IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

HEALTH CARE MONITORING SYSTEM FOR CARDIAC DISEASE USING ARTIFICIAL INTELLIGENCE

J.Gowtham[1], A.Purushotham[2], A.Vishnu Vardhan[3], Dr.T.Kiruba Devi[4] , Dr.M.Manikandan[5], Dr P,Dinesh Kumar[6]

[1,2,3]Student, Department of Computer Science and Engineering (Artificial Intelligence), Dr.M.G.R Educational andResearch Institute, Tamilnadu, India.

[4,5,6] Assistant professor, Department of Computer Science and Engineering (Artificial Intelligence), Dr.M.G.R Educational and Research Institute, Tamilnadu, India.

ABSTRACT

This paper presents an innovative solution for Monitoring Cardiac disease using Thingspeak App ,Artificial Intelligence and advanced sensors. Users can easily check their ECG readings,Heart Beat and Temparature by staying home.Detecting cardiac diseases early and providing ongoing monitoring by clinicians has the potential to decrease mortality rates. Nevertheless, achieving precise detection of heart conditions in every instance and providing round-the-clock consultation by a physician is impractical due to the additional intelligence, time, and expertise required. An alternative strategy involves gathering data from IoT devices and electronic medical records linked to patient histories, which are then transmitted to predictive analytics platforms stored in the cloud.

KEYWORDS: Electrocardiagram(ECG),Remote monitoring,Heartrate,Bloodpressure,EDAsensor, DHT11sensor, Health telemetry

1. INTRODUCTION

Rapid technological advancements have ushered in a new era of interconnected progress, driven by the innovative Internet of Things (IoT) technology. The term "Internet" denotes the communication technique, while "Things" encompasses a wide array of devices equipped with wireless sensors, software, electronics, actuators, and interconnected networks. IoT empowers these devices to gather and exchange information seamlessly, often with minimal human intervention. It effectively transforms ordinary objects into intelligent entities through network connectivity. With IoT, physical and computational systems can communicate and collaborate extensively, facilitating efficient data exchange. Through IoT infrastructure, interconnected objects can be remotely monitored, detected, and managed, thereby streamlining user tasks. This paradigm shift revolutionizes the approach governments take to interconnectivity and the establishment of industry and production processes.

In response to the demand for enhanced living standards, people in the modern world have increasingly sought high-quality assistance within their living environments. Consequently, numerous organizations and businesses have explored the advantages of implementing IoT applications to create a new network of interconnected objects in consumers' daily lives. As a result, all sectors of industrial progress are urged to maintain a steady pace to meet these demands and contribute to the global improvement of living standards. The healthcare sector, in particular, plays a crucial role in ensuring worldwide safety as it directly impacts human life. However, health systems worldwide face unprecedented financial, social, and environmental challenges. The adoption of innovative IoT technologies holds the potential to enhance the healthcare industry and address these challenges effectively.

The integration of IoT technologies, including cloud computing and mobile sensors, offers a promising solution to address various limitations associated with data processing, storage, accessibility, security, and distribution. While IoT has not been extensively utilized in monitoring health and safety (H&S) products, it has found widespread application in various aspects of the healthcare industry, such as monitoring patients' health status, blood pressure, and electrocardiogram (ECG) readings. In the healthcare sector, numerous H&S products require regular inspection by facility managers. However, managers often face challenges in accurately assessing the usage of each device, leading to the inefficient allocation of resources. Consequently, this process demands significant time, effort, and financial investment, as well as a substantial workforce to manage effectively.

To address these challenges and ensure compliance with regulatory standards, it is imperative to implement an innovative monitoring system built upon IoT infrastructure. Such a system enables remote construction, operation, and control of health and safety (H&S) products via a network, facilitating the analysis and exchange of data with cloud support. This approach simplifies processes, accelerates operations, and reduces costs, making IoT a preferred solution within the healthcare industry. Consequently, healthcare organizations worldwide have transitioned into efficient, interoperable, and coordinated systems, enhancing overall effectiveness and responsiveness.

To ensure that health and safety devices meet regulatory standards for continuous daily use, this approach involves monitoring changes in weight, level, and battery status. The collected data are then stored and analyzed in the cloud to make informed decisions. Smart sensors play a crucial role in gathering data from these devices, enabling the monitoring of various facility statuses in real-time.

As a result of the proposed smart monitoring system, various workplaces can be monitored simultaneously, offering benefits to building service managers and customers, particularly in hospital settings. Information and communication technology (ICT) plays a pivotal role in achieving efficiencies and enhancing health and safety (H&S) facility systems to meet diverse and frequent update requests. Leveraging the IoT framework, building service managers can secure contracts for multiple facilities, ensuring that all equipment is readily available and avoiding disruptions in daily operations. Consequently, customers receive prompt and reliable service. Hospitals can mitigate risks and safeguard the well-being of patients and staff by identifying H&S devices that are critically low or non-compliant with regulatory standards, thereby ensuring compliance and enhancing overall safety measures.

2. LITERATURE REVIEW

The literature review reveals a wealth of research on disease prediction systems utilizing various data mining techniques and machine learning algorithms in medical settings.

Polaraju et al. [7] introduced a heart disease prediction model employing a Multiple Regression Model, demonstrating the efficacy of Multiple Linear Regression in forecasting heart disease likelihood. Their study utilized a training dataset comprising 3000 instances with 13 attributes, partitioned into 70% for training and 30% for testing. The results indicate that the Regression algorithm exhibits superior classification accuracy compared to other methods.

Marjia et al. [8] developed a heart disease prediction system utilizing KStar, J48, SMO, and Bayes Net, as well as Multilayer Perceptron through WEKA software. Through k-fold cross-validation, SMO and Bayes Net demonstrated optimal performance compared to KStar, Multilayer Perceptron, and J48 techniques. However, the accuracy levels achieved by these algorithms were deemed unsatisfactory, prompting the need for further improvement to enhance diagnostic decisions.

Seema et al. [9] investigated techniques for predicting chronic diseases by analyzing historical health records using Naïve Bayes, Decision Trees, Support Vector Machine (SVM), and Artificial Neural Network (ANN). A comparative study of these classifiers revealed SVM's highest accuracy rate overall, while Naïve Bayes performed best for diabetes prediction.

Dwivedi et al. [10] recommended various algorithms, including Naive Bayes, Classification Tree, KNN, Logistic Regression, SVM, and ANN, for disease prediction. Their findings highlighted Logistic Regression's superior accuracy compared to other algorithms. Shahi et al. [11] proposed a Heart Disease Prediction System employing Data Mining Techniques, utilizing WEKA software for automated disease diagnosis and enhancing healthcare center services.

These studies underscore the importance of employing advanced data mining techniques and machine learning algorithms to improve disease prediction accuracy and enhance healthcare outcomes.

3. DESIGN AND ARCHITECTURE DESIGN OF THE SYSTEM

This section provides an overview of the proposed system and outlines the components, techniques, and tools utilized in its development. In order to create an intelligent and user-friendly heart disease prediction system, an efficient software tool is essential for training large datasets and evaluating multiple machine learning algorithms. The system will be implemented through the development of a smartphone-based application designed to detect and predict heart disease risk levels.

In addition to software components, hardware elements such as Arduino or Raspberry Pi, various biomedical sensors, a display monitor, and a buzzer are required to construct the continuous patient monitoring system.

These hardware components will facilitate real-time data collection and monitoring, enabling timely interventions and improving overall patient care.

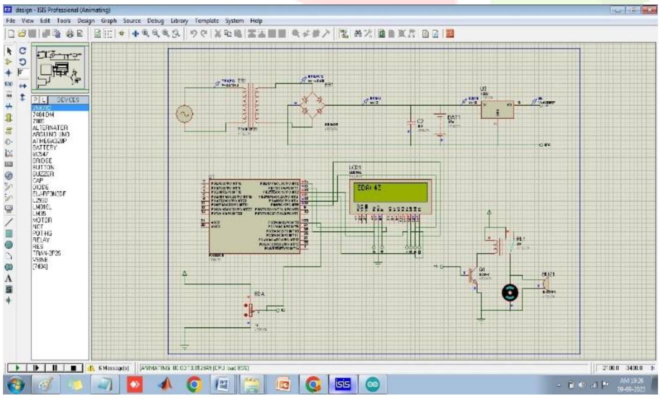


Figure 1 illustrates the workflow of the entire system.

3.1 BLOCK DIAGRAM OF THE SYSTEM

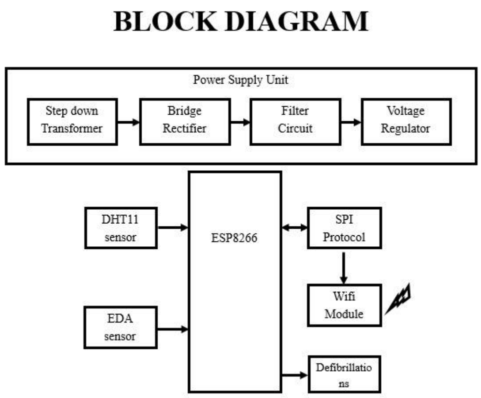


Figure 2 Block Diagram of the System

Overall, this power supply unit provides a regulated DC `voltage to the defibrillator's internal circuitry and also includes additional components for sensing the environment and potentially transmitting data wirelessly.

3.2 ANALYSIS OF DATA

ThingSpeak™, a service provided by MathWorks®, the creators of MATLAB® and Simulink®, is an IoT analytics platform that enables users to aggregate, visualize, and analyze live data streams in the cloud. With ThingSpeak, users can instantly visualize data posted by their devices or equipment. Additionally, ThingSpeak allows users to execute MATLAB code within the platform, enabling online analysis and processing of incoming data. This feature accelerates the development of proof-of-concept IoT systems, particularly those requiring analytics. Moreover, ThingSpeak eliminates the need for setting up servers or developing web software, making it an ideal solution for small- to medium-sized IoT systems.

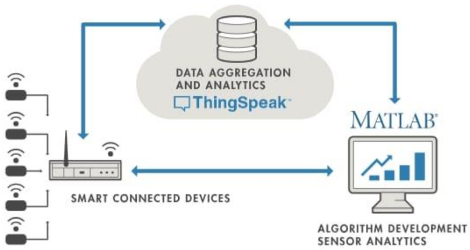


Figure 3 Analysing Data through Think Speak

With the integrated MATLAB engine within ThingSpeak, users can conduct calibrations, develop analytics, and transform their IoT data. Additionally, the MATLAB engine facilitates the creation of custom charts directly within ThingSpeak. Users with a commercial ThingSpeak license can execute MATLAB calculations lasting up to 60 seconds. Furthermore, a commercial license grants access to MATLAB Toolboxes, including those for machine learning, signal processing, system identification, and more, allowing users to leverage advanced capabilities within ThingSpeak, provided they possess a valid license for the respective toolbox.

4. HARDWARE DESIGN IMPLEMENTATION

The system employs an ESP8266 microcontroller, a budget-friendly chip with Wi-Fi capabilities. Connected to the ESP8266 are a DHT11 sensor, responsible for measuring temperature and humidity, and an EDA sensor, which gauges electrodermal activity (EDA). EDA serves as an indicator of sweat gland activity and can be utilized to monitor stress levels.

The ESP8266 processes the data from the sensors and transmits it to a cloud server via the Wi-Fi module. The cloud server can then be used to store and analyze the data, and to send alerts to healthcare providers if there are any signs of potential problems.

The power supply unit ensures the ESP8266 receives the required power. It includes a step-down transformer that reduces the voltage from the mains supply to a safe level for the ESP8266. The bridge rectifier then converts the AC voltage from the transformer into DC voltage. A filter is employed to smooth out the DC voltage from the rectifier. Finally, a voltage regulator is utilized to provide a stable 3.3V supply to the ESP8266, ensuring consistent and reliable operation.

The defibrillator is not part of the monitoring system, but it is shown in the diagram because it may be used to treat cardiac arrest, which is a potential complication of some cardiac diseases.

Overall, the hardware implementation of this healthcare monitoring system is relatively simple and low-cost. This makes it a potentially viable option for home monitoring of patients with cardiac disease.

Here are some additional details about the hardware components:

- The DHT11 sensor is a cheap and simple sensor that can be used to measure temperature and humidity. It is not the most accurate sensor, but it is sufficient for most home monitoring applications.
- The EDA sensor is a more complex sensor that measures electrodermal activity. EDA is a measure of sweat gland activity, which can be used to track stress levels. EDA sensors are more expensive than DHT11 sensors, but they can provide more valuable data.
- The ESP8266 is a widely-used microcontroller, particularly favored in DIY projects due to its affordability and built-in Wi-Fi module.
- The ESP8266 integrated Wi-Fi capability makes it an ideal choice for projects requiring internet connectivity, offering a convenient and cost-effective solution for various applications.

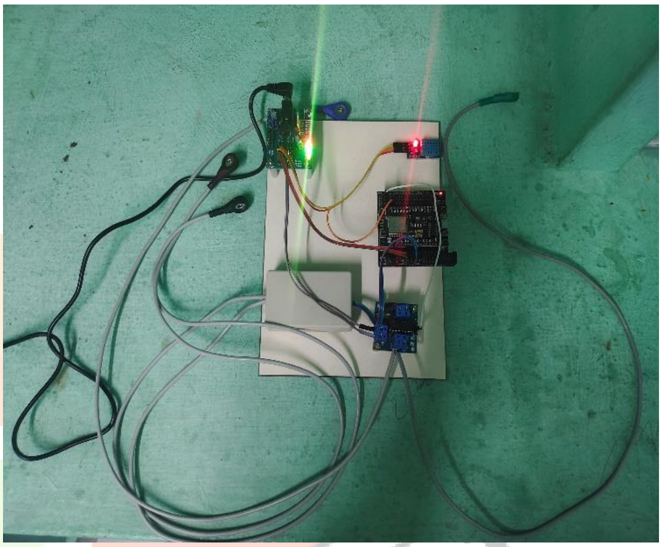


Figure 4 Hardware Implementation

5. COMPARISON OF EXISTING SYSTEM AND PROPOSED SYSTEM

Existing system	Proposed system
Without an accurate and reliable method to assess pain levels, doctors may struggle to provide appropriate and timely pain management for patients. This can lead to prolonged suffering, reduced quality of life, and potential complications in the recovery process.	One of the significant advantages of this system is its ability to detect abnormal heart rates and body temperature early on. By setting thresholds and providing real-time monitoring, the system can promptly alert the patient, their emergency contacts, and even the doctor when critical values are reached. This early detection can potentially prevent serious health events, such as heart attacks, by enabling timely medical intervention.
If patients are hesitant to communicate their pain levels due to concerns about additional costs, there is a risk that some may undergo unnecessary surgeries. This not only poses physical risks but also places financial burdens on both the healthcare system and the patients.	The system allows for remote monitoring of vital signs, enabling individuals to keep track of their health from the comfort of their homes. The portability of the device ensures that patients are not confined to hospitals and can carry the monitoring device with them wherever they go. This not only provides convenience but also enhances the overall quality of life for patients.

6. RESULT ANALYSIS

Through meticulous design and implementation, the system emerged as an efficient, functional, and dependable cardiovascular disease detection system. It performed admirably, meeting the initial minimum expectations set forth. Anticipated to offer substantial benefits to individuals and healthcare organizations alike, the system provides a computerized approach to diagnosing heart disease based on patients' health records.

In this section, the user interfaces (UIs) of the developed system are showcased and examined. These interfaces feature a range of graphical user interface (GUI) components, including labels, text fields, checkboxes, text areas, and buttons. Each component serves a specific purpose in enhancing user interaction and facilitating seamless navigation through the system's functionalities.

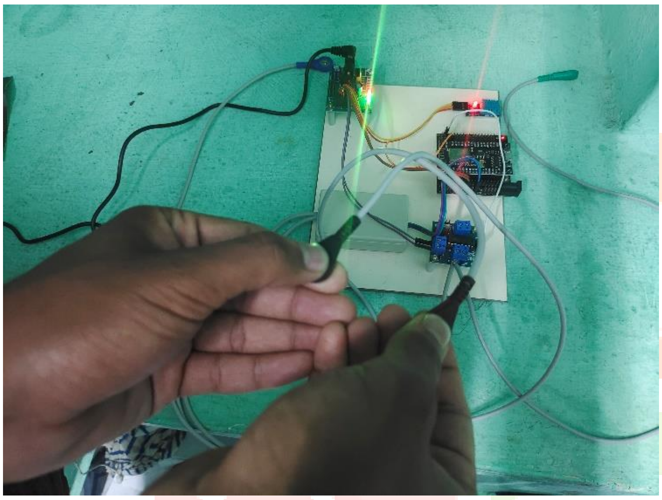
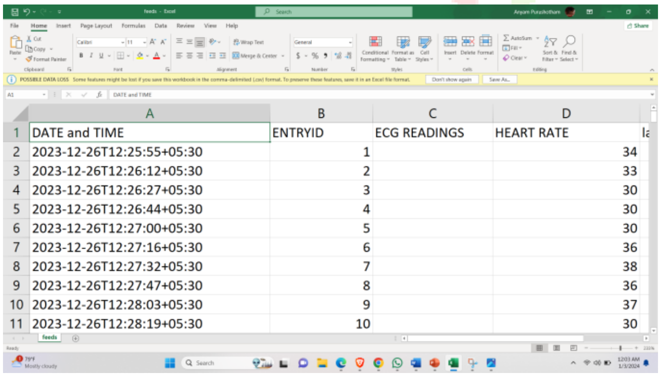
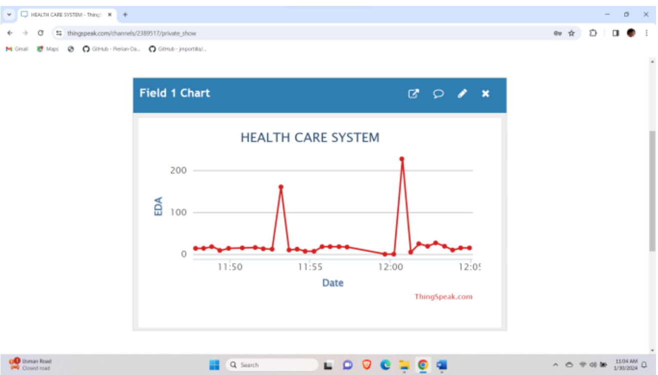


Figure 5 Final Implementation

Below mentioned Excel Sheet Shows The Time ,Date, Entry ID ,ECG Readings and Heart Rate of The Patient.



DATE and TIME	ENTRYID	ECG READINGS	HEART RATE
2023-12-26T12:25:55+05:30	1		34
2023-12-26T12:26:12+05:30	2		33
2023-12-26T12:26:27+05:30	3		30
2023-12-26T12:26:44+05:30	4		30
2023-12-26T12:27:00+05:30	5		30
2023-12-26T12:27:16+05:30	6		36
2023-12-26T12:27:32+05:30	7		38
2023-12-26T12:27:47+05:30	8		36
2023-12-26T12:28:03+05:30	9		37
2023-12-26T12:28:19+05:30	10		30



7. CONCLUSION

IoT applications have revolutionized healthcare technology, enabling the implementation of various assisted systems for healthcare monitoring and swift access to medical treatment and emergency services. Consequently, IoT-based healthcare systems play a crucial role in developing medical data systems, improving the quality of healthcare services, and ensuring patient safety.

This thesis proposes an IoT-based healthcare architecture aimed at tracking, tracing, and monitoring health and safety (H&S) products within workplaces using a GUI program. The proposed design, named 'Smart H&S Equipment Monitoring System for Distributed Hospitals', introduces a novel maintenance system for early detection of critically low H&S devices across various facilities. Smart sensors are utilized for data collection and status monitoring, with the primary objective of enhancing the safety of occupational personnel by predicting and monitoring changes in H&S equipment status in hospitals or workplaces. This enables building service managers to take preventive measures in real-time.

The real-time controlling and monitoring system is designed to access the status of consumable hospital devices, including first aid boxes, earplug dispensers, life jackets, and fire extinguishers. This approach helps hospitals and companies avoid unnecessary waste of time and effort by reducing workforce requirements compared to previous manual maintenance methods. The proposed system yields reliable results and can effectively manage numerous consumable H&S products across different district hospitals and companies, all while meeting regulatory requirements. Ultimately, this aids in reducing time, costs, efforts, and workforce resources associated with H&S product management.

8. REFERENCES

[1] D. Niewolny, “How the Internet of Things Is Revolutionizing Healthcare,” White Pap., vol. October, pp. 3–5, 2013.

[2] D. Metcalf, S. T. J. Milliard, M. Gomez, and M. Schwartz, “Wearables and the internet of things for health: Wearable, interconnected devices promise more efficient and comprehensive health care,” IEEE Pulse, vol. 7, no. 5, 2016.

[3] P. Fraga-Lamas, T. M. Fernández-Caramés, M. Suárez-Albela, L. Castedo, and M. González-López, “A Review on Internet of Things for Defense and Public Safety,” Sensors (Basel)., vol. 16, no. 10, pp. 1–44, 2016.

[4] H. S. Kang et al., “Smart manufacturing: Past research, present findings, and future directions,” Int. J. Precis. Eng. Manuf. - Green Technol., vol. 3, no. 1, pp. 111–128, 2016.

[5] G. Alex, B. Varghese, J. G. Jose, and A. Abraham, “A Modern Health Care System Using IoT and Android .,” Int. J. Comput. Sci. Eng., vol. 8, no. 4, pp. 117–121, 2016.

[6] G. Muhammad, S. M. M. Rahman, A. Alelaiwi, and A. Alamri, “Smart Health Solution Integrating IoT and Cloud: A Case Study of Voice Pathology Monitoring,” IEEE Commun. Mag., vol. 55, no. 1, pp. 69–73, 2017.

[7] M. S. Mahmud, H. Wang, A. M. Esfar-E-Alam, and H. Fang, “A Wireless Health Monitoring System Using Mobile Phone Accessories,” IEEE Internet Things J., vol. 4662, no. c, pp. 1–1, 2017.

[8] O. A. Mahdi et al., “RESEARCH ARTICLE A comparison study on node clustering techniques used in target tracking WSNs for ef fi cient data aggregation,” no. August, pp. 2663–2676, 2016.

[9] “Reasons — Why workplace safety is Important?,” Bastion Safety Solutions. .

[10] H. A. S. Executive, “Why is health and safety training important?” [Online]. Available: http://www.hse.gov.uk/treework/training-is-important.htm. [Accessed: 04- Feb-2019].

[11] Health and Safety Authority, “Our Vision : healthy , safe and productive lives,” pp. 1– 52, 2016.

[12] Nasrullah Patel, “Internet of things in healthcare: applications, benefits, and challenges,” 2019. [Online]. Available: https://www.peerbits.com/blog/internet-of- things-healthcare-applications-benefits-and-challenges.html. [Accessed: 30-Apr-2019].

[13] S. B. Baker, W. Xiang, and I. Atkinson, “Internet of Things for Smart Healthcare: Technologies, Challenges, and Opportunities,” IEEE Access, vol. 5, no. January 2018, pp. 26521–26544, 2017.

[14] H. F. Atlam, R. J. Walters, and G. B. Wills, “Internet of Things: State-of-the-art, Challenges, Applications, and Open Issues,” Int. J. Intell. Comput. Res. , vol. 9, no. 3, pp. 928–938, 2018.

[15] M. M. Rathore, A. Ahmad, A. Paul, J. Wan, and D. Zhang, “Real-time Medical Emergency Response System: Exploiting IoT and Big Data for Public Health,” J. Med. Syst., vol. 40, no. 12, 2016.

[16] J. Jin, J. Gubbi, S. Marusic, and M. Palaniswami, “An information framework for creating a smart city through internet of things,” vol. 1, no. 2, pp. 112–121, 2014.

[17] NOKIA (s.f.), “IoT for Smart Cities | Nokia,” 2017. [Online]. Available:https://www.nokia.com/networks/services/iot-for-smart-cities/.

[18] a Zanella, N. Bui, a Castellani, L. Vangelista, and M. Zorzi, “Internet of Things for Smart Cities,” IEEE Internet Things J., vol. 1, no. 1, pp. 22–32, 2014.

[19] A. Zanella, N. Bui, A. Castellani, L. Vangelista, and M. Zorzi, “Internet of Things for Smart Cities,” IEEE Internet Things J, vol. 1, no. 1, pp. 22–32, 2014.

[20] H. Arasteh et al., “IoT-based Smart Cities : a Survey Iot-based Smart Cities: a Survey,” Environ. Electr. Eng. (EEEIC), 2016 IEEE 16th Int. Conf., no. August, pp. 2– 7, 2016.

[21] M. M. Rathore, A. Ahmad, A. Paul, and S. Rho, “Urban planning and building smart cities based on the Internet of Things using Big Data analytics,” Comput. Networks, vol. 101, no. May, pp. 63–80, 2016.

[22] Darrell M. West, “How 5G technology enables the health internet of things,” Cent. Technol. Innov. Brookings, no. July 2016, pp. 1–20, 20