Remote Manipulation of a Robotic Arm by using Infrared Sensors

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ABSTRACT

This project consists in how to adapt a manipulation system to a Robotic Arm by using infrared sensors. A personal computer is used as a control device to have a graphic interface. The control program was developed in Visual Basic so as to have a screen with an interactive menu showing the different parts of the robotic arm. This program has its main feature in the "keyboard-mouse" interface, which has a graphic screen with buttons to make the robotic arm react to the instructions sent by infrared signals. The words assigned to any button are made of two parts: The first one takes the four most significant bits to start up the power module and the second one, takes the four least significant bits to specify which joint will be moved.

Keywords: Infrared sensors, digital design, robotic arm, visual basic

1 INTRODUCTION.

This project consists in how to adapt a manipulation system to a Robotic Arm by using infrared sensors. A personal computer is used as a control device to have a graphic interface. The control program was developed in Visual Basic so as to have a screen with an interactive menu showing the different parts of the robotic arm. This program has its main feature in the "keyboard-mouse" interface, which has a graphic screen with buttons to make the robotic arm react to the instructions sent by infrared signals. The words assigned to any button are made of two parts: The first one takes the four most significant bits to start up the power module and the second one, takes the four least significant bits to specify which joint will be moved.

2 ROBOTIC ARM DEFINITIONS

A robotic arm is a multifunctional, programmable manipulation device, designed to move materials, tools or specialized devices by using programmed movements so as to make different tasks. Some arms have just one movable joint, but there are some others with two, three, four or even five movable ones. The robot configuration is the physical shape of its robotic arm. In a robot, a robotic arm able to move in a spherical way is called revolution axes arm, the other important robotic arms are: Polar axes arms, cylindrical axes arms and x and y axes arms. There are three ways to move a robotic arm joint such as electric, hydraulic and pneumatic

3. CONTROL PROGRAM

To send the control signals to the robotic arm, a program using Visual Basic was made. This software can not take direct control of computer peripherals, but allows creating programs easily with graphics and user interfaces under Windows environment. Therefore this language is used as a control and manipulation development platform of the robotic arm supported on a system to "translate" some C language abilities, which is able to control computer peripherals. This system is similar to DLL, which is programmed in a language different than Visual Basic. Once this template is made, is possible to use it as any other available in Windows. The program designed to control and manipulate the robotic arm movements allows watching, on a computer screen, five windows, each one corresponding to one joint movement.

3.1 Main Screen

Figure 3.1 shows the main screen with five windows, a control bar and a condition one. Each window shows one of the five joints that the robotic arm has, to monitor its movements. The control bar (keyboard-mouse interface) is which allows controlling user's desired movements. Condition bar (binary interface monitor) shows the current condition through binary indicators as well as movements in real time.

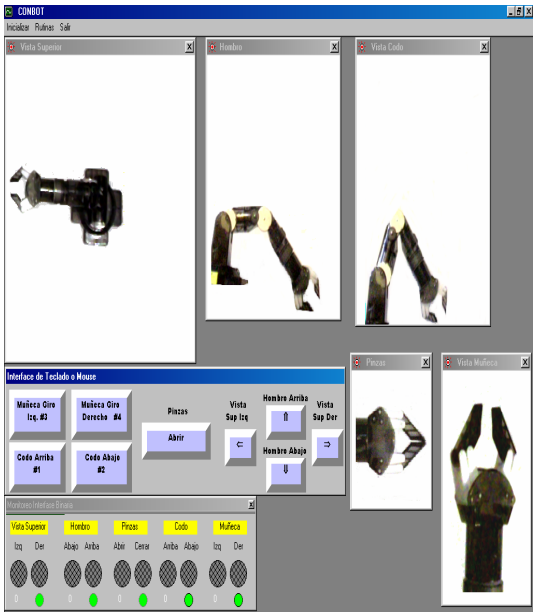

Figure 3.1 Main screens.

4. PARALLEL INTERFACE

The parallel interface transfers 8-bit data between two devices at the same time. The parallel transmission advantage is that most computers and peripheral devices process data this way. The disadvantage is they are expensive, especially when the distance between emitter and receiver is long. Therefore, parallel interfaces are used to transmit data when equipments are close to each other such a computer and a printer.

As serial transmission does not use as many wires as parallel transmission does, this is used for long distance communications.

Movements control signals are sent from the computer to the robotic arm through parallel port. Figure 4.1(a) shows how the binary code 0110 is transmitted from A to B, in parallel. As it is shown each bit (A_0 to A_3) has its own transmission line and, therefore, four bits can be transmitted at the same time in one clock cycle (T). This kind of transmission is called *parallel at a bit level*. Figure 4.1(b) shows how the same binary code is transmitted in serial. Because of this, four clock cycles (4T) are required to transmit the whole word. This kind of transmission is called *serial at a bit level*. Obviously, the main reason to choose serial or parallel transmission consists in speed and simplicity.

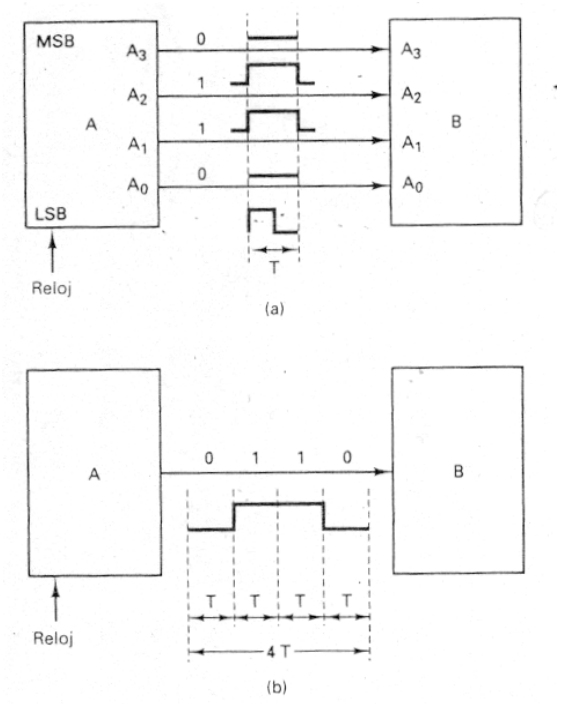

Figure 4.1 Data transmission: (a) parallel, (b) serial

5. ROBOTIC ARM TELECONTROL.

The main objective of a communication system is to send information from one place to another one in an electrical signal way. Basically, every communication system consists of three main parts: Transmitter, means of transmission and receiver as Figure 5.1 shows.

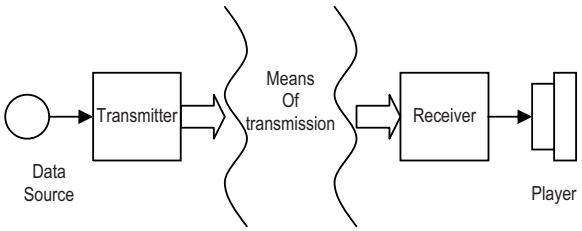

Figure 5.1. Communication system model.

Ideally, information coming out from the receiver output device should be a perfect copy of the coming in information. This requires that the communication system from the source to the player works such as a lineal circuit, invariant through time, with an infinite band width and without noise; however, this kind of communication system is impossible to find in real life, as every real transmitter and receiver add noise, are non-lineal and with a limited band width.

Depending on the way form that carries the data sent through communication lines, communication systems can be either analog or digital.

In digital communication systems, information or data are inside 1's and 0's strings different than analog communication systems where information is inside a continuous electrical wave form. Figure 5.2 shows the encoder and decoder timing diagram.

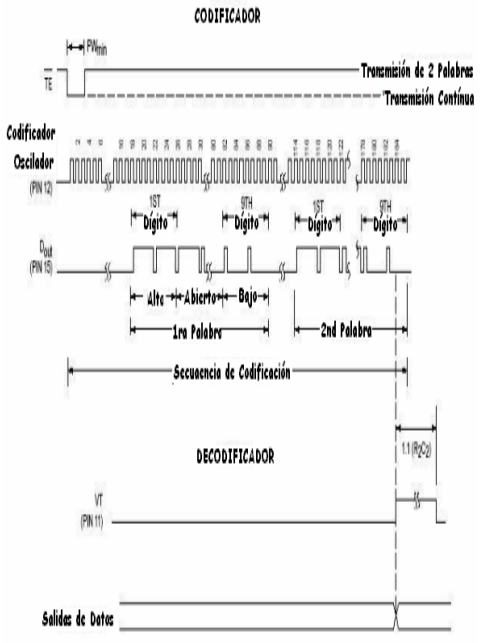

Figure 5.2. Encoder-decoder timing diagram.

Every binary digit is encoded into pulses. Logic 0 is encoded as two short consecutives pulses. Logic 1 is encoded as two long consecutives pulses. Once bits are all encoded, the digital output signal will be modulated to be sent through the communication channel.

6. CONCLUSIONS.

This prototype helps to see the way that a robotic arm can be used to move materials, tools or specialized devices by using programmed movements to make different tasks and it had the objective of designing software able to control, under Windows environment, the robotic arm's movements.

Theoretically robotic arms usages could be extended to almost every imaginable area where mechanical tasks are needed, tasks made, nowadays by men or, even impossible to do by them (e.g. a Martian surface exploration). It is understood in this context that mechanical task is every activity that involves physical presence and movement by the task maker.

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