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Abstract—This document describes a prototype of domotic smart plugs. The system developed includes the smart plugs, a server and a web interface that allow the user to monitor the power consumption of each individual appliance connected and power them on and off remotely. Furthermore the system, provided that its settings are correct, keep the user from turning on enough appliances to trigger the circuit breaker. The prototype has been developed keeping in mind issues of power consumption and reliability of communication between components of the system while keeping the traffic light.

Index Terms—Domotic plugs; Reliable UDP; ADD MORE

I. Introduction

Nowadays, keeping track of the domestic energy usage is a common scenario in domotic applications that aim to monitor the real-time watt consumption of home appliances. In most cases the solution is a sensor connected to the main safety switch yielding the total energy consumption. Our approach, to get more detailed information and to have control on the use of power by the appliances, is to have an energy sensor for each plug connected to the 220V line. In the following paragraphs, we present our *proof of concept* (POC) which, functionally, consists of three main components: the smart plugs, the main server and the web interface. In our POC, we have modified the architecture described in [1] obtaining a specific low-energy consume-driven infrastructure. This consists of: the smart plugs, a central processing unit (for the main server) and a device (for the web interface). In a home scenario these devices are connected to the home wireless router. The communication between smart plugs and server occur over UDP with a simple form of reliability implemented at the application level, and tested using Wireshark [2]. The smart plugs have been prototyped using Arduino and the server has been written in Java. Let's now consider a use case example: the user sets the maximum power consumption possible in the home and then turns on two appliances. When this happens

for the first time the system decides, based on the type of appliance connected, a default value for the maximum power usage of the appliance. This value is then updated to reflect the real maximum power usage of the appliance. Now that the system is running and some appliances are turned on, the user will be able to switch on only the appliances that consume less then the available power. Our POC covers this use case and shows that such a system can be practical and useful and that the traffic generated isn't enough to sensibly worsen the performances of the typical home WLAN. To summarize, the system keeps the power usage from reaching the maximum limit set by the user by forbidding the power on of appliances that consume more then the available power. It also gives granular information about the devices consumption and allows the user to turn on or off appliances remotely (via web interface). Aside from the main use case, in the age of climate awareness, such a system could be interesting to an environmentally conscious user that can monitor the power usage of appliances but also could set the maximum power consumption to be lower then the real one in order to use less power or save money.

II. General architecture

The architecture implemented differs from the most common architectures used in this scenario in two major aspects, first most homes don't have this kind of system even in place, instead a circuit breaker triggers for safety reasons when too much power is being consumed. Second, when a similar system is used it usually relies on cloud computing or external services. In contrast our system offers the functionalities already described and both computing and data storage are done locally. This can be an advantage in terms of both privacy and security. Furthermore, this is in advantage in terms of reliability: our system doesn't need an internet connection to properly work, instead it just needs a working WLAN. However, while this aspect is significant, the development

of the prototype hasn't focused on the security aspects and some issues will be discussed in the appropriate section. The architecture of the system is such that if need be it can be easily modified to use third party services.

The general architecture has 3 main components: the smart plugs, an UDP server, the web interface.

The smart plugs have been prototyped using Arduino. The module drives a sensor, needed to gather data on the power consumption and communicates with the UDP server

After describing some architectural design aspects,

A. Smart plugs

B. Server

C. Web interface

III. SYSTEM RESULTS

REFERENCES

[1] Y. Tong and Z. Li, "Design of intelligent socket based on wifi," in *2017 4th International Conference on Information Science and Control Engineering (ICISCE)*, 2017, pp. 952–955.

[2] [Online]. Available: https://www.wireshark.org/docs/