



Low Cost Patient and Healthcare Record System

Team B14

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Background

- Working in El Salvador
- Small community clinics all throughout country
- 1 doctor, 2 nurses, 5-10 health promoters
- Each person must be seen a certain number of times a year
 - Either home visit or consultation



Año	Edad	Incidencia	Prevalencia	Fallecido	E	F	M	A	M	J	J	A	S	O	N	D
2011																
2012	68	✓	✓	viva												
2013	69	✓	✓	viva	<u>2-12</u>									<u>20-13</u> F		
2014	70	✓	✓	viva					<u>2-14</u> T							
2015										T						



Customer Needs

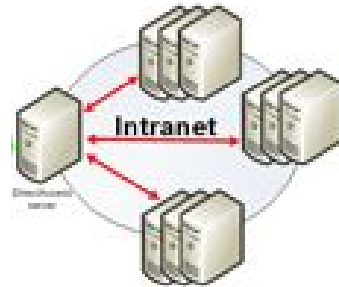
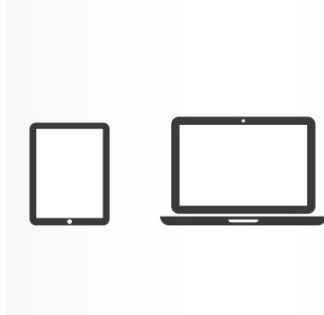
- Viewable on a cell phone/tablet
- User experience
- Patient Data
- Appointment tracker/reminders
- HIPAA compliant



Final concept and justification

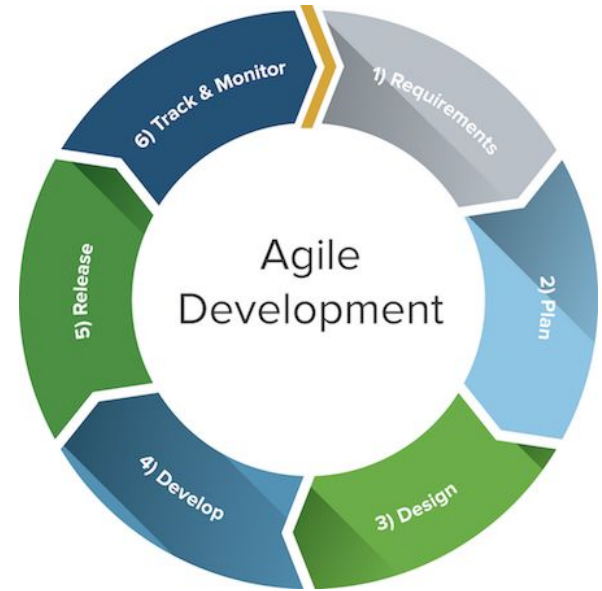
Web application connected on a locally hosted network

- Web app can be converted in mobile app
- Initially hosted locally with ability to expand to globally



Agile Development

- Short release increments
 - 2-week iterations
- Quicker user feedback
 - Show to user every two weeks
- Testing during development
 - Quality code right away

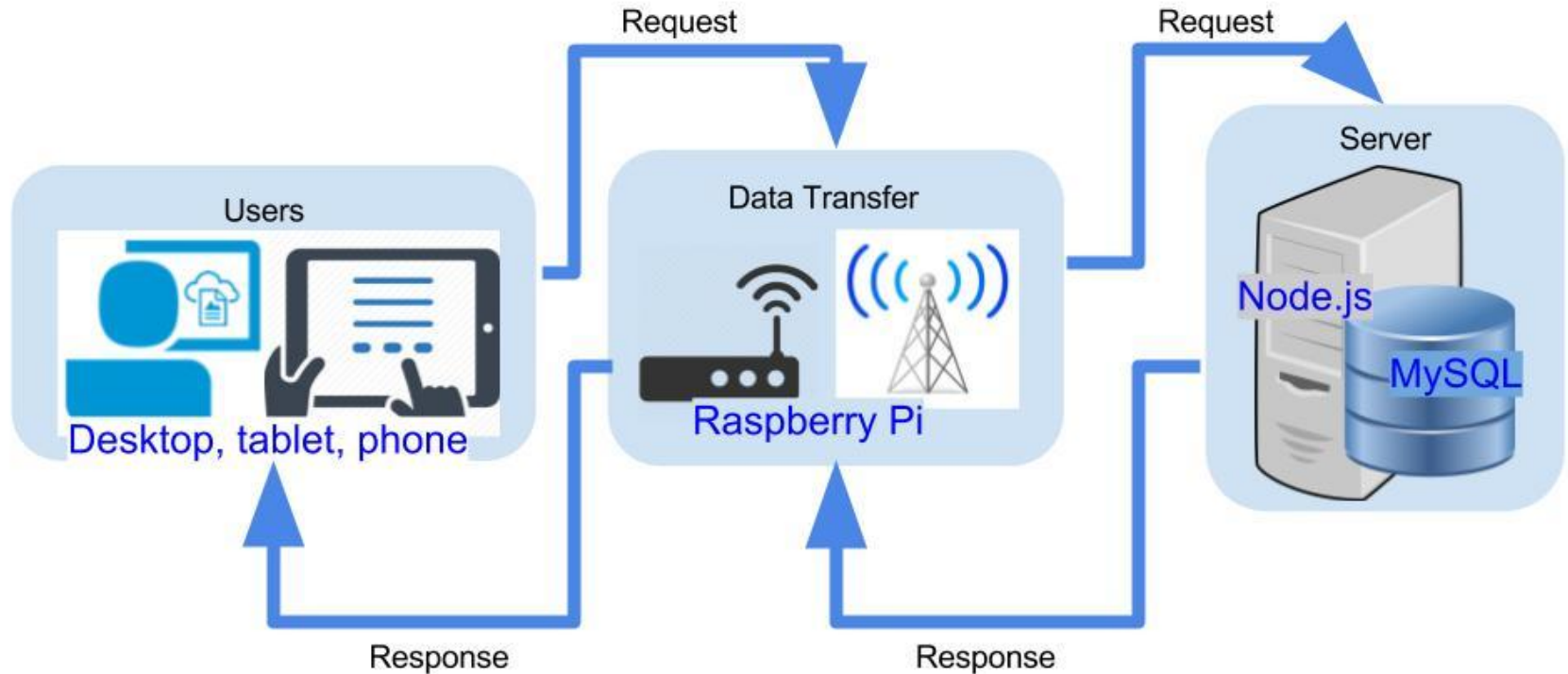


Technology Decisions

Technologies used in our web-based application:

- Node.js (Web Server)
 - One language (Javascript) for backend and frontend
 - Widely used, maintainable for future developers
- Angular (Front End)
 - Modern UI building tool
- MySQL (Relational Database)
 - Industry standard, relational
- Raspberry Pi (Router or Server)
 - Extensive online resources
- Samsung Tablet
 - Mimics the type of tablet used in an El Salvadoran health clinic

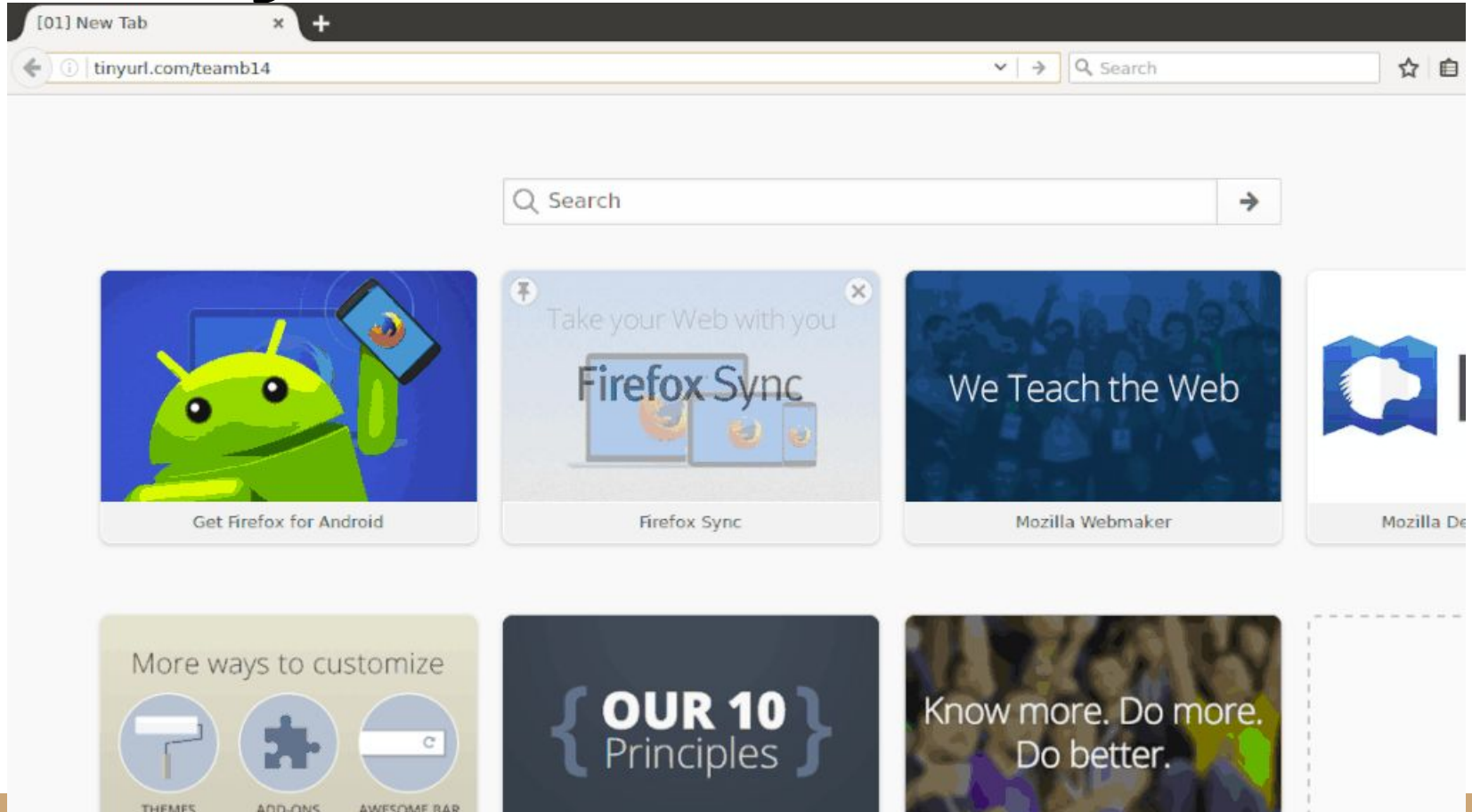
Delivered System Overview



Try it out!

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Lista de Pacientes



Nombre	Zona	Grupo	Cita Próxima	Factores de Riesgo
Julio Perez	2	2	2017-10-30	Smoking
Alvaro Diaz	6	0	2016-08-28	None
Lupita Brizuelas	1	0	2017-08-28	Biological

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Lupita Brizuelas

Classification: 2
Fecha de Nacer: 04/03/1983
ID del Paciente: 06-14-U-[]-E-005-005-02
ID de la Familia: 5
Nombre del Eco: 1
Id de la Zona: 1
Sexo: 3
ID Grupal: 0
Factores de Riesgos: Biological
Chronic Illness:
Notes:
Información: Lupita Brizuelas

Historia de Citas

Fecha	Tipo	Incidencia	Prevalencia
2012-09-27T20:10:09.000Z	Sick checkup		
2017-05-01T09:00:00.000Z	Home Visit		
2015-10-13T23:40:00.000Z	Consultation		
2017-07-14T00:00:00.000Z	Consulta		

Nueva Cita

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Create Patient



Nombre:

David

Fecha de Nacimiento:

03-11-1995

ID del paciente:

88

Personas en la familia:

5

Nombre del ECO:

1

Zona:

1

Sexo:



Hombre



Mujer

Classification del Grupo:



I



II



III



IV

Factores de Riesgo:

Consumo de alcohol, c



Chronic Illness:

None

Notes:

None

Cancel

Create Patient

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David Vitale



Classification: 7
Factores de Reiso: 31/10/1995
Descriptive patient ID: 1
Fecha de nacimiento: 1
Sexo: 1
Zona: 1
Patient Sex: M
ID: 1
Eco Name: Consumo de alcohol, drogas, tabaco
Chronic Illness:
Notes: None
Información: David Vitale



Historia de Citas

Año	Edad	Incidencia	Prevalencia	Mes
2014	23	Visita a la Casa	Sana	Feb
2015	24	Consultation	Sana	Jul
2016	25	Visita a la casa	Sana	Dec

Nueva Cita

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David Joseph Vitale



Classification: 7
Factores de Riesgo: 30/10/1995
Descriptive patient ID: 1
Fecha de nacimiento: 1
Sexo: 1
Zona: 1
Patient Sex: M
ID: 1
Eco Name: Consumo de alcohol, drogas, tabaco
Chronic Illness:
Notes: None
Información: David Joseph Vitale

Historia de Citas

Año	Edad	Incidencia	Prevalencia	Mes
2014	23	Visita a la Casa	Sana	Feb
2015	24	Consultation	Sana	Jul
2016	25	Visita a la casa	Sana	Dec

Nueva Cita

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HORARIO

📅 April 4, 2017 - May 3, 2017 ▼

Pacientes

Dato

Tipo

Julio Perez

2017-05-01

Home Visit

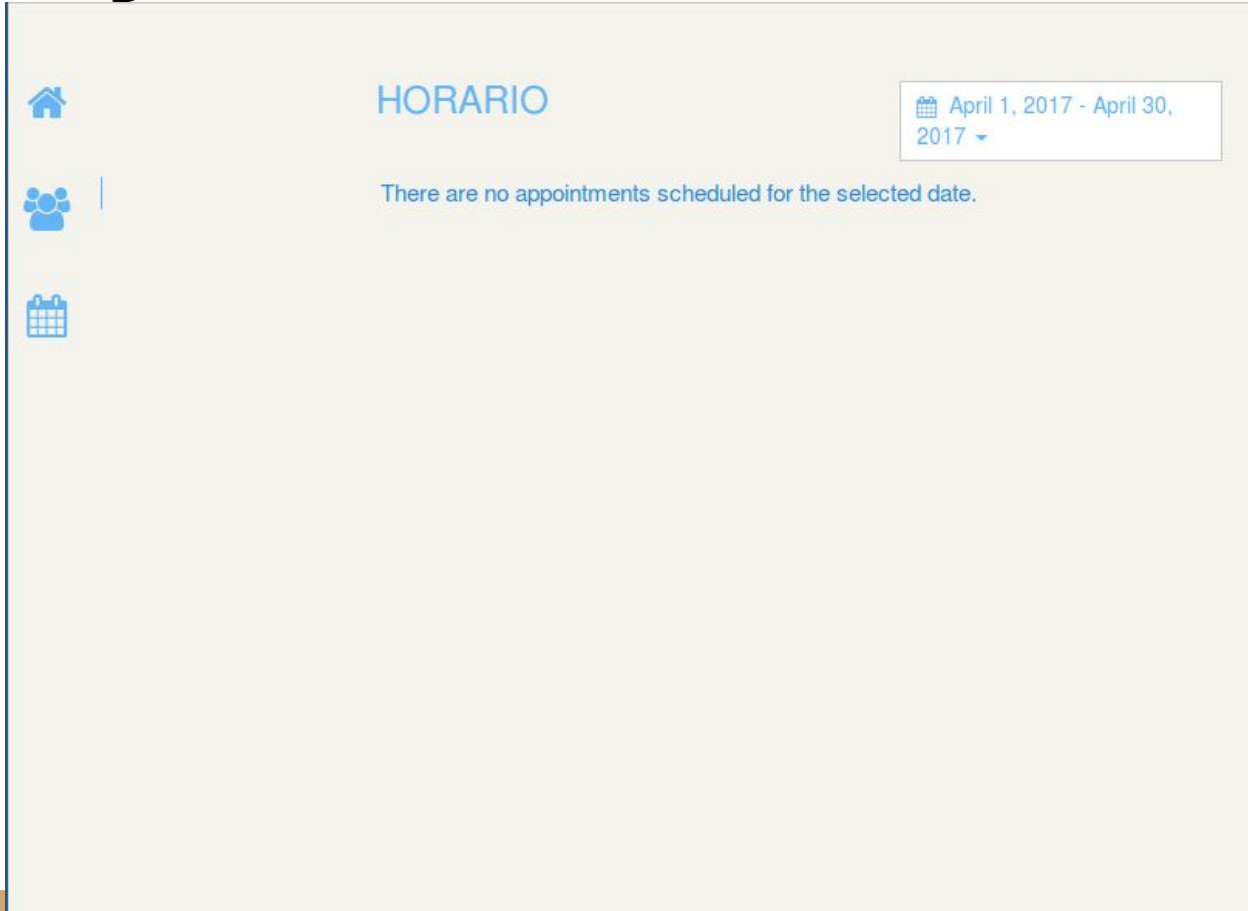
Lupita Brizuelas

2017-05-01

Home Visit



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HORARIO



April 4, 2017 - May 3, 2017 ▾

Pacientes

Julio Perez

Lupita Brizuelas

Dato

2017-05-01

2017-05-01

Tipo

Home Visit

Home Visit



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David Vitale

Classificación:

9

Fecha de Nacer:

02/11/1995

ID del Paciente:

51

ID de la Familia:

1

Nombre del Eco:

1

Id de la Zona:

1

Sexo:

M

ID Grupal:

1

Factores de Riesgos:

Consumo de alcohol, drogas,
tabaco

Chronic Illness:

Notes:

None

Información:

David Vitale

Historia de Citas

Fecha

Tipo

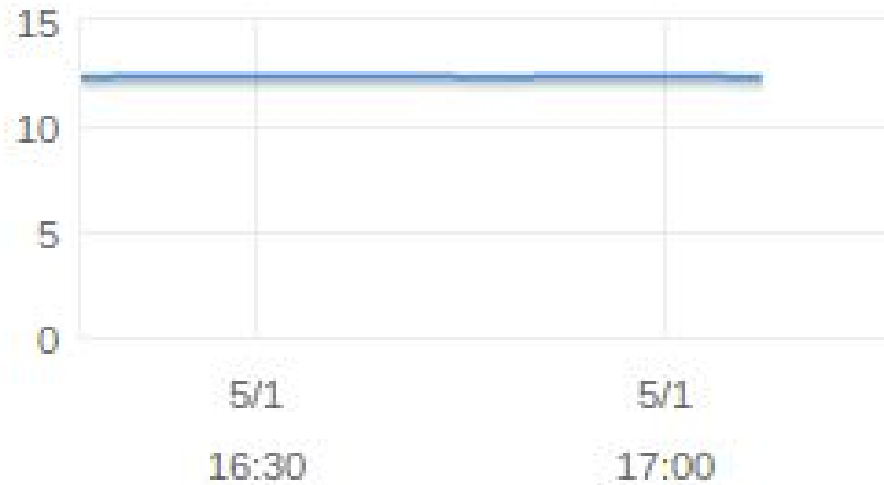
Incidencia

Prevalencia

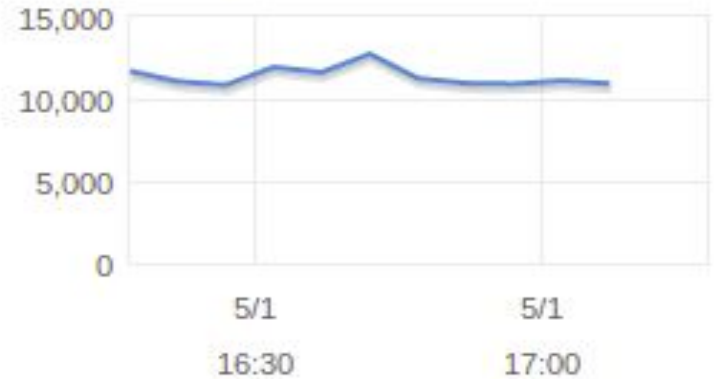
Nueva Cita

Scalability

CPU Utilization (Percent)



Network In (Bytes)



Network Packets Out (Count)



Validation and Verification

- CPU/Network usage was minimized
- Non-technical users can navigate the web page
- Stress testing by student developers in the GasDay Laboratory
 - Crashing the server for unhandled errors
 - SQL Injection
 - Not following the correct input format ("kittens" for an appointment date)

Raspberry Pi Proof Of Concept

CPU: 1.2 GHz (ARMv8)

Bluetooth Low Energy

802.11n Wireless LAN

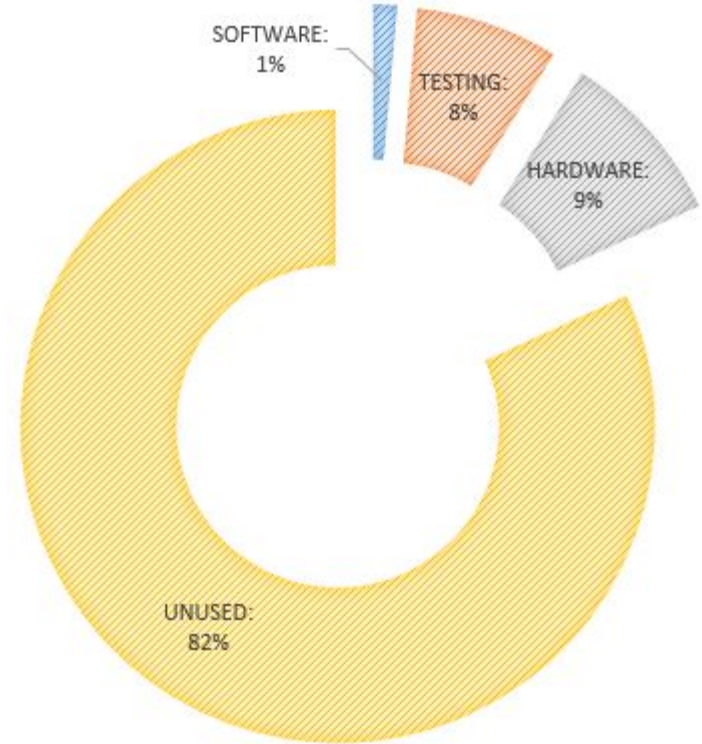
1GB RAM

- **Wireless Access Point**
- Server
- File Storage (External Hard Drive)
- Captive Portal



Budget and Timeline

- Economic feasibility
 - \$2000 NIH Budget
- Development Costs
- Overall System Costs



Budget and Timeline

SEPTEMBER - DECEMBER	JANUARY - MAY
<ul style="list-style-type: none">● Background/Market Information● Customer Needs<ul style="list-style-type: none">○ Speak w/ Contacts○ Surveys● Risks/Processes● System Requirements● Overall System Plan<ul style="list-style-type: none">○ Initial Code Base○ Hardware Decisions	<ul style="list-style-type: none">● Hardware<ul style="list-style-type: none">○ Order Components● Software<ul style="list-style-type: none">○ Setup MySQL/Node.js○ Add Patient (Information)○ Delete Patient (Information)○ Authentication● User Interface<ul style="list-style-type: none">○ Make it similar to current systems they use● Testing<ul style="list-style-type: none">○ Speak w/ Contacts

Summary

- Problem
 - Lack of efficiency and reliability with paper files
- Solution:
 - Electronic scheduling and filing system
- Future Work:
 - Implementing this system in El Salvadoran Health Clinics
 - Cloud hosting vs. Local hosting
 - Bug fixes
 - Future Senior Design groups



Questions?




Appendix


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← ⓘ Search or enter address

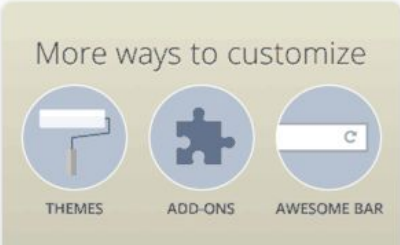
Q Search




Get Firefox for Android



Firefox Sync



Customize Firefox



Mozilla Manifesto

Certificate Viewer: "Senior Design Team B14"

General

Details

Could not verify this certificate because the issuer is unknown.

Issued To

Common Name (CN)

Organization (O)

Organizational Unit (OU)

Serial Number

Senior Design Team B14

Marquette University

College of Engineering

00:87:D1:C6:1C:E5:9D:F5:1B

Issued By

Common Name (CN)

Organization (O)

Organizational Unit (OU)

Senior Design Team B14

Marquette University

College of Engineering

Period of Validity

Begins On

Expires On

May 2, 2017

September 16, 2044

Fingerprints

SHA-256 Fingerprint

SHA1 Fingerprint

37:3E:C3:FA:1A:EF:FA:1B:16:AB:20:AD:12:A5:AB:07:5C:E9:77:D1:CD:DB:45:F1:36:67:32:C9:46:32:3E:EE

04:25:A4:7B:37:F8:6A:84:72:41:F2:2F:54:B6:E2:56:2D:D9:23:81

Close

Questions?



Backup (Acknowledgements)

- Dr. Diaz
 - Past experience working in a clinic
 - Currently located in the US
- Dr. Brizuela
 - Worked at an ECO closely with Promotores
 - Currently in El Salvador, working in higher administration for the healthcare system
- Dr. Olson (Faculty Advisor)
 - Spent last summer in El Salvador
 - Helped with project scope, refining details
- GasDay Development Team
 - Provided black-hat stress testing on the final system

Backup (Feasibility)

- Human Aspect

- Spanish Language Application on a tablet they are familiar with
- Useful level of notifications
- Offline data storage

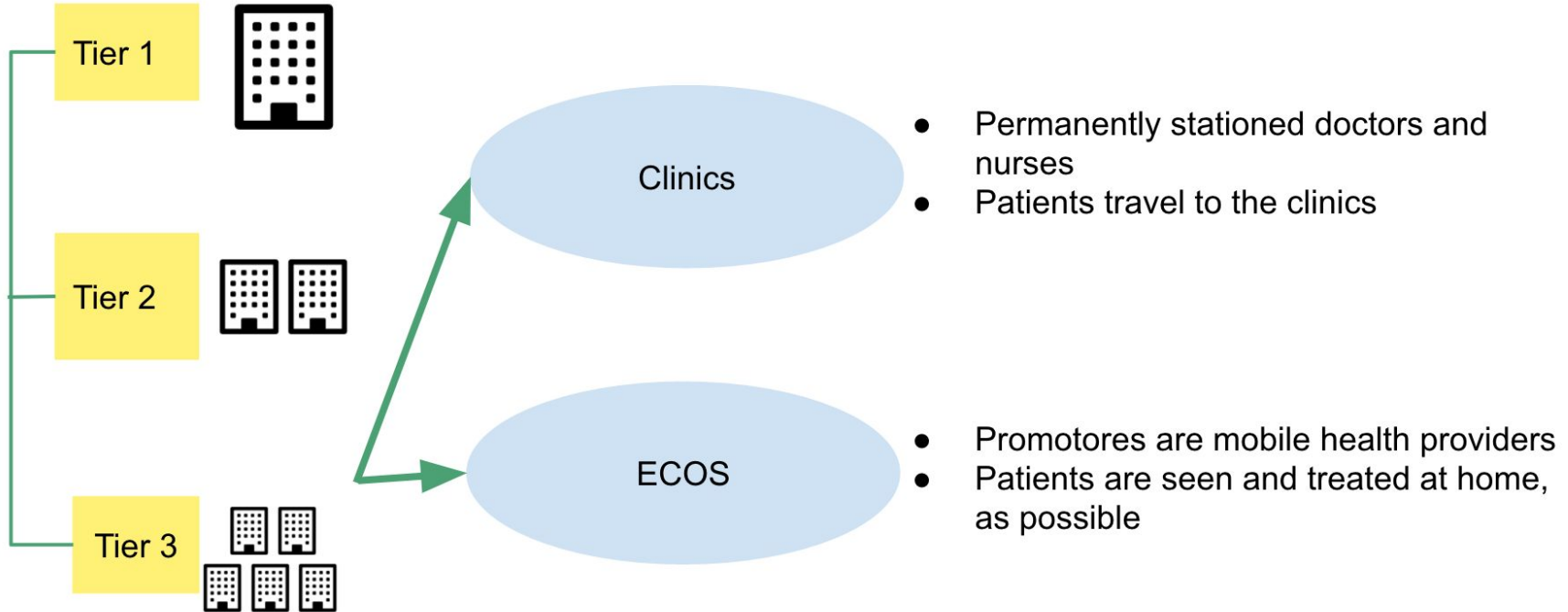
- Technical Aspect

- System stability and platform independence
- For future developers...
 - Stable, long-lasting platform
 - Well documented, clean code
- For promotores...
 - System setup documentation
 - Server upkeep/troubleshooting documentation

- Economical Aspect

- Ensuring technology used matches the economic needs of the customer
 - Use existing servers and clients

Backup (background health system)



Backup (Concept Selection)

		Concepts					
		Base Option		Internet		Intranet	
Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Affordable	15%	3	.45	2	.3	1	.15
Scalable	10%	3	.3	5	.5	5	.5
Reliable	20%	3	.6	4	.8	5	1
High volume of storage	10%	3	.3	5	.5	4	.4
HIPAA compliant (Patient information Privacy)	20%	3	.6	4	.8	5	1
Multiple options for hardware	7.5%	3	.225	4	.3	5	.375
Offline functionality	10%	3	.3	3	.3	4	.4
Data storage	7.5%	3	.225	5	.375	4	.3
	Total	3		3.875		4.125	
	Rank	3		2		1	
	Continue	no		no		yes	

		Concepts					
		Base Option		Web application		Mobile application	
Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Organization	10%	3	.3	5	.5	5	.5
Efficiency	10%	3	.3	4	.4	4	.4
Affordable	10%	3	.3	1	.1	1	.1
Scalable	7.5%	3	.225	5	.375	5	.375
Easy to use	7.5%	3	.225	4	.3	4	.3
Ability to update information	10%	3	.3	3	.3	3	.3
Reliable	7.5%	3	.225	5	.225	5	.225
Spanish	10%	3	.3	3	.3	3	.3
Multiple options for hardware	7.5%	1	.075	5	.375	4	.3
Offline functionality	7.5%	3	.225	3	.225	3	.225
Notifications for scheduling	5%	1	.05	5	.25	5	.25
Next Visit date calculation	2.5%	1	.025	4	.1	4	.1
Availability of hard copy information	5%	3	.15	2	.1	1	.05
	Total	2.655		3.55		3.425	
	Rank	3		1		2	
	Continue	no		yes		no	

Image References



Image References

Slide 4: Image from Dr. Diaz

Slide 6: Image from

<http://www.wisegeek.org/what-are-the-disadvantages-of-electronic-medical-records.htm>

Slide 7: Image from

<https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwjU5YXB4NXQAhVH4iYKHTVuDQkQjRwIBw&url=https%3A%2F%2Fbuildfire.com%2Fmobile-apps-vs-mobile-sites-good-for-business%2F&bvm=bv.139782543,d.eWE&psig=AFQjCNHaXIB2CrDM1AI2czC9iwiehw4QPA&ust=1480776497042771>

And from

<https://wintelinfrablog.wordpress.com/2009/11/03/step-by-step-guide-demonstrate-directaccess-in-a-test-lab/>

Concept Selection

Application Platform

		Web application		Mobile application	
Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score
Scalable	7.5%	5	.375	4	.3
Multiple options for hardware	7.5%	5	.375	4	.3
Offline functionality	7.5%	3	.225	3	.225
	Total	3.55		3.35	

Data Transfer Method

		Internet		Intranet	
Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score
Reliable	20%	4	.8	5	1
HIPAA compliant	20%	4	.8	5	1
Offline functionality	10%	3	.3	4	.4
	Total	3.875		4.125	

Problem and Solution

Problem: Manual filing system, unreliable scheduling system

- Labor-intensive
- Unorganized

Solution: Electronic, automatic filing and scheduling system

- Efficient
- Organized
- Expandable

Budget Breakdown

