Augmenting Object with IoT to Enhance Elders' Social Life

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Abstract. We describe an IoT system composed by a thermos flask with embedded sensors, microprocessor and network interface. The system connects to the internet after recognizing activity and sends a message over online social network-OSN (e.g. Twitter/Facebook) when hot coffee is brewed. The idea is to create a device that engage people to interact face-to-face, bringing old habits of drinking coffee as an excuse to socialize. Drinking coffee with friends is a world habit; in the south of Brazil the tradition to cultivate and drink coffee is very strong (especially in elderly people's life). The device is set to an ideal scenario and we can collect data from user's brewing coffee and therefore his daily consuming habits. The prototype is being improved before testing it with a large number of users and has providing new perspectives about the concept of "OSN based on IoT" and IoT to promote social interaction.

Keywords: Internet of Things · Online social network · Thermos flask · Social interaction

1 Introduction

The pervasive and ubiquitous technology present worldwide has been benefited by reducing small components that can be embedded in objects [1]. Many factors contribute to this increasing number of connected objects including size, price, communication protocols and computational power of electronic components, as a phenomenon observed since Moore [2]. Nowadays, this integration of electronic and smart sensors in objects has received the name of Internet of Things or IoT [3]. Applications of IoT vary from entertainment, economy, communication, security and surveillance. IoT is also applied in health fields, such as monitoring, accessibility, orientation, promotion and prevention. The idea behind IoT is not to build a single object with large computational power but to distribute this power into small and connected objects. This tendency confirms the legacy of Mark Weiser on calm technologies [4].

In relation to health, we can see an increasing number of elderly people [5]. Besides the impact of the growing number of elderly people on economy and public and private sector, the loss of cognitive functions and other chronic and age-related diseases have been pushing forward researches that pay attention to this part of population, to the

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wellbeing and quality of life [6, 7]. The terms of assistive technology, smart houses, or domotics for health are linked to *IoT for health* [8] or their variations: *IoTcare* or u-health.

We will describe an IoT system that takes advantage of the unobtrusive presence of an object in the kitchen of most families in Brazil, especially in elders' houses. The object is a thermos flask with embedded sensor, microprocessor and network interface. The system can connect to the internet after sensing hot coffee is in the thermos flask and the device sends a message over online social network – OSN (e.g. Twitter/Facebook) inviting friends to drink it at their house.

From many other possibilities, we are committed to discuss about how IoT brings people together. We know that IoT can help people in everyday activities [9], including people with disabilities [10], however less attention has been given to IoT regarding social interaction. Our basic questions are: How can we stimulate social interaction among old people who live alone? How can we augment an ordinary object transforming it into a communication tool in order to enhance social life [11]? These questions have pushed us in direction of a "Social Internet of Thing" [12], and other researchers have been challenged to create a smart architecture to integrate all sorts of objects, including those that mediate a context for social interaction [13, 14].

2 IoT and Healthcare: Wellbeing

The expectation of life has been growing over the past years worldwide. Technology, better healthy habits, sanitary condition and prevention programs contribute to a greater number of old people. In Europe and Japan, this large number of old people is addressing political investments which contributes to higher rates in life expectancy [15].

Many researchers pointed out the necessity to lead old people into a social integration and this is an important element to promote health and wellbeing [16]. Old people who live by themselves may lose the sense of community, autonomy and social participation. On the other hand, young people are the majority of OSN users and this mediated communication help them maintain connection with other friends, even if they are physically distant. Based on this, we aim to integrate a common act executed by an elder at home (making coffee) with a device that invites closer users to have coffee at their home.

An example of IoT technology in the health field is an IoT system described by Carmen Domingo related to people with disabilities [10]. The system uses sensors, actuators and monitoring stations (such as cell phones, smartphone, tablet PC, etc.), nano-nodes, RFID tags and readers/writers in order to help and guide users with visual, hearing and physical impairing.

We daily interact with many objects in different places and context. For instance, kitchens have several manually operated devices. In this way, designers and technologists are bringing affordable objects to make life easier. The integration of technology in the kitchen is a natural movement, especially in the field of domotics [17, 18] and experimental works as mentioned by Spence [19].

Some examples confirm the idea of "smart" objects in the kitchen as a way to facilitate life. There are coffee machines, refrigerators, microwave ovens connected and activated from a distance. These "magical" things remind us the objects talking and acting with us, usually seen in the imaginary and creative world of cartoons. Somehow, IoT makes inanimate objects alive. In the real kitchen environment today, we can see ideas like "*HAPIfork*", a fork that counts the time you spend during meals, how many times you take the fork into your mouth and the gap between chews [20]. Another idea is "*Liftware*", a fork designed for people with Parkinson that tries to stabilize the hands tremors [21]. *"Pred Pad*" is a weight scale that measures the food weight and shows, in real time, some nutritional data with an app [22]. Some other ideas create smart objects with online social networks, not addressing directly to health topic, but it can be useful to understand the variety of approaches. For example, "*Whirlpool Co"* is a cooker with an interactive touchscreen cooktop that displays recipes, Facebook/Twitter updates, News and weather forecast. Finally, "*Smart Fridge*" can "see" the products inside the fridge, helping the user identify when the food is expiring [23].

Based on this background and observing elderly people from a city in the south of Brazil, we prototyped a system that helps us identify when an old user brewed coffee. By taking this into consideration, it is possible to know the frequency coffee is made and infer about time spent at home and social life.

3 Description of the System

The thermos flask we are designing is going in a different direction from researches on automatic or "smart" coffee machines – which are more common in developed countries. Many of these promising "smart" coffee machines are addressing to brewing control and yet need improvements [24]. Our focus is on storing coffee rather than making coffee, once it is made the interaction may occur through internet.

Cultural aspects of consuming and sharing coffee with friends and family using a thermos flask to maintain the hot temperature of the beverage for long periods is commonly observed in Brazil. While in other countries the machine keeps the temperature, in Brazil the choice of the majority is usually a thermos flask.

We took an ordinary thermos flask and embedded it with temperature sensor, microcontroller, processor and communication module that logs in an OSN account inviting closer friends to drink coffee and make company to the old users. The system has an LM35 (small temperature sensor) that is placed on the top of a commercial device (Fig. 1) and it is connected to an Arduino Uno R3 microcontroller.

A communication module "Ethernet Shield" is responsible for connecting the system to the internet, and to request permission to post a message on the users' Twitter account. The sensor is responsible for checking when the temperature is equal (=) or higher (>) than 80°C inside the flask so then the system sends a single tweet. Thus, it is noticeable that coffee was brewed with boiled water. As a first version, a LED was installed to give a feedback when communication is made. After that, the tweet is sent, e.g.: "*Come over and have some coffee with me!*". After the message was posted, Twitter blocked further

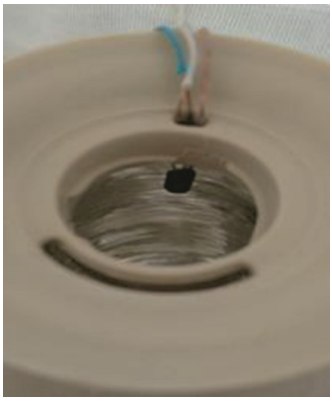

Fig. 1. LM35 sensor embedded inside the container of the flask. It was prototyped with Arduino UNO R3 and Ethernet Shield module and it was attached using a nylon body band. Photo: Authors.

tries to post again for over 12h, that happened because we were using a single message, and due to it being equal to the other previously posted and also due the short time between them, Twitter considered it as a spam.

In order to get past this problem, a "database". The system, after sending a message, skips to another one and this way Twitter won't consider it as a spam, which will allow us to tweet at any time. Generating different contents permits us to give the system a sense that the messages were posted by humans. Every random number is linked with a different message.

4 Conclusion and Further Developments

It is important to highlight that in most part of the world, when age comes, people start losing their autonomy. It becomes bad for the elderly, once that most part of them tend to live by themselves, showing difficulty in accomplishing basic daily activities. Having said that, it is possible to introduce the concept of IoTCare for supporting communication and interaction, especially for those who live alone. It consists of improving the quality of life by promoting social interaction between users who are losing social communication opportunities.

Considering it, the idea of the thermos flask came as a life changing landscape. Analyzing some life styles of elderly people it is possible to say that most of them feel alone and most part of the time, they have no one to share their experiences with. With an embedded technology, the thermos flask helps them connect with people around; making not only some shorts connections with people, but inviting them to personally come to their place. It is important to remember that interaction is not the only role of the object (which is making coffee), but tracking some routines as well. This tracking can be useful to the family, for example, where they can see if their beloved relatives are keeping with their daily activities.

Further test in a bigger group of users will point to other directions; improvements in the system are needed in order to resist impact or water. It is also on the list the necessity to test and validate the architecture of the system with many thermos flasks working simultaneously.

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