A CONCEPTUAL PROPOSAL FOR DEVELOPING AND IMPLEMENTING A FEDERATED E-HEALTH PROTOTYPE PLATFORM

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Abstract - This paper explains a proposal for a research project that will be focused on specifying, designing, prototyping, and testing a Federated e-Health Portal System that would satisfy the overall requirements by public and private hospitals, medical centers and clinics in Jordan. Extended literature surveys will be conducted and selected staff from the health sector in Jordan (Ministry of Health, Medical Associations, Doctors, Dentist, sample Patients, etc.) will be interviewed and consulted in an effort to collect and formalize a decent set of requirements for the intended e-Health Portal. Health care services in Jordan are provided in each hospital and/or medical center using separated health information management systems. Health care providers (e.g. hospitals, medical centers and privately owned and operated registered clinics) need to be fully integrated such that any patient will be able to visit any doctor anywhere within the country while at the same time his/her record and history is transparent to all of these doctors (e.g. with his/her permission). Also, he/she should be able to get his/her medicine from any pharmacy within the country" The outcome of this research project (e.g. e-Health Portal) would be distinguished from existing systems used in other countries as follows; our e-Health Portal will be comprehensive and specific to Jordan as it will be based on requirements driven directly from the various interviews referenced above. All testing will be driven by those doctors and patients that would have been interviewed at the beginning of the project.

Index Terms - e-Health, e-Health Portal, web-based e-Health, e-Health systems, public and private hospitals, Health Jordan, Jordan, software requirements, software architecture, software design, software prototyping, software testing, and software evaluation.

I. INTRODUCTION

Health services include all services dealing with the diagnosis and treatment of disease, or the promotion, maintenance and restoration of health. They include personal and non-personal health services [1]. Health services are the most visible functions of any health system, both to users and the general public. Service provision refers to the way inputs such as money, staff, equipment and drugs are combined to allow the delivery of health interventions [1]. e-Health is the use of information and communication technologies (ICT) for health. The e-Health unit works with partners at the global, regional and country level to promote and strengthen the use of ICT in health development, from applications in the field to global governance [2, 3, 4]. This paper explains a research project that expands health system in Jordan to a national level e-Health portal for Jordan [5].

II. RESEARCH PROJECT JUSTIFICATIONS

A. The intended research project will support Amman Arab University (AAU) in a number of ways including:

a. The support and expansion of AAU's community service efforts, through serving the Jordanian Health Sector.

b. The support and expansion of AAU's applied research efforts.

c. Activating AAU's Consulting Services Center through producing a detailed consulting proposal to be submitted to the Ministry of Health. The intended Consulting Proposal would address the main issues related to the integration of all existing Health Systems in Jordan such that only minimal modifications – if and only when needed - will be allowed in existing systems. Rehabilitation of all existing infrastructure (datacenters, servers, storage, networks, etc.) and software systems will be taken into consideration as well.

d. Activating the AAU's Consulting Services Center will encourage other AAU staff to look into potential opportunities to provide Consulting Services to the various sectors in Jordan.

e. Creating partnerships with local institutions such as Ministry of Health and Higher Scientific Research Council in Jordan.

f. Activating the AAU's Consulting Services Center will put AAU in a leading position in the Consulting Services Business in Jordan and within the region. As a result, this will generate much revenue to AAU.

B. Integrating medical service providers in Jordan through an e-Health Portal system will:

a. Enable upper management in the health authorities in Jordan to have easy and online access to all types of statistical views and reports on all health service providers across the country and the various services that are provided by them.

b. Facilitate collaboration among health service providers in Jordan.
c. Optimize paper-based works and correspondence (e.g. transformation into a semi paperless e-work environment and transforming all correspondence among doctors, health service providers, pharmacies, insurance providers, etc. into an automated e-correspondence).
d. Eliminate all manual exchange of patients' information and history (e.g. transformation into an automated e-work environment).
e. Eliminate all duplications of health services (e.g. no one can then cheat on the provincial health system due to the ability of making his/her record transparent across all health services providers).

III. RESEARCH PROJECT OBJECTIVES

The main objectives of this research are as follows:
1. Identify the main aspects, features, and functions that are essential in an e-Health Portal such that it becomes very beneficial to the Health Sector in Jordan. This objective will be achieved through conducting an extended literature surveys as well as interviewing and meeting with key people from the Health Sector in Jordan.
2. Specify and design a decent e-Health Portal that satisfies the targeted aspects, features, and functions, which are referenced in the previous objective.
3. Develop and implement a prototype version of the targeted e-Health Portal.
4. Test, evaluate, and enhance the prototype in collaboration with the key people, which are referenced in the first objective.
5. Prepare a comprehensive report that will illustrate the tasks and activities completed during the project period. Also, it will present the outcomes of the research project along with a set of reasonable recommendations and a plan for future extended work. In addition to that, the budget spending will be detailed in that report.
6. Prepare a consulting proposal for submission to the Health Authorities in Jordan (e.g Ministry of Health, Medical Associations, etc.) for the purpose of providing them with long-term consulting services with the goal of developing, deploying the e-Health Portal targeted by this research project and using it in the health sector across the country.

IV. THE ANTICIPATED BENEFITS OF DEPLOYING AND USING E-HEALTH PORTAL

Deploying and using e-Health Portals can:
1. Provide a platform for information sharing among health stakeholders across Organizations, Jurisdictional / Geographical Boundaries, as well as Disciplines and Domains.
2. Improve Health Services Delivery through:
- Having coordination among healthcare professionals enhanced,
- Making information of availability of services accessible,
- Allowing rapid access to the services (e.g. advise, remote monitoring, interpretation, diagnosis and treatment),
- Encouraging clients to actively participate in e-Health Educational Programs,
- Personalizing care for the patient by a complete picture of the patient's medical history,
- Improving the productivity of healthcare professionals by immediate data availability and that helps reduce unnecessary or duplicated tests,
- Improving the capacity for data exploitation, investigations and that leads to better training of new healthcare professionals, and
- Minimizing costs and maximizing efficiency in development and evolution e-Health products and provision of appropriate services.

3. Improve Quality of Services through:
- Forming and sustaining business relationship with the clients and facilitating collaboration among care givers (e.g. second opinion, and care givers and patients e.g., compliance with care plan),
- Reducing adverse events (e.g. adverse drug effects),
- Increasing accuracy in detecting health problems or monitoring the effects of treatment, and
- Increasing the speed and accuracy of detecting infectious disease outbreaks.
- 4. Improve Efficiency of Services through:
- Increasing access to integrated patient information,
- Improving care coordination,
- Reducing duplicate tests and prescriptions,
- Reducing patient / provider travel costs, and
- Improving information management resulting in reduced costs.

V. THE ANTICIPATED VALUE-ADDED OF DEPLOYING AND USING E-HEALTH PORTALS

The main Value-added of deploying and using e-Health Portals can be summarized as follows:
1. Fast Information Retrieval.
2. Accurate Data.
3. High Reliability.
4. Eliminate Redundancy.
5. Friendly.
6. Efficiency & Cost Reduction.
7. Improving Quality.
8. Empowerment of Consumers / Patients
9. Encouragement.

10. Education.
11. Enabling Information Exchange.
12. Scope Extension.
13. Ethics.
14. Equity.
15. Legal Framework around Deploying and using e-Health

VI. E-HEALTH PORTAL PRE-LIMINARY FUNCTIONS

The main preliminary functions of the e-Health portal are:

1. Structural Modules
- Population Data System Module
- Corporate Resources Catalogue Module
- Operators and Professionals Management Module

2. Accessibility Modules
- Patient Healthcare Module
- Admission Module
- Agendas and Appointments Module
- e-Health Services Module

3. Request Management Modules
- Diagnostic Tests Module
- Medical Inter-Consultations Module
- Medical Orders Module
- e-Prescriptions Module

4. Healthcare Modules
- Consultations Module
- Casualty Module

5. Hospitalization Module
- Day Hospitalization Module

6. Departmental Modules
- Radiology Module
- Laboratory Module
- Dietetics Module
- Blood Bank Module
- Pharmacy and Unidose Module
- Rehabilitation Module
- Records Module

7. Clinical Stations Modules
- Doctors Station Module
- Nursing Staff Station Module
- Other Healthcare Professionals Station Module

8. Management Support Modules
- Invoicing Module
- Payments Module
- Shifts Management Module
- Infrastructure Module
- Materials Management Module

9. Data management modules:
- Top Management Control Panel Module
- Data-warehouse Module
- Medical Indicators Module

10. Communication Channels between Healthcare Professionals and their Patients Modules
- SMS Incorporated Platform Module
- e-Mail Incorporated Platform Module
- Other Messaging Systems Modules1. Fast Information

VII. CHALLENGES AROUND DEPLOYING AND USING EHEALTH PORTALS

The following categories of challenges that would affect the move to deploying and using e-Health Portals should be taken into consideration:

- Organizational Challenges.
- Cultural Challenges.
- Industrial Challenges.
- Legal Challenges (e.g. Privacy and Data Security).
- Technology and Standards Challenges.
- Challenges that relate to the National / Regional e-Health Strategy.
- User Challenges (e.g. Acceptance)

VIII. PATIENTS GENERIC REQUIREMENTS IN E-HEALTHPORTALS (A CANADIAN PERSPECTIVE)

This section was derived based on a Canadian Patients Perspective that was illustrated in several publications, which the researcher had the opportunity to examine during the past two years. Similar effort will be carried out during the execution of this research project to derive the perspective of patients in Jordan.

Health care services in Jordan are provided in each hospital and/or medical center using separated health information management systems. Health care providers (e.g. hospitals, medical centers and privately owned and operated registered clinics) need to be fully integrated such that any patient will be able to visit any doctor anywhere within the country while at the same time his/her record and history is transparent to all of these doctors (e.g. with his/her permission). Also, he/she should be able to get his/her medicine from any pharmacy within the country".

The following categories of people (e.g. Canadian Perspective) should be taken into consideration and interviewed before the technical specifications of any targeted e-Health Portal can be derived and finalized:

1. **Patients** - Each patient should have:

a. A unique record that is shared by all of these health services providers. This requires having all existing patient's databases

b. A unified record of his/her history of visits to his/her doctor(s) as well as his/her admissions into hospitals. His/her future visits shall be added to that unified record of history.

c. A unified record of his/her history of medicine perceptions along with the names of the doctor(s) and

the health service providers associated with these prescriptions. Also, this should be associated with the details of the pharmacies and pharmacists who provided the required medicines per these perceptions. **d**. A unified record of his/her history of medical insurance plans.

2. **Doctors** - Each doctor and his/her team should be able to access his/her patients' records, but after being authorized by the patients themselves or legitimate higher authorities. Then examine his/her patient and type his/her observations and recommendations; and upload scanned copies of any paper works he/she produces for the patient.

3. **Dentists** - Each dentist and his/her team should be able to access his/her patients' records, but after being authorized by the patients themselves or legitimate higher authorities. Then examine patient and type his/her observations and recommendations; and upload scanned copies of any paper works he/she produces for the patient.

4. **Nurses** - Each nurse should be able to access his/her patients' records, but after being authorized by the patients themselves or legitimate higher authorities. Then examine his/her patient and type his/her observations and recommendations; and upload scanned copies of any paper works he/she produces for the patient.

5. **Physiotherapists** - Each physiotherapist should be able to access his/her patients' records, but after being authorized by the patients themselves or legitimate higher authorities. Then examine his/her patient and type his/her observations and recommendations; and upload scanned copies of any paper works he/she produces for the patient.

6. **Midwives** - Each midwife should be able to access her patients' records, but after being authorized by the patients themselves or legitimate higher authorities. Then examine her patient and type her observations and recommendations; and upload scanned copies of any paper works she produces for the patient.

7. **Practicing & Professional Caring Personnel** - Each should be able to access his/her patients' records, but after being authorized by the patients themselves or legitimate higher authorities. Then examine his/her patient and type his/her observations and recommendations; and upload scanned copies of any paper works he/she produces for the patient.

8. Pharmacists / Pharmacies - Each should be able to access his/her patients' medicine records, but after being authorized by the patients themselves or legitimate higher authorities. Then issue the medicine as per instructed in the prescriptions.

9. Health Care Providers (Hospitals, Medical Centers, Clinics, etc.) - Each should be able to utilize the targeted portal to perform their daily operational transactions. Also, they should be able to get the reports and KPIs they need.

10. Health Care Insurance Authorities / Firms - Each should be able to utilize the targeted portal to perform their daily operational transactions. Also, they should be able to get the reports and KPIs they need.

IX. RESEARCH METHODOLOGY OVERVIEW

This research project will possess two main phases.

Phase I

During the first phase, should this proposal be approved for funding by AAU, research assistants needed for the first phase (e.g. mainly AAU senior students and/or MSc students) will be recruited and hired. Then, we will conduct expanded literature surveys to identify and figure out the factors/parameters (e.g. aspects, features, functions, success factors, failure factors, etc.) that are critical to e-Health systems in general and to e-Health Portals in specific. The focus will be on (i) existing e-Health systems that can be examined on the web; and (ii) papers published in the various e-Health and Information Systems Online Journals, Printed Journals, Magazines, Conference Proceedings, etc. Once these factors are identified, we will conduct a series of interviews with selected upper management staff at the Ministry of Health as well as the Medical Associations in Jordan. The researchers will discuss these critical factors during these interviews. Such factors will be subject to modification, elimination, and/or addition of new factors.

Phase II

During the second phase, comprehensive technical specifications for the targeted e-Health Portal will be derived based on the outcomes of the previous phase. Such technical specifications will be presented in a formal format that can be communicated to designers, developers as well as technical management staff. Then a complete design for the e-Health Portal will be derived based on the outcome specifications of the previous phase. The design will take into consideration all critical factors identified in the second phase of the literature review and the series of interviews. A partial set of functions and features from the outcomes of the previous phase will be selected and a design for a prototype portal will be made accordingly. Then, a prototype portal will be developed, deployed, tested and presented to the partners and stakeholders of this project. This will demonstrate the intended functionalities and features to the participating hospitals and entities from the health sector in Jordan. The prototype will be tested by the researchers as well as the participants. All defects uncovered during the test phase will be fixed in the prototype and an enhanced version of the prototype will be delivered.

After all, a comprehensive report will be produced to describe all tasks and activities performed by the researchers and the participants throughout the project

duration. Then, a detailed consulting report will be prepared for submission to the health authorities in Jordan to provide them with long-term consulting services towards developing and deploying a full version of the e-Health Portal that was targeted by this research project.

X. RESEARCH PROJECT PHASES AND ANTICIPATED OUTCOMES

This research project will go through the following phases:

Phase I

I-1 Preparation of this proposal

I-2 Round table discussion of this proposal with the co-researcher(s)

I-3 Submit this proposal to AAU for their approval

I-4 Recruiting the required staff for Phase I (e.g. mainly AAU senior students and/or MSc students) All research assistants needed for this phase are selected and hired.

I-5 Survey existing e-Health systems - A document that presents a list of features and functions for a decent e- Health Portal System

I-6 Survey related literature and publications - A document that presents success and failure factors as well as notes and observations derived by other researchers in respect to designing and implementing e-Health systems

I-7 Prepare a solid action plan (with questions and triggers) to meet and interview with key people from the Health Sector in Jordan - An action plan document to meet with the targeted people (e.g. Ministry of Health; Medical associations; Sample Hospitals, Medical Centers, Clinics, etc.)

I-8 Prepare a set of questionnaires that will be used to collect the feedback from the interviewed key people per the above task - A set of questionnaires

I-9 Conduct the targeted interviews and meetings per the action plan referenced above - A document that presents all comments, needs, wishes and requirements collected during these interviews and meetings

Phase II

II-1 Recruiting the required staff for Phase II - All research assistants for this second phase are selected and hired

II-2 Derive detailed technical specifications of the targeted e-Health Portal based on the surveys, interviews and meetings - A document that presents the detailed technical specifications for the targeted referenced above

II-3 Discus the technical specifications with those who were interviewed from the health sector before they are finalized - A revised and finalized version of the technical specifications document that is referenced above

II-4 Derive a comprehensive design, for the targeted e-Health Portal - A document that presents the detailed design of the targeted e-Health Portal. It will present the following:

a. The high-level architecture of the system

b. The required hardware, network and storage specifications

c. The security layer's specifications

d. The front-end and user interface layer's specifications

e. The processing layer's specifications

f. The connectivity to the portal specific databases as well as to the remote hospital, medical centers and clinics remote databases layer's specifications

g. The skeleton and specifications of the portal specific databases

II-5 Select a set of the features and functions that will be included in the first version of the targeted e-Health Portal (e.g. the Prototype) - A document that presents the features and functions that will be included in the Prototype

II-6 Develop a reasonable set of test scenarios for testing the Prototype - A document that presents a reasonable set of test scenarios for the Prototype

II-7 Develop the Prototype - A Prototype system of the targeted e-Health Portal

II-8 Execute the test scenarios on the Prototype - A document that presents the researchers early observations on the Prototype

II-9 Revise the Prototype per the test observations - A revised Prototype

II-10 Present the Prototype to the people who were interviewed earlier - A document that presents the feedback received on the prototype from the people who were interviewed.

II-11 Prepare a detailed report on the entire research project - A detailed report on the research project

II-13 Prepare a detailed Consulting Proposal for submission the health authorities to provide them with long-term consultation services - A detailed Consulting Proposal to be submitted to the health authorities in Jordan (e.g. Ministry of Health, etc.).

II-14 Submit the entire outcomes of this research project to AAU for final review and approval AAU Approval and Closure of the project

XI. RESEARCH PROJECT REQUIREMENTS

Project requires the following manpower

1. One Project Administrator - 12 Months

2. Two Literature and Systems Survey Assistants - 4 Months

3. Two Interviews Assistants - 3 Months

4. One Systems and databases Specifications and Design Assistant - 6 Months

5. One Security Layer Design Assistant - 3 Months

6. One Web Development Assistant - 4 Months

Equipment and Accessories requires for the project

1. One High-Performance Laptop Computer
2. One High Performance Desktop Computer
3. Three Laptops (for the research assistants)
4. Three Desktop Computers (for initiating a new Lab for the project)
5. Two LaserJet Printers (Lab + principal researcher)
6. Two Scanners ((Lab + principal researcher)
7. Accessories (LaserJet Printers Cartridges, Printer Papers, Router, Cables, Headphones, etc.)
8. One Photocopy machine
9. Stationary

CONCLUSION

The paper explained about, designing, prototyping, and testing a Federated e-Health Portal System for the country of Jordan.

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