BatSignal:
System Design Document

Bryan Young
youngb2@wit.edu

Joe Moraal
moraalj@wit.edu

Zach Thornton
thorntonz@wit.edu

Computer Science 2015
Wentworth Institute of Technology

June 24, 2015

Contents

1 Introduction

1.1 Purpose and Scope

This document describes the hardware and software components of the BatSignal distributed sensor network. This document is intended for use by developers implementing BatSignal.

1.2 Project Executive Summary

The BatSignal network is designed to function as a rapid response alert system capable of identifying, by sensor ID, situations of distress or emergency. The system passively collects audio captures from the sensors and analyzes them for keywords or phrases. When the system detects a matching keyword or phrase it dispatches an email to a list of administrators and displays a notification on the system console.

The system is designed to be physically scaled according to the needs of the location of installation. Controller nodes are installed at or near administrative areas with sensor nodes installed in patient rooms, inhabited spaces, common areas, etc. Communication propagate through the BatSignal mesh network allowing nodes to communicate with the controller despite physical distance.

1.2.1 System Overview

1.2.2 Design Constraints

1.2.3 Future Contingencies

1.3 Points of Contact

1.4 Project References

1.5 Glossary

1.5.1 System Specific Definitions

System Specific Definitions	

1.5.2 Technical Definitions

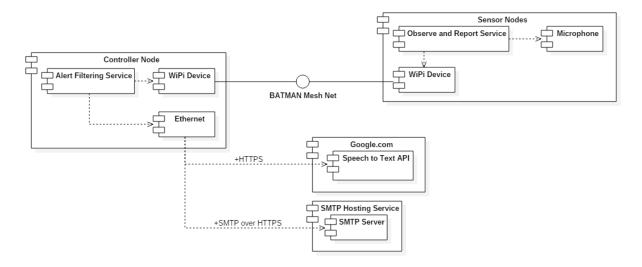| Technical Definitions	
CPU	Central Processing Unit
GPIO	General Purpose Input Output
GPU	Graphical Processing Unit
MHz	Mega-Hertz
USB	Universal Serial Bus
SoC	System on a Chip

1.5.3 Industry Definitions

Industry Definitions	
B.A.T.M.A.N	Better Approach to Mobile Ad-hoc Networking

1.6 Document Organization

In the following sections this document will define the overall system architecture followed by more detailed hardware and software architectures.

2 System Architecture

2.1 System Hardware Architecture

2.2 System Software Architecture

2.3 Internal Communications Architecture

3 Human-Machine Interface

The BatSignal Distributed sensor network expects

3.1 Inputs

3.2 Outputs

4 Detailed Design

4.1 Hardware Detailed Design

4.1.1 Raspberry Pi 2

Both versions of BatSignal nodes target the Raspberry Pi model 2 board. These systems have the following capabilities:

Raspberry Pi 2 Specifications	
Cost:	$35 USD
SoC:	Broadcom BCM2836
CPU:	900MHz quad-core ARM Cortex-A7
GPU:	Broadcom VideoCore IV, OpenGL ES 2.0, OpenVG 1080p30 H.264 high-profile encode/decode
Memory (SDRAM)iB:	1024 MiB
USB 2.0 Ports:	4 (via intergrated USB hub and LAN9512)
Onboard Storage:	Micro Secure Digital / MicroSD slot
Onboard Network:	10/100 wired Ethernet RJ45
Real-time Clock:	None
Power Ratings:	650 mA, (3.0 W)
Power Source:	5 V (DC) via Micro USB type B or GPIO header
Size:	85.0mm x 56.0 mm x 17mm
Weight:	40g

4.1.2 Wi-Pi WLAN Module

Wi-Pi WLAN Module Specifications	
Cost:	$15.52
Physical Interface:	USB 2.0
Wireless Standards:	IEEE 802.11n Backward compatible with IEEE 802.11g and IEEE 802.11b
Transmission Speed:	11b: 1/2/5.5/11 Mbps 11g: 6/9/12/18/24/36/48/54 Mbps 11n: up to 150 Mbps
Frequency Range:	2.4 to 2.4835 GHz
Working Channel:	1 to 13
Transmit Power:	20dBm (max)
Security Features:	WPA-PSK/WPA2-PSK WPA/WPA2 64/128/152 bit WEP Encryption

4.1.3 Microphone

Microphone Specifications	

4.2 Software Detailed Design

A   Appendix