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SMART INNOVATIONS AND SMART COMMUNICATIONS IN SMART CITIES

Lidija Madžar[1]; Aleksandra Perović; [2] Jovan Veselinović[3]

Abstract

The concept of a smart city is a technologically modern urban area focused on its citizens, in which contemporary technologies, electronics and sensors are applied with the aim of collecting specific data and using them for assets and resource management, as well as improving the efficiency of local services and reducing energy, operating and other costs. As such, it encompasses a wide range of initiatives, from more advanced urban transport networks and communal services, through more efficient lighting, all the way to more interactive and responsive city administration and the development of integrated infrastructure. The goal of this article is to determine the relevance and importance of the most common smart innovations and intelligent communications related to the modern concept of a smart city, by applying the desk research method. In addition to the analysis of the smart cities' global market, the article also provides a detailed overview of the most significant smart innovations and intelligent communications on which the functioning of modern smart cities rests. The authors conclude that smart cities represent our imminent future, especially in light of ongoing climate change, the threat of new pandemics and natural disasters, and the need for sustainable development.

Keywords: *smart city, smart innovations, intelligent communications, digital technologies, climate change, environment.*

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THE ROLE OF DRONES AND INTELLIGENT REFLECTIVE SURFACES IN BROADBAND TRANSMISSION OVER 5G AND B5G MOBILE NETWORKS IN SMART CITIES

Filip Rađenović[4]*; Branislav Rađenović*[5]

Abstract

This paper presents innovative technologies that should enable broadband data transmission necessary for the implementation of new services and functions in smart cities. The technologies that we expect to be applied in 5G and B5G (6G) mobile networks have been analysed in particular. Given that these networks imply a significantly higher density of base stations, it is expected that drones will be largely used for their implementation as aerial base stations (ABS). Drones can be used as carriers of appropriate antenna systems, which by their nature are complex active devices and have significant energy consumption. Another variant is to install the so-called intelligent reflective surfaces (IRS), by their nature passive devices and therefore more energy efficient. The principles of functioning, advantages and disadvantages of the IRSs are presented in more details.

Keywords: *smart city, drones, Internet of Drones (IoD), B5G, 6G, intelligent reflecting surface (IRS)*

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PRIVACY RISKS IN THE SMART CITY CONTEXT: THE VPN CONUNDRUM FROM ENTERPRISE PERSPECTIVE

Nemanja Pantelić [6]*; Sreten Gligorić*[7]

Abstract

The escalating demand for privacy is promptly reshaping enterprise IT security in accordance with industry best practices. While smart cities advocate privacy as a core concern from both ethical and economical perspectives, authors of the paper, working as IT security consultants, have been witnessing outdated, insecure and impractical trends in using VPN as a primary security factor. The paper aims to outline the key weaknesses of the VPN approach as well as to propose an alternative perspective based on the current best practices and researches.

Keywords: *VPN, Identity, Security, Privacy, Smart, Cities*

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WEAK POINTS OF SMART CITIES

Milica Varšandan[8]; Čaba Varšandan[9]; Draško Vidović[10]; Duško Bogdanić[11]

Abstract

Smart cities represent an innovative approach to urban planning and general infrastructure management. Advanced technologies are used to improve the quality of life of all citizens. Regardless of the promising aspects, implementations of smart cities, and even the very meaning of the phrase "smart city", face a number of challenges that require careful considerations. This paper gives some ideas about the weaknesses of smart cities. We consider the subject of privacy, risks arising from security issues, digital divide (i.e., the types of permanent distributions of people it can cause), dependences caused by the technology, additional costs and necessary financing, the necessary regulations that do not exist, and some standards that are in the process of implementation but are not mature enough. By analyzing all the known aspects, we will emphasize the need for an approach that includes authorities, industries, academic communities, and, of course, all other citizens. We will try to disclose some suggestions that can serve as an initial strategy or initial guidelines for a better tomorrow. Without such efforts, smart cities would not be able to become technologically advanced and at the same time to be sustainable and resistant to the challenges of the future.

Keywords: *smart cities, challenges, weaknesses, security approaches.*

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ZERO TRUST SECURITY IN IOT

Aleksandar Zakić [12]*; Slaviša Trajković*[13]*; Marko Zakić* [14]*; Alen Kamiš* [15]

Abstract

Zero Trust security is an IT security model that requires strict identity verification for every person and device trying to access resources on a private network, regardless of whether they are sitting within or outside of the network perimeter.
Traditional IT network security is based on the castle-and-moat concept. In castle-and-moat security, it is hard to obtain access from outside the network, but everyone inside the network is trusted by default. The problem with this approach is that once an attacker gains access to the network, they have free rein over everything inside.
This paper describes a different concept compared to the standard way to protect IoT devices.

Keywords*: IoT, IT security, private network, smart cities.*

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IPV6 PROTOCOL IN IOT TECHNOLOGIES

Ana Nikolić[16]*; Aleksandar Zakić*[17]*; Milan Gligorijević*[18]
Alen Kamiš[19]

Abstract

The Internet of Things (IoT) describes a network of physical objects - things - embedded with sensors, software, and other technologies to connect and exchange data with other devices and systems over the Internet that can range from the common household object to ultramodern industrial-scale devices. There are more than forty billion IoT devices today, and this number may grow to 125 billion by the end of 2030. The basic method of Internet protocol networking is the definition of unique identifiers, so-called. IP address, for each connected device over the Internet. The system is automated to deliver packets of information from one source to another. The question is, how can these billions of IoT devices cause problems for this method of networking? The answer is simple: the IPv4 protocol does not give us enough space for all the devices we want to connect. We ran out of IP addresses back in 2011, so a new protocol was created in 2012 that will cover all our needs in the future.
With the partnership of several major countries, the Internet Society officially launched IPv6 in 2012 and continued acquisition over the past 12 years.
This paper deals with the topic of the transition of the IP protocol from the old to the latest version - IPv6 - with a small analysis of both protocols, their differences and adopted advantages.

Keywords: *IoT, IPv6, IP, smart cities.*

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INTRODUCTION OF THE USE OF ARTIFICIAL INTELLIGENCE IN THE PRODUCTION OF CHICKEN MEAT AS A NECESSARY NEED OF THE INDUSTRY SURROUNDING THE SMART CITY

Mario Stojanović[20]*; Mladen Gligorijević*[21]*; Dejan Anđelković*[22]

Abstract

The use of artificial intelligence (AI) in the production industry can be extremely useful in several ways, starting from primary production itself, through fattening broilers, and at the end of the meat production process itself, which includes slaughtering, cooling, cut ups, measuring and packaging, transportation. Artificial intelligence can contribute the most through optimization of the production process, control of the production process, quality control, predictive maintenance, robotization, improvement of supply chain management as well as product personalization. When it comes to the complete cycle of chicken meat production, nowadays complete robotic solutions are available for each of the mentioned processes. Man only has the role of operator in such solutions. I am of the opinion that with the help of AI the human as an operator can be replaced and, in that way, get a far more efficient system and use a fully automated production process. In short, artificial intelligence has the potential to improve various aspects of operations in the meat industry, from production and product quality to supply chain management and customer satisfaction.

Keywords: *Optimization of production processes, Robotization, Quality control, Predictive maintenance, Improvement of supply chain management, Personalized products*

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CHALLENGES IN SMART EDUCATION ENVIRONMENTS: AN INSIGHFUL OVERVIEW

Lidija Paunović[23]*; Aleksandar Stokić*[24]*; Marija Nikolić*[25]

Abstract

As technology continues to advance, it has a profound impact on various aspects of society. One of the areas where smart technology can be applied is in the field of education. However, the process of implementing these technologies is complex and requires a multidisciplinary approach. While there are numerous benefits to using these technologies, there are also various challenges that need to be addressed. This paper delves into some of the challenges that arise in the implementation of smart education and categorize them for better understanding. The research builds upon previous studies and reveals new challenges that emerge with deeper implementation of smart technologies in educational environments.

Keywords: *Smart Education, Smart Technology, Smart Learning, Electronic Learning*

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IMPROVING AND OPTIMIZING PUBLIC LIBRARY SERVICES USING SMART TECHNOLOGIES

Aleksandar Stokić[26]*; Lidija Paunović* [27]

Abstract

The potential application of smart technologies in libraries should be perceived first as a strategy and, secondly as a software solution. The emphasis should be on improving services and strengthening the library's and target groups' relationships. Also, smart technologies should provide better working conditions and optimize business processes. Implementing smart technologies represents a strategic approach to improving library operations, and the main goal is to improve the quality of services provided. The new approach should encourage activities such as promotion of libraries, communication with existing and potential users and maintenance of good business relations with associates and business partners. The implementation of smart technologies shortens the time required for searching and locating publications, monitoring the book collection, and the movement of users through the library. To improve efficiency, it is necessary to carry out a strategic implementation of smart infrastructure in the library environment. Thus, the modern way of communicating with library service users involves using information systems, and technologies and integrating computer and mobile applications.
The paper will present smart technologies that can significantly optimize business processes within the library and improve communication and interaction with users of library services.

Keywords: *smart technologies, library services, integrated library systems (ILS), optimization of business processes*

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SAFETY IN SCHOOLS: THE SIMULATION OF EVACUATION AT THE ELEMENTARY SCHOOL CAR KONSTANTIN IN NIŠ

Radoje Jevtić [28]; Violeta Dimić [29]; Jovan Ničković[30]; Ivana Antić [31]

Abstract

Evacuation generally presents a very complex and responsible task, no matter what kind of object or location is in a plan for the evacuation. Reasons for evacuation are mostly well known. These are earthquakes, fire, overflow, tsunamis, terrorist attacks, and others. A major significant factor for evacuation is a lot of humans, particularly immobile, hard-mobile persons and children. This fact can significantly make evacuation difficult, complicated and even hard possible or impossible. The simulation software application presents many benefits because of prediction, calculation of evacuation times and determining evacuation routes.
In this paper, the evacuation time of each evacuation exit was calculated by the simulation software Pathfinder (version 2023). The results of this paper were done by an appropriate simulation model at the elementary school Car Konstantin from Niš with all potential exit doors. Simulations predicted two scenarios with occupants' speeds: 1m/s, 1.5 m/s, 2m/s, 2.5 m/s, 3m/s and 3.5 m/s. The contribution of these results is applicable because the calculation of evacuation times for every combination of potential exits facilitates potential evacuation situations.
Evacuation problems can be much better and effectively analyzed with the software. Particular benefits from the simulation software used are in the sense of safety, cheapness and prediction.

Keywords: *evacuation time, evacuation route, pupils and staff, simulation software, safety*

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THE INFLUENCE OF INDUSTRY 4.0 IN PHARMACY AND PHARMA 4.0 CONCEPT

Radoje Jevtić [32]; Jovan Ničković[33]; Dragan Vučković [34]; Momčilo Ranđelović [35]; Jugoslav Đorđević[36]

Abstract

As an especially important part of the chemical industry, the pharmacy industry provides the production of pharmacy resources, medicaments, and a lot of other things that serve human health protection. The importance of this kind of industry is crucial for human health and, related to that fact; products of this industry are under strict and detailed national and international regulations. The quality system must be established and functioning at an exceedingly high level. That demands strict, detailed, and precise synchronization of many production processes and procedures with principles from production practice. As can be seen, there are almost unlimited fields for appliances of modern technologies that Industry 4.0 brings to the service of humans and human health. Realized changes are so great that future functioning cannot be imagined without basic principles of Industry 4.0, such as real-time monitoring, smart factories, smart manufacturing, medicament robotization production, the influence of the Internet of Things, etc. All of the notes have brought a new concept in pharmacy - the Pharma 4.0 concept. This paper was written to show the influence of Industry 4.0 in the pharmacy field, achieved benefits, innovative solutions, different smart manufacturing, transferring and storing of huge amounts of data, and data integrity and quality management in the form of one total new principle and concept - Pharma 4.0.

Keywords: *human`s health, industry 4.0, pharmacy, Pharma 4.0*

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CITY MARKETING AND SMART CITY SOLUTIONS

Bela Muhi[37]*; Jovana Kisin*[38]

Abstract

Today, not only manufacturers, products and brands compete, but also countries, regions and cities too. While products compete for consumers, cities compete for tourists, investors, skilled labor, talented students etc. In recent years, the role of marketing has increased worldwide in the competition between cities, but also between regions and countries. This competition requires marketing expertise and the correct use of marketing tools that enable cities to build and maintain their competitiveness and positive image. Increased cities around the world are introducing so-called Smart City solutions. Those cities that have introduced such smart systems have been able to successfully use them as a tool for city marketing and to create a new city image.

Keywords: *smart city, marketing, image*

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GENETIC ALGORITHMS AND MACHINE LEARNING AS THE BASIS OF ALL IMPLEMENTED SOLUTIONS IN SMART CITIES

Stefan Popovic[39]; Sonja Djukic Popovic[40] ; Dejan Djukic[41]; Milan Gligorijevic[42];

Abstract

The significance of the development of genetic algorithms and machine learning is inevitable today. All engineering solutions used in the construction of smart cities must contain an artificial intelligence component in their software part. The work deals with the needs of designers during the development of smart cities and the current opportunities offered by the market.

Keywords: *genetic algorithms, machine learning, artificial intelligence, smart cities, neural networks*

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VETSOL - ENERGY ISLAND IN TRAFFIC

Emil Peić Tukuljac[43]*; Zoran Anišić*[44]

Abstract

The application of sophisticated technical solutions makes it possible to increase security in modern, smart cities. VETSOL represents an energy island that should enable the achievement of self-sustainability in the field of traffic and structures that enable the lighting of intersections and road sections, support of light signaling, video surveillance of main highways and their intersections, as well as the distribution of information necessary for optimizing traffic in smart cities. VETSOL is a hybrid, energy structure that should enable the rational use of renewable and alternative energy sources, and is based on a wind generator that can drive the wind or the movement of air masses created by traffic, as well as a photovoltaic panel that increases the efficiency of the wind generator, and at the same time converts solar energy into electricity energy. The accumulated energy of the VETSOL plant provides a backup for the traffic signal system, provides better visibility of road sections and intersections by lighting them, powers video surveillance, which provides insight into the dynamics of traffic on certain sections, and at the same time helps to shed light on the causes of accidents. VETSOL is designed to support island operation as well as a networked global surveillance system. VETSOL combines several technical solutions that have proven to be successful in urban environments.

Keywords: *smart cities, traffic, green energy, solar panels, wind generators*

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MULTI-OBJECTIVE MATHEMATICAL OPTIMIZATION IN THE SMART CITY SUPPLY PLANNING PROBLEM

Sonja Djukic Popovic[45]

Abstract

The mathematical model of multi-objective decision-making is of key importance for the development of the smart city model. Today's accelerated development of information technologies is closely related to the development of mathematical models. This paper deals with the problem of smart city supply planning and a mathematical model that could describe that supply.

Keywords: *mathematical optimization, smart city, mathematical model, information technology, supply*

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OVERVIEW OF WIRELESS TECHNOLOGIES IN WIRELESS PERSONAL AREA NETWORKS FOR IoT INTEGATION IN SMART CITIES

Ana Bašić[46]*; Dragan Rastovac*[47]*; Dejan Viduka* [48]

Abstract

The main goals of the development of smart cities are to improve the quality of life of citizens, to improve energy efficiency and to reduce the emission of greenhouse gases. The use of modern technologies, such as wireless networks and Internet-based applications, has made smart cities a reality. The development of wireless communication technologies enabled the application of the Internet of Things (IoT) concept. IoT technology is key for development of smart cities because it has made it possible to connect all devices and city infrastructure via the Internet. The goal of the research was to review wireless technologies in Wireless Personal Area Networks (WPANs) for IoT applications. The characteristics of Bluetooth, ZigBee and Z-Wave technologies, their application in the IoT concept, advantages and disadvantages are analyzed. The aim of the research was to compare these three technologies in terms of speed, coverage, energy efficiency, accessibility, cost and network capacity.

Keywords: *Bluetooth, ZigBee, Z-Wave, WPAN, Internet of Things (IoT)*

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THE USE OF BUSINESS INTELLIGENCE IN THE DEVELOPMENT AND MANAGEMENT OF SMART CITIES

Miloš Ilić[49]*; Vladimir Mikić*[50]

Abstract

In recent years, smart cities, as well as their development and management, have become a popular study topic among researchers. Smart cities, through the use of different technologies, produce vast amounts of data. Business intelligence (BI) is a set of techniques and procedures used for collecting and analyzing data and turning it into useful insights that can assist in decision-making. For these purposes, BI employs various tools to process data and display analytical findings with some kind of visualization, such as reports, charts, or different gauges. This paper aims to show how essential BI can be for the development and management of smart cities. The integration of smart cities and BI technology can bring great benefits for residents and city officials since it may provide them with valuable information that can address complex issues.

Keywords: *Bussiness intelligence, Smart cities, Databases, BI tools, Data mining*

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WASTE MANAGEMENT IN ORDER TO PROTECT THE ENVIRONMENT IN A SMART CITY - VIEW OF THE ODNESI.RS PLATFORM

Ivana Popović[51]*; Stevan Ivanković*[52]

Abstract

In the modern world, technologies are advancing rapidly which leads to the transformation of our lives, providing more efficient services and improved quality of life. Smart cities lay the foundations for a sustainable future and carry key elements of urban innovation. More efficient services, through digital platforms, enable easy implementation of ideas and expression of needs. Even in today's world, recycling is an important segment towards achieving the goal of a more environmentally responsible urban environment in which we all perform. A digital platform, odnesi.rs can enable the implementation of ideas into action, improving efficiency and encouraging awareness of the importance of recycling both in today's age and in the future.

Keywords: *smart city, digital platform, recycling*

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APPLICATION OF FUZZY AHP APPROACH FOR DESIGNING MODEL OF SMART CITY DEVELOPMENT

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Abstract

Each city represents a unique system where different actors, citizens, administration, and utility companies undertake numerous activities, creating complex interactions and interdependencies. Previous initiatives aimed at creating a platform for a smart sustainable city have proven that there is no one-size-fits-all approach to making a city "smarter" and sustainable. It is critical to develop a methodology that will assist in determining the best route to the end objective, a sustainable and smart city, by thoroughly grasping the unique ecological and social city surroundings, priority activities, history, and distinctive traits. Our research attempts to formulate a plan for the smart city scheme in Serbia. Additionally, we aim to model and optimize the proposed concept based on a systematic evaluation of the various dimensions and corresponding indicators that govern the smart city framework. The paper relies on a ranking system for these dimensions and indicators. The applied methodology is a mathematical method that uses a phased approach to the analytical hierarchical process, FAHP, which hierarchically classifies the whole system through various criteria and sub-criteria with expert opinions.

Keywords: *smart city; Serbia; sustainability; fuzzy AHP, development, MCDM*

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AI IN SMART CITY

Nina Đuričić[56]*; Stefan Mihajlović*[57]

Abstract

The trend of rural-urban migration is important and follows in urban areas. These changes create many challenging situations for the municipal authorities, including increasing demands for urban efficiency, environmental protection, health offerings It is proposed that have been respected (AI) and its systems, including learning systems, because most promising technologies that can help them deal with challenging situations old useful tasks did things a developed with systems including robotics, telecommunications and healthcare. Using AI techniques for record mining and pattern recognition, cities can collect, analyze and make informed choices based primarily on the amount of information generated per 2d of the city, commonly called “big figures”. This fact can be due to sensors, cameras, databases and the web. Through the definition and application of large records the AI smart town proposal has the potential to increase productivity, reduce costs and increase the quality of life but the use of AI in smart city in exercise, now increases not technology of simple but in addition morality and imprisonment seeking conditions .This article will provide a high-level view of AI in smart cities and identify the ethical and legal implications of its application in smart cities.

Keywords: *artificial intelligence, smart city, big data, transportation, autonomous vehicles, machine learning*

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DESIGN OF ALLPASS-BASED IIR FULLBAND DIFFERENTIATORS USING LINEAR PROGRAMMING

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Abstract

5G technology is one of the main prerequisites for the Smart Cities paradigm. 5G transceivers can notably benefit from the utilization of sophisticated signal processing techniques such as advanced digital differentiators due to the requirements for high data rates, low latency, and efficient spectrum utilization. This paper investigates the design of all-pass based infinite impulse response full band differentiators using linear programming. Obtained differentiators.
are optimal in the sense that relative error of the magnitude response is minimized in the Chebyshev sense. Since the starting optimization problem is non-linear, it is divided into several sub-problems that can be easily solved. As compared to existing all-pass based solutions, proposed differentiators have an additional design parameter that allows a further decrease in the magnitude response error.

Keywords: *allpass filter, fullband differentiators, linear programming, parallel allpass structure, magnitude response error minimization*

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NEURAL NETWORK-POWERED INTRUSION DETECTION SYSTEM

Đorđe Karišić[62]*; Milan Čabarkapa*[63]

Abstract

This paper provides a comprehensive exploration of an approach addressing the dynamic challenges posed by modern cyber threats through the integration of neural networks into intrusion detection systems. The given approach emphasizes the necessity for adaptive defences in the face of ever-evolving threats, which camouflage as normal network traffic. The methodology, meticulously detailed in the paper, defines the importance of constructing such a system that adeptly identifies underlying patterns in the network data.

Keywords: *Neural Networks, Intrusion Detection Systems, Cybersecurity, Machine Learning, Adaptive Defence Mechanisms*

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QUALITY MANAGEMENT OF THE CONSTRUCTION OF SMART CITIES, WITH REFERENCE TO THE CONTROL OF THE MATERIALS THAT ARE INSTALLED

Bojana Miličić[64]; Dražen Jovanović[65]; Boško Jovanović[66]

Abstract

Quality management is an important activity that is aimed at improving performance, which reduces costs, raises employee morale and constantly acts to improve the quality of products. This also affects the competitive position of the company in the market, strengthening the trust of the users themselves. Construction constantly strives to adopt new quality elements in order to gain an advantage over the competition.
The modern development of quality management has resulted in the establishment of full quality management TQM (Total Quality Management).

Keywords: *qvality, TQM, reinforcing steel, standards, testing*

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APPLICATION OF ARTIFICIAL INTELLIGENCE WITHIN THE „SAFE CITY“ CONCEPT

Vladimir Čabrić[67]*; Nikola Gligorijević*[68]*, Danilo Strugarević*[69]

Abstract

Urbanization is a global trend, that is, the settlement of cities because of all the possibilities they offer. A large influx of population into cities also requires an increase in security. Safe City is a concept that, using modern technologies and artificial intelligence, should help governments, communities and businesses to reduce the possibility of crime and create an environment where people feel safe and comfortable.The aim of the paper is to present the possibility of using modern technologies and artificial intelligence in order to increase the safety of city dwellers. The paper explains the analytical tools that can be used within the Safe City concept, which aim to increase safety, prevention and rapid response to emergencies.

Keywords: *Safe city, Artificial intelligence, Smart city, Safety*

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SMART CITIES THROUGH THE EYES OF THE YOUNG: PERSPECTIVES AND CHALLENGES

Mitar Miki Tepić[70]

Abstract

This research delves into the attitudes and perceptions of adolescents aged 15-19 regarding smart cities, uncovering the principal challenges and opportunities they perceive. A mixed-methods strategy was employed, involving a survey of one hundred individuals to evaluate their comprehension and opinions on smart city initiatives, technological breakthroughs, and enhancements in urban life quality. Results indicate a prevalent, albeit partial, awareness of smart city principles among the youth; however, a notable understanding and engagement deficit remains. About 68% of respondents recognize the potential of smart cities to improve quality of life yet concerns about data privacy and the efficacy of these cities in addressing urban issues remain. The study emphasizes the critical roles of accessibility, security, and innovation, particularly highlighting the significance of artificial intelligence and smart mobility solutions for the future of urban areas. Despite prevailing doubts, many young people show a readiness to inhabit and contribute to the development of smart cities. The findings stress the imperative for specialized educational initiatives and urban planning approaches that are inclusive, aimed at diminishing informational voids and encouraging active involvement of the youth in smart city evolution.

Keywords: *Smart cities, Adolescents, Technological breakthroughs, Privacy concerns, Urban enhancement, Youth involvement.*

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APPLICATION OF THE RESIDUE NUMBER SYSTEM (RSA) TO IMPROVE THE PERFORMANCE OF THE RSA (RIVEST-SHAMIR-ADLEMAN) ALGORITHM

Milija Pavlović[71]*; Negovan Stamenković*[72]

Abstract

In the digital age, cryptography is a crucial discipline for data protection and privacy preservation. Achieving a high level of security in cryptographic algorithms requires efficient management of large numbers. In this context, the Residue Number System (RNS) stands out as a significant technique that can significantly enhance the performance and efficiency of cryptographic operations. This paper explores the advantages of applying RNS in the field of cryptography, focusing particularly on analyzing the key aspects of this technique.

The RSA (Rivest-Shamir-Adleman) algorithm is among the most well-known and commonly used algorithms for cryptographic encryption and digital signing. Traditionally relying on integer arithmetic, researchers have recognized the potential benefit of employing the Residue Number System (RNS) to improve the performance and efficiency of this algorithm. This paper extensively investigates the implementation of the RSA algorithm using RNS, analyzes the advantages of this approach, and identifies challenges that may arise during the application of this technique. This analysis contributes to a better understanding of how RNS can enhance the performance and efficiency of the RSA algorithm, as well as the challenges that may arise in practice.

Keywords: *RSA, RNS, encription, decription, CRT, modul,*

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TRANSFORMATION OF URBAN SPACES OF SMART CITIES THROUGH ADVANCED GRAPHICAL USER INTERFACES (UI)

Luka Alebić[73], *Dejan Viduka*[74] *and Davor Vrandečić*[75]

Abstract

This paper explores the key aspects of user interface design for smart cities. We analyze the key elements and challenges in creating smart city interfaces that support the needs of diverse populations, the complexity of urban environments, data security, and the integration of technology platforms. Implementation and evaluation of the user interface are key steps in ensuring efficiency and compliance with user needs. We study the processes of testing, evaluating and optimizing interfaces, as well as metrics for measuring performance and user satisfaction. We also explore future directions and trends in user interface design, including integration of advanced technologies, personalization of experience, connectivity and interoperability, innovative models of citizen participation, and an emphasis on sustainability and social responsibility. Through the application of these insights and approaches, it is possible to create interactive, user-oriented platforms that support the vision of inclusive, sustainable and technologically advanced smart cities. Continuous monitoring and adaptation to new trends and technologies are key to ensuring that user interfaces are ready for the challenges of the future and provide an optimal experience to their users.

Keywords: *user interface (UI), user experience design (UX), smart cities, computer graphics and digital transformation*

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A MODIFIED VERSION OF GRADIENT DESCENT ALGORITHM AS A SOLUTION OF LOCAL MINIMUM PROBLEM IN ARTIFICIAL NEURAL NETWORK

Goran Keković[76]; *Rade Božović*[77]; *Negovan Stamenković*[78]

Abstract

In this paper, software based on modified gradient descent and backpropagation algorithms for overcoming the local minimum problem in artificial neural networks is proposed. During the training of the artificial neural network, at the end of each epoch, the existence of the global minimum was checked over successive values of the loss function and by determining the percentage of successfully classified samples from the training and test sets. The software is written in the C# programming language in an object-oriented manner. It is written in a modular way in the sense that it has its own mathematical library and can be upgraded with other algorithms of artificial neural networks.

Keywords: *Artificial neural networks, Neuron weights, Global minimum, Gradient descent, Backpropagation algorithm, C# programming language*

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TIME SERIES MODELS FOR WEATHER FORECASTING IN SMART CITIES

Milos Todorov [79]*; Ninoslava Tihi*[80]*; Srdjan Popov*[81]*; Biljana Stamatovic*[82]

Abstract

Weather catastrophes are highly destructive occurrences that impact numerous sectors, such as public health, agriculture, industry, and the environment. In order to prevent this catastrophic event, many prediction methodologies can be implemented in smart cities. The Seasonal ARIMA method is the most used approach for time series forecasting. This study aims to outline a technique for the preparation and evaluation of raw data, specifically focusing on its application to meteorological data sets. Applying a mathematical-informatics model for time series, using R and its library *forecast* for prediction, the following results were obtained.

Keywords: *Smart cities, mathematical-informatics model, time series, SARIMA, weather forecasting, R*

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PPG SIGNAL ANALYSIS FOR BLOOD VESSEL CONDITION ESTIMATION VIA THE MOBILE APPLICATION "ECG FOR EVERYBODY"

Stevan Jokić[83]*; Ivan Jokić*[84]*; Branislav Gerazov*[85]*, Nenad Gligorić*[86]

Abstract

The prevalence of cardiovascular diseases underscores the need for accessible and reliable tools for early detection and monitoring. In the context of smart cities, accessible healthcare solutions are pivotal for promoting community well-being. This paper presents an innovative approach utilizing Photoplethysmography (PPG) signal analysis via the mobile smartphone application "ECG for Everybody" to estimate blood vessel conditions, fostering enhanced healthcare accessibility within urban environments. This paper presents a novel approach utilizing Photoplethysmography (PPG) signal analysis through the mobile application "ECG for Everybody" to estimate blood vessel conditions. Through intuitive visualization and real-time feedback, users can monitor their vascular health conveniently and proactively. PPG signals, acquired through smartphone sensors, offer a non-invasive means to assess vascular health.

The proposed methodology involves preprocessing PPG signals to mitigate noise and artifacts, followed by feature extraction to capture relevant physiological information. Key features such as pulse amplitude, pulse width, and pulse transit time are extracted and utilized for blood vessel condition estimation. Machine learning algorithms are employed on recordings collected by smartphone application to train models correlating PPG features with vascular health parameters.

Experimental results demonstrate the efficacy of the proposed approach in accurately estimating blood vessel conditions. The integration of PPG signal analysis into a mobile platform represents a significant advancement in accessible healthcare technology, with promising implications for early detection and intervention in cardiovascular diseases.

Keywords: Photoplethysmography (*PPG) analysis, machine learning, deep learning, wavelet transformation, ECG for Everybody*

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AN OPTIMAL THRESHOLD ADAPTATION OF ENERGY DETECTOR IN COGNITIVE RADIO FOR SMART CITIES APPLICATIONS

Rade Bozović[87]*; Goran Kekovićć*[88]

Abstract

A smart city is a technological modern concept of interconnection between different devices with mission to collect and post-process different data type. Based on that gained information, efficiency of different services across the city, such as security, energy consumption, safety is optimized and improved, what significantly raise quality of living of their citizens. The concept implies integration of advanced information and communication technologies. Lack of radio spectrum is one of the main challenges for wireless networks performance due to coverage and capacity issues. Cognitive radio technology enables efficient usage of radio spectrum. In order to avoid or minimize interference spectrum sensing function is of a crucial importance for cognitive radio operations. Due to its low implementation complexity, non-coherent energy detector, which is based on comparison of the detected signal energy with the decision threshold, represents a good choice for spectrum sensing. In this paper closed-form solution for energy detector threshold adaptation in cognitive radio is described.

Keywords: *advanced smart communications, cognitive radio, energy detector, spectrum sensing, threshold adaptation.*

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INCLUSIVE SMART CITY

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Abstract

Popular phrase „Smart Cities“ is in use for some time and it has different meanings: City which is environment friendly or „green“, sustainable city which employs tehnical solutions. The usual approach to smart cities is tehnical.
Smart city should allow every citizen to use all offered services, public and private , in the most convenient way. People with disabilities are part of the city and they have to use completely the advantages of access to the products, urban equipment , services and information. People with disabilities are sometimes denied better interaction with the city because very important informationand instructions aren’t accessible.
Inclusive Smart City suggests to broaden the vision of smart city so that people with disabilities could be considered as users and potential users of urban technologies.
The aim of the work is, based on analysis of studies available, to show the concept of inclusive smart city and the way to improve the accessibility of transport and managing life of disabled in urban spaces.

Keywords: inclusi, offered services, urban spaces, smart city

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THE CURRENT HUB OF ARTIFICIAL INTELLIGENCE IN SERBIA

Milica Vujadinović[92]*; Aleksandra Stojkov Pavlović* [93]

Abstract

Artificial intelligence (AI) could bring new value to a vast number of areas of life and work. The scope of AI application is still in its early stages in Serbia, mostly in industry or agriculture workplaces, but Serbia is making significant efforts to make this area come to life. The main research question is "What is the current state of AI in Serbia?" The research concludes an investigation of the Serbian rankings in AI worldwide, existing and upcoming legislative and institutional bodies, both domestic and international, with focus on EU AI Act a novelty, novelity, which could bring a better understanding of technologies, appreciating the tremendous potential of AI, but also pointing out the risks of using intelligence opposed to humans and preventive measures. The author's aim is to keep track of the situation in AI and digital technologies and the area of availability of technologies in Serbia.

Keywords: *AI, Intelligent Tools, Governance, Legislative, Industry, EU AI ACT*

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AN OVERVIEW OF A CONCEPTUAL MODEL OF AGILE MEETINGS PROBLEMS AND PROCESS ISSUES IN SOFTWARE INDUSTRY

Maja Gaborov[94], Željko Stojanov[95], Mila Kavalić[96], Dragana Kovač[97], Igor Vecštejn[98], Verica Gluvakov[99]

Abstract

Agile meetings are the core of agile methodologies and deserve attention. Given that various problems arise during meetings, the aim of this paper is to present a conceptual model of problems in agile meetings and their relationship with process issues in the IT industry. The problems were identified through literature analysis, and the presented model is based on the interpretation of the identified problems and their relationships. In addition, the presented model includes relationships between agile meeting problems and process problems identified in the literature. Each meeting problem, process problem, and all relationships in the model are discussed. The model can serve as a basis for a more comprehensive examination of problems in agile meetings.

Keywords: *conceptual model, agile meetings, meetings' problems, process issues, agile, software industry*

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POSSIBILITIES OF APPLYING IOT IN THE MUNICIPALITY OF GRAČANICA

Nebojsa Denić[100], *Kostadinka Stojanović*[101], *Jelena Stojanović*[102]

Abstract

The purpose of the research of this work is to investigate the possibilities of applying modern technologies in solving current problems in rapidly growing environments such as the municipality of Gračanica. Based on a studious analysis of the relevant literature, the concrete contribution to the understanding of the role and importance of IoT will be investigated and thus increase its use for the needs of so-called smart cities, i.e. municipalities, and at the same time answer the question of whether we can define IoT as one of the key elements of smart cities, municipalities or cities that use digital and information-communication technologies (hereinafter ICT) for more efficient operation of traditional networks, services and systems for the benefit of residents and the economy are called smart cities or communities. Smart cities and municipalities are a growing paradigm that has emerged from the convergence of many technologies such as the Internet of Things, big data and real-time systems. The purpose of smart cities and municipalities is to better coordinate resources and processes for quick response and efficient work. One of the most important priorities of the neighbouring countries is the digital transformation of public administration and society in general. It is about combining the innovative use of digital technologies, activities and processes. The digital transformation of municipalities and cities is the most pervasive step and includes broad changes, the result of which is the use of new business models through the implementation of smart services with the aim of creating and achieving greater added value. The result of the digital transformation of cities and communities are smart cities and municipalities. Many areas in a city or municipality can become "smarter" with the help of IoT, that is, they offer opportunities for automatic real-time monitoring to obtain data and turn it into meaningful and useful information. Research results indicate that this could significantly improve the effective control and management of vital functions in cities, for example property, education, traffic and smart parking management, water management, public health, environmental monitoring, energy efficiency, waste management and utility services in order to make more efficient use of resources. and improving the lives of citizens of the municipal administration of Gračanica.

Keywords: *IoT, smart cities, digitization*

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PARADIGMS OF APPLICATION OF BUSINESS DATA ANALYSIS AND BUSINESS INTELLIGENCE IN PUBLIC ADMINISTRATION AND LOCAL SELF-GOVERNMENT

Kostadinka Stojanović[103], *Nebojsa Denić*[104], *Jelena Stojanović*[105]

Abstract

This research paper will present the concept of data collection that provides the possibility of applying analytical methods, including business intelligence and methods, techniques and tools for processing large amounts of business data. The importance and amount of data in all areas, including municipalities, is growing year by year. In the past, municipalities have lagged behind the private sector in the area of business intelligence, but in recent years progress has been felt in this area. Currently, municipalities are still exploring and learning what solutions are available for smart cities and communities. As determined by European and national strategies in this area, education in the field of data will be key, because as the work shows, there is still a lot of room for improvement. In any case, the work will contribute to a better understanding of the importance of smart cities and municipalities and business intelligence, because it was presented to all holders of the municipal budget and will be used as a basis for further activities of the Municipality. municipality in this area. Last, but not least, policies in this area, both European and Slovenian, aim at increasing digitization. We are in a period when so-called smart cities, smart villages, smart municipalities are being born. Business intelligence is also key in this light, as it enables smart communities to make better decisions and thus achieve their goals more easily. It could be said that business intelligence gives intelligence to smart municipalities. I estimate that in the future, despite the current lack of knowledge in the field of data, municipalities will increasingly be digitized, digitally transformed and that there will be more and more solutions and good practices in this area. The municipality will follow the goals of digital transformation and the goals of the Digital EU Agenda and will definitely achieve them by 2030, which means that with the help of business intelligence, it could be transformed into a smart municipality. However, it is difficult for me to estimate what the level of transformation will be, which I could explore in further analyses.

Keywords: *Data analysis, business intelligence, digitization*

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TRANSFORMATION OF E-ADMINISTRATION INTO DIGITAL ADMINISTRATION AND SMART CITIES AND VILLAGES

Jelena Stojanović[106], *Nebojsa Denić*[107], *Kostadinka Stojanović*[108],

Abstract

This research paper will present the concept of data collection that provides the possibility of applying analytical methods, including business intelligence and methods, techniques and tools for processing large amounts of business data. The importance and amount of data in all areas, including municipalities, is growing year by year. In the past, municipalities have lagged behind the private sector in the area of business intelligence, but in recent years progress has been felt in this area. Currently, municipalities are still exploring and learning what solutions are available for smart cities and communities. As determined by European and national strategies in this area, education in the field of data will be key, because as the work shows, there is still a lot of room for improvement. In any case, the work will contribute to a better understanding of the importance of smart cities and municipalities and business intelligence, because it was presented to all holders of the municipal budget and will be used as a basis for further activities of the Municipality. municipality in this area. Last, but not least, policies in this area, both European and Slovenian, aim at increasing digitization. We are in a period when so-called smart cities, smart villages, smart municipalities are being born. Business intelligence is also key in this light, as it enables smart communities to make better decisions and thus achieve their goals more easily. It could be said that business intelligence gives intelligence to smart municipalities. I estimate that in the future, despite the current lack of knowledge in the field of data, municipalities will increasingly be digitized, digitally transformed and that there will be more and more solutions and good practices in this area. The municipality will follow the goals of digital transformation and the goals of the Digital EU Agenda and will definitely achieve them by 2030, which means that with the help of business intelligence, it could be transformed into a smart municipality. However, it is difficult for me to estimate what the level of transformation will be, which I could explore in further analyses.

Keywords: *Data analysis, business intelligence, digitization*

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MODERN TEHNOLOGIES AND THEIR APPLICATION IN "SMART HOUSES"

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Abstract

The rapid development of information and communication technologies in the 21st century and their widespread increasingly affect people's daily lives. We are living in an era of application of artificial intelligence in most aspects of human life. Smart phones have long since become our indispensable everyday companion that helps us in the realization of numerous activities. We notice that smart systems have become an imperative of modern life. Surveillance cameras, door opening sensors, smart home appliances, are only part of the smart systems that are increasingly entering households. Recently, the terms "smart house", "smart building" and "smart city" have started to appear.
In an effort to gain insight into the interest of our fellow citizens in using smart devices in their household, we conducted a survey of a group of citizens. In the questionnaire, six questions were asked with the offered answers, which are correlated with the offer of smart devices on the domestic market. With the questions asked in the questionnaire along with the answers provided, we identified the needs and interests of the surveyed group of citizens in improving the comfort of living with the help of smart devices. The answers received were statistically processed. Based on the calculated statistical indicators, we analyzed the obtained statistical data and drew a conclusion about the amount of smart devices used in households, the interest of citizens in their use, as well as the reasons why they have not used them so far.

Keywords: *modern technologies, smart devices, smart house.*

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USE OF MACHINE LEARNING FOR SMART AND CLEAN STEEL

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Abstract

This study leverages machine learning in Electric Arc Furnaces steel waste recycling to enhance sustainable steel production, reduce the level of environmental pollution and resource consumption. It focuses on balancing material and energy efficiency, particularly managing degradation elements like Mn and Si. In addition, the approach mitigates recycling limitations by effectively reducing the accumulation of Cu and Sn in the end product, thus enhancing its overall quality. Analyzing and predicting the behavior of different parameters in different process conditions, it is possible to optimize the simultaneous use of materials and the removal of impurities. This approach also contributes to the reduction of the steel industry's carbon footprint, aligning with global decarbonization efforts and advancing sustainable manufacturing practices. As the steel industry continues to evolve under the influence of Industry 4.0 technologies, analytic methods of processing process data are becoming increasingly important in achieving environmental sustainability and economic efficiency.

Keywords: *EAF, carbon footprint, machine learning*

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SMART PARKING

Jovana Danilov[114];

Abstract

This research explores the implementation of smart parking systems through the utilization of Internet of Things (IoT) technology. We provide an overview of the potential development of the Internet of Things in the context of smart cities. Subsequently, the existing landscape of smart parking systems is analyzed in detail, with a focus on smart parking systems and the technologies used in them. The architecture of smart parking systems is described in detail to understand how IoT technology supports their functionality.

The implementation of smart parking systems, including sensor installation, system configuration, and the operation of smart sensors, is thoroughly explained. Throughout this paper, we discuss how IoT technology enhances the efficiency and management of parking spaces. The conclusion emphasizes the importance of smart parking systems in the context of urban modernization and provides guidelines for further research.

Keywords: *smart parking, smart cities, IoT*

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BILATERAL EXPONENTIAL AS SIGMOID IN MULTILAYERED NEURONAL NETWORKS

Dejan Djukic[115]*; Stefan Popovic*[116]

Abstract

We are witnessing a flurry of emerging smart technologies, facilitating human existence in general, and in particular in organising and managing life in cities. Establishing correct models of the environment and producing a reliable mechanism for information association is an essential requirement for describing a technology as smart. A very popular class of models nowadays is formed by artificial neuronal networks arranged as multilayered perceptrons. The quality of a neuronal model depends essentially on the successful learning of the mathematical relation governing the information processing. The learning in multilayered perceptron networks is achieved through numerical optimisation methods, being performed repetitively in large number of cycles. Therefore, it is important to strive for a parsimonious use of computational resources. In this work, we propose the use of the bilateral exponential function as the nonlinear sigmoid map in perceptrons. This function is very similar in form to the usually employed sigmoid functions, such as the hyperbolic tangent. Yet, the computation of the bilateral exponential function saves the computational effort of one special function computation, compared to the hyperbolic tangent. In addition, gradient methods of machine learning require also the computation of the sigmoid function derivative. Here again, the use of the bilateral exponential saves an additional multiplication operation. Whilst it may appear trivial, one needs to be aware that the savings achieved in one neuron during one cycle of training are multiplied by the number of neurons times the number of cycles. In practice, this may amount to an improvement of computational speed of orders of magnitude, when compared to the networks using a conventional sigmoid function. In this work, we describe the newly proposed function, we show its adequacy of performance when compared to the hyperbolic tangent and some other sigmoid functions, and we estimate the computational savings obtained by its use.

Keywords: *smart city, intelligent systems, artificial neuronal networks, perceptron networks, machine learning, steepest descent optimisation, sigmoid functions.*

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COMPUTER VISION GATEWAY FOR REAL-TIME ON-SITE ANALYTICS IN SMART CITIES AND PERI-URBAN AGRICULTURE

Branko Brkljač[117]*; Milan Brkljač*[118]

Abstract

Current state of edge computing technology is characterized by high level of integration and increasing device availability for different application domains. In the design of computer vision systems for real-time analytics in smart cities there are various components that require significant engineering effort in order to be efficiently deployed and managed by system operators. This is especially true in the case of edge devices performing on-site processing or being deployed as generic computing platforms for different application scenarios. In such cases, continuous development cycles can be affected by the need to integrate various vendor specific software frameworks and the lack of unified middleware. In this paper we propose an architecture of computer vision gateway based on open-source software capable of simultaneously performing processing of different input data streams, artificial intelligence (AI) based inference, and generating output data streams in the form of processed video or extracted analytics. System architecture is demonstrated on heterogeneous computing edge device with hardware acceleration capabilities in both video coding and AI domains. Through proposed unification of data acquisition, information processing and data distribution, gateway allows easier design of novel vision-based applications in settings corresponding to the concepts of smart cities and peri-urban agriculture.

Keywords: *edge devices, computer vision, real-time processing, video stream analytics, middleware for the edge (middlewedge)*

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DIGITAL EVIDENCE READINESS: A STRATEGIC APPROACH FOR LEGAL COMPLIANCE IN ORGANIZATIONS

Zsolt Illési[119]*; Erika Illésiné Wolner*[120]

Abstract

In the digital era, the indispensability of high-quality digital evidence in legal proceedings underscores a critical challenge for organisations across the globe. As business operations increasingly move to digital platforms, the imperative for organisations to ensure digital evidence readiness has never been greater. This study explores how important it is to prepare organisations for collecting, preserving, and using digital evidence, which is vital for supporting claims and defences in criminal, civil, labour, administrative, and other legal situations. It highlights the multifaceted role of digital evidence in complying with legal and regulatory frameworks, mitigating risks, and safeguarding organisational interests. The discourse extends to a comprehensive examination of the fundamental elements that underpin practical digital evidence readiness, including governance and management functions, organisational structures, technologies, tools, and the necessary competencies and training for staff. Organisations can improve their legal compliance posture through a strategic approach that integrates these elements and strengthens their readiness to address legal challenges. The research outlines the significance of top management's commitment, cross-disciplinary cooperation, investment in appropriate tech solutions, and ongoing staff training to ensure the organisation's preparedness in handling digital evidence. This discussion explains how to manage digital evidence and guides organisations trying to understand the legal complexities of the digital age.

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INNOVATION IN THE DIGITAL AGE: NAVIGATING AI CHALLENGES

Zeljko Tekic[121]

Abstract

The digital revolution, driven by artificial intelligence (AI), is reshaping industries and challenging traditional innovation paradigms. AI's unique properties, such as malleability and continuous learning, redefine the innovation process, shifting focus from designing products to algorithms and data provision. Scholars recognize the need for new conceptualizations in innovation management to account for these changes. In response, we propose a comprehensive typology of companies in the data-driven world, aiming to facilitate theoretical advancements and strategic decision-making. The typology categorizes companies based on their business model, and control over data and algorithms, identifying five archetypes. By employing this framework, we explore innovation strategies and challenges for each archetype, offering practical insights to decision-makers and helping them in navigating the evolving AI landscape. As interest in AI transformation grows, effective frameworks like this typology become crucial for understanding and navigating its complexities, providing a roadmap for organizations to thrive in the era of AI-driven innovation.

Keywords: *AI, artificial intelligence, innovation, challenges, typology*

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