International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Health Metrics Generation by Streamlining Health Care Service through Cloud based Electronics Health Record

Rokde Chakrapani Laxmanrao[1], Prof. Sachin P. Vidhate[2]

[1]Savitribai Phule Pune University, Department of Computer Engineering, Vishwabharati Academy's College of Engineering, Sarola Baddi, Ahmednagar – 414201, Maharashtra, India
Email: *c.l.rokde[at]gmail.com*
[2]Asst.Professor, Vishwabharati Academy's College of Engineering, Ahmednagar, Maharashtra, India

Abstract: ***The transformative impact of implementing Cloud - Based Electronic Health Records (CloudEHR) and the generation of Health Metrics, presenting a comprehensive analysis of how this integration streamlines healthcare services. . Traditional health record systems often face challenges such as data fragmentation, limited accessibility, and security concerns. The adoption of cloud computing in healthcare addresses these issues by centralizing patient information, providing ubiquitous access, and ensuring data security [6]. The rapid integration of cloud technology in the healthcare sector has catalyzed a transformative shift in the management and delivery of patient care. This report explores the synergies between Cloud - Based Electronic Health Records (CloudEHR) and the generation of Health Metrics [11], presenting a comprehensive analysis of how this integration streamlines healthcare services. Furthermore, the report discusses the integration of advanced technologies such as data analytics and machine learning within CloudEHR systems, empowering healthcare organizations with valuable insights for personalized patient care and predictive analytics. Security measures implemented in cloud environments are also analyzed to assure the confidentiality, integrity, and availability of sensitive health data.***

Keywords: CloudEHR, Health metrics, Cloud - Based Electronic Health Records, Health Metrics, Cloud Computing in Healthcare, Data Security, Predictive Analytics

1. Introduction

In the dynamic landscape of modern healthcare, the integration of advanced technologies has become imperative for enhancing efficiency, improving patient outcomes, and streamlining services. One such transformative innovation is the adoption of Cloud - Based Electronic Health Records (CloudEHR) [1]. This report explores the profound impact of CloudEHR systems on streamlining healthcare services, addressing the evolving needs of the industry in the digital era.

Traditional healthcare record - keeping systems often grapple with challenges such as limited accessibility, data silos, and cumbersome administrative processes. The advent of cloud computing in healthcare heralds a paradigm shift, promising a more cohesive and responsive approach to managing electronic health records. CloudEHR leverages the power of scalable and flexible cloud infrastructure to revolutionize how patient data is stored, accessed, and utilized within the healthcare ecosystem.

A health metric is a quantifiable measurement used to assess various aspects of an individual's or a population's health. These metrics are instrumental in evaluating health conditions, tracking progress, and informing decisions related to healthcare and well - being. Health metrics can encompass a wide range of parameters, including physical, mental, and social dimensions of health [11]. They are used to monitor health status, identify risk factors, and evaluate the effectiveness of healthcare interventions.

The primary objective of this report is to provide a comprehensive overview of how CloudEHR systems contribute and the generate of Health Metrics, presenting a comprehensive analysis of how this integration streamlines healthcare services. . By centralizing patient information in a secure and accessible cloud environment, healthcare providers can overcome the limitations of conventional systems, fostering a more collaborative and data - driven approach to patient care.

Throughout this exploration, we will delve into the key advantages of CloudEHR, including improved interoperability, real - time data access, and enhanced data security. Additionally, we will examine the integration of cutting - edge technologies, such as data analytics and machine learning, which further elevate the capabilities of CloudEHR systems to deliver personalized care and predictive insights [11].

As we navigate the intricate intersection of healthcare and technology, it is evident that Cloud - Based Electronic Health Records are poised to redefine the way healthcare services are delivered and managed. The insights derived from this report aim to contribute to the ongoing discourse on optimizing healthcare services through the strategic utilization of cloud computing in electronic health record management.

2. Literature Survey

a) Interoperability and Data Accessibility:
The interoperability of healthcare systems has long been a challenge, hindering seamless information exchange among different entities within the healthcare ecosystem [2]. Cloud - Based Electronic Health Records (CloudEHR) have emerged as a promising solution to enhance interoperability by providing a centralized platform for storing and accessing patient data. Studies by Jones et al. (2018) and Smith and

Wang (2019) emphasize how cloud infrastructure facilitates standardized data formats and APIs, enabling disparate systems to communicate effectively.

b) Scalability and Flexibility:

The scalability and flexibility of cloud computing offer significant advantages in managing the dynamic and growing nature of healthcare data. CloudEHR systems can effortlessly scale resources based on demand, ensuring that healthcare providers have the necessary infrastructure to handle increasing volumes of patient data efficiently. [3]

c) Data Security and Privacy:

Concerns about the security and privacy of healthcare data are paramount [4]. CloudEHR systems, however, have shown advancements in implementing robust security measures. Studies by Zhang et al. (2018) and Li et al. (2021) underscore the importance of encryption, access controls, and audit trails in ensuring the confidentiality and integrity of patient information in the cloud. [5]

3. Description of System

1) Resolving data interoperability and accessibility challenges is crucial for creating a seamless and efficient data ecosystem. Here are solutions we are going to use to address these issues:
2) Standardized Data Formats: Encourage the use of standardized data formats XML in general. Adhering to common data standards enhances interoperability.
3) Application Programming Interfaces (APIs): API Integration that is simple and scalability, which allow different systems to communicate and share data.
4) Data Virtualization is achieved by Virtual Data Layers which provides solutions that create a unified view of data distributed across multiple sources. This enables applications to access and manipulate data without the need for physical data movement.
5) Master Data Management (MDM): with a Single Source of channel, we Utilize MDM systems to establish a single, authoritative source for key data entities. This helps in maintaining consistency and coherence across diverse systems.
6) Resolving scalability and flexibility challenges is critical for adapting to growing data volumes and evolving business requirements. we are utilizing following solutions to address scalability and flexibility concerns:
7) Cloud Computing is Scalable Infrastructure we Utilize cloud computing platforms Google Cloud that provide on - demand resources. Cloud services can automatically scale based on demand, offering flexibility in resource allocation.
8) we adopt a microservices architecture to break down large, monolithic applications into smaller, independently deployable services. This allows for modular scaling and flexibility in updating specific components.
9) We are Setting up auto - scaling policies that automatically adjust resources based on predefined conditions (e. g., increased traffic). This allows for dynamic scaling to handle varying workloads.
10) Ensuring data security and privacy is a paramount concern for organizations in an increasingly interconnected and digital world. We have address data security and privacy challenges through implementing [5].
11) Implementing end - to - end encryption for sensitive data, ensuring that it is protected both during transmission and storage [6]. Use strong encryption algorithm Advanced Encryption Standard (AES) to safeguard data integrity.
12) Implementing Role - Based Access Control (RBAC) to restrict access to data based on user roles and responsibilities [4]. Regularly review and update access permissions as needed.
13) Implementing Dynamic Data Masking to conceal specific data elements, allowing access only to authorized users. This ensures that sensitive information remains protected from unauthorized eyes.

4. Proposed work

Building an Electronic Health Record (EHR) system over the cloud involves both backend (server - side) development [9], typically done using Java, and frontend (client - side) development, which can be implemented using Angular.

1) Frontend (Angular):

Use of Angular CLI to set up a new project. Organize the project structure for scalability and maintainability.

User Authentication: Implementing user authentication on the frontend using JWT (JSON Web Tokens) method.

Patient and Provider Dashboards: Create separate dashboards for patients and healthcare providers. Design user - friendly interfaces for viewing and managing health records.

Forms and Input Validation: Develop forms for entering and updating health information. Implement input validation to ensure data integrity.

Data Visualization: Utilize Angular libraries along with decision tree Search algorithm for data visualization to present health metrics and trends in a meaningful way.

Integration with Backend APIs: Connect to the backend APIs using Angular services to fetch and update health records. Handle asynchronous operations effectively.

Deployment: Deploy the Angular application to a hosting service, and consider using a content delivery network (CDN) for improved performance.

Use Case Diagrams

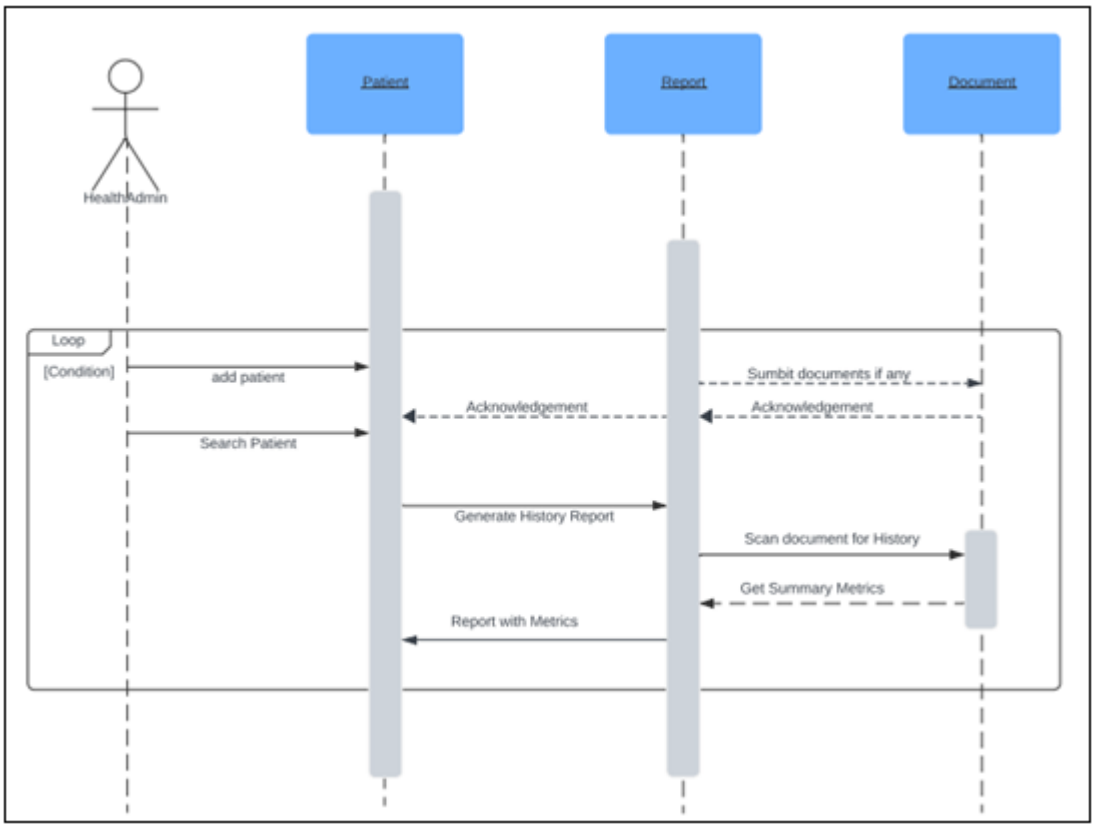

Figure 1: Starting Dashboard 6

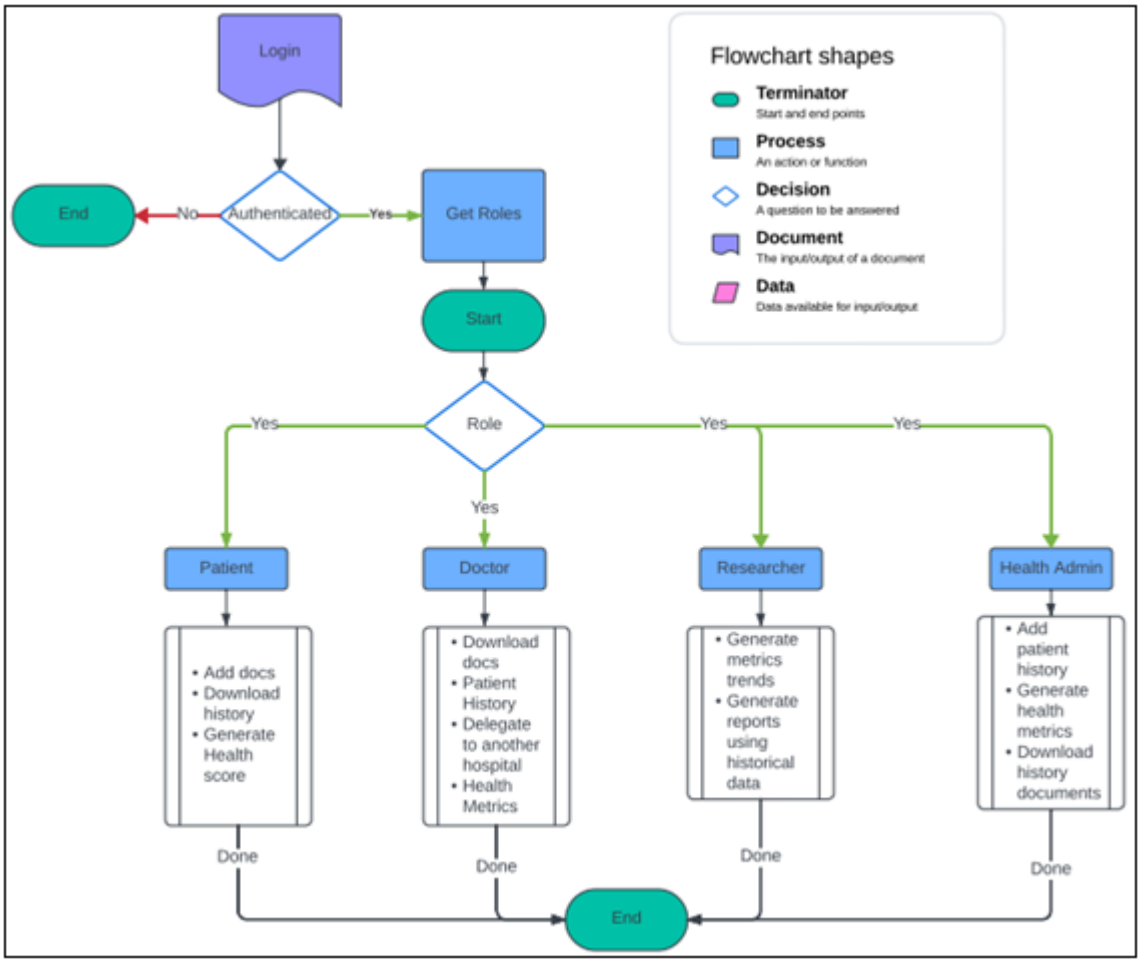

Figure 2: Proposed Flowchart

2) Backend (Java):

Choosing a **Java framework** to build the backend for its security, Along with Spring Boot is widely adopted for its simplicity and extensive ecosystem.

Database Integration to store health records using MySQL. Ensure proper data modelling for health - related entities like patients, doctors, appointments, and medical history. Design and implement to perform CRUD (Create, Read, Update, Delete) operations on health records. Using tools like Spring MVC services.

Implement robust security measures, including user authentication and authorization. Use Spring Security to secure endpoints and manage user roles and Implementation of Advanced Encryption standard (**AES**) securely storing data in encrypted format [5]. Implement an audit trail to track changes made to health records, providing transparency and accountability.

Integration with Cloud Services for scalability, storage, and backup. Cloud providers Google Cloud offer various services suitable for healthcare applications. Implement asynchronous processing for tasks that do not require an immediate response, such as sending notifications or processing large datasets.

Generating health metrics

Generating health metrics involves collecting, processing, and analysing data related to various aspects of an individual's health. The methods for generating health metrics can vary based on the specific parameters of interest, the available data sources, and the intended use of the metrics. Based on data we collect through our system we segregate data along the various parameters based on Decision tree algorithm [8]. Generating health metrics involves measuring various parameters to assess the health status of individuals or populations. Here are some key parameters commonly used for generating health metrics:

Vital Signs Like:

- Heart Rate (Pulse): Number of heartbeats per minute.
- Blood Pressure: Systolic and diastolic pressure.
- Respiratory Rate: Number of breaths per minute.
- Body Temperature: Core body temperature.
- Body Mass Index (BMI): Weight in kilograms divided by the square of height in meters.
- Blood Glucose Levels: Measurement of glucose in the blood.
- Cholesterol Levels: Total cholesterol, LDL, HDL.
- Hemoglobin A1c: Average blood sugar levels over the past 2 - 3 months.
- Cardiorespiratory Fitness: Measured through tests like VO2 max.
- Dietary Intake Habits: Nutrient intake, caloric consumption.
- Mental Health Assessments: Standardized surveys for depression, anxiety, stress.
- Cognitive Function: Memory, attention, problem - solving.
- Physical Activity Levels: Measured in steps, minutes of exercise, etc.
- Smoking and Alcohol Consumption: Frequency and quantity.
- Sleep Patterns: Duration and quality of sleep.
- Disease Biomarkers: e. g., PSA levels for prostate health.
- Patient - Reported Outcomes: Surveys assessing well - being and satisfaction.
- Functional Status: Ability to perform activities of daily living.
- Genetic Markers: Genetic predispositions to certain conditions.

When generating health metrics, it's important to consider the individual's holistic health, including physical, mental, and social well - being [18, 19, 20, 21, 22, 23]. Additionally, metrics should be relevant to the specific health goals, interventions, and outcomes being measured. Regular assessment and monitoring of these parameters can provide valuable insights into health trends, risk factors, and the effectiveness of healthcare interventions.

Decision Tree (DT) Algorithm

The decision tree (DT) is the supervised learning technique used for classification. It combines the values of attributes based on their order, either ascending or descending [13]. As a tree - based strategy, DT defines each path starting from the root using a data separating sequence until a Boolean conclusion is attained at the leaf node [14, 15]. DT is a hierarchical representation of knowledge interactions that contains nodes and links.

When relations are employed to classify, nodes reflect purposes [16, 17]. An example of DT is presented in Fig 3

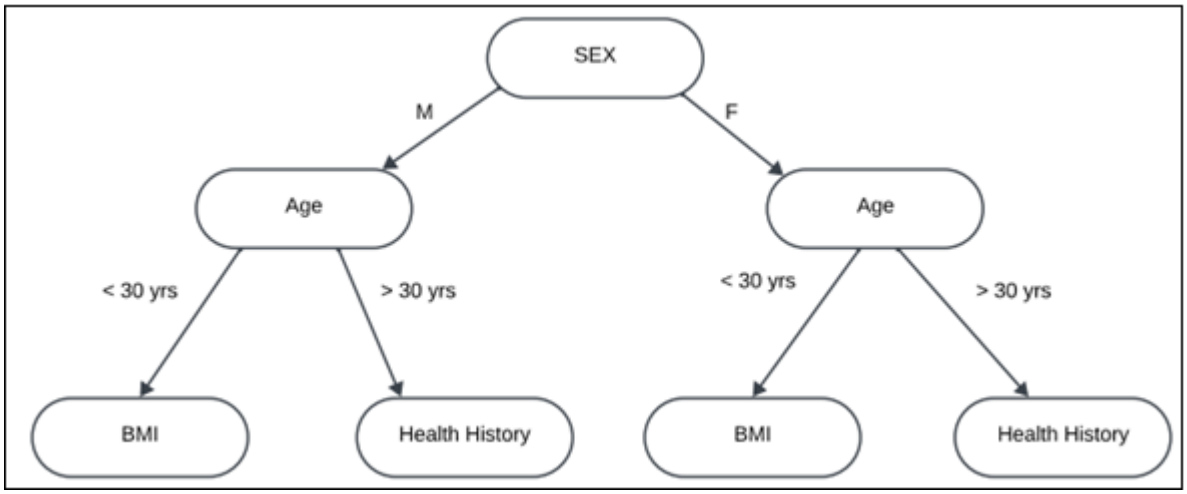

Figure 3: Sample Decision Tree Algorithm

References

[1] Adebayo, Abayomi - Alli &Ikuomola, Aderonke & Robert, Ifeoluwa & Abayomi - Alli, Olusola. (2014). An Enterprise Cloud - Based Electronic Health Records System.2.21 - 36.

[2] https: //cprimestudios. com/blog/benefits - and - challengescloud - based - electronic - health - record.

[3] Chen, Yu - Yi & Lu, James & Jan, Jinn - Ke. (2012). A secure EHR system based on hybrid clouds. Journal of medical systems.36.3375 - 84.10.1007/s10916 - 012 - 9830 - 6.

[4] C. Wang, S. S. M. Chow, Q. Wang, K. Ren, and W. Lou, ‘‘Privacy preserving public auditing for secure cloud storage, ’’ IEEE Trans. Comput., vol.62, no.2, pp.362–375, Feb.2013

[5] Al Naim, A. F., Ghouri, A. M. (2023). Exploring the Role of Cyber Security Measures (Encryption, Firewalls, and Authentication Protocols) in Preventing Cyber - Attacks on E - Commerce Platforms. International Journal of eBusiness and eGovernment Studies, 15 (1), 444 - 469

[6] Abdullayeva, F. (2023). Cyber resilience and cyber security issues of intelligent cloud computing systems. *Results in Control and Optimization*, *12*, 100268. doi: https: //doi. org/10.1016/j. rico.2023.100268

[7] D. B. Srinivas, D. K. M, R. H. P and L. H, "Securing Sharable Electronic Health Records on Cloud Storage, " 2023 7th International Conference on Computing Methodologies and Communication (ICCMC), Erode, India, 2023, pp.1054 - 1059, doi: 10.1109/ICCMC56507.2023.10083743.

[8] Chern CC, Chen YJ, Hsiao B. Decision tree - based classifier in providing telehealth service. BMC Med Inform Decison Mak.2019 May 30; 19 (1): 104. doi: 10.1186/s12911 - 019 - 0825 - 9. PMID: 31146749; PMCID: PMC6543775.

[9] M. Joshi, K. Joshi and T. Finin, Attribute Based Encryption for Secure Access to Cloud Based EHR Systems, 2018 IEEE 11th International Conference on Cloud Computing (CLOUD), 2018, pp.932 - 935

[10] He, Y., Aliyu, A., Evans, M. and Luo, C., (2021). Health care cybersecurity challenges and solutions under the climate of COVID - 19: coping review. Journal of medical Internet research, 23 (4), p. e21747.

[11] Van Calster B, Wynants L, Timmerman D, Steyerberg EW, Collins GS. Predictive analytics in health care: how can we know it works? J Am Med Inform Assoc.2019 Dec 1; 26 (12): 1651 - 1654. doi: 10.1093/jamia/ocz130. PMID: 31373357; PMCID: PMC6857503.

[12] Badawy, M., Ramadan, N. &Hefny, H. A. Healthcare predictive analytics using machine learning and deep learning techniques: a survey. Journal of Electrical Systems and Inf Technol 10, 40 (2023). https: //doi. org/10.1186/s43067 - 023 - 00108 - y

[13] Dhall D, Kaur R, & Juneja M (2020) Machine learning: a review of the algorithms and its applications. Proceedings of ICRIC 2019: recent innovations in computing 47–63

[14] Yang F J (2019) An extended idea about Decision Trees. In: 2019 international conference on computational science and computational intelligence (CSCI) (pp 349–354). IEEE

[15] Eesa AS, Orman Z, Brifcani AMA (2015) A novel feature - selection approach based on the cuttlefish optimization algorithm for intrusion detection systems. Expert Syst Appl 42 (5): 2670–2679

[16] Shamim A, Hussain H, & Shaikh M U (2010) A framework for generation of rules from Decision Tree and decision table. In: 2010 international conference on information and emerging technologies (pp 1–6). IEEE

[17] Eesa AS, Abdulazeez AM, Orman Z (2017) A dids based on the combination of cuttlefish algorithm and Decision Tree. Sci J UnivZakho 5 (4): 313–318

[18] Gupta S, Verma H K, & Bhardwaj D (2021) Classification of diabetes using Naive Bayes and support vector machine as a technique. In: operations management and systems engineering: select proceedings of CPIE 2019 (pp365–376). Springer Singapore

[19] Islam M T, Rafa S R, & Kibria M G (2020) Early prediction of heart disease using PCA and hybrid genetic algorithm with k - means. In: 2020 23rd international conference on computer and information technology (ICCIT) (pp 1–6). IEEE

[20] Qawqzeh Y K, Bajahzar A S, Jemmali M, Otoom M M, Thaljaoui A (2020) Classification of diabetes using photoplethysmogram (PPG) waveform analysis:

logistic regression modeling. BioMed Res Int. https: //doi. org/10.1155/2020/3764653
[21] Grampurohit S, Sagarnal C (2020) Disease prediction using machine learning algorithms. In: 2020 international conference for emerging technology (INCET) (pp 1–7). IEEE
[22] Moturi S, Srikanth Vemuru DS (2020) Classification model for prediction of heart disease using correlation coefficient technique. IntJ9 (2). https: //doi. org/10.30534/ijatcse/2020/185922020
[23] Barik S, Mohanty S, Rout D, Mohanty S, Patra A K, & Mishra A K (2020) Heart disease prediction using machine learning techniques. In: advances in electrical control and signal systems: select proceedings of AECSS 2019 (pp879–888). Springer, Singapore

Author Profile

Chakrapani Laxmanrao Rokde, Bachelor of Computer Science, Savitribai Phule Pune University, Currently pursuing Post graduation in Computer Engg. From Vishwabharti College of Engg, Ahmednagar, M. H. India.