

Using E-management to solve Crowd Problems Evidence from: Hajj Event

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Received: 29/12/2023

Accepted: 12/01/2024

Abstract:

Crowd management operation is a vital aspect of ensuring audience and maintaining order in various places, such as religious events, pilgrimage, sports events. Effective crowd management requires a comprehensive understanding of crowd behavior, and the implementation of appropriate strategies, through the use of electronic management and various technological media to facilitate crowd control. This paper provides an overview of Crowd management and Electronic administration uses, drawing on research and previous studies. The paper sheds light on the Kingdom of Saudi Arabia's commendable efforts to manage and guide pilgrims during the Hajj season by employing cutting-edge technologies.

Keywords: Crowd Management; Electronic Management; Nusuk; Smart cards; E-bracelets.

Jel Classification Codes: J24,O15, O33.

ملخص:

تعتبر عملية إدارة الحشود جانباً حيوياً لضمان الجمهور والحفاظ على النظام في الأماكن المختلفة، مثل المناسبات الدينية والحج والأحداث الرياضية، تتطلب الإدارة الفعالة للحشود فهماً شاملاً لسلوك الحشود، وتنفيذ استراتيجيات المناسبة من خلال استخدام الإدارة الإلكترونية والوسائط التكنولوجية المختلفة لتسهيل السيطرة على الحشود. تقدم هذه الورقة نظرة عامة حول إدارة الحشود واستخدامات الإدارة الإلكترونية اعتماداً على الأبحاث والدراسات السابقة، وتسلط الورقة الضوء على جهود المملكة العربية السعودية الجديدة بالثناء لإدارة وتوجيه الحجاج خلال موسم الحج.

كلمات مفتاحية: إدارة الحشود، الإدارة الإلكترونية ، نسك ، البطاقات الذكية ، الأساور الإلكترونية.

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1. INTRODUCTION

Crowd management process is a critical aspect of modern society, as it involves the coordination and control of large groups of individuals in public spaces. From religious events and concerts to protests and political rallies. Furthermore, crowd management plays a crucial role in ensuring public safety and security.¹ in general; the science of crowd management is a multifaceted field that draws on a range of disciplines, including psychology, sociology, engineering, and computer science. By studying the behavior of crowds and developing innovative technologies and strategies, studies in the field aim to improve the efficiency and effectiveness of crowd management, reduce the risk of accidents and emergencies, and enhance the overall experience of those attending public events. in addition, the importance of effective crowd management only continue to grow, making it a vital area of research and development.²

The Hajj is an annual Islamic pilgrimage to Mecca, the holiest city for Muslims, where Mecca is located in the Kingdom of Saudi Arabia which is responsible for organizing and managing the Hajj pilgrimage each year.³ During the Hajj, millions of Muslims from around the world gather in Mecca to perform a series of worships, including circumambulating the Kaaba, standing at the plain of Arafat, and stoning the devil at Mina. To ensure the safety and well-being of pilgrims, the Saudi government has implemented various measures to organize and manage the flow of pilgrims during the Hajj days, which involves implementing crowd control measures, providing transportation services, and ensuring that pilgrims follow the designated routes and schedules, providing medical and emergency services as well. ⁴

The Kingdom has studied the E-Management of Crowd closely and has even lunched many administrations for Crowd Management within the

ministry of Ministry of Hajj and Umrah, which conducts specialized studies of problems and crises relating pilgrims affaires, providing Numerous recommendations and suggestions based on expertise and familiarity with the personal experiences.. This has enabled the Kingdom to become a leader in crowd management according to all standards. **5**

The study holds great importance of E management in managing the crowds, thus shedding light on operations, digital applications, and networks and administrative efforts taken in the Kingdom in managing the hajj and umrah every year.

2. Crowd Management:

2.1. Crowd Management Definitions:

Crowd management can be defined as the process of planning, organizing, and directing the movement of people in a particular space to ensure safety, security, and orderliness. According to Stott and Reicher (1998), crowd management involves the management of social identity in order to reduce the potential for conflict and disorder. In addition, it involves the provision of appropriate information and communication to ensure that people are aware of the rules and regulations governing their behavior in a particular space.**6**

Another definition of crowd management is provided by Mullins (2003), who defines it as the process of planning, organizing, and directing the activities of individuals in a crowd to ensure their safety and well-being. This involves a range of activities, including the provision of adequate facilities, such as toilets and first aid stations, as well as the deployment of appropriate security personnel to maintain order. Similarly**7**, according to Fruin (1993), crowd management involves the design and management of spaces in such a way as to minimize congestion and ensure the efficient movement of people.**8** other authors such as Evers (2004) and Quarantelli (2005) emphasize the importance of communication and information sharing in effective crowd management, particularly in emergency situations. Overall, crowd management involves a range of activities and strategies aimed at ensuring the safety, security, and well-being of individuals in a particular space.**9**

The first subtitle opens with an introduction that presents the specific problem under study and describes the research strategy. The first subtitle opens with an introduction that presents the specific problem under study and describes the research strategy. The first subtitle opens with an introduction that presents the specific problem under study and describes the research strategy.

2.2. Specific Features of Crowds

Crowds are a unique and complex social phenomenon that exhibit specific features that distinguish them from other forms of social gatherings. These features have been extensively studied and documented by researchers in the field of crowd psychology. Some of the specific features of crowds are summarized in Table No. 1 below:

Table No. 1: Specific Features of Crowds

Feature	Description
Large numbers	Crowds typically consist of a large number of people, which can range from a few hundred to tens of thousands. This large number of people can create challenges for crowd management, including issues related to congestion and safety
Anonymity	In a crowd, individuals can often remain anonymous, which can lead to a sense of reduced accountability and increased risk-taking behavior. This anonymity can also make it difficult for crowd management personnel to identify and respond to potential threats or incidents
Emotional contagion	Crowds can be highly emotive and can exhibit emotional contagion, where individuals can quickly adopt the emotions of those around them. This can lead to the rapid spread of emotions, including fear, panic, and excitement, which can impact crowd behavior and management.
Lack of	Crowds are typically informal and lack formal

formal organization	organizational structures. This can make it difficult for crowd management personnel to communicate with and control the crowd effectively
Diversity	Crowds can be diverse, consisting of individuals from different backgrounds, cultures, and social groups. This diversity can create opportunities for conflict and misunderstandings, which can impact crowd behavior and management
Temporary nature	Crowds are often temporary in nature, gathering for specific events or occasions. This can create challenges for crowd management, as personnel may have limited time to plan, organize, and respond to potential incidents or emergencies

Source: Prepared by authors depending on: Franzoni, V., Biondi, G., & Milani, A. (2020). Emotional sounds of crowds: spectrogram-based analysis using deep learning. Multimedia tools and applications, 79(47-48), 36063–36075.

2.3. Crowd Size Categories:

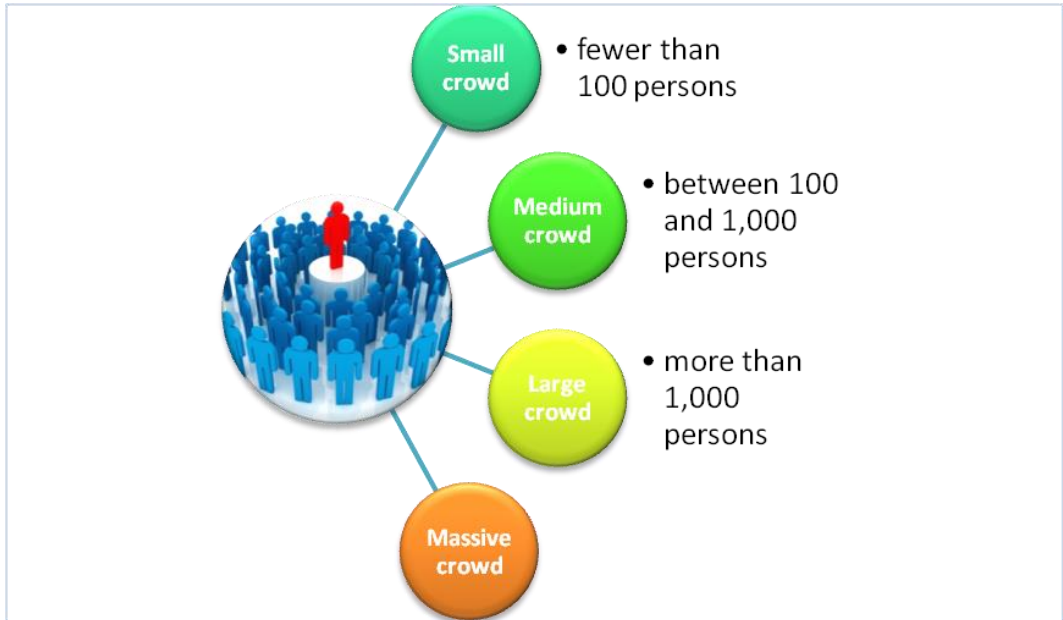
Generally, there are four primary classifications of crowds, which can be outlined as follows:**10**

- **Small crowd:** A small crowd is typically defined as having fewer than 100 people. This type of crowd is often seen at local events, such as community festivals or town hall meetings.
- **Medium crowd:** A medium crowd is typically defined as having between 100 and 1,000 people. This type of crowd is often seen at larger events, such as concerts or sporting events.
- **Large crowd:** A large crowd is typically defined as having more than 1,000 people. This type of crowd is often seen at major events, such as political rallies or sporting championships.
- **Massive crowd:** A massive crowd is typically defined as having more than 100,000 people. This type of crowd is often seen at religious pilgrimages or political demonstrations.

It is important to note that these are just a general vision, and the specific definition of crowd size can vary depending on the context. For example, a small crowd at a sporting event might be considered a medium

crowd at a community festival. Below Figure illustrates the Crowd Size Categories.

Figure N1: Crowd Size Categories



Source: Prepared by researchers.

2.4. Effective Crowd Control Methods:

An effective crowd control method is crucial to maintaining public safety, preventing chaos, and ensuring a peaceful environment for everyone involved. There are three primary phases of an effective crowd control method: preparation, response, and post-event analysis.¹¹

- **The first phase is preparation:** This phase involves assessing the situation, identifying potential risks, and developing a comprehensive plan to manage the crowd. The plan should take into account factors such as the size of the crowd, the location of the event, the type of event, and the potential for incidents to occur.

The preparation phase also involves coordinating with other agencies, such as law enforcement, medical services, and event organizers, to ensure that everyone is on the same page and ready to respond if needed.

- **The second phase is response:** This phase involves implementing the plan developed in the preparation phase and responding to any incidents or emergencies that arise. The response phase requires:

- quick thinking,
- Effective communication,
- And the ability to adapt to changing situations.

It is essential to have a well-trained and well-equipped crowd control team that can handle any situation that arises. The response phase also involves monitoring the crowd and identifying any potential issues before they escalate into a more significant problem.

- **The third phase is post-event analysis:** This phase involves evaluating the effectiveness of the plan and identifying areas for improvement. The post-event analysis should include input from all stakeholders, including the crowd control team, event organizers, law enforcement, and medical services. The analysis should focus on identifying what worked well and what did not work well, and developing recommendations for future events.

3. E-management:

3.1. Definitions and Importance:

E-management refers to the use of electronic technologies to improve management practices in organizations. The concept involves the application of digital tools and platforms to manage and coordinate business operations, resources, personnel, and communication among managers and employees. According to scholars such as Eom, Lee, and Choi (2018), e-management involves the integration of electronic systems and processes into management practices with the aim of improving organizational performance and productivity. ¹²Similarly, Liu, Li, and Xu (2019) define e-management as the use of digital technologies to streamline management practices and increase efficiency. The adoption of digital technologies also enhances decision-making and improves customer satisfaction,¹³ as noted by Chen and Huang (2019). Additionally, Boulos and Hani (2020) highlight the use of electronic systems and processes to enhance organizational agility, responsiveness, and competitiveness. ¹⁴

According to the above definitions, it can be said that E-management is becoming increasingly important in today's digital age, as organizations seek to leverage its benefits; such as: **15**

- **Improved efficiency:** E-management tools and platforms can improve the efficiency of management practices by streamlining processes and reducing manual tasks.
- **Enhanced communication:** Electronic communication tools enable managers to easily communicate with employees and collaborate with other managers, regardless of location.
- **Better decision-making:** E-management tools can provide managers with real-time data and insights, enabling them to make more informed decisions.
- **Increased productivity:** By automating routine tasks and improving collaboration, e-management can boost productivity levels across an organization.
- **Greater agility:** E-management can help organizations respond more quickly to changing market conditions and customer demands, by providing real-time data and insights.
- **Improved customer satisfaction:** E-management can help organizations deliver better customer service by providing faster and more efficient service delivery.
- **Competitive advantage:** Organizations that adopt e-management practices can gain a competitive advantage by improving operational efficiency, productivity, and customer satisfaction.

3.2. Electronic Management Characteristics:

Electronic management refers to the use of digital systems and tools to manage and control various aspects of enterprise activities. here are some characteristics of electronic management:**16**

Figure n 2: characteristics of electronic management



Source: prepared by researchers

- **Automation:** One of the primary characteristics of electronic management is automation. Electronic systems can automate routine tasks and processes, such as data entry, record-keeping, and report generation. This can help to reduce errors, save time, and increase efficiency.

- **Integration:** Electronic management systems can integrate with other systems and devices, such as accounting software, inventory management systems, and customer relationship management (CRM) software. This allows for seamless data sharing and communication between different departments and stakeholders.

- **Centralization:** Electronic management systems can centralize data and information, making it easier for managers and employees to access and share information. This can help to improve collaboration and decision-making, as well as reduce the risk of data loss or duplication.

- **Scalability:** Electronic management systems can be scaled up or down as needed to meet the changing needs of a business. This makes it easier to

adapt to growth or changes in the market, without having to invest in new hardware or software.

- **Security:** Electronic management systems can provide robust security features, such as user authentication, data encryption, and access controls. This helps to protect sensitive data and prevent unauthorized access or data breaches.

- **Analytics:** Electronic management systems can provide valuable insights and analytics into business operations, such as sales trends, customer behavior, and inventory levels. This can help managers to make data-driven decisions and improve overall performance.

3.3. Shifting From Traditional To Electronic Management:

The shift from traditional management to electronic management has become increasingly common in recent years. The most important points can be presented briefly: **17**

- Saves time and effort by automating routine tasks.
- Reduces costs by eliminating paper-based processes and physical storage space.
- Improves collaboration and communication between departments and stakeholders.
- Provides robust security features to protect sensitive data.
- Provides valuable insights and analytics to make data-driven decisions.
- Offers flexibility and scalability to adapt to changing business needs.

3.4. Using Electronic Management Techniques in Crowd Management:

In recent years, technological advancements have revolutionized the way we approach crowd management, making it easier to manage large groups of people in a safe and efficient manner. Where companies and organizations are using various techniques to and manage crowds, and the most important of them are:

- **Using sensors and real-time data analysis:** By leveraging sensors placed throughout an event space, event planners can collect real-time data on the movement and behavior of attendees. This information can then be analyzed to identify potential bottlenecks, overcrowded areas. This allows

event planners to proactively adjust event plans and allocate resources to ensure that attendees are safe and comfortable.

- **Using mobile applications:** Mobile apps can be used to provide attendees with real-time updates on event information, schedules, and any changes to the event plan. They can also be used to provide attendees with personalized recommendations on where to go and what to do base on their interests and preferences. This not only enhances the attendee experience but also helps event planners manage crowds more effectively by guiding attendees to different areas of the event space.

- **utilize artificial intelligence (AI) and machine learning:** AI algorithms can be used to analyze real-time data from sensors and mobile apps to make predictions about crowd behavior and identify potential safety concerns. Machine learning algorithms can also be used to optimize crowd flow patterns and allocate resources more efficiently based on historical data.

4. RESULTS AND DISCUSSION

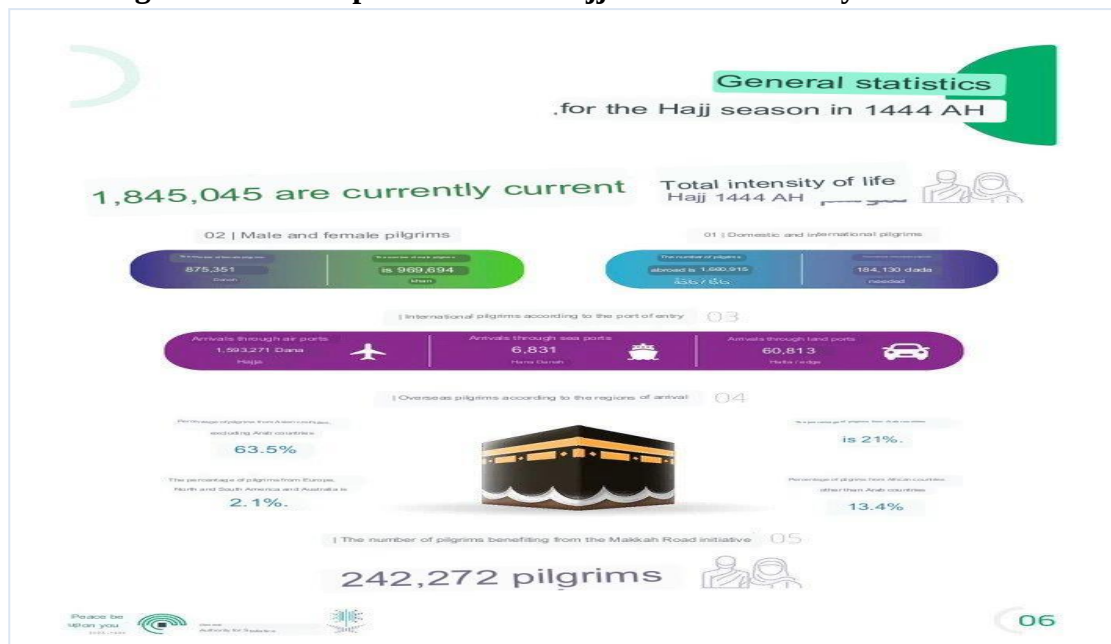
4.1 Hajj Statistics Metadata

According to exclusive statistics released by the Saudi General Authority for Statistics, the total number of pilgrims for the year 2023 reached 1.845 million, including 1.66 million pilgrims from abroad and 184.13 thousand pilgrims from within the country, comprising both citizens and residents.

The authority further revealed that out of the total number of pilgrims, 346.21 thousand pilgrims (21%) came from Arab countries, while 1.06 million pilgrims (63.5%) were from Asian countries. Additionally, 221.86 thousand pilgrims (13.4%) came from African countries and 36.52 thousand pilgrims (2.1%) came from Europe, America, Australia, and other unclassified countries.¹⁸

The Statistics Authority also reported that male pilgrims outnumbered female pilgrims, with 969.69 thousand male pilgrims and 875.35 thousand female pilgrims. In terms of arrival points for pilgrims from abroad, air ports were the most popular with 1.59 million pilgrims, followed by land ports with 60.81 thousand pilgrims, and sea ports with 6.83 thousand pilgrims.¹⁸

Figure n 3: Descriptive data for Hajj statistics for the year 2023



Source: Descriptive statistics for Hajj 2023, available at: <https://www.mubasher.info>

4.2. Nusuk platform:

The launch of the innovative "Nusuk" platform by the Ministry of Hajj and Umrah marks a significant milestone in the digital management of crowds during the annual Hajj pilgrimage. With its user-friendly interface and advanced features, the platform streamlines the arrival procedures for millions of pilgrims expected to perform the sacred rituals in 2023. **19**

By enhancing the quality of services provided to guests of Rahman and enriching their religious and cultural experience, Nusuk aligns with the ambitious goals of the Saudi Vision 2030 programs to promote sustainable development and modernization of the country's infrastructure and E-services

Figure n 4: Nusuk Platform

At your service 24/7

Communication channels before arriving to the Kingdom of Saudi Arabia		Communication channels after arriving to the Kingdom of Saudi Arabia	
Phone	00 966 9200 31201	Phone	00 966 9200 02814
Email	support@hajj.nusuk.sa	Email	care@haj.gov.sa
Social media	@Hajj_nusuk	Beneficiary Care Center on Twitter	@MOHUCare
Direct service	Through visa centers in targeted countries		

 **نُسُك حَجَّ**
Nusuk Hajj

► The platform serves pilgrims from Europe, the Americas, and Australia

► **hajj.nusuk.sa**
@Hajj_nusuk

Source: About Nusuk, available at: https://www.nusuk.sa/?gclid=Cj0KCQjwn_OlBhDhARIsAG2y6zONp4Pb0Ls1WmRrvXpuxIkVVG3qHLu082aVleRwBtkCNr2ITmSaMaAvp4EALw_wcB&gclsrc=aw.ds

Nusuk Hajj platform offers a convenient and efficient way for pilgrims from over 58 countries across Europe, America, and Australia to register, book, and make electronic payments for a variety of services.

These services include:¹⁹

- Accommodation,
- Sustenance,
- flights,
- Guidance,
- Transportation.

The platform also provides comprehensive information about the countries covered in the first stage of launch. With a user-friendly interface

and a wide range of features, the platform is designed to enable pilgrims to perform the Hajj rituals with ease and peace of mind. Whether you're a first-time pilgrim or a seasoned traveler, Nusuk Hajj has helped you.

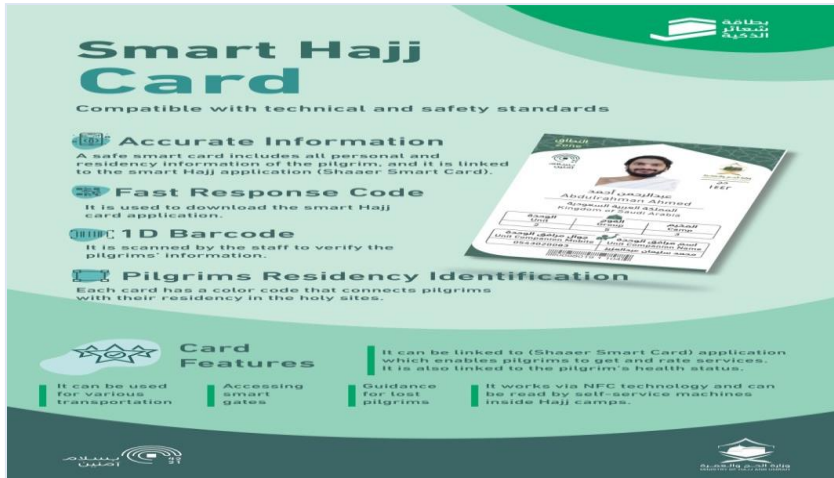
4.3 Hajj Smart Card:

As part of its digital solutions services for Hajj season, the Ministry of Hajj and Umrah through Nusuk platform has launched the Hajj Smart Card. this service aims to streamline procedures and facilitate crowds management (the pilgrims), and plays a crucial role in guiding lost individuals and facilitating communication with Hajj group leaders.²⁰

According to the ministry, there are two versions of the smart card. The digital version can be accessed through the Nusuk application and provides comprehensive information about the pilgrims, including their place of residence, health records, itinerary, and other services. mean while, The printed smart card, , includes details such as identity number, nationality, and the address of the pilgrimage company. Additionally, it features a QR response code. In addition the smart card offers various digital services, including: ²⁰

- Complaint submission,
- Service evaluation,
- And a map highlighting important sites.

Figure n 5: Smart Hajj Card



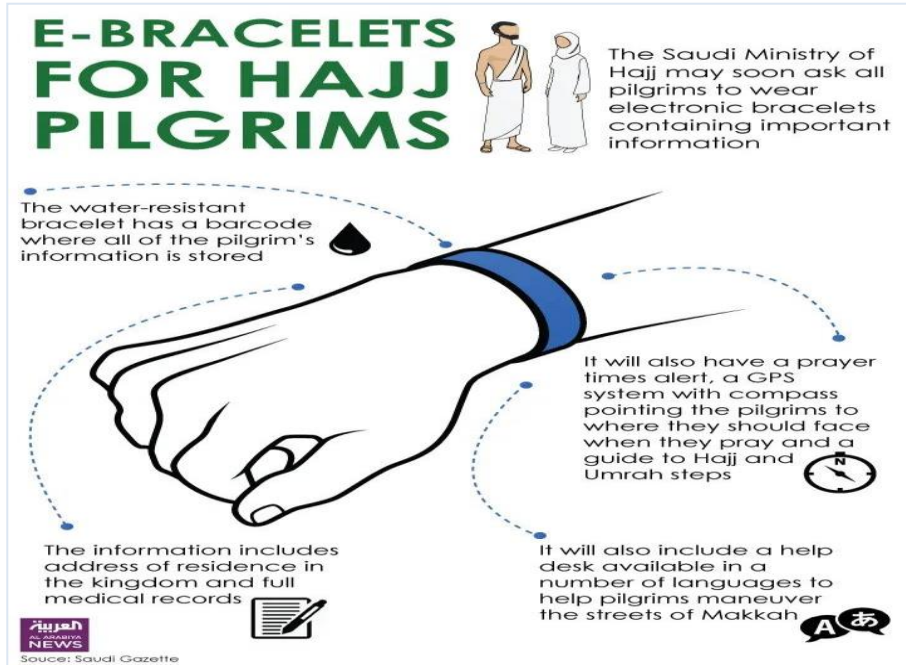
Source : Ministry of Hajj and Umrah, Ministry's digital transformation efforts streamline Hajj services, available at: <https://www.arabnews.com/node/2327856/saudi-arabia>

4.4 E-Bracelets for Hajj:

The Ministry of Hajj and Umrah has recently announced a groundbreaking initiative that is set to revolutionize the experience of the millions of pilgrims who flock to Makkah each year. As of this year, all hajj pilgrims will be provided with bracelets that contain personal and medical information, which will prove invaluable in ensuring that authorities can provide the necessary care and support, as well as identify individuals. **21**

The bracelets are also water-resistant and connected to GPS, allowing them to provide worshipers with vital information regarding the timings of prayers, and a multi-lingual help desk that will guide non-Arabic speaking pilgrims through the various rituals of the annual Islamic event. This innovative move by the Ministry of Hajj and Umrah is a major step towards enhancing the safety and well-being of all pilgrims, and is sure to be welcomed by the millions of Muslims who make the journey to Makkah each year.**21**

Figure n 6: E-Bracelets For Hajj



Source: AL ARABIYA NETWORK, bracelets for all hajj pilgrims, available at: <https://english.alarabiya.net/life-style/travel-and-tourism/2016/07/01/Hajj-safety-Saudi-Arabia-introduces-hi-tech-bracelets-for-all-pilgrims>

6. CONCLUSION

E-services management has transformed the way of interactive with enterprises, governments, and each other. From online shopping and banking to E-government services and telemedicine, as technology continues to advance at a rapid pace and the demand for digital solutions grows, E-services are poised to play an even more critical role in the management of crowds. This is particularly true when it comes to issues such as digital security, privacy, and accessibility, which are essential for ensuring that E-services can be used by everyone, regardless of their circumstances. The benefits of e-services in the field of crowd management are undeniable, as they have already proven to be effective in streamlining processes, improving communication, and enhancing safety and security,

whether it is managing crowds at large-scale events, hajj and umrah, or sports events.

Saudi Arabia authorities have been running the Muslim Hajj pilgrimage for the past 100 years, and where numbers reach up to 3 million pilgrims from 193 countries, including senior citizens, people with disabilities, and children in an area measuring 33 km² in only six days. furthermore, The Saudi Ministry of Hajj and Umrah administers a digital system of crowd management, under which dozens of departments are operating to execute certain tasks such as regulating traffic flow at the holy sites in Mina, Mount Arafah, Muzdalifah, and the Grand Mosque of Mecca, by controlling the movement of pilgrims, while providing E-services for pilgrims such digital application, websites, E-bracelets, smart cards.

Crowd management in Hajj is based on striking a balance between traditional and E-services, while taking high-precision cyber security precautions via using smart systems, high intelligence software, Artificial intelligence technologies and algorithms, Sensor thermal cameras, especially during the stoning of the devil ritual at Mina Valley over the course of three days in an area that does not exceed 5 km².

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