

# PIC CONTROLLER BASED PROCESS CONTROL SYSTEM USING GSM

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**Abstract:** Devices with microcontroller are widely used in industrial field. We use network interface for connecting more than one device for parallel control. Here we present a design of PIC controller based embedded RS 485 interface. In this design the RS 485 module can be converted into network interface to obtain connectivity with the device. The design mainly consists of process control unit, RS485 communication module and GSM communication module. In the design the data can be transmitted from industrial device to process control unit and also data can be transmitted on mobile through GSM modem, when administrator requests for data. All the machines are authenticated by the administrator, using a password; administrator can control all the process of machines.

**Keywords-** PIC microcontroller, SPI, RS 485 interface bus, GSM modem, RS 232.

## I-INTRODUCTION

With the development of network technology and communication technology, the need that industrial control can be completed via network or wireless n/w has become a trend. In traditional industrial control system or data acquisition system, the structure that one host connects multiple serial devices through multiport serial cards is adopted. The task of host is to communicate with each industrial device, process data and interact between the operator and host computer. This structure is feasible in the case of fewer devices, lower transmission rate. But when a host needs to connect more serial devices at the same time with higher transmission rate and the data processing is more complex, the system performance is poor. In addition, these serial devices connect .The same host may be geographically far and this will increase the length of wiring and drop communication quality. So a solution need be found to realize the communication between industrial control devices and RS 485 bus. As the embedded system itself has the performance of network and human-mobile interaction, it is possible that the embedded system replaces the previous control method. So our project is based on the design of PIC controller based embedded RS 485 interface is presented .In the design the RS 485 module can be converted into n/w interface. In our project we are control the process of the three machines like ADC machine, RPM measurement and temperature measurement. Each machine is connected to the microcontroller itself. All devices are connected through bus topology. Assign one device is main unit and main unit is connected to the PIC controller (Process unit) through SPI interface. With the process control unit which collect

the data from all machine through RS 485 communication and can be sent to the mobile through GSM modem. Where the mobile is an administrator. All the process can be control by local user or mobile user.

## II-SYSTEM DESIGN

The main purpose of the design is to make traditional monitoring and controlling system have the capabilities of remote monitoring or data transmission by introducing Rs 485bus and SPI. In the design, structured modular design method is adopted and the system is mainly composed of SPI, Controlling Unit, GSM module and RS 485 interfacing bus, as shown in Fig. 1.

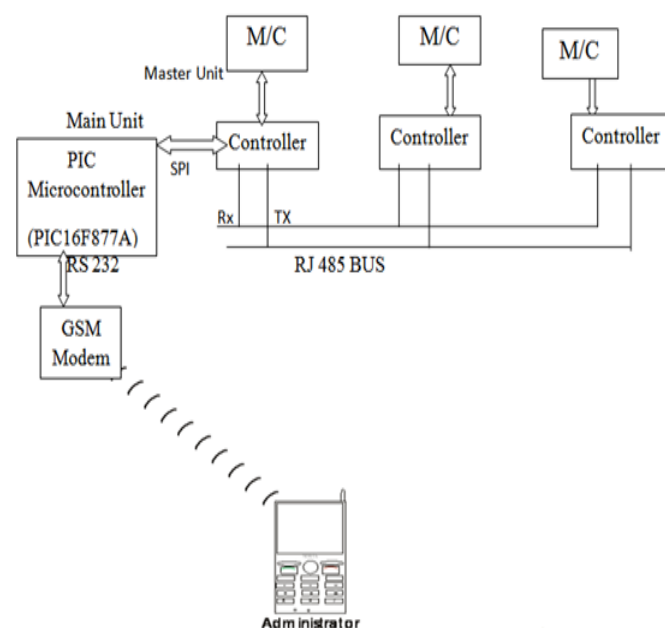


FIG. 1 SYSTEM STRUCTURE

SPI communication is the interface between control processing unit and Master unit. Its work is to receive data form RS 485 unit and then transmit them to the microcontroller PIC 16F877A.

Processor control module is the core part of the design, in which the PIC chip PIC16F877A is used to complete the

complex operations and receive a lot of data from RS 485 as a slave. In the module, data link between SPI port and RS 485 interface bus is established, SPI data stream format is specified, the transmission rate between serial data stream and data packets is controlled and data packet is received from master unit and sent to the GSM modem through RS 232 communication.

The MAX485 is low-power transceivers for RS-485 and RS-422 communication. The IC contains one driver and one receiver. The driver slew rates of the MAX485 is not limited, allowing them to transmit up to 2.5Mbps. These transceivers draw between 120 $\mu$ A and 500 $\mu$ A of supply current when unloaded or fully loaded with disabled drivers.

In the GSM module, it received data form control unit through RS 232 and sent to Mobile user through wireless communication.

The mobile user is an administrator; it received or sent the data to all machines by the unique ID of machines.

### III.COMUNICATION MODULE DESIGN

#### A. SPI Interface

SPI interface is used to realize synchronous serial data transmission between Control unit and master unit (all machine through RS 485 BUS) all devices by way of Half-duplex communication. Its data transfer rate is up to several Mbps. SPI interface works in master-slave mode and it includes four signals: *SCLK*, *MOSI*, *MISO*, and */SS*. *SCLK* is the common clock in the entire SPI bus, *MOSI* is the master output, slave input, *MISO* is the host input, slave output and */SS* is used to mark slave., slave input, *MISO* is the host input, slave output and */SS* is used to mark slave. In two devices which communicate with each other via SPI bus, the slave is low level and host is high level in */SS* pin.

The interface circuit of PIC16F877A and master unit shown in Fig. 2. Through the SPI interface, the maximum transfer rate achieves 2Mbps which meets the majority of applications. Master unit reads input data at rising edge of *SCLK* and reads output data at falling edge of *SCLK*; the 00 pattern of PIC16F877A is selected. So the data outputted from master unit.

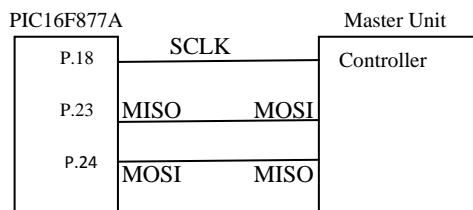


FIG. 2 SPI INTERFACE BETWEEN PIC16F877A AND MASTER UNIT

#### B. RS 485Interface bus

In the RS 485 interfacing bus, the collect data from all machines are sent to mater unit and collect the data from control unit then sent to the all machines. The RS 485 interfacing bus is performing the all process according to the Control unit Command.

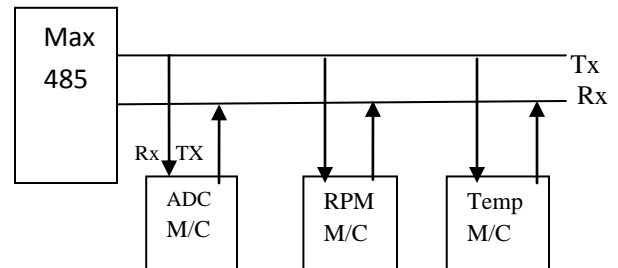


FIG.3.RS 485 BUS INTERFACE

### IV. SOFTWARE DESIGN

#### A. PIC.C Transplanting

For the transplanting of Embedded C code, its main task is to re-write the codes which are associated with the processor and compiler [3], the codes include the following: redefinition of compiler-related data type, interrupt-switching code, stack, the initialization functions for task stack, task-switching function and so on. The transplanting is completed in the following environments: the compiler tool is PIC 16F877A for PIC microcontroller. All the code is design for project we are used MPLAB IDE Tools V8.70. The coding is design in Embedded C code is Compiling by PIC.C compiler.

#### B. Data Transmission

In order to transmit the data from RS 485 to SPI serial, two system tasks are established in PIC.C. One is to receive front-end data through SPI interface and the other is to transmit data to RS 485.

1) SPI receiving task: For the case that the data are transmit to GSM modem, the data which have been arrived at SPI port are stored into SPI sending buffer and packaged according to format and then are sent to the PIC controller and then convert to the GSM modem then transmitted to mobile User.

2) RS 485 receiving task: In the RS 485 task, in order to receive the data from master unit in the system, the data are distributed to Rs485 bus. All machines are received data from bus then according to massage the machine check the own address if address is same the receive massage and perform task otherwise ignore the massage.

### V-SYSTEMS TESTING

After the software and hardware designs have been completed, the ultimate generated codes are compiled and downloaded in microcontroller for testing. The codes include hardware system startup code, In the testing, GSM modem is connected to PIC controller through RS 232. RS 485 interface bus unit and controller unit are connected by SPI. After connecting all hardware then taken some reading, and identify show that the Communications from both sides are successful, and also form that administrator control all the devices through mobile easily.

## VI-CONCLUSION

In order to transmit the data from an existing device with SPI interface to network, an embedded Ethernet interface based on PIC controller is designed. On the basis of hardware platform, Embedded C (PIC.C) is transplanted into the microcontroller PIC16F877A and the SPI serial data and RS 485 data packets can be converted to each other by software programming.

For traditional serial devices, the design provides an effective implementation to connect RS 485 and SPI serial interface with GSM. After the design an administrator can control all the industrial devices with the help of mobile. This design can be used widely in control system in industry.

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