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INTERNET OF THINGS IN THE SERVICE OF DEVELOPING SMART CITIES

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***Abstract**: The Internet of Things represents a key technology that contributes to the digital transformation of business and society on a global level. The concept of the Internet of Things is described as a global network that emerges by connecting smart devices via the Internet, enabling their mutual communication, as well as communication with the environment. The subject of this paper is the role of the Internet of Things (IoT) in the development of smart cities. Smart cities represent an innovative approach to urban development aimed at improving the quality of life for citizens, as well as environmental protection. The paper starts from the hypothesis that smart cities today are not only a global trend but also a necessity, as the integration of IoT with existing infrastructure contributes to faster problem-solving and better decision-making that are significant for citizens' lives. The aim of this paper is to present examples of IoT application in the development of smart cities worldwide, as well as in Bosnia and Herzegovina. The research results indicate that the implementation of the concept of smart cities is recognized worldwide, but also that certain cities in Bosnia and Herzegovina have engaged in the process of implementing specific components of smart cities.*

***Key words**: Internet of Things, smart cities, technology, technological solutions, Internet, smart devices*

***JEL classification:** L63*

1. INTRODUCTION

The concept of the Internet of Things (IoT) emerged through the connection of objects to the Internet for the purpose of monitoring new physical states and communicating with other objects and people. This concept transforms physical objects such as various types of devices, vehicles, and the like into "smart" devices, enabling them to be connected and exchange data. The Internet of Things represents a new era of modern technologies, providing companies with the opportunity to reduce costs, increase revenues, transform business operations, discover new value, create new services, and business areas (Tomanović, 2017).

The concept of smart cities has emerged due to the growing trend of urbanization and the increase in urban population. This population growth poses new demands on urban infrastructure, while also raising questions about environmental protection, quality of life, and social inequalities. Nevertheless, cities serve as epicenters of economic, social, and cultural activities, increasingly relying on information and communication technologies to more effectively address these challenges.
The advancement of technology and smart devices, which communicate with each other, has enabled the prediction of consumer needs and the development of solutions to meet them. This also requires businesses to adapt to the new business environment (Tomanović, 2017).

Smart cities utilize digital technologies with the aim of improving the quality of human life and ensuring environmental protection. Additionally, one of the key objectives of smart cities is to attract a large number of new residents and visitors who will invest in the city, leading to an

improved quality of life and the development of a thriving economic environment. The need for smart cities is growing day by day, driven by the increasing population, as the resources of the land are limited. The concept of a smart city is presented as a solution to all the problems that current cities are facing or will face (Cvetković & Adamović, 2019).
The need for smart cities is constantly growing, with the concept of a smart city being presented as a comprehensive solution to all the problems current cities are facing or will face in the future. Connecting an increasing number of smart devices to the internet for remote management or minimal human intervention is becoming increasingly common practice. With the advancement of Internet of Things (IoT) technology, this integration is successfully applied in various sectors such as households, industry, healthcare, agriculture, and transportation, etc. The Internet of Things brings many benefits, but it also brings numerous challenges, threats, and risks that require attention from researchers. Although IoT applications are widely present, in our region, including Bosnia and Herzegovina, they are only beginning to spread.

In this paper, the authors will strive to present all relevant and available information about the development, implementation, and current representation of IoT technologies. Considering the speed at which these technologies are developing, all data and information provided in the paper may quickly become outdated. The research and data analysis in this paper are based on the collection and systematic analysis of literature from secondary data sources. These sources include the examination of relevant professional and scientific literature, published scientific papers, case studies, websites of relevant companies, strategic documents, as well as current business practices.

Based on the available information, the identification of the degree of presence of Internet of Things (IoT) solutions in the market of Bosnia and Herzegovina and globally is planned. By analyzing the current state of IoT in Bosnia and Herzegovina, opportunities for young innovators and new investors who want to be pioneers in the market with new, intelligent solutions can be identified.

2. INTERNET OF THINGS CONCEPT

The Internet of Things represents a new paradigm that has transformed traditional lifestyles into modern high-tech living. Over time, numerous research studies and analyses have been conducted to enhance IoT technology. However, there are still many challenges and issues that need to be addressed to realize the full potential of the Internet of Things (Kumar, Tiwari, & Zymbler, 2019).

Although there is significant interest in the Internet of Things worldwide, there is no single universally accepted definition of this concept. Different groups use various definitions to describe or promote their views on what the Internet of Things entails and what its most important characteristics are (Rose, Eldridge & Chapin, 2015).
Kumar and colleagues (2019) state that the Internet of Things is an emerging concept that enables communication between electronic devices and sensors via the Internet to enhance people's everyday lives. Smart devices and the Internet are used to provide diverse and innovative solutions for various tasks. This technology is becoming increasingly important in everyday life and can be applied in various aspects of the social environment. Overall, the Internet of Things represents an innovation that encompasses a wide range of smart systems, intelligent devices, and sensors.

The term "Internet of Things" (IoT) was first coined in 1999 by British technology pioneer Kevin Ashton to describe a system where objects in the physical world could be connected to the Internet via sensors. Today, the term Internet of Things is increasingly used to describe situations where internet connectivity and computing capabilities are extended to various objects, devices, sensors, and everyday items. Although this term is relatively new, the concept of combining computers and networks for device monitoring and control has existed for decades. By the late 1970s, commercial systems were already being used for remote monitoring of electric meters via telephone lines. At the internet conference in 1990, the first device connected to the internet was introduced - it was a toaster with remote control capability via an IP connection. In the following years, other devices also became equipped with IP connections. This included a vending machine for soft drinks at Carnegie Mellon University in the USA and a coffee machine in the Trojan Room at the University of Cambridge in the United Kingdom, which remained connected to the internet until 2001. Although the beginnings were playful, intensive research and development of "networks of smart objects" contributed to laying the foundation for today's Internet of Things (Rose, Eldridge & Chapin, 2015).

The IoT provides an ideal infrastructure for communication among devices to offer smart solutions for everyday problems. These devices are aimed at users, enabling home automation, connected healthcare, smart vehicles, and remote device monitoring (Khang, Gupta, Rani & Karras, 2024).

The diversity of smart IoT applications has completely transformed the world of networks. Smart finance, smart grids, smart healthcare, and other smart services are examples of these uses (Taherdoost, 2023).

2.1. CHALLENGES AND RISKS OF INTERNET OF THINGS IMPLEMENTATION

The Internet of Things opens up new exciting possibilities but also raises new questions about the interaction between people and organizations operating in the digital world. Some of these questions include the collection, processing, and ownership of citizens' data and the potential need to establish new legal or technical frameworks to exercise greater control over such a large and complex environment. At the same time, unnecessary restrictions on the development of the IoT market should be avoided (Božić, 2020).

The risks are diverse, ranging from customer data theft to industrial espionage and cyber attacks with serious consequences. They evolve and change rapidly, sometimes even daily. When it comes to implementing IoT solutions, cybersecurity must be a priority and developed from the very beginning. Only secure implementations can strengthen trust in the digital world, which is a key factor for sustainable provision of digital services to customers.

With the increase in connected devices, the opportunities to discover and exploit vulnerabilities in these devices also increase. Poorly secured devices can serve as entry points for cyber attacks, allowing malicious individuals to reprogram the device or cause it to malfunction. Such devices can also expose user data that individuals can misuse. Malfunction or a faulty device can also create a security vulnerability. These issues are significant, if not greater, for small, inexpensive smart devices than they were for computers, which traditionally served as endpoints in internet communication. The competitive price and technical limitations of these devices pose challenges for manufacturers in adequately implementing device security features, potentially creating long-term vulnerabilities greater than previously experienced with computers and their components. In relation to the highly interconnected nature of IoT devices, every poorly secured IoT device that is online potentially affects the security and resilience of the internet globally, not just locally. Take, for example, an unprotected refrigerator or another household smart device infected with malware; it could send thousands of harmful spam emails using home Wi-Fi, without the user's knowledge (Džanić, 2017). Data privacy is also a key pillar of trust. Many questions arise, such as what companies collecting data from IoT devices do with that information, whether they share or sell it to third parties, and what undesirable consequences could arise from the misuse of that data. It is clear that our personal data holds economic value, which raises concerns about how that data is used and whether there is potential for misuse (Džanić, 2017).

All these questions are of paramount importance as they are inseparable from ethical aspects, and their regulation within a legal framework is necessary. The key challenge arises from national legislations that apply within territorial borders, while the internet does not recognize such limitations. The transfer of data collected through IoT devices can lead to legal complications, especially concerning personal or sensitive data, opening up potential issues related to data protection and their transfer beyond the borders of national laws.

3. DEVELOPMENT OF SMART CITIES

The development of smart cities encompasses various aspects, including people, community, and technology. To truly be smart, a city must emphasize the importance of its people and community, not just technology. With the help of technology, a smart city has the potential to become more creative, improve governance, and enhance quality of life (Miah & Amin, 2020).

Lazović and Đuričković (2018) highlight in their work that the development of smart cities arises from two parallel processes that have spontaneously unfolded. The first process involves the emergence and proliferation of the Internet of Things (IoT), while the second process represents the transformation of the urban concept under the influence of the global digital economy. Due to the development of information infrastructure, it is no longer necessary to live and work in the central part of the city. Instead, the periphery becomes the focal point. Additionally, large cities with more than ten million inhabitants today function as information cities, and their survival is unthinkable without a strong presence of the information economy.

A smart city is one that is fully connected and equipped with technology to enhance the lives of its citizens. As wireless, Bluetooth, and sensor technologies have become more affordable, they are no longer limited to expensive devices such as

computers and mobile phones but are now used in almost all types of devices. This has resulted in every physical object being able to be equipped with advanced sensors and connectivity to become a smart object that generates a large amount of data (Cvetković & Adamović, 2019).

According to Grand View Research, the size of the global smart cities market was estimated at $748.7 billion in 2023 and is projected to grow at a combined annual growth rate (CAGR) of 25.8% from 2023 to 2030.

Increasing urbanization, the need for efficient resource management, public concern for security, and growing demand for energy-efficient environments are the main drivers for market growth. Due to the COVID-19 pandemic, countries have implemented strict isolation and mobility measures to prevent the spread of the virus. During the pandemic, the dependence of global economies on urban areas and the importance of public health protection in smart city initiatives were highlighted. However, organizations are attempting to implement new technologies such as the Internet of Things (IoT) and artificial intelligence (AI) to overcome the challenges they faced during the pandemic (Grand View Research, 2024).
Although smart city projects require a diverse set of technologies such as IoT, AI, and smart sensors for monitoring urban infrastructure, their implementation varies from city to city. Key drivers for implementing smart city solutions include the need to improve cities, reduce energy consumption, and concerns about increasing environmental waste (Grand View Research, 2024).

3.1. BASIC COMPONENTS AND APPLICATION AREAS OF SMART CITIES

To provide a detailed description of the broad picture found during the review of selected literature, we identified three platforms used to define the basic framework of a smart city. These platforms are: smart physical infrastructure, smart civic infrastructure, and smart digital infrastructure**.**

Smart physical infrastructure plays a crucial role in shaping the fundamental structure of smart cities. It provides the foundation for creating new and innovative solutions that enhance the quality of life in urban environments. Its purpose, among others, is to enable the development of smart housing, which encompasses all components related to the development of smart urban infrastructure such as smart homes, smart buildings, as well as the management and improvement of public services, including cultural activities, tourism, and education. In addition to smart housing, the purpose of smart physical infrastructure also extends to smart mobility. Smart mobility represents a strategy for citizens' movement using various forms of transportation in an intelligent manner. This concept involves the optimal utilization of different types of vehicles through precise information obtained from information and communication technologies. It focuses on reducing the use of personal vehicles, improving the efficiency of public transportation, and protecting the environment by reducing emissions and energy consumption. It is evident that urbanization has a wide range of effects, including increased energy demand, infrastructure construction, wastewater management, and ensuring clean water, significantly impacting the environment. However, the ecological impact of urbanization can be mitigated through appropriate planning of smart physical infrastructure, which enables greater efficiency and cost reduction in resource management.

According to Khang and colleagues (2024), smart civic infrastructure encompasses various key domains such as smart people, governance, economy, and lifestyle, with several key components. Smart individuals in smart cities utilize their knowledge to solve problems intelligently. This domain includes various elements such as human resources, digital education, community contribution, and public engagement. Smart civic infrastructure is not possible without smart governance.

Smart governance of cities utilizes information and communication technologies to improve decision-making processes and expedite administrative procedures. This involves better collaboration among various stakeholders, including public services, city officials, private companies, and citizens. This is achieved by providing innovative urban services and tools for citizens, such as mobile applications for participating in decision-making processes and collecting data of interest to smart communities (Bellini, Nesi & Pantaleo, 2022).

Bellini and colleagues (2022) in their work state that the smart economy uses information and communication technologies to connect local and global markets, enabling the provision of e-business and e-commerce services to increase productivity. Additionally, it includes the concept of the sharing economy, where individuals or companies offer services using their assets, as well as peer-to-peer marketplaces. Artificial

intelligence and machine learning techniques are used to build predictive models and improve recommendation systems for e-commerce in retail. NFC and wireless sensor technologies facilitate payment and transaction processes, while in some cities, such as Shenzhen, mobile phones replace cash and bank cards in everyday transactions.

IoT technologies and computing have a wide application in mobile healthcare, especially in remote patient monitoring, telemedicine, medication reactions, and community healthcare. These aspects become even more relevant during the COVID-19 pandemic. For remote monitoring, wearable or implanted devices such as cardiac devices, airflow monitors, and blood glucose meters are used, connected to the cloud via wireless sensor networks. This has led to the development of body sensor networks or wireless body area networks, enabling the integration of different data sources for collecting patients' biometric and physiological information for IoT healthcare applications. Smart hospitals also use IoT technologies to provide services to medical staff and patients, including patient identification and monitoring in hospitals and smart management of medical instruments that support decision-making processes (Bellini, Nesi & Pantaleo, 2022).

Khang and colleagues (2024) state that smart digital infrastructure builds interaction between residents and government employees and enables horizontal activity functioning. This platform encompasses vital domains such as smart networks, smart data, and smart sensors with numerous key components. Smart networks play a role in collecting, accumulating, and delivering information and data in any direction or location. The transmission and reception of simultaneous data are energetically synchronized with smart networks. Smart data is digitally collected via smart networks through various sensors, and the relevant data can be qualitatively processed, aiding in quick information processing. This domain includes components such as data resources, information linking, and data analysis. Finally, smart sensors analyze input data using predefined internal algorithms, eliminating unnecessary, processed, and unrelated data and sending it to the data center. This key component of smart networks records precise and automatic information.

3.2. SMART CITIES AROUND THE WORLD

The introduction of smart cities worldwide brings about a complete change in how cities function and deliver services to their residents. This global trend encompasses the application of advanced technological solutions to improve efficiency, sustainability, and the quality of life in urban areas. Smart cities are becoming symbols of innovation and transformation. In this chapter, we will explore some of the cities that stand out for their smart infrastructure and innovative solutions.

One of the best examples currently is Singapore, due to its significant efforts in daily data collection. Singapore launched its "Smart Nation" program back in 2014, where they implemented a large number of cameras and strive to add even more cameras so that the authorities can monitor the density of people in specific parts of the city and at appropriate times, as well as the cleanliness of public spaces, and even the movement of local vehicles at any given moment. Additionally, Singapore has an online platform called "Virtual Singapore" where most of the data is stored, allowing the authorities access to real-time information on how the city operates. Such information can help the government, for example, assess how people might react in the event of an explosion in a shopping center or how a disease might spread throughout the city. The goal is for Singapore to become a "Smart Nation" where people will live carefree and fulfilling lives, enabled by seamless technology that will offer exciting opportunities for all (Cvetković & Adamović, 2019).

Dubai boasts over 50 smart services and 22 governmental entities participating in the "Smart Dubai Initiative" administrative program. Additionally, the Dubai government offers the use of their "Dubai Now" application, where residents can pay traffic violation fines through the app. Cameras installed on roads record drivers who violate traffic rules and directly send fines to their email addresses. The same application allows residents to pay utility bills, call taxis, find the nearest ATMs, renew vehicle registration, or report law violations to the police (Cvetković & Adamović, 2019).

A third example is Barcelona. The implementation of the smart system includes smart street lighting that adjusts to the current situation, turning on if there are events on the road and turning off if the streets are empty. Parking sensors allow residents to immediately receive information via the application about available parking spaces at any given time, eliminating the need to circle and search for parking spots. Waste sensors, which are actually vacuum containers, allow garbage to pass through pipes underground and be stored. This solution solves the problem of noise from garbage trucks and significantly

reduces maintenance costs (Cvetković & Adamović, 2019).

4. APPLICATION OF THE INTERNET OF THINGS IN THE DEVELOPMENT OF SMART CITIES IN BOSNIA AND HERZEGOVINA

As in most countries worldwide, the population in Bosnia and Herzegovina is moving to large cities such as Sarajevo, Banja Luka, and Bijeljina. The reason lies in people's desire to secure a better life. Most cities in Bosnia and Herzegovina have abandoned areas, dysfunctional public spaces, deteriorating public buildings, and outdated residential neighborhoods. The increased energy consumption of these neglected buildings negatively impacts public budgets, exacerbates financial challenges for low-income families, and ultimately increases the city's ecological footprint. Taken together, this urban problem adversely affects the health, well-being, and quality of life of residents (UNDP in Bosnia and Herzegovina, 2020).

IoT is now used in almost all sectors of the economy, which is quite expected given the increasing level of digitization worldwide. In addition to providing speed and greater efficiency, as well as environmental protection, these technologies are also very profitable, which explains their popularity among large companies (Novaković, 2021).

Local communities in Bosnia and Herzegovina are increasingly recognizing the importance of digital transformation for the future. Aware of the costs and challenges of implementing "smart city" solutions, they actively seek partners to follow global trends and enhance the delivery of public services.

Street cameras are one form of IoT that is significant in our present time and also present in our region. These cameras function by automatically detecting anticipated violations depending on the parameters set, thanks to advanced software. Their major advantage is that they regularly report violations committed, thus enabling the swift and efficient punishment of offenders. Thanks to traffic cameras, which contribute to penalizing improper driving, pedestrians' lives are much safer. Additionally, the smart traffic light system works in conjunction with the technology equipped in many vehicles, alerting them to upcoming changes in traffic lights. This would help vehicles equipped with such systems to reduce waiting time at traffic lights. This application is most useful for emergency vehicles. It operates by the traffic control system registering approaching traffic at intersections and reacting in the best possible way to maintain the highest efficiency of vehicle flow. Research teams believe that by introducing smart traffic lights, the waiting time for drivers at light changes could be reduced by over 28 percent, and CO2 emissions by as much as 6.5 percent (Novaković, 2021).

Electronic toll collection is a wireless system for automatically collecting fees charged to vehicles using highways or specific bridges and tunnels. It is a faster alternative to traditional toll booths, where vehicles must stop, and the driver manually pays the toll in cash or by card. Vehicles using the system are typically equipped with an automatic device for such transactions. When a vehicle passes by a toll reading device along the road, the radio signal from the reader activates the transponder, which returns the identification number registering the vehicle's use of the road, and the electronic payment system charges the toll to the user. The main advantage is that the driver does not have to stop, reducing traffic congestion. The payment system usually requires users to pre-register and deposit money into an account with a reduced balance, which is debited each time they pass through a toll point. This payment system is much more economical and faster, significantly facilitating travel (Novaković, 2021).

The UNDP in Bosnia and Herzegovina and the City of Sarajevo launched the Smart Sarajevo Initiative, funded through the UNDP Country Investment Fund. The key objectives of the initiative were broad citizen participation and "community-owned city renewal"; leveraging technology to improve public services and urban infrastructure; and fostering SMEs, startups, and the private sector towards a knowledge-based economy (UNDP in Bosnia and Herzegovina, 2020).

Additionally, in Bosnia and Herzegovina, there has been the emergence of so-called Smart Home systems, which monitor and control everything happening in smart homes or apartments in real-time. One of the national telecommunications operators in Bosnia and Herzegovina, Mtel a.d. Banja Luka, offers Smart Home services to its clients with a monthly subscription fee of 5.99 KM and an equipment package priced at 99 KM. Smart Home systems include:

- The Mtel Smart Home application (available for Android OS version 5 and higher, as well as IOS version 10 and higher)
- A central unit that connects Smart Home devices

- Smart Home cloud services that enable control and management of systems from remote locations
- Smart Home devices that provide home automation management (Ilić, Damjanović, Katanić, 2023).

The need for smart cities is growing day by day. In the age of technological advancement, when our daily lives increasingly depend on innovations, municipalities and cities in Bosnia and Herzegovina are seeking their way to join key global initiatives.

The project "Smart Cities - Towards the Digital Transformation of Cities in BiH" was launched to support progress towards creating smart cities. It has been implemented since 2021 as part of the develoPPP.de program, and is carried out by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the Federal Ministry for Economic Cooperation and Development of the Federal Republic of Germany (BMZ), in collaboration with companies LANACO and DVC Solutions, as well as the association of IT companies in BiH, Bit Alliance.

Prijedor, Zenica, and Tešanj are local communities that have received the gift of the smart GoParking application. The GoParking system uses modern technologies such as sensors and cameras to facilitate parking management. It enables quick finding of available parking spaces and payment via SMS or card. In Prijedor, this system covers around 250 parking spaces, and the number of payments via SMS messages has tripled.
Pale and Zvornik have implemented the Citizens Patrol application to improve the lives of citizens in urban areas. This application facilitates communication between local institutions and citizens, allowing them to anonymously report communal and other issues via their mobile phones. At the same time, it helps institutions to react quickly and solve these problems. The applications are available for users of Android and iOS operating systems.

In the area of the city of East Sarajevo and the municipality of East Ilidža, the Smart Public Lighting project was implemented as part of the EU Med Esmartcity project, implemented by the East Sarajevo Development Agency (RAIS). The system self-regulates and currently achieves energy savings of 47% compared to a conventional public lighting system, with a trend of increasing savings by 1% per month at this moment. An application has also been developed that enables monitoring and management of public lighting, adjusting the lighting levels to the needs, and measuring air pollution levels. The mentioned installation is a pioneering endeavor in this part of Europe and represents the first fully functional smart city service in the Western Balkans region, consisting of a hardware component in the form of sensor blocks for measuring specified parameters and a software component in the form of a data center for collecting and saving data, their classification, processing, and analysis using advanced artificial intelligence and machine learning algorithms. The established real-time system can monitor the following parameters: motion, illumination, and air quality parameters: temperature, pressure, humidity. Although it may not cover a large area, this project serves as an inspiring example of how cities can transform their environments into sustainable, inclusive, and smart communities that provide a high quality of life for all residents (Mastilović, 2019).

CONCLUSION

This paper defines the basic concept of the Internet of Things (IoT) and its role in the development of smart cities. The Internet of Things enables the interconnection of various devices via the internet and communication among them. With the expansion of IoT technologies in recent years, it is considered that the era of the Internet of Things is yet to come. IoT should be implemented in a way that users have complete trust in its application, in order to fully enjoy the benefits that this technology brings.

To keep pace with modern times, cities are adapting, giving rise to a new concept of city management called "smart city." The concept of a smart city aims to provide a better quality of life for every individual in the city, by integrating innovative and modern technological solutions for successful and high-quality resolution of all urban issues. Smart cities are described as cities that aim to increase the quality of life of every individual based on existing infrastructure, investments, and the application of smart solutions. Smart cities enable real-time monitoring and analysis of data, contributing to better decision-making and addressing the challenges faced by cities. The implementation of these technologies also encourages investment in the economy, creating new employment opportunities and enhancing the competitiveness of cities at the global level.
Living in large cities is challenging for residents and those responsible for creating favorable conditions for them. Cities are often designed without the capacity for the current number of inhabitants and their standard of living. Therefore,

cities must adapt and become "smarter," but these requirements change over time, necessitating constant adaptation and future prediction.

Based on a review of recent research literature, we have identified three platforms used to define the basic framework of a smart city. These platforms are: smart physical infrastructure, smart civic infrastructure, and smart digital infrastructure. These platforms make a scientific contribution by enabling a systematic approach to studying the fundamental elements of smart cities, and they represent a foundational concept that shapes the structure and functioning of modern urban environments, providing various opportunities for improving the standard of living and efficient resource management.

Smart physical infrastructure provides the foundation for developing innovative solutions that enhance the quality of life in urban environments, particularly through smart housing and mobility. Smart civic infrastructure, as a key area in smart cities, provides insight into various aspects of social, economic, and cultural life, emphasizing the importance of smart governance and the digital economy in improving the efficiency of urban processes.

With a focus on smart grids, data, and sensors, smart digital infrastructure is a crucial element for establishing interaction between citizens and authorities, enabling efficient data collection, analysis, and utilization to enhance everyday life in cities. Through systematic study of these platforms, it is possible to gain a deeper understanding of the complexity of contemporary challenges and contribute to the development of innovative solutions that will support sustainable urban development worldwide.

In addition, the paper identified numerous risks and challenges facing the Internet of Things (IoT). For the further development of IoT technology, it is crucial to focus on security, privacy protection, and building user trust. Ensuring authentication and authorization mechanisms for both users and devices, as well as controlled data transmission between various IoT devices and platforms, is important. Moreover, due to the potential collection of users' private information without their knowledge, it is necessary to devise mechanisms to protect this information while ensuring the accuracy and reliability of the data. Control over personal data, improvement of privacy protection technologies, and the development of methodologies and tools for managing user and object identity are also key aspects. Finally, building trust must be an integral part of the IoT system design.

The need for smart cities is growing day by day. With the development of information and communication technology, the Internet of Things is becoming ubiquitous in almost every industry, which will likely result in even greater adoption in the future. In Bosnia and Herzegovina, progress in the field of smart cities and IoT technology lags behind developed countries. Although some cities have recognized the importance and potential of IoT application, the implementation of smart urban solutions is still limited. However, there is optimism due to the increasing presence of this topic at forums and conferences, enabling the exchange of information and potentially leading to increased activity in the development of ideas and technological solutions. Bosnia and Herzegovina has the potential for advancement in many areas such as agriculture, meteorology, waste management, industry, public administration, and healthcare. However, to realize this potential, broader acceptance and support from municipal authorities are needed, as well as alignment of regulatory acts to create better conditions for project development and attracting investors and donors.

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