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January 21, 1999

Dr. Andrew Rawicz
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Re: ENSC 370 Project Proposal, *Peace of Mind- Medication Delivery System*

Dr. Rawicz,

The improper use of medication is a common occurrence for elderly and confused persons, especially when multiple does are taken at different times of the day. Out of all the elderly persons that are hospitalised each year 30% of these cases are due to the over or under doses of medication.

Prescriptek proposes an automated delivery system that will ensure medications are taken at the proper times and in the correct amounts. An interface with a pharmacy will allow for the proper programming of the device as well as an indicator if the subject has been taking their medication. The automation of medication delivery will give the user added freedom and peace of mind.

Feel free to contact any member of Prescriptek at the phone number indicated above if you wish to discuss our proposal.

Sincerely yours,

The Prescriptek Team:
Bryce Pasechnik
Damian Nesbitt
Derek Young
Rob Boyes
Michael Boquist

ENSC 370
Project Proposal

PREscriptek
Rx

Peace of Mind- Medication Delivery System

Team members:

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January 21, 1999

Executive Summary

The improper use of medication is a common occurrence for elderly and confused people, especially when multiple does are taken at different times of the day. Of all people over the age of 65 that are hospitalised, 30% of these cases are dues to over or under doses of medication. Large amounts of health care dollars are required when nurses work door to door delivering the proper medication. Many elderly people are placed in old age homes when they are unable to take their medication. Prescriptek proposes an automated delivery system that will ensure medications are taken at the proper times and in the correct amounts. This device will allow for persons to remain independent in their homes, as well as save wasted taxpayer money. Proposed interfaces will ensure security for the user, as well as a means for the pharmacy to monitor the actual medication intake. A user-friendly interface, as well as an easy load system will reduced maintenance time and boost the safety features of the device. This medication delivery system gives peace of mind to the user.

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List of Figures and Tables

1. Introduction

People who suffer from chronic diseases must take prescribed medications, some of that are required to be taken at different times during the day. A vast majority of these people are not taking their medications properly and are consequently put into care homes. Often these patients are visited by home care workers several times a day to have their medication administered. Unfortunately the care homes are full and care workers travelling door to door is a burden on Medicare.

Taking three or more pills during the day can be confusing, especially when different groups of pills are taken at each time during the day. The current medication containers such as the box-type and bubble sheets are considered to be failures. The bubble sheets are used as "bingo" cards and the box devices still require too much concentration and effort from the user to make it a practical device.

Our company, Prescriptek, is proposing to build a medication dispenser for those people who require assistance with taking their medication. The dispenser must be affordable so that all people who require assistance will be able to afford one. The device must also be safe and efficient giving the user the peace of mind that they desire.

2. Medication Dispenser Proposal

2.1. Background

The following statistics demonstrate the need for medication compliance.

- 125,000 people die each year from non-compliance, twice the number killed in automobile accidents.[1]

- Almost 30% of all hospital admissions for people over the age of 65 are directly attributable to medication non-compliance.[2]

- Approximately 40% of the people entering nursing homes do so because they are unable to self-medicate in their own homes.[3]

- About one-half of the 1.8 billion prescriptions dispensed annually are not taken correctly, contributing to prolonged or additional illness.[4]

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[1] A. Anderson, Update on Patient Non-Compliance
[2] Arch Interm Med 1990; 150:841-845
[3] Feasibility Study, Biomedical Business International, January 1988
[4] Medication and the Elderly, Ch.4 pp. 67-68, 75

- At the present time, more than 7 million households have an unpaid "care-giver" who is providing assistance to a family member age 50 or older.[5]

2.2. Competition

The two most widely used devices for medication distribution are the blister pack and the box-types. The blister pack and box-type devices are considered to be failures by the professionals who work with people who are using these devices. Medications are still being misused causing unnecessary physical trauma. Figure 1 shows a basic box type pill dispenser setup.
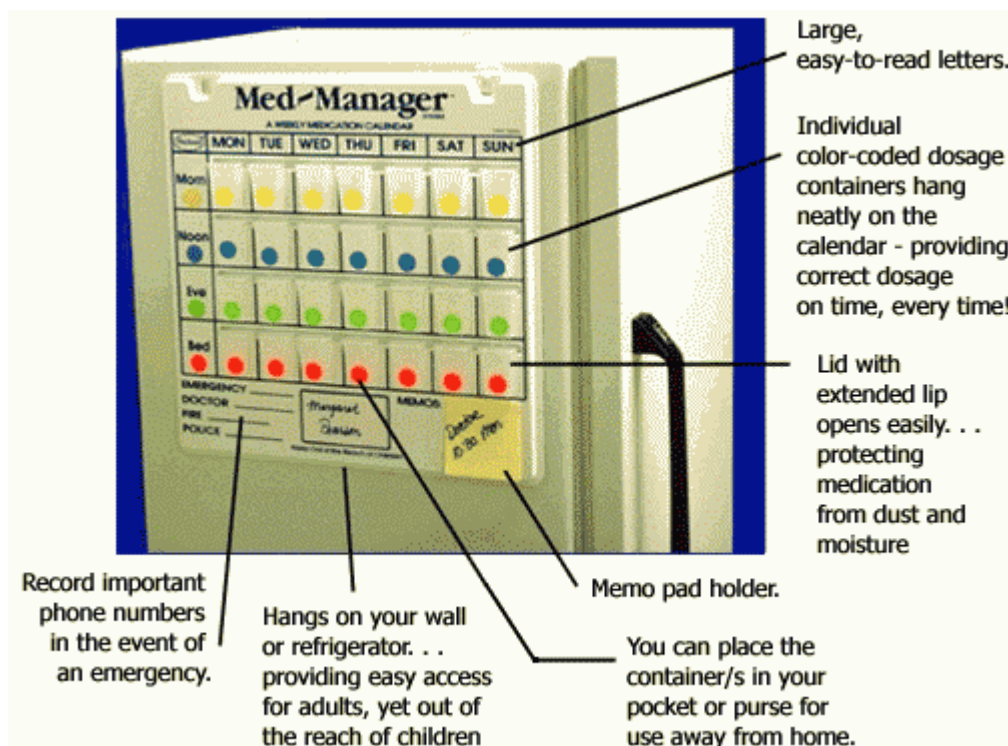

Figure 1: Medmanager Medication Management System

Even with an organization scheme as shown in Figure 1, medication is still being misused. The person using this dispenser is still required to make an effort to remember to take their medications.

Searching the Internet and patent databases we have found an automated pill dispenser that was released by a company called CompuMed. However, we believe that the device's $1200 price tag and poor implementation of key features leaves Prescriptek plenty of room for improvement. Prescriptek

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[5] Family Circle 6/25/91, pp. 46

proposes cheaper, more elegant solution to the problem of medication non-compliance.

2.3. System Overview

The medication dispensing mechanism will consist of a specialized mechanical system, a user / maintenance interface as well as a microprocessor in charge of dosing times and safety monitoring. Figure 2 gives the basic function of the medication delivery system.
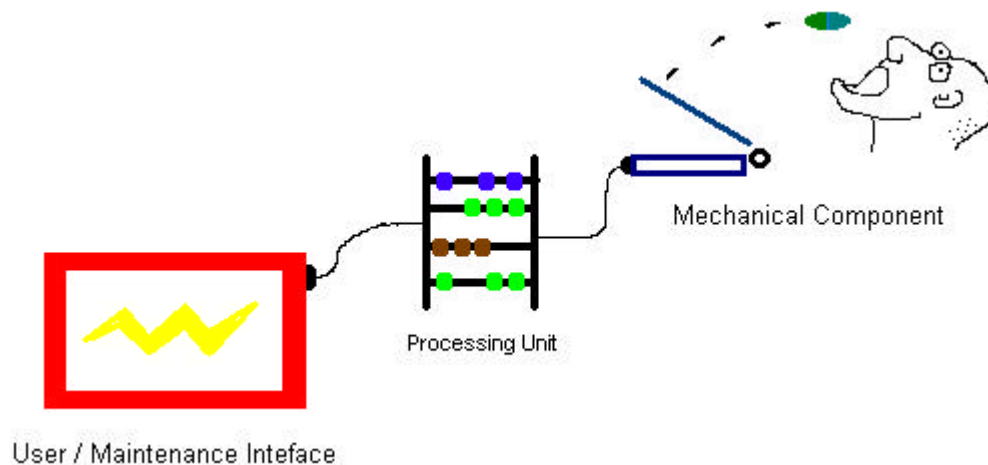

Figure 2: Basic Design Structure

2.4. Proposed Design Solution

Two designs are under consideration. The first of the designs is the portable unit, that would consist of a device which is small enough that could be carried by user and greatly increase their freedom. The second design is a home based unit that would sit in the subject's home and dispense the medication as required.

Either of these designs will require certain design aspects that will be indicated below in 2.5–2.7.

2.5. Mechanical system

The mechanical system should distribute pills in a manner that will eliminate the manual the pill sorting that is required by the CompuMed device. This can be accomplished by different methods of containment and mechanical actuation. A few of the possible techniques are as follows:

- Linear stacking of the medication (similar to a PEZ dispenser)

- A cork-screw gear that separates the medication

2.6. User and Maintenance Interface

We have proposed several methods that will allow an interface for programming the device with the proper medication. An indicator will signal when the medication needs to be taken and it should be taken with food or water. A few of the items that we may integrate into our system follows:

- Modem link with a pharmacy (may help in alerting others if there is a problem)

- Voice and Alarms to indicate the medication should be taken

- A display showing what the medication should be taken with

- A possible disk drive for programming the device

- Sensors indicating if the medication has been removed

2.7. Safety features

This is the most important feature of our device. Safety features must be used to ensure that the proper medications are taken at the right time. Failure to monitor the patient's compliance could result in harm to the patient. Some of the safety features under consideration are as follows:

- Not allowing for extra doses to be taken, or some override feature

- Sensor that determines if the medication is still present

- Sensor that checks each delivered medication ensuring that it is in the correct amount

3. Sources of Information

The initial idea for the project came from a relative of one of the project team members. As a Long-term Care Assessor, she is responsible for the placing of the elderly in old age homes as well as the distribution of homecare workers. As such, she is able to observe any inadequacies in the present health care system. The proper distribution of medication seemed to be her greatest concern. Her insight will be used to help determine the needs of the persons taking medications.

Another member of the team also has relatives in the pharmaceutical business. Their feedback will be an important view on the technical side of the device as well as the regulation requirements that are required for a potentially hazardous device.

Aside from these sources, the Internet and library will be our main sources of information. Textbooks, journals and research papers may also assist in the construction of our product.

4. Budget

Table 1 shows our estimated expenditures for our medication delivery system.

Table 1: Proposed Budge for Developing Prescriptek's Prototype

Items	Estimated Cost ($)
Microprocessor(s) and Programmer	$350
EEPROM Memories	$50
Power Supplies (AC adapters, Batteries)	$100
Mechanical Actuators	$100
Misc. Electronic Components	$100
Case/Housing	$50
LCD's/touch pad's	$100
Miscellaneous Costs	$200
Total Cost	**$1050**

Due to the uncertainty in how exactly how we intend to design and implement our Medication Delivery System, our budge proposal, at this point, is our best guess at project expenditures.

5. Funding

While our goal is to create a low cost medication delivery system, development of our prototype is expected to be expensive. There is a great deal of overhead in setting up and constructing a prototype such as investing in a microprocessor programmer as well as the trial and error process of experimenting with different components.

We are investigating several possible areas of funding. We have already submitted a proposal for funding to the Engineering Science Student Endowment Fund. Due to the helpful nature of our proposed device, we are intending on seeking funding from the Wighton Development Fund as well.

Outside these two sources of funding, we are going to seek potential funds from BC Medicare. We feel that they will be interested in sponsoring our project as they are currently spending a great deal of money on health care workers that aid elderly

people in taking their medication. We are also going to look for sponsorship from various electronics companies in the form of product discounts or donations.

6. Schedule

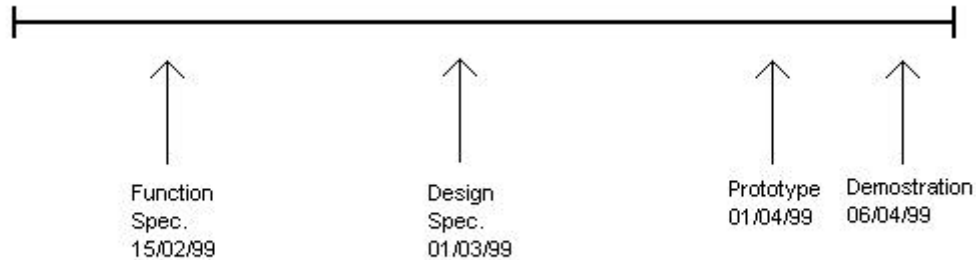In order to reach our goal of a finished product, we have designed a basic milestone chart as seen in Figure 3.

Function
Spec.
15/02/99

Design
Spec.
01/03/99

Prototype
01/04/99

Demostration
06/04/99

Figure 3: Basic Milestone Chart

7. Team Organization

Prescriptek is a company whose goal is to deliver a good dependable product. We are composed of a group of five hard working, dependable people – Mike Boquist, Rob Boyes, Derek Young, Damian Nesbitt, and Bryce Pasechnik. We are all third year engineering students and all have exceptional experience in the engineering industry. Please refer to our resumes in Appendix A for a further description of our skills.

Prescriptek, unlike most companies, has taken a non traditional approach to organizing the management layer of the company. There is no CEO, CFO, or COO. There is no single person in charge of any one aspect of the company. Rather, all decisions will be group decisions. While this can lead long unproductive meetings and difficult decision making, we believe that all our interests and goals are similar enough for this not to be a problem. Secondly, we have decided upon several decision making tactics to aid in coming to difficult decisions.

When faced with a particular problem, we intend to discuss it as a group. Present possible solutions as well as our individual preferences regarding the solution. In concluding any particular solution, we will vote. In order for and decision to be made final, 3 out of 5 people must be in favor of the decision. For very important decisions, where the happiness of group members is at stake, we insist that 4 our of 5 people are in favor of the decision. By requiring these steps in making a

decision, we hope to eliminate the hatred that can build up against a single decision maker such as a CEO and to hopefully arrive at the best possible solution.

In order to ensure progress in our project, at the conclusion of every group meeting we set a time for our next meeting - usually within the next couple days. As the project matures, our group meetings will decrease in frequency, however, we intend to meet at least once a week at a designated time and place to discuss individual progress. We also intend to make extensive use of email to keep in touch with group members.

It is unclear at this time who will be working on what part of the project. However, when our design becomes more concrete, we intend to assign groups of individuals to specific elements of the project. We will, however, not limit a particular person from working on any particular part of the project as we all wish to learn as much as we can during the course of this project.

This project will require a great deal of commitment as well as technical expertise to complete within our allotted time frame. We believe that as a team, our dedication and technical skills as well as our ability to work together will allow us to accomplish our goal.

8. Conclusion

Prescriptek is dedicated to the assistance of people with disabilities. The automation of medication dispensing is a step forward in assistive devices encouraging independence and eliminating anxiety resulting from trying to remember when medication must be taken.

Our team of highly qualified engineering students is equipped with the knowledge and the skills that are required to make this device a reality. Adhering to a strict budget along with the simplification and reduction of unnecessary components we will be able to make our device an affordable alternative to the present technology.

Appendix A: Resumes