

Suresh Chandra Satapathy
Amit Joshi
Nilesh Modi
Nisarg Pathak *Editors*

Proceedings of International Conference on ICT for Sustainable Development

ICT4SD 2015 Volume 2

Advances in Intelligent Systems and Computing

Volume 409

Series editor

Janusz Kacprzyk, Polish Academy of Sciences, Warsaw, Poland
e-mail: kacprzyk@ibspan.waw.pl

About this Series

The series “Advances in Intelligent Systems and Computing” contains publications on theory, applications, and design methods of Intelligent Systems and Intelligent Computing. Virtually all disciplines such as engineering, natural sciences, computer and information science, ICT, economics, business, e-commerce, environment, healthcare, life science are covered. The list of topics spans all the areas of modern intelligent systems and computing.

The publications within “Advances in Intelligent Systems and Computing” are primarily textbooks and proceedings of important conferences, symposia and congresses. They cover significant recent developments in the field, both of a foundational and applicable character. An important characteristic feature of the series is the short publication time and world-wide distribution. This permits a rapid and broad dissemination of research results.

Advisory Board

Chairman

Nikhil R. Pal, Indian Statistical Institute, Kolkata, India
e-mail: nikhil@isical.ac.in

Members

Rafael Bello, Universidad Central “Marta Abreu” de Las Villas, Santa Clara, Cuba
e-mail: rbellop@uclv.edu.cu

Emilio S. Corchado, University of Salamanca, Salamanca, Spain
e-mail: escorchado@usal.es

Hani Hagrass, University of Essex, Colchester, UK
e-mail: hani@essex.ac.uk

László T. Kóczy, Széchenyi István University, Győr, Hungary
e-mail: koczy@sze.hu

Vladik Kreinovich, University of Texas at El Paso, El Paso, USA
e-mail: vladik@utep.edu

Chin-Teng Lin, National Chiao Tung University, Hsinchu, Taiwan
e-mail: ctlin@mail.nctu.edu.tw

Jie Lu, University of Technology, Sydney, Australia
e-mail: Jie.Lu@uts.edu.au

Patricia Melin, Tijuana Institute of Technology, Tijuana, Mexico
e-mail: epmelin@hafsamx.org

Nadia Nedjah, State University of Rio de Janeiro, Rio de Janeiro, Brazil
e-mail: nadia@eng.uerj.br

Ngoc Thanh Nguyen, Wroclaw University of Technology, Wroclaw, Poland
e-mail: Ngoc-Thanh.Nguyen@pwr.edu.pl

Jun Wang, The Chinese University of Hong Kong, Shatin, Hong Kong
e-mail: jwang@mae.cuhk.edu.hk

More information about this series at <http://www.springer.com/series/11156>

Suresh Chandra Satapathy · Amit Joshi
Nilesh Modi · Nisarg Pathak
Editors

Proceedings of International Conference on ICT for Sustainable Development

ICT4SD 2015 Volume 2

 Springer

Editors

Suresh Chandra Satapathy
Department of Computer Science and
Engineering
Anil Neerukonda Institute of Technology
and Sciences
Visakhapatnam, Andhra Pradesh
India

Amit Joshi
Sabar Institute of Technology
Sabarkantha, Gujarat
India

Nilesh Modi
Narsinhbhai Institute of Computer Studies
and Management
Kadi, Gujarat
India

Nisarg Pathak
Narsinhbhai Institute of Computer Studies
and Management
Kadi, Gujarat
India

ISSN 2194-5357 ISSN 2194-5365 (electronic)
Advances in Intelligent Systems and Computing
ISBN 978-981-10-0133-8 ISBN 978-981-10-0135-2 (eBook)
DOI 10.1007/978-981-10-0135-2

Library of Congress Control Number: 2015955863

© Springer Science+Business Media Singapore 2016

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, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

This Springer imprint is published by SpringerNature
The registered company is Springer Science+Business Media Singapore Pte Ltd.

Preface

These AISC volumes contain the papers presented at the ICT4SD 2015: International Conference on Information and Communication Technology for Sustainable Development. The conference was held during July 3–4, 2015 at Hotel Pride Ahmedabad, India, and communally organized by ASSOCHAM Gujarat Chapter, ACM Professional Chapter, GESIA and Sabar Institute of Technology, Gujarat and Computer Society of India, as Knowledge Partner. The objective of this international conference was to provide an opportunity for researchers, academicians, industry persons, and students to interact and exchange ideas, experience, and expertise in the current trend and strategies for Information and Communication Technologies. Besides this, participants were also enlightened about the vast avenues, current and emerging technological developments in the field of ICT in this era, and its applications. The conference attracted a large number of high-quality submissions and stimulated cutting-edge research discussions among many academic pioneering researchers, scientists, industrial engineers, and students from all over the world and provided a forum for researchers. Research submissions in various advanced technology areas were received and after a rigorous peer-review process with the help of program committee members and external reviewers, 154 (Vol-I: 77, Vol-II: 77) papers were accepted with an acceptance ratio of 0.43. The conference featured many distinguished personalities such as Mr. Job Glas, Head of Mission, NBSO, Netherlands, Mr. Volkmar Blech, Zera GmbH, Germany, Dr. Mukesh Kumar, TITS, Bhiwani, Dr. Vipin Tyagi, Jaypee University, Guna, Prof. Pravesh Bhadviya, Director, Sabar Education, Mr. Bipin V. Mehta, President CSI, Mr. Hemal Patel, MD, Cyberoam, Ms. Bhagyesh Soneji, Chairperson, ASSOCHAM, and Mr. Jay Ruparel, President, GESIA. Separate invited talks were organized on industrial and academia tracks on both days. The conference also hosted a few tutorials and workshops for the benefit of participants. We are indebted to ASSOCHAM Gujarat Chapter, Sabar Institute of Technology and Computer Society of India, ACM Professional Chapter for their immense support to make this conference possible on such a grand scale. A total of 18 sessions were organized as a part of ICT4SD including 15 technical, 2 plenary, and 1 inaugural

session. The Session Chairs for the technical sessions included Dr. Chirag Thaker, GEC, Bhavnagar, India, Dr. Vipin Tyagi, Jaypee University, MP, India, Dr. Munesh Trivedi, ABES Engineering College, Ghaziabad, India, Dr. Ramesh Thakur, DAVV, Indore, India, Dr. Dilip Kumar Sharma, GLA University, Mathura, India, Dr. Bhushan Trivedi, GLS University, Ahmedabad, India, Dr. S.M. Shah, KSV University, India, Dr. Nikita Vats Doohan, Indore, MP, India, Dr. Harshal Arolkar, GIS University, Ahmedabad, India, Dr. Priyanka Sharma, Raksha Shakti University, Ahmedabad, India, Dr. Nilesh Modi, KSV, Ahmedabad, India, Dr. Satyen Parikh, Ganpat University, India, Dr. Sakshi Kaushal, UIET, Punjab University, India, Dr. S.C. Satapathy, Visakhapatnam, India, and Dr. Nisarg Pathak, KSV, Ahmedabad, India.

We express our sincere thanks to the members of the technical review committee for their valuable support in doing critical reviews to enhance the quality of all accepted papers. Our heartfelt thanks are due to the National and International Advisory Committee and CSI Execomm Members for their support in making this a grand success. Our authors deserve big thanks since it is due to them that the conference was such a huge success.

Our sincere thanks to all the sponsors, press, print, and electronic media for their excellent coverage of this convention.

July 2015

Suresh Chandra Satapathy
Amit Joshi
Nilesh Modi
Nisarg Pathak

Contents

Implementing the Logical Security Framework for E-Commerce Based on Service-Oriented Architecture	1
Ashish Kr. Luhach, Sanjay K. Dwivedi and Chandra K. Jha	
Indian Sign Language Translator Using Kinect	15
Pratik H. Suvagiya, Chintan M. Bhatt and Ritesh P. Patel	
Formal Transformation of UML Diagram: Use Case, Class, Sequence Diagram with Z Notation for Representing the Static and Dynamic Perspectives of System	25
Monika Singh, A.K. Sharma and Ruhi Saxena	
A Survey of Android Malware Detection Strategy and Techniques	39
Mohit Sharma, Meenu Chawla and Jyoti Gajrani	
A Review on Dynamic View Selection	53
Anjana Gosain and Heena	
Software Project Estimation Using Fuzzy Inference System	61
V.S. Dhaka, Vishal Choudhary, Manoj Sharma and Madan Singh	
Linear and Nonlinear Modeling of Protein Kinase B/AkT	81
Shruti Jain and D.S. Chauhan	
Lost Connectivity Restoration in Partitioned Wireless Sensor Networks	89
Ranga Virender, Dave Mayank and Verma Anil Kumar	
Analysis of Authentication Techniques Adopted by End Users in Real-Life Cloud Implementation	99
Bansi Khimani and Kuntal Patel	

Network Analysis of ICMP Ping Flood DoS Attack in WiMAX and Wireless LAN.	109
Anu Raheja and Ajit Singh	
Scheduling in Big Data Heterogeneous Distributed System Using Hadoop.	119
Shraddha Thakkar and Sanjay Patel	
A New Differential Scan-Based Side-Channel Attacks Against RSA Cryptosystem	133
Darshna Dalvadi, Badal Kothari and Keyur Shah	
Grey Wolf Optimizer (GWO) Algorithm for Minimum Weight Planer Frame Design Subjected to AISC-LRFD	143
Vishwesh Bhensdadia and Ghanshyam Tejani	
Child Growth Mentor—A Proposed Model for Effective Use of Mobile Application for Better Growth of Child	153
Siddhi Shah, Shefali Naik and Vinay Vachharajani	
Design and Development of a Rule-Based Urdu Lemmatizer.	161
Vaishali Gupta, Nisheeth Joshi and Iti Mathur	
Enhanced Microstrip Patch Antenna Using Metamaterial for DECT and Aircraft Wireless System Applications.	171
Sunita, Gaurav Bharadwaj, Monika Kunwal and Kiran Aseri	
An Enhanced Strategy to Minimize Makespan in Cloud Environment to Accelerate the Performance.	179
Himanshu Sachdeva, Sakshi Kaushal and Amandeep Verma	
Prefix Length-Based Disjoint Set Tries for IPv6 Lookup.	193
Ravina Jangid, C.P. Gupta and Iti Sharma	
Implementation of FAST Clustering-Based Feature Subset Selection Algorithm for High-Dimensional Data	203
Smit Shilu, Kushal Sheth and Ekata Mehul	
Performance Comparison of 2D and 3D Zigbee Wireless Sensor Networks.	215
Ranjana Thalore, Manju Khurana and M.K. Jha	
Enhancement of Data Security by PMK Technique	223
Pallavi Sharma, Mukesh Kumar and Kirti Saneja	
Privacy-Leveled Perturbation Model for Privacy Preserving Collaborative Data Mining	233
Alpa Kavin Shah and Ravi Gulati	

Extended Bellman Ford Algorithm with Optimized Time of Computation 241
 Neha and Akhil Kaushik

Supervised Link Prediction Using Forecasting Models on Weighted Online Social Network. 249
 Anshul Gupta, Shalki Sharma and Hirdesh Shivhare

Dual-Band Rectangular-Shaped Antenna with Sideway Extension at Top and Bottom for WLAN and WiMax Applications 263
 Shalini Porwal, Ajay Dadhich, Sanjeev Yadav, H.S. Mewara and M.M. Sharma

A Framework to Rank Nodes in Social Media Graph Based on Sentiment-Related Parameters 271
 Meghna Chaudhary and Harish Kumar

Development of Analytical Method to Determine the Deflection of Tapered Cantilever Beam with Inclined Loading Condition Using Software Simulation. 281
 Kishan H. Joshi and Chetankumar M. Patel

Bio-inspired Ultralow Power Design of Comparator with Noise Compensation Using Hysteresis Technique Designed for Biomedical Engineering (Pacemaker). 289
 Jubin Jain, Vijendra Maurya and Anu Mehra

Comparative Analysis of Different Architectures of MCML Square Root Carry Select Adders for Low-Power Applications 299
 Ginni Jain, Keerti Vyas, Vijendra K. Maurya and Mayank Patel

Improvement in Quality of Extractive Text Summaries Using Modified Reciprocal Ranking. 307
 Yogesh Kumar Meena and Dinesh Gopalani

A Novel Compact Monopole Multiband Antenna for WiMAX/Satellite/Military Applications. 317
 Ashu Verma, Bhupendra Singh, Sanjeev Yadav and Preeti Jain

Critical Study and Analysis of Cyber Law Awareness Among the Netizens 325
 Aniruddhsinh Parmar and Kuntal Patel

Information Communication Technologies for Research and Academic Development. 335
 Dinesh Kumar Saini, Lakshmi Sunil Prakash and Hemant Gaur

An Insider Cyber Threat Prediction Mechanism Based on Behavioral Analysis 345
 Kaushal Bhavsar and Bhushan H. Trivedi

Enhancing Amplifier Characteristics Using Quantum Dots	355
Parnika De, Jeetesh Giri Goswami and Murtaza Abbas Rizvi	
An Approach to Secure Internet of Things Against DDoS.	367
Krushang Sonar and Hardik Upadhyay	
Issues in Quantitative Association Rule Mining: A Big Data Perspective	377
Dhrubajit Adhikary and Swarup Roy	
A Framework for Temporal Information Search and Exploration.	387
Parul Patel and S.V. Patel	
Item Amalgamation Approach for Serendipity-Oriented Recommender System	397
Ravi Shah, Ashishkumar Patel and Kiran Amin	
A Two-Stage Integrated Approach of DNA Cryptography	405
Neha Nandal and Suman Panghal	
Advanced Irrigation Systems Impacting Sustainability and Reducing Water Needs—Role of ICT in Irrigation.	415
S.M. Gopikrishna	
Parallelization of Load Flow Analysis	427
Chayan Bhatt, Rahul Saxena, D.P. Sharma and R. Jaya Krishna	
Hierarchical Role-Based Access Control with Homomorphic Encryption for Database as a Service.	437
Kamlesh Kumar Hingwe and S. Mary Saira Bhanu	
Hybrid Miner Tracking System at 2.4 GHz for Underground Mines.	449
Amber Haidery and Kanchan Bakade	
Partition-Based Frequent Closed Pattern Miner	459
Anu Soni, Mukta Goel and Rohit Goel	
A Study of Working of Ad Auctioning by Google AdWords	471
Farhat Jahan, Pranav Fruitwala and Tarjani Vyas	
A Novel Approach for Polarity Determination Using Emoticons: Emoticon-Graph	481
Manalee Datar and Pranali Kosamkar	
Scheduling for Distributed Applications in Mobile Cloud Computing	491
Hitesh A. Bheda and Chirag S. Thaker	

High Availability of Databases for Cloud 501
 Yogesh Kr. Sharma and Ajay Shanker Singh

Customized Parameter Configuration Framework for Performance Tuning in Apache Hadoop. 511
 Bhavin J. Mathiya and Vinodkumar L. Desai

Hand Skin Classification from Other Skin Objects Using Multi-direction 3D Color-Texture Feature and Cascaded Neural Network Classifier 523
 Sonal Gupta, Munesh C. Trivedi and Suraj kanya

Texture Features for the Detection of Acute Lymphoblastic Leukemia 535
 Vanika Singhal and Preety Singh

Design and Implementation of Non Touch Enabled Password System 545
 Monica Varia and Hardik Modi

Intelligent Web Security Testing with Threat Assessment and Client Server Penetration 555
 Hardik Gohel and Priyanka Sharma

QoS-aware Autonomic Cloud Computing for ICT 569
 Sukhpal Singh and Inderveer Chana

Emerging Green ICT: Heart Disease Prediction Model in Cloud Environment. 579
 Anju Bala, Shikhar Malhotra, Nishant Gupta and Naman Ahuja

Energy Conscious Allocation and Scheduling of Tasks in ICT Cloud Paradigm 589
 Tarandeep Kaur and Inderveer Chana

Controlling of FPGA-Based Optical Polarimeter Using LabVIEW. 603
 Binal Baraiya, Amish Shah and Hiren Mewada

Automatic Intelligent Traffic Controlling for Emergency Vehicle Rescuing. 611
 Megha Tank, Hardik Mewada, Viraj Choksi and M.B. Potdar

A Capacity Constraint Distributed Data Dissemination Protocol for Ad Hoc Cognitive Radio Networks 621
 Dipjyoti Deka, Sanjib Kumar Deka and Nityananda Sarma

Enhancing Performance of Security Log Analysis Using Correlation-Prediction Technique 635
 Kanchanmala Bharamu Naukudkar, Dayanand D. Ambawade and J.W. Bakal

Differential Weight Based Hybrid Approach to Detect Software Plagiarism	645
Nrupesh Shah, Sandip Modha and Dhruv Dave	
Selecting Favorable Reference Nodes to Aid Localization in Wireless Sensor Networks	655
Gaurav Dhaka and Nileshkumar R. Patel	
A Scientometric Analysis of Smart Grid Implementation at Distribution Feeder	665
J.P. Sharma, Devendra Bhavsar and Laxmi Chand Sharma	
Enhancing Web Search Results Using Aggregated Search.	675
Dhara Bakrola and Snehal Gandhi	
Managing Heterogeneity by Synthesizing Composite Data.	689
Manjeet Kantak and Sneha Tiwari	
A Novel Approach to Filter Topic Related Important Terms Within Document.	697
Payal Joshi and S.V. Patel	
Domain-Driven Density Based Clustering Algorithm.	705
Neethu Antony and Arti Deshpande	
Adaptive Approach of AODV and DSDV Routing Protocols Using Optimal Probabilistic Logical Key Hierarchy in MANET	715
Harshit Prakash Patidar and Neetu Sharma	
Re-clustering Approach Using WCA in AODV and DSDV Routing Protocols in MANET	733
Harshit Prakash Patidar and Neetu Sharma	
Issues and Challenges of Heterogeneous Datasets in MapReduce Framework of Big Data Environment	751
Saraswati Gupta, Vishal Bhatnagar and Ramneet Singh Chadha	
Strong Virtual Password Scheme Using Reference Switching on Coded User Parameters and Phishing Attack.	761
Tank Himadri and Harsora Vinay	
Need of ICT for Sustainable Development in Petroleum Industry	771
Amit Singh and Sandhya Singh	
Hybrid K-Mean and Refinement Based on Ant for Color Image Clustering.	779
Lavi Tyagi and Munesh C. Trivedi	

A Framework for Secure Data Storage in Mobile Cloud Computing	791
Vinodray Thumar and Vipul Vekariya	
Hindi Word Sense Disambiguation Using Cosine Similarity	801
Sarika and Dilip Kumar Sharma	
A Multi-classifiers Based Novel DoS/DDoS Attack Detection Using Fuzzy Logic	809
Jatin Patel and Vijay Katkar	
Author Index	817

Committee

Advisory Committee

Mr. H.R. Mohan, Past President, CSI
Prof. Bipin Mehta, President, CSI
Mr. P.N. Jain, Add. Sec., R&D, Government of Gujarat, India
Dr. Srinivas Padmanabhuni, President ACM India
Dr. Anirban Basu, Vice President, CSI
Prof. R.P. Soni, RVP, Region III, CSI
Dr. Malay Nayak, Director-IT, London
Mr. Chandrashekhar Sahasrabudhe, ACM India
Dr. Pawan Lingras, Saint Mary's University, Canada
Prof. (Dr.) P. Thrimurthy, Past President, CSI
Dr. Shayam Akashe, ITM, Gwalior, MP, India
Dr. S.C. Sathapathy, Visakhapatnam, India
Dr. Dharm Singh, Windhoek, Namibia
Prof. S.K. Sharma, Pacific University, Udaipur, India
Prof. H.R. Vishwakarma, VIT, Vellore, India
Prof. Pravesh Bhadviya, Director, Sabar Education, India
Mr. Mignesh Parekh, Ahmedabad, India
Dr. Muneesh Trivedi, ABES, Gaziabad, India
Dr. Chandana Unnithan, Victoria University, Australia
Prof. Deva Ram Godara, Bikaner, India
Dr. Y.C. Bhatt, Chairman, CSI Udaipur Chapter
Dr. B.R. Ranwah, Past Chairman, CSI Udaipur Chapter
Dr. Arpan Kumar Kar, IIT Delhi, India

Organizing Committee

General Chairs

Ms. Bhagyesh Soneji, Chairperson, ASSOCHAM Gujarat
 Mr. Jay Ruparel, President, GESIA
 Mr. Bharat Patel, COO, Yudiz Solutions

Organizing Chairs

Dr. Durgesh Kumar Mishra, Chairman, Division IV, CSI
 Dr. Rajveer Shekhawat, Chairman, ACM Udaipur Chapter

Organizing Co-chair

Dr. Harshal Arolkar, Associate Professor, GLS Ahmedabad

Members

Dr. Vimal Pandya, Ahmedabad, India
 Dr. G.N. Jani, Ahmedabad, India
 Mr. Nilesh Vaghela, Electromech, Ahmedabad, India
 Mr. Vinod Thummar, SITG, Gujarat, India
 Dr. Chirag Thaker, GEC, Bhavnagar, Gujarat, India
 Mr. Maulik Patel, SITG, Gujarat, India
 Mr. Nilesh Vaghela, Electromech Corp., Ahmedabad, India
 Dr. Savita Gandhi, GU, Ahmedabad, India
 Mr. Nayan Patel, SITG, Gujarat, India
 Dr. Jyoti Parikh, Associate Professor, CE, GU, Ahmedabad, India
 Dr. Vipin Tyagi, Jaypee University, Guna, India
 Prof. Sanjay Shah, GEC, Gandhinagar, India
 Dr. Chirag Thaker, GEC, Bhavnagar, Gujarat, India
 Mr. Mihir Chauhan, VICT, Gujarat, India
 Mr. Chetan Patel, Gandhinagar, India

Program Committee

Program Chair

Dr. Nilesh Modi, Professor and Head, NICSMS, Kadi

Program Co-chair

Dr. Nisarg Pathak, SSC, CSI, Gujarat

Members

Dr. Mukesh Sharma, SFSU, Jaipur
 Dr. Manuj Joshi, SGI, Udaipur, India
 Dr. Bharat Singh Deora, JRNRV University, Udaipur
 Prof. D.A. Parikh, Head, CE, LDCE, Ahmedabad, India
 Prof. L.C. Bishnoi, GPC, Kota, India

Mr. Alpesh Patel, SITG, Gujarat
Dr. Nisheeth Joshi, Banasthali University, Rajasthan, India
Dr. Vishal Gaur, Bikaner, India
Dr. Aditya patel, Ahmedabad University, Gujarat, India
Mr. Ajay Choudhary, IIT Roorkee, India
Dr. Dinesh Goyal, Gyan Vihar, Jaipur, India
Mr. Nirav Patel, SITG, Gujarat
Dr. Muneesh Trivedi, ABES, Gaziabad, India
Mr. Ajit Pujara, SITG, Gujarat, India
Dr. Dilip Kumar Sharma, Mathura, India
Prof. R.K. Banyal, RTU, Kota, India
Mr. Jeril Kuriakose, Manipal University, Jaipur, India
Dr. M. Sundaresan, Chairman, CSI Coimbatore Chapter
Prof. Jayshree Upadhyay, HOD-CE, VCIT, Gujarat
Dr. Sandeep Vasant, Ahmedabad University, Gujarat, India

About the Editors

Dr. Suresh Chandra Satapathy is currently working as Professor and Head, at the Department of CSE at Anil Neerukonda Institute of Technology and Sciences (ANITS), Andhra Pradesh, India. He obtained his Ph.D. in Computer Science and Engineering from JNTU Hyderabad and his M.Tech. in CSE from NIT, Rourkela, Odisha, India. He has 26 years of teaching experience. His research interests include data mining, machine intelligence, and swarm intelligence. He has acted as program chair of many international conferences and edited six volumes of proceedings from Springer LNCS and AISC series. He is currently guiding eight scholars for Ph.Ds. Dr. Satapathy is also a senior member of IEEE.

Er. Amit Joshi has experience of around 6 years in academic and industry in prestigious organizations in Rajasthan and Gujarat. Currently, he is working as Assistant Professor in the Department of Information Technology at Sabar Institute in Gujarat. He is an active member of ACM, CSI, AMIE, IEEE, IACSIT-Singapore, IDIS, ACEEE, NPA, and many other professional societies. Currently, he is Honorary Secretary of CSI Udaipur Chapter and Honorary Secretary for ACM Udaipur Chapter. He has presented and published more than 40 papers in national and international journals/conferences of IEEE, Springer and ACM. He has also edited three books on diversified subjects including Advances in Open Source Mobile Technologies, ICT for Integrated Rural Development, and ICT for Competitive Strategies. He has also organized more than 25 national and international conferences and workshops including International Conference ETNCC 2011 at Udaipur through IEEE, international conference ICTCS—2014 at Udaipur through ACM, international conference ICT4SD 2015—by Springer recently. He has also served on Organizing and Program Committees of more than 50 conferences/seminars/workshops throughout the world and presented six invited talks at various conferences. For his contribution towards society he has been awarded by The Institution of Engineers (India), ULC, the Appreciation Award on the celebration of Engineers, 2014 and by SIG-WNs Computer Society of India on ACCE, 2012.

Dr. Nilesh Modi has rich experience of around 13 years in academics and in the IT industry. He holds a doctorate in e-Security (Computer Science and Application). Continuing his research on cybersecurity, presently he is pursuing postdoctoral research on Wireless Communication and Security and certification as Ethical Hacking. He has a good number of research papers in his name and has presented more than 75 research papers in international and national journals and conferences. He has delivered a number of expert talks on e-Security and hacking in national and international conferences. Dr. Modi, a person with vibrancy, is an active life member of CSI, ACM IEEE, IACSIT, IACSI, and IAEng apart from his academic and industrial careers. As a consultant, he contributes to different system development projects with the IT industry and has carried out different government projects.

Dr. Nisarg Pathak is an astute and result-oriented professional with 10 years of experience in teaching and carving state, national, and international events like workshops, seminars, and conferences. Being a mathematics scholar and a computer science professional, he is actively involved in the research of data mining and big data analytics. He has a strong list of national and international publications to his name. Dr. Pathak is currently Associate Professor of Computer Science and Application at Narsinhbhai Institute of Computer Studies and Management affiliated to Kadi Sarva Vishvavidyalaya. He received his Ph.D. from Hemchandracharya North Gujarat University in Computer Science and his Master's in Mathematics from the same university. His other tenures include research fellow at Indian Statistical Institute, Kolkata, and Indian Institute of Science, Bengaluru.

Implementing the Logical Security Framework for E-Commerce Based on Service-Oriented Architecture

Ashish Kr. Luhach, Sanjay K. Dwivedi and Chandra K. Jha

Abstract Logical security of the modern E-commerce system is one of the major issues, effecting the growth of sophisticated E-commerce systems. Due to poor designing and configuration of the modern E-commerce's system, they lacked in quality attributes such as logical security. In the last decade, the number of highly equipped and trained intruders is increased significantly, due to increase in availability of computer systems and internet. These highly equipped and trained intruders are serious threat for the growing E-commerce industry. One of the leading Indian newspapers in 2013 reported about bugs on some of the most famous E-commerce websites such as Western Union and Facebook. This paper proposed a logical security framework for the small- and medium-sized E-commerce systems. The proposed logical security framework is inherited the benefits of service-oriented architecture and presents an analysis of the eminent security attacks which can be prevented. The proposed logical security framework is implemented and validated on osCommerce, an open source E-commerce.

Keywords Service-oriented architectures · Web services · Encrypted database · Security attacks · Legacy systems

1 Introduction

With the rapid development in information and communication technology (ICT), computers became the most valuable assets to the governing body. This rapid development in ICT transforms the physical existence of the markets and E-markets

A.Kr. Luhach (✉)
Dronacharya College of Engineering, Gurgaon, Haryana, India
e-mail: ashishluhach@gmail.com

S.K. Dwivedi
BBA University, Lucknow, U.P., India

C.K. Jha
Banasthali University, Jaipur, Rajasthan, India

introduced. Organizations start moving toward fast and dependable systems to cope up with the changing customer's demands from legacy organizations. These legacy systems have established very important tactical elements to the arrangements. The maintenance of legacy systems increased, and outweighs the benefit they generate to the organizations [1]. Legacy systems can prevent enterprises from transforming toward E-commerce, but customers are quick to take over. For instance, an organization implemented a home-grown E-commerce platform 10 years ago, which has already updated its legacy systems numerous times in the final ten. Updating the existing system means patching up new functionality and operability on top of already built legacy systems, now the organization ends up with a scheme which is not upgradable or even difficult to put back. These systems were tightly coupled with their legacy systems, and it is almost impossible to shift from these legacy systems to fast and reliable systems without involving the business [2]. These legacy systems are not compatible with modern days E-commerce systems, as today's E-commerce systems have demands of dynamic commercial enterprise applications, which are developed on the concepts of loose coupling and flexibility.

Service-oriented architecture (SOA) is an information technology advancement in which the already existing applications of an organization employed with the various services available in a network, for example, World Wide Web. These types of services which can be easily integrated with the existing one can be developed using SOA. The main problems for developing sophisticated E-commerce systems are integration and transmission of information but SOA can ease the above-mentioned problem as SOA has the feature of loose coupling. SOA has the feature of open standard protocols and excellent encapsulation; this makes SOA the apt pick to employ E-commerce system [3].

2 SOA and Traditional Software Architecture

At present, lot of research is going on and various conferences being conducted on E-commerce to bring all the academicians and researchers together to provide help and support to the organizations, so these organizations can migrate toward modern days E-commerce. The general idea behind developing SOA is to incorporate software into services. SOA applications are embedded into network services using XML. Web services attract organizations and various businesses to get the benefits of connectivity through the networks [4]. Table 1 shows the evaluation of various parameters between SOA and component-oriented software architecture (COSA) [5].

Table 1 Evaluation between SOA and COSA

Service-oriented architecture (SOA)	Component-oriented software architecture (COSA)
Flexible and loose coupling	Tight coupling
Harmonious services	Blocked applications
Information-oriented	Object-oriented
Independent of the implementation details	Deep understanding of the implementation details required
Development of interaction and reusability	Long development cycle
Flow-oriented	Function-oriented
Isomeric technologies	Isomorphic technologies

3 Security Analysis of SOA-Based E-Commerce

For accessing the E-commerce system, the users have to authenticate himself as a transaction or enterprise user. If an attacker bypasses this security mechanism of E-commerce system he will be able to gain access to the core database and product search area of E-commerce system. Figure 1 shows the generic system prototype of E-commerce system [2]. Figure 1 shows that the transaction users get access to the E-commerce platform that consists of various business service components, for example, customer information service, etc. through a web server but the enterprise user can access the business service components by directly communicating with simple object access protocol (SOAP). E-commerce system is not only used for online transactions but also can be practiced as a sequential publication of services such as banking services. Most of the E-commerce systems consist of various business services, for example, a famous E-commerce, Policybazar.com provides various services to their customer such as motor and health insurance. These different business services can be managed by diverse vendor or by different departments within the same organization such as Policybazar.com has different departments for the motor and health insurance which manage their own business services. The different services managed by the different departments make an E-commerce a service-oriented heterogeneous system [6, 7]. On the basis of literature review conducted for this research, it is concluded that this heterogeneous E-commerce system will have design and security issues which are as follows.

3.1 Certificate Duplicity

To gain access to E-commerce system components, user must have a valid certificate of authentication. The authentication certificate is issued by identity management service (IMS) upon the subsequent submission of authorized login credentials by the

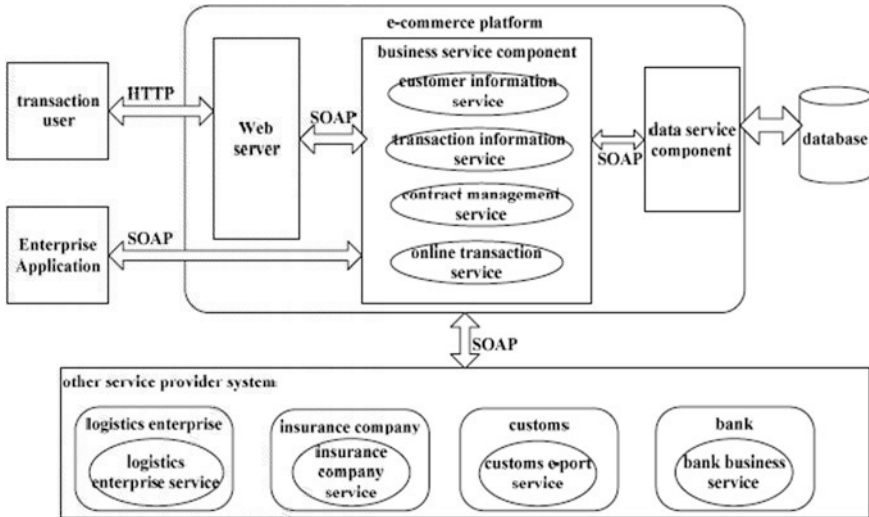


Fig. 1 System architecture of E-commerce platform

user. An intruder or attacker can generate the authorization certificate by gaining some kind of information from the user or through IMS.

3.2 Unsecure Protocols

All kind of communication between the user and E-commerce system is based on the protocols. The most common protocol used for this type of communication is hypertext transfer protocol (HTTP). In contrast, E-commerce requires a more sophisticated protocol for communication, when it comes to handle man-in-middle attacks by the attacker to access the important information from the communication. Man-in-middle attacks can be defined as the form of attacks in which intruder or attacker establishes a network connection with source and destination and relay messages between them giving sender and receiver an illusion that they are communicating directly [8].

3.3 No Filters Mentioned on the Application Level

Code or request filters may be used to block the security threats at the initial entry point of the communication with the E-commerce system. The absence of these kinds of filters at the application level can promote the attackers attempt, which may lead to a security attack. This type of attack which an attacker can perform in

the absence of the code or request filters is cross-site scripting and remote file inclusion [9].

3.4 Database Security

Database is the backbone of any E-commerce system and lot of emphasis put on the database security. Attacker can penetrate into E-commerce database without breaking an extra shell of the security which was not there. Infected database may lead to leakage of the sensitive information of the customers and organization [10].

4 The Proposed Security Framework and Implementation for SOA-Based E-Commerce

The proposed logical security framework has the benefits of SOA designing approach. The proposed logical security framework is designed to secure the E-commerce system from known computing threats or attacks. Figure 2 shows the proposed logical security framework. In the proposed logical security framework both the transaction and enterprise users can communicate with the E-commerce system through SOAP instead of earlier or traditional frameworks in which only the enterprise users can directly communicate with E-commerce system through SOAP. The proposed logical security framework consists of a special code or request filtering security layer known as input sanitization and all transaction/enterprise users requesting to access the business service components of the E-commerce system are conceded through this additional security layer. Rule-based plug-in is defined in the proposed logical security framework which implements an additional security layer. For efficient monitoring of the incoming and outgoing packets, intrusion detection system (IDS) and intrusion protection system (IPS) are employed in the proposed logical security framework. With the help of IDS and IPS, each and every packet is monitored and infected packets can be blocked or traced easily. Figure 2 clearly shows that the database of the E-commerce is maintained on a completely different web server named as Server 2 in the proposed logical security framework. All the business service components are maintained on a different web server named as Server 1. The communication between Server 1 and Server 2 is closely monitored by the IDS and IPS, which actually create additional layer of defense from attacker attempt. By placing both business service components and database on different servers, it is very easy to disconnect the database from the E-commerce to ensure the minimal loss of the sensitive information either related to customers or organization.

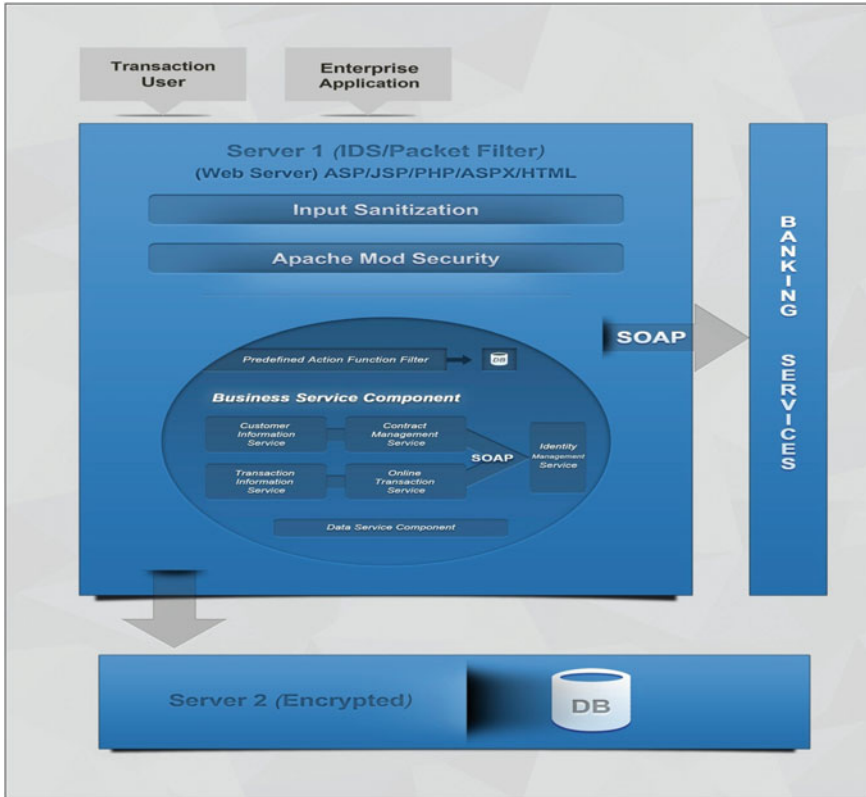


Fig. 2 Proposed logical security framework

5 Usage Scenario

In this part, we look at the usage scenario of the suggested framework. Figure 3 depicts the flow of events in this scenario and the interaction directions between different elements.

- The end user would like to access the E-commerce, for example, a user attempting to buy DVDs from an E-commerce site. He accesses the information related to DVDs under the movies section using his login credentials.
- The web application running on the E-commerce websites uses SOAP messaging and HTTPs for communication.
- The authentication assurance services, which are based on username and password pairs, permit the users to access the DVDs detailed information. The authentication assurance is managed by IMS. To access the business service component uses must be successfully through IMS.

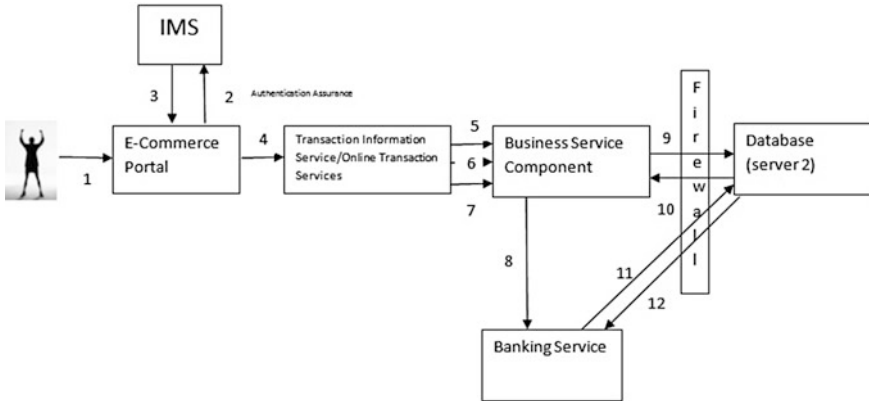


Fig. 3 Usage scenario of the proposed framework

- The user’s service requests are first sanitized and then monitored by IDS/IPS before being forwarded to the database.
- The database is maintained on different servers and connected to business service components via firewall.
- Banking services can be accessed through business service components and connected to the database via firewall.

The presented scenario outlines how the proposed framework fulfills the security essential for today’s E-commerce system. First, input sanitization solves the risk of certificate duplicity. Predefined actions, filters mentioned in proposed framework, are responsible for separating out the actions specified on web pages. The database is maintained onto a totally different server, which is monitored by IDS/IPS. The presentation of IDS/IPS will avoid the denial of service attempts.

6 Results and Discussion

The proposed logical security framework is validated on an open source E-commerce system, osCommerce. osCommerce provides free of cost online E-commerce solutions for various organizations. osCommerce allows organizations to arrange up their online stores without software costs or license fees. Till now, the osCommerce community provided more than 5,000 add-ons that are absolutely free of cost. osCommerce also provides customized solutions for individual clients equally well. osCommerce implemented with PHP as web scripting language and uses MySQL as database for their server data. The combination of PHP and MySQL allows osCommerce Online Merchant to run on whatever network server environment that supports PHP and MySQL, for example, Linux, Solaris, BSD, Mac OS X, and Microsoft Windows environments. osCommerce was started in

March 2000 and has since matured to a solution that is powering many thousands of online shops around the globe. The implementation benefits which are already implemented so far for the proposed logical security framework are discussed below.

6.1 Input Sanitization

It provides an extra layer of security for the proposed logical security framework as it verifies all the incoming packets submitted by the attacker or user. If the user request consists of any special characters to bypass the security layer such as '#@123*,' this extra layer of security will clean the user submitted input as '123' and forwarded to the next layer for further operation. This extra layer will resolve the issue of certificate duplicity. The highlighted text shown in Fig. 4 is a sample of infected input submitted by the attacker to bypass the security mechanism of an E-commerce system. The input sanitization layer of the proposed logical security framework will clean the infected input submitted by the user as shown in Fig. 5.

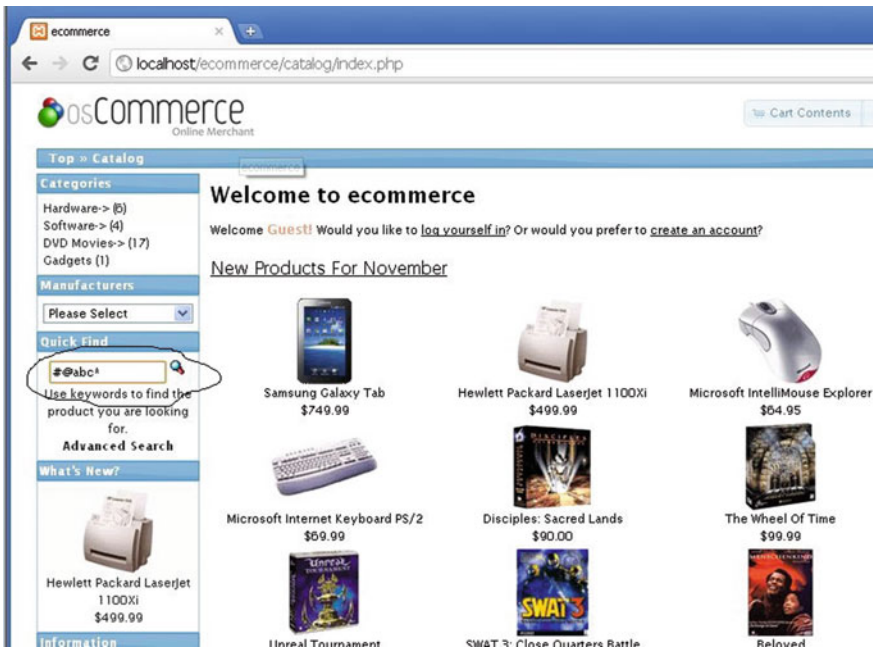


Fig. 4 Sample of infected input

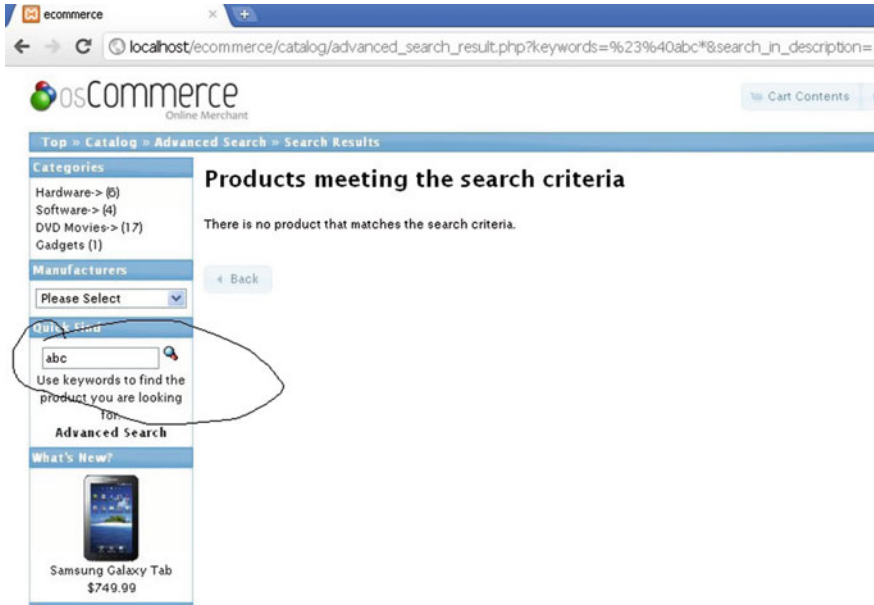


Fig. 5 Sanitized input by the proposed logical security framework

6.2 Rule-Based Plug-in for Additional Security

This security layer provides an extra layer of security for the proposed logical security framework. This layer comes into play when the attacker successfully bypasses the initial layer of filtration which is input sanitization layer. This additional security layer is created by defining the various rules for accessing the business service component of the E-commerce system. These rules are just another filtering and blocking technique for the input submitted by the user. The user request is matched with the created rules and if matched with the created rules, then the user requested is blocked and rejected. Figure 6 shows the sample user attempt for retrieving the important information without proper means of authentication. Figure 7 shows that the users attempt is filtered and blocked by the proposed logical security framework. The user request was denied and web page remains the same as highlighted.

6.3 Predefined Action Filters

These types of action filters are used to block the attacker attempt of remote code execution or SQL injection. If somehow attacker bypasses the input sanitization and rule-based plug-in for additional security and able to execute his infected code, then

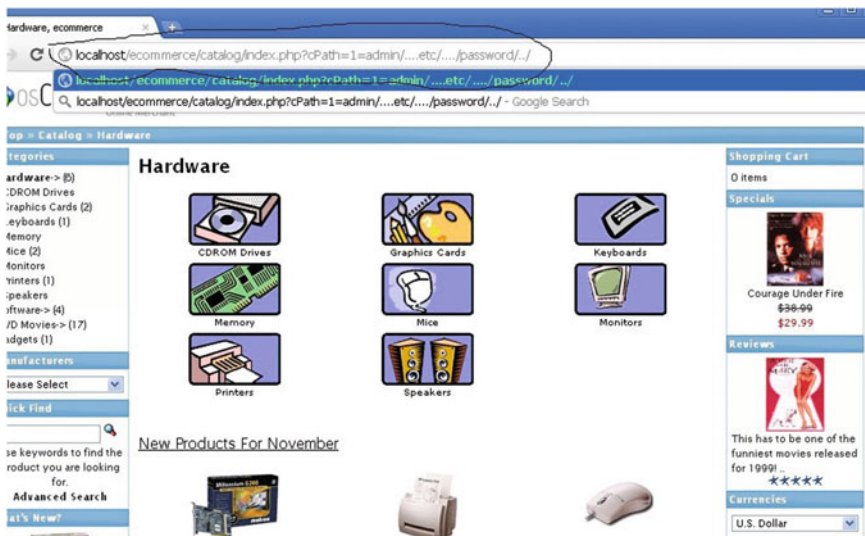


Fig. 6 User attempts to include the local files into their commands



Fig. 7 Local file inclusion is blocked by proposed security design

these predefined action filters block the infected code or program executed by the attacker. Figure 8 shows user attempt of SQL Injection as infected URL and Fig. 9 shows the filtering of the same for the proposed logical security framework and the web page remains the same.

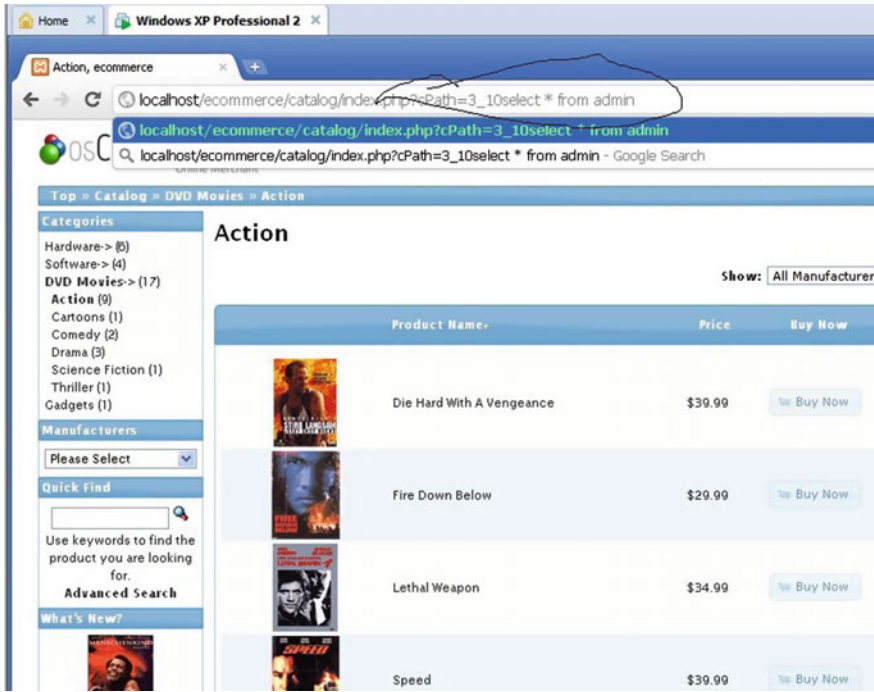


Fig. 8 User attempt of SQL injection

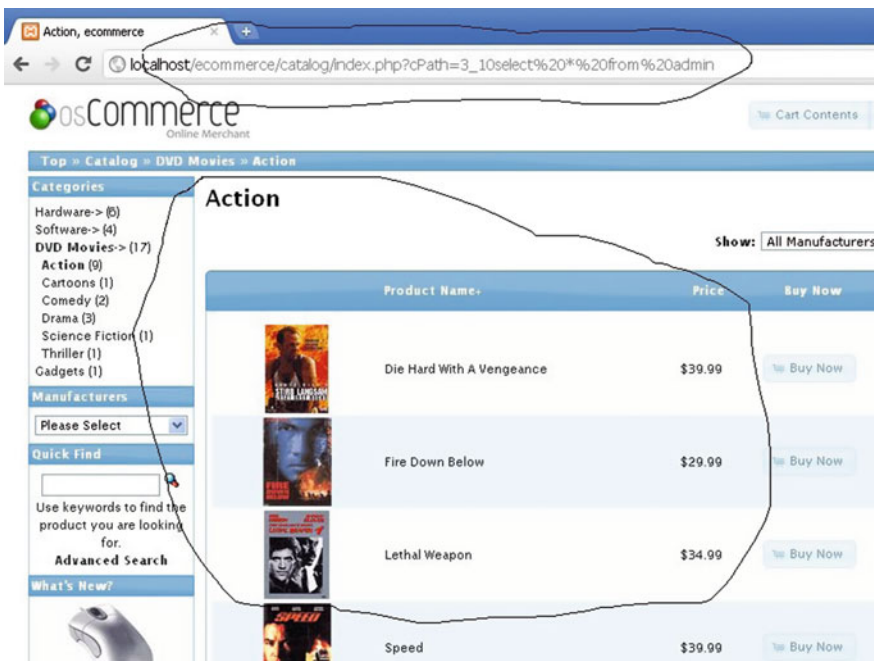


Fig. 9 Action filtering for the proposed security design