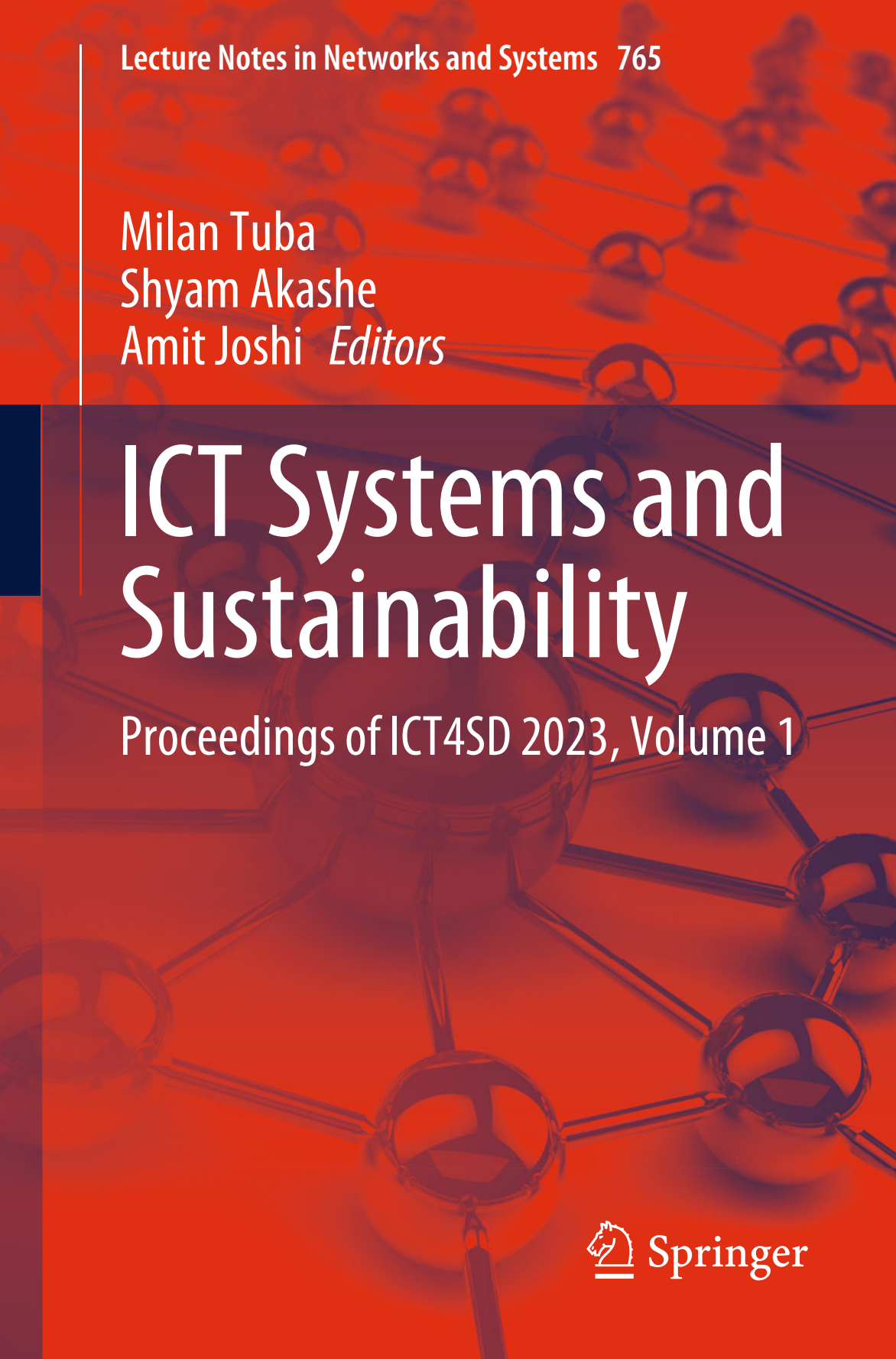
Lecture Notes in Networks and Systems 765

Milan Tuba
Shyam Akashe
Amit Joshi *Editors*

ICT Systems and Sustainability

Proceedings of ICT4SD 2023, Volume 1



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Preface

The eighth International Conference on ICT for Sustainable Development (ICT4SD 2023) targets theory, development, applications, experiences, and evaluation of interaction sciences with fellow students, researchers, and practitioners.

The conference is devoted to increasing the understanding role of technology issues and how engineering has day by day evolved to prepare human friendly technology. The conference will provide a platform for bringing forth significant research and literature across the field of ICT for Sustainable Development and provide an overview of the technologies awaiting unveiling. This interaction will be the focal point for leading experts to share their insights, provide guidance, and address participant's questions and concerns.

The conference will be held on August 3–4, 2023, at Hotel Vivanta by TAJ, Panaji, Goa. The conference is organized by Global Knowledge Research Foundation and Managed By: G R Scholastic LLP, State Chamber Partner Goa Chamber of Commerce and Industry and National Chamber Partner Knowledge Chamber of Commerce and Industry.

Research submissions in various advanced technology areas were received and after a rigorous peer-review process with the help of program committee members and 185 external reviewers for 1100+ papers from 16 different countries including Saudi Arabia, USA, Singapore, Denmark, Norway, Denmark, Ghana, United Arab Emirates, The Netherlands, Iraq, Bangladesh, Japan, Malaysia, and Finland, out of which 165 were accepted with an acceptance ratio of 0.16. These will be presented in 18 parallel sessions in two days and organized physical at Goa and virtual on Zoom including one inaugural and one keynote session.

Technology is the driving force of progress in this era of globalization. Information and Communication Technology (ICT) has become a functional requirement for the socioeconomic growth and sustained development of any country. The influence of information communications technology (ICT) in shaping the process of globalization, particularly in productivity, commercial, and financial spheres, is widely recognized. The ICT sector is undergoing a revolution that has momentous implications for the current and future social and economic situation of all the countries in the world. ICT plays a pivotal role in empowering people for self-efficacy and how

it can facilitate this mission to reach out to grassroots level. Finally, it is concluded that ICT is a significant contributor to the success of the ongoing initiative of start-up India.

In order to recognize and reward the extraordinary performance and achievements by ICT and allied sectors and promote universities, researchers and students through their research work adapting new scientific technologies and innovations, the two days conference had presentations from the researchers, scientists, academia, and students on the research work carried out by them in different sectors.

Belgrade, Serbia — Milan Tuba
Gwalior, India — Shyam Akashe
Ahmedabad, India — Amit Joshi

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Editors and Contributors

About the Editors

Milan Tuba is Professor of Computer Science and Mathematics, Head of the Artificial Intelligence Project at Singidunum University and Vice-Rector of Research at Sinergia University, is included in both versions of the Stanford University list of 2% of the most influential scientists in the world in all disciplines, one for contribution during the entire career and other for contribution in the previous year (for years 2020–2022). He was Vice Rector for International Relations, Singidunum University, Belgrade, Head of the Department for Mathematical Sciences at State University of Novi Pazar and Dean of the Graduate School of Computer Science at John Naisbitt University. Professor Tuba is the author or coauthor of around 300 scientific papers (cited more than six, 600 times, h-index 49) and editor, coeditor or member of the editorial board or scientific committee of number of scientific journals, Springer books, congresses and international conferences. He was invited and delivered more than 90 keynote and inaugural lectures at international conferences.

He received B.S. in Mathematics, M.S. in Mathematics, M.S. in Computer Science, M.Ph. in Computer Science, Ph.D. in Computer Science from University of Belgrade and New York University. From 1983 to 1994 he was in the USA at Vanderbilt University in Nashville and Courant Institute of Mathematical Sciences, New York University and later as Assistant Professor of Electrical Engineering at Cooper Union School of Engineering, New York. During that time, he was the founder and director of Microprocessor Lab and VLSI Lab, leader of the NSF scientific projects and theses supervisor. He was the mentor of dozens of doctoral and master's dissertations at the Faculty of Mathematics University of Belgrade, Singidunum University, University of Sarajevo, State University of Novi Pazar, John Nesbitt University and University of East Sarajevo. He was teaching more than 20 graduate and undergraduate courses, from VLSI Design and Computer Architecture to Computer Networks, Operating Systems, Artificial Intelligence, Image Processing, Calculus and Queuing

Theory at numerous universities in Europe and the USA. Professor Tuba is a member of the National Agency for Accreditation of Universities of the Republic of Serbia.

His research interest includes Artificial Intelligence, Deep Learning, Neural Networks, Nature-inspired Optimization Algorithms, Image Processing, Computer Networks. Senior Member IEEE, ACM, AMS, SIAM, IFNA, Executive Board of IASEI.

Shyam Akashe is Professor at ITM University, Gwalior, Madhya Pradesh, India. He completed his Ph.D. at Thapar University, Punjab, and his M.Tech. in Electronics and Communication Engineering at the Institute of Technology and Management, Gwalior. He has authored 190 publications, including more than 50 papers in SCI-indexed journals. His main research focus is low-power system on chip (SoC) applications in which static random access memories (SRAMs) are omnipresent. He has authored two books entitled Moore's Law Alive: Gate-All-Around (GAA) Next Generation Transistor published by LAMBERT Academic Publishing, Germany and Low Power High Speed CMOS Multiplexer Design published by Nova Science Publishers, Inc., New York, USA. He has also published over 120 papers in leading national and international refereed journals of repute. Dr. Akashe has participated in numerous national and international conferences and presented over 100 papers.

Dr. Amit Joshi is currently the Director of Global Knowledge Research Foundation, also an entrepreneur and researcher who has completed his graduation (B.Tech.) in Information Technology and M.Tech. in Computer Science and Engineering and completed his research in the areas of Cloud Computing and Cryptography in Medical imaging with a focus on analysis of the current Government Strategies and World forums needs in different sectors on security purposes. He has an experience of around 12 years in academic and industry in prestigious organizations. He is an active member of ACM, IEEE, CSI, AMIE, IACSIT-Singapore, IDES, ACEEE, NPA and many other professional societies. Currently he is a Chairman of Computer Society of India (CSI) Udaipur Chapter and Secretary for Association of Computing Machinery (ACM) Udaipur Professional Chapter. Further currently he is also the International Chair of InterYIT at International Federation of Information Processing (IFIP, Austria), He has presented and published more than 50 papers in National and International Journals/Conferences of IEEE and ACM. He has also edited more than 20 books which are published by Springer, ACM and other reputed publishers. He has also organized more than 40 National and International Conferences and Workshops through ACM, Springer, IEEE across five countries including India, UK, Thailand, Europe. Apart from this academic involvement he is also associated with the Business and Industry Community across the globe. He is currently the Director of Emanant TechMedia (P) Limited which focuses on ICT and web based services. With Global Knowledge Research Foundation his major work area is focussed on building and making effective linkages among bureaucrats, industry associations, Academic Leaders and regulatory authorities for effective connectivity for taking up common issues related to research in different sectors and has organized more than 20 Industry forum Events and recognised and felicitated Awards Ceremonies

through his organizations in last 5 years. Liaisoning/communications with State as well as Central establishments along with corporate and Academics to take Industry and Government Sector together. He is majorly focusing on Academic Tie-ups for Medical, Engineering and management sectors, for the same he is representing the organization in many delegations to countries including USA, UK, Canada, Israel and visited more than 15 countries. He always looks forward and strives for Networking in various sectors with a focus on Education and Industry Sector.

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Web Application for Monitoring Foundry Processes Using IoT

Sharada M. Kori, Mahesh A. Kori, Akshata S. Kori, and Parth Zanvar

Abstract Web application for monitoring Foundry Processes using IoT tracks all the manufacturing processes like pattern making, molding, melting, pouring, injection, cleaning, fettling, and inspection. Currently, the industries carry out the process of tracking by manual means of report maintenance, but by implementing the web application, all of the works related to the monitoring of the industrial process can be done on the phone/laptop itself. The customers who have placed order for any product can also track the status of their order and keep themselves updated. The owner/CEO of the company too can track what all activities/tasks are being carried out and can also check with the status of the products being manufactured. He/she need not go onsite for tracking but can track from his home or from anywhere in the world by just one click. Hence, at the end of the entire process of manufacturing, we also get to the success rate, i.e., the total products manufactured from the given raw materials and what was the wastage. We have also implemented a temperature monitoring system which monitors the temperature of the furnaces used during the melting process. As the temperature near the furnace is too high, it is very risky for the workers to go near it, and hence by implementing the temperature monitoring system using IoT, we can minimize the human involvement near the furnace.

Keywords Web application · Foundry Process · IoT · Automation · Monitoring system

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1 Introduction

1.1 Web Application

Web applications are computer programs that are hosted by a web server and accessed via a web browser over a network such as the Internet. They are used to perform various functions such as content management, customer relationship management, and e-commerce [1]. Web applications range from simple static web pages to complex dynamic web sites and web services. Web applications enable users to interact with a web server through a graphical user interface (GUI) or web page [2].

Web applications are software programs that are designed to be accessed over the internet through a web browser. They can be used for a wide variety of purposes, including communication, collaboration, data management, entertainment, and more.

Some common examples of web applications include webmail (such as Gmail or Outlook.com), online calculators, social media platforms (such as Facebook or Twitter), e-commerce shops (such as Amazon or eBay), and productivity tools (such as Google Docs or Trello).

While some web applications may be optimized for use with a specific browser, most are designed to be accessible from any web browser, including popular options like Google Chrome, Mozilla Firefox, Safari, and Microsoft Edge. This makes them highly flexible and widely accessible to users across different devices and platforms.

How Web Applications Work

Web applications are accessed through a web browser, which sends a request to the web server. The web server processes the request and sends back a response, which is displayed in the user's browser.

Behind the scenes, web applications typically consist of multiple layers. The web server manages the incoming requests and serves up the appropriate resources, such as HTML, CSS, and JavaScript files. The application server handles the logic of the application, processing user inputs and generating responses. The database stores any necessary data, such as user accounts, product listings, or transaction records [3].

Web applications are typically developed using a combination of front-end and back-end programming languages. HTML, CSS, and JavaScript are used for client-side programming, which creates the user interface and handles user interactions. Back-end programming languages like Python, Java, or Ruby are used to build the server-side logic, which processes data and generates responses.

One advantage of web applications is that they can be developed relatively quickly and easily by small teams. This is because they use standardized technologies and can be accessed from any web browser, making them highly portable and accessible to a wide audience [4].

1.2 JavaScript

JavaScript is a high-level programming language that is commonly used for creating dynamic and interactive web pages. It is a popular language for front-end development, which involves creating the user-facing parts of web applications such as forms, menus, and animations.

What JavaScript can be used for?

JavaScript is used to create interactive web pages, add functionality to web pages, validate forms, create cookies, detect browsers, create image rollovers, create calculators, and much more. JavaScript can be used to develop both client-side and server-side applications. It is most commonly used to create interactive web pages, but can also be used to create desktop applications, mobile apps, games, and more.

1.3 CSS

Cascading Style Sheet is used to control the style of a web document.

Resistance Temperature Detector

A resistance temperature detector (RTD) is a type of temperature sensor that is used to measure temperature in a wide range of applications. It works by measuring the resistance of a material, such as metal, as its temperature changes. RTDs are commonly used in industrial applications such as process control, power plants, and manufacturing facilities. They are also used in medical equipment, food and beverage processing, and other areas where accurate temperature measurements are necessary. Unlike thermocouples and thermistors, RTDs are not self-powered and require an external source of power to operate [5].

A Platinum Resistance Temperature Detector (PRTD) is a type of temperature sensor used for measuring temperatures of liquids and gases. It is a solid-state device consisting of a coil of fine resistance wire made from a platinum alloy, wound on an insulating ceramic core. The resistance of the wire increases linearly with temperature, allowing the PRTD to be used as a thermometer with a high degree of accuracy. The PRTD is a popular choice for industrial, medical, and scientific applications, due to its durability, accuracy, and low cost.

Types of resistance temperature detector

- Copper—0–180°.
- Nickel—220 to 300°.
- Tungsten—200 to 1000°.

1.4 JSX

JavaScript XML is a special kind of JavaScript object that can be used to represent and store XML data. It can be used to parse, traverse, and manipulate XML documents. JavaScript XML documents can also be converted to and from JSON, HTML, and other data types.

2 Methods and Materıal

To design and develop a web application for Monitoring Foundry Processes using web widgets on Mobile Phones and implementation of IoT.

2.1 Objectives

Input Objectives

1. Input design is a critical phase in the development of computer-based systems. It involves the process of creating a plan for how user input will be captured, validated, processed, and stored by a computer system. The input design process aims to ensure that the data entered into the system is accurate, complete, consistent, and relevant to the needs of the users and the organization. It involves understanding user requirements and designing user interfaces, data capture forms, and input validation routines that facilitate data entry and minimize errors.
2. By designing an effective data entry screen, users can enter data more efficiently, reduce errors, and increase productivity. The screen should be intuitive and easy to navigate, with clear instructions and guidance to assist users in entering accurate data. Additionally, the screen should allow for easy editing and correction of data, as well as provide a way to view and review the entered records.
3. When data is entered into an information system, it is important to ensure that the data is accurate, complete and conform to the required format. To achieve this, data validation checks are performed to ensure that the entered data is valid and meets the required criteria. If any errors or discrepancies are found, appropriate messages are displayed to prompt the user to correct the input.

Output Objectives

1. Designing computer output requires a systematic and organized approach, with a focus on meeting user requirements and providing a user-friendly experience. By following a structured design process and considering various factors, the resulting output can be effective, efficient, and meet the needs of the users.

2. Choose appropriate methods for presenting the information.
3. The primary objective of the output is to convey information about past activities, current status, or projections of the future. The output should provide users with a clear understanding of the state of the system, including its performance, trends, and potential issues. Additionally, the output should signal important events, opportunities, problems, or warnings to alert users to significant changes or issues.

2.2 Existing System

The existing system is a manual one in which the industry maintains and tracks all the industrial activities in the books and one can access the data by looking at the books itself, and there is no source through which the data can be accessed by means of online sources. Thus, maintenance of the data is also a tedious job and one has to maintain records of up to last 10 years, and thus, maintaining them in the books is unreliable.

Disadvantages of existing system

- Recording and maintaining become a tedious job.
- The furnace environment is very warm and there is risk involved if there is human intervention in and around the furnace; thus, by the implementation of the sensors, human interaction can be minimized and necessary protocols could be followed if the temperature is known well in advance.
- There is no existing research on industrial process management and recommendations.

Proposed System

- Here, we focus on helping the employees as well as the customers.
- The employees can utilize the web application and can monitor the entire manufacturing process and can keep track of the various processes like casting, molding, etc.
- The customers on the other hand can also keep a track of the status of the order they have placed and can make suitable decisions depending upon the status with respect to the future course of action.
- The other benefit of the system is that it also makes sure that there is safety involved while working in and around the furnace and can help with monitoring the temperature of the furnace.

2.3 Requirement Specifications

Requirement specifications are essential for any project. They provide a framework for the development process, that includes an understanding of the customer's

requirements, the software's capabilities, and the team's resources. The requirements are categorized into two types and are listed below.

2.4 Functional Requirements

Functional requirements are indeed an essential part of a requirement specification document. Their main purpose is to describe the specific functions that the system or software application should perform to satisfy the needs of its users or stakeholders. The depiction of the requirements of the system is presented below:

- The initial stage should be a login page for the company to access the portal.
- The company details and the services offered should be displayed.
- It should provide services like live temperature monitoring and live monitoring of the industrial activities.
- Live industrial activity monitoring should include the live status of the foundry manufacturing process.

2.5 Non-functional Requirements

Non-functional requirements are a critical part of a requirement specification document and describe the features, characteristics, and attributes of a system that are not directly related to its functional behavior. Based on these, the non-functional requirements are as follows (Fig. 1):

- The system should be secure and portable.
- The system should have an easy to use, user-friendly frontend.
- The system should perform efficiently in a short amount of time.
- The system should provide easy maintenance.
- The system should be easily scalable.

2.6 Hardware and Software Specifications

Hardware Specification

- Arduino UNO.
- 3-wire PT100 sensor.
- LCD with PCF8574.
- MAX 31865 IC.

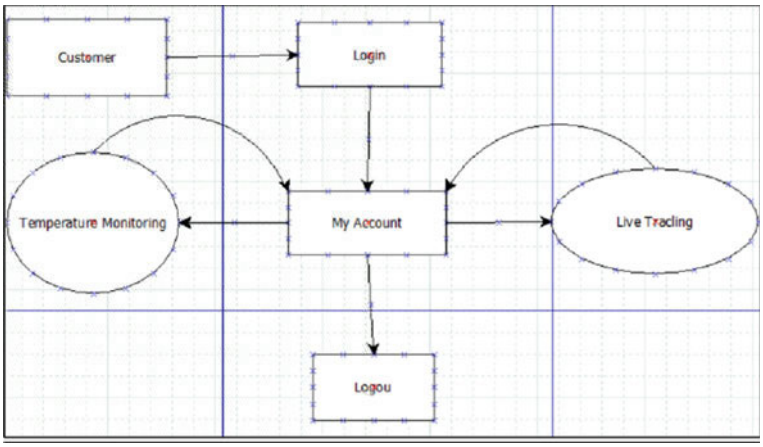

Fig. 1 Data flow diagram

- SSOP footprint.
- Resistance temperature detector.

Software Specification

Operating system: Windows/Linux/MacOS.

Programming language: JavaScript.

Web technologies: MERN Stack.

Mobile platforms: Android/iOS.

Cloud platforms used: GCP, AWS IoT.

Development IDE: Visual Studio Code.

3 Design Details

3.1 Data Flow Diagram

A data flow diagram (DFD) is a graphical representation of a system or a process that shows the flow of data through it. It is a visual representation of the inputs, outputs, processes, and data stores of a system, and it is used to describe how data moves through the system.

A DFD typically consists of four components.