REMOTE CONTROL OF WATER PUMP STATIONS WITH MICROCONTROLLER

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Key Words: Remote Control, PIC16F84, Pump Stations

ABSTRACT

In this study, remote control of three different pump stations using 16F84 microcontroller is implemented. At main point PC with an external modem is activated C programming language. At remote points PIC 16F84, another external modem are required for asynchronous communication. Both sides can call each other to sent status information. With this system remote control of water pumping stations can be activated.

I. INTRODUCTION

A remote control system for pumping stations is implemented by means of an asynchronous communication system. In large rural areas there are a lot of pumping stations which requires to tackle growing operational costs. It is related reduce energy costs and on-going technical monitoring of the process or equipment.

In order to solve these problems a remote controlling system for pumping station operations is implemented with low cost microcontroller system. It rationalizes the technical supervision, provides new solution for monitoring water pumping stations by enabling remote controlling.

II. REMOTE CONTROL SYSTEM

The system is run from a stationary PC and phone line. In remote side, it is used a microcontroller (PIC16F84). It consists of all peripherals such as memory, I/O ports, timers, and it is cheaper, more economical, simple, and easy to control compare to microprocessor units. PIC16F84 microcontroller contains 35 instruction sets, with 1024 program memory [2-3]. Communication with remote parts of the system is based asynchronous data transmission protocols. In each frame of data transmission start bit, control characters and stop bits are added. Start bit is always one single bit but the number of stop bits can be one or more.

Control commands are data in length of eight bits. Data transmission starts with start bit, then from D0 (LSB) to D7 (MSB) bits send sequentially. Finally to stop bit is included. Data transmission rate is set by means of software (usually 2400 bps) on a central computer. The communication speed, length of data, the number of stop bits should be same on transmitter and receiver parts. In communication, RS232 serial interface standards are used with UART transmission. In this standard, all pins in RS232 port are used as shown in Table 1.

Table 1 RS232 pins and their functions [5]

Shortening Name	Name
TD	Transmit Data
RD	Receive Data
CTS	Clear to Send
DCD	Data Carrier Detect
DSR	Data Set Ready
DTR	Data Terminal Ready
RTS	Request To Send
RI	Ring Indicator

III. WORKING PRINCIPLES OF SYSTEM

The main task of the system is data flow control between PC side and microcontroller sides to eliminate human interactions and provide data sharing (see figure 1). On PC side there is very low configured computer connected to telephone line by external modem. The voltage level of both sides is different. In PC RS232 voltage level is around ±3-25 volt, on m C side it is in TTL level. For level conversion it is necessary to use totally 3 units MAX232 converters IC. There must be used buffer to increase data transmission reliability. These buffers are already in those chips [4].

Initially, DTR pin in PIC set to active (logic zero) then DSR pin in modem must be active. PIC16F84 sends data

to modem made RTS pin active (RTS output pin become in logic zero). After checking CTS pin whether active or not, if so, modem ready to receive data. PIC starts to send data from TxD pin and on the other side modem receive from RxD pin. Whenever stop bit is send it ends. Data transmission sequences are as follows.

Send START bit
Wait 417 m seconds
Send LSB bit
Wait 417 m seconds
Send second bit
Wait 417 m seconds

……

Send STOP bit after MSB bit
Wait 417 m seconds

Thus, one byte data has already sent to modem. Modem implements ringing, answering or internal settings using AT commands. Remote side is ringed or answered. Whenever handshaking is realized, both sides are ready to send or receive data by repeating steps given above. In the system there are two m C. One of them is for data receiving other is for transmission. In the system 3 pump stations are remotely controlled by using 6 instruction commands (8 bit length). System is only send status information on first connection. For microcontroller side system circuit diagram is shown in figure 2

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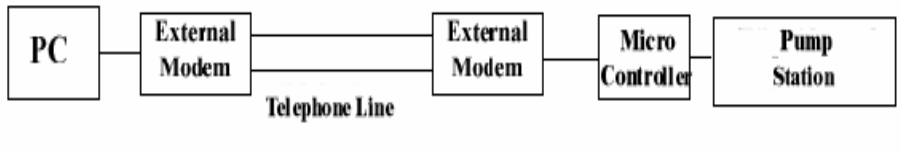

Figure 1 Block diagrams of remote control system

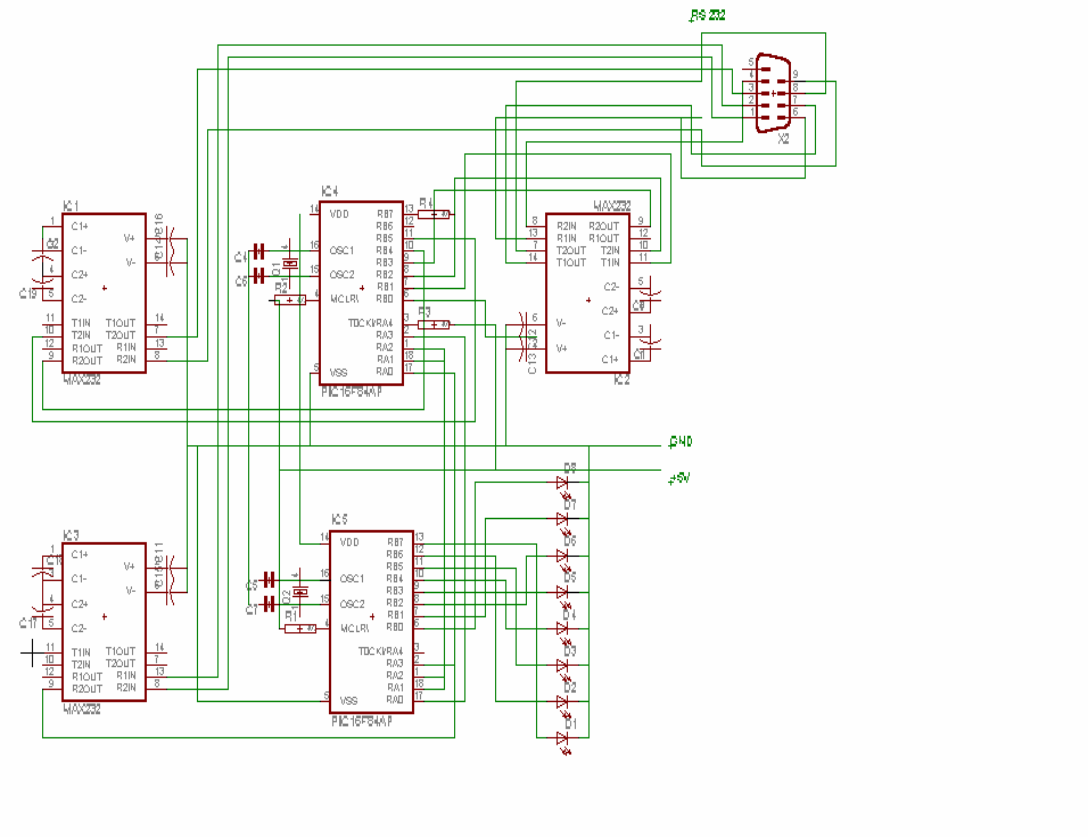

Figure 2 Circuit diagram of PIC16F84 microcontroller

IV. CONCLUSIONS

In this study, using low configured, cheap PC, and external modem three different pump stations are remotely controlled by commonly used microcontroller PIC16F84.

The number of controlled nodes can be increased by using a m C which have more input-output pins. Using GSM modem and cellular phone mobile communication can be implemented with sending back SMS information to center or mobile maintenance team to take any action. This initial study is still useful at the stage of designing to control of remote devices. It can be included database support to automate data logging, or periodic activation of system can be provided by software changes.

REFERENCES

1. Hartman M., et all : "Water Pumping Stations Remote Control System in depression Areas Based GSM-900 Cellular Communications System" Modern Problems of Radio Engineering, Telecommunications and Computer Science, 2002. Proceedings of the International Conference , 2002 Page(s): 291 -293
2. http://www.antrak.org.tr
3. http://www.microchip.com
4. Morston RM., "Digital Logic IC Pocket Book", Newness,1996
5. Dinçer G. Her Yönüyle Seri Port, Era Bilgi Yay.,1999