FINAL YEAR PROJECT 2009/2010

Project Proposal for

ELECTRONIC BED HEAD TICKET AUTOMATION SYSTEM

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APPROVAL FORM
The project titled Electronic Bed Head Ticket Automation System is supervised by me and is acceptable as a final year project.

Signature:

Date:
1. INTRODUCTION

As the world advances to the modern information age, a lot of automation solutions have been introduced in various fields in order to maintain on-time, secured, and low-cost services to meet the needs of the fast-moving society. In this process, one field that lacks behind is the health care field. Even though a lot of highly technical advanced electronic devices are introduced to hospitals, the major reason for this drawback is doctors and nurses who are the most important personnel of a hospital system, are not actively taken in to the automation system. The most critical bottleneck in automating a hospital system is deemed to be the automation of bed head ticket which is the base for all the treatments carried out.

So providing a solution that automates the bed head ticket will be very crucial for the overall idea of hospital automation. So far, several efforts had been carried out to meet these particular objectives, but they have been ended up with failures due to the lack of concern about the change management aspects of the hospital system automation. The major concern should be on doctors. They are too much matured people to be changed and should not be prompted to work directly on highly technical features. So the approach of giving doctors software interfaces will fail immediately. One other most important thing will be the levels of technical and health care related knowledge of different personnel in the health care system.

So the aim of this project is to remove the bottleneck of bed head ticket digitalization taking the correct approaches. The major feature of the solution will be the fact that the bed head ticket will be a hybrid system which includes the usual paper-based bed head ticket for the purpose of avoiding any changes to doctors’ usual working style and an electronic version of the bed head ticket derived from the first handwritten version for the automation purposes.

The other main target of the project is to generalize the solution as a framework to which other features of a hospital automation system can be added as extensibility options. The necessary hardware and software interfaces will be provided once we discover the whole domain. This will lead to a complete hospital automation system while all the modern technologies and even the other health care and biomedical projects carried out in our university and all around the world can be used with much more value. Also this will serve as a base for development of standards in the field. The final outcome will be one other contribution towards a paperless world.
2. CLASSIFICATION OF THE PROJECT

This Bed Head Ticket Automation project basically falls under the category of product development. But we can point out something more than that. The primary outcome of this project will not only be the automated bed head ticket, but a base for a complete hospital automation system. That means we will be able to come up with a basic hardware and software framework that can be used to build a complete hospital automation system around that.

3. OBJECTIVES

The primary objective of the project is to come up with a complete solution for the bed head ticket automation feature of a hospital automation system. This project will attempt to turn health care service persons towards modern automation technology, smoothly with least conflicts. The next most important objective is to provide a well defined hardware and software framework to build a complete hospital automation system around this base. Here, we are going to provide a general interface for a DICOM protocol interpreter which is a separate project carried out by another project team. We are also focused to keep our approach in such a way that this solution can be easily embedded in existing half featured hospital automation systems. One other most important feature we are focusing on is covering the complete domain of bed head ticket automation in a way such that any party who would add features to our system or further develop our system will not have to discover any part of this particular domain again by interviewing personnel in a hospital system. Our product development concerns with compatibility and health care regulations to avoid frustrations in Hospital and health care environment.

4. JUSTIFICATION FOR THE SELECTION OF THE PROJECT

The major objectives of the project is to remove the major bottleneck in the process of hospital automation. Once this is completed the existing hospital automation systems can integrate this solution to make their systems much more autonomous. The hardware and software frameworks which are expected to provide with this solution will lead to a complete hospital automation system.

This system is developed with a rich API and a framework so that this can be deployed to any kind of application which needs a sophisticated wireless input/output system. As an example, in the retail industry managers can use this system as an easy access point. Another usage of this system is in the factory and warehouse automation system. Especially, production supervisors can use this system to keep track of the issues on the spot.

1A standard, which is currently designated as Digital Imaging and Communications in Medicine and supports operation in a networked environment using the industry standard networking protocol TCP/IP.
Thus, this project will be an application of our framework. It is aimed to provide general interfaces for any electronic biomedical instrumentation used inside the hospital system. Thus, this will lead to easy operation of those highly technical instruments by making data retrieving process into almost autonomous. This fact will also be valuable when thinking about the other health care and biomedical related projects that are carried out in our university. This will serve as a gateway for them to come into the real process of hospital automation. Also the output of this project will provide hardware and software bases for the development of standards in the particular field which will be a great value for the product development processes and researches related to the field.
5. LITERATURE SURVEY

The literature survey has been divided into several parts as described below.

5-A. Portable input devices to get doctors’ handwriting

- **Digital Tablet**
  A digitizing tablet is a computer input device that allows hand drawings and hand writing to be given as input to a PC in a similar to the way one draws images with a pen on paper. To avoid the user being felt difficulties with the new method, a paper notebook can be used on top of the device and the special pen has an ink cartridge to write on the paper as usual. Most tablets connect to the PC trough USB while some other use wireless communications. Examples: Genius GNote 7000, Wacom Graphic Tablets, Genius PenSketch 9x12, Ace Hardware DigiMemo 692 (DM692) (There are many digitizing tablets available in the market for prices from $40 to $250.)

- **FLY Pen**
  FLY Pen is a digitalizing pen which is generally referred as a pentop computer It actually reads and remembers what it writes. This is done using a powerful optical scanner and a built-in processor. A specially designed paper is needed to use with a fly pen and it is not a cost effective product. Examples: FLY PEN produced by LeapFrog Enterprises

- **E-Paper displays with touch screen**
  E-paper is a display technology which displays text and images by the reflection of light. This technology consumes low power due to the fact that it doesn’t use blacklight. There are many products available in the market which uses e-paper displays but these products are not cost effective at the moment. Also e-paper is not in the market for development purposes.

- **OLED (Organic LED) displays with touch screen**
  OLED screen is consisted with arrays of light emitting diodes (LED) whose emissive electroluminescent layer is composed of a film of organic compounds. This technology is used in products such as Sony CLIÉ PEG-VZ90 television, and Samsung OLED televisions.

5-B. Portable display units

- **E-book Readers**
  There are a lot of E-book readers available in the market. The major problems with these E-book readers are there are no E-book readers with color displays and there are only a few models which have A-4 size display. They can be used to download files of a supported format and view it on the display. They also provide touch screens for the user...
to navigate through the documents which are being viewed. Examples: iRex Iliad, Sony Reader PRS-505, Hanlin eReader V3

- Photoframe:
These devices are used to download a collection of images and view them. They also provide touch screen features for navigation through the image collection. Examples: Kodak’s touch-screen digital photo frame Pandigital touch-screen digital photo frame

- Programmable Touch Screens:
There are some products in this category which comes with a touch screen and a display. They provide a programmable interface with known communications protocol. Most of these screens are used as display units in industrial automation systems by directly interfacing to PLCs. Examples: EST240 5.7” Intelligent Programmable Color Touch Screen EST555Z 10.4” Intelligent Programmable Color Touch Screen

6. SCOPE OF THE PROJECT

- Come up with a way to digitalize the prescription used in today’s bed head ticket.
- Come up with a FPGA based mobile device which will be the base that is used as the input output gateway in the ward.
- Develop interfaces in FPGA based device for pluggable equipment (ECG, Temperature, and Blood Pressure) used in Hospitals.
- Implementing a touch screen enabled display unit attached to the FPGA based mobile device.
- An RF ID based system is integrated into the FPGA based mobile device to classify bed head tickets and paper used in them. Paper used in the bed head ticket have RF-IDs embedded into them.
- Implementing Zigbee to communicate within the hospital LAN.
- Implementing a database for the purpose of storing and retrieving data.
- Implementing a user friendly GUI (for Nurses/ Doctors) with a network application.
- Provide a well defined API and hardware interfaces.
- Developing a web application for remote logging.
7. HIGH LEVEL ARCHITECTURE

- The input device should get the doctors handwriting as its primary input.
- Other hardware features of a hospital automation system (electronic biomedical devices, patient tracking systems...) can be directly plugged in to the FPGA based mobile device.
- All the data inputs to the mobile device are guided to the Data Processing Server through the network. Since these data processing tasks are not mission critical there is no need for them to be implemented on hardware, software algorithms may be sufficiently efficient.
- Database Server keeps all the records of the Bed Head Ticket Automation System. The database architecture will be easily extended to include other sources of data in a complete hospital automation system.
- The Server will work as the remote login access point to the system. Necessary security should be provided in this part of the system.

Fig. 1. High Level Architecture
8. FUNDING OF THE PROJECT

We don’t have any funding arrangements for the project at the moment. We are expecting to find sources for funding in the Feasibility Survey stage. We have noted the following sources as the sources of funding.

- SLIC (Sri Lanka Investors Commission)
- Since this product is the base for a complete hospital automation system we can market this idea to a company which would use this base for further development of a hospital automation system.

Since these project recourses include a several consumer products (Digital Tablet, E-Book Reader..., general purpose communication modules (Zigbee modules) and testing kits (FPGA testing board) we have a great opportunity to purchase them as reusable resources through agreements with a company in the electronics business.
Fig. 2. Time Line
9. BUSINESS PLAN

The primary outcome of our project will be a complete bed head ticket automation solution and a comprehensive software and hardware framework for the development of a complete hospital automation system around it. But the final outcome will be a generic hardware and software integrated framework which is possible to be used in many other industries like retail industry, plant automation systems and warehouse automation systems. The general behavior of our system in such other industries would be working as a handwritten input taking gateway and as an intermediate communications gateway. The API suite that we expect to provide will cover almost all necessary features for a hospital automation system and would be generic as much as possible for other application areas.

Even though we are focusing on the health care market, there are only few opportunities there due to the fact that hospital automation is not much discussed at the moment. But the other mentioned fields (retail market automation, Production floor automation...) are now widely discussed and there exist many systems which are deployed for those purposes. So we have a great possibility in marketing our system in one of those fields.

Our solution will be almost unique because of the fact that our approach to the input gathering is different from almost all sorts of such systems. And one of our greater strengths would be the generic approach that we expect to use in framework development. That would lead our solution to ensure its place in the market as a unique product. It’s obvious that our immediate customers cannot include any company, organization or authority which would use the final automation system because we are focusing on the framework part. So our customers should be an organization which would likely use our base to develop a complete automation system or further develop our basic framework to be 100% generic and market it for different industries. Because our customers are chosen like that our local market will be somewhat small. But if those selected customers can take our solution to the global marketplace then ultimately our market will be huge. We are planning to reach our targeted customers since the initiation of the project. In the feasibility survey we expect to reach them and negotiate with them for funding purposes also. During that time we can get some idea about other industrial applications of our solution and use that experience in order to provide a much more generic solution. Here we have to market our targeted product as a generic tool that falls in the business scope of each particular customer. If we can find some customer who is extensively engaged in hospital automation business then we have a lot of opportunity to market them our solution as generic but specially focused on the hospital automation domain. We also can advertise our product through technological exhibitions and through social networks to reach the targeted market.

Since we are focusing on a generic core solution there may not be much more business competitors in that sense because we are using a novel approach. But we have to compete
with existing approaches used for the same purpose. This kind of competition will be very huge because of the wide existence of automation systems. So our focus is on to provide a solution which can easily be integrated into existing automation systems and also our solution provides a framework around which new automation systems can be built. We will always follow governmental regulations to avoid clashes between employees and the proposed system.

Our business model has two approaches. One is marketing the generic core framework as a base for various automation and management systems. The other approach is marketing custom solutions built around our core framework. In the second approach we won’t expose the core framework to our customers. Funding for the development of the core should be done in any of the two mentioned approaches. That funding will be from maximally Rs.150000/-. In the second approach we need funding also for the development of customized solution kits for the particular industrial application. The amount of those funding depend on the application area.

Since this is a novel approach that can be used to replace parts of existing systems the major risk will be change management in the application areas. So we have to design our approach and solution in such a way that smooth changing is possible. That’s why we are specially focused on hybrid solutions. In the approach of marketing the core we will face some risks regarding the level of general behavior and extendibility of the solution.