



HAL
open science

Information Technology in Disaster Risk Reduction

Yuko Murayama, Dimiter Velev, Plamena Zlateva

► **To cite this version:**

Yuko Murayama, Dimiter Velev, Plamena Zlateva. Information Technology in Disaster Risk Reduction: Third IFIP TC 5 DCITDRR International Conference, ITDRR 2018, Held at the 24th IFIP World Computer Congress, WCC 2018, Poznan, Poland, September 20–21, 2018, Revised Selected Papers. Springer International Publishing, AICT-550, 2019, IFIP Advances in Information and Communication Technology, 978-3-030-32168-0. hal-02799276

HAL Id: hal-02799276

<https://inria.hal.science/hal-02799276>

Submitted on 8 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

Editor-in-Chief

Kai Rannenberg, Goethe University Frankfurt, Germany

Editorial Board Members

TC 1 – Foundations of Computer Science

Luís Soares Barbosa, University of Minho, Braga, Portugal

TC 2 – Software: Theory and Practice

Michael Goedicke, University of Duisburg-Essen, Germany

TC 3 – Education

Arthur Tatnall, Victoria University, Melbourne, Australia

TC 5 – Information Technology Applications

Erich J. Neuhold, University of Vienna, Austria

TC 6 – Communication Systems

Burkhard Stiller, University of Zurich, Zürich, Switzerland

TC 7 – System Modeling and Optimization

Fredi Tröltzsch, TU Berlin, Germany

TC 8 – Information Systems

Jan Pries-Heje, Roskilde University, Denmark

TC 9 – ICT and Society

David Kreps, University of Salford, Greater Manchester, UK

TC 10 – Computer Systems Technology

Ricardo Reis, Federal University of Rio Grande do Sul, Porto Alegre, Brazil

TC 11 – Security and Privacy Protection in Information Processing Systems

Steven Furnell, Plymouth University, UK

TC 12 – Artificial Intelligence

Eunika Mercier-Laurent, University of Reims Champagne-Ardenne, Reims, France

TC 13 – Human-Computer Interaction

Marco Winckler, University of Nice Sophia Antipolis, France

TC 14 – Entertainment Computing

Rainer Malaka, University of Bremen, Germany

IFIP – The International Federation for Information Processing

IFIP was founded in 1960 under the auspices of UNESCO, following the first World Computer Congress held in Paris the previous year. A federation for societies working in information processing, IFIP's aim is two-fold: to support information processing in the countries of its members and to encourage technology transfer to developing nations. As its mission statement clearly states:

IFIP is the global non-profit federation of societies of ICT professionals that aims at achieving a worldwide professional and socially responsible development and application of information and communication technologies.

IFIP is a non-profit-making organization, run almost solely by 2500 volunteers. It operates through a number of technical committees and working groups, which organize events and publications. IFIP's events range from large international open conferences to working conferences and local seminars.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is generally smaller and occasionally by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is also rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

IFIP distinguishes three types of institutional membership: Country Representative Members, Members at Large, and Associate Members. The type of organization that can apply for membership is a wide variety and includes national or international societies of individual computer scientists/ICT professionals, associations or federations of such societies, government institutions/government related organizations, national or international research institutes or consortia, universities, academies of sciences, companies, national or international associations or federations of companies.

More information about this series at <http://www.springer.com/series/6102>

Yuko Murayama · Dimiter Velez ·
Plamena Zlateva (Eds.)

Information Technology in Disaster Risk Reduction

Third IFIP TC 5 DCITDRR International Conference, ITDRR 2018
Held at the 24th IFIP World Computer Congress, WCC 2018
Poznan, Poland, September 20–21, 2018
Revised Selected Papers

Editors

Yuko Murayama
Tsuda University
Tokyo, Japan

Dimiter Velev
University of National and World Economy
Sofia, Bulgaria

Plamena Zlateva
Institute of Robotics
Bulgarian Academy of Sciences
Sofia, Bulgaria

ISSN 1868-4238 ISSN 1868-422X (electronic)
IFIP Advances in Information and Communication Technology
ISBN 978-3-030-32168-0 ISBN 978-3-030-32169-7 (eBook)
<https://doi.org/10.1007/978-3-030-32169-7>

© IFIP International Federation for Information Processing 2019

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

The effects of disasters are very serious and it may take a very long time to recover from the destruction caused. Related damage can be severe and offering relief may lead to expenses in the billions of euros. There has been an increase in natural disasters in the past years and it is expected that their frequency will continue in the coming years.

Owing to the multidisciplinary nature of work in the field of disaster risk reduction, people from various backgrounds will be included in this field of research and activity. Their backgrounds are likely to include industry, diverse geographical and global settings, not-for-profit organizations, agriculture, marine life, welfare, risk management, safety engineering, and social networking services.

At present, at global and national levels, a wide range of scientific and applied research activity is conducted in the area of disaster risk reduction concerning individual types of disasters. Modern information and communication technologies (ICT) can facilitate significantly the decision-making processes from the point of view of disaster risk reduction.

Following the increasing number of disasters worldwide and the growing potential of both ICT and ICT expertise, at its General Assembly held during October 8–9, 2015, at the Daejeon Convention Center, Daejeon, South Korea, IFIP established the Domain Committee on Information Technology in Disaster Risk Reduction in order to:

- Promote disaster risk reduction within the ICT community
- Provide an additional opportunity for IFIP members to work with other specialized bodies such as the UN, UNISDR, ICSU, ITU and ISCRAM
- Coordinate the efforts of member societies as well as different Technical Committees and Working Groups of IFIP in the disaster-related field

The disaster support offered by the Domain Committee is based on the following major pillars:

- Information acquisition and provision
- Shelter information management for local governments
- Disaster information systems
- State-of-the-art ICT (such as the Internet of Things, mobile computing, big data, and cloud computing)

IFIP's Domain Committee on Information Technology in Disaster Risk Reduction organized the Third IFIP Conference on Information Technology in Disaster Risk Reduction (ITDRR 2018), during September 20–21, 2018, at the Poznan University of Technology, Poznan, Poland. ITDRR-2018 was co-located with the 24th IFIP World Computer Congress.

ITDRR 2018 provided an international forum for researchers and practitioners to present their latest R&D findings and innovations. The conference was focused on various ICT aspects and the challenges of disaster risk reduction. The main topics

included areas such as natural disasters, big data, cloud computing, the Internet of Things, mobile computing, emergency management, disaster information processing, disaster risk assessment and management.

ITDRR 2018 invited experts, researchers, academic, and all others who were interested to disseminate their work to attend the conference. The conference established an academic environment that fostered the dialogue and exchange of ideas among different levels of academic, research, business, and public communities.

The Program Committee received 32 paper submissions, out of which 12 research papers were finally accepted. We are particularly grateful therefore to the members of the Program Committee, and the many reviewers of papers, for their dedication in helping to produce this volume.

August 2019

Yuko Murayama
Dimitar Velez
Plamena Zlateva

Organization

IFIP Conference on
Information Technology in Disaster Risk Reduction

General Chairs

Yuko Murayama
(IFIP Vice President)

Tsuda University, Japan

Plamena Zlateva

Institute of Robotics, Bulgarian Academy
of Sciences, Bulgaria

Program Committee Co-chairs

Dimiter Velev

University of National and World Economy,
Bulgaria

Igor Grebennik

Kharkiv National University of Radio Electronics,
Ukraine

Finance Chair

Eduard Dundler
(IFIP Secretary)

Laxenburg, Austria

Publicity Chair

Jun Sasaki

Iwate Prefectural University, Japan

Steering Committee

Diane Whitehouse (IFIP TC9:
ICT and Society Chair)

The Castlegate Consultancy, UK

Erich Neuhold (IFIP TC5:
Information Technology
Application Chair)

University of Vienna, Austria

Jose G. Gonzalez

University of Agder, Norway

A Min Tjoa (IFIP Honorary
Secretary)

Vienna Technical University, Austria

Program Committee

Andreas Karcher	Universität der Bundeswehr, Germany
Benny Benyamin Nasution	Politeknik Negeri Medan, Indonesia
Chrisantha Silva	Computer Society of Sri Lanka, Sri Lanka
Denis Trcek	University of Ljubljana, Slovenia
Gabriela Marín-Raventós (IFIP Councillor)	University of Costa Rica, Costa Rica
Gansen Zhao	South China Normal University, China
Hans J. Scholl	University of Washington, USA
Henrik Eriksson	Linköping University, Sweden
Hsin-Hung Wu	National Changhua University of Education, Taiwan
Hyenyoung Yoon	Seoul National University, South Korea
Jaziar Radianti	University of Agder, Norway
Jian Cao	Shanghai Jiaotong University, China
Josune Hernantes	University of Navarra, Spain
Julie Dugdale	University of Grenoble, France
Jun-Seok Joseph Hwang	Seoul National University, South Korea
Kai Rannenber (IFIP Vice President)	Goethe University Frankfurt, Germany
Kaninda Musumbu	Université Bordeaux, France
Kim Hee Dong	Hankuk University of Foreign Studies, South Korea
Kyungsoo Pyo	National Disaster Management Research Institute, South Korea
Leire Labaka	University of Navarra, Spain
Mariki Eloff	University of South Africa, South Africa
Mariyana Nikolova	NIGGG – BAS, Bulgaria
Michinori Hatayama	Disaster Prevention Research Institute, Kyoto University, Japan
Mihoko Sakurai	University of Agder, Norway
Mike Diver	Australian Computer Society, Australia
Monika Buscher	Lancaster University, UK
Murray Turoff	New Jersey Institute of Technology, USA
Norberto Patrignani	Politecnico di Torino, Italy
Naoto Matsumoto	Sakura Internet Research Center, Japan
Nariyoshi Yamai	Tokyo University of Agriculture and Technology, Japan
Nirit Bernstein	Institute of Soil, Water and Environmental Science, Israel
Orhan Altan	Istanbul Technical University, Turkey
Patrick Letouze	Universidade Federal do Tocantins, Brazil
Rajan Raj Pant	Information Technology Security Emergency Response Team, Nepal
Saji Baby	GEO International Environmental Consultation Co., Kuwait

Sergei Kavun	University of Banking of the National Bank of Ukraine, Ukraine
Sergei Ohrimenco	Laboratory of Information Security, AESM, Moldova
Shi Yizhe	Shenyang University of Chemical Technology, China
Shunsuke Fujieda	University of Tokyo, Japan
Starr Roxanne Hiltz	New Jersey Institute of Technology, USA
Stewart James Kowalski	Norwegian University of Science and Technology, Norway
Tadeusz Czachorski	Institute of Theoretical and Applied Informatics – PAS, Poland
Tao Bo	Earthquake Administration of Beijing Municipality, China
Tatsuya Yamazaki	Niigata University, Japan
Tetsuo Noda	Shimane University, Japan
Tullio Tanzi	Institut Mines-Telecom – Telecom ParisTech, France
Victor Amadeo Bañuls Silvera	Universidad Pablo de Olavide, Spain
Victor de Pous (IFIP Legal Counselor)	Netherlands
Wang Guoxin	Earthquake Engineering Research Institute, Dalian University of Technology, China
Wei-Sen Li	National Science and Technology Center for Disaster Reduction, Taiwan
Wolfgang Reinhardt	Universität der Bundeswehr, Germany
Youwei Sun	Earthquake Administration of Beijing Municipality, China
Yoshitaka Shibata	Iwate Prefectural University, Japan
Yutaka Kikuchi	Kochi University of Technology, Japan
Zong Xuejun	Shenyang University of Chemical Technology, China

Contents

Recovery Watcher: A Disaster Communication System for Situation Awareness and Its Use for Barrier-Free Information Provision	1
<i>Yuko Murayama, Kayoko Yamamoto, and Jun Sasaki</i>	
Preparing a Smart Environment to Decision-Making in Emergency Traffic Control Management.	12
<i>Jacimar F. Tavares, Marcos R. S. Borges, and Adriana S. Vivacqua</i>	
A Systematic Review on the Use of Groupware Technologies in Emergency Management	22
<i>Jacimar F. Tavares, Leandro da Silva Gonçalves, Patricia do Amaral Gurgel M. Gonçalves, and Marcos R. S. Borges</i>	
CBRN Risk Analysis Using the Analytical Tools of the WAZkA System . . .	36
<i>Ryszard Antkiewicz, Zbigniew Tarapata, Dariusz Pierzchała, Jarosław Rulka, and Andrzej Najgebauer</i>	
Analyzing Cascading Effects in Interdependent Critical Infrastructures.	50
<i>Ahmed Abdelgawad, Mohamed Saleh, and Jose Gonzalez</i>	
Strategy of Effective Decision-Making in Planning and Elimination of Consequences of Emergency Situations	66
<i>Igor Grebennik, Viktor Reshetnik, Ata Ovezgeldyev, Valerii Ivanov, and Inna Urniaeva</i>	
Geological – Geomorphological Features of River Catchments in Flood Susceptibility Assessment (on the Example of Middle Struma Valley, Bulgaria)	76
<i>Valentina Nikolova, Plamena Zlateva, and Ivan Dimitrov</i>	
Real-Time Tornado Forecasting Using SLHGN.	97
<i>Benny Benyamin Nasution, Rahmat Widia Sembiring, Muhammad Syahrudin, Nursiah Mustari, Abdul Rahman Dalimunthe, Nisfan Bahri, Berta br Ginting, and Zulkifli Lubis</i>	
Universally Designed Beacon-Assisted Indoor Navigation for Emergency Evacuations	120
<i>G. Anthony Giannoumis, Terje Gjøsæter, Jaziar Radianti, and Cristina Paupini</i>	
Micro Failure Region Models Inducing Massive Correlated Failures on Networks Topologies	130
<i>Nicolás A. Boettcher, Yasmany Prieto, and Jorge E. Pezoa</i>	

Tweeting About Floods of Messinia (Greece, September 2016) - Towards a Credible Methodology for Disaster Management Purposes 142
Stathis G. Arapostathis

Organizational Features in Disaster Risk Management Systems 155
Yury Alejandra Castillo Manyoma, Nicolas Daniel Gómez Reyes, and Luz Esperanza Bohorquez

Author Index 175