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 system is designed as a rapid response alert system capable of identifying emergencies and reporting their location. The system passively captures audio from the sensors and analyzes it for keywords or phrases. When the system detects a match it dispatches an email to a list of administrators and displays a notification on the system console.
The system is designed to be scaled according to the needs of the location of installation. Control nodes are installed at or near administrative areas with sensor nodes installed in patient rooms, inhabited spaces, common areas, etc. Communications propagate through the BatSignal mesh network allowing nodes to communicate with the controller over a distance.

1.2.1 System Overview

The system is divided into nodes. The nodes form a mesh network that relays data from the first type of nodes called sensors to the second type of node called the control node.
Python modules installed on the sensors passively read the input from a microphone. The input from the microphone is fed into python's speech recognition module. The input is then sent to the control node over the mesh network either as plain text or compressed plain text.
Python modules installed on the control node passively receives the sensor's data. It then parses through the text looking for control phrases. Upon recognizing a control phrase an email is sent to a list of administrators containing the full triggering text input.

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

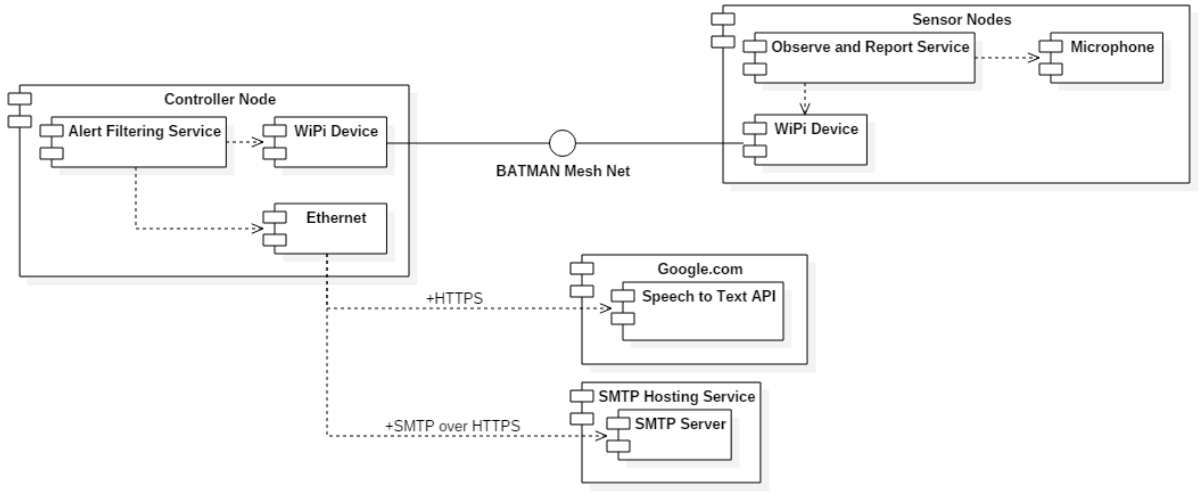
1.5.3 Industry Definitions

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