Fuzzy Systems and Soft Computing
ISSN : 1819-4362

CONTACTLESS GUEST EXPERIENCE: MODERNIZING THE HOTEL INDUSTY

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ABSTRACT Contactless guest experience in the hotel industry is on rise due to technological advancements and, in part, due to the pandemic. Due to growing awareness of the potential hazards associated with physical contact and touch, COVID-19 has significantly increased the popularity of contactless services. Because of this, hotels are putting more money into creative methods to provide visitors a hands-free experience. Numerous firms in the hotel sector have embraced new technologies over the past few years, including smartphone door locks, instant messaging, automated check-in and check-out, voice technology, digital concierge bots, keyless entry, etc. This technological intervention allows customers to have more control over their stay, while also making things easier for everyone. It is not only more convenient, saving the guests time but also makes them feel safer with a means to increase hoteliers revenue. In view of its growing importance, this paper discusses the attributes of contactless services, its application in hotel industry and overcoming challenges in its implementation.

1.INTRODUCTION The COVID-19 pandemic has caused fundamental and seismic changes in the hotel industry (Hao, 2021). The most significant of these are customers' concerns regarding social distancing, hygiene, and safety. The new normal for the future hotel industry has, therefore, shifted from "high-tech" and "high-touch" to "hightech" and "low-touch", thus making the contactless services necessary. Contactless services refer to "adoptions of Artificial Intelligence intended to provide face-to-face services in a seamless, intelligent and adaptive manner, and these services are sustained in the background by the related service organization and its employees, with no direct contact between customers and employees"(Lee & Lee, 2021). The core of contactless service in the hotel industry is the use of cutting-edge technology to avoid unnecessary human-tohuman touch and create the safest service experience for both clients and staff (Rahimizhian & Irani, 2020). Being customer-centered, the hotel industry is characterized by perishable, inseparable, intangible and simultaneous consumption. Therefore, designing an engaging customer experience is key to business success. Contactless hotel services create augmented sense-feel-think-act-relate experiences for customers, which in turn leads to customer satisfaction (Chen, Tzeng, Tham & Chu, 2021).To safeguard customers and employees, many hotels around the world have adopted contactless services, including mobile control (e.g., mobile check-in and check-out, digital payments, and digital menus), voice control (e.g., smart speaker TVs, AC, lighting, curtains), facial recognition (e.g., check-in, keyless entrance, payment),motion sensing (e.g., automatic doors, touchless elevators), robotic services (e.g., room service, concierge), to name a few (Gursoy & Chi, 2020; Hao et al., 2020; Hao, 2021). Today visitors not only demand but also expect contactless transactions. McKinsey (2022) found that "the United States has seen a 20% increase in preference for contactless operations," resulting in a significant

change in what customers anticipate from businesses.Criton's research highlights that 80% of travellers would download a hotel app that would enable them to check in, acquire all the information they require, and check out. Further, research reveals that 47% of travellers would be more likely to order room service via an application, and 48% would be more likely to use the hotel restaurant if they could order food via an application. Moreover, 73% of travellers would use an application that allows them to open the door to their hotel room, 30% would check-in and out via a web page, and 47% would be more likely to order room service via an application. ("Contactless Guest Experience as the Future of Hospitality", 2022). Thus, contactless hotels are expected to become a standard in the travel and hospitalityindustry. The concept of contactless service is not new, and numerous contactless technologies, including selfservice, robotic services, and the internet of things, existed long before the pandemic. However, these technologies have been redesigned to focus on the contactless feature across the customer journey in response to the present pandemic threat(Rosenbaum & Wong, 2015; Wu & Cheng, 2018; Kim & Han, 2020). But there is a limited research on the newly emerged contactless services in hotel industry (Gursoy et al., 2020; Min, 2020; Hao & Chon, 2021; Kim, Kim & Hwang, 2021). Therefore, this paper is a modest attempt to the understanding of contactless servicesin hotel industry.

2. LITERATURE SURVEY

A)A. Sardar, S. Umer, R. K. Rout, S. H. Wang, and M. Tanveer, "A secure face recognition for IoT-enabled healthcare system," ***ACM Transactions on Sensor Networks, vol. 19, no. 3, pp. 1-23, 2023.***

The paper presents a comprehensive study of integrating facial recognition technology into an IoT-enabled healthcare system, emphasizing the need for enhanced security and privacy in healthcare settings. In modern healthcare systems, safeguarding patient data and ensuring secure access to health-related information have become crucial, especially with the rise of IoT-connected devices that continuously collect patient data. This study aims to address these concerns by proposing a secure face recognition-based authentication system that leverages IoT for healthcare applications.The authors design a secure IoT-based healthcare system that utilizes facial recognition to authenticate users, particularly healthcare professionals, patients, and visitors. The system consists of several components, including a face recognition module, an IoT network that collects and transmits healthcare data, and a secure cloud platform for data storage and processing. The facial recognition system ensures that only authorized individuals, such as doctors or nurses, can access sensitive medical data.The proposed system integrates multiple layers of security to ensure data confidentiality and integrity. It employs advanced encryption techniques for data transmission and uses biometric data as a means of secure user authentication. The system's IoT-enabled design allows for the remote monitoring of patients, enabling healthcare providers to access patient data securely from any location, improving patient care and overall system efficiency.One of the key challenges addressed in this paper is the need to maintain patient privacy while leveraging facial recognition technology. Facial recognition systems inherently raise privacy concerns, particularly with regard to the collection, storage, and usage of sensitive biometric data. The authors discuss how these concerns are mitigated by implementing robust security measures, such as encryption, anonymization, and secure cloud storage. Moreover, the system complies with relevant healthcare privacy regulations, including HIPAA (Health

Insurance Portability and Accountability Act), ensuring that patient data is not exposed to unauthorized individuals.The performance of the proposed system is evaluated through simulations and real-world implementations. The system's face recognition accuracy is tested in various environments, including low-light conditions, and against different demographic groups to ensure that it works reliably across diverse scenarios. The authors report that the system achieves high recognition accuracy, low false positive rates, and rapid authentication times, making it an efficient solution for healthcare environments.The paper concludes that IoT-enabled face recognition systems can significantly enhance security and privacy in healthcare applications, ensuring that sensitive patient data is only accessible to authorized individuals. It also highlights potential areas for future research, including the integration of AI-based analytics for improved decision-making, and the development of more advanced encryption techniques to further enhance data security.

B)M. Rajmohan, C. Srinivasan, O. R. Babu, S. Murugan and B. S. Kumar Reddy, "Efficient Indian Sign Language Interpreter For Hearing Impaired," *Second International Conference On Smart Technologies For Smart Nation, pp. 914-917, 2023.*

This paper proposes a novel solution for interpreting Indian Sign Language (ISL) through a machine learning-based system. The system aims to bridge communication gaps for individuals with hearing impairments by translating sign language gestures into comprehensible text or speech. The authors focus on creating a more efficient and accurate Indian Sign Language interpreter by leveraging computer vision and deep learning algorithms.Communication is a fundamental human need, and for individuals with hearing impairments, sign language is a vital medium of interaction. However, there is a scarcity of reliable and real-time ISL interpretation tools, especially in the Indian context where regional variations exist. The lack of such tools often leads to social isolation and communication barriers for hearing-impaired individuals. This paper addresses these challenges by proposing a system that can automatically interpret ISL gestures, offering real-time communication solutions for the hearing impaired.The proposed ISL interpreter system uses a combination of computer vision, deep learning, and gesture recognition techniques. The system captures hand gestures using a camera and processes the visual input using a deep convolutional neural network (CNN). The CNN is trained on a large dataset of ISL gestures, enabling the system to recognize and classify individual signs with high accuracy. Once the gesture is recognized, the system translates it into corresponding text or voice output, which can be understood by individuals without knowledge of sign language.To improve the accuracy of gesture recognition, the authors use data augmentation techniques, including varying lighting conditions, backgrounds, and hand positions. This ensures that the system performs well in different real-world environments. The system also integrates a feedback loop, where the user can correct the system's output, thereby improving its performance over time.The system is evaluated using a diverse dataset of ISL signs, which includes gestures from various Indian states, ensuring that regional variations are taken into account. The system achieves high recognition accuracy, with minimal latency in translating sign language gestures into text or speech. The authors also perform a user study with individuals from the hearing-impaired community to assess the system's usability and effectiveness. The feedback from users is overwhelmingly positive, with the system being

described as intuitive, fast, and reliable.The authors conclude that their proposed Indian Sign Language interpreter system offers a promising solution to the communication barriers faced by individuals with hearing impairments. The system's use of deep learning for gesture recognition ensures high accuracy, while the real-time translation of gestures into text or speech makes it highly effective for everyday communication. Future work will focus on expanding the system's capabilities to handle more complex sentences, integrating it into mobile platforms for wider accessibility, and enhancing its robustness to handle various environmental conditions.

C)V. Sharma, S. Srinivasan, C.S. Ranganathan, N. Latha, and G. Elavel Visuvanathan, "Real-time Monitoring of Women's Safety Through Bluetooth Low Energy and iBeacons," *Second International Conference on Smart Technologies for Smart Nation*, pp. 1282-1287, 2023.

In recent years, ensuring the safety of women in public spaces has become a critical concern. This study addresses these concerns by proposing a real-time monitoring system that utilizes Bluetooth Low Energy (BLE) technology and iBeacons to track and ensure the safety of women. The system is designed to function in real time, providing instant alerts to pre-configured contacts or authorities in case of any emergency.The use of BLE for monitoring offers several advantages, primarily its energy efficiency and widespread compatibility with mobile devices. iBeacons, a form of BLE-enabled device, are strategically placed in various locations, such as public transport systems, shopping malls, parks, and other public areas. These beacons emit signals that can be detected by mobile devices, such as smartphones or smartwatches, worn by the user. When a person enters or exits a predefined zone, such as a shopping mall or a street corner, the beacon detects the person's presence and triggers an event.The system works by pairing BLE devices, such as smartphones, with iBeacons. The Bluetooth-enabled devices continuously monitor the location of the user, which helps in tracking their movement within a specific range. Each iBeacon has a unique identifier and broadcasts it periodically, which is then detected by the smartphone application. As the user moves around, the app continuously updates their location within a virtual map of the area. This real-time location tracking ensures that the safety of women can be monitored without any active input from the user.In emergency situations, the system can send automated alerts. For example, if a woman feels unsafe or is in distress, she can press a button on her mobile device or initiate an emergency signal through the app. This will trigger an alarm, notifying the nearest authorities or pre-configured emergency contacts with the woman's real-time location. The ability to quickly alert others can drastically reduce response times and increase the chances of timely intervention.The system also includes a feature for tracking the route of the individual. It logs the user's movements from the moment they activate the system, allowing for the monitoring of their entire journey. This feature is especially useful if the individual goes off-course or into an area that is not safe. This log can be accessed by emergency responders or the authorities for investigation.Another notable feature of the system is its integration with existing public safety networks, such as surveillance cameras and emergency response units. By linking BLE-based monitoring to citywide safety infrastructure, the system enhances the overall effectiveness of public safety. This integration can also help predict potentially dangerous situations based on the tracked data, such as unusual movements or patterns that could indicate a threat.Moreover, the use of BLE and iBeacons ensures that the system is both cost-

effective and scalable. BLE devices are relatively inexpensive and require minimal power, making them ideal for widespread deployment. Since iBeacons do not require constant interaction, the system operates passively, meaning the user does not need to actively engage with it unless in an emergency. This also reduces the likelihood of the system being deactivated by the user, ensuring that it remains functional at all times.The real-time nature of the monitoring system provides significant advantages in ensuring the safety of women. It offers immediate alerts and provides authorities with accurate, real-time data to assess and respond to situations swiftly. The integration of Bluetooth Low Energy and iBeacons allows the system to be highly flexible, as it can be deployed in various settings and adapted to different geographic locations. The system can be expanded to cover larger urban areas, ensuring comprehensive coverage for women across multiple regions.In addition to enhancing safety, the system can also be used to analyze movement patterns over time. This feature can be used to identify areas where incidents are more likely to occur, providing valuable data for urban planning and the allocation of safety resources. Authorities can use the information to better deploy surveillance equipment or increase the presence of law enforcement in high-risk areas.However, the system also faces several challenges, particularly related to privacy concerns. Since the system tracks the user's location in real-time, there must be strict regulations in place to ensure that this data is not misused. Users must have full control over their data, including the ability to delete or modify their information at any time. Additionally, the system should ensure that the data is encrypted and transmitted securely to prevent unauthorized access.Despite these challenges, the system holds significant promise for improving women's safety in public spaces. By combining the power of Bluetooth Low Energy and iBeacons with real-time tracking and emergency alert features, the system offers an innovative solution to a pressing social issue. Its ease of use, combined with its cost-effectiveness and scalability, makes it an ideal tool for ensuring that women can move through public spaces with greater confidence and security.In conclusion, this system represents a step forward in leveraging technology to enhance public safety. With its ability to provide real-time monitoring, emergency alerts, and integration with public safety networks, it has the potential to revolutionize how women’s safety is managed in urban environments. As cities and communities continue to embrace smart technologies, systems like this can become integral parts of modern public safety infrastructure, contributing to safer, more secure environments for everyone

3. SYSTEM DESIGN

3.1. EXISTING SYSTEM

The embedded system using image processing for instantaneous access to a patient's medical history is discussed in. It has become inconvenient for every medical record on each doctor's appointment; thus, most modern healthcare facilities now require patients to provide a unique identifier before accessing their records online. In this article, we forego using a serial number and instead rely on facial recognition. Knowing patients' medical histories is helpful in critical care settings. The suggested system uses a Raspberry Pi as the central processing unit and a camera to acquire facial data. Face recognition establishes a person's identity in a still image or a single video frame. To identify an individual from a photo, face recognition systems often use a database of pictures of people and compare those pictures to the images. Face recognition technology is ubiquitous today, used in everything from banking software to identify

individual customers to traffic cameras to identify lawbreakers.

3.2. PROPOSED SYSTEM

The system aims to improve the hotel business by integrating IoT devices with OpenCV-based face recognition technology to provide contactless guest services and strong identity verification. Facial biometrics are used to identify and verify guests, doing away with the need for physical identification documents and allowing for personalized services to be provided safely and conveniently, all of which contribute to the system's goals of optimizing guest check-in processes, improving operational efficiency, enhancing guest experiences, and increasing security.

4.IMPLEMENTATION

4.1. BLOCK DIAGRAM

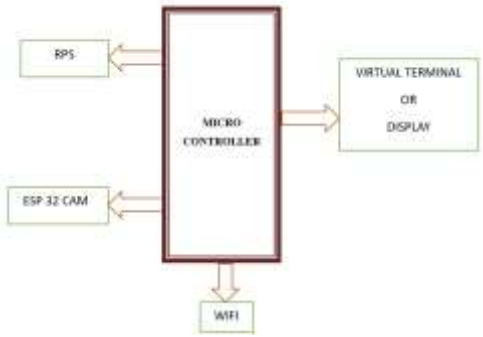

Fig : Block Diagram

4.2. DESCRIPTION

REGULATED POWER SUPPLY:

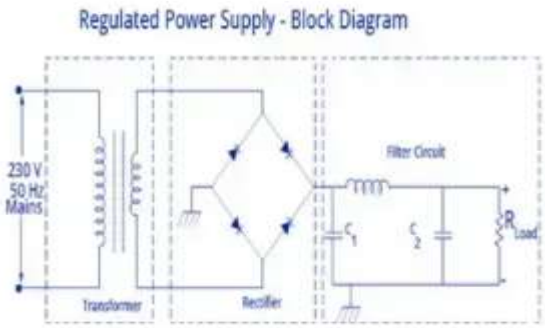

Fig : Regulated Power Supply Diagram

- **Regulated Power Supply Definition**: A regulated power supply ensures a consistent DC output by converting fluctuating AC input.
- **Component Overview**: The primary components of a regulated power supply include a transformer, rectifier, filter, and regulator, each crucial for maintaining steady DC output.
- **Rectification Explained**: The process involves diodes converting AC to DC, typically using full wave rectification to enhance efficiency.
- **Filter Function**: Filters, such as capacitor and LC types, smooth the DC output to reduce ripple and provide a stable voltage.
- **Regulation Mechanism**: Regulators adjust and stabilize output voltage to protect against input changes or load variations, essential for reliable power supply

ARDUINO

The Arduino is a family of microcontroller boards to simplify electronic design, prototyping and experimenting for artists, hackers, hobbyists, but also many professionals. People use it as brains for their robots, to build new digital music instruments, or to build a system that lets your house plants tweet you when they’re dry. Arduinos (we use the standard Arduino Uno) are built around an ATmega microcontroller — essentially a complete computer with CPU, RAM, Flash memory, and input/output pins, all on a single chip. Unlike, say, a Raspberry Pi, it’s designed to attach all kinds of sensors, LEDs, small motors and speakers, servos, etc. directly to these pins, which can read in or

output digital or analog voltages between 0 and 5 volts. The Arduino connects to your computer via USB, where you program it in a simple language (C/C++, similar to Java) from inside the free Arduino IDE by uploading your compiled code to the board. Once programmed, the Arduino can run with the USB link back to your computer, or stand-alone without it — no keyboard or screen needed, just power.

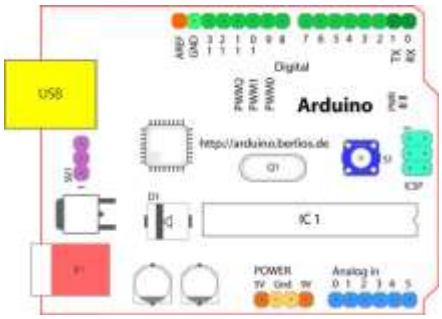

Fig: Structure of Arduino Board

ESP32

ESP32 is a single 2.4 GHz Wi-Fi-and-Bluetooth combo chip designed with the TSMC ultra-low-power 40 nm technology. It is designed to achieve the best power and RF performance, showing robustness, versatility and reliability in a wide variety of applications and power scenarios. The ESP32 series of chips includes ESP32-D0WD-V3, ESP32-D0WDQ6-V3, ESP32-D0WD, ESP32-D0WDQ6, ESP32-D2WD, ESP32-S0WD, and ESP32-U4WDH, among which, ESP32-D0WD-V3, ESP32-D0WDQ6-V3, and ESP32-U4WDH are based on ECO V3 wafer

ESP32 INTEGRATED CAMERA

Overview

- The ESP32-CAM is a small size, low power consumption camera module based on ESP32. It comes with an OV2640 camera and provides onboard TF card slot.
- The ESP32-CAM can be widely used in intelligent IoT applications such as wireless video monitoring, WiFi image upload, QR identification, and so on.

Features

- Onboard ESP32-S module, supports WiFi + Bluetooth
- OV2640 camera with flash
- Onboard TF card slot, supports up to 4G TF card for data storage
- Supports WiFi video monitoring and WiFi image upload
- Supports multi sleep modes, deep sleep current as low as 6mA
- Control interface is accessible via pinheader, easy to be integrated and embedded into user products

ESP8266 WI-FI MODULE:

In 2014, an ESP8266 Wi-Fi module was introduced and developed by third-party manufacturers like AI thinkers, which is mainly utilized for IoT-based embedded applications development. It is capable of handling various functions of the Wi-Fi network from another application processor.

It is a SOC (System On-chip) integrated with a TCP/IP protocol stack, which can provide microcontroller access to any type of Wi-Fi network. This article deals with the pin configuration, specifications, circuit diagram, applications, and alternatives of the ESP8266 Wi-Fi module.

What is the ESP8266 Wi-Fi Module?

An ESP8266 Wi-Fi module is a SOC microchip mainly used for the development of end-point IoT (Internet of things) applications. It is referred to as a standalone wireless transceiver, available at a very

low price. It is used to enable the internet connection to various applications of embedded systems.

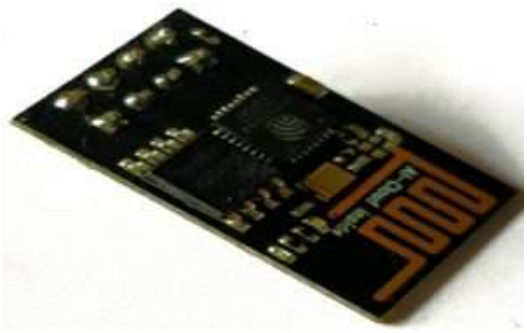

Fig ESP8266 Wi-Fi Module

WORKING

The system is based on a combination of innovative technology designed to completely transform the hospitality industry. The latest technique uses face recognition powered by OpenCV and the IoT to provide visitors with safety and comfort. The system's heart combines cameras and IoT devices to gather and analyze face pictures. This eco system like network was built to facilitate check-in, increase safety measures, and improve passenger satisfaction. The underlying concept develops over a series of interrelated steps:

- The procedure starts when a visitor enters the hospitality. When visitors enter a room, activate the cameras to take their images. These cameras are stationed in prominent locations like lobby entrances and check-in counters for maximum coverage. Through the underlying IoT infrastructure, the collected images are quickly transferred to a central processing unit. High-quality cameras are placed at key locations throughout the hospitality, such as the front desk, the lobby, and the parking lot.
- Guests' faces as they approach the venue are captured by these cameras and used as training data for facial recognition software. Once data reaches the central processing unit, it is processed using OpenCV's robust computer vision capabilities. The first process, called facial detection, entails the computer finding the face in the picture. Algorithms that identify a user's unique facial landmarks are used for this challenging endeavor. After a face is specified, the system extracts its unique traits to create a mathematical representation called face embedding.
- The system's face recognition features are crucial to its operation. The face embeddings are analyzed and compared to a guest profile database connected to existing facial templates. The system analyzes the identified face traits to see whether they correspond to any of the templates in the database using advanced algorithms. This method uses machine learning to adapt to different camera angles, lighting conditions, and facial emotions.
- After a suitable match has been located, the system's ability to make decisions at the moment becomes useful. The system initiates predetermined procedures based on the guest's profile. If the identification is successful, the system may unlock the guest's door, play a custom welcome video, or send a notification to the front desk. These exchanges take place in real time, elevating the experience for the visitor and optimizing business processes. To protect private information during transit and storage, the system uses encryption techniques.
- Images of guests are converted into face embeddings to protect their privacy. Visitors and other interested parties may be

certain their data is protected to the greatest possible standards. The system evolves and improves as different visitors use it. The technology enhances accuracy with time, making it possible to cater to various people and situations. This self-improving learning mechanism will eventually grow to produce consistently accurate recognition results.

- Access control measures may include key card access or human verification of the visitor's identification. To prevent interruptions in service to customers in the event of a system breakdown or inaccuracy, many businesses use redundancy systems. The system's primary goal is guest identification and authentication, but it has other uses beyond the check-in process. It may be incorporated into the visitor experience, from customized room settings to amenity access management and preference-based marketing.

CONCLUSION

The demand for contactless services has increased as hotels worldwide attempt to equip its personnel and provide a smooth, enhanced guest experience with modern contactless technologies. The contactless service trend is essential for guests to have a pleasant service experience by shortening the purchase path from the customer perspective while simultaneously giving the hotel competitive edge over others. Against this backdrop its imperative that hotels are able to deliver services by blending digital amenities with traditional human services. In this regard, hoteliers should look into various points of contact between staff and guests to map out areas where contactless technology could be applied to reduce exposure while simultaneously preserving the brand's uniqueness. In conclusion, as technology is replacing conventional service delivery techniques, contactless services in hotels in becoming a new standard for customers expecting best experience with less friction and hassle.

[1] A. Sardar, S. Umer, R. K. Rout, S. H. Wang, and M. Tanveer, "A secure face recognition for IoT-enabled healthcare system," *ACM Transactions on Sensor Networks*, vol. 19, no. 3, pp. 1-23, 2023.

[2] M. Rajmohan, C. Srinivasan, O. R. Babu, S. Murugan, and B. S. Kumar Reddy, "Efficient Indian Sign Language Interpreter For Hearing Impaired," *Second International Conference On Smart Technologies For Smart Nation*, pp. 914-917, 2023.

[3] V. Sharma, S. Srinivasan, C.S. Ranganathan, N. Latha, and G. Elavel Visuvanathan, "Real-time Monitoring of Women's Safety Through Bluetooth Low Energy and iBeacons," *Second International Conference On Smart Technologies For Smart Nation*, pp. 1282-1287, 2023.

[4] S. Valarmathy, K. Radhika, K. Bashkaran, S. Selvarasu, and C. Srinivasan, "Intelligent Baggage Management in Airports: A Cognitive IoT Approach for Real-Time Tracking, Optimization, and Passenger Engagement," *7th International Conference on Electronics, Communication and Aerospace Technology*, pp. 1876-1880, 2023.

[5] T.R. Saravanan, A.R. Rathinam, J. Lenin, A. Komathi, B. Bharathi, and S. Murugan, "Revolutionizing Cloud Computing: Evaluating the Influence of Blockchain and Consensus Algorithms," *3rd International Conference on Smart Generation Computing, Communication and Networking*, pp. 1-6, 2023.

[6] M. Santhanalakshmi, S. Dhanalakshmi, M. Radhika, G. Kavitha, G. Elavel Visuvanathan, and C. Srinivasan, "IoT Enabled Wearable Technology Jacket for Tracking Patient Health and Safety System," *Second International Conference On*

Smart Technologies For Smart Nation, pp. 918-922, 2023.

[7] R. Krishna Vanakamamidi, L. Ramalingam, N. Abirami, S. Priyanka, C. S. Kumar, and S. Murugan, "IoT Security Based on Machine Learning," *Second International Conference On Smart Technologies For Smart Nation*, pp. 683-687, 2023.

[8] R. Raman, C. J. Rawandale, R. Meenakshi, S. Jayaprakash, R. Latha, and C. Srinivasan, "Real-Time Video Management System for Robotic Waste Sorting and Recycling Using IoT and Machine Learning," *Second International Conference On Smart Technologies For Smart Nation*, pp. 227-232, 2023.

[9] P. Santhuja, S. Srinivasan, C.S. Ranganathan, and N. Latha, "Route Stability with Node Reliability-Based Auto Reconfiguration in Wireless Mesh Network," *Second International Conference On Smart Technologies For Smart Nation*, pp. 1271-1275, 2023.

[10] U. Shamova, "Face recognition in healthcare: general overview," *Language in the sphere of professional communication*, pp. 748-752, 2020.

[11] S. Srinivasan, R. Raman, C.B. Thacker, and A. Shrivastava, "Smart Crosswalk Management with Vehicle-to-Pedestrian Communication," *International Conference on Sustainable Communication Networks and Application*, pp. 992-997, 2023.

[12] V. K. Verma, V. Kansal, and P. Bhatnagar, "Patient Identification using Facial Recognition," *International Conference on Futuristic Technologies in Control Systems and Renewable Energy*, pp. 1-7, 2020.

[13] B. Varshini, H. R. Yogesh, S. D. Pasha, M. Suhail, V. Madhumitha, and A. Sasi, "IoT-Enabled smart doors for monitoring body temperature and face mask detection," *Global Transitions Proceedings*, vol. 2, no. 2, pp. 246-254, 2021.

[14] R. Raman, L. Ramalingam, K. Kishorbhai Sutaria, M. Kamthan, S. Sangeetha, and S. Murugan, "Smart Warehouse Solutions for Efficient Onion Buffer Stock Management System," *7th International Conference on Electronics, Communication and Aerospace Technology*, pp. 1260-1265, 2023.

[15] J. W. Lin, M. H. Lu, and Y. H. Lin, "A Contactless Healthcare System with Face Recognition," *4th International Conference on Intelligent Green Building and Smart Grid*, pp. 296-299, 2019.