

Modular Biometric Monitoring System

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- Hardware development
- Software development
- Conclusion



Introduction

- Background & Overview
- Project Summary
- Project Resources

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Background

- Importance of monitoring patients
- Current situation
- Timely response to critical patients
- FCC approval of wireless spectrum for medical devices

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Value Proposition

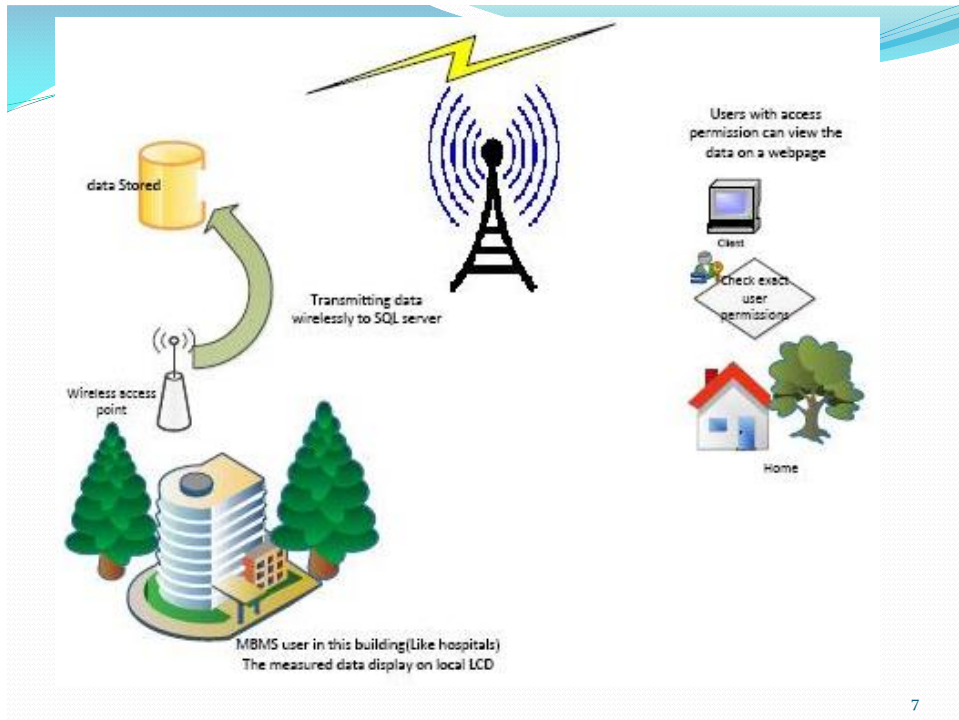
- Several patients could be remotely monitored by a single care provider.
- Improve response time and reduce overall staffing requirements.

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System Overview

- Measures biometric data
- Collects measurements
- Send measurements to a database
- Viewable on web browser

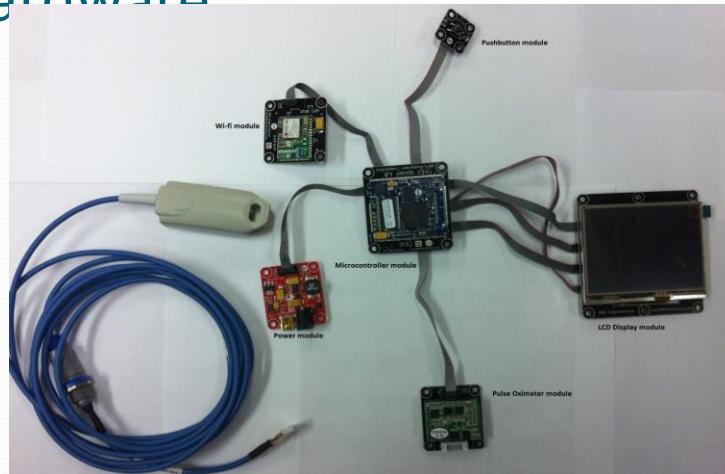
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Project Resources

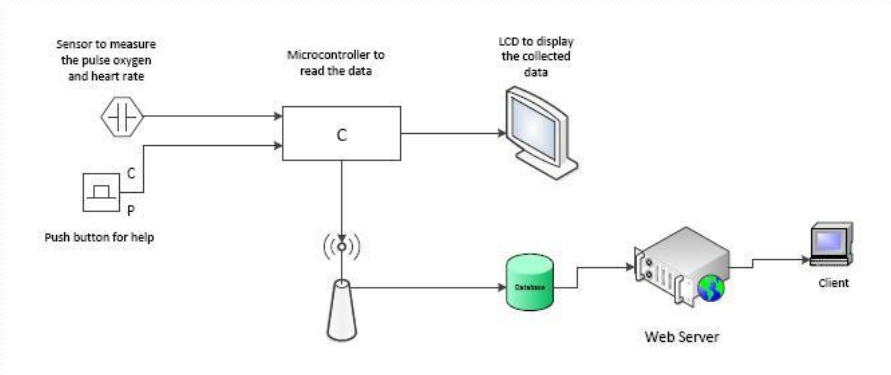
- Cost
 - Project Cost vs. Actual Cost
- Schedule (Time)
 - Projected time vs. actual time
 - Obstacles

Hardware



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System Design Overview



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Hardware Components

- Microcontroller
- Pulse Oximeter sensor
- Pushbutton module
- Wireless module
- Power module

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Hardware Components

- Component research and selection
 - .NET Gadgeteer
 - Produced commercially
 - Open source code
- Component testing
 - Tools used
 - Functionality
 - Met specifications

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Software Development

- Development
 - Device
 - Database
 - Web interface
- Testing

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Software

Biometric Data Path



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Program

```

- HRGraph: SimpleGraph
- baseFont: Font
- window: Window
- canvas: Canvas = new Canvas()
- txtStatusMessage: Text
- txtMsgHR: Text
- txtMsgO2: Text
- SignalStrength: int
- useDebug: bool = true
- name: string
- pulseRate: string
- oxSat: string
- timer: GT.Timer
- IsNetworkUp: bool = false
- IP: string

- ProgramStarted() : void
- setupWindow() : void
- pulseOximeter_ProbeDetached(sender: PulseOximeter) : void
- pulseOximeter_ProbeAttached(sender: PulseOximeter) : void
- pulseOximeter_Heartbeat(sender: PulseOximeter, reading: PulseOximeter.Reading) : void
- pulseOximeter_Heartbeat(sender: PulseOximeter, reading: PulseOximeter.Reading) : void
- button_ButtonPressed(sender: Button, state: Button.ButtonState) : void
- timer_Tick(timer: GT.Timer) : void
+ SendPulseOxData(name: string, pulse: string, oxg: string) : void
- req_ResponseReceived(sender: HttpRequest, response: HttpResponse) : void
- startWIFI() : void
- wifi_RS21_NetworkUp(sender: GTM.Module.NetworkModule, state: GTM.Module.NetworkModule.NetworkState) : void
- wifi_RS21_NetworkDown(sender: GTM.Module.NetworkModule, state: GTM.Module.NetworkModule.NetworkState) : void
- Interface_WirelessConnectivityChanged(sender: object, e: WIFIRS9110.WirelessConnectivityEventArgs) : void
+ NTPTime(TimeServer: string, GmtOffset: int) : bool
- Interface_NetworkAddressChanged(sender: object, e: EventArgs) : void

```

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Database

- Used SQL Server 2008
 - Originally developed three table
 - Reduced to two table for time

Web Interface

- Local Internet Information Service (IIS)
- ASP.NET web pages

MODULAR BIOMETRIC MONITORING WEB

Home Monitor About

MONITOR

This is the monitor page

Doe

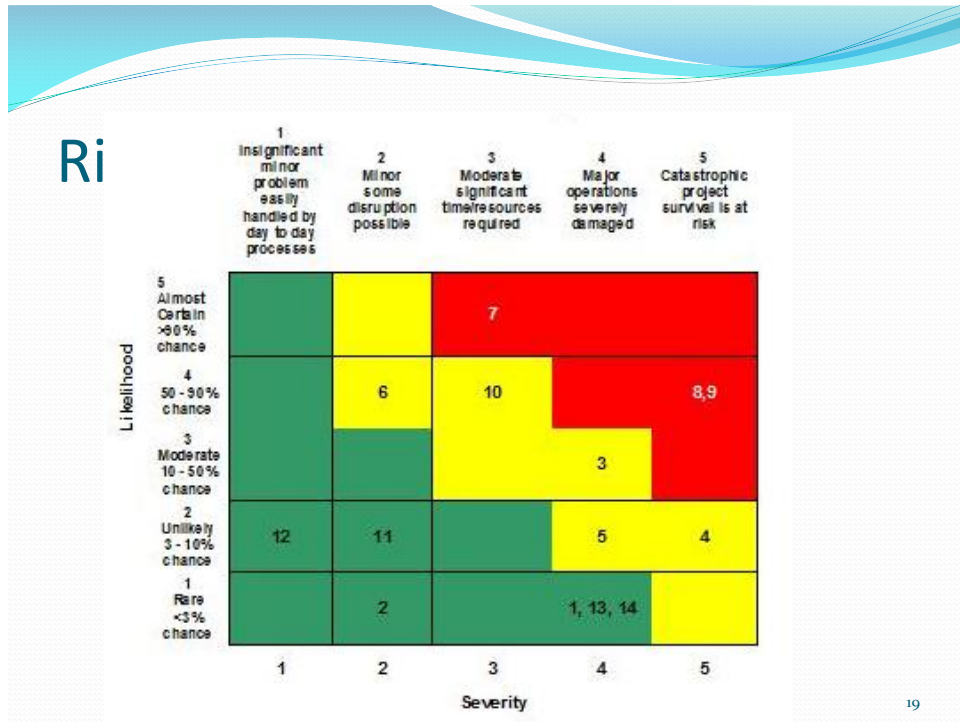
HeartRate	O2Sat	TxTime
86	99	4/24/2013 9:19:00 PM
92	98	4/24/2013 9:18:50 PM
93	99	4/24/2013 9:18:40 PM
96	98	4/24/2013 9:18:30 PM
100	98	4/24/2013 9:18:20 PM
96	98	4/24/2013 9:18:10 PM
91	98	4/24/2013 9:18:00 PM

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WCF Service

- Windows Communication Foundation (WCF) provide unified programming model and runtime support for building Web services applications
- Tested with WCF Client Tool

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Significant Risks

- Risk 6: Improperly written code cause delay in software delivery
- Risk 9: Unable to access proper SQL server forces modification to project scope
- Risk 10: WIFI encryption not supported by selected wireless device forces modification to project scope.

Lessons Learned

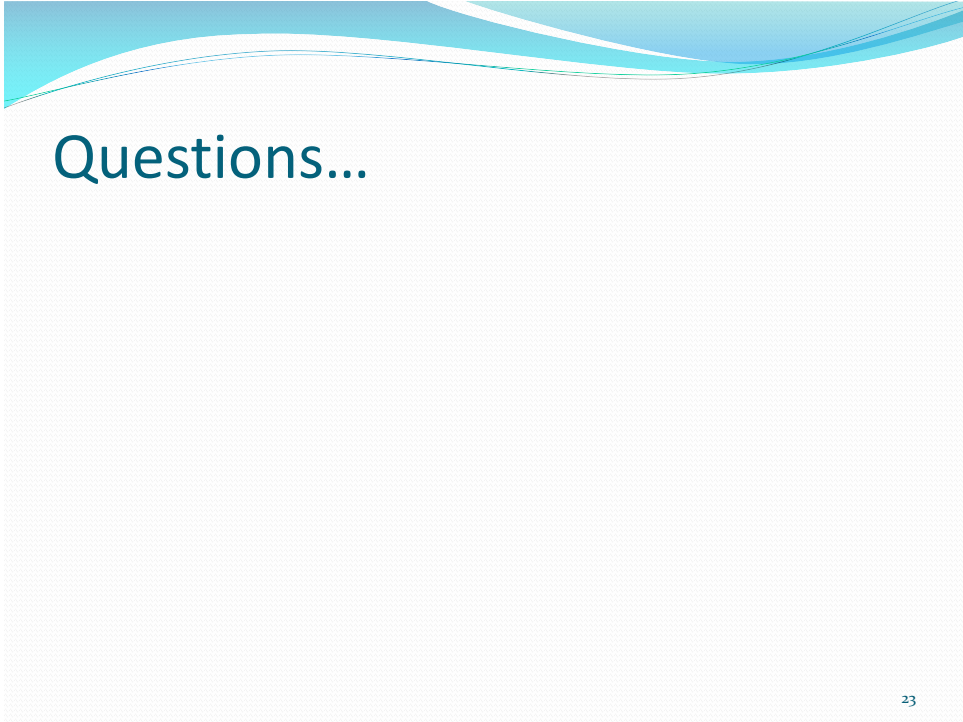
- Using time efficiently to achieve the goal
- Applying relevant education experience
- Dividing the project into tasks
- Following the project time line
- Lack of training in C# programming language
- IPFW computer labs did not support development in C#

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Future Development

- Secure website development
- Update database schema to support secure website
- Encrypt biometric data
- Enable touchscreen for interaction
- Build the logic to detect out of range data
- Enable alerts for data out of range
- Develop suitable battery pack

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Questions...