

Group Five
Project Proposal

Personal Medication Scheduler

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Context of the Problem

- The problem that we are approaching is the misuse of medication, particularly common within the elderly.
- There are many elders who are taking multiple pills daily and commonly forget to take their medication at the scheduled time.
- Also, there are many cases where they forget that they have already taken the medication scheduled for that day and take an excessive dose.

Supporting Research

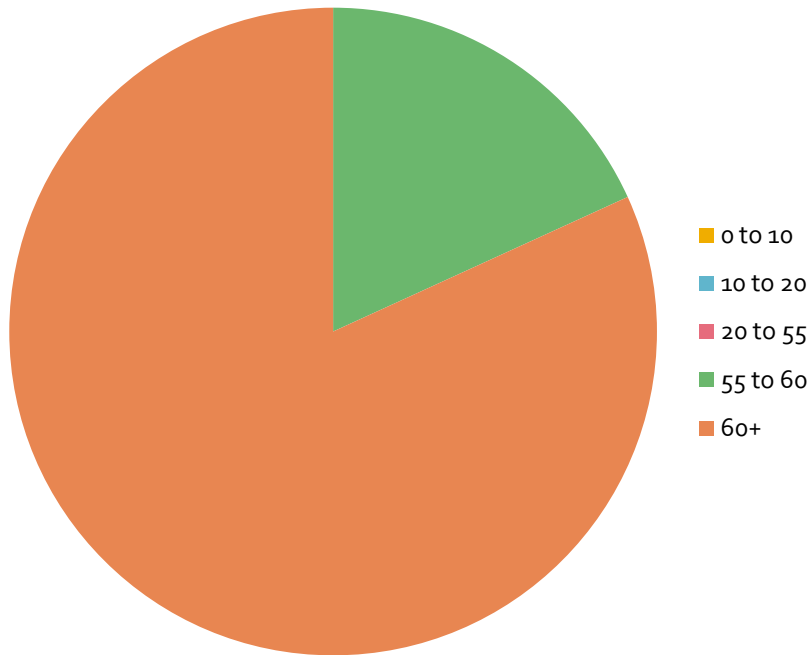
- “In fact, statistics show **38 million senior Americans have drug complications every year. 180,000 of those complications could kill.**”
- “Data suggest that the use of three or more drugs a day places elderly people at particular risk of poor compliance. Estimates of as many as 25% of older people taking at least three drugs. **The most common noncompliant behaviour of the elderly appears to be underuse of the prescribed drug.**”
- Control of medication dosage in elderly patients
 - **Over 100,000 people are estimated to die each year in the United States due to failure to adhere to prescribed treatment.**
 - **One in every five (21%) patients never follow their prescription**
 - **One in every twenty (6%) are not capable of identifying their own medicines**
- For many seniors, prescription drug abuse can quickly lead to addiction, creating or compounding pre-existing physical and psychological issues.

Supporting Research

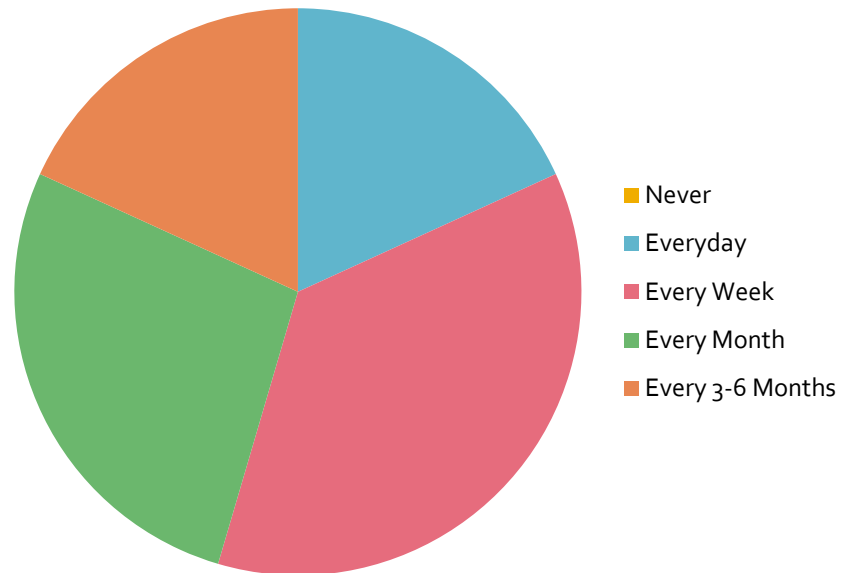
- **10% of all hospital admissions** are the result of prescription medication noncompliance.
- **23% of all nursing home admissions** are due to failure to take medications accurately.
- The average length of stay in hospitals due to medication noncompliance is 4.2 days.

Supporting Research Survey

Age Group Encountering Problems

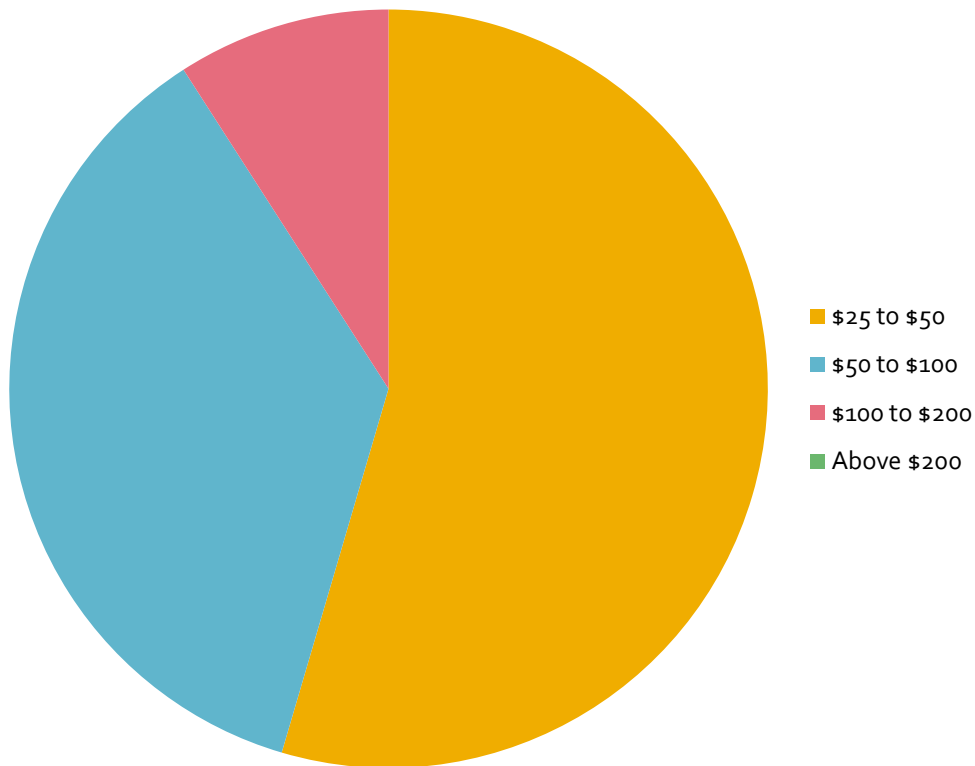


Patients Encounter Problems



Supporting Research Survey

Reasonable Price for Solution



100% of care providers did not claim to know any patients who currently use electronic pill dispensers.

Possible Solutions

- 1. Home Care Nursing
- 2. Customized Blister Packaging
- 3. Existing Device: Electronic Medication Management Assistant
- 4. New Programmable Medication Dispenser

Home Care Nursing

- According to "The New York Times," the monthly cost of in-home care can easily exceed \$1,500, even if children are present to provide minor care much of the time.
- Advantages:
 - Can force unruly patients to take medication
 - Home caretakers services offered provincially and privately almost everywhere
- Disadvantages:
 - High Cost, Unaffordable for many, Time Flexibility
- Cost: Around \$1500 per month (2-3 hours a day)

Customized Blister Packaging

- Cost: First month is free then price is \$1 per medication per month.
- Advantages: Cost efficient, easily accessible by anyone (no technology restraints)
- Disadvantages: Medication will be exposed once the package is open for that day, patients aren't restricted to taking only one days' worth of medication, no reminders

Customized Blister Packaging



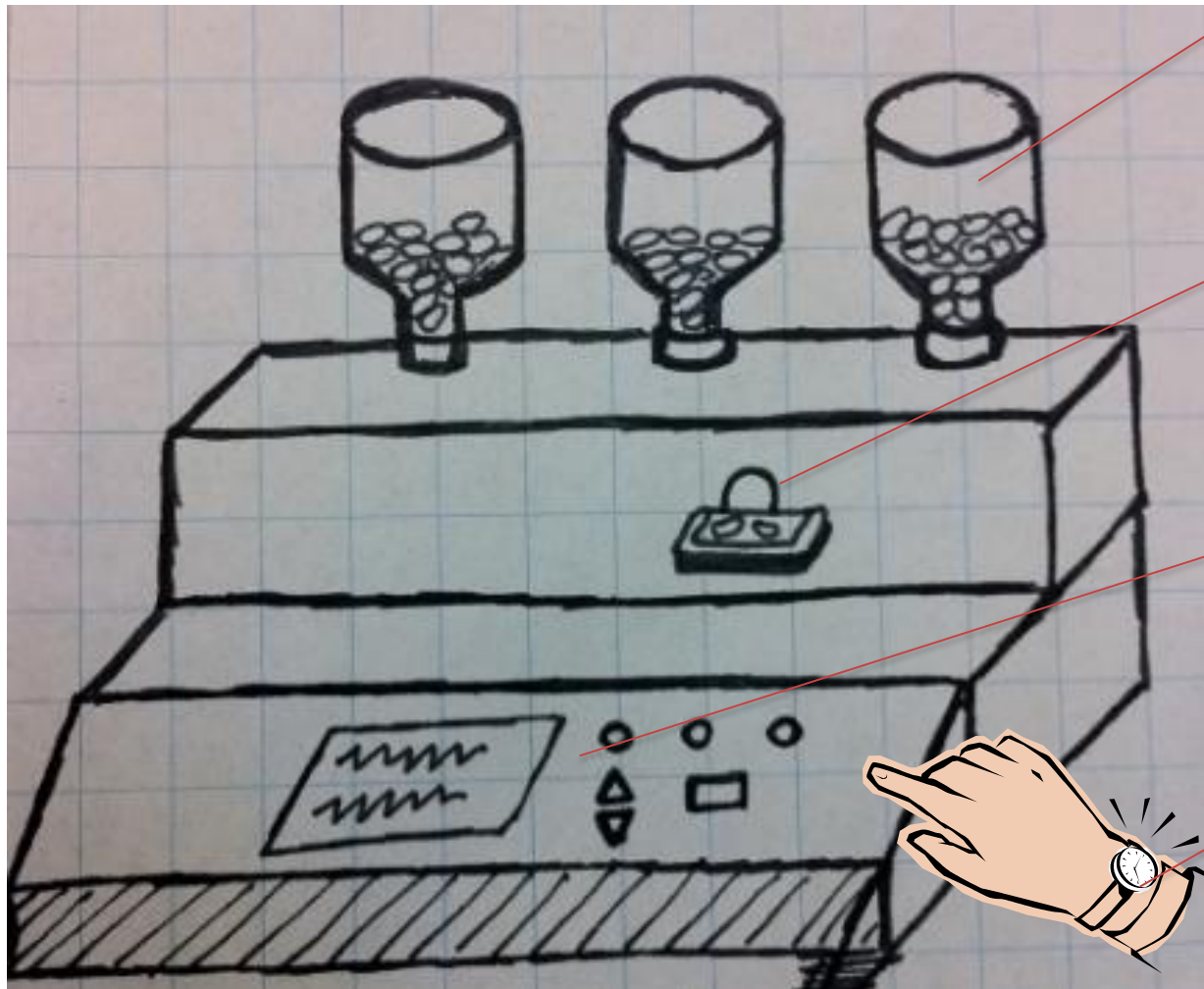
Existing Electronic Medication Assistant



Existing Electronic Medication Assistant

- Cost: \$489.95
- Advantages:
 - Easy set up
 - Lockable, keeps medication safe
 - Portable
- Disadvantages:
 - High cost
 - Different medication share same compartments, cannot differ between different kinds of medication.
 - Alarm is located on device and can only be heard if patient is near or in same room

Our Solution : Programmable Medication Dispenser



Removable and reusable pill containers

Pill dispensing station with weight sensor to detect pills

LCD with buttons to program schedule

Alerts patient through a wireless receiver on a wrist band

Project Design Goals

- Dispense pills following a programmable schedule
- Detect and alert the patient when a dosage is forgotten
- Can function without a PC interface
- Easy to learn, simple to use for elderly

Project Design Constraints

- Functioning Budget:
 - \$250 for PCB
 - \$400 for Design Components
- Size, pill dispensing system must be small enough to fit on a countertop
- Simple, operating the system must not be a burden for the patient

Feasibility Study

Solution	Advantages	Disadvantages	Cost
Home Care Nursing	Reliable Trustworthy Care	Expensive Not available at all times	\$1500+ monthly
Customized Blister Packaging	Cheap Easy and simple	Cannot schedule times or alert patient when medication is forgotten Different types of medication may be opened at the same time.	Few Dollars a month for each medication
Electronic Medication Assistant	Reliable Easy set up Lockable, keeps medication safe Portable	Expensive Cannot differ between different kinds of medication Can only alert if patient is near	\$489.95
Programmable Medication Dispenser	Can alert the patient anywhere in the house Simple to use Can support different types of medication Scalable design, can organize and schedule many kinds of medication at once	Can't force patients from intentionally disobeying prescription	<\$200

Prototype Design Alteration

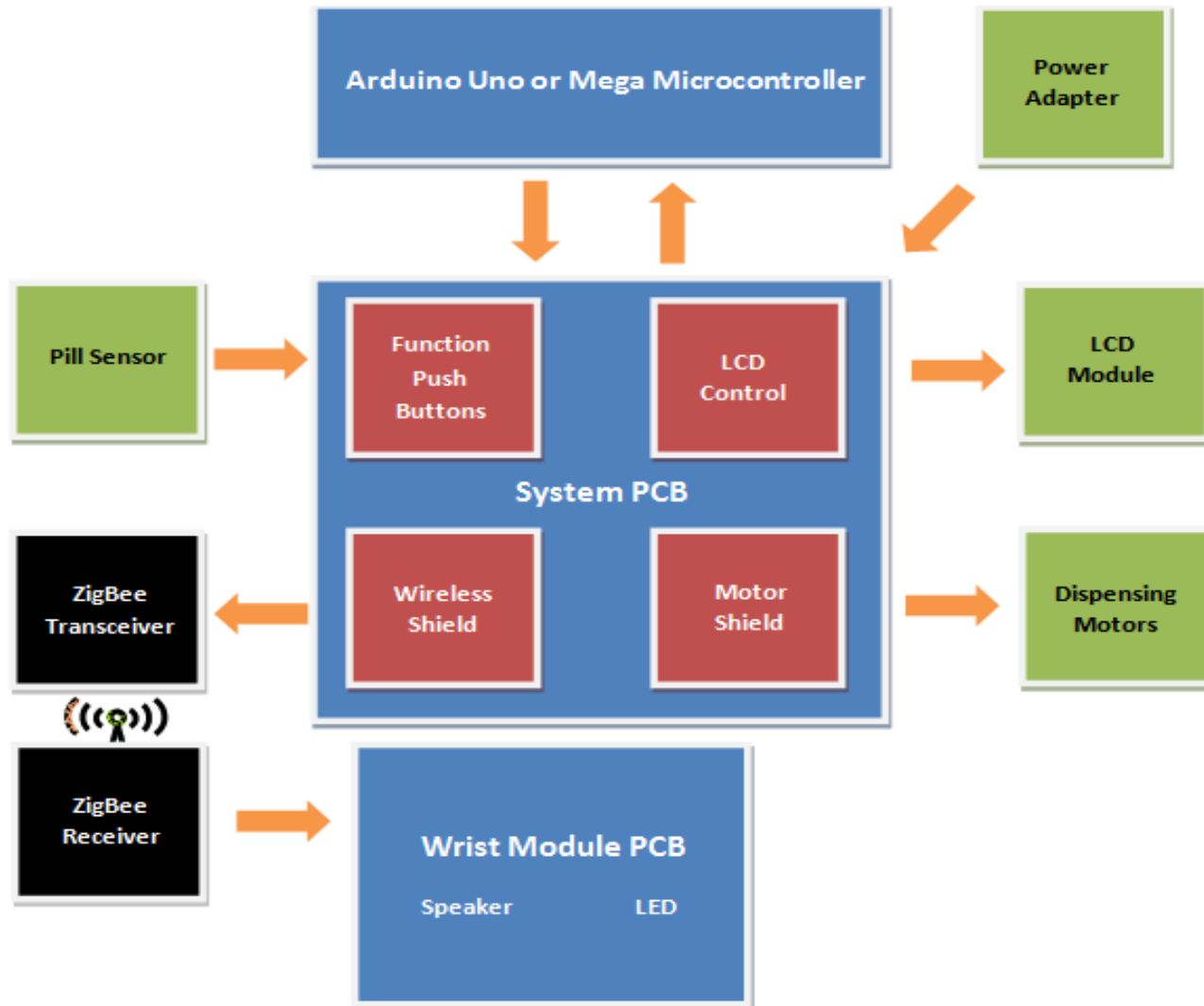
- Circular or Linear weekly pill dispensing
 - Could not differ between different kinds of medication



Prototype Design Alteration

- Electronic Weight Sensor instead of Infrared Sensor to detect pills
 - More reliable in the case of transparent or translucent pills
- Wireless SMS notification
 - Not all patients have access to cell phones
- PC connection, to monitor medication consumption and notify caregiver:
 - Not all elderly patients have access to a PC

High Level Design



Estimated Project Cost

■ Printed PCB:	\$55 - \$150
■ Machined System:	
■ Custom designed Pill Dispenser:	\$50
■ Optional Electronic or Mechanical Access Lock to medication:	\$20
■ Small Servo motors for medication dispensing (5):	\$67.5
■ Medication Compartments:	\$15
■ Pill collection Box:	\$10
■ Power Supply (AC Adapter):	\$10
■ LCD Module:	\$20
■ Push Buttons for Programming Dispenser (5):	\$25
■ Infrared Sensor:	\$2.48
■ Zigbee Wireless Module (1):	\$30
■ Arduino board:	\$55
■ Wrist Strap Notification Unit:	
■ ZigBee Wireless module(1):	\$30
■ CR 2033 3V battery and enclosure:	\$5.5
■ Small audio speaker	\$5
■ LED for hearing impaired patients	\$4
Total Prototype Cost	\$423

Hardware and Software Components

- Hardware:
 - PCB Design
 - Dispensing Unit (built In Machine Shop)
 - Wristband construction
 - Sensors
- Software:
 - Wireless communication
 - Microcontroller programming
 - LCD, Pushbutton, timer, motor control, sensor input

Who's Doing What?

- Wireless Communication and Wristband (Usama and Edgar)
 - communication between Dispenser and wristband
- Machine Shop (Farhad, Edgar)
 - Construction of dispenser
- Sensor and PCB Design (William, Farhad)
 - Constructing, testing, and interfacing the sensors and motors
- Microcontroller Programming (William, Usama)
 - Timing for pill dispensing, motor controls, LCD display, bush button programming, medication sensor reading, dispense counting for refill notification, wireless notification sent
- Website with project description
 - Edgar, Farhad, William, Usama

Proposed Schedule



Question Period

- Please feel free to ask questions