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

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Abstract:

- Internet of Things (IoT) considers a future that can connect something/someone/ any service with appropriate information communication technology that it brings innovation in the fields of home, smart home, medical system, article surveillance, and logistics. Because of this inclination, this paper develops a trailblazer: Internet of Things-aware, intelligent architecture, that can be used to monitor and track patients and other related computing devices personnel, and within hospitals premises. In line with the IoT vision, we propose IoT based healthcare architecture dependent on different but complementary technologies, especially the WSN, RFID, and smart mobile, all interacting via a Constrained Application Protocol (CoAP) over low-power wireless personal area network (6LoWPAN) framework. The framework possesses the capability to gather data instantaneously in natural status and in physical conditions of patients after which it gets processed for analysis, thereby providing services to the user.

Keywords — IOT, Cloud Computing, Environment, Wireless Sensor Network

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I. INTRODUCTION

WIRELESS SENSOR NETWORK (WSN) TECHNOLOGY POSSESSES THE CAPABILITY TO DEVELOP AND TRANSFORM THE WAY OF LIFE IN VARIOUS FIELDS SUCH AS ENTERTAINMENT, INDUSTRY, RETAIL, TRAVEL, HEALTHCARE, EMPLOYEE CARE, AND EMERGENCY MANAGEMENT. WIRELESS SENSOR NETWORKS, ARTIFICIAL INTELLIGENCE RESEARCH, AND PERVASIVE COMPUTING, HAVE BUILT MULTIFACETED CONCEPTS OF ENVIRONMENTAL INTELLIGENCE TO SUBDUE THE DIFFICULTIES WHICH WE COME ACROSS IN OUR DAILY LIVES.

NOTABLY, ONE OF THE WORLD'S BIGGEST ISSUES OVER THE PAST FEW DECADES WAS THE EVER INCREASING POPULATION OF THE ELDERLY IN ADVANCED NATIONS COUNTRIES. THE POPULATION REFERENCE STATION , PREDICTS THE POPULATION OF MORE THAN 65 YEARS OF ADVANCED NATIONS COULD REACH CLOSE TO 20% OF THE TOTAL POPULATION IN THE NEXT 20 YEARS. THEREFORE, THE NECESSITY TO PROVIDE QUALITY CARE TO THE AGING POPULATION QUICKLY AND REDUCE MEDICAL EXPENSES IS OF MUCH IMPORTANCE. A REASSURING USE IN THE FIELD IS THE INCORPORATION OF DETECTION AND END USER ELECTRONICS TECHNOLOGY THAT ALLOW FOR PEOPLE TO BE MONITORED CONTINUOUSLY

2. LITERATURE REVIEW

WSN in healthcare and cloud computing Due to technological advances in poor network systems and medical sensors, medical care has seen some development in recent years—take for instance the advent of Wireless Sensor Networks (WSN). These

WSNs is renowned for realizing promises to greatly strengthen and expand the quality of care in a various fields and different parts of the population. An example: early system prototypes of the WSNs observed to show the possibility of early detection of clinical deterioration through hospital real-time patient monitoring. In cases of massive disasters by automatic electronic triage, first aid enables massive (on-the-spot) investigation of human decorum and perennial diseases to improve the quality of life for the old .

Cloud Computing for Healthcare Applications By using cloud computing, it provides users with various benefits, including reducing the waste of both information system resources and electricity, increasing the efficiency and availability of data centers, and reducing operational costs. Healthcare applications based on cloud computing utilize cloud computing environments and offer the following benefits for patients and caregivers . Patient privacy and security: Cloud service provider expertise provided highly confidential medical data and increased security (Private Cloud) to avoid process leakage

IoT is growing rapidly. In the coming years, medical departments are expected to witness the spread of IoT and to boost new e - Health IoT devices and applications. Medical devices and applications are expected to process important personal data, e.g., personal medical data. Additionally, such smart devices can connect to the global information network for access at all times regardless of their location. Therefore, IoT's medical domain can be the target of an attacker. As shown in Figure 1, and from the viewpoint of medical needs, to promote the complete introduction of IoT in the medical field, it goes without saying that it is crucial to recognize and scrutinize individual functions of IoT privacy and security. In addition to that, security regulations, weaknesses, risk assessments, and incidence response should also be identified.

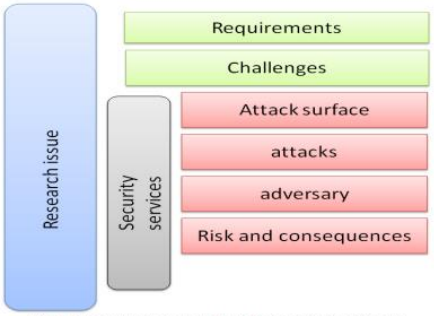

Fig 1. Security issues and challenges in healthcare

Figure 2 shows the proposed model of healthcare system architecture. In the model, the data is collected from different hospital wireless sensor network which accumulates and uploaded to the cloud infrastructure. The use of smart gateway is to collect and process the data and also control the system operation. Network management and security analysis monitor the network and detect anomalies which present in the network. At the user interface level, the model provides man services such as ambulatory services, some recommendation, emergency services, and location-based services.
Smart devices can be connected to the smart healthcare framework network to observe medical personnel constantly, all day long, gathering, and compiling data. The developed framework may also be utilized for security intents, and as smart services for collecting data through the Internet and from several applications including education, commerce, etc. In healthcare environments, it may be utilized to produce an improved and low-cost smart patient care and can provide access to information by patients about their personal treatment. Additionally, the smart healthcare framework supports patients' capacity to interconnect with medical staff.

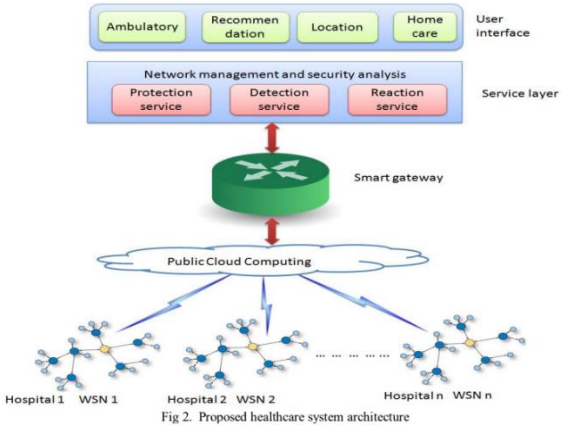

Fig 2. Proposed healthcare system architecture

3. METHODOLOGY

A. Research and Problem Identification:
- Identify healthcare challenges that can be addressed with technology.
- Research existing healthcare architecture models and technologies.

B. Architectural Design:
- Create a blueprint for the healthcare architecture that integrates Cloud Computing and WSN.
- Decide on the number and placement of sensors, data transmission methods, and the cloud infrastructure.

C. Data Security and Privacy:
- Implement security measures to protect sensitive healthcare data.
- Ensure compliance with relevant data privacy regulations, such as HIPAA or GDPR.

D. Sensor Deployment:
- Install sensor nodes in the healthcare environment to collect patient data.
- Ensure sensors are properly calibrated and configured for accurate data collection.

E. Data Transmission:
- Establish protocols for transmitting data from sensors to the cloud.
- Ensure reliable and efficient data transfer, considering factors like data volume and latency.

F. Cloud Setup:
- Set up cloud servers and storage for data processing and analysis.
- Choose appropriate cloud service providers, like AWS, Azure, or Google Cloud.

G. **Data Processing and Analysis**:
- Develop algorithms and software for data analysis on the cloud.
- Extract meaningful insights from the collected healthcare data.

H. **User Interface and Access**:
- Create user-friendly interfaces for healthcare professionals to access and interpret data.
- Ensure accessibility from various devices, like computers, tablets, and smartphones.

I. 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.

J. **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.

K. Implementation:

- Deploy the healthcare architecture in the selected case study setting.

L. **Data Collection and Monitoring**:

- Collect data from the sensors within the case study environment.
- Continuously monitor data transmission and system performance.

M. User Feedback:

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

N. **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.

4. DISCUSSION

Researchers all over the world are beginning to explore various technical solutions to mobilize the possibilities of IoT and complement existing services in order to strengthen medical provision. In addition, there are many typical applications in the medical field and many cases of the threats and challenges to be introduced in the wireless sensor network from the necessity to ensure the required reliability level and the privacy and security of medical data

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.

5.CONCLUSIONS

THE PURPOSE OF THIS PAPER WAS TO ASSESS THE MEDICAL ENVIRONMENT WITH REGARDS TO THE APPLICATION OF CLOUD COMPUTING, THE EMPLOYMENT OF WIRELESS SENSOR TECHNOLOGY, AND INTERNET INTEGRATION. THE EMPLOYMENT OF WIRELESS SENSOR TECHNOLOGY HAS EMERGED AS AN IMPORTANT CHARACTERISTIC OF ADVANCED HEALTHCARE SERVICES IN REAL TIME. THIS PAPER PROPOSED A SYSTEM ARCHITECTURE WHICH IS SUPPOSED TO COLLECT BOTH THE ENVIRONMENTAL CONDITIONS AND THE PATIENT'S PHYSIOLOGICAL PARAMETERS IN REAL TIME AND BE ABLE TO SEND THEM TO THE CONTROL CENTER. THE IOT SMART GATEWAY IS RESPONSIBLE FOR COLLECTING AND PROCESSING DATA, MANAGING THE SYSTEM, AND SERVICE EXECUTION. THEREFORE, IT CONTROLS MONITOR, ANALYZES, CONTINUOUSLY DETECT THE OVERALL SYSTEM OPERATION. THE PROPOSED SYSTEM ALSO FOCUSES ON SECURITY LEVEL WHICH PROVIDES THREE SECURITY SERVICES I.E., PROTECTION SERVICES, DETECTION SERVICE AND REACTION SERVICES WHICH HELPS TO DETECT AND MONITOR THE WSN NETWORK.

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