1. Introduction

A home intercom system allows individuals to communicate with each other between rooms. This system can be made more intelligent by adding cameras, microphones and functionality that allows users to specify rooms to page and know where other users are located. This system will be implemented with Raspberry Pi 3 devices as they allow for enough processing power to run the system but are also compact, which will keep the system usable and out of the way. The resulting system should be able to work out of the box and allow for full user functionality.

1.1 Purpose

This document is intended to specify requirements for the Smart Home Intercom project and related software. It will explain the functions and constraints of the finished product and provide a reference for progress on the project for the client and project assignees.

1.2 Scope

The Smart Home Intercom system uses Raspberry Pi 3 devices as nodes for a method of communicating within a home between rooms. The system should run out-of-box and require little configuration by the end user. Users can place calls to specific rooms from one node to another, selecting between audio and video communication. Each node will run the same software, so each node will be able to talk to every other, and have the option to send a call to all nodes at once.

1.3 Definitions, acronyms, and abbreviations **Add to this as we add more terms

Term	Description
Node	A single unit of the Smart Home Intercom system
User	An individual using the system
UI	User interface for each node
Client	Individual requesting the product
Project assignees	Individuals responsible for completing the requirements of the project
rPi	Raspberry Pi 3

1.4 References **Add as needed

[1] IEEE Software Engineering Standards Committee, “IEEE Std 830-1998, IEEE Recommended Practice for Software Requirements Specifications”, October 20, 1998. Source: http://www.math.uaa.alaska.edu/~afkjm/cs401/IEEE830.pdf

[2] http://www.cse.chalmers.se/~feldt/courses/reqeng/examples/srs_example_2010_group2.pdf

1.5 Overview

This document describes the intended function of the finished product and associated requirements. Section 2 describes in detail the finished product, constraints, and assumptions associated with the project. Section 3 discusses specific requirements and explains why they are necessary for the scope of this project.

2. Overall description

This section provides a high-level view of the product, its intended functions, and the type of user that it’s designed for.

2.1 Product perspective

This product will be independent in the sense that it is not a part of a larger system, although future projects may incorporate this one. The system will consist of nodes that communicate over a network. Each node will contain a Raspberry Pi, a camera, as well as I/O for audio. The system will need to incorporate streaming, network, and encryption libraries in order to function.

All sensitive data transmitted between nodes, including video and audio data, must be encrypted so that even if it is intercepted, it is unusable.

Since the rPi has a limited amount of memory, the libraries used for network and encryption will have to be considered in terms of overhead as well as functionality. The quality of video streaming will also be a consideration, and will be affected by the method of network connection used.

2.2 Product functions

A user will be able to place a call from one node to any other node in the house. The user can stream audio with the option of streaming video as well. A touch screen interface will allow the user to interact with the system and view video feed from other rooms.

The system will be able to detect when a person is in another room, and keep track of which room this is. If a call is placed from another room in the house, it will inform the user that the other person was last in this tracked room so that they can choose to place the call there. Since this feature will have to distinguish a person from other moving objects such as pets, facial or shape recognition may be necessary.

2.3 User characteristics

This system should be able to be used by most people with minimal instruction and set-up. Since the main functionality only involves placing and accepting calls with simple buttons, no technical experience should be needed to use this system.

There will be three types of user for the system, which are set by the user: admin, standard, and guest. A node set to guest mode will only be able to receive calls, and will not receive video calls unless the other node authorizes it. This mode would be useful for a device placed outside, for example as a method of communicating with someone outside the front door.

In standard mode, a user can place and receive calls, including video calls (if accepted from the other node). This mode would be intended for rooms that guests in a house would be likely to frequent, such as a kitchen or living room. This is also the mode that new nodes would default to.

Admin mode allows a user to view video feed from any room and broadcast a message to the entire house (every node). This provides additional functionality for the system to double as a monitoring device for other rooms, for example as a baby monitor. Since this mode would allow complete access to video feeds and tracked locations of other people, a pre-set PIN would be required to ensure that the user is authorized.

2.4 Constraints

The main hardware for this system should be built using a Raspberry Pi 3 for its affordability and processing power required for this project. The system should have its own mesh network separate from the public internet, and allow a new device node to be easily added into the system by most users. Upon starting the device the UI application for the Intercom system

A possible constraint might be that the mesh network might not be able to reliably stream video to a device multiple nodes away, because the more nodes the information has to hop over the more it degrades and the video becomes more stuttered and choppy at the receiving end of the video.

2.5 Assumptions and dependencies

Beginning this project, it is assumed that the provided Raspberry Pi 3s will have the Linux-based operating system Raspbian installed. Furthermore, it is assumed that there is sufficient hardware resources to run a network from the nodes themselves rather than relying on a central device to do so. More generally, it is assumed that the Raspberry Pi 3s will be able to handle the overhead of the required software libraries for this project. The application that will eventually run on this hardware relies on these assumptions, and will have to be altered if any of them are incorrect.

2.6 Apportioning of requirements (stretch goals)

Ideally, the Home Intercom System would incorporate additional features to make the product more compelling to a greater range of users. For example, the ability to display calendar appointments and weather information by connecting securely to a device with internet connection. Another future requirement could enable the system to detect pets apart from people, allowing the user to view video feeds of rooms with pets in them.

3. Specific requirements (See 5.3.1 through 5.3.8 for explanations of possible specific requirements. See also Annex A for several different ways of organizing this section of the SRS.)

**A.5 method of organization

3.1 External interface requirements

3.1.1 User interfaces
3.1.2 Hardware interfaces
3.1.3 Software interfaces

3.2 System features

1. Ability to stream video and audio between nodes
    a. Functioning mesh network
    b. Method of encrypting video and audio
    c. Hardware configured for appropriate I/O
2. Functional user interface
    a. Application that can run on Raspbian
    b. Back-end for interface
3. Ability to detect people in a room
    a. Identify a person from another moving object such as a pet (options listed)
        i. Facial recognition
        ii. Sensors (temperature, infrared)
        iii. Image analysis
    b. Store last known location of a person
4. Minimal first-time setup
    a. Startup/power-on script to initialize application properly
    b. Application auto-launches, locks in
5. Installation
    a. Wall-mountable
    b. Powered through wall socket

3.3 Performance requirements

1. Ability to broadcast video and audio between nodes with minimal delay and latency (at most 10ms).
2. Video at a minimum of 20 fps (verify against hardware.)

3.4 Design constraints

3.5 Software system attributes

3.6 Other requirements

Gantt Table (joined numbers can be done at the same time):

1st	Documentation and Research
2nd	Benchmarking rPi3
3rd/4th/5th	Implementing audio system
3rd/4th/5th	Implementing camera system
3rd/4th/5th	Implementing mesh network
6th	Implementing encryption
7th	Developing UI
8th	Compiling into application
9th	Verifying application on clean install/unit
10th	Expo/class presentation

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