Wireless Metropolitan Area Network - New Generation

With this project we power the internet of things (iot) with a simplest communication solution based in cc1110 module, a low-power sub- 1 GHz system-on-chip (SOC) designed for low power wireless applications. With this project it was developed a wireless network to connect low-energy objects, such as parking sensors or electricity and water meters, which need to be continuously on or not and emitting small amounts of data.

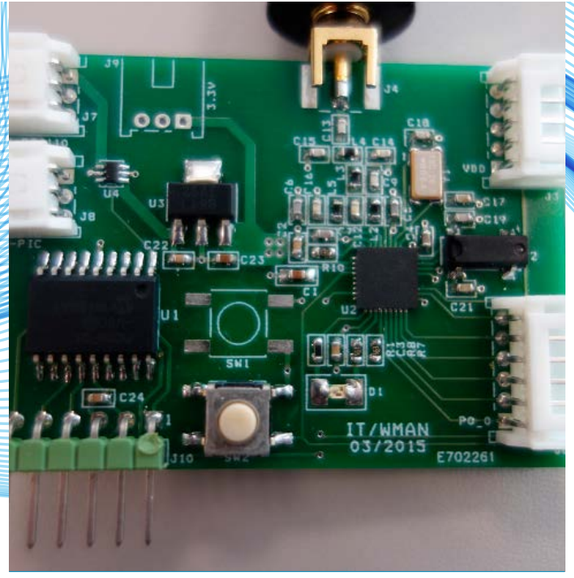

Fig. 1 Developed hardware.

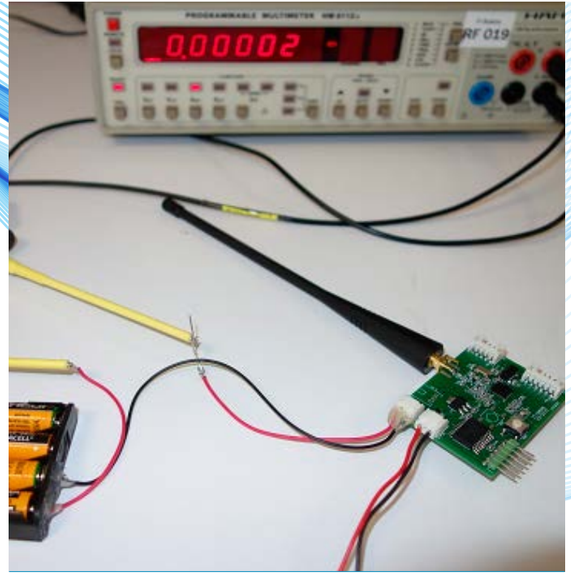

Fig. 2 Consumption current in sleep mode.

Main Project Team

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Funding Agencies

QREN	**60,777€**
Start Date	01/09/2013
Ending Date	01/06/2015

Indicators

Journal Papers	1
Conference Papers	3
Concluded MSc Theses	2

Two Main Publications

R. Gonçalves, a. D. Duarte, R. M. Magueta, N. B. C. Carvalho, P. Pinho, **rfid tags on paper substrate for bottle labelling**, procedia technology, vol. 17, No. 1, Pp. 65 - 72, November, 2014

R. Gonçalves, R. M. Magueta, N. B. C. Carvalho, P. Pinho, **rfid passive tag antenna for cork bottle stopper,** ieee ap-s/ursi international symposium, memphis, tn, united states, july, 2014

PROJECT WEBPAGE URL

https://www.it.pt/Projects/Index/2083

GENERAL MOTIVATION AND OBJECTIVES

Actually, there are some commercial solutions for the development of internet of things concept, but these solutions have some limitations, such as the price, the consumption and the need to use the manufacturers databases to support the communication infrastructure. In that sense we decided to develop a wireless metropolitan area network (wman) based in a system on chip (soc) suited for systems where very low power consumption is required. The final solution is a wman with low cost passive sensors, low power consumption and high coverage, great than 3 km. The system presents also only one base station, end devices, one access point and a range extender, that allows to extend the coverage.

CHALLENGE

The main objective of wman-ng project is to develop a cellular style system that has been set up to provide low power low data rate, and low cost communications for remote connected devices, that provides a tailor-made solution for low- throughput internet of things and m2m (machine to machine) applications. In that sense the first approach was to test or validate two commercial systems: weightless and sigfox. However, after a careful analysis, weightless would only be only available from the second half of 2014 and the investment would be very large at that time. Sigfox also have some problems, in particular it requires the use of its own database to support the telecommunication infrastructure. The main challenge on this project was therefore to design a wireless communication device, exploring an open communication protocol, or develop a simple one, in a small cost effective package that could communicate at considerable distances with minimal energy consumption.

WORK DESCRIPTION AND ACHIEVEMENTS

In order to implement such as system as proposed previously, we decided to use the cc1110 integrated circuit from texas instruments. It is a low-cost true system-on-chip (soc) device designed for low-power and low voltage wireless communication applications, making this system easy to use as well as improving performance. It integrates a microcontroller unit with a radio frequency front-end in a single chip. The main features of the radio front-end are: high sensitivity (-110 dbm at 1.2 Kbaud) and frequency range (300 - 348MHz, 391 - 464MHz and 782 - 928 MHz). We used 868 MHz. Using this soc and the okumura-hata model we obtained a simulated coverage great than 5 km and the battery life is near of 20 years. It was developed the suitable hardware and software using the simpliciti that is a simple low-power rf network protocol aimed at small RF networks. This open-source software is an excellent start for building a network with battery-operated devices using one of ti's low-power RF system-on-chips (soc). A microstrip antenna was also designed for use in the base station. The measured gain was 6,57 dBI the measured results were obtained with two different heights (6m and 30m). In order to lower the consumption a wake up radio system was introduced.