Industrial Processes Automation

MSc in Electrical and Computer Engineering

Scientific Area of Systems, Decision, and Control

Winter Semester 2010/2011

1st Lab Assignment

Alarm System for Intrusion Detection

This work aims the implementation of an intrusion detection alarm system, in a restricted space as a small room or a residence. The intrusion will be detected resorting to an infrared sensor, installed in such a way that points towards the main entrance of the space to be protected. A switch is also installed on an window of the aforementioned space.

The automation system that constitutes the alarm is to be implemented in the Schneider PLCs available on the lab. The models to be used are five Micro 3722 and one Premium 57. This document is composed of two parts: the first describes the guidelines for the first session on the lab and the second describes the functional specifications of all the work, that will be developed in the next four weeks.

Part B

The second part of this laboratory assignment consists on the implementation of an automated solution to the identification of a key pressed, on the available keyboard with 12 keys. This device is central to the user to interact with the intrusion detection alarm system under design. The solution foreseen is the design of one or more ladder sections (optionally on structured text or instruction list), to identify the key pressed. If no key is pressed this solution must store -1 as the result. For the digits '0' to '9' the corresponding value must be stored and the values 10 and 11 correspond to the keys '#' and '*', respectively.

Remark that it will be required to read and validate sequences of keys in the next assignment.

1. Identify the console inputs and outputs for the keyboard, to be used on the intrusion detection alarm system.

PLC Inputs	Identifier	Outputs	Identifier

Remark: verify carefully that it can exist keys that are connected simultaneously as an input and an output to the PLC.

2. Describe the reading/identifying strategy to be implemented to solve this problem.

3. Describe the number of timers, their functions, time bases, and modes of operation.

Desc. Timers	Function	Time Base	Mode of Operation

4.   Design one or more sections to solve the key reading task.

5. Upload the program proposed to the PLC and run. Comment on the results obtained.

6. Comment the following statement: "The solution to read and identify one key requires the keyboard to be scanned one, but not periodically."

Paulo Oliveira
IST, October 18th 2010

Annex

Functional Specifications

General Characteristics of the Alarm:

A switch with three positions must be used to set the modes of operation of the alarm, as detailed next:

i) OFF – this mode deactivates the alarm completely.

ii) PRESENCE DETECTOR – the infrared sensor is used to detect the movement on the room/space, that be signalized resorting both to a lamp and to the buzzer on the panel. The lamp should be on for 5 seconds, upon the detection of each person, and an acoustic signal with the duration of 1 second should be emitted.

iii) ACTIVE – in this mode the alarm is to be used. The following phased can be identified:

a) when requested for activation, a period of 30 seconds of inactivity is set to allow the user to abandon the space, and afterwards remains permanently activated.

b) upon intrusion detection, by the infrared sensor or the window switch, the alarm evolves to the warning phase.

c) the alarm lights a warning on the panel and after 5 seconds the buzzer must be activated. The warning must be a periodic signal with 1 second on and 2 seconds off.

d) The alarm can be deactivated pressing the # key on the command panel.

Advanced Characteristics of the Alarm:

An advanced alternative for the alarm activation/deactivation consists on the use of a code previously set by the human owner (e.g. 9665). To implement the activation function, the following procedure must be implemented:

a) switch the alarm mode to ACTIVE.

b) introduce the activation code (e.g. 9665).

c) press #, and wait for 30 seconds to allow the user to abandon the space.

d) start the intrusion detection function, i.e. the alarm is fully operational.

To deactivate the alarm, upon intrusion detection or to allow the use of the space, the following instructions must be accomplished:

a) introduce the secret code (the same as the activation one, e.g. 9665).

b) Press #

c) change the alarm mode to a mode other the ACTIVE.

Special Characteristics of the Alarm:

A safer mode of operation for the intrusion detection alarm is to allow the user to change the activation/deactivation code. The code 0000 is initially used, as a factory preset. To change the code, the following operations must be done:

a) press *, followed by the pre-programmed code.

b) Introduced the new code to be used, finished by *

In the case where a mistake occurs, press the code **** to reset the code to the factory default.

Available Material

In the laboratory there are six different working places, all with similar PLCs but different consoles. In the workplaces five have a PLC Schneider, mode 3522 and one has a Schneider Premium 57 PLC. All of them have a power supply with 24V and/or 12V and a desktop PC, with the PLC Pro 4.7 development software and the PLC manuals, in pdf format.

In each workplace there will be also a alarm console with the following components:

*	wood alarm console.
*	12 buttons keyboard, with a configuration as described next
*	12 V buzzer
*	1 infrared sensor.
*	1 three positions switch
*	1 two positions switch.
*	set of electrical contacts

1	2	3
4	5	6
7	8	9
*	0	#

The solution for this automation problem must be based on the languages described on the IEC 1131-3 standard, i.e. *ladder diagrams, instruction list* and *structured text*.