Web-CAN Interface for Access Control and Monitoring

F. Ribeiro, J. C. Metrôlho, E. R. Lopes

Departamento de Engenharia Informática, Escola Superior de Tecnología de Castelo Branco
fribeiro@est.ipcb.pt, metrolho@est.ipcb.pt, eurico@est.ipcb.pt

***Abstract*— This paper describes a web-based system which allows the user to manage and to do real time monitoring the access to the educational building spaces, using two data nets. The first one is based on the CAN bus for data acquisition and actuation tasks to which are connected control devices like, magnetic cards readers, door locks and sensors. The second one is an Internet/Intranet infrastructure and uses standard web technologies like PHP and Java to provide an effective control and real time monitoring. This system is implemented on the Linux operating system using the Apache HTTP server and make use of standard technologies in use on the Web, to make an effective campus-wide security system. To close the gap between these two nets we used a CAN/Intranet gateway. In this paper the system layout and its main components are described.**

***Index Terms*— Access Control, Security, Field buses.**

I. Introduction

THE fundamental objective of any access control system is to protect system resources against inappropriate or undesired user access [1]. Another function is the management of accessing times and/or users.

Due to the World Wide Web (WWW) technology success this has been widely used to synthesize several applications with great effect in web environments. Also the evolution of the DataBase Management System (DBMS) allowed them to become a central component of programming environments.

In this article we propose an approach to access control systems, which will bring about a successful marriage of the web and roles of individual users [2]. We propose an architecture to achieve an effective campus-wide security system. To reach our goals we propose the assembly of several different technologies. In our proposal we have two different kinds of data nets. The first one is based on the *Controller Area Network* (CAN) bus for data acquisition and actuation tasks. The technology for remotely accessing CAN devices presented in this paper can easily be used, or adapted, for other solution of remote data acquisition [3]. The second one is the Internet/Intranet and uses standard web technologies like Professional Home Page (PHP) and Java providing an effective control and real time monitoring. To store all the system's information we use a MySQL database.

As accessing means for our security system, a magnetic card is used. This device allows user authentication (verifying their identity) and determining whether the user is permitted to accede to the desired location (classroom or labs). To provide reliability of the monitoring and control system, the access control technique must be directly integrated with the systems services, and must be able to support a wide variety of security system requirements.

The rest of this paper is subdivided into three parts: Section II presents the main goals to achieve this work; Section III describes the proposed architecture, with the main components and used technologies; The succeeding section describes some functions, and finally the last section we conclude with future work.

II. Goals to Achieve

Based on a cost /security relation we choose to use magnetic cards. The magnetic card is a portable device that all users, students and staff, carry and is also an identity card. This card has an acceptable level of security to be used in the generality of the installations.

The system's main requirements are:

1) to be modular and allow its adaptation to different installations;
2) to be flexible enough to allow integration of different types of access control equipment, namely, when the installations need higher standards of security;
3) to allow its management to be made through the Internet;
4) to allow customized search of access by schedules, users and spaces;
5) to guarantee the information security between access places and the central system.

III. System Architecture Overview

The system's main components are: one CAN/Intranet Gateway; a WWW server; a database server and CAN interface cards. This system's architecture is sufficiently flexible to allow its expansion.

Figure 1 shows the proposed architecture to achieve the proposed goals.

A. *Web server*

This system is implemented on the Linux operating system using the Apache HTTP server. It will manage the Internet/Ethernet interface for the system. It uses PHP and Java technologies to generate dynamic HTML pages according to the database information.

Using dynamic HTML pages, a user can manage the system information.

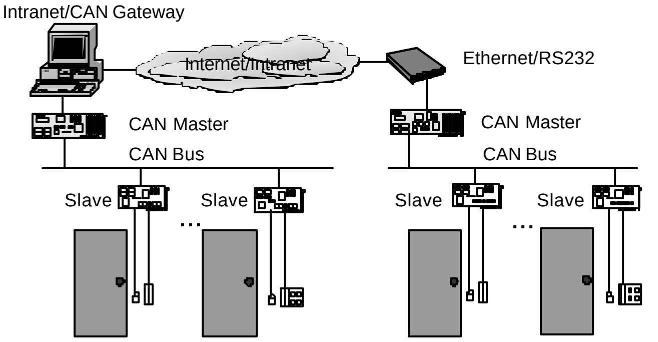


Fig. 1. Hardware architecture.

B. *CAN field bus*

The acquisition/actuation stage of the proposed access control monitoring system is being implemented using previous knowledge in the field bus area, based on a development board that has as main component a P80C592 8-bit microcontroller[4],[5].

The assembly of the access control stations (CAN boards) forms a hierarchical structure in a bus topology. In this bus a PC acts as a CAN/Intranet gateway and is connected to several slaves that will be located in the accessing points of the monitoring space/building. These slave terminals are CAN nodes, making possible the reading of data using fixed position card readers through an RS-232 link.

The location of the monitoring stations, within the building, allows the use of a wired solution. So, as means of communication we have elected a wired implementation using the CAN protocol, which has great flexibility and robustness needed in real-time control and noisy environments like this, with several electronic and mechanical equipments/labs, and because it allow significant baud rates (<1 Mbytes). Only standard (identifier with 11 bits) CAN frames are used because the used microcontroller meets the CAN protocol specification version 2.0 A and B (passive) of the CAN 2.0 specification [6]. This part of the system, allows expansion and configuration without compromising its performance. A number of up to 64 stations is allowed per CAN bus but this number can be higher [7].

Another reason is the message priority property when the CAN protocol is used. Since several different accessing priorities may occur, we design and implement a proprietary protocol to fulfill those requirements. For example, a message when a fire alarm or intrusion detection occurs a high priority message is sent to open or close all the doors respectively.

One of the main sources of data for this application is card ID information that every authorized person must have to walk in the monitoring zone. This information is collected using card readers with RS-232 output.

For the proposed solution, after the data gathering in the Slave boards, that have 32 Kb of data memory (RAM) to store samples, this data is sent to a database in the CAN/Intranet gateway PC dedicated to storing data related to the accessing points/doors. To allow this, each one of the CAN/Intranet gateway stations must have a transference data service that reads the received information, sent by the Slave nodes, and stores that in a database. After that, users that are approved by the domain would be able to access of all the information using a Web browser. In figure 1 is showed the layout for the acquisition/actuation stage of the proposed system.

C. *CAN/Intranet Gateway*

This system component is responsible for control of all the communications between CAN bus and Intranet/Internet. Receives information from CAN field bus, about existing accesses, and stores it in the database. It is also responsible for receiving information from de Intranet/Internet and sending it to the CAN bus in order to allow access to each one of the spaces. It's implemented in C++ language.

D. *System's database*

It's currently implemented using MySQL DataBase Management System (DBMS). All system information is stored in this database. Contain all information about access roles, users, as well a description of accesses to each one of the spaces and access history.

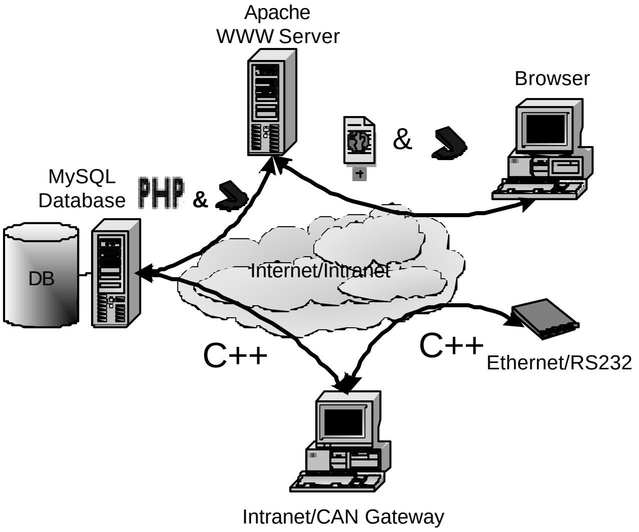


Fig. 2. Software technologies.

IV. Some Functionalities

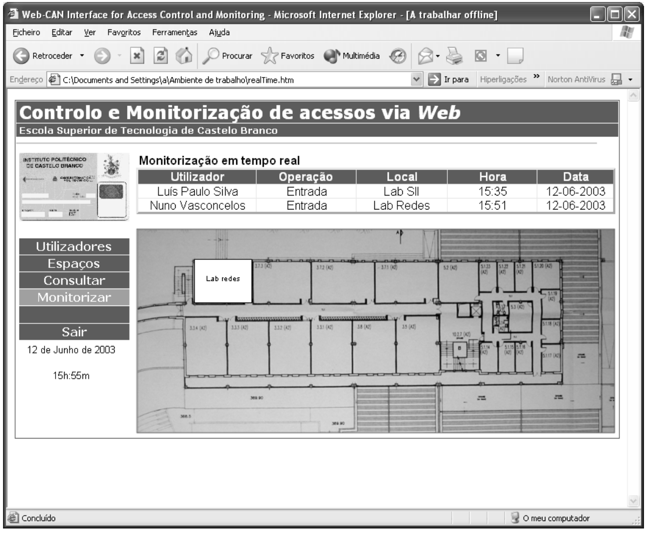
Using a browser a user can manage all the system's information. For access to the system's information a password is required. The system accepts two diferent levels of users: administrators that have total access for all system's information and guest that have some access constraints.

All the necessary information for the system to function well is stored in a database. This allows the user's and space information to be configure through the Internet. Operations like eliminate users or insert news users and its permissions to accede to each space are easily realizable using a browser. The search for customized information about accesses is also possible.

Another interesting feature is the access monitoring in real time, which allows each time someone tries to access a space, information about that to be automatically modified in the browser, thus allowing the monitoring of several access or attempts of access. This functionality is implemented in Java.

Some uncommon situations are also considered. For example the system allows locking, or unlocking, all doors from a remote place by an authorized user.

Although the system is still in a test phase it is already possible to present some results and to visualize some of its functionalities. Figure 3 shows the application that allows us the accesses monitoring in real time of each one of the spaces. It is possible to observe which had been the last accesses and, in real time, to get information on the accesses that are about to elapse.


Web-CAN Interface for Access Control and Monitoring - Microsoft Internet Explorer - [A trabalhar offline]
Ficheiro Editar Ver Favoritos Ferramentas Ajuda
Retroceder
Procurar
Favoritos
Multimédia
Endereço C:\Documents and Settings\a\Ambiente de trabalho\realTime.htm
Ir para
Hiperligações
Norton AntiVirus
Utilizadores
Espaços
Consultar
Monitorizar
Sair
Lab redes
Concluído
O meu computador

Controlo e Monitorização de acessos via *Web*

Escola Superior de Tecnologia de Castelo Branco

Monitorização em tempo real

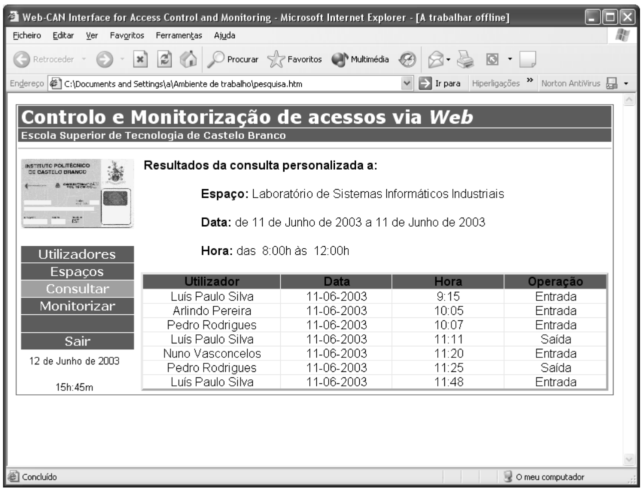
Utilizador	Operação	Local	Hora	Data
Luís Paulo Silva	Entrada	Lab SII	15:35	12-06-2003
Nuno Vasconcelos	Entrada	Lab Redes	15:51	12-06-2003

12 de Junho de 2003

15h:55m

Fig. 3. Real time access monitoring

The customized search of information of accesses and users is also possible. Figure 4 shows the result of a search personalized for space, date and time.


Web-CAN Interface for Access Control and Monitoring - Microsoft Internet Explorer - [A trabalhar offline]
Ficheiro Editar Ver Favoritos Ferramentas Ajuda
Retroceder
Procurar
Favoritos
Multimédia
Endereço C:\Documents and Settings\a\Ambiente de trabalho\pesquisa.htm
Ir para
Hiperligações
Norton AntiVirus
Utilizadores
Espaços
Consultar
Monitorizar
Sair
Concluído
O meu computador

Controlo e Monitorização de acessos via *Web*

Escola Superior de Tecnologia de Castelo Branco

Resultados da consulta personalizada a:

Espaço: Laboratório de Sistemas Informáticos Industriais

Data: de 11 de Junho de 2003 a 11 de Junho de 2003

Hora: das 8:00h às 12:00h

Utilizador	Data	Hora	Operação
Luís Paulo Silva	11-06-2003	9:15	Entrada
Arlindo Pereira	11-06-2003	10:05	Entrada
Pedro Rodrigues	11-06-2003	10:07	Entrada
Luís Paulo Silva	11-06-2003	11:11	Saída
Nuno Vasconcelos	11-06-2003	11:20	Entrada
Pedro Rodrigues	11-06-2003	11:25	Saída
Luís Paulo Silva	11-06-2003	11:48	Entrada

12 de Junho de 2003

15h:45m

Fig. 4. Search for customized information

V. Conclusion

The main goal of this work is to apply new technologies in an application area with utility in the real world and that could be easily adapted to other application areas (domotic, industry etc.). This work is in a development phase. However, some modules are already successfully developed and tested. The solution was designed to be expandable, by using a bus with great acceptance in the market which allows us to obtain resources/equipments easy. Another feature is the priority of accesses that could be defined by the user without limitations. In a world each time more web dependent this application allows remote configuration and monitoring of everything that is related with the protected spaces. All the information is stored in database to allow statistical analyses.

We believe that our contribution is an important step towards offering strong and efficient security management for access control systems.

References

[1] David F. Ferraiolo, Ravi Sandhu, Serban Gavrila, D. Richard Kuhn, Ramaswamy Chandramouli, "Proposed NIST standard for role-based access control," *ACM Trans. on Information and System Security*, vol. 4, 2001.

[2] Joon S. Park, Ravi Sandhu, Gail-Joon Ahn, "Role-based access control on the web," *ACM Trans. on Information and System Security*, vol. 4, pp 37-71, 2001.

[3] T. Ferreira, A. Coroado, A. Pereira, J. C. Metrôlho, E. R. Lopes, "Design and Implementation of a Data Pick Up System in Apparel Industry," in *Proc. 17th Int. Conf. on CAD/CAM, Robotics and Factories of the Future*, Durban, 2001, pp.1178-1182.

[4] *P8xC592 8-bit Microcontroller with on-chip CAN Data Sheet*, Philips Semiconductors, 1996.

[5] J. Metrôlho, C. Serôdio, Carlos A. Couto, "CAN based Actuation System for Greenhouse Control," in *Proc. of IEEE-Int. Symposium on Industrial Electronics*, Bled, 1999, pp. 945-950.

[6] *CAN specification-Version 2.0*, Philips Semiconductors, Hamburg, 1991.

[7] *CAN controller interface-PCA82C250*, Philips Semiconductors objective specification, 1994.