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Professional paper

EXPLORING THE IMPACT OF ARTIFICIAL INTELLIGENCE ON THE IoT AND DIGITAL AGENDA IN THE WESTERN BALKANS: INTEGRATING A PROPOSED WEB APPLICATION FOR REGIONAL ADVANCEMENT

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Abstract

The research presented in this paper originated from my master's thesis, and I have chosen to publish it together with my supervisor, who is the second author, to contribute to the existing body of knowledge. The technology known as the Internet of Things (IoT) continues to expand the current Internet infrastructure by facilitating connections and interactions between the physical and cyber worlds. IoT and its associated applications have significantly enhanced the quality of life on Earth. Advanced wireless sensor networks and their revolutionary computing capabilities have paved the way for various IoT applications to explore new frontiers, impacting nearly every aspect of daily life. Concurrently, the imperative of energy optimization has emerged as a major concern, driving the adoption of sustainable practices and green technologies. The fusion of Artificial Intelligence (AI) with IoT represents a potent combination, enabling the realization of unique projects and innovative solutions. The potential impact of IoT and AI is vast, promising transformative changes in the future landscape. Recognizing the magnitude of these advancements, the European Commission is committed to collaborating with partners and authorities in the Western Balkans to fully implement the digital agenda. To this end, the EU and Western Balkans ICT Dialogue Initiative, established by the Commission in cooperation with regional partners, will oversee the implementation of the Digital Agenda.

Keywords: Artificial Intelligence, IoT, Web Application, Western Balkan

1. Introduction

Information and Communication Technologies (ICT) have emerged as central drivers of economic competitiveness, predicated on knowledge acquisition and innovation. In an increasingly competitive technological landscape, the rapid evolution of novel problem-solving methodologies has become characteristic across various institutional domains. The ICT sector stands as a beacon of progress and innovation, exerting profound technological and economic influence on society at large. Central to its significance is the sector's propensity for developing transformative technologies that permeate and redefine societal and economic structures [1]. ICT practices are not confined solely to their own domain but extend to diverse sectors, adapting and influencing their operational frameworks. The advent of the Internet of Things (IoT), originating approximately two decades ago, has since witnessed global proliferation. IoT permeates myriad aspects of daily life, from domestic routines to industrial operations, underscoring its rapid expansion and industry growth. Projections indicate a burgeoning trajectory, with an estimated 29 billion connected devices anticipated for the year 2022, poised to escalate to 125 billion devices by 2030. This exponential growth is intertwined with the symbiotic relationship between Artificial Intelligence (AI) and IoT, heralding transformative possibilities for numerous industries [2]. AI augments IoT capabilities by automating processes, enhancing data analytics, fortifying security measures, and refining user experiences. The convergence of AI and IoT heralds a paradigm shift in technological landscapes, promising

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profound implications for industries, businesses, and economies alike [3]. AI-driven IoT ecosystems engender intelligent machines capable of autonomous decision-making, thereby revolutionizing operational frameworks with minimal human intervention. By harnessing data generated by IoT devices, AI facilitates insights that enhance efficiency, productivity, and personalized user experiences. Consequently, the synergy between AI and IoT transcends mere technological advancement, shaping the trajectory of future industrial and economic landscapes through intelligent automation and data-driven decision-making mechanisms [4].

2. Related Work

Before generating novel insights, it is imperative to ascertain the existing knowledge pertinent to the research subject. The "Related Work" section serves as a crucial component aimed at comprehensively synthesizing insights gleaned from the corpus of scholarly literature and prior research endeavors. In paper [5] author delineates the methodologies employed in leveraging intelligence to enhance the efficiency of the Internet of Things (IoT) domain, while also providing an overview of diverse security mechanisms applicable to IoT networks. The automation network and software-defined network represent crucial aspects within the framework of the Artificial Intelligence (AI) IoT System. The forthcoming trajectory of IoT is expected to yield significant economic and societal ramifications. Artificial Intelligence techniques, including Machine Learning and Deep Learning, possess the capability to imbue IoT devices and networks with adaptive mechanisms to address various security challenges. In paper [6] author encompasses an investigation into the applications of Artificial Intelligence (AI) within the framework of the Industry 4.0 paradigm. This study delves into the adoption of AI within the manufacturing sector and elucidates its role in fostering intelligence optimization. Furthermore, the implementation of the digital twin concept to enhance reasoning across diverse interfaces is expounded upon. Detailed examination is conducted on AI algorithms employed for communication and information intelligence. Additionally, the significance of AI in the realization of smart city initiatives is succinctly outlined within this research endeavor. In this paper [7] the authors conduct a comprehensive examination of the evolving landscape of Internet of Things (IoT) security within the context of Artificial Intelligence (AI) integration. They underscore the transformative impact of IoT across various sectors and emphasize the critical role of AI in enhancing IoT capabilities. However, the paper also acknowledges the emergence of novel challenges in ensuring the privacy and security of IoT systems in the era of AI. To address these challenges, the survey offers a range of comprehensive strategies for IoT security, encompassing an understanding of IoT security challenges, the utilization of AI methodologies, the implementation of resilient security frameworks, and the consideration of privacy and ethical concerns. Notably, the survey extends the traditional notion of security to encompass physical security threats alongside cyberattacks. Furthermore, the paper categorizes the challenges associated with IoT security, explores the application of AI in mitigating these challenges, presents various security frameworks and strategies, and emphasizes the importance of privacy and ethics in IoT security practices. Real-world case studies are employed to provide insights into practical implementations. Additionally, the survey investigates emerging trends in IoT security within the AI era, offering valuable insights into the future trajectory of IoT security research and practice. Overall, this survey significantly contributes to the understanding of establishing dependable and secure IoT systems by providing a comprehensive analysis of current IoT security conditions and the implications of AI advancements on them.

3. Research Methodology

To comprehensively investigate the Impact of Artificial Intelligence on the Internet of Things (IoT), this study employed a structured research methodology consisting of several key steps.

1. **Review and Motivation:** The research was initiated with a thorough review of existing literature and a clear articulation of the motivation driving this study. Utilizing academic databases, we conducted an extensive review of scholarly works related to the intersection of Artificial Intelligence and IoT. This step aimed to understand the current state of research, identify key trends, and elucidate the gaps in knowledge within this domain.

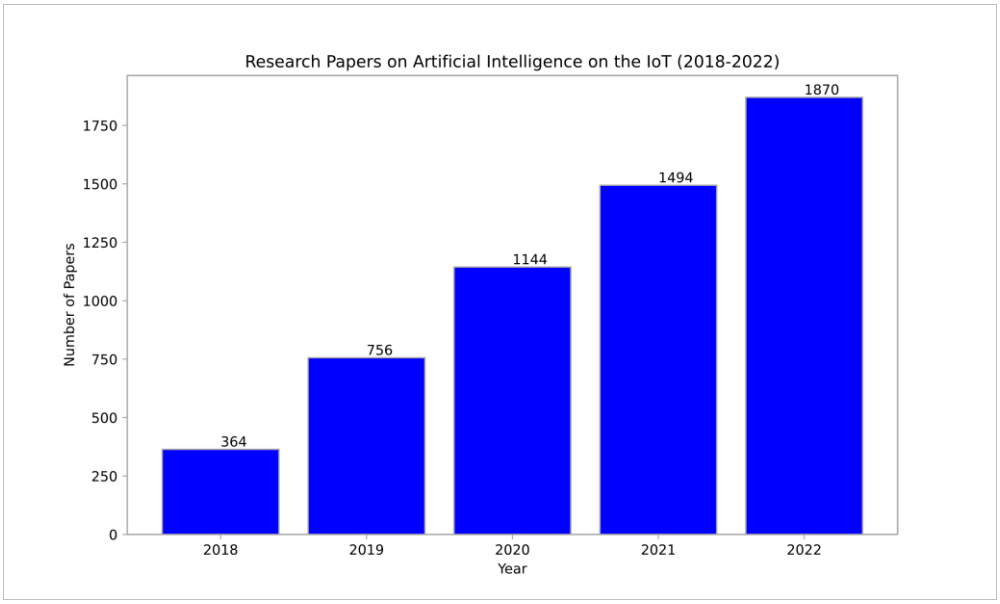

Figure 1: Research Papers published over years

2. **Data Collection:** Subsequently, we embarked on a meticulous data collection process. Drawing from diverse and credible sources, including academic journals, conference proceedings, industry reports, and reputable online platforms, we gathered data pertinent to our research questions.

Table 1: Companies/Organizations providing data

#	Name of Company
1	Ministry of Information Society and Administration of North Macedonia
2	State Owned Enterprise National Broadcasting
3	Agency for Electronic Communications of the Republic of North Macedonia
4	Macedonian Telekom
5	European Commission

3. **Identification of Gaps and Future Work:** While conducting research for our master's thesis, our initial step involved identifying gaps in the field. Moving forward, our focus is on formulating research questions for future investigation and subsequently addressing them.

By adhering to this methodological framework, we aimed to ensure rigor, coherence, and relevance in our research endeavor. Each step was meticulously executed to facilitate a comprehensive exploration of the Impact of Artificial Intelligence on the Internet of Things,

thereby contributing to the scholarly discourse and informing practical implications in relevant domains.

4. AI Integration in IoT Ecosystems

Currently, there's a gradual surge in the adoption of artificial intelligence (AI), big data, and the Internet of Things (IoT), along with other emerging technologies and applications, leading to a significant scientific and technological transformation [8]. Through the vast amount of data collected via interconnected IoT devices, algorithms and AI techniques can analyze and derive insights from this data, thereby facilitating the creation of public services and value. The growing utilization of AI, which offers sophisticated data analysis capabilities, substantially enhances the effectiveness of IoT [9]. AI methodologies can effectively tackle various problems through a two-stage process. In the initial stage, a series of AI models are constructed using machine learning algorithms and a comprehensive training dataset, ensuring the development of optimal models with substantial training data. Once these models are established, they can be utilized to interpret sensor data and guide system operations [10]. The integration of artificial intelligence (AI) and the Internet of Things (IoT) is increasingly tight. This close integration offers new prospects for enterprise IoT projects. Predictions suggest that in the future, an increasing number of IoT projects will incorporate artificial intelligence. The close collaboration between these two technologies will enhance the visibility of intelligent IoT system implementations [11]. Artificial Intelligence (AI) Integration within the Internet of Things (IoT) ecosystem represents a significant advancement in modern technology, promising enhanced efficiency, predictive capabilities, and intelligent decision-making processes. The convergence of AI and IoT opens up new avenues for innovation across various sectors, from healthcare to manufacturing and beyond. One of the key benefits of integrating AI into IoT systems is the ability to analyze vast amounts of data generated by interconnected devices in real-time. AI algorithms can extract valuable insights from this data, enabling proactive decision-making and predictive maintenance strategies [12]. For instance, in healthcare, AI-enabled IoT devices can continuously monitor patient health parameters and predict potential health issues, leading to timely interventions and improved patient outcomes [13]. Moreover, AI-powered analytics enhance the scalability and adaptability of IoT solutions. By leveraging machine learning algorithms, IoT systems can dynamically adjust their behavior based on changing environmental conditions and user preferences [14]. This adaptability is crucial in smart cities, where IoT sensors collect data on traffic patterns, energy consumption, and air quality. AI algorithms can analyze this data to optimize urban infrastructure and enhance resource allocation [15]. Furthermore, AI integration in IoT ecosystems facilitates autonomous decision-making and intelligent automation. Through techniques such as deep learning and natural language processing, IoT devices can understand and respond to complex commands, enabling seamless interaction with users and other devices [16]. This capability is particularly valuable in smart homes, where AI-powered assistants can control various connected devices based on user preferences and contextual information [17].

4.1.Artificial Intelligence Algorithms on IoT: Before we explore artificial intelligence algorithms, it's important to establish a clear understanding of what exactly an algorithm is. An algorithm represents a set of instructions designed to guide from an initial state to a desired outcome. Hence, it's crucial to note that an algorithm remains distinct from a computer program, despite often being executed by computers. The ultimate objective of an algorithm can vary widely. Its final instructions are crafted to handle potential eventualities that may arise during execution, often involving decisions, comparisons, or logical operations to accomplish the desired task. Within the realm of artificial intelligence, algorithms play a pivotal role in enabling

computers to learn and adapt [18] [19]. Machine learning, a subset of AI, empowers machines to learn autonomously without explicit programming, having evolved from principles of pattern recognition and computer learning theory [20]. In the context of IoT, machine learning serves various functions such as projecting future trends, detecting anomalies, and imbuing intelligence through the analysis of multimedia data like images, video, and audio. By employing sophisticated algorithms, machine learning enhances IoT systems' capabilities by efficiently processing vast datasets [21]. Below, we provide insights into some of these algorithms.

1. Decision Tree

A decision tree is a decision support algorithm designed to determine optimal outcomes efficiently. It excels in classifying and predicting various tasks. Structurally, it can be depicted as a tree in data structures, where nodes represent attributes, and branches represent the outcome of those attributes. Decision trees offer several advantages over other machine learning techniques, primarily due to their ability to deliver accurate results swiftly, consuming minimal computational resources [26]. Decision trees also provide visual representations of decision-making processes, particularly beneficial for implementing security policies in IoT environments [27]. Some notable advantages of decision trees include:

- Swift Detection and Low Computational Overhead: Decision trees demand minimal computational resources and exhibit rapid training and prediction times, often measured in milliseconds or seconds. Moreover, they require less memory compared to alternative methods, making them suitable for execution on resource-constrained IoT devices like Raspberry Pi [28];
- Privacy Considerations: Decision trees offer clear visual representations of decisions and decision-making processes, aiding in the formulation of privacy policies;
- Flexibility in Accuracy and Computational Efficiency: Decision trees afford users the flexibility to adjust the tree's depth, balancing between accuracy and computational power. Users can opt for shallower trees with slightly reduced precision but faster prediction times and lower computational demands. Conversely, deeper trees yield higher accuracy at the expense of increased computational requirements. This flexibility allows users to tailor the model to meet specific performance requirements or computing constraints, a feature absent in many other machine learning methods [29].

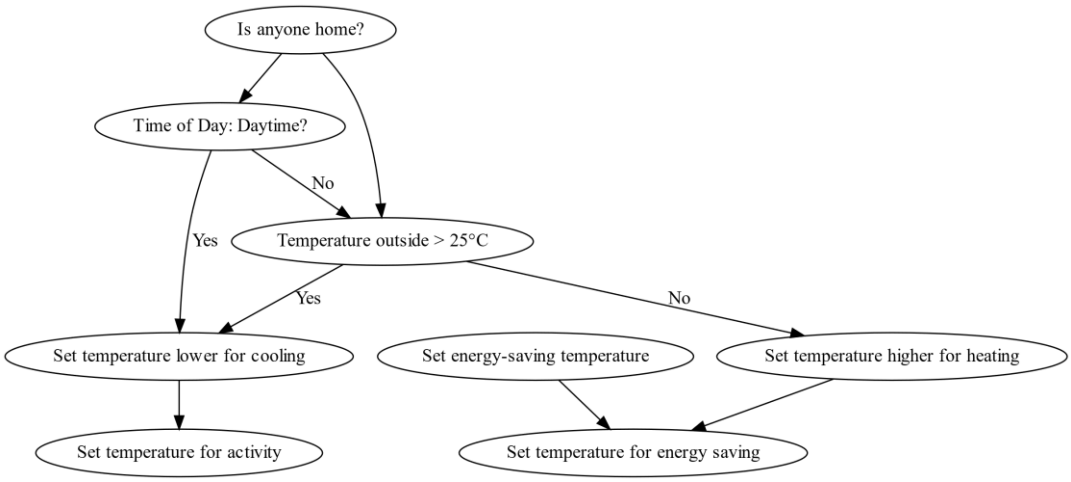

Figure 2: An Example Decision Tree for Smart Home Temperature Control

2. Case Based Reasoning

Case-Based Reasoning (CBR) is a cognitive problem-solving technique that leverages past experiences to address new problems. It retrieves similar cases from a case base and adapts their solutions to the current context. The core challenge in CBR is finding relevant cases from the repository. CBR employs two main coordination strategies: inductive learning and information control [22]. Cases are classified based on historical experiences, with two modes: problem-solving and interpretive. In problem-solving, old solutions are applied to new problems, with a warning message issued. In interpretive mode, cases are examined within the context of past situations [23]. Once a situation is assessed, the best matching case is retrieved and an approximate solution is derived. This adapted solution is then evaluated, either before or after application. If deemed unsatisfactory, the solution is adjusted or additional cases are considered. The advantages of CBR include its intuitive nature, system learning through new use cases, and ease of maintenance [24].

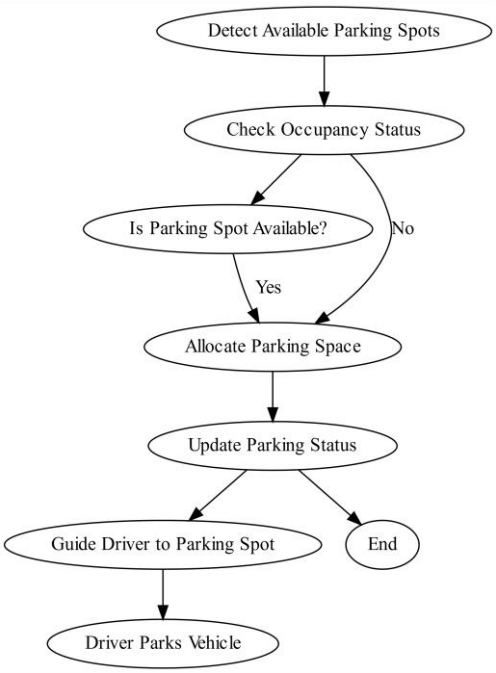

Figure 3: Flowchart illustrating the intelligent allocation of parking spaces using Case-Based Reasoning (CBR) in a smart city

3. Convolutional neural network (CNN)

Convolutional Neural Networks (CNNs) have sparked a revolution in computer vision applications, consistently surpassing traditional models and even human performance in image recognition tasks. While CNNs are primarily utilized in computer vision, their impact extends to various domains. CNNs are hierarchical models capable of processing diverse types of raw input data, including images and audio [25]. Through operations like convolution, concatenation, and activation function mapping, CNNs progressively extract semantic information, layer by layer, in a process known as feedforward operation. Ultimately, the final layer of the CNN transforms target tasks, such as classification or regression, into objective functions [26]. The advantages of using Convolutional Neural Networks include their ability to autonomously learn and produce output beyond the scope of their input data. Additionally, input is stored within the networks themselves, reducing reliance on external databases and ensuring

robustness against data loss. CNNs excel at multitasking without compromising system performance, and they can identify missing information and continue making accurate inferences [27].

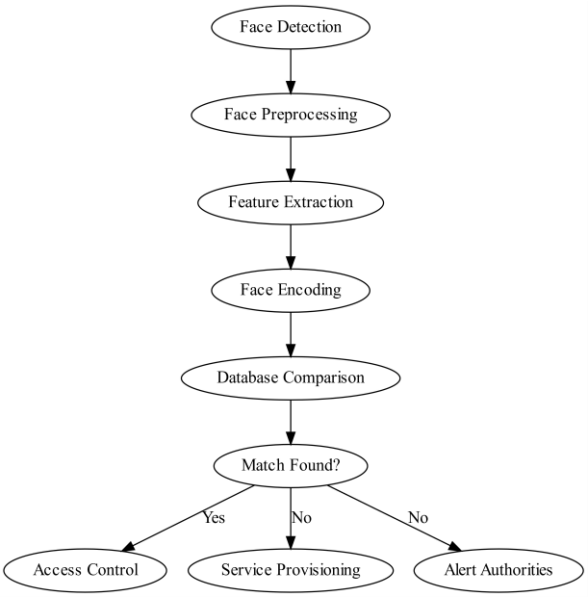

Figure 4: Face Recognition Flowchart for Smart City Using CNNs

4.2.Benefits of Artificial Intelligence in IoT: Combining AI with IoT offers numerous benefits by seamlessly collecting and transferring data to cloud or Internet-based spaces. Acting as the brain of IoT, AI facilitates decision-making and enables devices to respond effectively. This synergy results in various advantages for both companies and consumers, including proactive intervention, personalized experiences, and intelligent automation [28]. Let's explore some of these benefits:

1. Enhanced Operational Efficiency: AI in IoT analyzes continuous data streams and employs machine learning to predict operating conditions, optimizing processes and identifying areas for improvement;
2. Improved Risk Management: By leveraging AI, businesses can better understand and predict risks, automating responses to financial, safety, and cybersecurity threats;
3. Innovation in Products and Services: IoT and AI enable the rapid processing and analysis of data, leading to the development of new products and services, as well as enhancements to existing ones;
4. Scalability of IoT Devices: AI-powered IoT ecosystems streamline data analysis, reducing data volumes and facilitating connectivity among a wide range of IoT devices, from sensors to high-end mobile devices;
5. Reduction of Unplanned Downtime: Predictive maintenance with AI and IoT enables the anticipation of equipment failures and scheduling of maintenance, minimizing costly unplanned downtime in sectors like offshore oil and gas and industrial manufacturing;
6. Error Reduction: AI's precision and automation capabilities contribute to error reduction across various applications, including space exploration and other complex endeavors;
7. Digital Assistants: AI-powered digital assistants operate logically and efficiently, devoid of emotional distractions, making informed decisions and solving problems effectively [29] [30] [31] [32].

5. Digital agenda for Western Balkans

To align with the pace set by the EU, the Western Balkan countries must intensify their efforts. In collaboration with the European Commission, they are dedicated to fulfilling the Digital Agenda. Technology and digitization now permeate nearly every aspect of our lives, from communication and global information access to online commerce and innovation, vastly improving our daily experiences [33]. Yet, the Western Balkan countries lag behind the EU in Information and Communication Technology (ICT) sector development. To bridge this gap and prevent further disparity, the six countries and the EU pledge to meet the Digital Agenda objectives. Originally proposed on February 6, 2018, by the six Western Balkan nations in partnership with the European Union, the Digital Agenda launch commitment was set for April 2021. This initiative included plans to reduce roaming charges between the EU and Western Balkan partners. While the EU began its e-government efforts in 2001, achieving significant progress with nearly half of government services now fully online, the focus now shifts to enhancing digital literacy among citizens and entrepreneurs, optimizing existing technological infrastructure, and improving the efficiency of e-administration services [34]. In the years ahead, technology will play an increasingly vital role in enabling modern public administrations to address the challenges posed by globalization [35]. Key concerns include economic efficiency, social equity, cohesion, and public service reform. The EU emphasizes the establishment of e-administration and the concept of a service-oriented state, advocating for coordinated strategic guidelines, sharing best practices, and standardizing procedures across regions. Electronic administration, once solely focused on efficiency, has evolved into an economic and socio-political instrument, fostering the emergence of the service provider state and reshaping governmental systems to meet modern requirements. Rather than fixating on ideal organizational models, discussions on e-government should prioritize flexibility to accommodate the diverse needs of citizens. Electronic administration thus becomes indispensable for realizing democratic goals, active citizenship, and transparent decision-making processes [36]. The Government of North Macedonia, through its initiative Ministry of Information Society and Administration, is steadfast in leveraging ICT advantages to cultivate an advanced information society, thereby enhancing productivity, efficiency, and innovation in both the public and private sectors. Emphasizing the strengthening of digital infrastructure, North Macedonia is crafting strategies and electronic services to align with EU standards. Areas of focus include e-Administration, e-Government, e-Governance, e-Identification, e-Passport, e-Court, e-Taxation, e-Customs, e-Procurement, and e-Signature [37]. The implementation of these services holds significant importance in bridging the digital gap between our country and EU nations while expediting digital transformation domestically. Outlined in the action plan of the national ICT strategy 2021-2025, the Ministry of Information Society and Administration envisions the following pillars: Connectivity and governmental infrastructure; Centralization and streamlining of ICT and e-government services; Enhancement of digital literacy among citizens, workforce, and professionals; Promotion of research, development, and innovation; Establishment of robust data storage mechanisms; Provision of digital services with an emphasis on environmental sustainability; Creation of the Common Government Data Center; Development of the national optical transport network and Establishment of the State Digital Agency [38] [39].

5.1.Utilizing Digital Connectivity for EU-Western Balkans Cooperation:
Digitization offers a significant opportunity for the economies and societies within the region, as digital solutions can contribute to creating a sustainable, environmentally friendly, and resource-efficient economy, while also enhancing governance and public services for citizens. The adoption of digital services is increasingly becoming a significant component of exports

from the Western Balkans. With backing from the EU and the Regional Cooperation Council, the Western Balkans have been actively implementing the Digital Agenda since 2018. It is crucial for the Western Balkans to assess the progress made in implementation, pinpoint areas requiring accelerated efforts, and broaden the scope and ambition of the region's digital transformation. Notably, there is a pressing need for support in developing digital skills, e-government services, e-procurement systems, and e-health services, all of which can foster transparency, reduce costs, and enhance service delivery to both citizens and businesses, thereby addressing social concerns. Digitization stands as a primary priority for the EU in regional development, with a focus on aligning priorities between the Western Balkan states and the EU. Acknowledging the importance, the Western Balkan States have committed to monitoring digital transformation and progressing towards EU standards in electronic communications and the information society [40]. Below are brief evaluations of the digital readiness status of candidate countries for EU membership provided by the European Commission.

- Albania: As part of the process, the European Commission releases annual reports assessing the status of each candidate country, accompanied by recommendations and guidelines for digital reform priorities. The European Commission observed that Albania is moderately prepared in the areas of the information society and audio-visual media, aiming to align with the new European Code of Electronic Communications and approve the action plan for the digital agenda.
- Bosnia and Herzegovina: The European Commission noted that Bosnia and Herzegovina are in the early stages of preparation regarding the information society and audio-visual media, recommending the enactment of legislation on electronic communications in line with EU standards, as well as the development of a national strategy for broadband implementation.
- Montenegro: Montenegro is moderately prepared in the fields of information society and audio-visual media. The European Union has advised the establishment of administrative capacity to fulfill EU obligations.
- Serbia: The Commission acknowledged that Serbia is moderately prepared in the fields of the information society and audio-visual media, acknowledging achievements in the digital market, electronic government, and information society sectors. The European Commission recommended further alignment of electronic communications legislation with the updated EU regulatory framework, including the new European Electronic Communications Code.
- Kosova: Kosova, a potential EU candidate, has made some progress in the fields of information society and audio-visual media. The EU has recommended providing adequate resources to telecoms and media regulators to enable them to fulfill their duties independently.
- North Macedonia: North Macedonia is moderately prepared in the fields of information society and audio-visual media. Some achievements include the establishment of the National Competence Office for Broadband (BCO) and the expansion of e-Government services. The European Commission recommended North Macedonia to finalize its long-term ICT strategy.

5.2.Web Application Proposal: The proposed web application introduces a distributed system designed for the countries of the Western Balkans. Built with PHP for the backend and MySQL for the database, the application utilizes HTML5, CSS3, and JavaScript for the frontend. It comprises four main components:

1. Personal data accessible to citizens across all Western Balkan countries;
2. A fire detection system covering the entire territory of the Western Balkan states;

3. Monitoring of air quality across the Western Balkan region;
4. Demographic information for each country in the Western Balkans.

Upon launching the web application, users are prompted with an identification form to input their credentials for login.

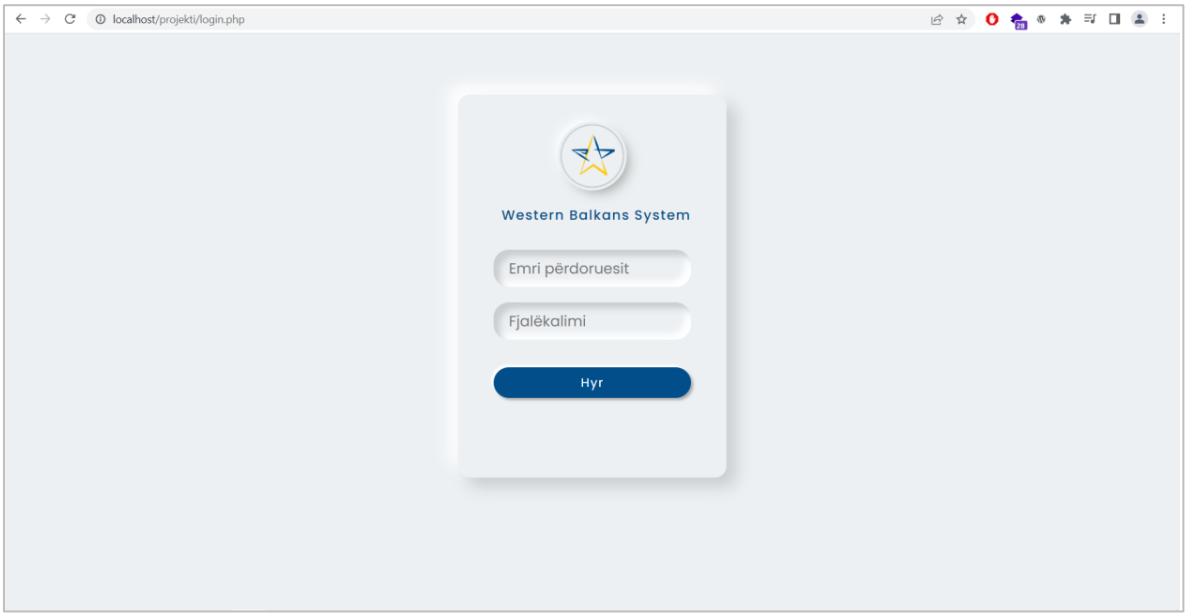

Figure 5: Login form

The identification process verifies user credentials with the database. If there's a match, access is granted; if not, an error message appears.

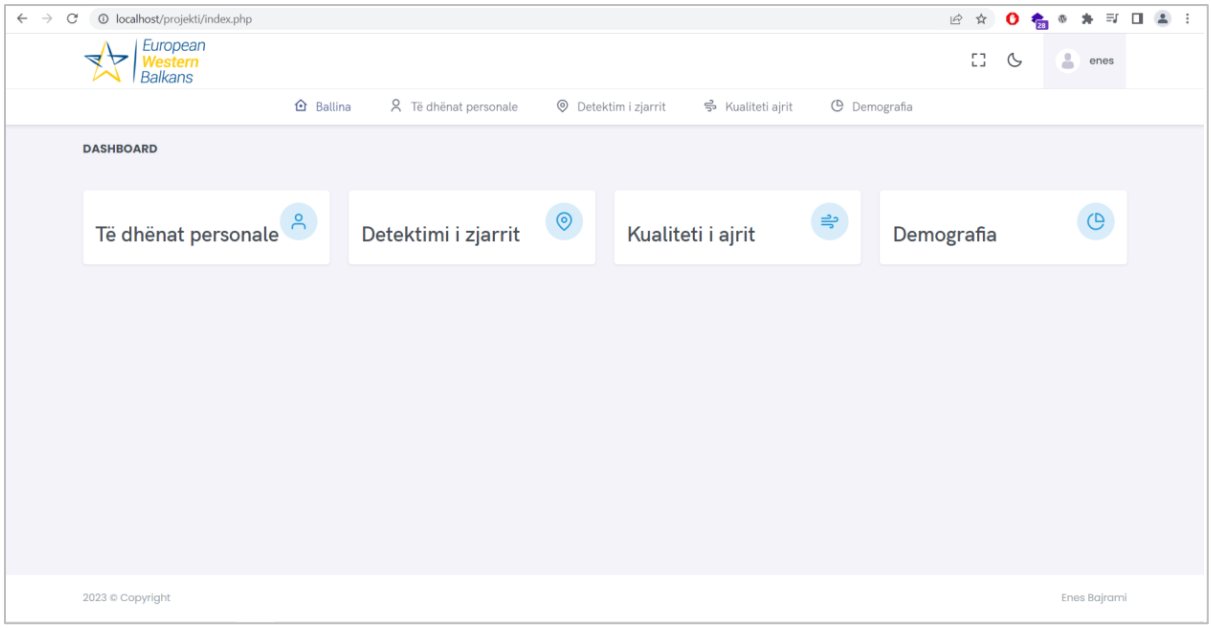

Figure 6: Homepage

After entering the correct credentials into the login form depicted in Figure 6, users are directed to the main page upon successful authentication. Here, users can access the four components available for utilization simply by clicking on their respective icons or links.

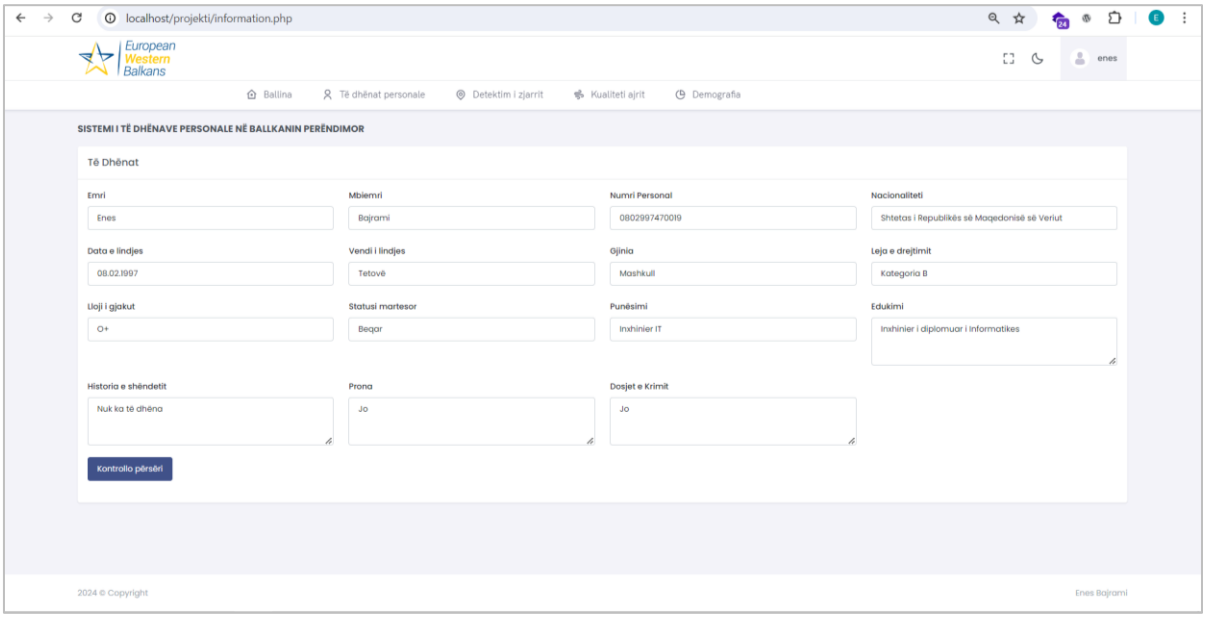

Figure 7: The part where the data is generated after it has been checked into the database

The first component is an information system with personal data, accessible only to authorized entities in the Western Balkans. It generates citizen profiles using unique personal identification numbers. Upon entering their ID, users' profiles are displayed, including basic info like name and surname, and more detailed data such as education, health, property, and criminal records.

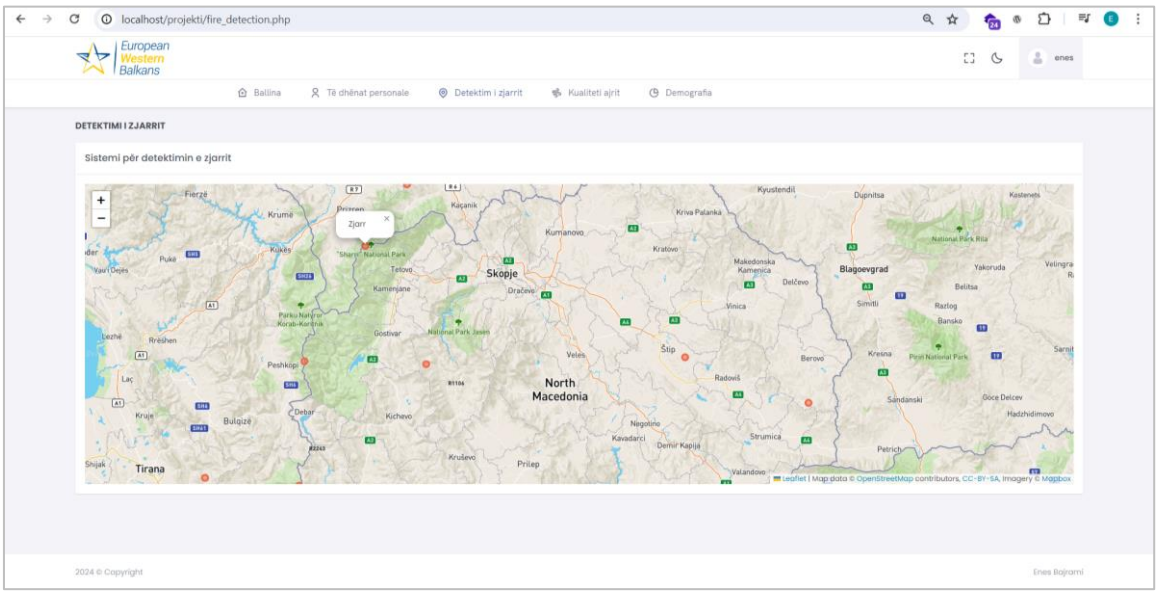

Figure 8: Fire Detection

The second component focuses on fire detection with an interactive map spanning all Western Balkan countries. It visually highlights fire locations using red dots, each accompanied by descriptive text. The lower section of the code manages these red dot visualizations, enhancing the system's effectiveness.

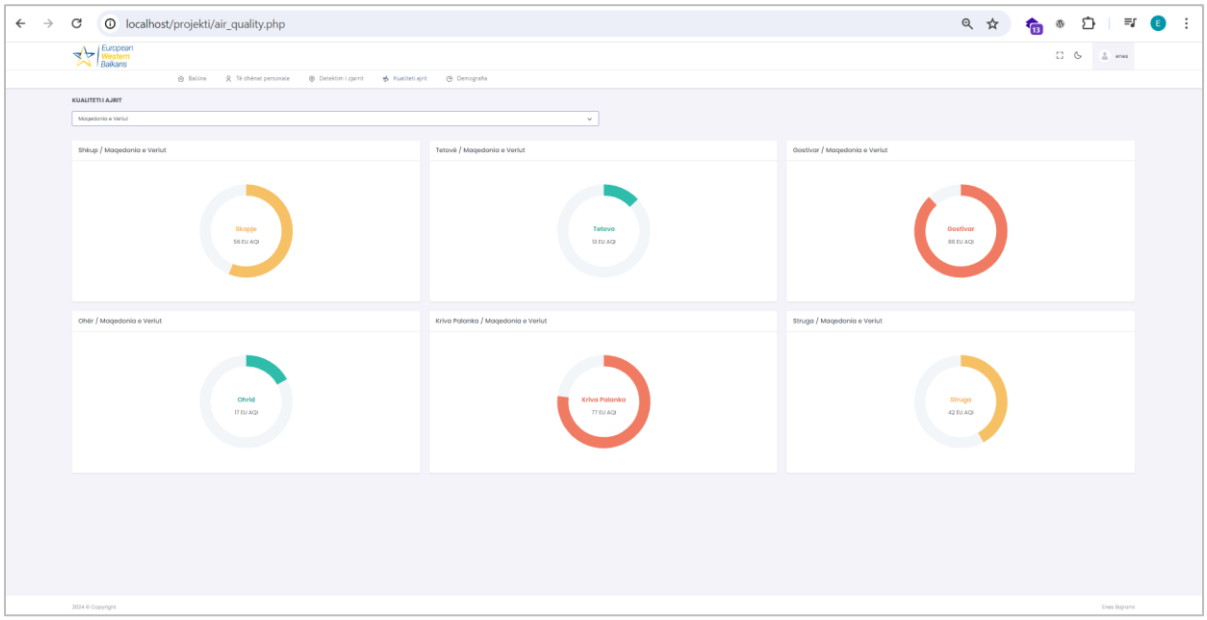

Figure 9: Air quality

The third component monitors air quality in six key Western Balkan cities. Users view detailed graphs with a consistent color scheme representing air quality levels, aiding easy interpretation.

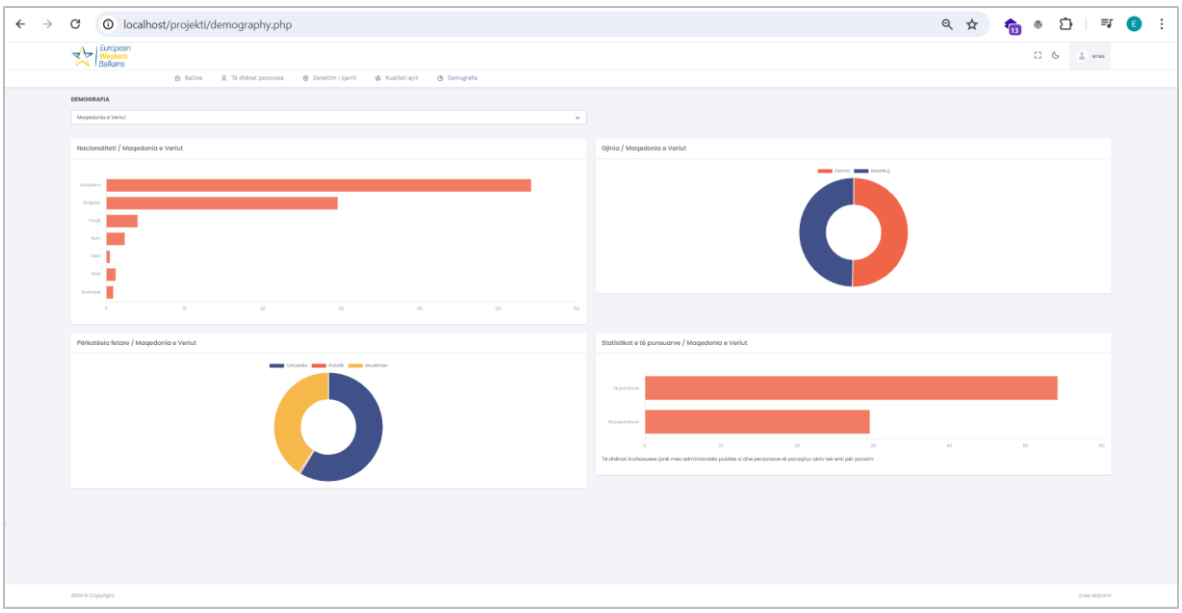

Figure 10: Demography

The final component focuses on demographics, presenting consolidated data from the six countries of the Western Balkans. This comprehensive dataset encompasses various demographic aspects, including nationality, gender distribution, religious affiliation, and statistics pertaining to employment within the public sector. Within this section, users can access graphical representations generated from the underlying data, offering visual insights into demographic trends across the region. Below, we provide excerpts of the code responsible for generating these graphical representations.

6. Conclusion and future work

6.1.Conclusion: Artificial intelligence (AI) has become a tangible reality for businesses and organizations, showcasing its ability to enhance process efficiency, reduce errors, and extract insights from big data. While fully human-like intelligent machines are not yet ubiquitous, subsets like machine learning (ML) and deep learning (DL) have found broad applications in enterprise and daily life. As the Internet of Things (IoT) expands rapidly, more devices are expected to connect to networks, aligning AI and IoT in reshaping technology landscapes. In the Western Balkans, the digital revolution is seen as an opportunity to catch up in the economic race with Western Europe. Governments prioritize digitization and talent retention to leverage the region's skilled workforce. The EU's Digital Agenda, extended to the Western Balkans, aims to equip citizens with digital skills and modernize public services, bolstering cybersecurity and fostering a conducive business environment. The proposed web application aims to establish a unified system accessible to specific institutions in the Western Balkans, leveraging efficient components to serve as a modern, web-based solution.

6.2.Future work: As technology advances, it becomes increasingly intricate and interconnected. Understanding complex systems like artificial intelligence (AI) and the Internet of Things (IoT) has become a focus of my research due to their complexity and the challenges they pose when things go wrong.

- AI Algorithms on IoT: My research explores new AI algorithms for IoT, such as Cumulocity, which enhances the management of diverse IoT devices through protocols like LwM2M and MQTT.
- Transition to Web 4.0: While current research is based on Web 3.0, I'm intrigued by the emergence of Web 4.0 driven by AI and machine learning. Future work will delve into this evolving landscape.
- Analysis of Electronic Systems and Broadband Implementation in North Macedonia: Collaborating with the government, we're enhancing administrative services through digitization, leveraging tools like ADA, an AI-based digital assistant. Additionally, efforts are underway to improve broadband infrastructure in alignment with EU standards.
- Proposed Web Application: Similar to ETIAS but more comprehensive, the proposed web application aims to streamline processes across Western Balkan states. Future comparisons will evaluate its performance and features against common regional applications.

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