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Booklets

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Title: Preliminary Development of a System to Manipulate and Monitoring a Flexible Manufacturing Cell

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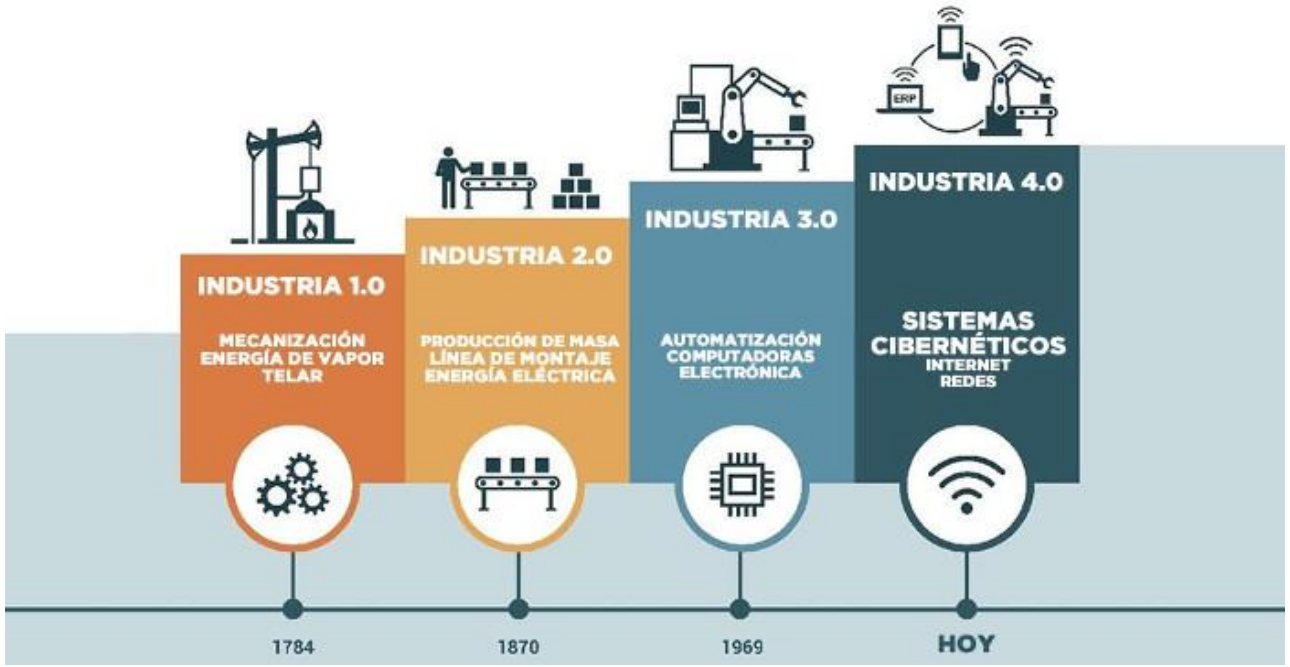
Introduction

In the context of the so-called fourth industrial revolution or industry 4.0, which is in pursuit to establish a fully automated industry through the digitization of manufacturing processes where flexible manufacturing systems are linked locally and globally, the creation of communication interfaces highly efficient and with low cost are of great relevance.

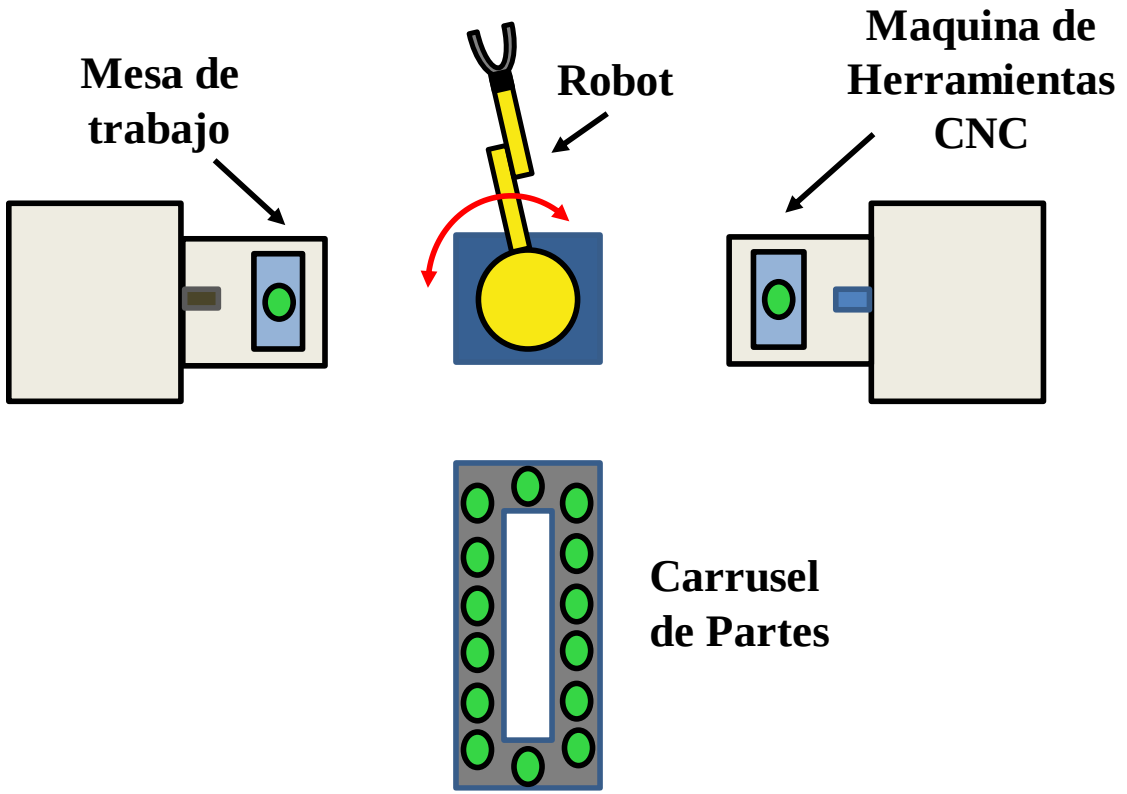


Introduction

¿Qué es un FMS?

Es una celda altamente automatizada de Tecnología de Grupos, que consiste de un grupo de estaciones de trabajo de procesos, interconectadas por un sistema automático de carga, almacenamiento y descarga de materiales.

Flexible porque es capaz de procesar varios productos y cantidades de producción que pueden ser ajustadas en respuesta a los comportamientos de la demanda



Introduction

¿Cuándo es flexible?

1. Prueba de variedad de partes. ¿Puede el sistema procesar diferentes productos en un modo de no-lote?

2. Prueba de cambio de programación. ¿Puede el sistema aceptar cambios en la programación de la producción?

3. Prueba de recuperación de errores. ¿Puede el sistema recuperarse de fallas y daños, mientras la producción no es detenida por completo?

4. Prueba de nuevas partes. ¿Pueden nuevos diseños ser introducidos a los existentes con relativa facilidad?

Introduction

Clasificación de FMS

Número de máquinas

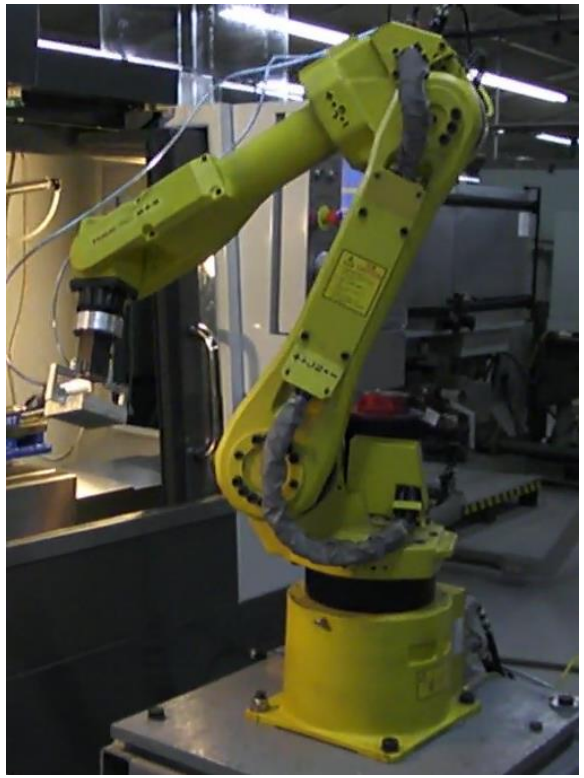
1. Celda de máquina sencilla (SMC - 1)
2. Celda de manufactura flexible (FMC - 2,3)
3. Sistema de manufactura flexible (FMS > 4 …)

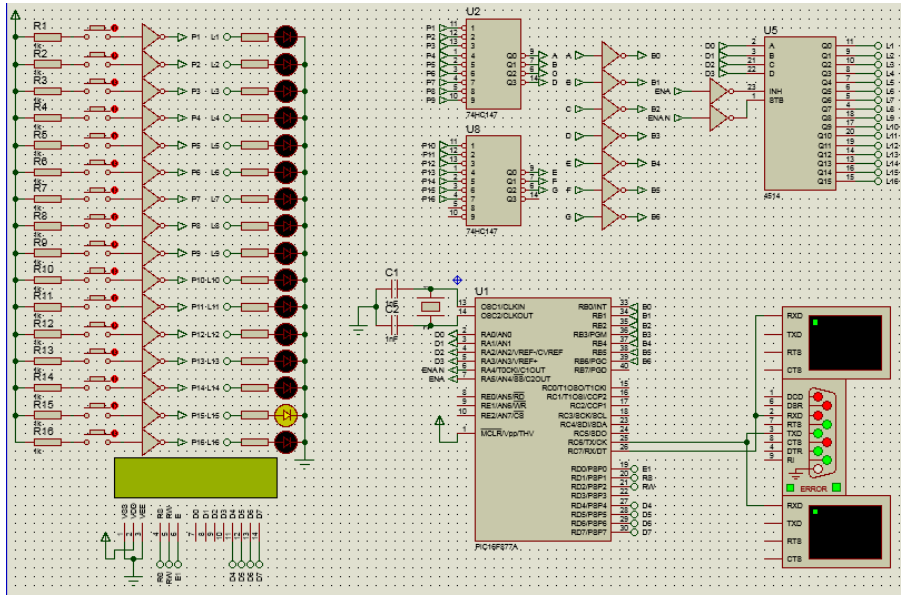
Nivel de flexibilidad (FMC, FMS)

1. FMS dedicado
2. FMS de orden aleatorio

Experimental Setup

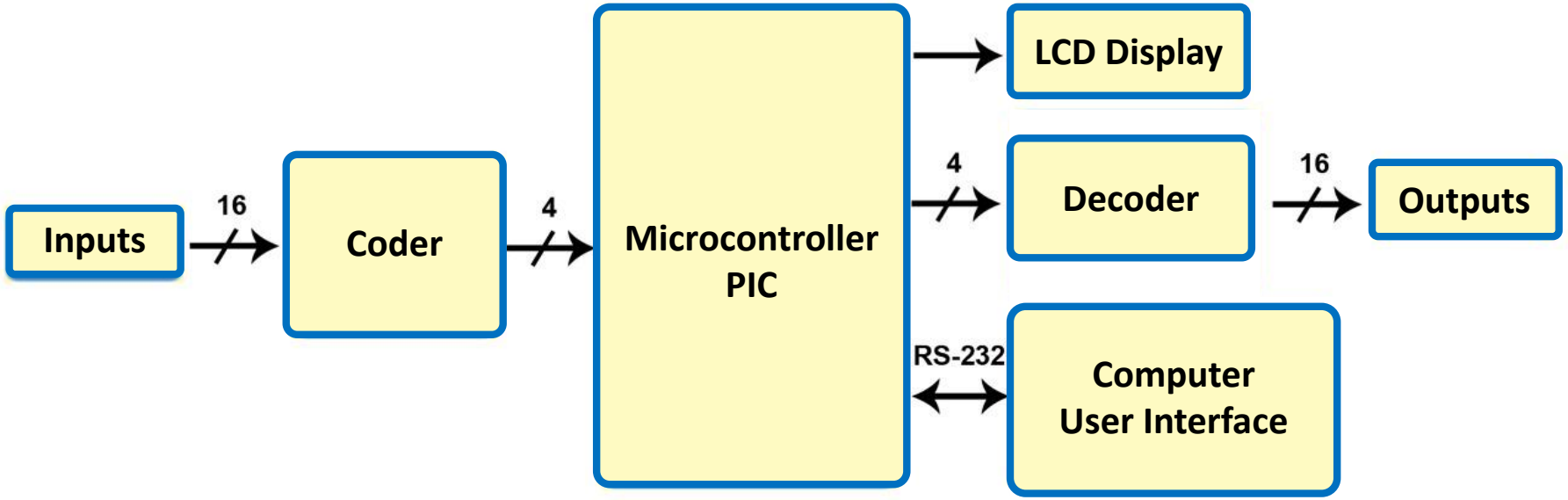
The proposed system was implemented using a microcontroller configured as a PLC, with inputs and outputs necessary to communicate a FANUC M6iB robot with a HAAS VF2 machining center, using simple signal communication, emphasizing the inherent advantage of being a device much cheaper to implement than a PLC with a certain commercial communication protocol.





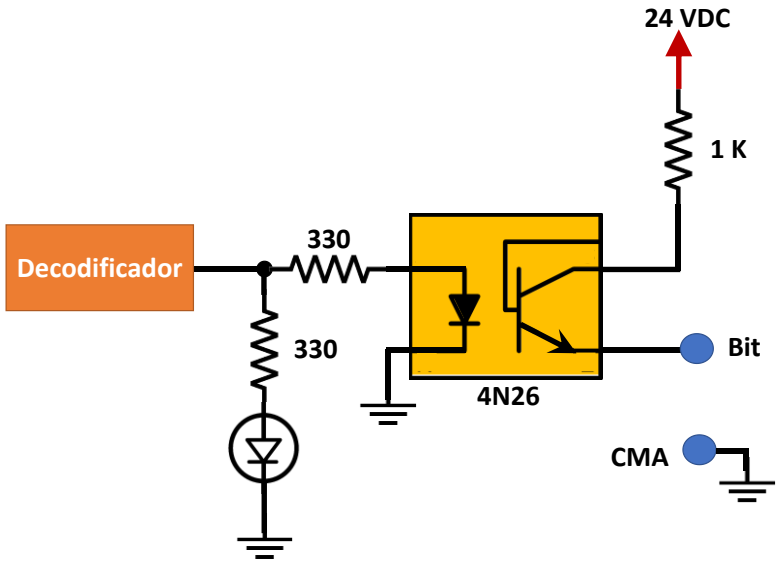
Experimental Setup

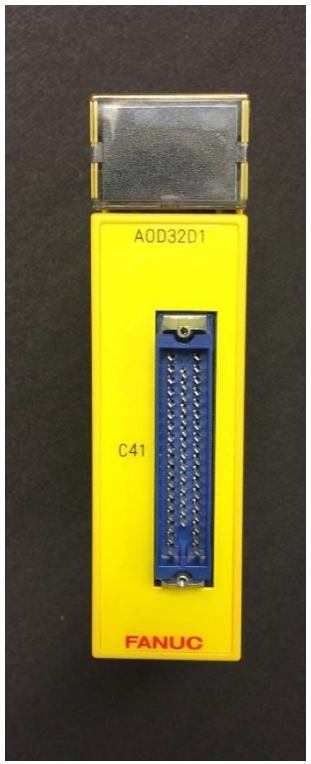
For the implementation of the communication card between the machining center and the robot, a Microchip 16F877A microcontroller was used. To scale the number of inputs and outputs of the card, encoders and decoders were used respectively, achieving a number of 16-bit for inputs and outputs. The RS-232 communication module of the microcontroller was used to communicate the card with a computer, where a user interface was developed with the LabVIEW.

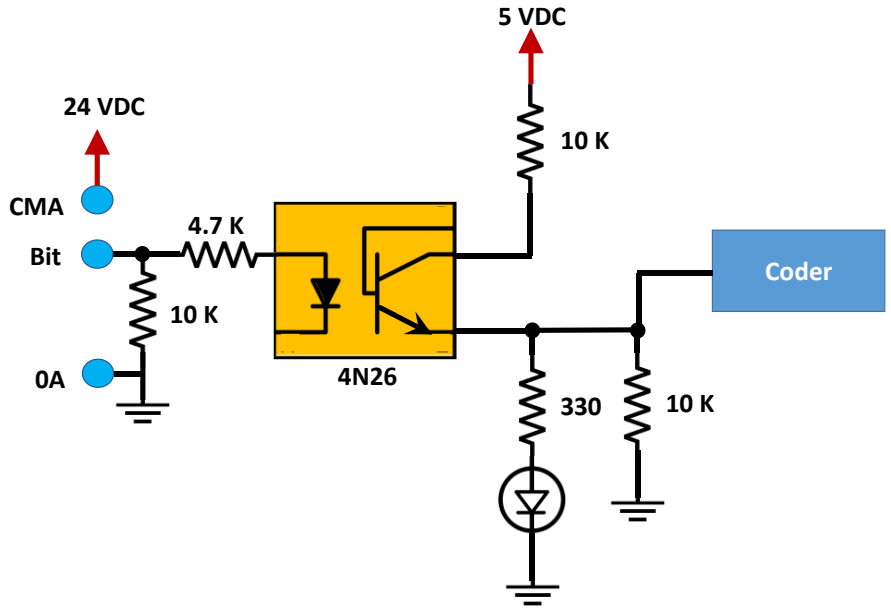


Experimental Setup

For the development of te comunications card between the robot and the electronics, the input modeule AID32E1 and output module AOD32D1 were used. Therefore, it is necessary to isolate the communication card and the robot connection modules, since the modules work at industrial voltage level of 24 V. Therefore, an optocoupler 4N26 was used for this purpose.

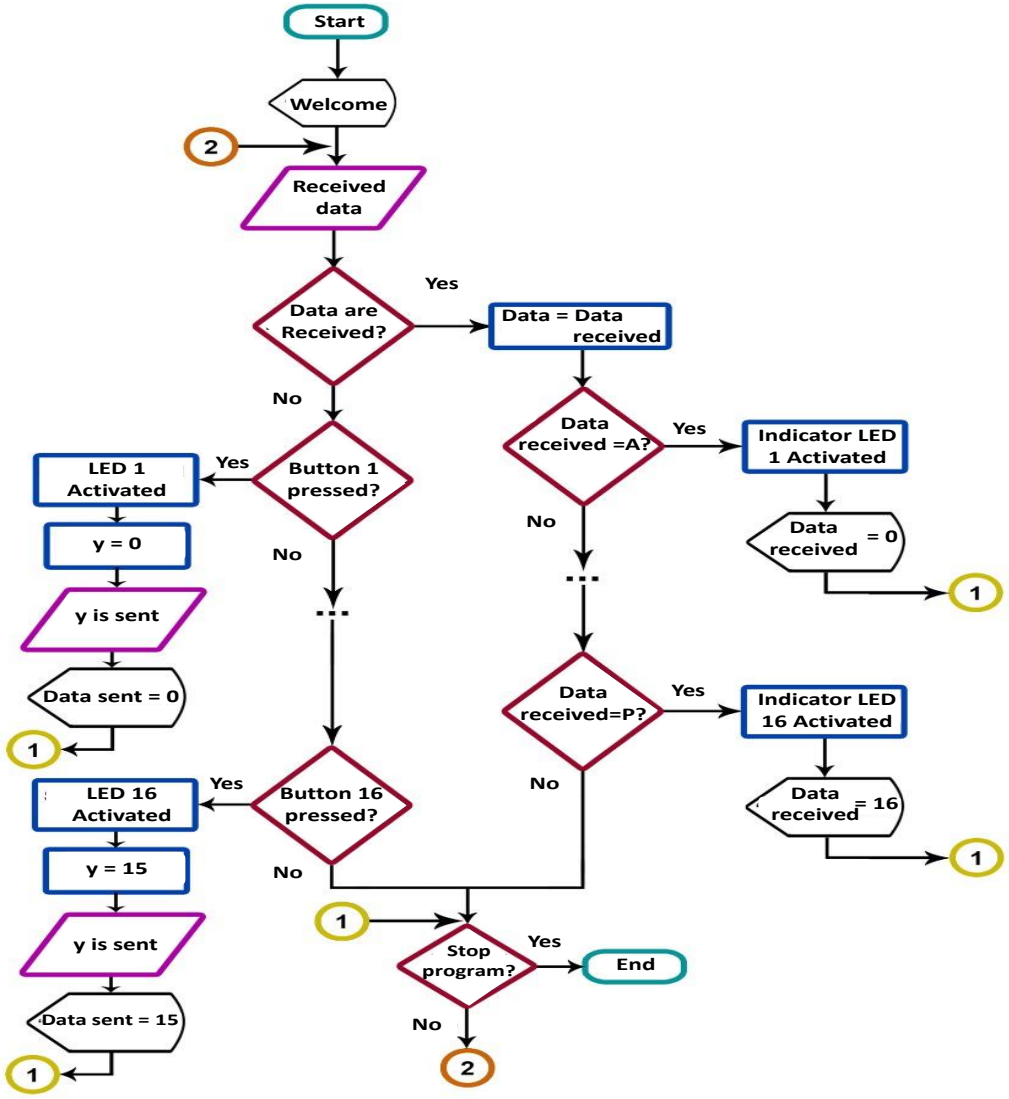


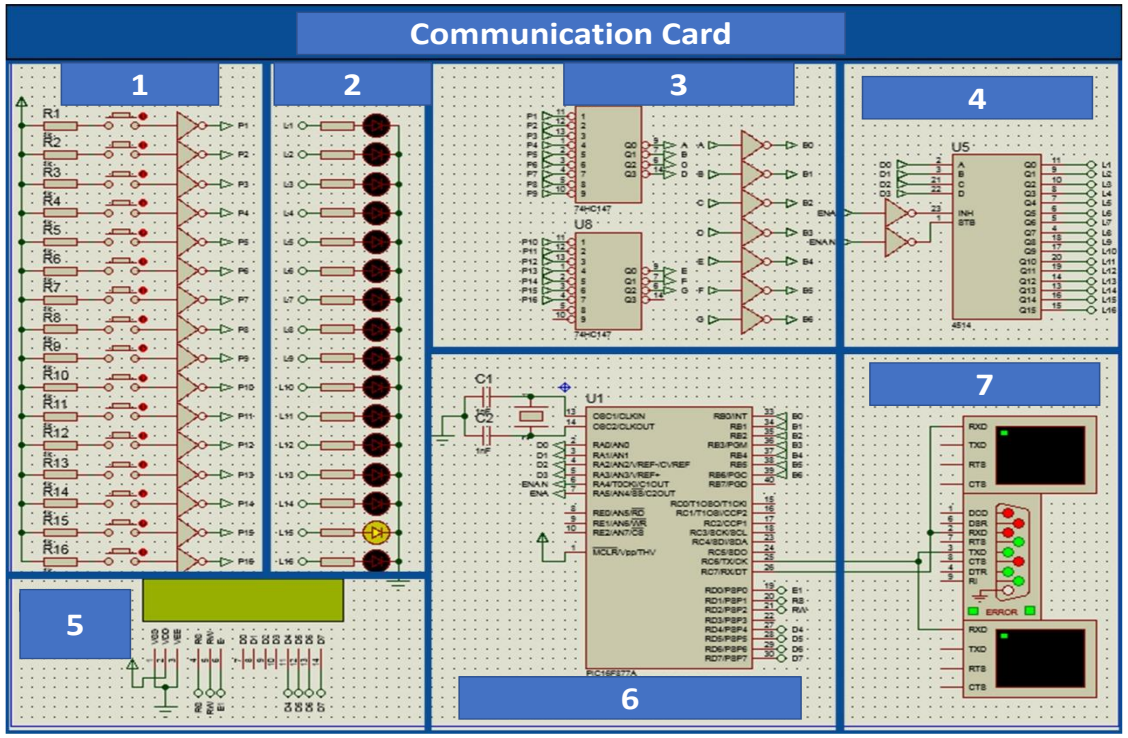




Experimental Setup

The software used to develop the firmware the communications card was the CCs Compiler, which contains the corresponding algorithm within the microcontroller.

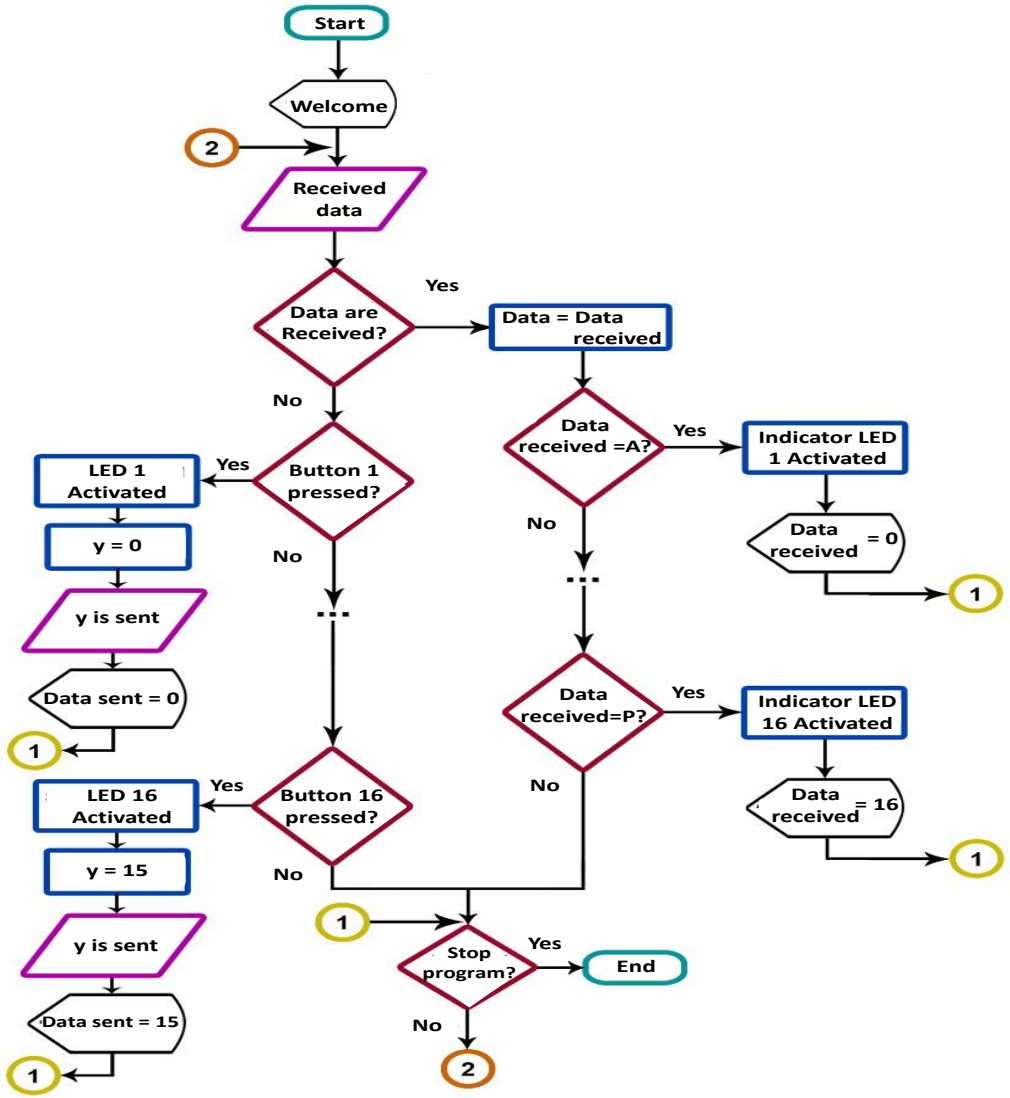


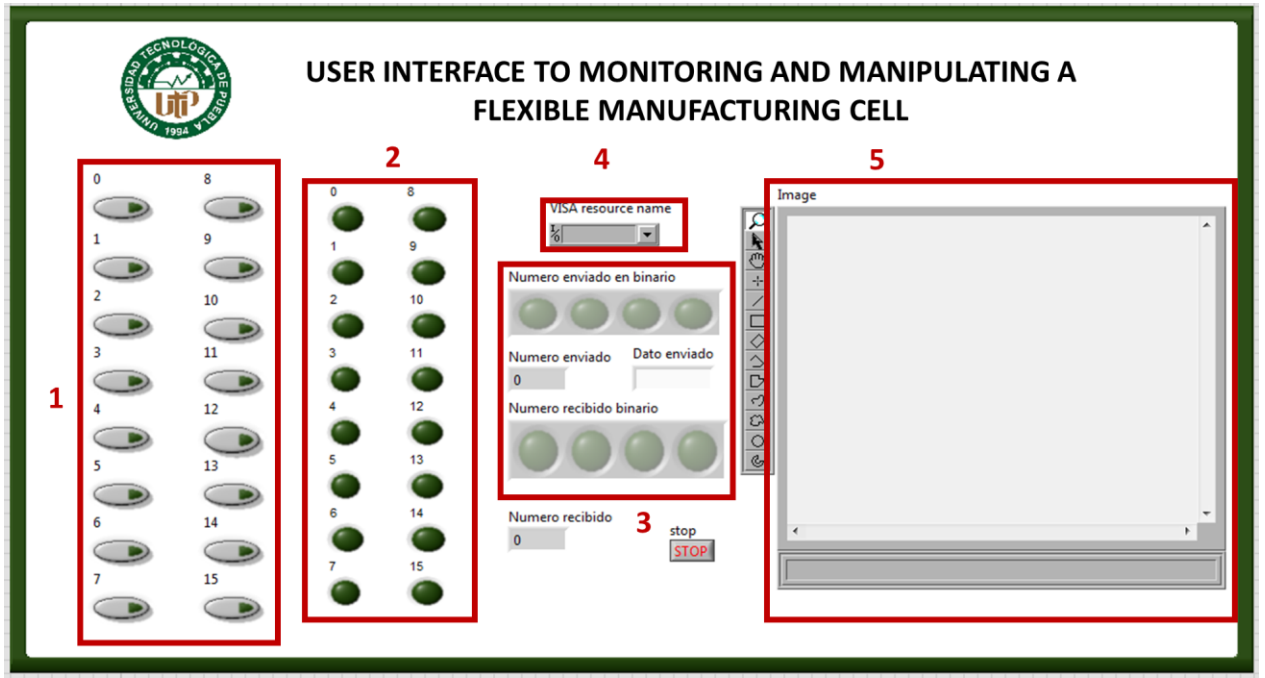


No.	Description
1	Input buttons
2	Output indicator LEDs.
3	Coders
4	Decoders
5	LCD 2x16 Display.
6	Microcontroller.
7	RS-232 COM port and virtual terminals.

Experimental Setup

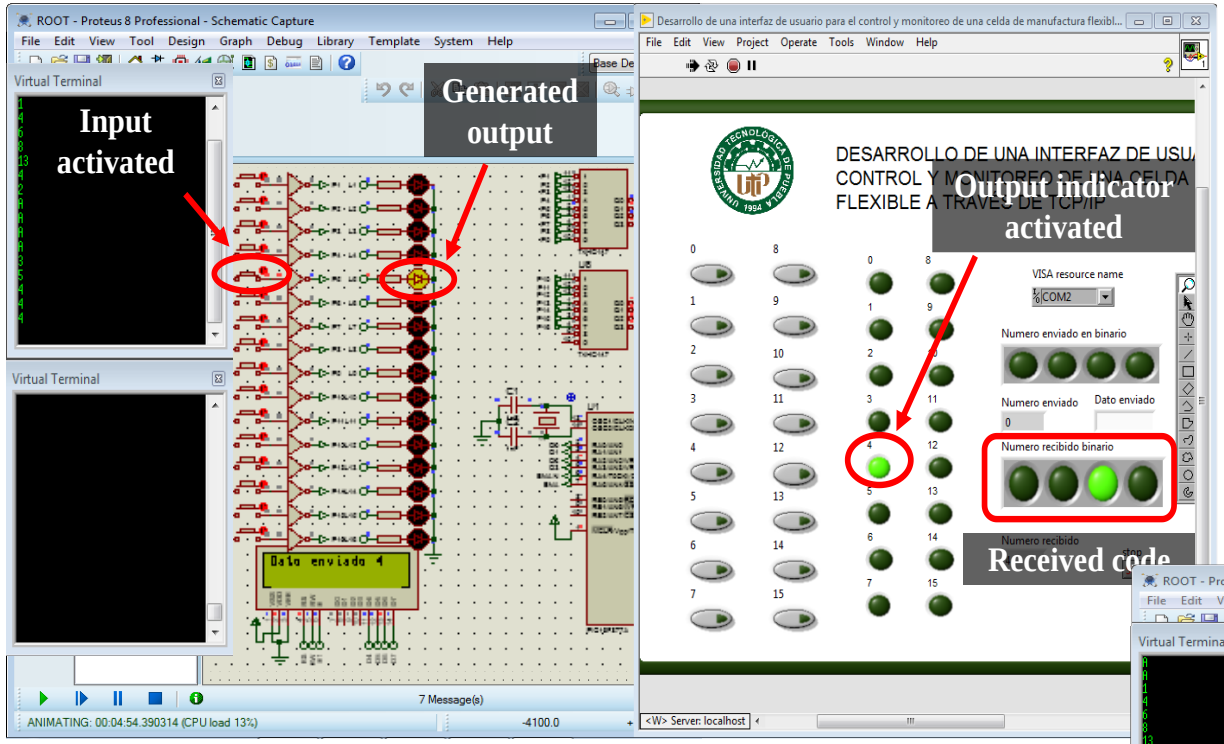
The software used to develop the user interface was LabVIEW, which contains the corresponding algorithm within the to communicate via RS-232 with the communications card.

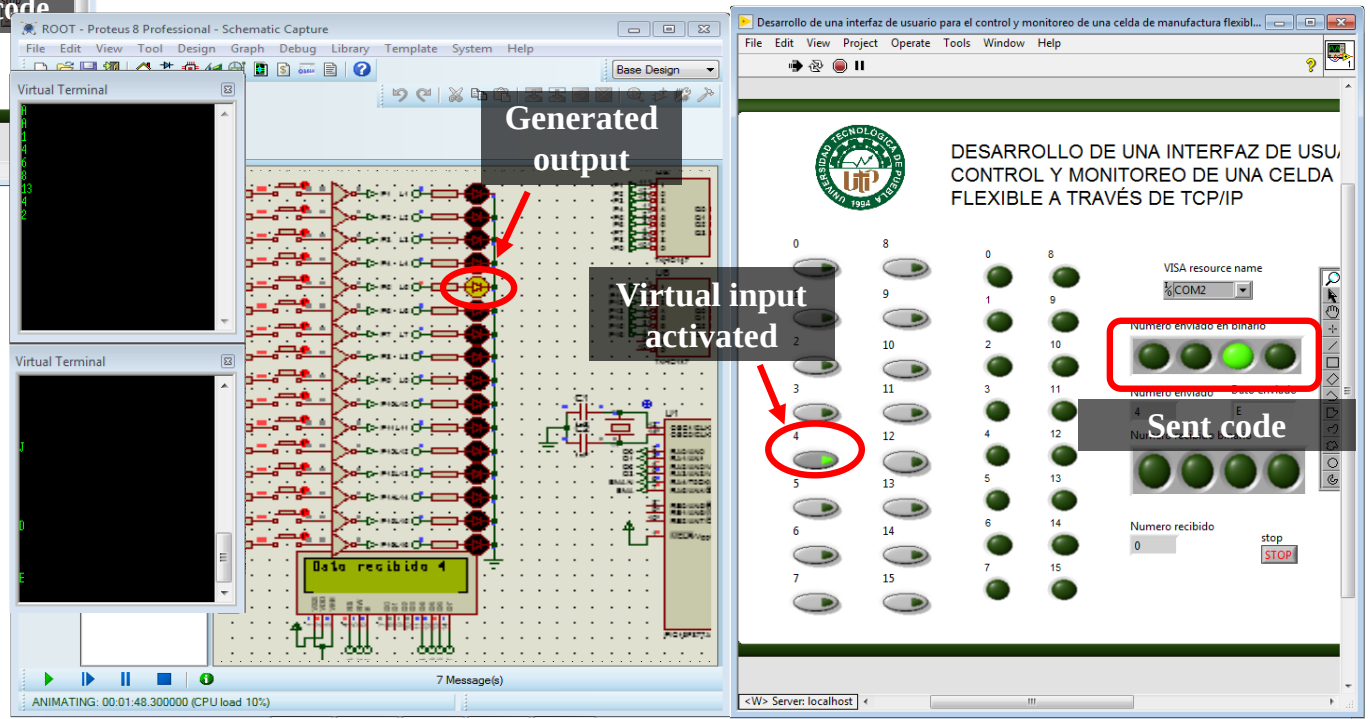




No.	Description
1	Buttons for writing data to the communication card to manipulate its outputs.
2	LED's indicating the data read.
3	Data code read (0 to 15) from the communication card.
4	RS-232 serial communication port selector.
5	Image indicator captured by the camera for visualization and monitoring of the process.

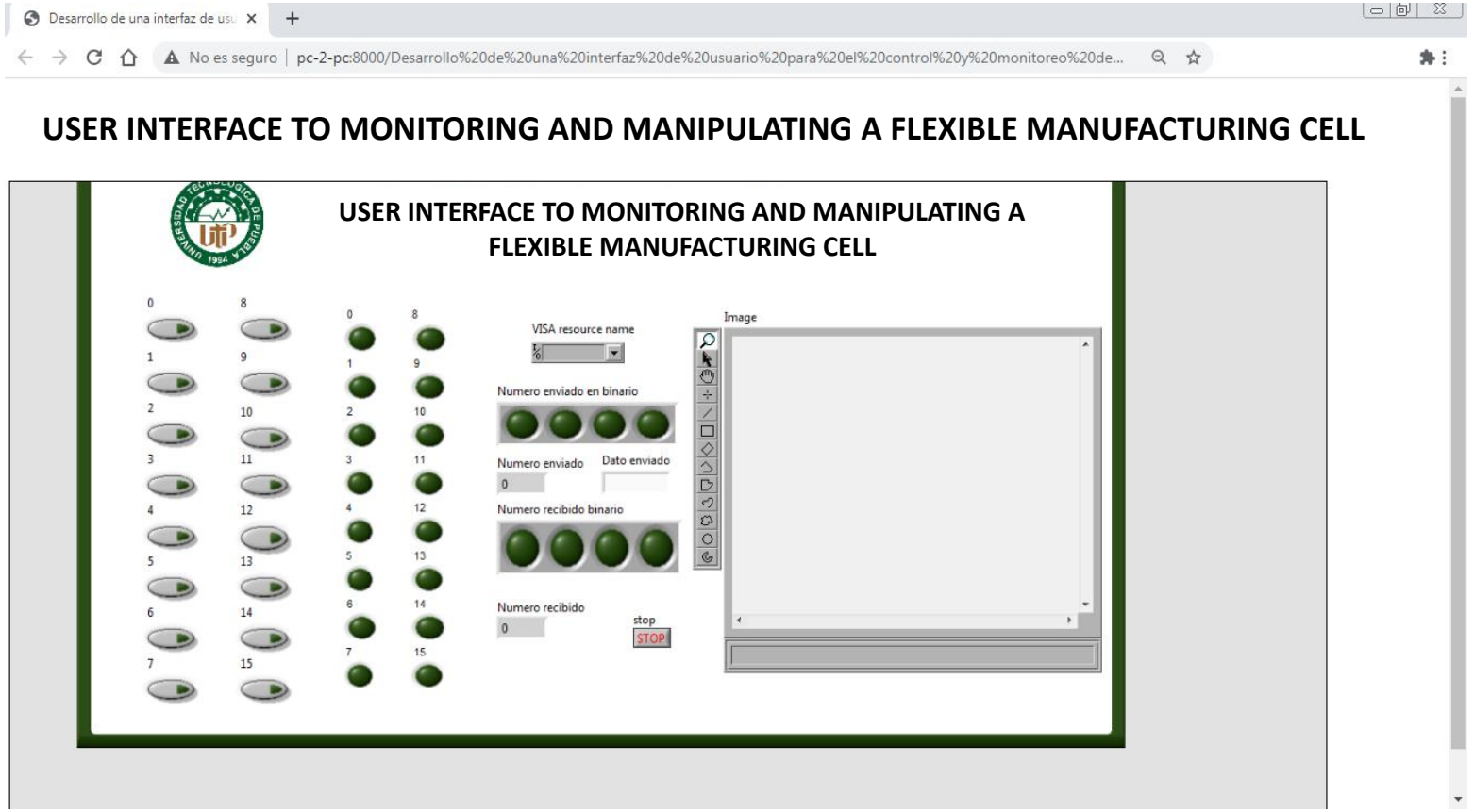
Results


Input activated
Generated output
Output indicator activated
Received code
Data enviado 4
DESARROLLO DE UNA INTERFAZ DE USU
CONTROL Y MONITOREO DE UNA CELDA
FLEXIBLE A TRAVÉS DE TCP/IP
VISA resource name
COM2
Numero enviado en binario
Numero enviado
Dato enviado
Numero recibido binario
Numero recibido


Generated output
Virtual input activated
Sent code
Data recibido 4
DESARROLLO DE UNA INTERFAZ DE USU
CONTROL Y MONITOREO DE UNA CELDA
FLEXIBLE A TRAVÉS DE TCP/IP
VISA resource name
COM2
Numero recibido
stop
STOP

Results

Finally, the interface was published on the internet using the LabVIEW Web Publishing tool. For our purposes, the monitoring mode was used, where the working process can be remotely observed.



Conclusions

A system to control a flexible manufacturing cell which can perform a certain process communicating workstations such as an industrial robot and a machining center has been developed.

Since there is no protocol compatibility, the communication was performed through the development of a communication card between the workstations execute a sequence of a certain process.

Moreover, this system can activate such sequence from a computer using a user interface, where it is also possible to activate inputs and outputs of the card manually from the computer. To monitor the system, a camera has been integrated to the system to observe the process.

Future work

Given the current health circumstances, this project, was only implemented at a simulation level. The physical implementation of the project is at construction level. In order to install and execute the system, it is being implemented this work using the corresponding elements for the integration of a Flexible Manufacturing Cell, which is the future work to be developed.

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