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**INFORMATION SYSTEM FOR HEALTHCARE
MANAGERS**

TERM II

Topic-

Philips HealthSuite - Remote Patient Monitoring System

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Remote Patient Monitoring System: Philips HealthSuite Digital Platform

1. Introduction of the Information System

One of the main technologies in modern health care is RPM, offering real-time collection, transmission, and analysis of patients' health data outside traditional clinical settings. One of the most advanced solutions for RPM is the Philips HealthSuite Digital Platform, HSDP. It was developed by Philips, a global leader in health technology, aimed at improving patient outcomes, optimizing care delivery, and streamlining healthcare operations through a cloud-based platform.

The platform, HSDP, combines an entire range of health devices and applications that track the patient's vital signs, including heart rate, blood pressure, glucose level, and oxygen saturation. The patient and caregiver-centric design leads to seamless interaction among all users involved. With IoT, cloud computing, and advanced analytics integrated, the program enables clinicians to intervene in a timely manner to prevent hospital readmissions and enhance the overall experience for the patient.

Another excellent feature of HSDP is that it can scale up to meet global health regulations, including HIPAA and GDPR, ensuring safe management of sensitive health information with patient confidentiality intact. Moreover, it can be configured with various devices and APIs, thus being able to easily adapt to different environments-from the individual practitioner's office to large-scale networks of hospitals.

We explore the key constituents of the Philips HealthSuite Digital Platform, processes on the front-end and back-end, network systems, data analytics capabilities as well as the technologies upon which they are based. Besides, we point out stakeholders and introduce some sample queries executed within the system and illustrate its function.

Philips HealthSuite Digital Platform

Philips HealthSuite digital platform is focused on providing a simple, fast and cost-effective cloud platform designed to support innovation in a healthcare regulated environment. By connecting devices, unlocking data and fostering collaboration it will help to encourage new forms of engagement, actionable insights and better health outcomes.

The ability to collect and analyse data is key to providing improved patient care. HSDP provides easy access to both clinical (EMR) and consumer data while allowing developers the ability to create a unified view without having to go app to app. This makes it possible to create a holistic view of the patient to help improve decisions related to ongoing care at the individual patient level. Applications created on HSDP have the potential to share and capture data with greater frequency and intelligence which can allow earlier interventions and strengthens the ability of providers to interact with patients in settings outside of the hospital. Applications built on HSDP can support a variety of patient engagement solutions that help to make it easier for patients to stay engaged throughout the healthcare continuum.

Examples of solutions that can be developed on HSDP include enterprise telehealth solutions, connected sleep monitoring, predictive analytics, medication adherence and clinical informatics capabilities to name a few. Simplicity, scalability and speed to market HSDP removes the complexity of building and managing your own healthcare security and privacy compliant cloud infrastructure and platform. We created HSDP to provide a shared expertise and fully managed cloud-based infrastructure and platform-as-a-service to eliminate the burden of having to develop and maintain it yourself. HSDP provides the tools to help speed your development time and your transition to the cloud, whether you have existing legacy products that you want to move to the cloud or want to develop cloud-native applications, or both. HSDP provides the services, technical tools and resources optimized for the creation and rapid development and deployment of connected healthcare and life science applications. HSDP provides a curated marketplace of foundational cloud services, such as databases and queues to support a wide variety of solutions.

2. Content

2.1 Front-End and Back-End Processes

Front-end Process:

HSDP has a patient and provider-centric front end with simple mobile and web applications through which it interfaces with users in following ways:

-*Patient Portal*: Patients will have access to the portal and will get their health information along with alerts from healthcare providers too. Since its interface is simple, elderly patients will not be troubled using it.

- *Provider Dashboard*: The health provider receives a snapshot of health metrics, trends, and alerts specific to the patient. Some of its features include live data visualization, patient history, and predictive insights.

Back-End Process:

Health data storage, processing, and safe transfers are the back-end process focus of HSDP. Below are some given components of it:

- Cloud Infrastructure: It is deployed on AWS so that it's an elastic and reliable environment.
- Data Integration Layer: This ensures that the IoT devices, EHR and third-party applications are not in conflict with each other.
- Security Framework: Above this includes advanced data encryption, multi-factor authentication, and monitoring compliance.
- HSDP's Cloud Foundry application hosting/build environment: A commercial Cloud Foundry environment for cloud-native development that meets regulatory requirements to support you in rapidly developing and testing applications
- Self-service model e.g. through developer web portals and extensive online documentation API's that provide developers with the ability to consume underlying orchestrated services.
- Abstraction layer on the cloud infrastructure and foundation cloud services that allows developers to consume the underlying services
- HSDP uses APIs, industry standards, such as OAuth2, and healthcare standards, such as HL7 and FHIR, to reduce your development effort. Full Operations support from HSDP: 24/7,365

days a year support to configure, maintain, monitor and provide operational availability of HSDP and the solution you are hosting on HSDP.

2.2 Network System Used

HSDP is highly dependent on the robust network infrastructure for smooth data flow.

- IoT Connectivity: It connects the health monitoring device of a person to the platform via Bluetooth, Wi-Fi, and other cellular networks.
- Cloud Connectivity: This utilizes fast internet and safe APIs for data movement over to cloud servers.
- Network Redundancy: This will ensure minimum downtime by using redundant server configurations and failover mechanisms.
- Security protocols-Uses VPNs, firewalls, and TLS encryption to protect data in transit.

Third-party data integrations: Access a wealth of data from third-party services and devices through Philips' partnerships with other industry platforms

Managed service: Use a host of features and advantages that come with a managed service, rather than a raw brokered service

Collect and store data: Data from users, health and wellness devices, and clinical datastores across the health eco-system in a managed cloud repository

Open APIs: Facilitate access to health data from multiple sources(devices, applications, systems) and enable faster development of consumer and professional applications

Data Security: Secure and encrypted storage capabilities,access control and healthcare compliant auditing and logging focused on providing requisite privacy and security of personaland clinical data

The standards-based interoperability between enabled apps and devices with third party systems via FHIR and HL7.Our secure identity and access management with a unified view into security policy, authorization, consent and data privacy.

Rapid and scalable integration: Provides a high performing integration engine with many built in capabilities to provide semantic interoperability, connecting On-premise with the cloud API based systems

API based flexible framework: Out-of-the-box support for REST based APIs, with support for a variety of message mapping and routing capabilities and custom integration to standard and application-specific workflows

Flexible messaging format support: Supports variety of messaging formats, such as HL7 (version 2 and 3) to HL7 FHIR, and enables integration with systems based on well-defined XML, JSON and other proprietary formats

Enterprise-identity approach: IAM provides capabilities for harmonizing multiple applications built on HSDP, enabling clients to use a single identity across multiple applications

Standard identity management workflows: Standards-based identity, authentication and authorization capabilities to eliminate redundant, error-prone, and often incomplete (re)-implementation of standard workflows

Cross-platform integration: Centralized set of enterprise identity and access management mechanisms that enable identity integration across consumer or healthcare applications built on HSDP

Collaboration with third parties: Support integration and collaboration with third-party applications and services through federation and single sign-on capabilities

2.3 Data Analytics Process

It is the core module of HSDP that transforms raw health data into actionable insights.

- Real-time Monitoring: Continuously monitors incoming data for anomaly detection and alerts for timely interventions.

- Predictive Analytics: Forecasts possible health risks by analyzing historical and real-time data with the help of machine learning algorithms.

- Trend Analysis: Enables tracking health trends over time to allow health care providers to adjust their treatment plans.

- Reporting Tools: It develops editable reports for clinicians and patients to help them make better decisions.

Marketplace of building blocks: Commonly used services, including databases and queues, in an environment that meets security and privacy regulatory requirements

Auditing and logging: Enhanced debugging efficiency, traceability, and compliance with privacy, security, regulatory standards for applications being developed

Specialized services: Services to increase developers' visibility into application activity

Notifications and configuration: Facilitations and loosely coupled integrations with other services

Environment for cloud-native development: Environment that meets regulatory requirements to support you in rapidly developing and testing cloud-native applications

Analyze

Our framework to ingest and manage data, execute ETLs

and analytics applications and visualize data.

More data, more insights: Provides the ability to develop big data analytics solutions to help derive predictions and meaningful insights

Simplification: Reduces the complexities of building and maintaining distributed big data computing environments by providing a common set of tools to ingest, transform, and extract data for advanced data visualization

Leading cloud expertise and regulatory compliant cloud infrastructure

HSDP meets the privacy, security, and regulatory requirements needed to protect an individual's sensitive data.

2.4 Technologies Used

HSDP uses all of the advanced technologies for its features:

- IoT Devices: Wearable sensors, smart monitors, and connected medical devices.
- Cloud Computing: AWS is used here for data storage, processing, and scalability.
- AI and Machine Learning: This runs Predictive Analytics, Anomaly Detection, and Personalized Health Insights.
- APIs: To ensure smooth interactions across devices and healthcare systems.
- Security Tools: Implement advanced encryption, intrusion detection systems, and compliance frameworks.

The core services for cloud-native development and managed infrastructure in order to deploy and continuously monitor application performance and the health status of systems.

3. Identify Stakeholders

The stakeholders that will be involved in the Philips HealthSuite Digital Platform include

- Patients: Direct beneficiaries, through the platform, monitoring their health and timely interventions.
- Health professionals: Doctors, nurses and other allied health professionals employ the system to improve the care quality of the patients.
- Hospitals and Clinics: Organizations that apply to enhance their activities toward serving patients better.
- Insurance Companies: Use these data insights to understand how claims can be prevented to support preventive care programs.
- Developers and IT Teams Developing and improving functionality and the security of the platform.

4. Sample Queries

Below are sample queries executed within the HSDP database:

****Query 1: Retrieve patient details for those with abnormal vital signs.****

```
```sql
SELECT patient_id, name, vital_sign, value, timestamp
FROM patient_vitals
WHERE vital_sign = 'heart_rate' AND value > 100;
```
```

****Query 2: Identify the number of alerts generated in the last 24 hours.****

```
```sql
SELECT COUNT(*) AS alert_count
FROM alerts
WHERE alert_timestamp >= NOW() - INTERVAL 1 DAY;
```
```

****Query 3: List patients monitored by a specific healthcare provider.****

```
```sql
SELECT p.patient_id, p.name
FROM patients p
JOIN providers pr ON p.provider_id = pr.provider_id
WHERE pr.name = 'Dr. John Doe';
```
```

****Query 4: Retrieve average blood pressure readings for a specific patient over the past month.****

```
```sql
SELECT AVG(systolic) AS avg_systolic, AVG(diastolic) AS avg_diastolic
FROM blood_pressure_readings
WHERE patient_id = 'P12345' AND reading_date >= CURDATE() - INTERVAL 30 DAY;
```
```

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