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A Proposed Healthcare Architecture using Cloud Computing in WSN Environment with a case study

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A B S T R A C T

The Internet of Things, or IoT, envisions a day when any object, person, or service may be connected by the use of suitable information and communication technology. This propensity led this research to create a groundbreaking intelligent architecture that is aware of the Internet of Things and can be used to track and monitor patients as well as staff members using linked computing equipment inside hospital buildings. According to the IoT vision, we suggest an IoT-based healthcare architecture that relies on various but complementary technologies, particularly smart mobile, RFID, and WSN. These technologies communicate with one another through a low-power wireless personal area network (6LoWPAN) framework and a Constrained Application Protocol (CoAP). The framework has the capacity to instantly collect data in both natural and physical settings of patients, following which it is processed for analysis and services are delivered to the user. The security component of the healthcare system's network is another major emphasis of the suggested concept. Three security services are included in the security model for Internet of Things-based medical services: protection, detection, and reaction

INTRODUCTION

Wireless Sensor Network (WSN) technology has the power to advance and revolutionize lifestyles in a number of industries, including retail, entertainment, industry, healthcare, employee care, and emergency management. Pervasive computing, artificial intelligence research, and wireless sensor networks have created complex ideas of ambient intelligence to overcome the challenges we confront on a daily basis. Notably, the growing number of old people living in developed nations over the past few decades has been one of the major global challenges. The station used for population reference. estimates that in the next 20 years, the percentage of people over 65 in developed countries may approach 20% of the entire population. Thus, it is critical to rapidly deliver high-quality treatment to the aging population while lowering medical costs. The integration of detection and end user electronics technology, which enables continuous monitoring of individuals, is a comforting use in the field. The varied and perhaps limited network traffic patterns and network devices in the medical Internet of Things make it a challenging field. The capacity to rapidly communicate information across geographic locations, compress information over time, and provide remote access to images are all features of electronic medicine. Secure connections between patients, hospitals, and medical facilities provide cost-effective communication. Networks for medical care that use wireless technology, such Wi-Fi, are thought to help with analysis and real-time monitoring. Globally, a great deal of experimentation is underway, beginning with the potential of Internet of Things-based medical technologies.

The outcomes show promise in a number of areas, including prototypes, apps, and services. Interoperability, security, and network foundation are also included. Research is being done on Wireless Sensor Networks (WSN) as a preliminary medical technology powered by IoT. IPv6-based low-power wireless personal area network (6LoWPAN) is used to create an IP-based sensor network. Vital signs like blood pressure (BP), body temperature, electrocardiogram (ECG), and oxygen saturation are gathered via a heterogeneous computing grid [5]. As mobile and stationary electronic devices, such medical terminals, convert their heterogeneous computing and storage functionalities, the Internet of Things (IoT) network is created on the hybrid computing grid.

LITERATURE REVIEW

WSN in cloud computing and healthcare Recent years have witnessed various advancements in medical care because to technology advancements in medical sensors and weak network systems; one such example is the introduction of Wireless Sensor Networks (WSN). These WSNs are well known for fulfilling their promises to significantly improve and broaden the standard of care across a range of industries and demographic segments. As an illustration, early WSN system prototypes were seen to demonstrate the potential for early clinical deterioration diagnosis through hospital real-time patient monitoring. First aid enables extensive (on-the-spot) evaluation of human decorum and

persistent diseases in cases of big calamities via automatic electronic triage, hence improving the quality of life for the elderly. Applications of Cloud Computing in Healthcare Users can gain a number of advantages from cloud computing, such as decreased operational expenses, improved data center availability and efficiency, and less waste of electricity and information system resources. Cloud-based healthcare applications make use of cloud computing environments and provide patients and caregivers with the following advantages. Security and privacy for patients: Highly private medical data was made available by cloud service providers, and enhanced security (Private Cloud) prevented process leaks.

One of the main concerns with sensor network medical applications is security breaches. Many security issues are also similar between the sensor network healthcare application and the WSN application interface. System security and information security are the two main categories of security issues. Threats and attacks have been divided into two main categories by numerous researchers: passive and aggressive. When data packets are forwarded within the system, passive attacks could occur. Attackers could change a packet's path or destination. A hacker using wireless communication technology can eavesdrop on a target and take advantage of health data. When compared to their inactive counterparts, active dangers have more detrimental effects. By listening in, a thief can ascertain the user's whereabouts. This can result in circumstances that could be fatal.

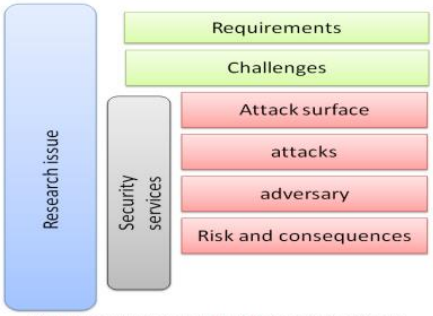

Fig 1. Security issues and challenges in healthcare

The suggested architecture concept for the healthcare system is depicted in Figure. The strategy involves gathering data from various hospital wireless sensor networks, aggregating it, and then uploading it to the cloud infrastructure. Smart gateways are used to process and gather data as well as manage system operations. Security analysis and network management keep an eye on the network and look for any anomalies. The model offers man services including location-based services, emergency services, ambulatory services, and some recommendations at the user interface level.

The smart healthcare framework network can be integrated with smart devices to monitor medical staff round-the-clock while collecting and organizing data. The created framework can also be used for security purposes and as intelligent services to gather data from various applications, such as commerce and education, and over the Internet. It can be used in healthcare settings to create more cost-effective and high-quality intelligent patient care and give patients

access to information about their individual care. Furthermore, the architecture for smart healthcare facilitates patient-physician communication.

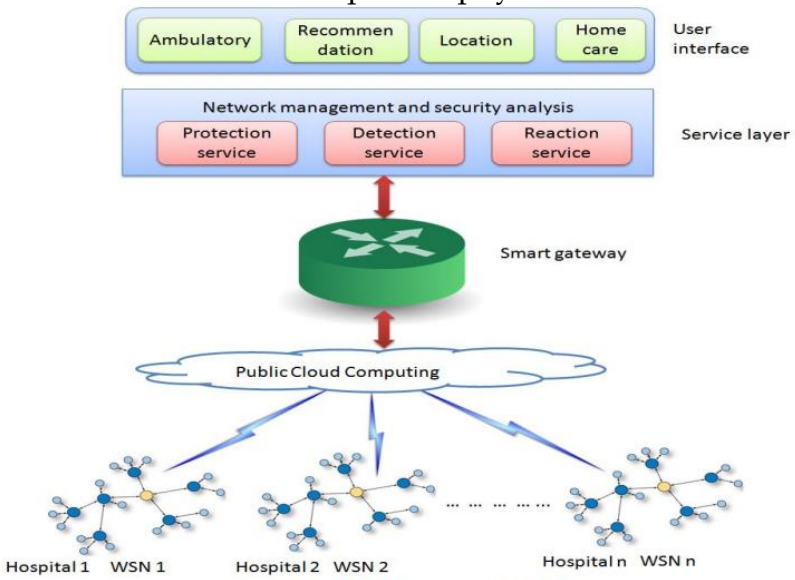

Fig 2. Proposed healthcare system architecture

METHODOLOGY

1. **Research and Problem Identification:**
   - Determine which healthcare issues can be solved by technology.
   - Examine current healthcare architecture models and technological advancements.
2. **Architectural Design:**
   - Design a blueprint for the cloud computing and wireless sensor network integration in the healthcare architecture.
   - Choose the cloud infrastructure, data transmission techniques, and sensor placement and quantity.
3. **Data Security and Privacy:**
   - Protect sensitive medical data by putting security measures in place and making sure.
   - applicable data privacy laws, such GDPR and HIPAA, are followed.
4. **Sensor Deployment:**
   - Place sensor nodes to gather patient data in the medical setting.
   - Verify that sensors are set up and calibrated correctly to obtain reliable data.
5. **Data Transmission:**
   - Create procedures for sending sensor data to the cloud.
   - Make sure that data is transferred reliably and effectively, taking latency and data volume into account.
6. **Cloud Setup:**
   - Construct servers and storage on the cloud to handle and analyze data.
   - Select the right cloud service providers, such as Google Cloud, AWS, or Azure.

7. **Data Processing and Analysis:**
- Create cloud-based software and algorithms for data analysis
- Draw significant conclusions from the gathered medical data.

8. **User Interface and Access:**
- Provide healthcare practitioners with intuitive interfaces to access and analyze data.
- Guarantee accessibility from a range of gadgets, including smartphones, tablets, and PCs.

9. Testing and Validation:
- Thoroughly test the entire system to verify that data is collected accurately and securely.
- Validate that healthcare professionals can effectively use the system.
- Case Study Selection:
- Choose a real-world healthcare facility or scenario for the case study.
- Ensure that it represents a relevant use case for the proposed architecture.

10. **Implementation:**
- Deploy the healthcare architecture in the selected case study setting.

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- Deploy the healthcare architecture in the selected case study setting. 12. Data Collection and Monitoring:
- Collect data from the sensors within the case study environment.
- Continuously monitor data transmission and system performance.

12. **User Feedback:**
- Gather feedback from healthcare professionals and patients using the system.
- Understand their experiences, challenges, and suggestions for improvement.

13. **Performance Evaluation:**
- Assess how well the proposed architecture meets its objectives in the case study.
- Evaluate its impact on patient care, data management, and overall healthcare efficiency.
- This methodology involves the systematic development and testing of a healthcare architecture using Cloud Computing in a WSN environment, followed by a real-world case study to evaluate its practical application. The case study helps to validate the effectiveness of the proposed architecture and provides insights for ongoing improvements.

DISCUSSION

These challenges are exacerbated by resource shortages inherent in wireless sensor network platforms. Cloud computing and wireless sensor technologies in the medical setting has been suggested in our proposed healthcare system. This system aims to enforce constantly increasing sensor data to populace-centered sensing applications from the various hospitals that may be used as up-to-date services in the cloud. A number of functions are provided in this framework that can automatically and wirelessly send and receive data to

numerous users. Due to the dynamic nature of the whole network, it can be utilized for exchange of information, recognition of smart IDs, placement of objects, and monitoring and tracking of objects. The cloud service model provides provisioning and use of economic resources. In some cases, this framework may be useful for patients who need more regular medical examinations, or for patients who cannot come to a doctor or need medical assistance at home. Because health care workers can monitor medical, such as exercise, weight, blood pressure, without going to a patient's hospital, it is necessary to consider smart health technology. Applying the IoT environment is a flexible way to link the latest measurement instruments, and you can build a smart network at home anytime anyplace.

CONCLUSIONS AND RECOMMENDATIONS

In some cases, this framework may be useful for patients who need more regular medical examinations, or for patients who cannot come to a doctor or need medical assistance at home. Because health care workers can monitor medical, such as exercise, weight, blood pressure, without going to a patient's hospital, it is necessary to consider smart health technology. Applying the IoT environment is a flexible way to link the latest measurement instruments, and you can build a smart network at home anytime anyplace.

ADVANCE RESEARCH

1. Literature Review and Gap Analysis:

1. Conduct an extensive literature review to identify existing research and technologies in healthcare architecture, Cloud Computing, and WSN.
2. Identify gaps and areas where current solutions are inadequate.

2. Problem Formulation and Hypothesis:

1. Define a clear problem statement that your research aims to address in the healthcare domain.
2. Formulate a research hypothesis that serves as the foundation for your work.

3. Theoretical Framework:

1. Develop a theoretical framework that integrates theories from healthcare, information systems, Cloud Computing, and WSN.

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