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Control System for Manipulation of Services in Ubiquitous Environment

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Abstract: *The ubiquitous computing are to guide a the creation of intelligent space, where of users already not interaction with a only the computation system but on with different computer system at a time and not necessarily a user is aware of this interaction. Recent research describes computer systems where the user accesses the services of a ubiquitous environment through mobile devices. The problem with these systems is the lack of full control over physical objects (e.g. doors, windows, heating systems, etc). In this paper, we propose the incorporation of a control system that allows manipulation of physical objects in ubiquitous environments by developing a communication protocol based on the standard USB 2.0*

Keywords: *communication protocol, control system, ubiquitous environment.*

I. INTRODUCTION

Since the last years, a computer revolution is changing the way of acting in society. It is going to the era in which a user controlling a PC, to the era where the user uses the same time several electronics platforms to access the information when you require it. This notion of Mark Weiser viewable in the year 1988 in his article "The Computer for the 21st Century" in which he noted "the most profound technologies are those that disappear ... weave themselves into everyday life until they become indistinguishable" [8]. This approach gave rise to what is now know as ubiquitous computing.

The notion of ubiquitous computing wager a to create intelligence environments where the technology are invisible of user, does present only where are need and easily a most interaction natural and easy. This conception proposes develop computer system that together with the use of mobile devices to communicate via wireless networks, same as in recent years has increased in popularity [4].

For achieve this invisibility, systems should be as free possible to the administration of human beings. In this way is especially difficult develop systems where mobile devices involving dynamically connect and disconnect from a network, if they require explicit configuration to work together and the management overhead outweighs any possible benefit.

Service discovery has been a major achievement in the area of ubiquitous computing by allowing the user through their mobile device to quickly find the services of an environment.

Once the user finds such services initiates an interaction with these. This interaction is based on the handling of service independently of the user location in the environment. Services will not necessarily be computer services, physical services may also exist. (E.g. control to open and close windows, doors, on or off lighting, ventilation, etc).

So, this way controlling a physical service involves knowing their status (e.g. on or off on a ventilator) and the transition can be made from one state to another. Include manipulation of physical services in a ubiquitous environment means developing a component that is responsible for managing the physical service and their status. In this way, include a control system in a ubiquitous environment will be able to bring the system from an initial state to a final state in a finite time [3].

To include a control system to a ubiquitous system should be a protocol that allows this communication.

Therefore, the development of this paper is to include control system architecture of a ubiquitous environment and the protocol to achieve the manipulation of a physical service.

II. HEADINGS

The distribution of this article is divided into 4 sections, section III describes the related **work** on service discovery systems, section IV presents the **proposed** control system and communication protocol, and section V presents **conclusions and future work** arising from this research.

III. RELATED WORK

Currently, the technological headway allow develop systems be geared to paradigm of ubiquitous computing. The building of ubiquitous environment provide of ways and means for that the users discover the services of an environment. The discovery is the process in which a network entity (client) is reported spontaneously from the availability of services or devices available on a network (resource), i.e., is a mechanism to dynamically refer to a network

resource for the customer to contact the resource [4].

A key part of a ubiquitous environment are the different areas, which are autonomous and independent, i.e., manage their own resources and services to exchange information with other areas [11]. Users who interact in these areas are considered nomadic user, because they acquire specific functions of the current environmental context.

Within a ubiquitous environment is required that the user can access and manipulate nomadic services offered by each area using mobile devices in this context mobile users have a wide range of mobile devices which is considered as heterogeneous devices [13].

Thus, market-leading companies in information technology have developed technologies for service discovery, as in the case of SSDP (Simple Service Discovery Protocol) [5] used by Microsoft, Intel, Sony and Samsung which supports a simple form of search in which customers specify the resource. Jini Network Technology [7] developed by Sun Microsystem's is a network technology to create a service infrastructure to adapt to change. Also, Bluetooth Special Interest Group (Bluetooth SDP) [15] is a protocol that defines the characteristics of services available for learning that are given to a device. These technologies allow service discovery. Therefore, creating service discovery systems involves using some components of these technologies.

B. SEDINU SYSTEM

Similarly, parallel research centers working in the construction of service discovery systems, such is the case SEDINU system (Service Discovery for Nomadic Users) [10]. A service discovery system where the user through their mobile device acquires information of hardware and software services provided by the areas of environment.

The feature that distinguishes this system is that it is intended to be a framework for building ubiquitous environments.

This system consists of three sites; Site A, Site B and Site C. See Figure 1.

The Site A, houses the module Application Tiny SEDINU responsible for showing the user the services available from the current autonomous area through their mobile device, the Site B, which contains the module Location Detector responsible for sending the current user coordinate system RBACSoft (Software - Role Based Access Control), who determines the current autonomous area where the user is located. And finally, the Site C consists of two modules, the module Service Manager and module Ad hoc Creator including system RBACSoft [10]. Thus, when the user accesses the environment, the system SEDINU provides user services through their mobile device. Thus, the host service interacts directly with the system to acquire information RBACSoft a database containing information on available services.

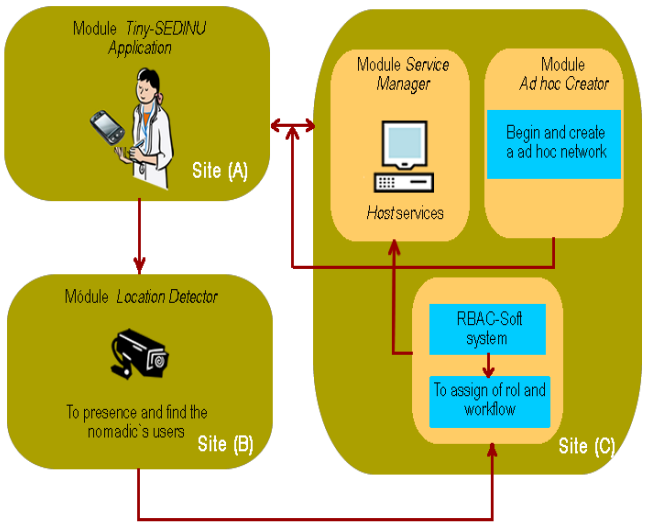

Figure. 1: Architecture of distribution SEDINU system

RBACSoft system has an important role within this system, besides providing information to the mobile device of services available includes a database for each of the autonomous areas of a ubiquitous environment. Therefore, our proposal is to add a control system and communication protocol to achieve this system for the manipulation of physical services in a ubiquitous environment.

IV. PROPOSAL

The development of our proposal consists of a new architecture in the development of ubiquitous environments by modifying the structure of the database RBACSoft component of SEDINU system and includes a control system to achieve the goal of manipulating a physical service.

This inclusion is to modify the structure of the database RBACSoft and add the following Add the entity Sistema_Control with the attributes idF_idAreaN1, idF_idobjetos, idF_idsistcontrol. Thus, it will log tuples a control system in the database corresponding to the autonomous area. Similarly, establishing the relationship cardinality of the entity AreaN1 with the entity Sistema_Control making it possible to lace a control system with each of the autonomous areas of a ubiquitous environment.

Similarly, to modify the entity RecursosA_N1 adding the attribute idsistcontrol join with attribute estado, ensure which these attributes: a control system can manipulate one or more physical elements in one or more autonomous areas and that a physical element can only be controlled by a control system.

Finally, add the entity Estados with attributes id_estado, nom_estado and idF_objetos. This with to store information of the states that each object can to have.

Thus adding control system architecture of an environment ubiquitous gives rise to a new structure of the database. See Figure 2. With this structured is possible to include a control system environment ubiquitous.

It should bear in mind that the building of a control system together the interaction of various components. (e.g. sensors, actuators, plants, etc). The interaction of these components will in order to bring the system form an initial state until a finite state, in a finite time [3].

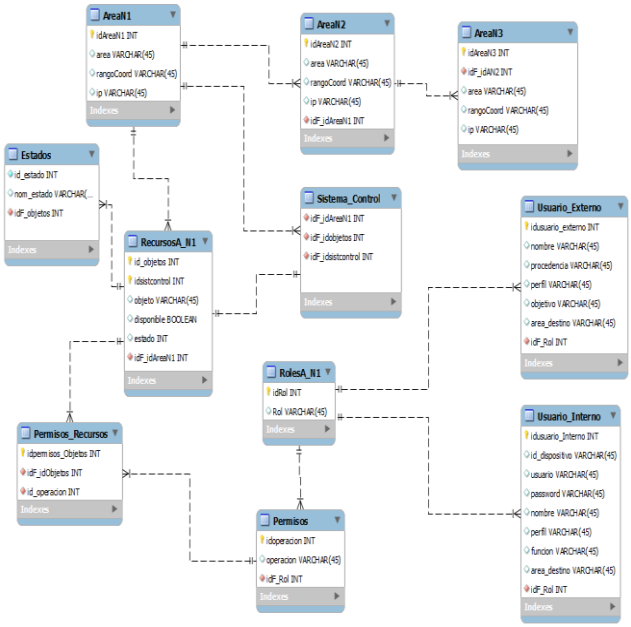

Figure. 2: Structure of database

A adding a control system is necessary to establish the communication between the services host, and a system control. We implement this communication with the standard USB 2.0 [2].

The communication using standard USB 2.0 is a viable option for establish this communication. The use of this standard is a accesible solution when you need to communicate to a computer with and external device (e.g. mouse, keyboard, printer, digital camera, store devices as hard disk). The using of this interface also allows control systems that handle specific functions (e.g. communication with a microcontroller).

Other feature with has this standard is the speed of transmission of the information, being of 480 Mbps, a considerable speed for manipulating a physical service in seconds. In addition to the USB 2.0 ports has automatic detection and configuration plug and play, being this possible without installing additional software or restart the computer to recognize USB [2].

The standard USB 2.0 deliver of advantages of send and received information a through of endpoints, when a device USB is connected at system, the system will recognize and configure it, the device is organized as a set of endpoints. Then the system sets all communication routes through pipes necessary between the host and each endpoint available in the configuration [6].

The use of endpoints ensures that the data sent from the control system to the host guarantees data delivery to the addressee and the package will be free of errors. Taking place that during the execution of protocolo rules the resulting information will be consistency in both components.

For to establish communication between the host services and control system there is a need to build a communication protocolo between two components, being essential to know the time when the user indicates manipulate a physical service and the time when has finished execution this action

The need of establish protocols for communication is fundamental for communication between machines and network devices, because the machines, though intelligent, are not human being that can run a task with a single instruction to tell the machine . Therefore, the need to build fast rules and protocols with strict procedures for deal with

any eventuality [12].

Thus, a control system consequence of great importance in the design of a ubiquitous environment. The following Figure 3 shows the inclusion of a control system in RBACSoft system. The Figure 3 describes the following process: User from your device **mobile** first authenticates with the **server** of current autonomous area, then, the **server** depending on the function and purpose of the nomadic user determines the task to be performed in the area. Subsequently, this information is stored in the **database**, after establishing the connection to the database, and establishing connection with the **control system** vía USB 2.0 standard and it is therefore possible to manipulate the **physical element** that is controlled by control system.

Once to include this component in the architecture of RBACsoft, the flow begin in the host services requesting the registration database of physical object, once acquire this information, then, host sends the data to the control system asking to change the object state.

For protocol, the host acquires information of registration from database, once that acquire sends a notification a control system for manipulate the element. The control system executes the action verifying its availability. Then, it returns a notification to the host and it will request an updated record in the database. If not run the action is notified to the host and does not update the record. Figure 4 presents the outline of this communication protocol.

One of the considerations of implementation of this communication protocol is to hold together the integrity of the database with current state of the object. This ensures that changes made to the database do not cause loss of consistency [14]. And, therefore, hold together in the control system with the database.

The design of this new architecture in the RBACsoft system consist to achieve the manipulation of physical service in a environment ubiquitous will allow on the user to have full control of physical elements from environment.

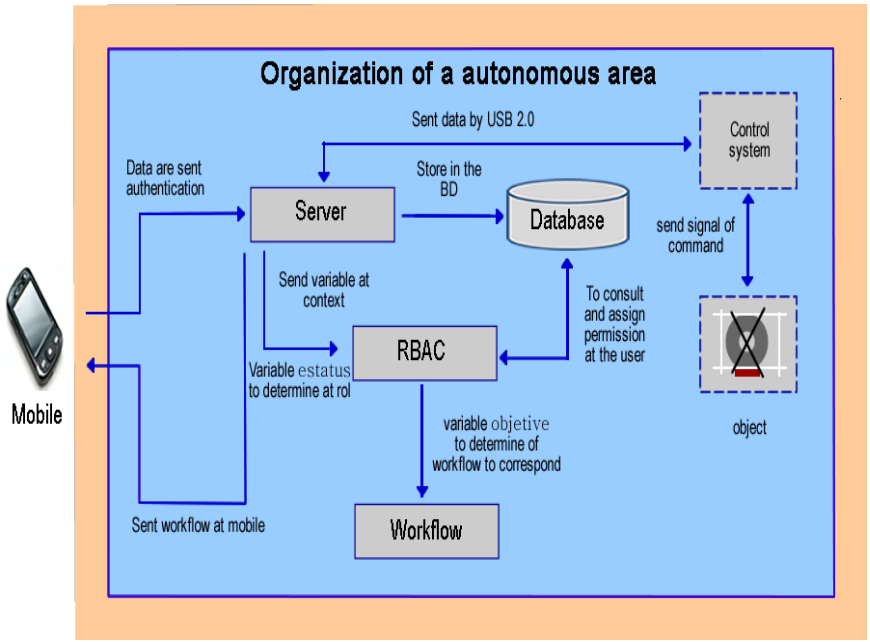

Figure. 4: Communication protocol.

V. CONCLUSION AND FUTURE WORK

We present the inclusion of a control system specifically RBACSoft system, since the information it provides is information acquired by SEDINU to display information to the user through their mobile devices. In the develop of this protocol lack the recognition of different physical devices in the control system, the test was implement with a physical device and working successfully. Other of the way research is develop a access concurrent of various mobile devices accessing on a same control system. Therefore, migrate our USB 2.0 protocol at USB 3.0, as a feature from USB 3.0 is the increment the speed of the information a changing of the 480 Mbps at 4,8Gbps. Finally, to make standard our protocol a fundamental component in the develop of ubiquitous environment of specifically manipulation of physical services

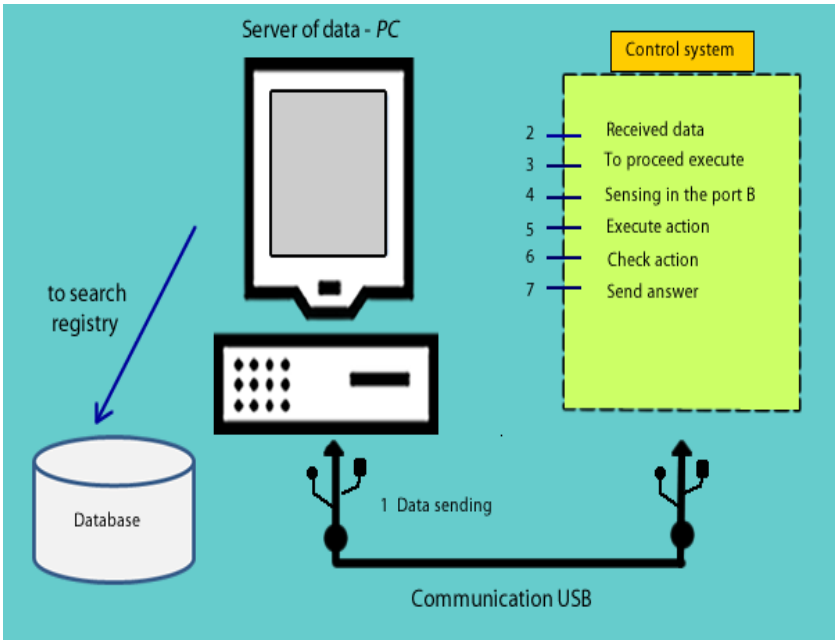

Figure. 3: Control system in RBACsoft system

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