SYSTEM DESIGN PROJECT: PROJECT PLAN

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DispensED - Group 17

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0.1 Purpose of this Document

This document is prepared as part of the project for the System Design Project course at the University of Edinburgh. This project plan will highlight the goals we have set as a team as well as how we will achieve them - Including a breakdown of our resources and overview of our organisational structure.

1 Goals

There is a large shortage of nursing staff across the UK. The NHS alone reported that nurses account for 38% of overall vacancies[1]. Care home staff, specifically, spend about 40-50% of their time with drug related activities. Administration errors occur 8.4% of the time [BAR+09], meaning if a patient receives medication three times a day, there is a 1 in 4 chance that an error occurs.
DispensED is aiming to develop a solution to the problems created by manual drug administration by creating a robot to do the bulk of the work. Our product will move around care homes to different residents' homes. The residents can then scan their identification and the appropriate drugs and vitamins will be dispensed. The system will also have a wide range of administrative functions available to staff, such as setting alerts on low stock levels or non-admittance of drugs.

1.1 Technical Subgoals

The system can roughly be divided into 4 parts, for each of which different milestones can be set. Those parts will be described in this chapter. The milestones are to be presented at each

[1] http://digital.nhs.uk/catalogue/PUB30033

demonstration, with the final demonstration being for the entire system.

1.1.1 Movement and Physical Frame

The robot needs to be able to move along the facility it is being deployed in, using motors mounted on a frame. The frame will also have to accommodate the other physical parts of the system, and handle communication to the central system.I'm The navigation will happen along predefined routes using marks on the floor.
The different milestones for these can be set as follows:

- Initial control of simple frame with pre-programmed movement
- Full frame with pre-programmed movement
- Full frame with remote-controlled movement

1.1.2 Dispensing of Medication

The robot will support giving out medication in two different ways:

- **Pre Packed Sets of Medication** Most care homes get pharmaceutical drugs come pre-packed from the pharmacy, sorted by patient. In this case, the robot must give out the container with the pre-packaged drugs to the correct patient. There needs to be support to store drugs for several different people that may not collect their drugs in order.
- **Single Pills (Vitamins)** For pills that do not come pre-packed (such as vitamins), a different kind of dispenser is needed. This dispenser must be able to give out single pills, one at a time.

Based on these two, the following milestones can be set:

- Dispensing of individual (vitamin) pills
- Dispensing of pre-packaged pills for specific patients
- Recognising when the pills have been taken by the patient

1.1.3 Vision

Several vision systems are needed in order for the robot to accomplish its objective:

- **Orientation** The robot must be able to recognise and process the markings on the floor that are used for navigation. Additionally, the system must know where the rooms are it is trying to service - separate floor markings or an alternative kind of internal representation of the environment may be used for this.
- **Barcode Scanning** Medication is dispensed to the patient after they have authorised themselves. The main form of authorisation will be bar codes (these could be affixed to the patients' wristbands). The system must be able to read the barcodes

This leads to the following milestones:

- Detecting target line and door markers
- Scanning barcodes and reporting the ID
- Generating directions for actual movement

1.1.4 Software Back- and Front-end

To support the robot in getting the appropriate medication to patients, there will be a back-end system in place, running on a central computer. This will hold a database of patients, medication, and what should be dispensed when. This, in turn will be accompanied by a user interface for nursing staff, to manage patients and monitor what medication has been delivered.
This leads to the following milestones:

- A design plan of how the software will be structured
- Back-end operations (databases)
- User interface

2 Resource Allocation

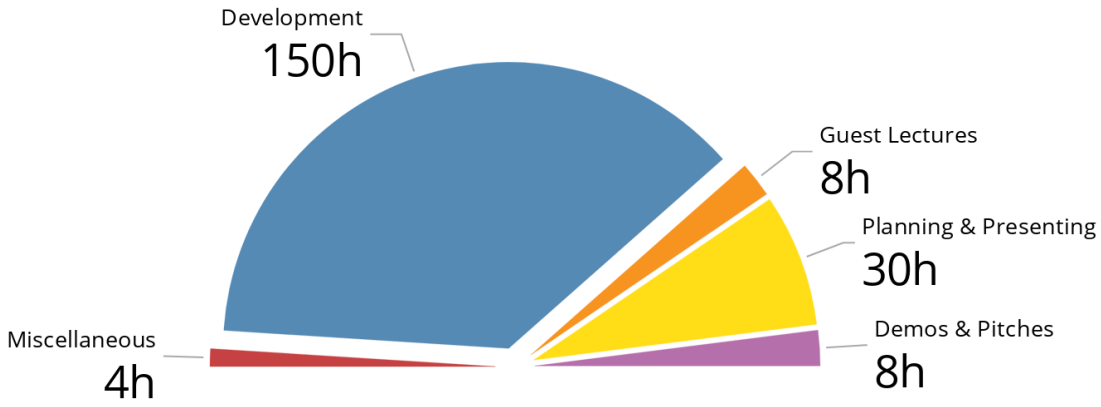

Figure 2.1: Planned Time Deployment

2.1 Time Planning

The Gantt chart (appendix 1) shows roughly what should be done when, and who responsible. While we believe Gantt charts are incredibly useful as tools to set goals and track progress, we don't think this should dictate the entire project. Especially considering the highly flexible nature of the sub-teams, the focus will be on meeting deadlines set in the Gantt chart, analysing what resources should be dedicated to certain resources based on progress.
One thing that has been kept open is the period leading up to the final demonstration. As this is a complex system with many parts, plenty of time is necessary to add them. If this turns out to be too long, the time will instead be used to expand on functionalities and polish up the final product.
In terms of actual time spent on the project, the pie chart (2.1) shows roughly how much time is spent on actual development of the system. This comes down to about 14 hours per person per week. This will not be tracked anywhere; instead, every member will compare his own contributions against those of others on the team, discussing any problems in the regular meetings.

2.2 Risks and Contingency Planning

The most apparent risk that would hinder project progress is absence of team members. As will be discussed in the next chapter, we split our team into different sub-teams. Every sub team has multiple members and the project management ensures that no one team member has knowledge that no other team member possesses. This way, the impact of any one team member being ill or otherwise unable to work is minimised.
Other risks arise from needing to recombine the smaller parts into one robot. Initially, the time leading up to the final demonstration will be used for this purpose, which should be enough. It is still essential for the sub-teams to keep communicating to keep this process as straightforward as possible.

Medication Dispensing	Software Back & Front End	Movement (physical)	Vision
Glen	**Alex**	**Philip**	**Jasper**
Tizzy	Bobby	Jasper	Stefani
Philip	Glen	Bobby	
Stefani	Tizzy	Alex	

Table 3.1: Sub Teams

3 Organisational Structure

3.1 Team Structure

The team structure follows loosely a Functional Matrix structure. Alexander was assigned as key contact and team manager. As previously mentioned, we split our team up into multiple sub-teams (table 3.1) working towards the sub-goals of their area. The bold person is the "owner" of the groups work, meaning they are the first point of contact.

The teams were created based on a combination of preference and competence, meaning each member will get to work on aspects they find interesting and are competent in as much as possible. To ensure the teams are communicating properly, each member is on two different teams, to create as much possible overlap between the teams as possible. This has the added benefit of ensuring that each team has an understanding of the other parts of the system.
While the teams are inherently flexible since members are on two teams simultaneously, there should also always be room for larger shifts. This could be due to unexpected workload, or if it turns out someone has valuable ideas for other aspects of the system. Any shifting like this would be discussed with the entire team.

3.2 Meetings

Every morning an informal catch-up is held so that everyone is able to be up to date with the current state of the system. These catch-ups usually just include any progress from the previous day as well as potential new issues / roadblocks that may have emerged.
The whole team meets with our mentor during a one hour fixed meeting slot on Thursdays at noon - everyone is expected to attend these meetings. Additional meetings follow a drop-in approach and are conducted as needed.

3.3 Communication and Tools

The main vector of communication is the team slack - we use Notion as platform for notes, drafts and project management. Specific tasks are allocated via trello-like boards in the To-Do section on notion. We decided to use Notion instead of Trello as it offers additional functionality. The way we manage both task allocation and progress tracking follows SCRUMBAN management system, a mix between SCRUM and KANBAN. This system picks out the most useful agile parts from KANBAN while maintaining clearly defined roles - We hope this will aid our team with more steady progress whilst not locking ourselves into an engineering process that requires planning very far ahead.
A private GitHub repository for code version control has been set up for the project. We have used GitHub as it was the most accessible since everyone already had an account.

Table 3.2: Tool Overview

Tool	Purpose	Link
Slack	Main Communications HUB, Chat	`https://sdpgroup17.slack.com/`
Notion	Meeting Notes, Project Management	`https://www.notion.so/dispensed/`
GitHub	Code Version Control	`https://github.com/xMythycle/DispensED/`

Bibliography

[BAR+09] Barber, N D. ; Alldred, D P. ; Raynor, D K. ; Dickinson, R ; Garfield, S ; Jesson, B ; Lim, R ; Savage, I ; Standage, C ; Buckle, P ; al. et:
Care homes' use of medicines study: prevalence, causes and potential harm of medication errors in care homes for older people.
`http://qualitysafety.bmj.com/content/18/5/341`.
Version: Oct 2009