

a master's thesis entitled "Discussion on the performance of W-CDMA microcell networks when there are non-operating base stations and the responses to problems," under the guidance of Senior Researcher Kazunori Okada (Professor of Collaborative Graduate School). He presented his thesis at a meeting convened for this purpose at the university on Feb. 5.

- (2) The trainee, Yasuhiro Tanaka (Tokyo Denki Univ. B4), prepared and submitted a graduate thesis entitled "Development and evaluation of a VoP system suitable for rescue activities in underground spaces," under the guidance of Expert Researcher Yasushi Hada.

3.36 March 2009

3.36.1 Demonstration test (additional test) of disaster information collection system using cell phones

A demonstration test on the collection of information through the use of terminals was carried out in Takamatsu City, Kagawa, on March 27 and 28, as in February, with citizens aged 20 to 70 years participating (Fig. 89). There were additional participants mainly in their 50s and 60s. An examination was conducted on whether the participants in the test last year remembered the operational method after one year.

3.36.2 Invited lectures

- (1) Seminar on the communication of information during a disaster

In a joint seminar held by the Kinki Bureau of Telecommunications, Kinki Emergency Communication Conference and Kinki Information Communication Conference in Osaka Museum of History on March 6, Group Leader Takizawa presented research and development into advanced ICT for disaster management and mitigation (Fig. 90). "The technology for convoluting information on the siren of an emergency vehicle" (research theme of Expert Researcher Kotaro Sonoda) disclosed therein was broadcast in detail for three minutes



Fig.89 Demonstration test of disaster information collection system using cell phones



Fig.90 Seminar on information communication during a disaster

during the NHK television program, "News Terrace Kansai," at 18:00 the same day.

- (2) Special session of Information Processing Society of Japan, "Current status of and future prospects for disaster management or mitigation using advanced IT technology"

In the special session of the Society held at Ritsumeikan Univ. on March 10, Group Leader Takizawa gave a lecture entitled "Information collection during a disaster using ubiquitous technology — damage estimation technology".

3.36.3 Presentation in China-Japan Science Forum and repeated investigation of Sichuan Earthquake disaster areas

Expert Researcher Jeong Byeong-pyo attended to the session of the 2008 Wenchuan Earthquake and Natural Disaster Mitigation in the 2nd China-Japan Science Forum held by the Japan Society for the Promotion of Science in Beijing on March 9 and 10. He gave a

poster presentation entitled “Estimation of Seismic Intensity Due to the 2008 Wenchuan Earthquake”. He also investigated the disaster areas of the Sichuan Earthquake as in October last year, and identified, from the interviews with the researchers there, the problems in the seismic intensity distribution presented by Chinese counterparts and in internal and external transmission of information. In this way, he confirmed the importance of our technology for estimating the extent of the damage.

3.36.4 Publications

- (1) Special coverage in J. of Inst. of Electronics, Information and Communication Engineers, March, 2009: “Information communication technology for disaster management or mitigation”

Expert Researcher Akihiro Shibayama was responsible for this special article as a guest editor. The following topics were provided by NICT researchers:

- Kazunori Okada: “Problems of cell phones during a disaster and the countermeasures”
- Yoshiaki Hisada (Kogakuin Univ.), Masahiro Murakami (Kogakuin Univ.), Akihiro Shibayama, and Takizawa: “Disaster mitigation measures in cooperation with local governments and residents for ultrahigh-rise buildings during a large-scale disaster”

- (2) An introductory article “Positioning of the use of RFID and assurances for safety and security” prepared by Group Leader Takizawa appeared in J. of Radio Engineering & Electronics Association FORN, March Ed.

3.36.5 Presentation of research results

- (1) Suzuki, Okada, and Nam: “Evaluation of the performance of W-CDMA microcell network when there are multiple non-operating base stations,” general meeting of the Inst. of Electronics, Information and Communication Engineers in 2009, B-5-1, March 2009.
- (2) Kei Sawai (Tokyo Denki Univ.), Hitoshi Kono (Tokyo Denki Univ.), Tsuyoshi Suzuki (Tokyo Denki Univ.), Hada, and Kuniaki Kawabata (RIKEN): “Development of a wire-

less sensor node with impact-resisting mechanism to protect against being dropped in the case of projected configuration,” 14th Robotics Symposia, 5C2, pp. 459–464, Mar. 16–17, 2009.

- (3) Hada, Takayuki Kaiso (Thinktube Inc.), Kentaro Matsuyama (Thinktube Inc.), Gyoda, and Takizawa: “Long-distance remote control of mobile robots using an ad hoc mesh network,” 14th Robotics Symposia, 5C3, pp. 465–470, Mar. 16–17, 2009.
- (4) Jeong, Sinsaku Zama (NRIFD), Takizawa, Makoto Endo (NRIFD), and Shibayama: “Development of information collection system using cell phones for use during a disaster,” J. of Japan Association for Earthquake Engineering, 9, 2, pp. 102–112, 2009.
- (5) Shibayama, Yoshiaki Hisada (Kogakuin Univ.), Masahiro Murakami (Kogakuin Univ.), Shinsaku Zama (NRIFD), Makoto Endo (NRIFD), Takizawa, Itsuki Noda (AIST), Ai Sekizawa (The Univ. of Tokyo), Koji Suematsu (Vector Research Inst.) and Akira Ohgai (Toyohashi Univ. of Tech.): “Research on disaster information sharing using a damage information collection system,” J. of Japan Association for Earthquake Engineering, 9, 2, pp. 113–129, 2009.
- (6) Shinsaku Zama (NRIFD), Makoto Endo (NRIFD), Kenichi Takanashi (NRIFD), Kiminori Araiba (NRIFD), Ai Sekikawa (The Univ. of Tokyo), Masafumi Hosokawa (FDMA), Jeong Byeong-pyo, Yoshiaki Hisada (Kogakuin Univ.) and Masahiro Murakami (Kogakuin Univ.): “Proposal and verification of efficient collection and usage of damage information,” J. of Japan Association for Earthquake Engineering, 9, 2, pp. 185–199, 2009.

3.37 May 2009

3.37.1 Open demonstration of NEDO contracted research, “High-speed search robots for use in confined spaces”

A demonstration test of NEDO contracted research into high-speed search robots moving in confined spaces was held for researchers

and the media at Hyogo Prefectural Emergency Management and Training Center on May 11. A communication system needed for remote control and the collection of information by multiple robots was constructed in the environment inside a 10-story building and operation of the robots was exhibited (Fig. 91).

3.37.2 New research group formed at the Inst. of Electronics, Information and Communication Engineers

A “third-class” research group investigating an information communication network for a safe and secure life, which aims at studying various technologies concerning information communication networks that provide safety and security from various viewpoints, including those from interdisciplinary areas with social sciences, was formed in the Engineering Sciences Society of the Inst. of Electronics, Information and Communication Engineers. The chairperson is Senior Researcher Kazunori Okada and there are 47 committee members. The duration is two years.

3.37.3 Research presentation

At the Robotics and Mechatronics Seminar 2009 of the Japan Society of Mechanical Engineers (ROBOMECH2009) held in Fukuoka on May 24 to 26, the following two presentations were given.

- Hada, Yasuhiro Tanaka (Tokyo Denki Univ.), Takayuki Kaiso (Thinktube Inc.), Kentaro Matsuyama (Thinktube Inc.), Tsuyoshi Suzuki (Tokyo Denki Univ.), and Takizawa: “Development and evaluation of a VoP system suitable for rescue activities in underground spaces,” 1A2-G19.
- Shoji Kawamoto (Chiba Inst. of Tech.),

Nobuto Hara (Chiba Inst. of Tech.), Tomoaki Yoshida (Chiba Inst. of Tech.), Eiji Koyanagi (Chiba Inst. of Tech.), and Hada: “Development of a LAN cable-installing robot,” 1A2-G20.

3.38 June 2009

3.38.1 Introduction of researches

Expert Researcher Jeong Byeong-pyo attended the 5th GIS Community Forum held in midtown Tokyo on June 4 and 5, where he gave a presentation on the entire concept of the research and development project into estimating damage during a disaster to support international firefighting/rescue teams. He explained some analytical examples in the case of the Sichuan Earthquake.

3.38.2 Senior member of Inst. of Electronics, Information and Communication Engineers

Senior Researcher Okada was awarded a senior member certificate, indicating that he has become a senior member (a new title) of the Inst. of Electronics, Information and Communication Engineers.

3.38.3 Results of RoboCup 2009

The team, Pelican United (joint team of five organizations: Int’l Rescue System Inst., Tohoku Univ., Chiba Inst. of Tech, AIST, and NICT), achieved the following results in the robotics world championship, RoboCup 2009, Rescue Robot League, held in Graz, Austria on June 29 to July 5 (Fig. 92).

Mobility: 1st prize
 Manipulator: 1st prize
 Autonomy: 2nd prize
 Championship: 2nd prize



Fig.91 Open demonstration of NEDO contracted research project

3.39 July 2009

3.39.1 Research presentation

Expert Researcher Jeong Byeong-pyo attended the IEEE Int'l Geoscience and Remote Sensing Symposium 2009, held in Cape Town, South Africa on July 13 to 17. He gave a research presentation entitled "Estimation of Seismic Intensity Due to the 2008 Wenchuan Earthquake".

3.39.2 NICT's Facilities' Open House

The facilities of NICT were opened to the public on July 24 and 25, when a rescue robot and other items were demonstrated. At the event, the studies conducted in the Disaster Management and Mitigation Group were presented (Fig. 93).

3.40 Aug. 2009

3.40.1 Joint disaster management drill held by Tokyo Metropolitan Government, Setagaya-ku and Chofu City

In the disaster management drill carried out in Setagaya Park on Aug. 30, a demonstration test of a cell phone terminal with a function for collecting damage information was conducted (Fig. 94). The main task was to verify the function of autonomous GPS positioning without assistance from base stations, which was developed earlier at the end of last year. Group Leader Takizawa, Expert Researcher Jeong and Guest Researcher Hosokawa (NRIFD) were there for the drill.

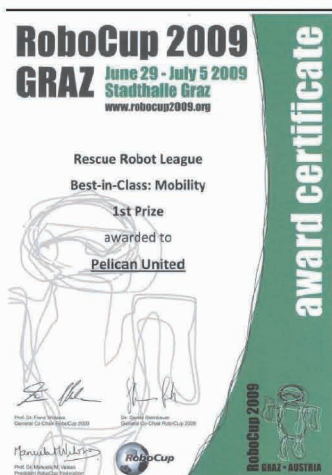
3.41 Sep. 2009.

3.41.1 Disaster Management Drill in Tokushima Pref.

Problems identified from the experience of The Iwate-Miyagi Nairiku Earthquake in 2008 and the Chuetsu Earthquake in 2004 include the problem of towns in mountainous areas becoming isolated, the collection of disaster information before the first action, and deteri-



Trophies of four sections



Certificate of Mobility section

Fig.92 Trophies and certificate obtained in RoboCup 2009

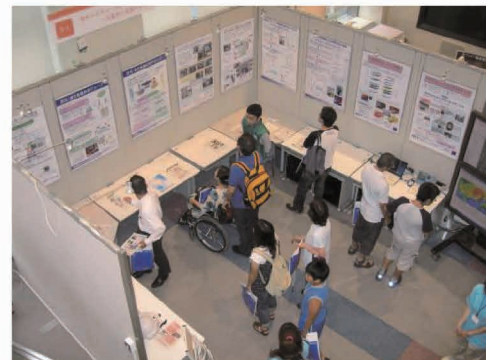


Fig.93 Facilities' Open House

oration in the potential for local disaster management due to depopulation and aging. In the disaster management drill in Tokushima Pref. carried out on Sep. 1, the following demonstration test was performed. The test involved the collection, transmission and sharing of disaster information in mountainous areas where cell phones cannot be used. The test was performed in cooperation with the Nat'l Research Inst. of Fire and Disaster, Fire and Disaster Management Agency, Ministry of Internal Affairs and Communications (Fig. 95). Guest Researcher Masafumi Hosokawa (NRIFD), and Expert Researcher Jeong Byeong-pyo participated in the drill.

(1) Test on image information collection (NICT)

A test was conducted to verify a system for collecting information on damage in isolated villages (with coordinated image data obtained by autonomous positioning) and well-being information using cell phone ter-

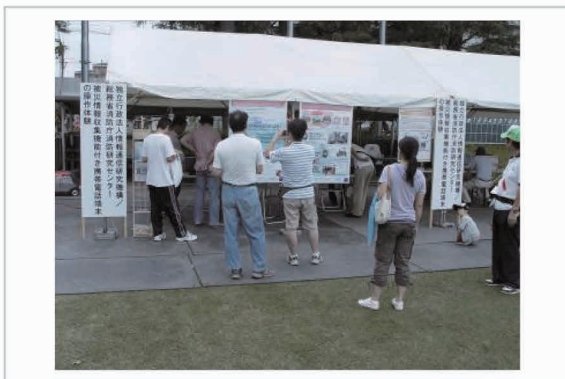


Fig.94 Joint disaster management drill held by Tokyo Metropolitan Government, Setagaya-ku, and Chofu City

minals that have a function for collecting damage information. The information stored in external memory was transmitted from the local disaster management centers to the information-sharing server of NRIFD via a long-distance wireless LAN. The information was displayed and shared with positional information at the drill headquarters.

(2) Test on collection of environmental monitoring data (NRIFD)

In the event that victims that need to be rescued in mountainous areas need to be protected during a disaster, a test was conducted that involved collecting data from fire alarms and environmental monitoring sensors, such as temperature sensors, via a long-distance wireless LAN, and transferring the data to the information-sharing server of NRIFD.

3.41.2 Society meeting of the Inst. of Electronics, Information and Communication Engineers (Niigata Univ.)

(1) A research meeting on an information communication network to ensure safety and security (“third class”) and its steering committee were held on Sep. 18. As the chairperson, Senior Researcher Okada gave a presentation on the action policy of the research meeting. In addition, Guest Researcher Hosokawa (NRIFD) and the trainee Mark (The Univ. of Electro-Communications) who is under the guidance of Senior Researcher Kazunori Okada, each gave research presentations. Approximately

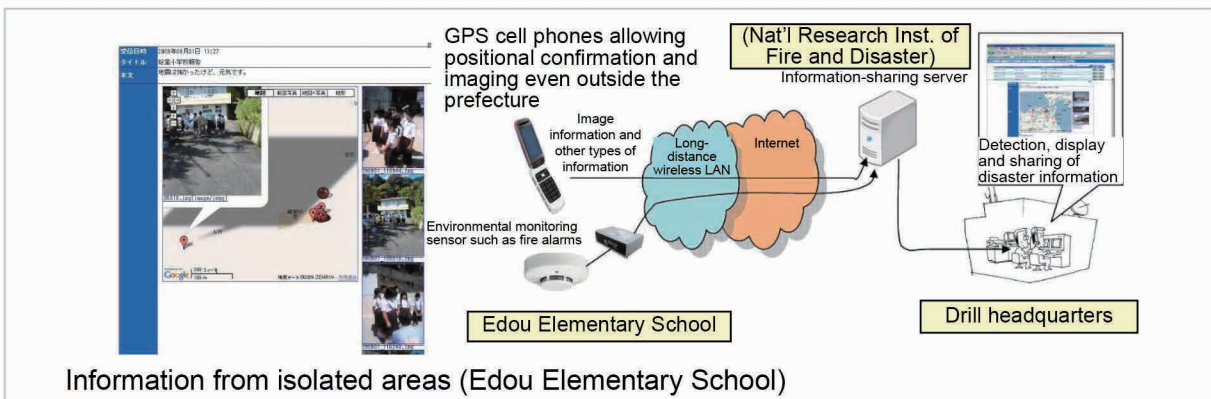


Fig.95 Disaster Management Drill in Tokushima Pref.

40 people attended.

- (2) In the panel session entitled “The social installation of an ad hoc network —possibility of application to safety and security—,” held on Sep. 16, which was planned by Technical Committee on Ad Hoc Networks of the Communications Society, Group Leader Takizawa guided the session as the session organizer (Fig. 96). Developmental examples aimed at application of an ad hoc network for disaster management and crime prevention created through research close to disaster-stricken areas, such as those in the Tokyo Fire Department and The Chugoku Electric Power Co.,Inc., were presented and discussed, and the possibility of their social application was examined.

3.41.3 Expert Researcher, Sonoda, transferred to Nagasaki Univ.

Expert Researcher Kotaro Sonoda who was responsible for studies on the application of acoustic signal processing for security and disaster management, was transferred on Oct. 1 to the Laboratory of Electronic Information Engineering, Dept. of Computer and Information Sciences and the Laboratory of Theoretical and Applied Software Science, School of Engineering, Nagasaki Univ., as an assistant professor.

3.42 Oct. 2009

3.42.1 Presentations at academic meetings

The following presentations were given in



Fig.96 Panel session in Society meeting of Inst. of Electronics, Information, and Communication Engineers

October 2009:

- Ayako Fukushima, Jeong Byeong-pyo, Astuyuki Ida, Shin'ichi Tsuchiya, and Yuji Hasemi: Proposal of an Evacuation Navigation System in the Event of a Natural Disaster, USMCA 2009 (Seoul, Korea)
- Jeong Byeong-pyo, Masafumi Hosokawa, Osamu Takizawa, Nguyen Hoang Nam, and Taewoon Kim: “Distribution of earthquake damage estimation using broadband satellite communications to support international rescue operations,” IEEE ATC 2009 (Vietnam)
- Jeong, Takizawa, Ayako Fukushima (Waseda Univ.), Makoto Endo (NRIFD), and Shinsaku Zama (NRIFD): “Development of an information collection system using cell phones,” J. of GIS Association of Japan lecture, GIS Association of Japan (Niigata)
- Kim, Jeong, Takizawa, and Masafumi Hosokawa (NRIFD): “Research into the automatic extraction of topographic classification information using DEM,” J. of GIS Association of Japan, GIS Association of Japan (Niigata)
- Jeong, Takizawa, Shinsaku Zama (NRIFD), and Masafumi Hosokawa (NRIFD): “Estimation of seismic intensity distribution of the earthquake off Sumatra Island (Sept. 30, 2009) using SRTM,” fall meeting of the Seismological Society of Japan (emergency session on earthquakes off Samoa Islands and off Sumatra Island), Seismological Society of Japan

3.42.2 Exhibition

- (1) CEATEC JAPAN 2009

At the NICT Super Event held in Makuhari Messe on Oct. 6 to 10, an exhibition entitled “Survival cell phones,” was presented in the area, “ICT for safety and security”. The results of damage estimation after Sichuan earthquake, China were displayed on the tiled display (Fig. 97).

- (2) Security & Safety Trade Expo 2009

An earthquake damage estimation system and a cell phone terminal with a function for collecting damage information were shown

in the exhibition held at Tokyo Big Sight on Oct. 21–23 jointly with the Nat'l Research Inst. of Fire and Disaster of Fire and Disaster Management Agency (Fig. 98).

3.43 Nov. 2009

3.43.1 Presentations at academic meetings

At the meeting of the Inst. of Social Safety Science held in Shizuoka, the following presentations were given.

- Makoto Endo (NRIFD), Shinsaku Zama (NRIFD), and Jeong: “Expansion of information-sharing tools for use in disaster management drills and the use of a simple means of information input”
- Jeong, Kim, Takizawa, Masafumi Hosokawa (NRIFD), and Shinsaku Zama (NRIFD): “Research into an algorithm for extracting topographic classification information of an alluvial fan using DEM”
- Jeong, Shinsaku Zama (NRIFD), Makoto Endo (NRIFD), Takizawa, and Ayako Fukushima (Waseda Univ.): “Development of information collection system

using cell phones — tests on convenience in practical operation of the system and system improvement”

- Ayako Fukushima (Waseda Univ.), Jeong Byeong-pyo, Yuji Hasemi (Waseda Univ.), and Atsuyuki Ida (Waseda Univ.): “Development of information collection system using cell phones — discussion on the period needed for information collection”

3.43.2 Exhibition

A system for collecting data in the disaster-stricken area, which was made by applying mobile robot technology and sensor network technology in cooperation with Tokyo Denki Univ. and RIKEN, for ad hoc use in a disaster-stricken area was exhibited at the Int'l Robot Exhibition 2009 held at Tokyo Big Sight on Nov. 25 to 28 (Fig. 99). In addition, a rescue robot that is being jointly developed was exhibited in the NEDO booth.

3.44 Dec. 2009

3.44.1 Lecture in AFICT 2009 and visit to NECTEC

Group Leader Takizawa, and Expert Researchers Jeong Byeong-pyo and Nguyen Hoang Nam, attended the Asian Forum on Information and Communications Technology 2009 held in Bangkok, Thailand, on Dec. 16. At the forum, Expert Researcher Nguyen Hoang Nam gave a lecture on research into estimating earthquake damage based on numerical altitude data obtained from artificial satellites and on the concept of international cooperation. They visited the Nat'l Electronics



Fig.97 CEATEC JAPAN 2009



Fig.98 Security & Safety Trade Expo 2009



Fig.99 Int'l Robot Exhibition 2009

and Computer Technology Center earlier on Dec. 15 and solicited cooperation for the international cooperative test on transmitting the results of estimating earthquake damage obtained by using Wideband InterNetworking engineering test and Demonstration Satellite “KIZUNA”(WINDS) (Fig. 100).

3.45 Jan. 2010

3.45.1 Estimation of seismic intensity distribution of the Haiti earthquake on Jan. 12, 2010

Expert Researcher Jeong calculated the seismic intensity distribution over a period of 16 hours after reports of the Haiti earthquake that occurred on Jan. 12 (Fig. 101). He provided the information via the Nat'l Research Inst. of Fire and Disaster and other means to the Fire and Disaster Management Agency of the Ministry of Internal Affairs and Communications and to the Caribbean Division, Latin American and Caribbean Affairs Bureau, Ministry of Foreign Affairs. The information was also urgently released to the media on Jan. 15.

[Media coverage]

“Haiti earthquake: estimated seismic intensity was 7 or more in the capital,” *The Mainichi Newspapers*, morning edition, p. 6, Jan. 16, 2010

“Haiti earthquake: seismic intensity of 6+ to 7 in the capital,” *The Nikkei*, morning edition, p. 13, Jan. 18, 2010

“Haiti earthquake, seismic intensity is 6+ to 7, as estimated by Japan professional,” *The Yomiuri Shimbun*, morning edition P. 33, Jan.



Fig.100 Lecture in AFICT 2009 and visit to NECTEC

24, 2010

3.45.2 Presentations at academic meetings and papers published

The following presentations were given and the following papers were published in January 2010.

- Takizawa, Kotaro Sonoda (Nagasaki Univ.), Katsunari Yoshioka (Yokohama Nat'l Univ.), and Suzuki: “Acoustic electronic watermark for emergency vehicle sirens,” Symposium on Cryptography and Information Security, Inst. of Electronics, Information and Communication Engineers (SCIS 2010)
- Takizawa, Masafumi Hosokawa, (NRIFD),

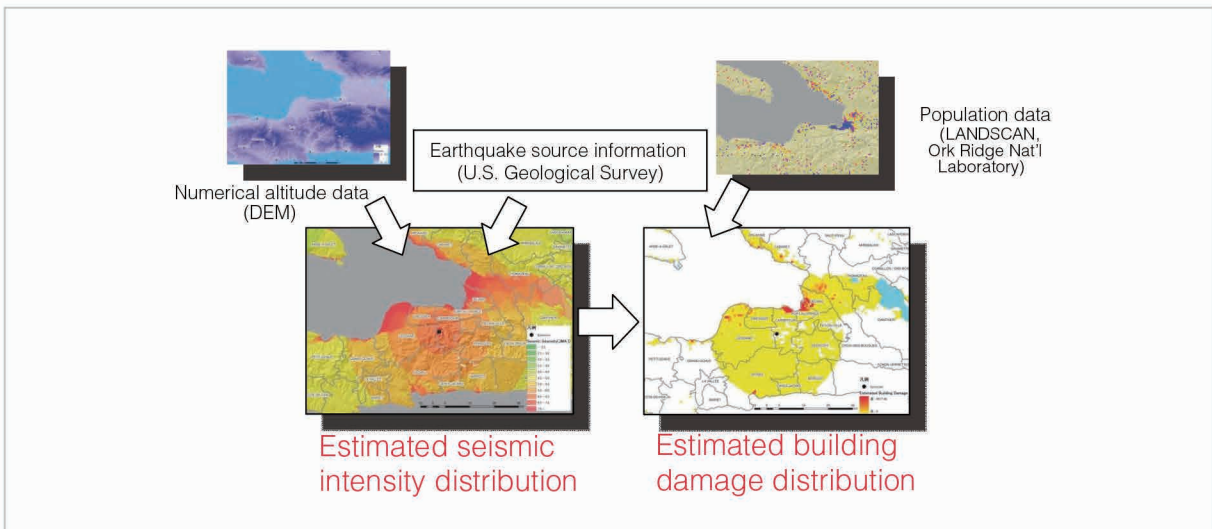


Fig.101 Estimated seismic intensity distribution of Haiti earthquake on Jan. 12, 2010

Yoshifumi Shimazaki (KDDI) and Hiroyuki Fukuoka (KDDI R&D Laboratories): “Development of label/message board function with added positional information in cell phone terminals in combination with Bluetooth and RFID,” *J. of Information Processing Society of Japan* Vol. 51, No. 1, pp. 174–179.

3.46 Feb. 2010

3.46.1 Open demonstration of project for estimating earthquake damage

As part of the research and development into systems for earthquake damage estimation that are in progress under the Disaster Management and Mitigation Group, an open demonstration of the developed system was given at the “Int’l Symposium on Wideband InterNetworking engineering test and Demonstration Satellite ‘KIZUNA’(WINDS)” (Fig. 102) held at the Science Museum (Kudan, Tokyo) on Feb. 4 and at the “Disaster/Crisis Management ICT Symposium 2010” (Fig. 103) held at Pacifico Yokohama on Feb. 5.

In the demonstration, the Nat’l Research Inst. for Fire and Disaster (Chofu City) provided disaster management headquarters connected to the demonstration site, and simulated a disaster area via the NICT headquarters. The NRIFD and the NICT headquarters,

which were 7.8 kilometers apart, were connected via a 5 GHz-band wireless access system. NRIFD was connected to the NICT headquarters and the site via WINDS. The demonstration was carried out according to a scenario whereby the rescue team on site has bidirectional image transmission and oral communication via IP phone with the Nat’l Research Inst. of Fire and Disaster, and rescues the victims with the instructions from the headquarters. A damage estimation server was installed at the NICT headquarters, and delivered the results of the estimation both to NRIFD and the demonstration site. Senior Vice-Minister of Internal Affairs and Communications, Naito, Senior Vice-Minister of the Ministry of Education, Culture, Science, Sports, and Technology, Nakagawa and Mr. Okumura, a member of the Council for Science and Technology Policy visited the site to inspect the proceedings.

3.46.2 Lecture and exhibition

(1) NICT Information Communication Security Symposium on security in the age of cloud computing

At the symposium held in Kokuyo Hall (Shinagawa, Tokyo) on Feb. 12, the trainee, Fumiko Takeuchi (Tokyo Univ. of Science), gave a presentation entitled “Cloud Service—from Disaster Management to Business Stimulation—”.



Fig.102 Open test in Science Museum



Fig.103 Open test in Pacifico Yokohama

- (2) 6th RFID Meeting of Japan Automatic Identification Systems Association (JAISA), 2009

At the meeting of RFID-related industries held in Kikai Shinko Building on Feb. 17, Group Leader Takizawa was invited to give a lecture entitled “RFID-based positioning and assurances for safety and security”.

- (3) The 14th Technology Against Earthquake Expo

At the exhibition held in Pacifico Yokohama on Feb. 4 and 5, cell phones that are useful for investigating damage and patrolling to prevent crime were presented, together with an estimation of the seismic intensity distribution of the Haiti earthquake.

3.46.3 Papers published

The following papers were published in Feb. 2010.

- Takizawa and Kyoko Makino (Mitsubishi Res. Inst.): “Insertion of encoding information text IH into plain text by controlling the line-feed position,” *J. of Inst. of Electronics, Information and Communication Engineers*, J93-A, No. 2, pp. 100–103.

3.47 March 2010

3.47.1 General meeting of the Inst. of Electronics, Information and Communication Engineers

- (1) A symposium on “Information communication networks for ensuring safety and security” was held on March 17–18. The symposium was planned by the research committee for information communication networks for ensuring safety and security (“third class” research meeting) of the Inst. of Electronics, Information and Communication Engineers. The chairperson was Senior Researcher Okada and the trainee Attoungble Kouakou Jean Marc (The Univ. of Electro-Communications), gave a presentation. In addition, a tutorial on the topic of “safety and security: challenges of information communication network-circuit-system technology,” which was planned jointly by the research meeting and the Technical Committee on Circuits and Systems, was held on March 18. During the tutorial, Guest Researcher Masafumi Hosokawa (NRIFD) gave a presentation.
- (2) The trainee, Takeuchi, gave a presentation entitled “Studies on Low-Power FM Broadcasting Using the Wireless Specifications for

Voice Assist for Use During a Disaster,” in the general session of the radio communication system A (mobile communication) on March 17.

3.47.2 Papers published

The following paper was published in March 2010.

- Gyoda, Nam, Okada, and Takizawa: “Evaluation of the performance of a wireless ad hoc network in the model of communication during a disaster,” J. of Inst. of Social Safety Science, No. 12, pp. 1–9.

3.48 April 2010

3.48.1 Diffusion through society of Cellular Phone Application for Safety/Disaster Information Collection and Transmission; “Easy-Reporter”

By 2009, the Disaster Management and Mitigation Group had mostly finished development of Cellular Phone Application for Safety/Disaster Information Collection and Transmission; “Easy-Reporter”. The application facilitates the acquisition of positional information by GPS, the acquisition of situational photography using the camera and the registration of the situation by item selection simultaneously. The application had been under development in collaboration with the Nat’l Research Inst. of Fire and Disaster, Fire and Disaster Management Agency, Ministry of Internal Affairs and Communications. The application has functions that are not found in similar applications, such as autonomous positioning without referring to a base station and the storage of collected information in external memory, even when transmission goes down or the network is congested, for example, if the cell phone base station is damaged. This application is intended to be used to ensure safety and security, to acquire damage information during a large-scale disaster, for example, by victims acquiring damage information during evacuation and providing the damage information to neighboring disaster management bases (such as shelters) or by delivering it to the disaster management head-

quarters. The application can also be used to identify places where it is necessary to exercise caution when patrolling to prevent crime.

In 2010, steps were underway to register the application in the download server of a communications carrier (au) and the application was ready for commercialization. One possibility of commercialization is to use the application for emergency notification during the transportation of radioactive materials, which was requested by the Japan Atomic Energy Agency (JAEA). Joint development of this kind of system started in 2009. JAEA examined the usefulness of the application in a demonstration test using terminals borrowed from NICT with the transportation workers (Fig. 104). The application was proposed to the Cabinet Office Nuclear Safety Commission and to those engaged in administration and industries related to safety regulation. The application was presented in a transportation accident-related investigation report issued by the Nuclear Safety Commission. The application was revised in 2009 due to a request for functional addition from JAEA, and JAEA examined the revised application in April.

3.48.2 Facilities’ Open House in the Nat’l Research Inst. of Fire and Disaster

Under a request made to the Disaster Management and Mitigation Group to hold an Open House when the facilities of the Nat’l Research Inst. for Fire and Disaster were



Fig. 104 Demonstration of the measures against a transport accident in Tokai-mura (photo from: JAEA)

opened to the public on April 16, we were able to exhibit four items. They were: an application for collecting information by cell phones (Easy-Reporter), a system for estimating earthquake damage, a long-distance wireless access system that connects NICT and NRIFD, and the convolution of information in the siren of an emergency vehicle. We demonstrated the actual machines, and strongly promoted the collaborative relationship between the two organizations (Fig. 105). The items exhibited remained on site under the management of the Center for Continuous Display after the facilities were open to the public.

3.48.3 Lecture

Group Leader Takizawa was invited to give a lecture entitled “Managing and mitigating disaster using the familiar ICT,” at a seminar held by the Communications and Information network Association of Japan (CIAJ) on April 22 (Fig. 106).

3.48.4 Papers published

The following papers were published in April 2010.

- Yasushi Hada, Takayuki Kaise (Thinktube Inc.), Kentaro Matsuyama (Thinktube Inc.), Koichi Gyoda, and Takizawa: “Wired and Wireless Hybrid Ad-hoc Network for Long Distance Navigation of Rescue Search Robots,” *J. of Information Processing Society of Japan*, Vol. 51, No. 4, pp. 1204–1214.

3.49 June 2010

3.49.1 Participation in RoboCup World Championship, Rescue Robot League —victory in manipulation section—

Expert Researcher Yasushi Hada traveled to the world championship of robotics technology, RoboCup 2010, Rescue Robot League, held in Singapore on June 19 to 25. The team, Pelican United, was made up five organizations: Int’l Rescue System Inst., Tohoku Univ., Chiba Inst. of Tech., AIST and NICT. The team achieved 4th rank overall among the 18 participating teams and was the highest of the three Japanese teams. It



Fig.105 Opening of National Research Inst. of Fire and Disaster to the public



Fig.106 Lecture given in CIAJ

achieved 1st rank in the Manipulation Class (Fig. 107). The teams ranked 1st to 3rd all came from Thailand, showing the rapid progress the country is making, where the research and development of robots is promoted under a national policy with strong support from the government and industry.

The aim of RoboCup is to evaluate the performance of various robots from different countries as they compete in the same field. The favorable results in this world championship show the disaster robot developed under NEDO contracted research “Strategic Development of Advanced Robotics Elemental Technologies” since 2006 has strong potential, even when seen from the global perspective. NICT was responsible for developing a communication system for use in long-distance search, for example, in an underground complex using robots. Expert Researcher Yasushi

Hada gave a scientific presentation on the newly developed directional variable antenna and a communication reconnection system at the Robotics and Mechatronics Seminar (ROBOMECH 2010) of the Japan Society of Mechanical Engineers held on June 13 to 16.

3.49.2 Papers published

The following two papers were published in J. of GIS Association of Japan in June 2010.

- Masafumi Hosokawa (NRIFD) Kenichi Takanashi (NRIFD), and Takizawa: “Cellular phone messaging system using indoor positioning by RFID,” GIS — Theory and Application, Vol. 18, No. 1, pp. 79–85.
- Takizawa, Masafumi Hosokawa (NRIFD), and Shibayama: “Development of a mobile terminal for monitoring damage that is compatible with many kinds of positioning RFIDs,” GIS — Theory and Application, Vol. 18, No. 1, pp. 87–93.

3.50 July 2010

3.50.1 NICT's Facilities' Open House

When the facilities of NICT were opened to the public on July 23 to 24, the Disaster Management and Mitigation Group demonstrated a rescue robot and other items in the booth on the 1st floor of the No.5 building (Figs. 108 and 109). special low power FM transmitter for voice assistance, which was developed for installation in shelters during large-scale disaster, was exhibited this year. FM radios were placed at two positions in the lobby of the main building and in the corridor

between the 4th and 5th buildings (Figs. 110 and 111) and an announcement broadcast from a steel tower was received. In addition, Group Leader Takizawa gave a lecture on “Disaster! Is communication assured?” in the seminar held on July 24.

3.51 Aug. 2010

3.51.1 Joint disaster management drill of Tokyo Metropolitan Government and Bunkyo-ku

The Easy-Reporter and the special low power FM transmitter for voice assistance were demonstrated in the joint disaster management drill of Tokyo Metropolitan Government and Bunkyo-ku held in Hakusan Campus, Toyo Univ. on Aug. 29. To demonstrate the special low power FM transmitter for voice assistance, a tent was erected on the ground (Fig. 112) and an FM antenna installed on the roof of the site (Fig. 113) were connected via a wireless LAN. The voice transmitted by VoIP was broadcast at 75.8 MHz. Although there was failure in the system because of the exceptionally hot weather, the demonstration was continued with a reserve machine available. A survey of the participants in the form of a questionnaire was also presented in the research meeting of the Japan Society for Disaster Information Studies in October. Before the drill, an article introducing the transmitter appeared in *The Eizo Shimbun* (Visual Communications Journal) Aug. 9, p. 11.



Fig.107 RoboCup World Championship, Rescue Robot League

3.52 Sep. 2010

3.52.1 Society Meeting of the Inst. of Electronics, Information and Communication Engineers

(1) In the session entitled, “Network technology to protect against a devastating disaster — if a major earthquake occurs,” which was planned by the Society Meeting of the Inst. of Electronics, Information and Communi-

cation Engineers, held in Osaka Pref. Univ. on Sep. 15, Group Leader Takizawa gave a keynote address entitled “The requirements of ICT to protect against a devastating disaster”. He also joined the panel discussion.

(2) The “third class” research committee on “Information communication network for ensuring safety and security” of the Inst. of Electronics, Information and Communica-



Fig. 108 Demonstration of rescue robot



Fig. 111 Satellite booth 2

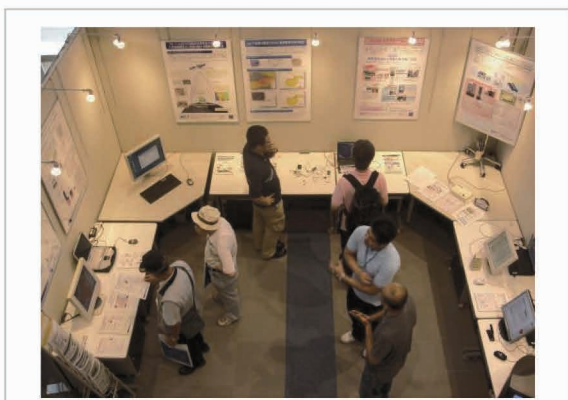


Fig. 109 Main booth



Fig. 112 Tent in disaster management drill



Fig. 110 Satellite booth 1

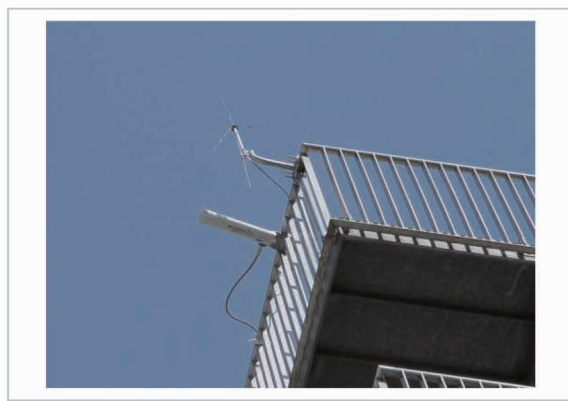


Fig. 113 FM antenna (right) and wireless LAN antenna (left)

tion Engineers, in which Senior Researcher Kazunori Okada was the chief examiner, held a symposium during the Society meeting on Sep. 16. The trainee, Han Jin Chun (The Univ. of Electro-Communications), gave a presentation entitled “Discussion on Prioritized Connection Control by Emergency Multi-System Access”.

3.52.2 Geospatial Expo 2010

- (1) This group presented an exhibition jointly with the Nat'l Research Inst. of Fire and Disaster in the Geospatial EXPO 2010 held in Pacifico Yokohama on Sep. 19 to 21 (Fig. 114).
- (2) Expert Researcher Nguyen Hoang Nam gave a lecture entitled “GIS-Based Earthquake Damage Estimation for Supporting Int'l Rescue Operations” on Sep. 20, during the business meeting on “Int'l symposium on safety and security through the integrated use of geographical special information: Geo-Intelligence” sponsored by the Cabinet Office (Council for Science and Technology Policy), which is also an activity of the Geospatial Expo 2010.

3.53 Oct. 2010

3.53.1 Security & Safety Trade Expo 2010

The team presented an exhibition jointly with the Nat'l Research Inst. for Fire and Disaster and Space Robotics Lab., Tohoku Univ. (Lab. of Professor Kazuya Yoshida and Associate Professor Keiji Nagatani) in the exhibition held at Tokyo Big Sight on Oct. 6 to 8 (Fig. 115). In this exhibition, research conducted by the Disaster Management and Mitigation Group and NRIFD were exhibited. A demonstration operations test of a volcanic search robot for monitoring active volcanoes was also conducted under the sponsorship of Technical Committee (on/of) Tele-operation Technology for Robotic Explorations in Active Volcano Area, the System Integration Division, Society of Instrument and Control Engineers. In the test, a robot able to traverse irregular surfaces, developed by Tohoku Univ. placed on Mount Asama was controlled

remotely from the Big Site via an ultrahigh-speed internet satellite WINDS (Fig. 116). Professor Kazuya Yoshida and the students participated in the test at Big Site, while Associate Professor Keiji Nagatani, the students and Expert Researcher Yasushi Hada participated at Mount Asama. This exhibition was reported, for example, in *The Dempa Times* (Oct. 6, p. 9, on 18, p. 4) and J. of Radio Engineering & Electronics Association, “FORN”. The WINDS was used in cooperation with the Space Communication Group, NICT and the Association of Radio Industries and Businesses.

3.53.2 Rescue robot test

Expert Researcher Yasushi Hada participated in a test on integrating maps obtained by multiple robots. The test was held as part of the NEDO contract research project in Tohoku Univ. on Oct. 12 and 13.

3.53.3 Presentations at academic meetings

- (1) In the meeting of the Japan Society for



Fig. 114 Geospatial EXPO



Fig. 115 Security & Safety Trade Expo 2010

Disaster Information Studies held at the Faculty of Safety Science, Kansai Univ. on Oct. 23, Group Leader Takizawa as chairperson of the session, gave a presentation entitled “Development of a Particular Low-Powered FM Broadcasting Device Capable of Broadcasting in an Area with a Radius of 500 Meters and Verification of the System in Disaster Management Drill”.

- (2) In the research meeting of the Geographic Information Systems Association (GISA)/GIS Association of Japan held at Ritsumeikan Univ. on Oct. 23 and 24, Expert Researcher Jeong Byeong-pyo gave a presentation entitled “Research into Spatial Information Communication System to Support the Activities of Int’l Firefighting and Rescue Teams—Estimation of Seismic Intensity Distribution and Building Damage Distribution in the Haiti Earthquake,” while Researcher Kim Taewoon gave a presentation entitled “Building Landform Classification Maps from DEM: Alluvial Fan Extraction Method”.

3.53.4 Exhibition held with the meeting of information communication/economy-related APEC ministers

At the exhibition (TELMIN 8) held together with the meeting of the information communication/economy-related ministers of APEC in Bankoku Shinryokan, Nago, Okinawa on Oct. 28 to 31, an earthquake damage estimation system was demonstrated. With participation of former members of the inter-

national emergency rescue team of the Tokyo Fire Department, the demonstration was held according to a scenario whereby a large-scale earthquake occurs in Chiang Mai, Thailand. This location was chosen as NECTEC in Thailand and the site at which the demonstration was conducted were connected via WINDS (Fig. 117). After a press interview on the first day, it was broadcast on the local NHK news. Although the demonstration was terminated immediately after press interview because of an approaching typhoon on the first day, the test was continued without problem on the second day, although there were some small system troubles. Minister Katayama for Internal Affairs and Communications made an inspection on Oct. 30th (Fig. 118).

3.54 Nov. 2010

3.54.1 Exhibition during the APEC Leaders’ Week [Japan Experience]

In the exhibition, Japan Experience, held



Fig. 117 Demonstration in APEC-TELMIN 8



Fig. 116 Remote control of a robot on Mount Asama



Fig. 118 Director Enami providing an explanation to Minister Katayama