Low Cost VoIP Intercom System for the Internet of Things

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Abstract. This paper describes the architecture of a wireless Voice-over-IP (VoIP) intercom system using 6LoWPAN. The 6LoWPAN standard describes a method for allowing low-power/low cost devices to participate in the Internet-of-things (IoT). By compressing the IPv6 headers, the standard achieves reasonable payload sizes and reduces power consumption as fewer bytes have to be transmitted. Performance results show the feasibility of the 6LoWPAN technology in VoIP.

Keywords: Internet of Things, 6LoWPAN, Voice over IP, Intercom

1 Extended Abstract

1.1 Motivation

Intercoms allow communication between a person and another individual or distributed group of people. This communication system is easy to use and plays therefore an important role in the context of ambient assisted living. Internet-Protocol (IP) based intercoms are very flexible. They can be placed anywhere you have an existing IP network with almost zero configuration. For instance, in the environment of a hospital or elderly home, it would be possible to build a whole IP-network of (mobile) intercoms in a plug-and-play manner, in order to connect them to a central control center or even to one or more relatives.

There already exist several IPv6 based commercial intercom systems, communicating over Ethernet or WiFi. The goal and novelty of this paper is to show the feasi-

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bility of an intercom system over a very low cost communication protocol 6LoWPAN (IPv6 over low power wireless personal area networks).

1.2 System Overview

The system architecture, as illustrated in Fig. 1, consists of four main components: the low-cost wireless front door unit (implemented on the Z1 development board from Zolertia), the 6LoWPAN gateway and Voice-over-IP (VoIP) client, the Asterisk communication server, and the indoor VoIP units. Due to the constraint resources and low bandwidth availability, the most challenging part of the system is the front door unit. We refer to the complete paper for the SW and HW implementation of this unit.

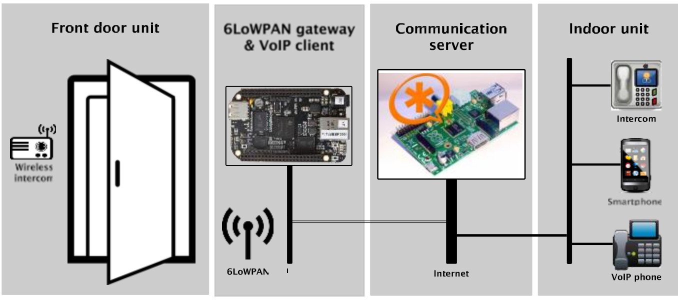

Fig. 1. Wireless intercom system overview

1.3 Performance Results

Resource management plays a crucial role in WSNs since most of the devices inside these networks have limited memory, energy and processing power. By analyzing the memory results, we can conclude that the intercom application has a small impact on the platform's memory. The largest part is consumed by the Contiki OS with the μIPv6-stack for handling the routing and IPv6 communications.

Another important aspect, considering the application, is the achieved throughput of the hardware platform. The results for the throughput measurements indicate that the platform is struggling to handle the streaming requirements. The bandwidth drops considerably at the carrier sense multiple access (csma) driver of the MAC layer, due to the channel check rate (CCR) that determines the transmit interval. For our measurements we used a CCR of 128. Changing this value could increase the throughput up to a certain point. At the application layer we only have enough bandwidth for one-way audio streaming, which forces us to shift to a half-duplex communication channel. Meaning, we have to opt for a push-to-talk solution to support two-way audio streaming. Another reason that prevents the platform from achieving a two-way audio connection is the collision detection system at the MAC layer.

In the future we will try to implement our application on a different hardware platform with more processing power and examine the impact on energy consumption as well as CPU load.

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