IT'S ENERGY CONSUMPTION SURVEILLANCE TECHNOLOGY (IoT)

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Abstract: With the development of the Internet network, the applications using this global network also developed. Thus, IoT (Internet of Things) technology is developed which means the network linking together the elements of computing and the sensors forming various systems such as smart grids, smart homes, smart transportation, smart cities, etc. Experts estimate that by 2020 there will be over 50 billion objects connected. This paper presents an embodiment of a system of supervision and control of the energy consumption of a home. The main benefits of such a system are many and they include energy saving, local or remote monitoring and controlling, security and protection, obtaining statistical information to optimize the functioning of things, etc.

The main issues discussed in the paper include the acquisition of information and its distance transmission via Internet, the command and distributed control in a particular area (e.g. housing), the modality of human-computer interaction and human-entity, the prevention and elimination of the errors and the increase of the operational safety.

The paper presents the ways to acquire the information from the supervised environment, the nature of information and the centralization of data for transmission over the Internet. At the same time, the possibilities of the distributed control in the chosen area are analyzed. It then describes how it is possible to make the Internet connection and the data transmission. Ways for the user interaction with the system through a command language or through a graphic system are also discussed.

Ensuring the safe operation of such a system is a main component that allows the desired results. The paper presents the methods and techniques used to ensure a high degree of system safety and an adequate supervision of the perimeter.

The analysis of the built system that uses such a technology brings many benefits that will surely involve the extension and improvement of the methods and the techniques used.

Keywords: surveillance control, monitoring, internet, data collection, data communication, human-computer interaction, safety oversight.

1. INTRODUCTION

The system developed is an original solution for monitoring the energy elements present in a particular space. Thus, the electricity consumption of the different consumers, the amount of light in different places in the space, the temperature, etc. can be monitored. These parameters are sent over the Internet and can be accessed remotely by those concerned. The system also allows sending the commands remotely to the various actuators present in the monitored space [1]. Besides monitoring that environment, users can also configure and send commands to the monitoring system.

Apart from ensuring the circulation of information through the Internet, the system should ensure its security from unauthorized access. This is why it uses a coded control language and the authentication techniques.

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The developed system has several components under the monitored area (Figure 1). The central element is represented by a computer system that allows one or more Internet connections via cable and / or radio (wireless). This computer system shall be provided with a number of numerical and analogical inputs / outputs for connecting the sensors and the actuators. Because these elements can be distributed in space at big distances, wireless connections can be used for their connection so that the number of cables used to be as low as possible.

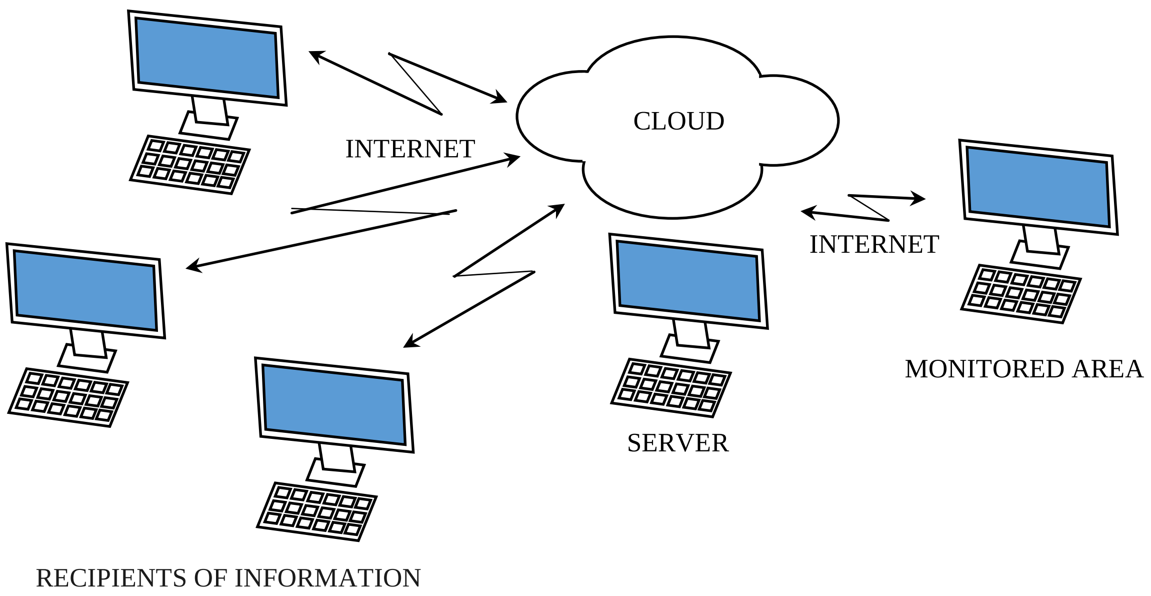

Fig.1. Surveillance system.

As shown in Figure 1, the monitoring computer system is connected to Internet through a connection to a server or to the cloud. Each connection type has specific characteristics.

The connection to a dedicated server appears as the main disadvantage because it represents a bottleneck and a server outage leads to the loss of connection to all beneficiaries. This disadvantage can be avoided if multiple servers are simultaneously connected. In this case, there must be a communication connection between servers so as to synchronize the information between them [2]. The advantage of using a server is the fact that this server can perform some useful tasks for the monitoring system (databases, processing of information, advanced ways of presenting information, etc.).

The cloud connection presents the advantage of easy access to the information. In this situation, a private cloud can be used in order to increase the data security if this is required.

2. THE SYSTEM USED IN THE MONITORED AREA

The area was monitored using a computer system of Raspberry Pi type. This system has the advantage of allowing the use of a number of digital inputs / outputs, USB and Ethernet connections and running a variant of the Linux operating system that allows the execution of programs written in Python language.

An Arduino UNO system is used in order to multiply the number of inputs / outputs and to use the analog inputs. This system connects with the Raspberry Pi via the USB interface. These two coupled systems are used for the correct operation and supervision of the system reset, the watchdog timer, similar to those in [3]. The Arduino UNO runs a program written in C ++ that monitors the sensors, the display of the local information and allows the introduction and implementation of the local controls.

The block diagram of the system used in the monitored area is shown in Figure 2. Because the supervised area is large, the connection of the sensors and actuators can be made directly to the inputs or through a wireless system.

We used two types of solutions: for connecting the sensors, the Texas Instruments CC110EM module was used and to connect wirelessly of the relay type actuators, the HX2262 module was used.

In this case, the actuators are designed to turn on or off devices such as light sources, heat sources, and computers, etc. For more complex actuators the CC110EM module can be used, which allows a complex connection of the commanded device [4] [5].

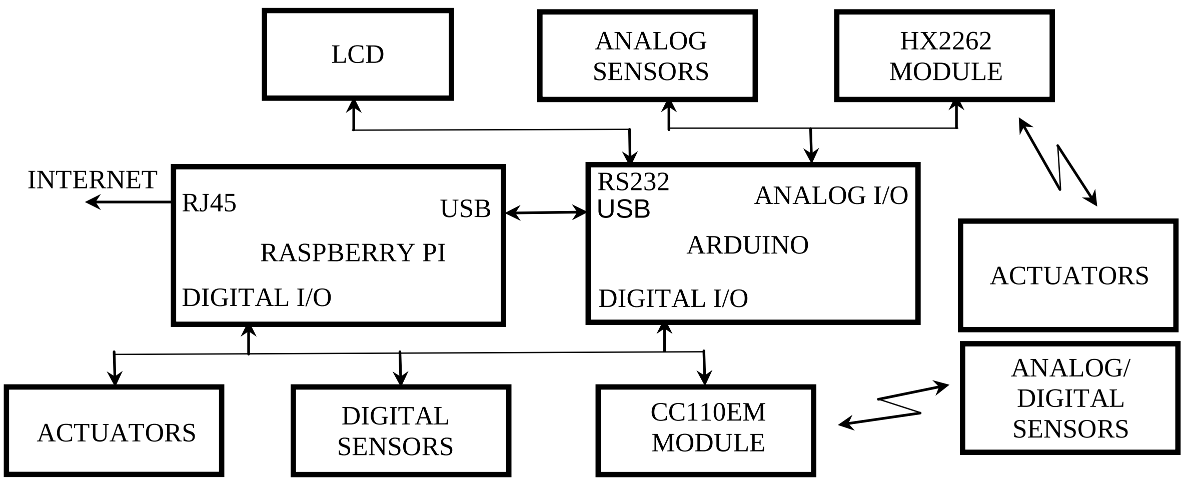

Fig.2. The computer system for the monitored area.

The Raspberry Pi computing system runs a program written in Python. The scheduled activities are: reading information from the cloud / server, sending information to the cloud / server, the surveillance of the system in order to smooth functioning, encoding / decoding information. It also checks on the correctness and security of the data.

The information read by the computer system are the system commands, the commands for the actuators or the system configuration words. This information is encoded in Hamming code and processed at the reception. Through the information conveyed, changes to the system configuration can be made (read sensors, actuation devices, ordered etc.) or the behavior of the system can be changed [6] [7]. The information sent by system computer of the monitored zone to the Internet represents the sensor data, images, text etc. This information is stored and processed on the Internet.

3. THE INFORMATION MONITORING SERVER

The flow of information sent by the hardware system of the monitored area is stored in databases on the one or more servers or in the cloud. This solution relieves the local system of the data retention and simultaneously enables complex processing of such data. Statistics with the history of the data are made and the display of the data in different formats for different users is used [8].

Also here, a first check of safety information is done. The safety of the information is provided from two points of view: from the point of view of unauthorized access and in terms of the accuracy of the information. Checking the access is done via mechanisms to verify the authenticity of the text and / or image. Checking the authenticity and the accuracy of the data is done through encryption and / or coding [9] [10].

The Internet information can be retrieved locally by the user and then processed further. In the application shown here for the takeover information, a special option was not provided, but any computer / tablet / regular phone with an Internet connection and a network browser can be used [11].

Using cloud technology brings numerous advantages of the proposed solution. But it is important to allow the installation of apps in the cloud so that the client devices do not require a special software procurement. Because the application requires certain security features to protect the integrity of the information and of the system then it is the possible to use certain applications on client devices.

4. CONCLUSIONS

The monitoring system presented in this paper has the advantage of access to information and the control of a remote system from any point in space. Because it is possible to remotely command the system and because it can make changes on the operation and configuration, special attention is given to security [12] [13].

The system is particularly useful for surveillance and remotely changing the environment. The experimental results have shown that the functioning of the system proved to be very reliable because of the multiple paths available to the user for operating in the system.

The main drawback of such a system is the response delay in the transmission of information. Such a system does not lend itself to situations that require a rapid response. Because of this, the system must be fitted with local tools for emergency response.

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