
- Temperature sensor	$ 60
- Ultrasonic sensors x 2	$ 100
- microphone	$ 20
- IP cameras x3	$ 600
- Analog camera	$ 80
Controller and electronics	$ 400
Communication system	

- Access point IEEE 802.11a	$ 180
- Internet video server	$ 300
- Ethernet IO x 3	$ 150
Total Cost	**$ 3,4610**

13. Lessons Learned

We have participated in Rescue Robot since 2006. We have learned a lot from the experiences in competing each year. We have seen what other did and we have learned how improve our robot every year. More importantly, we have learned that we cannot be successful without the cooperation of every team member.

References

1. Deveantech Ltd.: CMPS03 Magnetic Compass [Online]. Available: http://www.robot-electronics.co.uk/shop/Compass_CMPS032004.htm [2009, December 18]
2. SRF05 - Ultra-Sonic Ranger Technical Specification [Online]. Available: http://www.robot-electronics.co.uk/htm/srf05tech.htm [2009, December 18]
3. TPA81 Thermopile Array Technical Specification [Online]. Available: http://www.robotstorehk.com/sensors/doc/tpa81tech.pdf [2009, December 18]
4. SenseAir´s CO2-sensor in cars –a low cost product that works! [Online]. Available: http://www.senseair.se/PressRelease/ep_car_co2_engine_hemsida.pdf [2010, January 6]