Overview of Smart City Technologies: A Case Study of Designing a Multi-Service Smart Kiosk for Citizens

ALA BALTI[1], MOHAMED NAJEH LAKHOUA[2], MOUNIR SAYADI[1]

[1]University of Tunis, Research Laboratory LR13ES03 SIME, National High School of Engineering of Tunis, ENSIT, TUNISIA
[2]University of Carthage, Research Laboratory Smart Electricity & ICT, SEICT, National Engineering School of Carthage, ENICarthage, TUNISIA

Abstract: - This paper is dedicated to the preliminary study of aspects surrounding the Smart City, aiming to gain insight into what has been done and the technologies employed. Consequently, the study on the Smart City is presented initially, followed by the description of the relationship between the Smart City and the intelligent kiosk. Fact, this paper undertakes a meticulous examination of Smart City technologies, focusing on the design and implementation of a Multi-Service Smart Kiosk tailored for citizens, with a specific emphasis on the context of Tunisia. The initial section provides a comprehensive review of existing research, offering insights into the global landscape of Smart Cities and their technological underpinnings.
The case study presented in the paper centers on the relationship between Smart City infrastructure and the deployment of intelligent kiosks within Tunisia. This analysis encompasses an exploration of the specific challenges and opportunities faced by the country, considering factors such as urbanization trends, economic considerations, and societal dynamics unique to the Tunisian context.
This paper contributes to the development of culturally sensitive and contextually relevant Smart City technologies. The research ultimately aims to showcase Tunisia's commitment to fostering innovation and sustainable urban development through strategic investments in Smart City initiatives, positioning the nation as a noteworthy contributor to the global discourse on technologically empowered urban landscapes.

Key-Words: E-Government, Multi-Service Smart Kiosk, Smart city management, Smart City, Smart ecosystem, Smart Governance, Trust.

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1 Introduction

In contemporary discussions on improving public services and addressing issues related to modern technology, the concept of the Smart City has become synonymous with advancements in service enhancement. The notion of the Smart City represents a firmly established reality in the world when it comes to service improvement.
The Smart City concept signifies a new paradigm in urban development, aiming to enhance the quality of life for city dwellers by making the city more adaptive and efficient through the incorporation of new technologies within a smart ecosystem of objects and services see Figure 1.
This innovative approach to city management encompasses various aspects, including public infrastructures (buildings, urban furniture, home automation, etc.), networks (water, electricity, gas, telecommunications), transportation (public transit, smart roads and vehicles, carpooling, etc.), as well as e-services and e-administrations.

Fig. 1: Model of a Smart City [1]

The idea is to develop means and solutions that not only meet the needs of people but also protect resources and the environment. The analysis and evaluation of data provide cities with the opportunity to finely manage their economy, environment, and citizen impact. This intelligent management involves the ability to interconnect these levers so that they are no longer operated individually but are linked to one another.

2 Tools of the Smart City

There are connected tools that use new technologies to promote the development of innovative solutions for smart cities, such as [2], [3]:

Information and Communication Technologies (ICT): ICT builds a bridge between citizens and the government, allowing citizens to communicate with the government and enabling the government to build a city according to the wishes of the general will. These technologies help governments analyze demand structures to create a resource pool and address these demands effectively.

- **Internet of Things (IoT):** The IoT encompasses an increasing number of connected household appliances, sensors (such as thermostats or smoke detectors), smart meters, and connected security systems. These connected devices collect, store, and transfer data about our environment in real-time. In the context of the smart city, this data is analyzed and utilized to improve the public management of the city.
- **Sensors:** Though concealed, sensors are ubiquitous components in the urban landscape and are crucial in any intelligent control system. A process improves primarily based on its environment. For an intelligent control system to have optimal awareness of its environment, it must rely on a network of sensors designed to collect an ever-increasing amount of data.
- **Smart grids:** Intelligent recording of users' actions (e.g., electricity, gas, water consumption) for sustainable, more efficient, cost-effective, and safer resource consumption.
- **Artificial Intelligence (AI):** Smart cities are part of a digital revolution generating a phenomenal amount of data. However, this data is useless unless it can be properly managed to extract information. The massive amount of data requires the use of artificial intelligence to enable Machine-to-Machine interactions.

2.1 Components of the Smart City

In the literature, there are various models of smart cities. Among the most widely used models is the one proposed by Rudolf Giffinger, see Figure 2, an expert in analytical research on urban and regional development at the Vienna University of Technology. Giffinger's model outlines the six key factors to be considered in becoming a smart city.

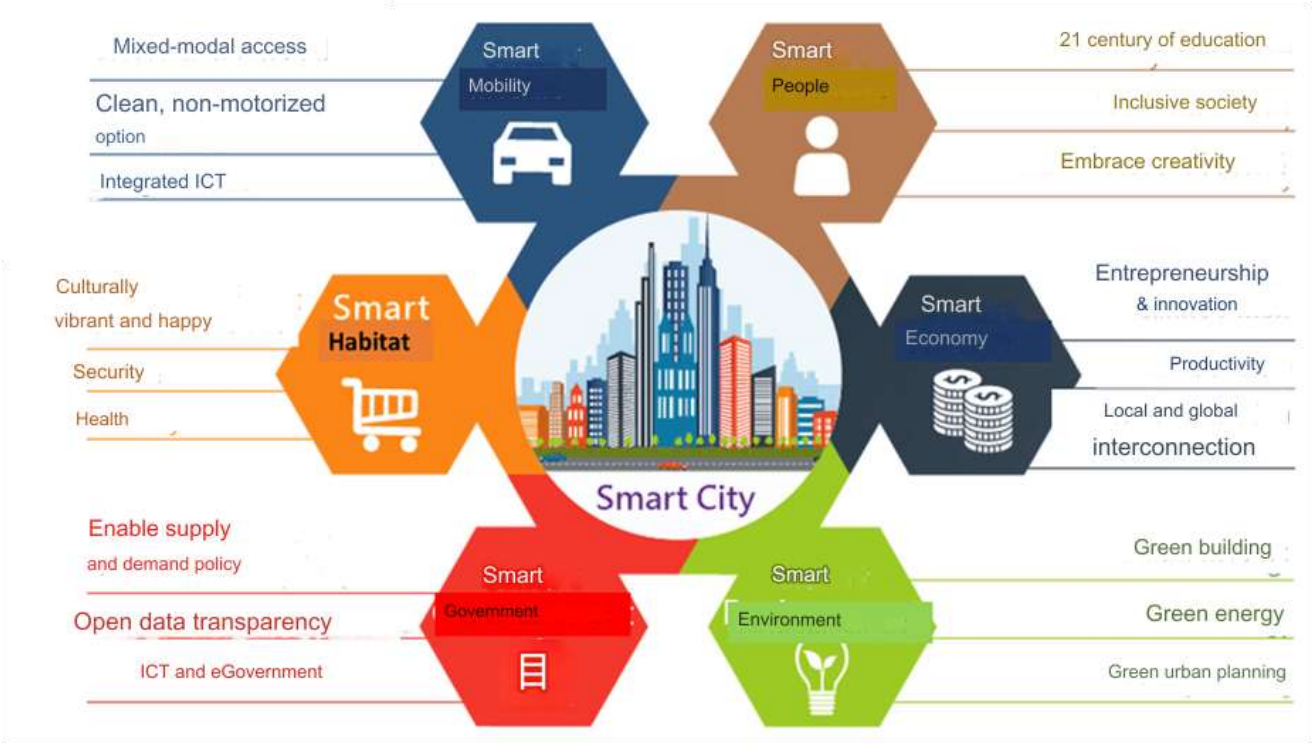

Fig. 2: Diagram of the six levers of a smart city [1]

The six major dimensions are [3], [4], [5]:

- **Smart Economy:** The concept of Smart Economy is broad, encompassing the economic dimension of the smart city. Faced with the integration of future technologies in industry, the rise of digital platforms, and the IoT-induced industrial revolution, new needs and expectations have inevitably emerged in consumer mindsets. MEDEF defines a Smart Economy as a more innovative and intelligent economy in which businesses must "do more with less" while meeting new consumer expectations and

behaviors. More concretely, the Smart Economy translates into the provision of new services, the production of new products, the development of new economic models, the interconnection between the local and global worlds, and the establishment of intelligent clusters and ecosystems of actors.

- **Smart Mobility:** Smart Mobility aims to offer real and sustainable solutions to urban mobility issues. It relies on the use of new technologies in telecommunications, the sharing economy, and online databases. This aligns with the overarching theme of the smart city, a crucial dimension in addressing the challenge of improving citizens' daily lives while minimizing resource consumption and respecting the environment. Access to real-time transport data via electronic screens in stations, metro cars, buses, or personal smartphones would provide users with a wealth of information [6].
- **Smart Environment:** In a smart city, various technological tools enable the protection and preservation of natural resources and environments, including water management, waste management, sustainable resource management, and energy management. Technologies like sensors for detecting leaks in water networks, tracking waste transport, or measuring air pollution levels provide real-time information [7].
- **Smart Living:** Smart Living covers the enhancement of all aspects of daily life in the smart city: well-being, health, safety, housing, culture, tourism, etc. It aims to create an attractive living and working environment, not only improving the daily lives of city dwellers but also promoting tourism and business by offering an appealing environment. Developing new services for optimizing health (e-health), ensuring safety in a culturally dynamic city, and understanding and changing consumer behavior through tailored solutions are part of this dimension.
- **Smart Governance:** Smart Governance involves services and interactions that link and integrate public, private, and civil organizations to make the city operate more efficiently. This participatory and integrated landscape of smart urban governance aims to leverage innovative, social, and technological solutions through community engagement. The goal is to place citizens at the heart of the city, being attentive to their needs, establishing effective communication with all residents, and encouraging their participation in citizen decision-making through the development of e-government [8],[9],[10].
- **Smart Citizen:** The concept of Smart Citizen is considered one of the three key dimensions of the Smart City, according to the 12th Annual International Conference organized by "Digital Government Research". Key factors categorized in the human dimension of smart cities address concepts such as creativity, knowledge, education, learning, and social capital. It is primarily a more humane approach that places the citizen at the center of concerns [11].

2.2 Limitations of the Smart City

The Smart City also presents several limitations. These limitations, currently documented in scientific literature, are quite numerous. Indeed, in discussions about what future cities might entail, ten challenges have been identified that the Smart City could contribute to, such as [2]:

- Overexploitation of natural resources
- Population growth
- Globalization of the economy and its risks
- Technological developments
- Geopolitical changes
- Mobility of people
- Aging population
- Social tensions and inequalities
- Insecurity (energy, food, water)
- Institutional and governance changes

To address these challenges, the Smart City will need to create synergy across various domains, including intelligent traffic management, the development of new transportation modes, optimization of energy consumption, waste management, and the protection of goods and services.

3 Smart Cities internationally and in Tunisia

3.1 Ranking of Smart Cities Worldwide

Becoming a Smart City is the new priority for many major cities, and this concept is unfolding and evolving in various metropolises worldwide as it represents an opportunity to enhance their public management by integrating new information and communication technologies such as artificial intelligence (AI) and the Internet of Things (IoT). So, which cities are the smartest in the world?

In 2019, 'HUB Institut' and 'Statista' provided insights through a study that presented a ranking of the smartest cities based on the level of intelligent urban development with a score out of 10. This score is derived from the analysis of 500 cities

across 24 factors distributed into 8 categories: transport and mobility, sustainability, governance, innovation, digitization, cyber security, standard of living, and expert opinions. This year, the IMD Business School in Singapore unveiled the first edition of its 'Smart City Index 2020,' in collaboration with the Singapore University of Technology and Design (SUTD). This ranking lists 109 cities worldwide, categorized based on their technological capabilities in five key areas: health and safety, mobility, activities, opportunities, and governance in April and May 2020.

3.2 Smart City Concept in Tunisia

The Smart City concept has notably integrated into Tunisia in recent years. Indeed, we have witnessed the impact of this concept in various areas. One of these areas is the urbanization of the population, which has experienced a significant increase compared to the Middle East and North Africa countries. Tunisia's urban population has risen from 57.95% in 1990 to 69.57% in 2020, with an average annual growth rate of 0.96%.

In Figure 3, the urbanization rate is expressed as a percentage of the total population.

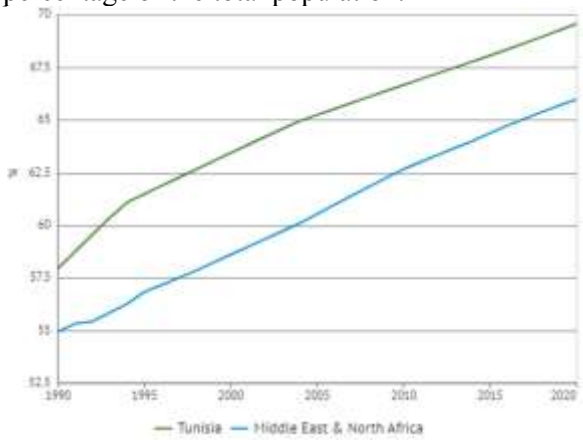

Fig. 3: Urbanization Rate as a Percentage of the Total Population (%) [8]

In the same vein, the Smart City is making headlines thanks to the second edition of the national caravan 'Tunisian Smart Cities' organized by the TSC association. Its primary objective is to promote the development of smart and sustainable cities in Tunisia, aiming to enhance the quality of life for citizens through the use of new technologies.

The TSC association (Tunisian Smart Cities) is inspired by Smart City initiatives launched by some Tunisian cities such as Bizerte and Kairouan, to organize a nationwide deployment through thematic workshops. Among these projects, the association has prepared a methodological guide for implementing a smart city approach in Tunisia based on three major axes:

- Identification of smart territories.
- Implementation of a smart city/smart village approach.
- Design of an eligibility framework for the Tunisian Smart Cities program.

To better integrate the general public in Tunisia into the concept of the Smart City and to give the efforts in this direction a greater chance of success, cohesion, and sustainability, various future projects have been outlined:

- **ITES and TSC Program:** With the resources that will be collected, published, and accessible to everyone, the ITES (Tunisian Institute of Strategic Studies) and the TSC association aim to facilitate and lay the groundwork for future generations in terms of territorial development and sustainable management. The program also includes the production of comprehensive studies in the preparation of major national events such as TSC 2025, Tunisia Smart Nation 2030, Tunisian Olympic Games 2040, and Sustainable Tunisia 2050.
- **Sfax Program:** One of the challenges in the future smart city of Sfax is to integrate various modes of transportation—rail, automobile, cycling, and walking—into a unified system that is efficient, easily accessible, affordable, safe, and environmentally friendly. Another challenge involves harnessing solar energy by installing photovoltaic panels to cover nearly two-thirds of the electricity consumption. Additionally, there is a focus on reducing potable water consumption through rainwater harvesting for daily use (toilets, washing machines, irrigation, etc.).
- **Ariana Program:** The project's concept is to progressively build a comprehensive and integrated modern city. It will contribute to the development of the overall economic and future map of the Tunisian Republic. By enhancing strategic planning, the city will be more attractive to both national and foreign investors, creating more employment opportunities and, consequently, economic growth.

4 Smart Kiosks in Relation to Smart City

The trade-in fake diplomas is thriving worldwide. Furthermore, the interconnection between education, the job market, and new information and communication technologies has led to a large-scale development of counterfeiting, especially fake diplomas. At this stage, the question arises: is the proliferation of fake diplomas a serious issue?

Unfortunately, yes. 'The number of fake diplomas in circulation is estimated to be over 500,000 in China alone' [12], indicating the magnitude of the problem worldwide.

Tunisia is not exempt from this phenomenon. For example, this year, the judicial police in Kairouan arrested a manufacturer of fake diplomas who had in his possession 62 counterfeit diplomas. It's noteworthy that many of his clients were hired based on the false documents he provided. Last year, during an interview on a private radio station, the Minister of Higher Education, Slim Khalbous, assured that, according to the files of the Court of Auditors, a faculty was issuing diplomas to students who had never attended classes. He cited examples of numerous African nationals who graduated from this faculty, even though they had never set foot there, and some of them had not even visited Tunisia. All of this demonstrates that counterfeiting is a real scourge that generates considerable profits for counterfeiters, penalizing both businesses and states [13].

Indeed, this phenomenon deserves greater attention and a modern and effective solution. Since the only authentications for diplomas are the official stamp and the signature of the study director, the problem lies in the fact that signatures are easily replicated, and official stamps have several flaws. Among these flaws: the inked content is visible, unprotected, and with new technologies, it is easy to counterfeit. Another flaw is that producing a custom stamp requires a lot of time and effort, resulting in a relatively high selling price.

It has become crucial for governments and businesses to effectively combat this phenomenon, which constitutes a flourishing activity with far-reaching effects. The goal of this contribution is to propose a solution to address this issue through an innovative approach. This solution comes in the form of a single and intelligent counter, based on RFID technology, capable of identifying whether diplomas are fake or not, and verifying directly with the diploma-awarding organizations that the candidate is indeed the holder of the relevant diplomas. The benefits of this solution include the authenticity and integrity of such a diploma, the minimization of all activities related to the production, communication, and use of fake diplomas, as well as transparency and simplification of administrative procedures [10].

The idea of improving such a public service or solving problems through modern techniques leads us to the concept of the Smart City. Therefore, to provide a more comprehensive approach to the subject, it is essential to emphasize the topic of the Smart City [11].

The implementation of the intelligent kiosk with the Alien ALR-9900 reader was one of the main objectives in our research work, as this reader is among the best solutions used in the RFID field. Moreover, Alien has a new fifth-generation reader architecture that intelligently adapts to its environment. However, due to a lack of hardware, we opted for another solution based on the Arduino MFRC522 RFID module [12].

Therefore, our goal was the implementation of a new diploma authenticity testing system, which we called the 'Smart Kiosk,' primarily based on radio-frequency identification (RFID). The use of this kind of new technology is highly popular in smart cities, as the world is oriented towards everything modern [8], [9], [10].

With this choice of modeling, we created a systemic model based on a strong coupling between the user and the smart kiosk by presenting three conceptual levels: 'presentation of the system structure,' 'presentation of the system operation,' and 'presentation of the system behavior' in the form of nine diagrams. The use of SysML modeling was rich, as it offered a multi-technology theoretical framework that allowed the merging and unification of different functional and non-functional requirements [9].

The term 'intelligent' would be limited to describing a quick, responsive, and reactive mind. For others, however, the term 'smart' encompasses 'intelligent,' as 'smartness' would only be possible when an 'intelligent' system adapts to the needs of the people using it. From this concept arises the importance of using smart kiosks for the development and improvement of public services, leading to the evolution of the Smart City.

Several points underscore the importance of smart kiosks in the Smart City, for example:

• The smart kiosk ensures the digitization of procedures in public administration. Taking our system as an example, it provides the administration with an effective tool to ensure the authenticity of diplomas and, consequently, combat the phenomenon of counterfeiting.

• In the field of smart governance, it guarantees transparency. Indeed, the smart kiosk allows citizens to access official documents easily and participate in the decision-making processes of a municipality, reducing the possibility for authorities to abuse the system for their interests or conceal relevant information.

• The smart kiosk presents an e-administration solution. The digitization of numerous services also

leads to their streamlining and the elimination of duplicates. According to the plan outlining the UK's online public services strategy, the same service operated via digital technology costs fifty times less than face-to-face service, thirty times less than postal exchange, and twenty times less than telephone exchange.

For all components of society, such as governorates, ministries, municipalities, and businesses, the smart kiosk remains the key element for the development of their city to achieve the goal of being 'Smart'.

5 Modeling Software

For the graphical modeling of SysML diagrams, we utilized Astah SysML, which is a general-purpose graphical modeling software for the specification, analysis, design, and verification of complex systems. It enables the quick creation of SysML diagrams with a refined and intuitive interface design. Additionally, it can encompass hardware, personnel, software, information, procedures, and facilities.

This tool has established a common, understandable, and clear language among engineering, mechanical, electronic, and software engineering specialists to design the architectures of complex systems more securely.

Astah SysML is designed to create the most intuitive and powerful SysML system available, focusing on three objectives:

- Simplicity: as it contains only SysML diagrams.
- Accessibility: it can run on PC, Mac, and Linux, facilitating seamless communication between teams, regardless of the operating system.
- Flexibility: the integration of "Mindmapping" with SysML has eased the collection and discussion of ideas. These "Mindmaps" can then be easily converted into requirements or other modeling elements simply through a drag-and-drop interface.

5.1 Behavioral Diagrams of the Proposed Smart Counter

For a simplification of notation, we called our proposal Intelligent Kiosk for Citizens with Smart Counter.

5.1.1Use Case Diagram

This diagram was employed to provide an overall view of our system and to identify its major functionalities. The diagram includes various use cases, as well as human actors (user, installer) and non-human actors (diploma, computer). Each represented case specifies an expected behavior of the system. The counter offers two services to the user: testing a diploma and providing information about it. Additionally, the system allows the installer to make changes in the program through a computer. Figure 4 shows the smart till use case diagram.

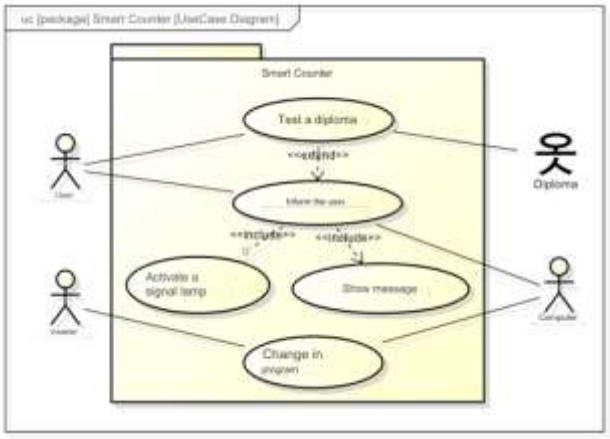

Fig. 4: Smart Teller Use Case Diagram

5.1.2 Sequence Diagram

In this diagram, we have depicted the interactions between actors and the system in chronological order. The dialogue between actors in each use case is described through messages.

The counter allows scanning of the diploma provided by the user and then requests authentication from the microcontroller. Once the authenticity verification is completed, the microcontroller produces one of two results:

- Valid Diploma Case (diploma information will be displayed on an LCD screen, and a green lamp will be lit).
- Invalid Diploma Case (an error message will be displayed, and a red lamp will be lit).

In Figure 5, we present the Smart Meter Sequence Diagram.

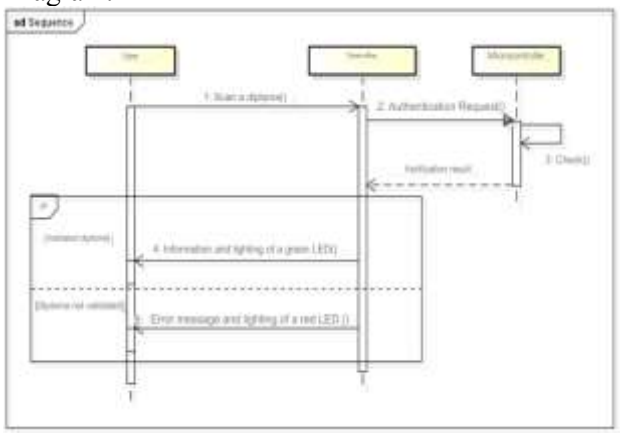

Fig. 5: Smart Counter Sequence Diagram

5.1.3 Activity Diagram

We employed this diagram to describe the algorithm governing the actions of the smart counter. The dynamics of the system are represented by specifying the sequential flow of its activities.

In this diagram, once a task is completed, the next one begins; there are no events associated with transitions (unlike the state diagram we will discuss in the next paragraph).

In Figure 6, we present Smart Counter Activity Diagram.

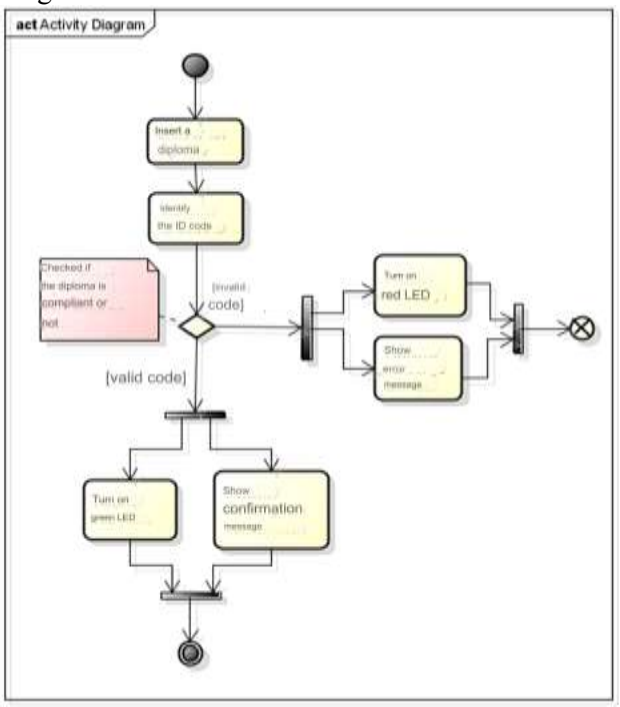

Fig. 6: Smart Counter Activity Diagram

5.1.4 State Machine Diagram

In the state machine diagram of the smart counter, we endeavored to depict the various states of the system based on its current state and the events that occur. The concept of this diagram is similar to a Grafcet, which is a behavioral description of the system, where the transition from one state to another is only made if the conditions are satisfied. Each state in the diagram represents a specific moment in the behavior of our system.

In Figure 7, we present Smart Counter State Machine Diagram.

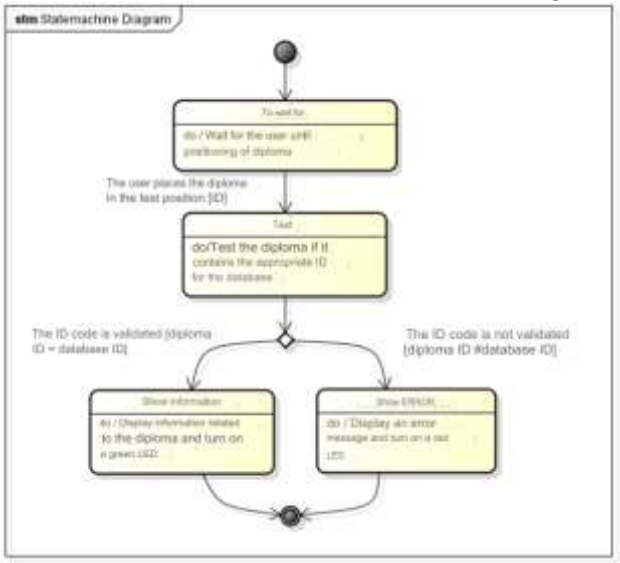

Fig. 7: Smart Counter State Machine Diagram

5.1.5 Block Definition Diagram

From this diagram, we were able to illustrate all the main components that make up the system and how they will interact with each other.

The graphical representation of this diagram is provided in the following figure.

In Figure 8, we present Smart Counter Block Definition Diagram.

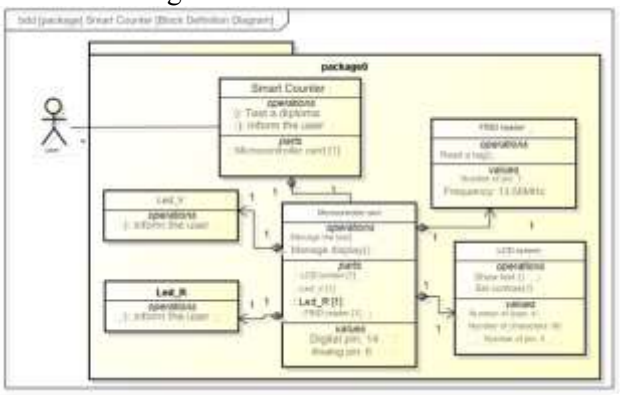

Fig. 8: Smart Counter Block Definition Diagram

5.1.6 Requirement Diagram of the Smart Counter

The requirement diagram allowed us to graphically restate the specifications while providing the opportunity for an internal dimension not offered by the specifications in the form of descriptive text and a unique identifier.

The first fundamental requirement pertains to the main purpose of the smart counter, which is to inform the user about the authenticity of a diploma. The otherrequirements are derived from the

aforementioned main requirement, implying an additional level of architecture.

In Figure 9, we present Smart Counter Requirement Diagram.

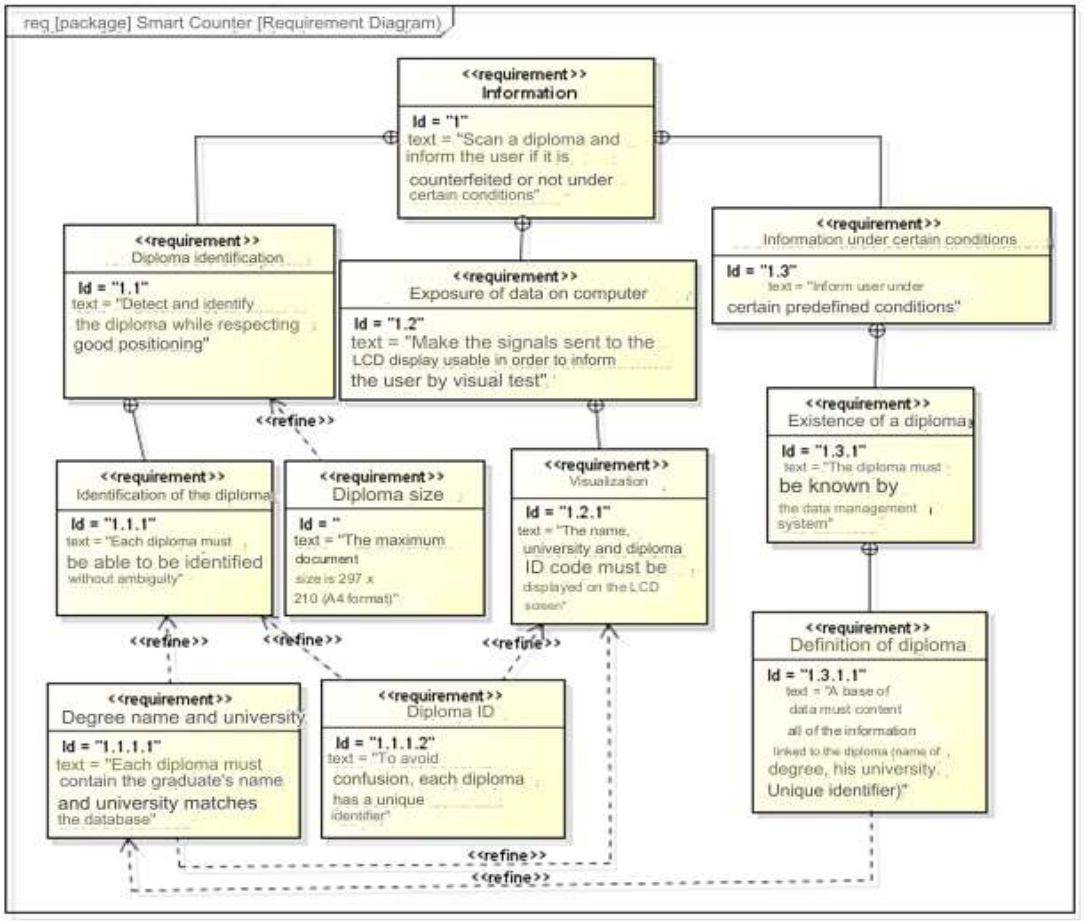

Fig. 9: Smart Counter Requirement Diagram

5.1.7 Package Diagram

When dealing with a large-scale system, it can be beneficial to decompose it into several parts, known as packages. A package is a grouping of various elements of a system (such as classes, diagrams, functions, interfaces, etc.). This helps clarify the model by organizing it.

Since our system is not overly complex, we have considered our system as a single unit.

5.1.8 Internal Block Diagram

The internal block diagram allowed us to represent the connections between components, similar to the block definition diagram, but also (and more importantly!) the exchanges of matter, energy, and information with the notion of ports.

In Figure 10, we present the Smart Counter Package Diagram.

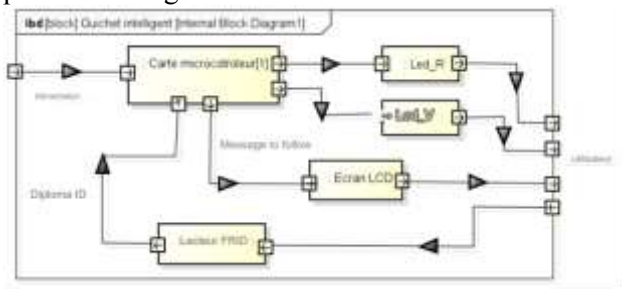

Fig. 10: Smart Counter Package Diagram

The parametric diagram is a specific SysML block diagram. Through a zone called "constraints," one can define the physical behavior laws of the designated element in the block.

In our system, there are no specific laws to adhere to or physical quantities to consider. Therefore, we do not need a parametric diagram for modeling the smart counter.

6 Conclusion

In this paper, we have gained a better understanding of the concept of the smart city. As we have seen, these two concepts, in a broader sense, are relatively recent and have gained considerable importance globally over the past few years. Given the multiplicity of strategies that can be employed to counteract the reprehensible trade in fake diplomas, this phenomenon constitutes a thriving activity that continues to grow day by day, but the search for a solution must not cease. In this context, the main objective of the research work was set.

Following this objective, we define the framework of our project. Firstly, we presented this new concept (Smart City) given the youthfulness of this topic, as well as the tools, components, and limitations of smart cities. Subsequently, we emphasized the ranking of smart cities worldwide and their existence in Tunisia. We also highlighted the importance of using smart kiosks for the development and improvement of public services, subsequently contributing to the evolution of the Smart City.

This part of the work provided us with greater efficiency in terms of the readability of the kiosk, showcasing it in its best light and visually representing it with all its components to facilitate its fabrication.

In conclusion, it is important to note that each technology explored in this research work requires extensive research. Furthermore, the smart kiosk test has shown promising results to continue and work in the same research area. Projects can be undertaken to valorize our research, such as: (1) proposing a part on 'Tunisia as a smart city' given the importance of this topic nationally and internationally, as well as the limited research on this concept. (2) exploring the possibility of a start-up using RFID technology for product or stock identification in the industry, as this sector presents significant global growth.

References:

[1] Hashem, Ibrahim Abaker Targio, Chang, Victor, Anuar, Nor Badrul, et al. The role of big data in smart city. International Journal of information management, 2016, vol. 36, no 5, p. 748-758.

[2] Dameri, Renata Paola, et al. Smart city implementation. Progress in IS; Springer: Genoa, Italy, 2017.

[3] Huseynova, Arzu, Mazanova, Ophelya, Khudiyeva, Pikakhanum, et al. Innovative way of solution of “Smart city” in Azerbaijan–city problems. WSEAS Transactions on Business and Economics, 2022, vol. 19, p. 1394-1402.

[4] Igor Astrov, "A Model-Based Control of Self-Driving Car Trajectory for Lanes Change Maneuver in a Smart City," WSEAS Transactions on Systems and Control, vol. 18, pp. 346-353, 2023, DOI:10.37394/23203.2023.18.36.

[5] Andrej Hrovat, Tomaž Javornik, "Radio Channel Models for Wireless Sensor Networks in Smart City Applications," International Journal of Applied Mathematics, Computational Science and Systems Engineering, vol. 3, pp. 71-75, 2021.

[6] Srihi, Sofienne, Balti, Ala, Fnaiech, Farhat, et al. Banking security system based on SVD fingerprints and cryptography passwords. In : 2018 International Conference on Control, Automation and Diagnosis (ICCAD). IEEE, 2018. p. 1-5.

[7] Vespa, Jonathan, Medina, Lauren, Et Armstrong, David M. Population estimates and projections. US Census Bureau, 2020, vol. 15.

[8] MA, Baihe, WANG, Xu, LIN, Xiaojie, et al. Location Privacy Threats and Protections in Future Vehicular Networks: A Comprehensive Review. arXiv preprint arXiv:2305.04503, 2023.

[9] González-Zamar, Mariana-Daniela, Abad-Segura, Emilio, Vázquez-Cano, Esteban, et al. IoT technology applications-based smart cities: Research analysis. Electronics, 2020, vol. 9, no 8, p. 1246.

[10] Luvisi, Andrea Et Lorenzini, Giacomo. RFID-plants in the smart city: Applications and outlook for urban green management. Urban forestry & urban greening, 2014, vol. 13, no 4, p. 630-637.

[11] Gope, Prosanta, Amin, Ruhul, Islam, Sk Hafizul, et al. Lightweight and privacy-preserving RFID authentication scheme for distributed IoT infrastructure with secure localization services for smart city environment. Future Generation Computer Systems, 2018, vol. 83, p. 629-637.

[12] Swamy, Jc Narayana, Seshachalam, D., Et Shariff, Saleem Ulla. Smart RFID based Interactive Kiosk cart using wireless sensor node. In : 2016 International Conference on Computation System and Information Technology for Sustainable Solutions (CSITSS). IEEE, 2016. p. 459-464.

[13] Aigerim Kulbaeva, Symbat Nakhipbekova, Aziza Mergenbayeva, Kamshat Akhmetova, Meruyert Kulbaeva, "Improvement of the

Efficiency of Urban Management within the Concepts of Smart City and Sustainable Development (As Exemplified by Cities in Kazakhstan)," WSEAS Transactions on Business and Economics, vol. 20, pp. 2692-2699, 2023, DOI:10.37394/23207.2023.20.229