eHealth4Ageing: Electronic Health Record for the Elderly

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Abstract— **This paper provides a brief outlook of the reference architecture and functionality of an elderly Electronic Health Record (EHR) system, termed eHealth4Ageing, that allows medical data to be stored and shared with other 3rd party systems under the National eHealth ecosystem of Cyprus.**

I. Introduction

By 2050, the number of adults, worldwide, aged over 65 years old, will nearly double [1]. In that context, the number of older adults living with chronic diseases will also increase, due to their vulnerability to such conditions [1]. As a result, the timely collection and availability of actionable medical information is a critical challenge towards providing elderly healthcare services that necessitate greater coordination. The latter, underpins the wider adoption of eHealth services that are geared towards elderly care. EHRs are considered the backbone of electronic Health (eHealth), designed to provide a well-documented and comprehensive patient record in order to increase the efficiency of care delivery [2]. In response to the aforedescribed challenges, eHealth4Ageing software-as-a-service (SaaS) solution facilitates storage, processing, and sharing of elderly EHR, in a secure and interoperable fashion, while implementing role-based access of different healthcare professionals and patients.

II. eHealth4Ageing System Architecture and Functionality

The system's design relied on clinical requirements, specifications, and use-case scenarios collected from healthcare professionals of several elderly healthcare clinics in Cyprus, in collaboration with Archangel Michael Elderly Center in Nicosia, Cyprus, acting as the early adopters of the eHealth4Ageing solution.

A. eHealth4Ageing Reference Architecture and Design

The system's architecture is conceptually divided into three main layers. First, the *Data Layer,* which includes the database server as well as data persistence mechanisms facilitating the integration of medical data, IHE interoperability profiles, and appropriate read/write access to the data through pre-specified procedures. Second, the *Application Layer,* which leverages the application server and logic allowing communication between the presentation and the data layers through Application Programming Interface (APIs) calls, while ensuring security protocols conformance. Finally, the *Presentation Layer,* which tackles the webserver and user interface (UI) components such as forms, reports and alerts accommodating the user access to the system.

The above-mentioned layers further encompass three additional components. More specifically, the *security and privacy* component that ensures high quality security, authentication and auditing functionalities. Then, the *interoperability* component that covers the connectivity with 3rd party systems via IHE profiles [3]. Lastly, the provisions for the *Cyprus National Contact Point (NCP)* connectivity component for cross boarder healthcare as specified at an EU level via the Connecting European Facility EU project [2].

From an implementation perspective, the platform architecture separates the Front-End from the Back-End. It adopts a distributed system approach, thus consisting of coupled services that do not use shared data storage, but instead, communicate via APIs. The system employs a Web Database with Java Database Connectivity for storage and processing of information. Furthermore, the Apache Tomcat Server is used to establish the connectivity between the system and the database. The Back-End's implementation uses Java both as a programming language and as a platform, supporting the APIs. The combination of three programming languages, namely HTML, CSS, and JavaScript is used to implement the system's UIs at the Front-End leveraging the React JS library.

B. eHealth4Ageing Content Management

The system's content is categorized into three sections: the *clinical*, the *therapeutic* and the *administrative* sections. The clinical section provides an electronic set of clinical data. The therapeutic section contains specialised diagnostic tests, reports and health data related to each specialty involved in the elderly's treatment. Finally, the administrative section includes the appointment scheduling and agenda viewing functionalities.

III. Expected Benefits

The vision driving the development of the eHealth4Ageing SaaS solution is to leverage state-of-art technologies facilitating the provision of eHealth services anywhere, anytime and on any-device, towards enhancing both the quality of care and life of the elderly population in Cyprus.

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