Computerized Access System for Entry into Enterprises

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Abstract - This paper develops two distinct systems in terms of their use: the classic centralized access control in a building (or building complex) based on a card and the proposed system of development for applications based on PIC 16F628 microcontroller. These systems are studied in terms of advantages and disadvantages involved in using them. In the second part of the paper shows how to implement video-tracking device used to access an enterprises.

Key-Words: System implementation, Microcontroler `PIC 16F628`, Programator `IC-Prog`.

1 Introduction

Obtaining permission for access is made using a personal card and a personal code associated to the card, which are read on every entry [3], [5]. Monitoring is done from a central computer that is connected to all inputs (Fig. 1). Classical system is composed of a set of access controls available at each entry and a program running on the central computer and allows database management and communication with the access controller [4], [7].
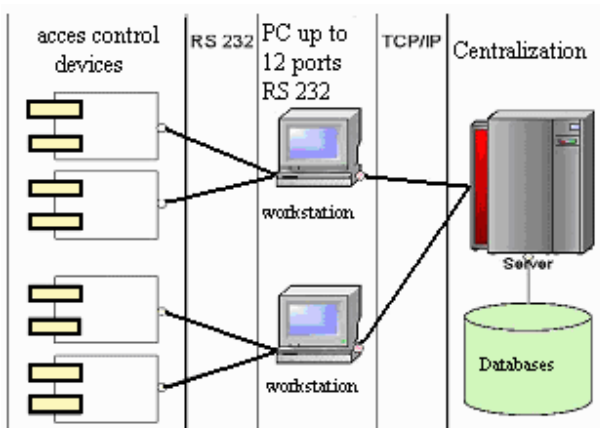

Fig. 1: Explanation of implementing a system of centralized control of access.

Using the selection of input buffers,   the microcontroller (proposed system)on every 24 ms reads their input values (the card respectively any pressed key). After reading 3 consecutive times the same values it is considered "qualified". After a "qualification" of a card, expect the introduction of 4 keys. Then all 5 values (5 bytes) are sent to the

personal computer PC through RS232 interface [5]. If through the same RS232 interface device receives data, it will command the relay outbreak which would lead to the opening of the door near which it is mounted.
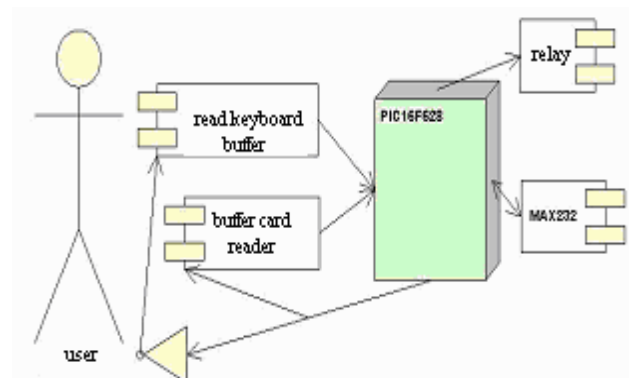

Fig. 2: Explanation of the access control device operation.

2 Hardware Implementation

The development system is designed to build the monitoring system and includes access of [8]: the assembler to generate executable files supported by PIC 16F628 microcontroller programmer and IC-Prog to program the PIC 16F628 microcontroller, but also an integrated environment, developed as a DOS application, based on menus, which provide an interface for simple and effective use of these two tools (Fig. 3). The input controllers are made up of a card reader, keyboard and have the possibility to action the mechanism which can lock / unlock the door (Fig. 4).
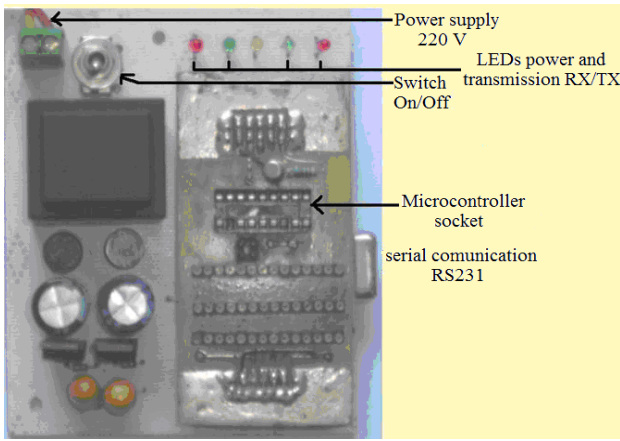
Fig. 3: Overview of device access control.

The keyboard is made up of the 12 buttons with two sets of contacts, each so that when you press a button, it will result in voltage on two inputs of the HCT "buffer/shift registers" [9]. Use this to decrease the number of entries, from 12, used for a normal keyboard, to 7 [3], [5]. For each of the buttons there are used two resistors of 5.6 k and two resistors 270. Resistances of 270 serve to protect the PIC by decreasing power, and resistances of 5.6 k are meant to help us pick a voltage required for that HCT 4.20 V. The keyboard is powered by a 5V DC source. The Card reader is composed of 7 fotodiods and 7 receptors in the infrared diode. When there is no shutter, "black bar on the transparent card", the receiver will act as a conductor, enabling the flow a tension between strength and mass. If between the photodiode and the receiver we have a shutter, the receiver will behave as a normally open circuit and between strength and mass and there won't be any voltage, so the entry into HCT will be 0 V. Depending on the number of bars on the card and the position they will have (diode that they will obstruct) at the entry into HCT, voltage will appear only in photodiode-receiver pair in the right bar that is not opaque so we can receive an unique code [1].
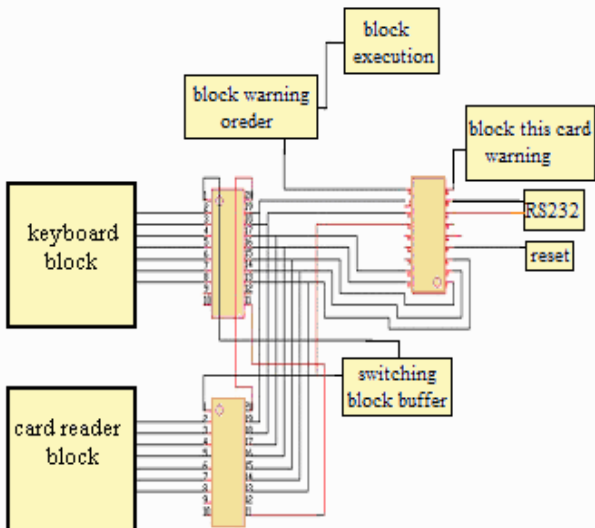

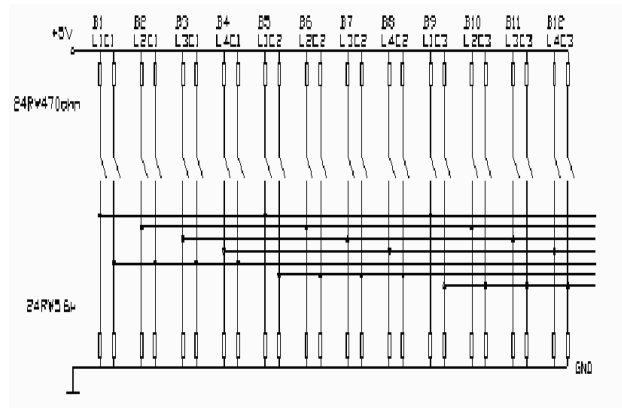Fig. 4: Block diagram of the access control system.
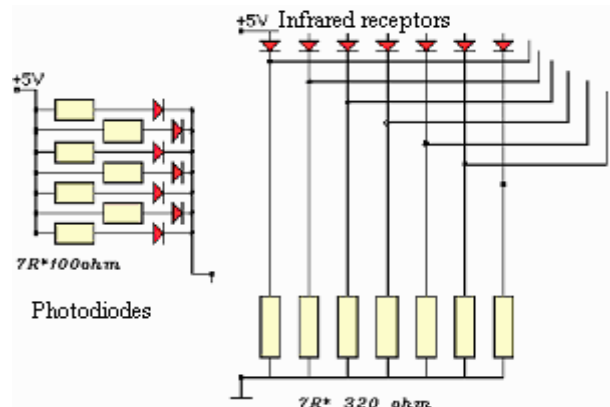

Fig. 5: Electric diagram of the keyboard.

Fig. 6: Electric diagram of the card's bar code reader.

PIC 16F628 requires two programmable voltage sources (one for 4.5-5.5 V V_{DD}, Fig.7) and another for V_{PP} (12-14 V) [7], [10].
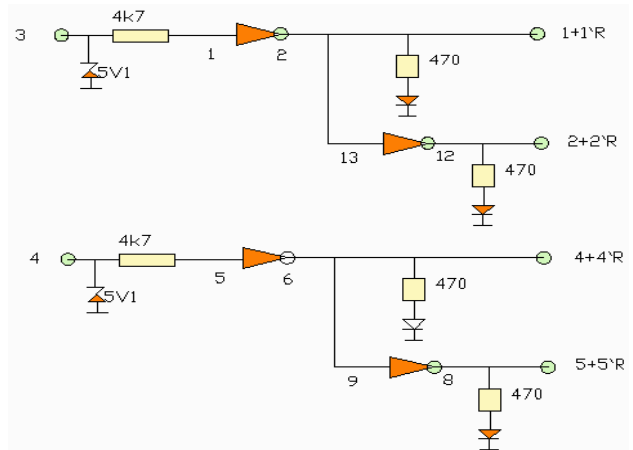

Fig. 7: Power scheme - the stabilization of the PIC 16F 628 programmer.
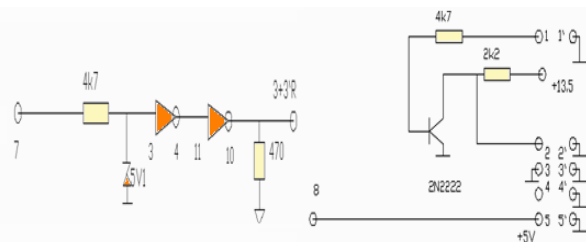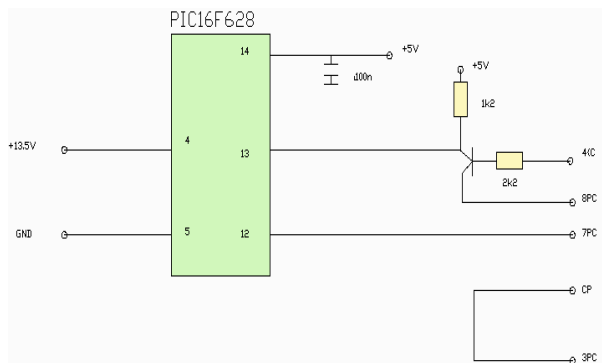

Fig. 8: Circuit board bottom.

Fig. 9: Circuits top plate "PIC socket".

3 Software Implementation

3.1 Architecture Softwer Used

The layer of dependence of the microcontroller comprises standard compiler *header* files containing declarations of identifiers (constants, variables and functions) relevant to the microcontroller used (Fig.10). Service layer is based on the precedent and makes available through its interfaces three components: reader card, reader keyboard and communication with PC via RS232 interface. Application layer is the highest level of software of the device and is composed of three components: initializer, the main manager and a module for internal timerele of the application. System operation is ensured by a minimal operating system (OS) which is intended to initiate other components, to manage interruptions (internal and external) and to call handler functions of the application services at the exact time intervals [6].
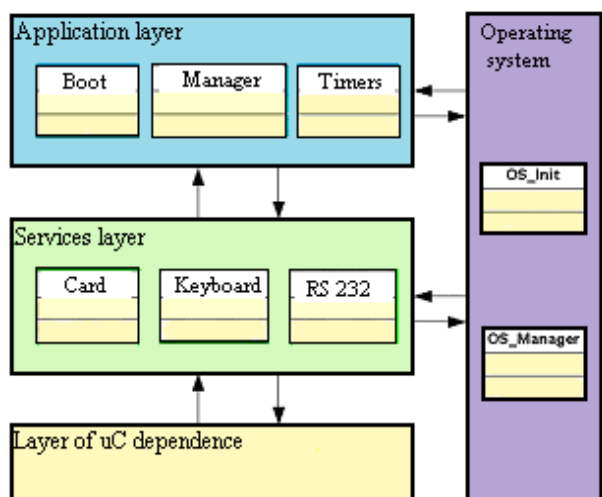

Fig.10: Explanation on software architecture of the access control system.

Program "Electronic Control Unit" ECU works as follows: in the idle state, every 25 to 25 ms the card reader is checked, when a voltage is detected on any of the 7 inputs, ie placing the card, it passes to the

next step, in which the program expects pressing a sequence of 4 keys [8]. It is mandatory that the 4 keys to be typed in a range of 7 seconds. If in the 7 seconds the code is typed, a minimum 40-bit code consisting of information about the reader and the keyboard is transmitted to the computer. This code is checked in a database and depending on whether or not the code exists, the door opens or not. If the sequence of 4 keys is not pressed within 25 ms, the program goes again idle waiting for the introduction of a new card. Read keypad and card reader is done using HCT sites that when the pin OE "0"have to exit and entrance and taking the OE is "1" to exit their "0" irrespective of having to input (Fig.11).

3.2 Programming PIC16F Microcontroller 628

PIC 16F628 microcontroller is programmed using one of two ways: series or parallel. Serial mode allows programming while the microcontroller is in the user system. This allows more flexibility of design [2].
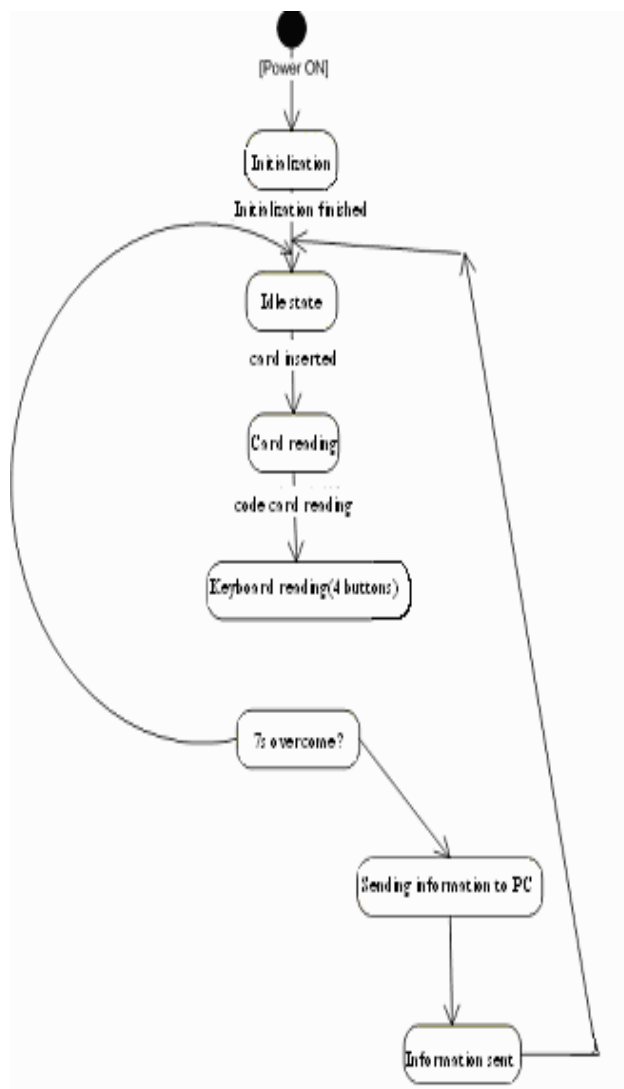

Fig. 11: Scheme logic.

Parallel mode facilitates faster programming, because the date is loaded into the microcontroller with more flow. Both modes can be selected to start processing programming. Mode of programming PIC 16F628 microcontroller offers programmable user memory, data memory, special locations used for ID (memory locations) and the fuse configuration of the microcontroller. Entry into how programming / verification is done by retaining pins RB6 and RB7 in "0" logic while MCLR pin increases from V_{iL} to V_{iHH} (increased tension).Being in this mode, user program memory and configuration memory can be accessed and configured in either series or parallel modes. Initial mode of operation is serial, and the accessed memory is the memory that is accessed user Progam. In this way the pins RB6 and RB7 are
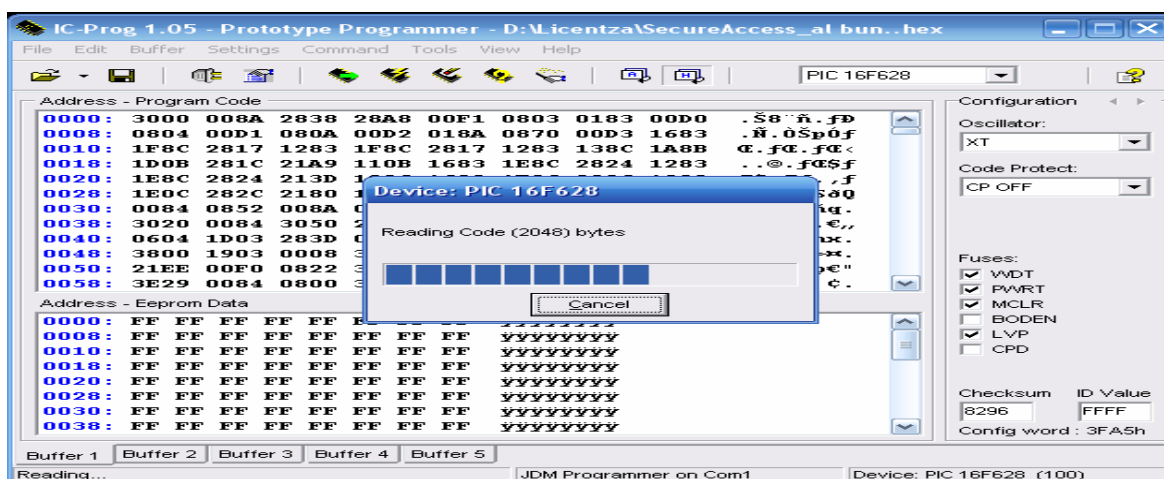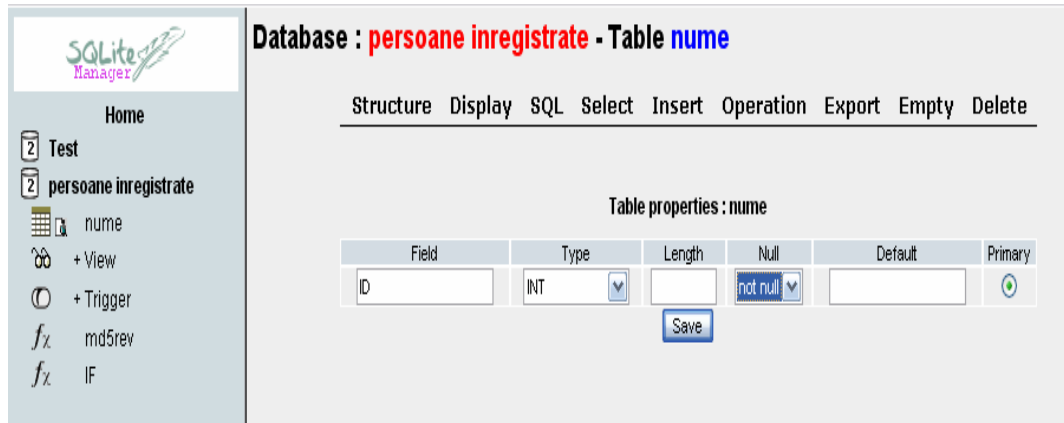

Fig. 13: Explanation on reading memory.
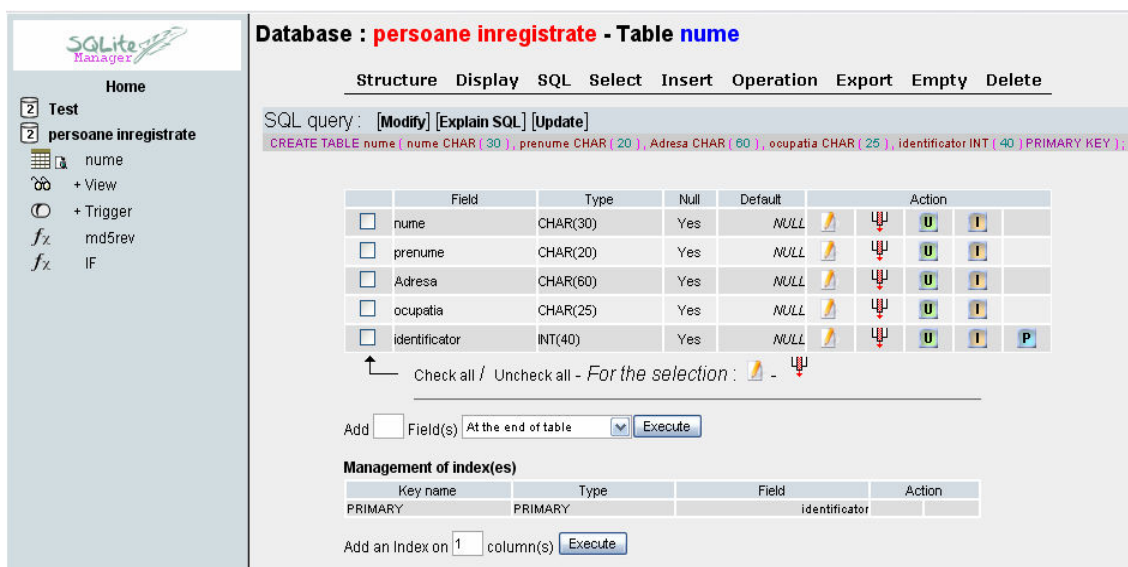
Fig. 14: Explanation on creating tables.

Fig. 15: Explanation of placing fields.

Trigger Schmitt charged. Sequence into how programming/verification places all internal logic reset state (the MCLR pin was initially V_{iL}). This means that all inputs and outputs are in State of reset. To introduce a command, 6 impulses of tact are executed on the RB6 pin [2]. All orders are sent with LBS (most humble bit) first. Data words are transmitted throughout the LBS first. Data is transmitted to the front mounted and loaded downward on the front of the tact. Orders that are varied and include: *Load Configuration, Load Data for Program Memory, Read Data From Program Memory, Read Data From Data Memory* (Fig.13), *Increment Address, Begin Programming* (Fig.14). After receiving the command *Read Data From Data Memory*, the chip will send data bits out of the memory data from the second front of tact entry. Like the previous state, data memory is 8 bits wide and therefore the first 8 bits which are output form the current date. Before starting any programming commands (*Begin Programming*) it should be given

a loading control. Programming close memory (user program memory, configuration or data) will begin after this command is received and decoded. PIC 16F628 microcontroller uses an intelligent programming algorithm that requires a variable voltage V_{DD}. The algorithm calls for a verification of the program to $V_{DD(min)}$ - V_{DD} minimum specified operating the chip - as in $V_{DD(max)}$ - maximum specified operating V_{DD} to for the cip. Verification to $V_{DD(min)}$ guarantees a good "edge of deletion". Verification to $V_{DD(max)}$ ensures a good "program margin". Current programming must be done with V_{DD} within V_{DDP} (4.5 - 5.5 V) - V_{CC} range required during programming. Microcontroller programmer must check the levels of $V_{DD(max)}$ and $V_{DD(min)}$ specified.

It is indicated that these levels are user selectable. All schedules that do not meet these requirements can be classified only as "prototype" or "development" and not as programming quality "production".

3.3 Create Database Records

Fig.17: Explanation on the editing table.

A database consists of tables, which in turn are made up of entries arranged in fields. A row in the database comprises: a *name* which can not contain spaces and a *type* value that varies from column to column. A first add in any database, it is better to be a field named *id*, and the type to be whole (INT), and a special setting for this first line of table is choosing the value *auto_increment* of the "Extra" category, and then the *primary* option must be checked (Fig. 14)**.**
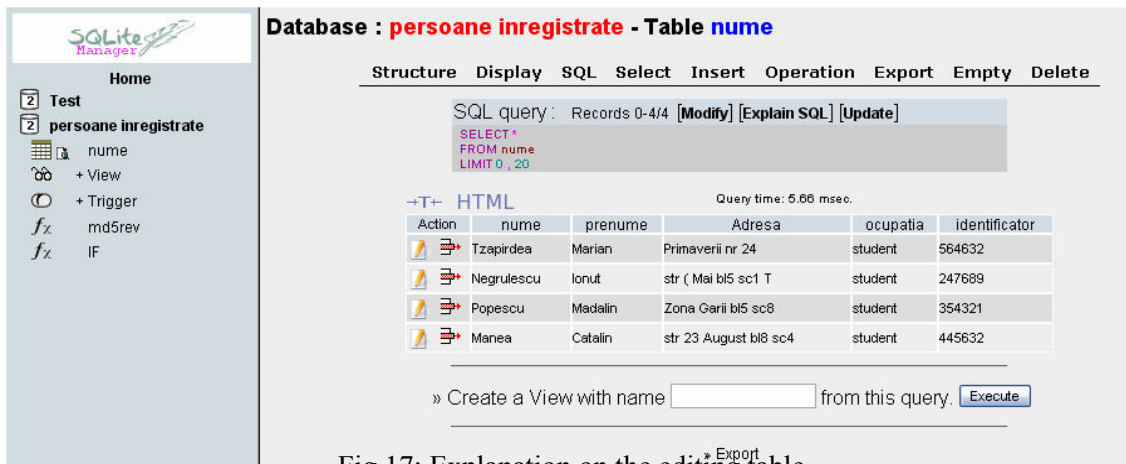
this case there will be more priority levels. If the person seeking access is not registered in the local database or in the center one, access is not allowed. To obtain permission for access it is necessary for the owner to be registered in the database of the central computer and receive conirmation from the supervisor. To obtain permission for access it is necessary for the owner to be registered in a computer database without confirmation needed
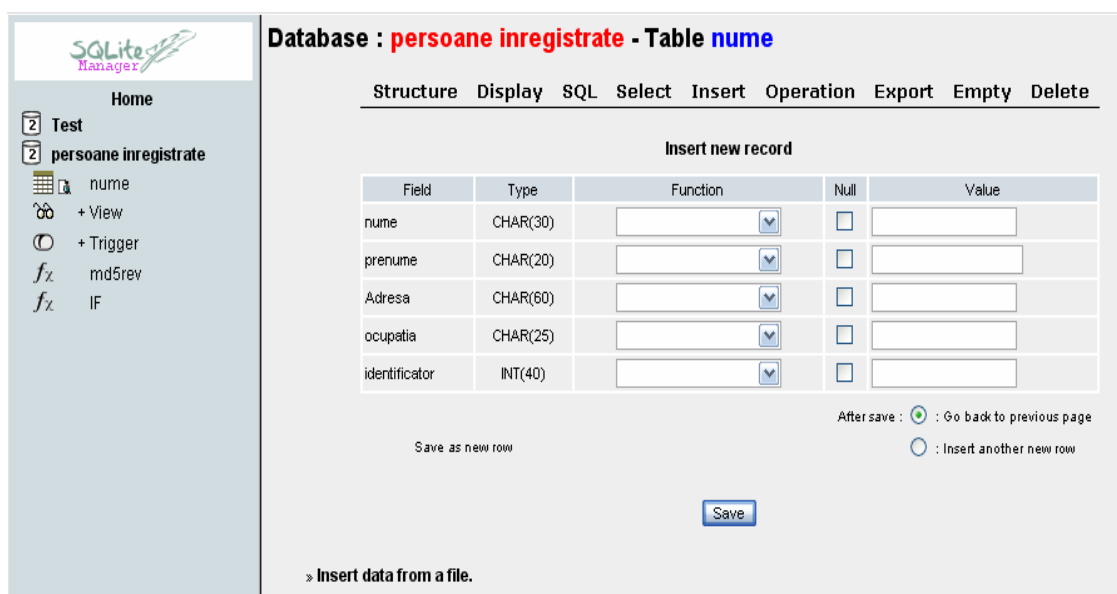

Fig. 16: Explanation of data entry.

After entering all the fields that are desired in the database, it will generate the code needed to create the table and the fields will be displayed in the table (Fig.15). The next phase will bring the necessary information in the table created (Fig.16). Last step is to display all records present in table (Fig.17).

4 Development Opportunities

The system can be designed with multiple levels of priority and its operation can be made without the presence of a computer, with an initial database right in memory of PIC 16F628 microcontroller. In

from the supervisor. Access is allowed by a decision taken locally, into the respective entry, not needing notification and confirmation of the computer or supervisor. The Number of components that can compose the local access controller can be increased as follows: card reader, keyboard with 12 keys (numbers 0-9, the keys "*" and"#"); display with four digits of 7 segments; the mechanism of locking/unlocking the door with magnet.

Inserting the card. In the rest mode, the machine displays a segment moving clockwise, signaling that it is operational and ready for reading a card or code. When introducing a card, it is read, during

which the display shows for a half-second the message "Read". If reading is successful it displays a message "Card Out" signaling that it must be removed from the card reader. If you put in a defective card or it has been introduced reverse, it displays the message "Card Err", in which case an appropriate card must be reintroduced [11]. After removing the card, the personal code must be entered in the machine displaying to that end "Code".

Typing the code. The personal code is made of four digits and must be entered after the card was read and the machine displays the message "Code". After typing the four digits, a numerical key must be pressed , it is considered as the first of a new four-digit code. So if you typed a wrong number, you can return to introduction of the Code by pressing the confirmation key #. Key "#" is ignored if it is introduced a full four-digit code. Typing sign "*" does not have any effect. The Card and personal code may be introduced in reverse order, so the code can be typed before placing the card when the system shows the segment that rotates clockwise. In this case, after preesing the confirmation key "#", it displays the message "Card" and expects the interductio of the access card. When the card was read , the doors is opened.

The decision to release the entry. After reading the card and personal code, the access controller checks if the information received is in its own memory. If so (priority level 1) it operates the door opening mechanism and displays the "Open Door" message. The message stays on as long as the door is kept unlocked, or about 10 seconds. If the data read from the card access and keyboard are not found in local memory, the controller signals the central computer. It seeks series card and identity code received by the controller in the database access rights. If case the information is found, it searches in the database of the cards, the holder's name and level of priority assigned. If the priority level 2 does not require confirmation of the supervisor, it reports to the appropriate command input controller to unlock the door. If the person seeking entry is found in the access database with a priority level 3, the decision to open the door is taken by the supervisor. If the central computer is not working or the monitoring program is inactive, input controllers can not decide to unlock the door unless for a priority level 1 [12].

Release mechanism of entry consists of a magnet system which when operated allows opening the door by simply pushing it. When the access controller takes the decision to unlock the door, the mechanism is activated for about 10 seconds.

5 Video Access Building

In this part of the paper shows how to implement a tracking device used to access a building. The proposed system includes several functional blocks as distinct but interrelated structure (Fig. 18). Access area is monitored by a video camera connected to a computer and send pictures to it.

Communication interface consists of two blocks namely: INT1 (interface 1) representing the connection between PC and controls the transmission mode, the reception of data from that block and watch the TX / RX modules which is the emission -reception [7]. The area has not watched a special construction. and video camera depends on the environment and working conditions in the system.
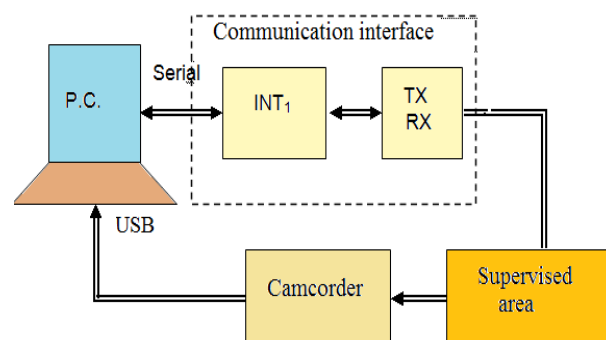

Fig.18: Block diagram of video access system.

The system has in its area of supervision and communication with the computer interface. Supervised area is reach of unauthorized persons and must be performed so as to have one background color to avoid confusion when processing images. Is mounted above the zone of surveillance camera surveillance.

Through its images are taken of the area surveyed, which represent information in files by giving a command, which is the response information. Camcorder is connected to the computer via the USB port [7].

For this implementation we used a webcam, Trust 120 SpaceCAM, 640x480 resolution, up to 30 fps. Video camera mounted on a stand above the zone of action, so have the range of visibility throughout the area to observe all possible positions of unauthorized person (Fig. 19). For this implementation we used a webcam, Trust 120 SpaceCAM, 640x480 resolution, up to 30 fps. Video camera mounted on a stand above the zone of action, so have the range of visibility throughout the area to observe all possible positions of unauthorized persons.
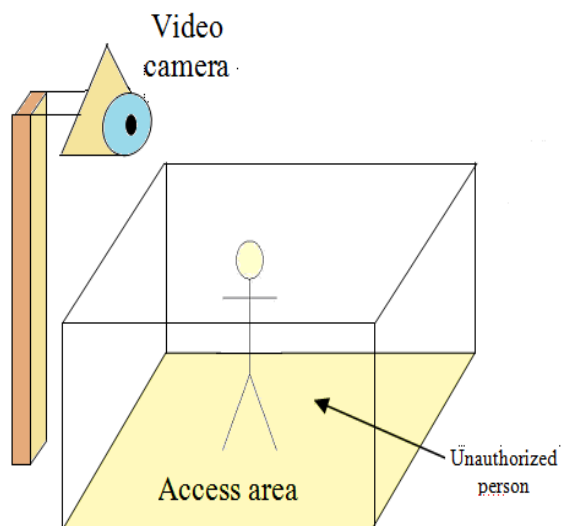
Fig. 19: Definition of surveillance zone.

In Fig. 20 is a schematic diagram of electronic device that has access to the building in its composition: AT89C2051 integrated circuit, which manages the access-control device, with necessary auxiliary circuit elements - external oscillator circuit (quartz) and RESET circuit - and the circuit force, L293, engine power required for access device.

External oscillator is achieved with a 12MHz quartz and it gives the frequency of the microcontroller. P1 port lines were used for control integrated circuit L293, a driver capable of 1A output current distribution channel. Each channel is controlled by a logic gate TTL (Transistor Transistor Logic). A separate source of power which maintains logic gate is used to operate at low voltage to reduce losses. L293 has 16 pins and four pins used to run central heating to radiator cooling. This supports an integrated circuit voltage for motors connected, LV, up to 36V, and the logic voltage levels, V_{SS}, up to 36V. The maximum acceptable voltage for input VI is more than 7V [13].

The scheme has been used to control electronic access device were used for each engine driving the door, instead of limiting diodes, two decks of diodes that were mounted so as to have the same effect, but to reduced the number of wiring tracks. The electronic diagram of the device is not provided and the communication of a microcontroller with other devices.

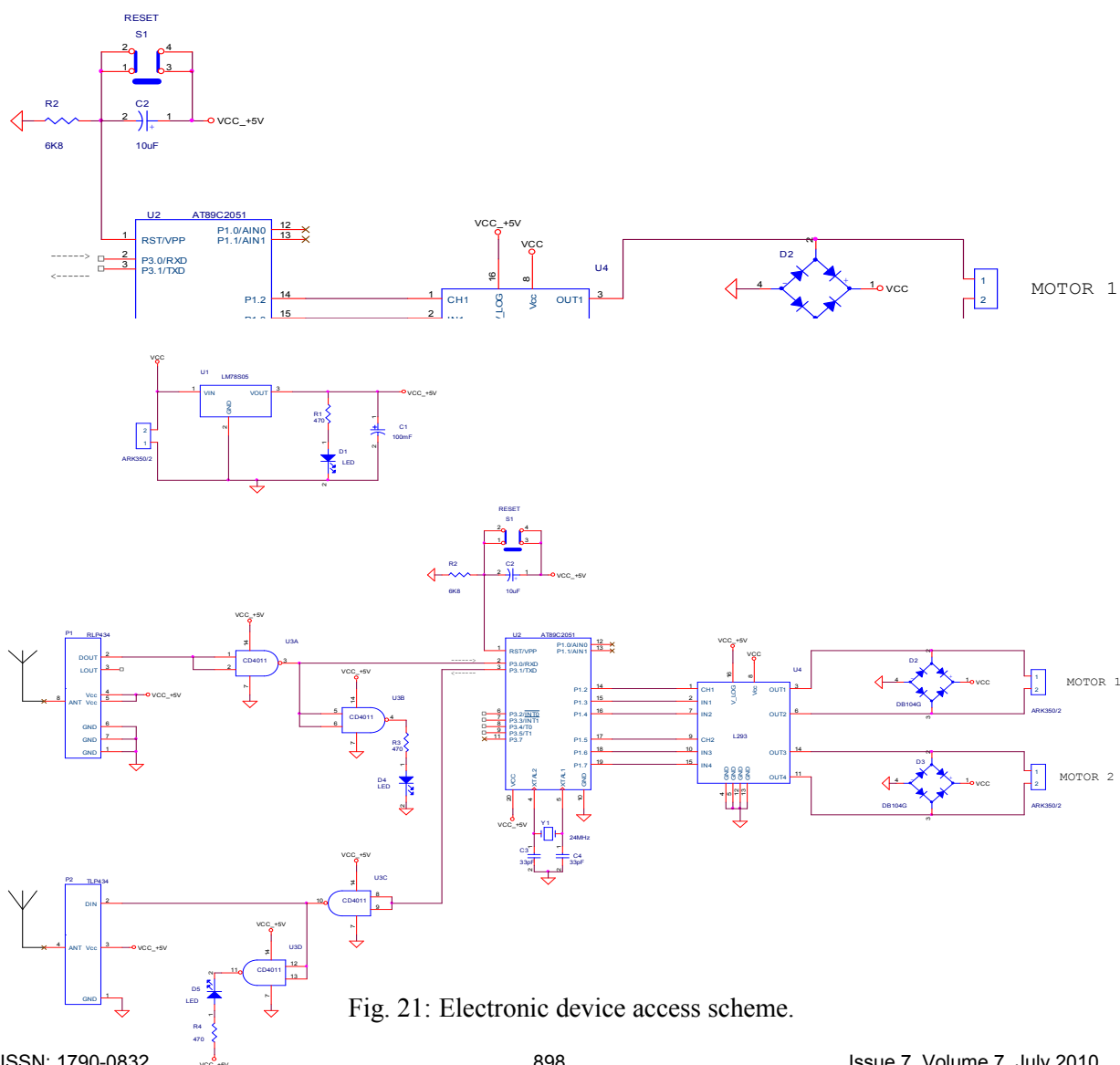A very simple way to connect the microcontroller is to use its serial lines. These lines

Fig. 21: Electronic device access scheme.

can make a direct connection with the serial port of computer, either by wire or by radio. Emission and radio were used for transmission and reception modules, respectively TLP315, RLP315, TLP433 and RLP433. These modules operate at frequencies of 315 and 433.92 MHz. TLP (circuit used for transmission) can be fed to a voltage between 2V and 12V, maximum current drawn when the supply voltage of 2V is 1.64 mA, and the case supply voltage of 12V is 19.4 mA. RLP (circuit used for the reception) can be fed to a voltage between 3.3V and 6V.

These modules operate using amplitude modulation [1], [2], [8]. Allow a transfer rate from 512 bps and 200 kbps. A big advantage of these modules is that enable transmission, that digital reception without the need for analog-digital conversion or digital-analog. Thus, communication between two digital devices can be done very simply using these modules, the only condition being that you can work seriously. Modules used have reduced size, as observed (Fig. 21), we are required other than for adjustment circuit logic levels. Interfacing modules for radio transmission and reception of computer to use integrated circuit MAX232.

Fig. 21 is a schematic diagram of the electronic-computer communication radio modules. MAX 232 is a level converter circuit specialized Charge-Pump, which converts received input logic levels to levels appropriate for the output circuits namely: converts 12 V logic levels from the computer serial port TxD line, the levels of 0-5 V TTL logic necessary for most digital integrated circuits; converts 0-5V logic levels received as the external digital integrated circuits in logic levels required 12V PC serial port RxD line. To obtain pulses as unmodified form, and MAX232 circuit modules between the transmission and reception using an integrated circuit CD4011 buffer role.

5 Conclusions

The access control in buildings is an application for use in any area where it is needed a safety mechanism and increased protection of the inputs. The proposed system allows centralized control of access into a building or building complex. The system can monitor any application for access (entry) in the complex from the outside and inside the complex to buildings and interior rooms. Each card contains a unique code unchangeable, so the owners of the access cards can be perfectly identified. The combination of a holder, card and code is stored in a central database. The decision of allowing entry is made according to the acces card and associated code by consulting a database in the central computer (server) and a supervisor and there are three levels of access. If the person seeking access is not registered in the database nor does it grant access by the supervisor, access is not allowed. To obtain permission for access it is necessary for the owner to be registered in a computer database without the need for confirmation from the supervisor. To obtain permission for access is necessary for the owner, besides the fact that they are registered in the database, to receive confirmation from the supervisor. Database for access rights is updated by the supervisor of the central computer. The system of development for applications of PIC 16F628 controller make up for building support and possibly the maintenance and further improvement of the access control system.

In the second part of this work was described in order to access a device built using images captured from a video camera and wirelessly transmitting commands.

This paper is a perspective on the supervision and control unauthorized access, minimum cost and performance.

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