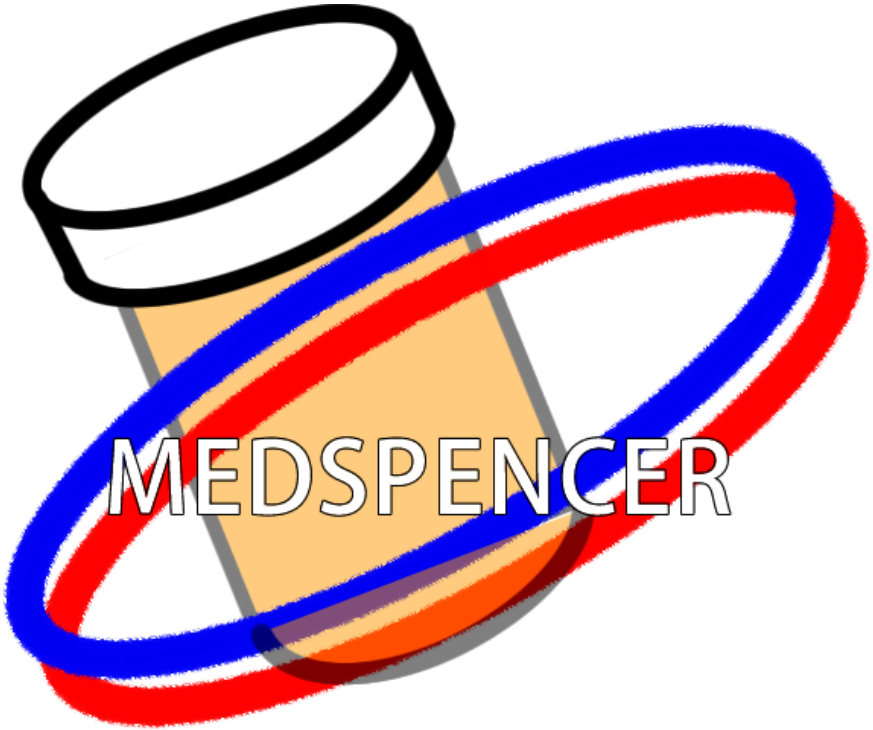

GROUP 6

IVAN ALVAREZ

GUSTAVO MORALES

SAKEENAH KHAN

MATTHEW HOOVER

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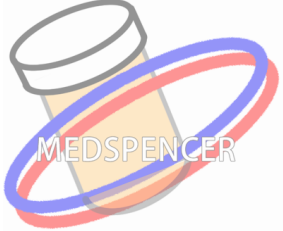
MOTIVATION

- **Medication nonadherence** limits the effectiveness of health care services and prescribed medications
- **~50% of patients** with chronic illnesses don't take medications as prescribed[1]
- Implications include **decreased quality of life**, poorly managed symptoms, and even death[2]
- Costs the health care system **over $300 billion a year** due to additional doctor visits, emergency department visits, and hospitalizations[2]

MEDSPENCER

[1] Sabaté, Eduardo, editor. Adherence to Long-Term Therapies: Evidence for Action. World Health Organization, 2003
[2] Zullig, Leah L. "Engaging Patients to Optimize Medication Adherence." NEJM Catalyst, NEJM Group, May 2017

MAIN IDEA



- **Main goal:** To increase medication adherence in patients that have complicated medication regimes with multiple prescription medications and schedules.

- **Our solution:** The Medspencer will sort and schedule doses and notify patients to take their medicine. It will also report to the caretaker and physician on the patient's adherence.

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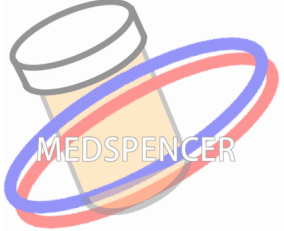
GOALS & OBJECTIVES



- To avoid medication nonadherence
  - Including forgetting to take a dose, accidental overdose, and mixing up medications
  - Solution: Sort and schedule doses, and notify the patient to take the dose
- To track the patient's medication adherence
  - Record when the patient does/doesn't take their medication
  - Send monthly report to the physician and caretaker on patient's adherence
  - Solution: Utilize wi-fi module to send emails
- To securely contain prescription medications
  - So wrong person doesn't take medications, and to avoid overdose
  - Solution: Fingerprint identification to grant access to the correct Patient or the Administrator

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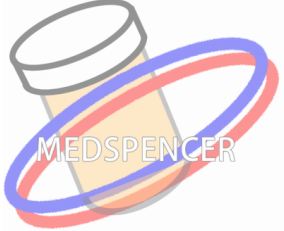
PROJECT OVERVIEW & FEATURES



- **Touchscreen**-based user interface
- Caretaker manages **prescriptions** and **schedules**
- Patient identification via **fingerprint** reader
- **Speaker** alerts patient at scheduled dosage time
- Medicine is dispensed to patient using **motors**
- Compliance reports **emailed** to physician regularly

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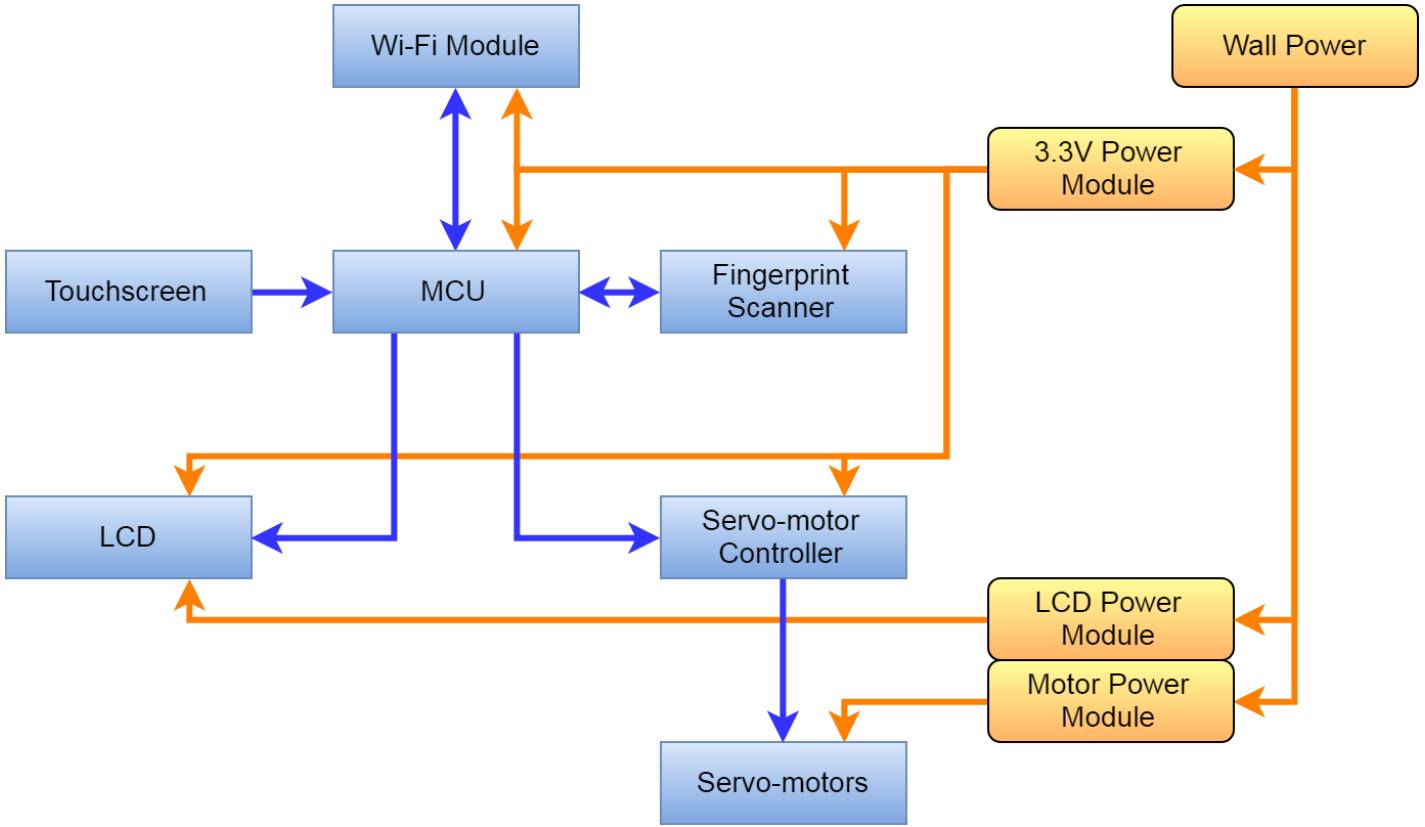
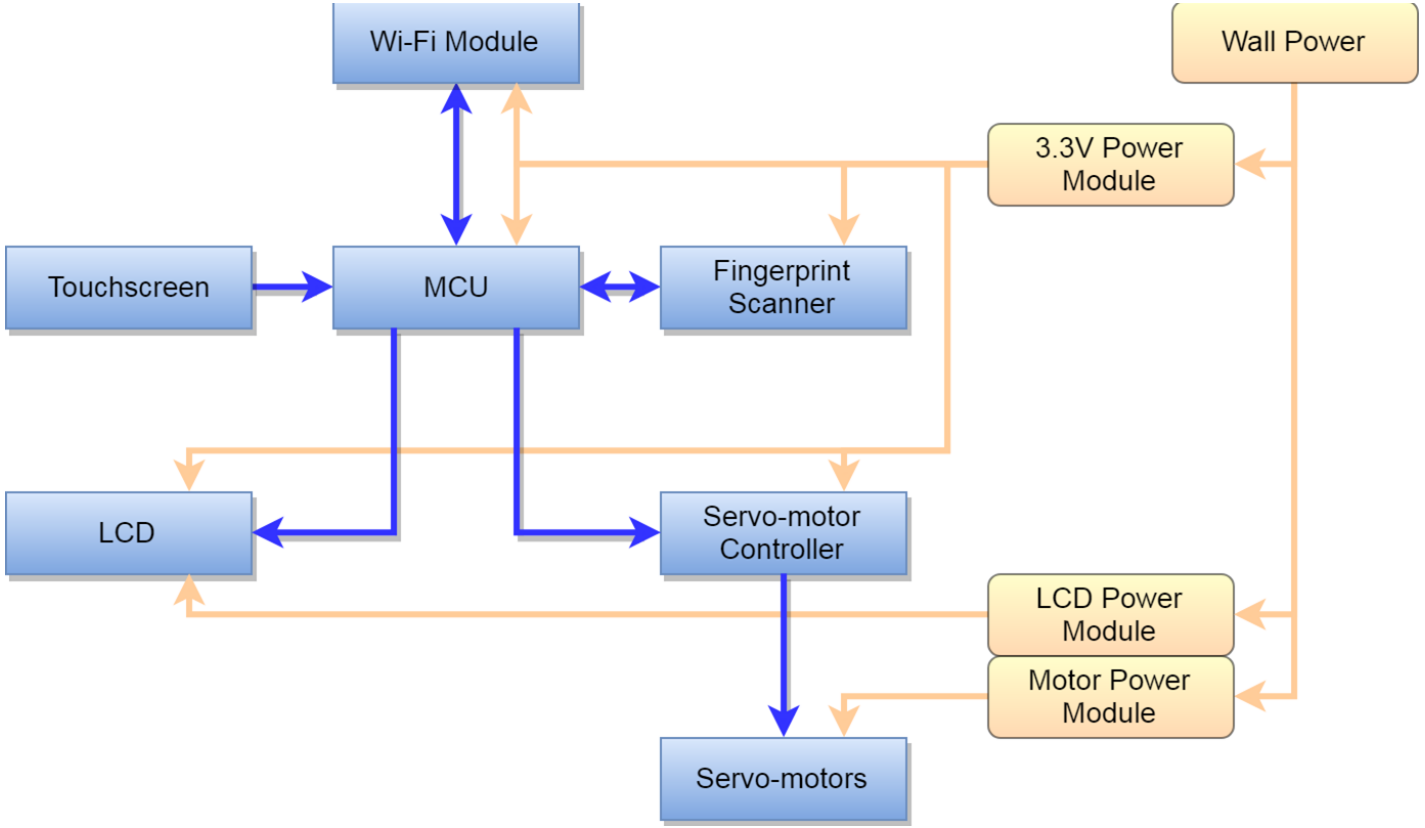
HARDWARE DIAGRAM



DATA DIAGRAM



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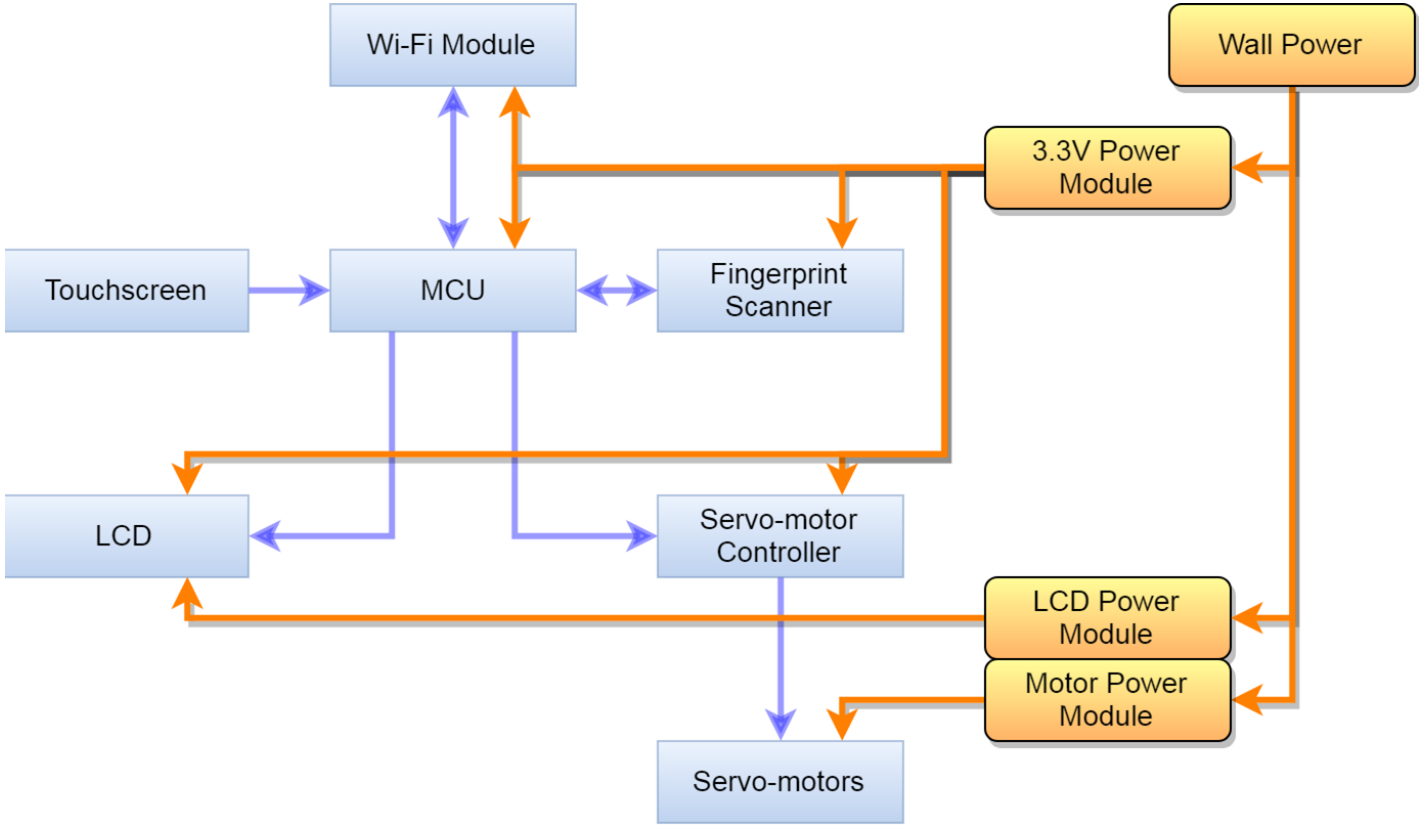
POWER DIAGRAM



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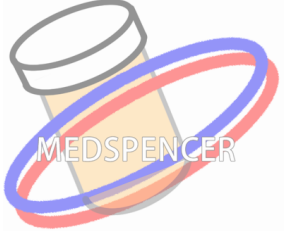
VOLTAGE SPECIFICATIONS

Component	Voltage
Domestic power outlet	120 V
Desired Voltage input	12~15V
Microcontroller	3.3 V
Touchscreen	10.4 V
Wi-fi Module	3.3 V
Servo Motors	4.8-6.5 V
Speaker	5 V



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Standards

IEEE	FDA	IPC
IEEE 1588	Design and Manufacturing Section V	IPC 2221
IEEE P1619	Device Testing Considerations Section VI	IPC A600F
IEEE 830		IPC A630
IEEE 11073		IPC 771B

House of Quality

Engineering	Marketing	Quality	Ease of Use	Pill Capacity	Security	Installation Time	Cost	Engineering Targets
		+	+	+	+	-	-	
Quality	+	⇑	⇑	↑	↑	↓	↓	
Power Usage	-	↓						< 500 W
Screen Size	+	↑	↑		↑			7" WVGA
Memory Size	+	↑	↑	↑			⇓	> 1 MB
Dimensions	-	↓		⇓			↓	< 2' x 1' x 1'
Cost	-	↓		↓	↓		⇓	< $2000

Legend

↑	Positive Correlation
↓	Negative Correlation
⇑	Strong Positive Correlation
⇓	Strong Negative Correlation

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PROPER DOSAGE TIME

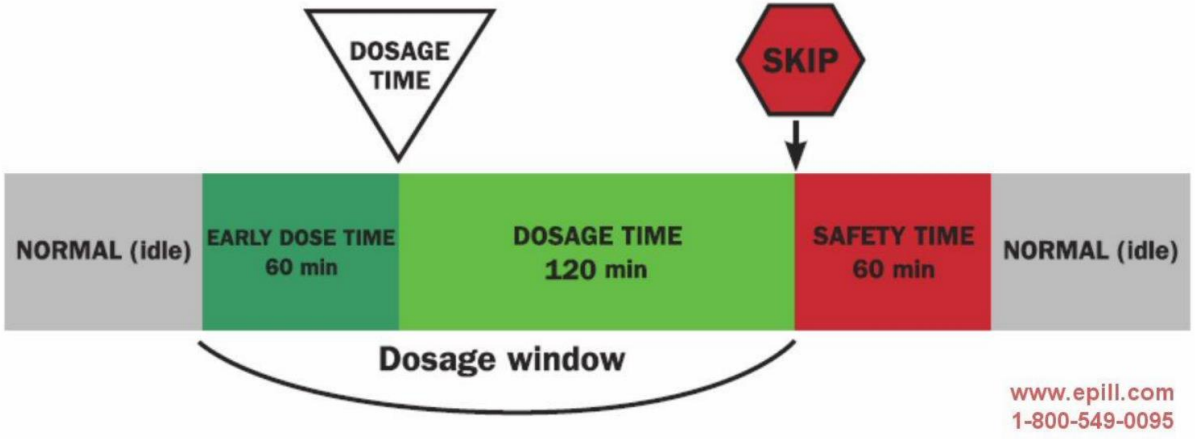
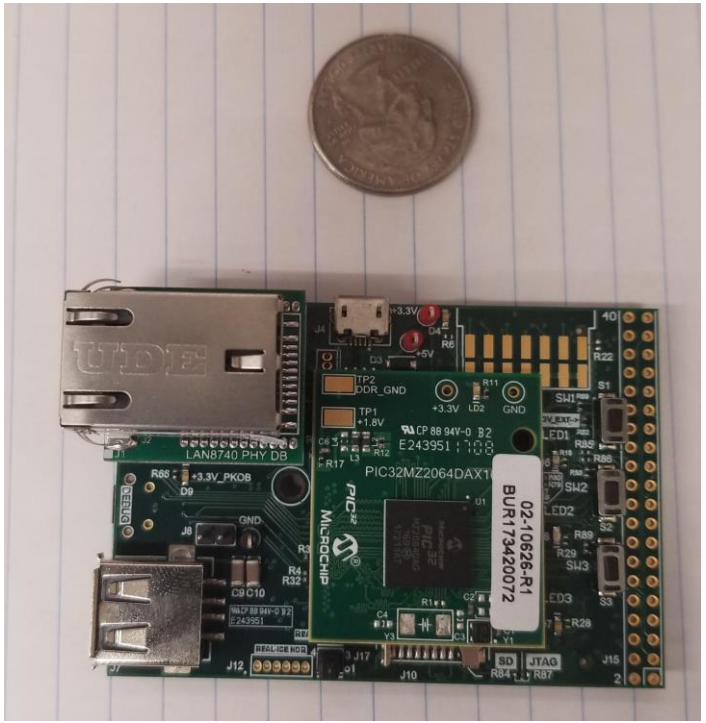


Image Courtesy of e-pill ® Medication Reminders

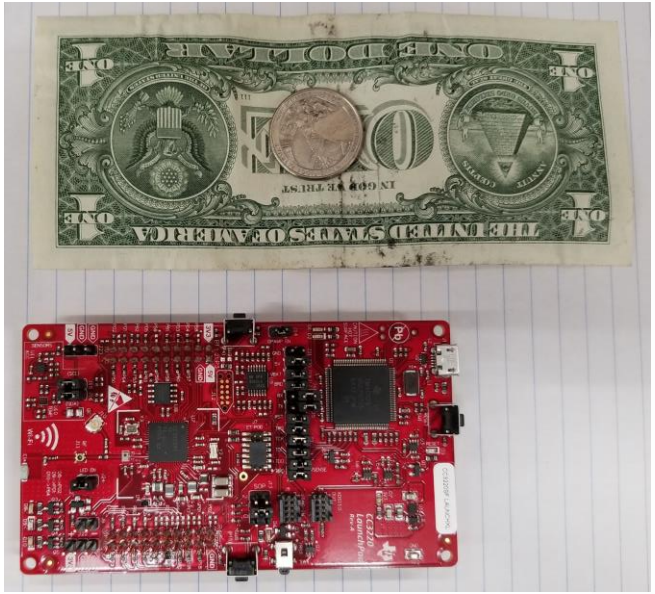
MICROCONTROLLER

- Microchip PIC32MZ DA
- Graphics Processing Unit
- LCD Controller
- Real Time Clock
- Communication Interfaces
- Development Board



WI-FI MODULE

- Texas Instruments CC3220SF
- V supply: 3.3 V
- Wi-Fi Communication to the internet
- Update Database information
- Transmit Reports by email to Doctor’s office



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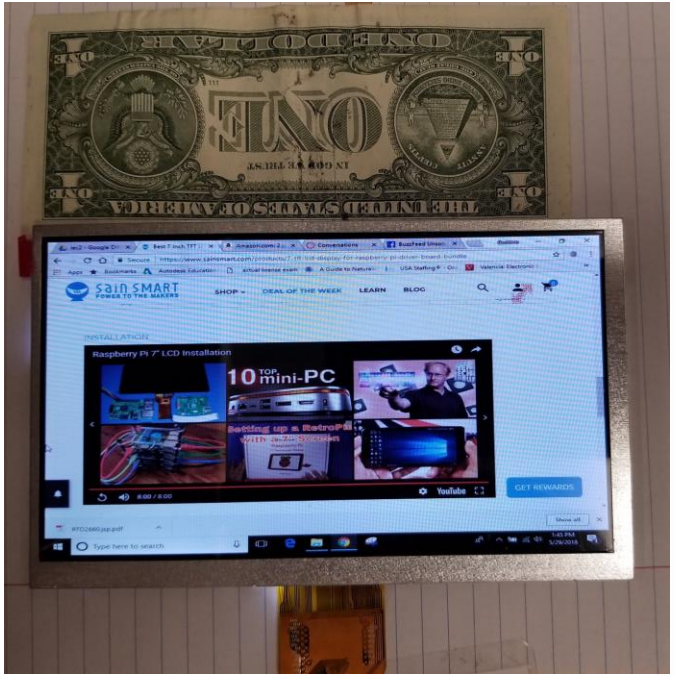
DISPLAY

- Innolux AT070TN90
- 7” WVGA (800 x 480)
- Resistive touch panel



FINGERPRINT SCANNER

Fingerprint module R307

V supply: 4.2-6 V or 3.3 V

I supply: 50 (typ), <75-80 mA

I/O tolerance: 5 V or 3.3 V

5 μA

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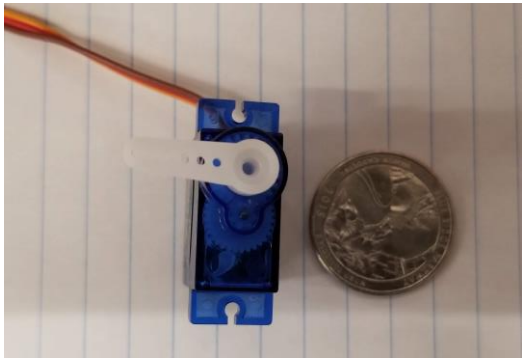
SERVO MOTORS

Servomotor SG90

V Supply: 4.8 ~ 6.5 V

I supply: 550 mA

I/O tolerance: 3.3 ~ 5 V



POWER

Power supply: 120V domestic power outlet

AC/DC Converter to transform and rectify AC power supply

Voltage regulators and Current limiting circuits ensure appropriate operating levels for each hardware component

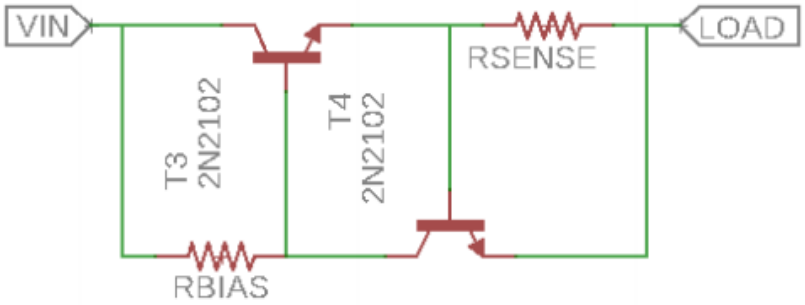


Figure 35. Basic current limiting circuit

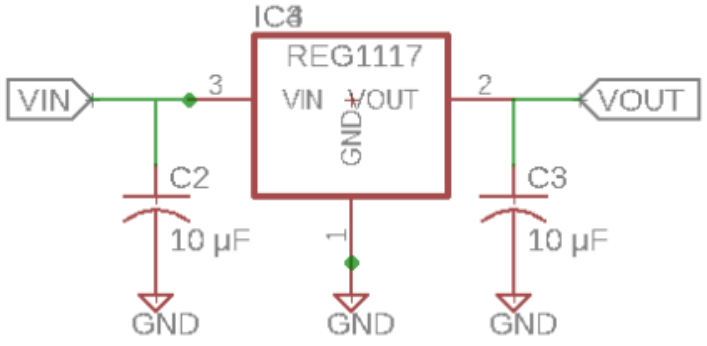
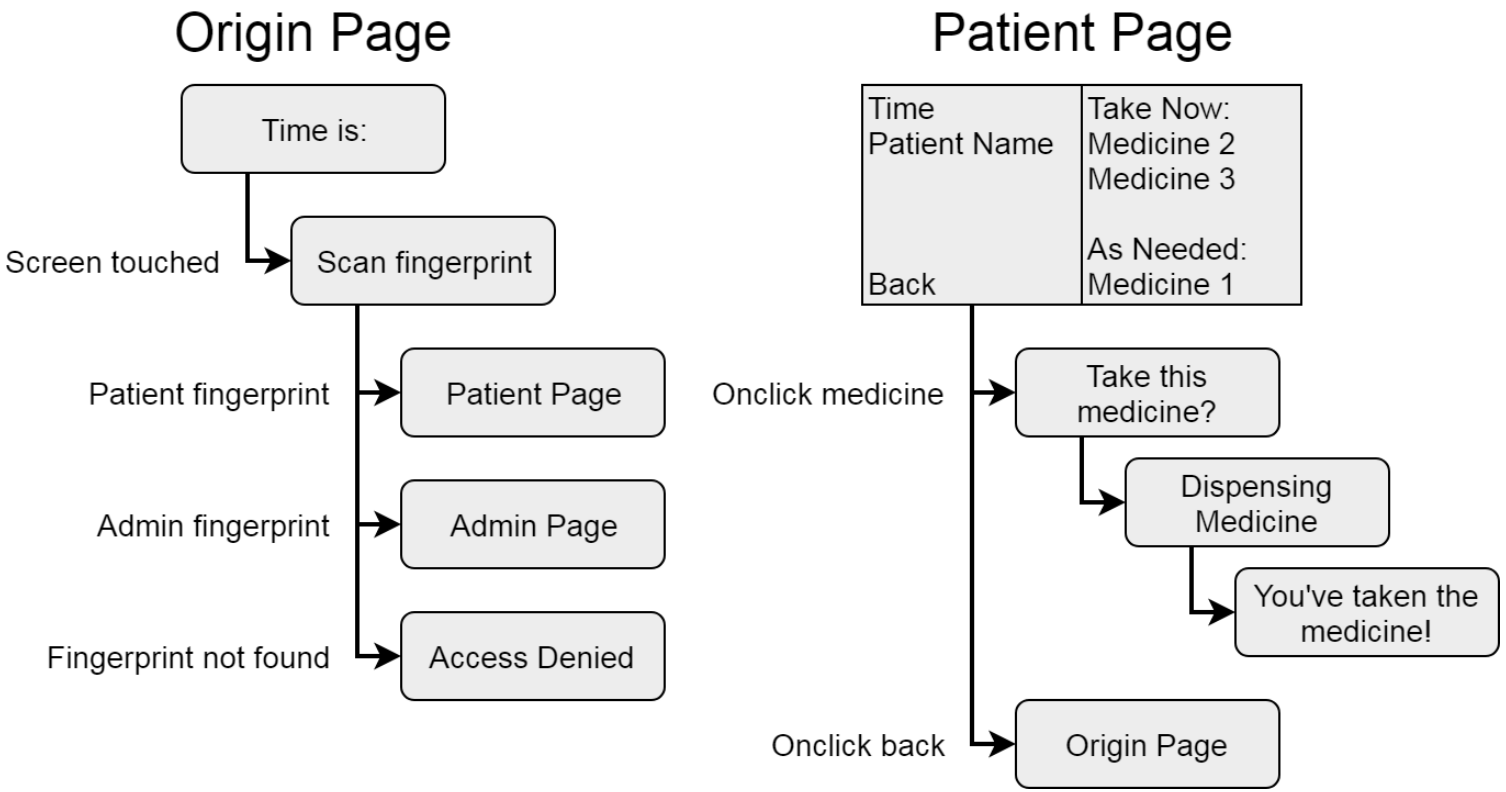


Figure 34. Basic connections for fixed-voltage voltage regulator

User Interface Hierarchy



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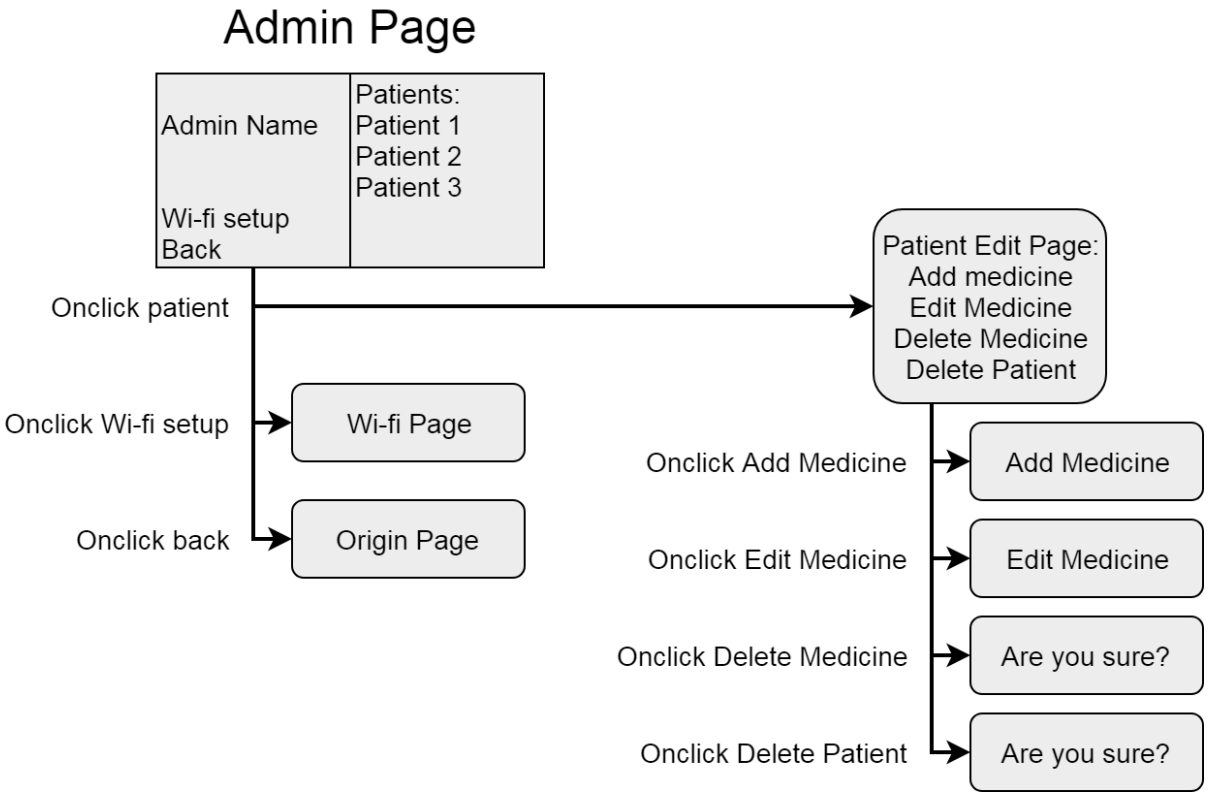
User Interface Hierarchy



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WORK DISTRIBUTION

Name	Wi-Fi	Processor	Display	Fingerprint	Servo Motors	Power
Sakeenah		T	T	S	S	P
Ivan	P	S	S			T
Gustavo	T			P	P	S
Matthew	S	P	P	T	T	

P = Primary

S = Secondary

T = Tertiary

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Budget

Item	Part Number	Supplier	Price/Unit	# Units	Price
Fingerprint Reader	R307 Scanner	aliexpress	$ 14.00	1	$ 14.00
Servo Motor	SG90	Kuman	$ 1.89	7	$ 13.20
Display	AT070TN90	aliexpress	$ 20.00	1	$ 20.00
Microcontroller	PIC32MZDA	Microchip	$ 18.00	1	$ 18.00
Development Board	PIC32MZDA Starter Kit	Microchip	$ 130.00	1	$ 130.00
Wi-Fi Module	CC3220SF LanuchXL	Texas Instruments	$ 6.99	1	$ 6.99
Speaker	CQRANQI0007US	Amazon	$ 7.87	1	$ 7.87
PCB Design		EPECTEC	~ $ 40	1	$ 40
Total					$ 267.06

FINANCING

The project will be financed by Esperanza Behavioral Health and Services in Orlando, Florida.

As the project will not exceed the cost of $300, the group is buying parts during the testing and prototype stages and the sponsor will return all investment when the final product is finished.

PROGRESS

May 1:	Purchased components
May 15:	Starting to write code for the project
May 22:	Starting to test hardware components
	Preparing CDR presentation slides
June 1:	CDR presentation
June 15:	First PCB
June 22:	Project progress Demo
July 13:	Second PCB
July 23:	Final project due

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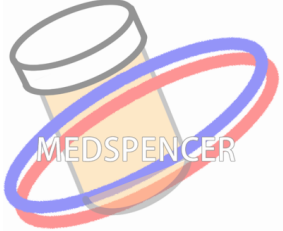

PROTOTYPING & PCB LAYOUT

Prototyping phase: verifying design and hardware/software implementation

Using development boards and breadboards and Multimeter

Test and check circuits in the lab

Finalize the PCB schematics order the PCB

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ISSUES

- While building the breadboard prototype, the servo motors and the fingerprint reader should be programmed in the same file, so libraries were an issue.
- The assembly of a new kind of filter to the servo motor.
- Interconnection between modules.
- Wifi module did not wanted to establish connection.

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QUESTIONS?

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