605.601— Foundations of Software Engineering
Fall 2020
Project Case Statement

GoodMead: A Hospital Management System

GoodMead is a large hospital in a metro city within a fully developed country. This hospital provides diverse types of health-related services in pediatrics, gynecology and obstetrics, orthopedics, radiology, dentistry, sports medicine, and so on.

A detailed review of the current systems and methods of the hospital was carried out. The review is a part of a comprehensive e-business strategy aimed at modernizing the hospital's information technologies and systems. This included a review of the following processes: patient admission, staff scheduling, maintaining patient records, managing laboratory test results, identifying and utilizing historical medical records, managing drugs, managing inventory, allocating funds, and utilizing facilities.

As a result of the review and ensuing discussions by the board of GoodMead, a new "program of work" has been commissioned. This program of work comprises key IT projects dealing with new development, integration, transformation, and extension activities. The aim is to provide a fully integrated software solution that is on the cloud. Cost effectiveness and efficiency in providing patient services, effective use of hospital resources, and compliance with current and upcoming regulations are some of the key goals of this strategy.

The new software development project is approved by the board in conjunction with a reputed consulting company. The project is called HMS (hospital management system). HMS has a dedicated business objective, separate budget, a project director, three project managers, and a team of analysts, designers, developers, and testers.

The briefing given to this HMS project is to develop an Internet-enabled, cloud-based and secure software solution that will handle all current and future hospital management processes. Successful implementation of HMS should result in ease of access to patients and staff, quicker registration and tracking of patients' details, and in general a smoother day-to-day operation. HMS is aimed at providing value to patients, staff, administrators, and regulators. HMS is also meant to enhance collaboration of GoodMead with other business entities (such as pharmacies, laboratories, and police and ambulance services).

The project director for the HMS is working closely with the principal consultant of the consulting firm to seek advice on software development processes, architectural frameworks, software engineering approach (object-oriented), design standards (they have agreed on using the UML), CASE tools for modeling (they have agreed on StarUML, although some users are comfortable using Visio), and testing approaches. The decision as to which implementation technology should be used is yet to be made by the technical architects of the system (e.g., whether the system will be implemented in .NET or J2EE and which corresponding cloud platform will be used). Expertise from the medical administration domain is sought to capture and enhance the hospital's business processes and ensure legal compliance.

A recent senior level workshop carried out over two days included the program director, all three project managers, principal consultant, senior business architects, consulting enterprise architects, and special advisors from the field of medical technology. The following summarizes the resolutions in point form:

1. The hospital has a large outpatient department (OPD) that provides medical consultations and prescriptions, usually during the day. There are at least two shifts, as the OPD is open from 8 a.m. to 10 p.m.; the OPD is staffed with doctors, specialty physicians, nurses, receptionists, and various other related roles. The OPD is the first area of the hospital that needs to be upgraded for its business processes and support systems.
2. The hospital has 10 sophisticated operating theaters. There are many pre- and postsurgical activities (including pre- and postnatal activities). Many processes around the afore-mentioned activities are not documented. Instead, the staff carries them out based on their knowledge and experience. The processes that require mandatory documentation are not very well supported by the software system. There is an urgent need to upgrade these processes, which include not only dealing with the patients' medical procedures and corresponding legal documentation (such as signing of authority to perform certain medical procedures and nomination of next of kin) but also optimization of facilities management. Diagnostic tests, including blood tests, x-rays, and so on, are carried out on the hospital's premises. However, the ownership and operation of these laboratories are independent of GoodMead hospital. Therefore, there is a need for coordination and collaboration between the software systems used by the laboratories and HMS.
3. The hospital is continuously in touch with various local, regional, and national pharmaceutical organizations that manufacture and supply drugs; this enables the hospital to get the latest information on existing and new drugs and new medical experiments and allows it to provide input on those experiments and trials. Thus, the senior team sees great opportunity for knowledge sharing and collaboration in the areas of provisioning drugs, availability of latest instruments and medical technologies, and exchange of innovative ideas in medical research.
4. Staff-related processes (e.g., checking availability of physicians and surgeons and scheduling nursing and support staff) are not currently optimized. Many processes are manual, and occasionally administrative staff uses physical notepads, diaries, and whiteboards to check the availability of and book doctors. HMS should be able to handle the scheduling of consultations of patients with the respective medical staff and scheduling work rosters for nurses and administrative staff.
5. Internal administrative systems (such as booking of surgeries in operating theaters or schedules of attending nurses) either use tools such as a local Access database created by people with no software engineering background or, much worse, on whiteboards. These administrative functions are to be moved to the Internet-enabled, cloud-based system that will be managed remotely.
6. Security in terms of storage and access of data and patient privacy have come out on top as key concerns and risks from a legal and compliance viewpoint. The government regulatory specialist on board in this project has advised that patient data are part of a government initiative on electronic medical records (EMRs). The EMR initiative enables sharing of data on the cloud to enable emergency services to access it based on preauthorized IoT devices. Privacy of those data remains on the highest compliance needs of government regulatory bodies and cannot be compromised under any circumstances.
7. User interfaces of the software solutions are specified and designed with usability in mind. HMS is to be used by a wide age range of user groups—young and old, and users with

disabilities. HMS needs to comply with the government requirements on the accessibility of the system.

8. Performance and security of HMS are separately specified as nonfunctional requirements and they are part of the agreement between the program director and the board.
9. A range of relative cross-functionalities (such as sports information) needs to be included to attract and keep nonpatients at the site as well. The purpose of it is to keep the community aware. This is part of GoodMead's social responsibility
10. Creating efficiencies in operational processes of the hospital is vital to handling the reduction in charities and partial government funding to the hospital. HMS is meant to provide those operational efficiencies and corresponding metrics and measurements to prove its success.
11. There is no software architecture at all in the hospital. Development of HMS will be based on a robust enterprise architecture that will cover any system that exists within the hospital and then the corresponding system architecture for HMS.
12. A part of this project is the creation of a comprehensive Not only SQL (NoSQL) database that can handle multimedia files. These files contain selected past consultations in audio and video forms, email messages in unstructured format, and summaries of medical journals and newspaper reports. These data and their associated analytics are available to various authorized users such as doctors, consulting doctors, patients, and service providers (such as biowaste cleaners).
13. The use of NoSQL/multimedia databases is a strategic decision that aims to provide optional extensions to the project. This extension is to incorporate the use of remote consultations by doctors and registered nurses through audio and video media using high-speed connectivity.
14. The development process for HMS is to follow Agile software development process. Thus, the entire HMS development team is trained in the use of Agile and all its associated techniques and practices.
15. Testing of the HMS solution will be carried out both internally and externally (alpha and beta) in an iterative and incremental manner.

So, what do we want to do in our team project or assignment?

We want to be creative – and think where we can use our Software Engineering, knowledge, experience or even a simple idea that can help the hospital management as presented in the above case or something relevant.

I would like each team to think about the case and just gather your ideas – please see the Getting Started document as well.