International Journal of Applied Engineering Research
ISSN 0973-4562 Volume 10, Number 3 (2015) pp. 6103-6111

http://www.ripublication.com

Wireless Control Of Industrial Process Using RF Signal

T.Thaj Mary Delsy

Assistant Professor, Department of EIE
Sathyabama University
Chennai, Tamilnadu, India
delsykennedy@gmail.com

Abstract

Panel control instrumentation is one of the most adopted techniques in large industries. The control panel instruments like switches and monitors are connected to the processor through wires .These wires are used to transmit the measured variable from processor to control panel and process variable from control panel to the processor. There is a possibility of loss of data when there is a discontinuity or water clog in underground wiring during rainy seasons. This may lead to improper process.
In order to overcome this, radio frequency waves are used to transmit the signal to the process plant from the control panel. In control room of the industries, personal computer is connected with the level converter and RF transmitter. In the process plant we have RF receiver, process device and the processor like pump, blower. This project can control the pump which is used in the oil industries and Blower which is used to reduce the heat of the heater.

Key words — RF signal, panel control, Pump, Blower.

I. INTRODUCTION

Wireless control of industrial process is a correct solution to avoid the losses of data in the receiving end. Many literatures reveal the capability of RF based control of industries.[1,2].This paper deals the wireless control of basic industrial process like pump, blower, etc. The setup consist of RF transistor and receiver module in which the RF receiver is connected with the process like pump and blower in the process area. The RF transmitter it connected with the PC in the control room for away from the process area, distance between the process station and the control room is about more than 100m.The control program is written in turbo C. The Signal is given into the transmitter by pressing the corresponding key in the keyboard and received in the

receiver end. The commands like number1, number 2, number 3, etc given in the PC, which is corresponds to on, off, provide time delay etc.The number 1 is given then the pump get on, number 2 is corresponds to pump off stage of the pump, number3 is corresponds to blower on , number 4 is corresponds to blower off and so on.

II. CONTROL ROOM AND PROCESS STATION MODULES

The functional Blocks available in the RF transmitter module is PC with C language, Level converter, RF transmitter and RF receiver, Controlling Device, Microcontroller, Pump, Blower **.** Figure 1.1 denotes the basic blocks of the control room circuit and figure 1.2 represent the modules in the process station. The output from the PC is giver to the level converter circuit by RS232 cable. The level converter converts the PC data into a data which is suitable for the transmitter ie, it converts +/- 9volts in to 0-5 volts TTL level. The level converter output data is transmitted by the transmitter of 433MHz which is operated in AM mode. In receiver side ,for this project 433MHz receiver is used for receiving a data of character string. This data is fed in to the micro controller; here the received data is compared with the program that is present in the microcontroller. According to the microcontroller output the relay gets controlled, it will control the device which is connected to it. Here BASCOM software is used for the microcontroller programs.

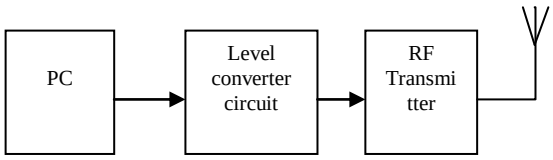

Fig1.1: Different modules in the control room

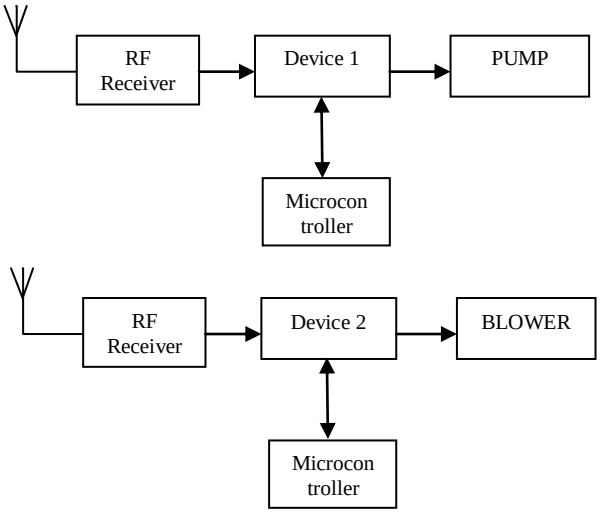

Fig:1.2 Different modules in the process station

III. CIRCUIT REPRESENTATION OF THE TRANSMITTER AND RECEIVER MODULES

The circuit is controlled by a PC through the com port 1 Set to 2400 baud rate. Here PC controlling software is returned in Turbo C is used for select the command like, device1 on,device1 off, device1 on,device2 off ,etc. In this project we can operate 2 remote circuits. This can be expanded in to an unlimited remote circuitary .A 9 pin to 9 pin 3 way cable (RS232) is used to connect the PC to this circuit.RS232 data from the PC is connected to Max232 IC ,it converts the RS232 data into Transistor-Transistor Logic level ie, it converts +/- 9 volts into 0-5volts.The transmitter line of the Max 232 is connected to the 433MHz transmitter module. The transmitter transmits the string of data. Here one red led is connected in transmitter; it indicates data transmission is in progress. The transmitter module operates at 433MHz in AM mode. In this circuit we are using IC7805, it converts 12volts into 5volts that is suitable for power ON the circuit.

The receiver circuit receives the data that is sent by the transmitter, decoded and switch on or off the relay remotely. The receiver circuit is controlled by a micro controller Atmel 89c2051 with a crystal frequency of 11.0597MHz.Pullup 10K resistors are used on both the ports P1 and P3.A reset switch is used for external reset. For serial transmission pin 3.0 is connected to RF module which operates at 433 MHz that has a range of 100 meters.

The microcontroller transmit pin is in normally inverted logic, so we use inverting buffer 4049 to set right the problem. The software in the microcontroller constantly checks for incoming data, if this data is applicable for device1 or device2, the circuit instantly switch on or off a relay that can be connected to a main power electrical device.Port1.0 is used to drive a 12V relay through a transistor 2N2222 that energies the relay coil. The microcontroller does not have sufficient power to drive a transistor directly, so here we use a buffer and a single transistor. A similar buffer, transistor combination is used on port1.1 to derive a12V buzzer. The buffer is used to give a short beep for ON condition and two short beeps for OFF condition.

The circuit can be made to drive up to 10 devices without any major change in the circuit. The software can identify the device code and turn it on/off .

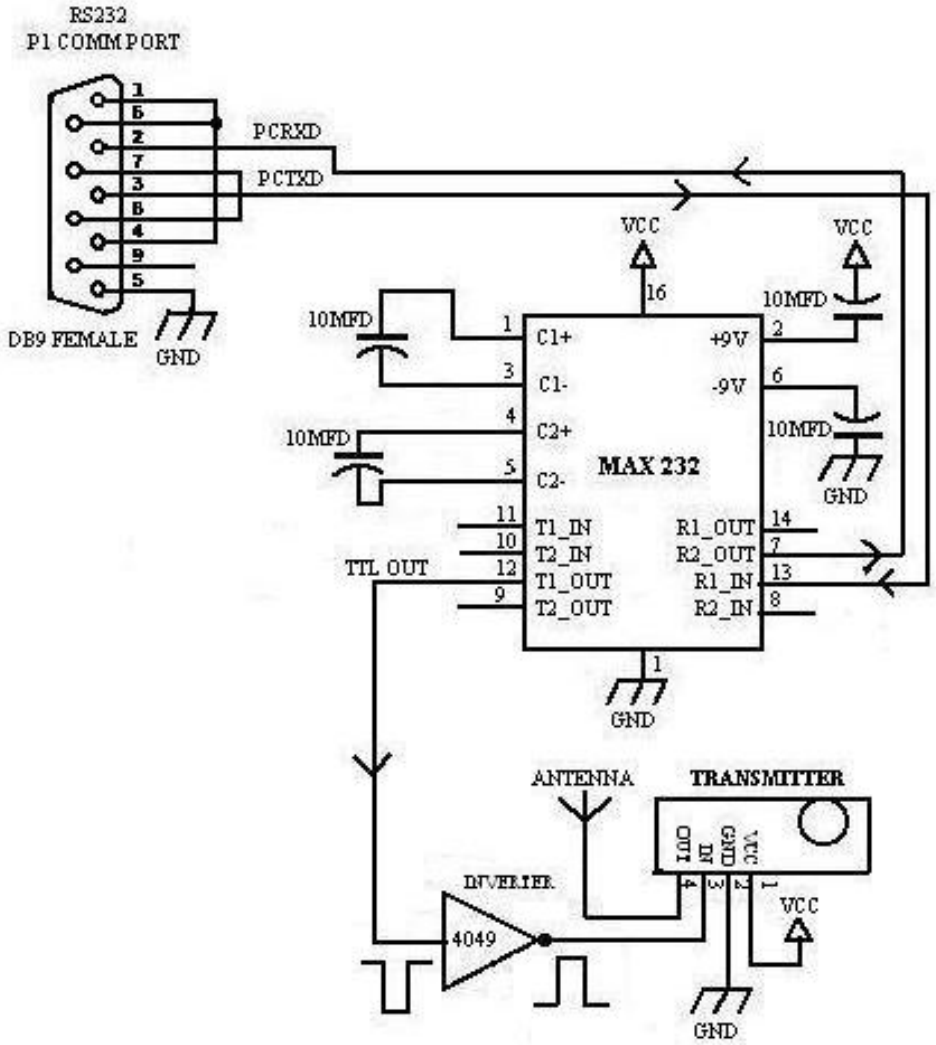

Figure 3.1 circuit involves the connection of various components in the transmitter module in the control room

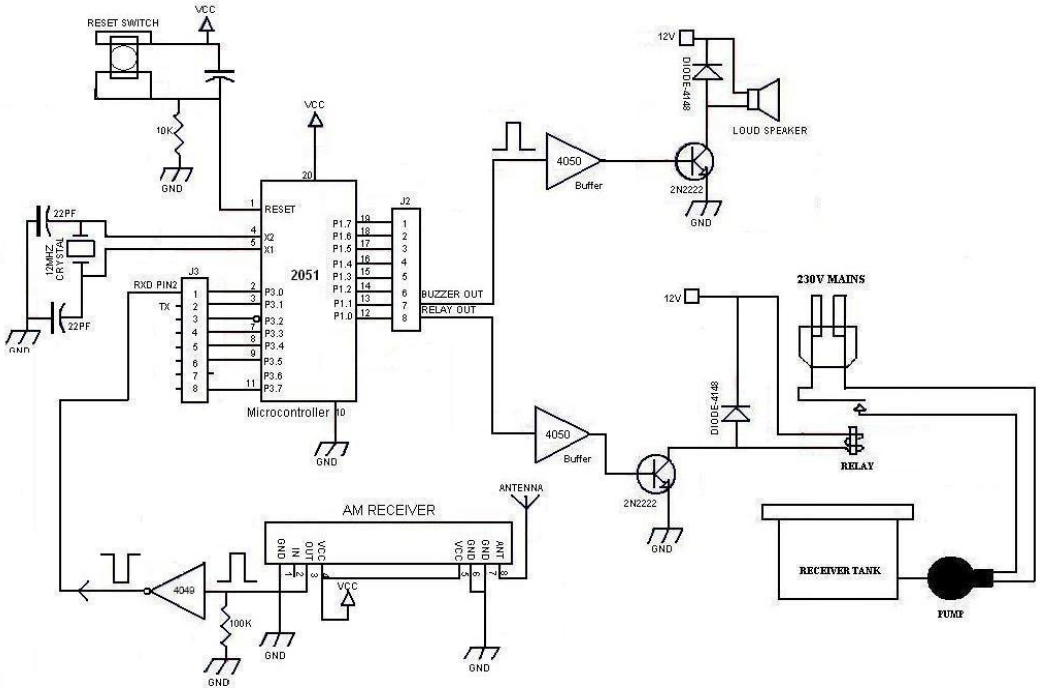

Figure 3.2 circuit involves the connection of various components in the receiver module for the Pump

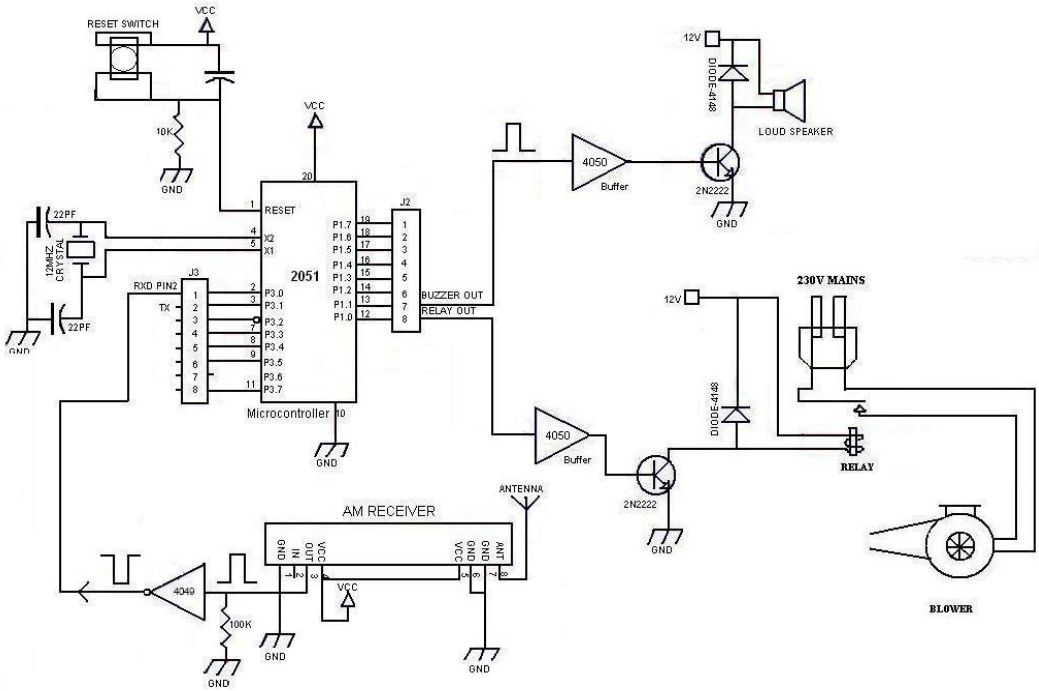

Figure 3.3 circuit involves the connection of various components in the receiver module for the Blower

IV. DESCRIPTION OF THE VARIOUS COMPONENTS INVOLVED IN THE DESIGN PROCEDURE

The 9 pin to 9 pin 3 way cable is used for the connection between the PC and the module. The pin description is given as follows .Pin 1 is the Received Line Signal Detector (CD), pin 2 represent for Transmitted Data (TxD), pin 3 for Received Data (RxD), Pin 4 is meant for DTE Ready (DTR), pin 5 represent the ground, pin 6 is DCE Ready (DSR), pin 7 is for Clear to Send (CTS), pin 8 is Request to Send (RTS), pin 9 is for Ring Indicator (RI).

The Max232 level converter is a standard serial interfacing for PC and rs 232c. It is work in the negative logic, that means logic 1is (-3 to -12)V and logic 0 is (+3 to +12)V. It contains four sections , the first section is dual charge-pump DC-DC voltage converters, second one is RS-232 drivers, third is RS-232 receivers, and fourth and final one is receiver and transmitter enable control inputs.

Inverting Buffer IC 4049 named as HEF4049B it provides six inverting buffers with a high current output capability require to drive the TTL or high capacitive loads. The buffers are also used to convert logic levels of up to the voltage of 15 V to standard transistor-transistor logic levels. The non inverting buffer namely as IC 4050 called HEF4050B provides six non-inverting buffers with high current output capability is used to drive the TTL or high capacitive loads. The microcontroller 2051 is one of the 20 pin version of the 8051. The AT89C2051 is a low-voltage, CMOS 8-bit microcomputer with 2 Kbytes of Flash programmable and erasable read only memory (PEROM) which provide the high performance. The device is manufactured using Atmel's high density nonvolatile memory technology and it is matches with the industrial standards. A versatile 8-bit CPU is combine with flash on a monolithic chip, the Atmel AT89C2051 is a suitable microcomputer. The AT89C2051 is used to provides a highly flexible and cost effective solution to many of the embedded control applications. The standard features of this is flash memory of 2 Kbytes , RAM capacity of 128 bytes, 15 Input / Output lines, two number of 16-bit timers and counters, a five vector two-level interrupt architecture, full duplex serial port, the precision analog comparator, and the on-chip oscillator and clock circuit. In addition, the AT89C2051 is designed with static logic for operation down to zero frequency and supports the software in the selectable power saving modes. The operational features of the 2051 is fully Static Operation in the frequency limit 0 Hz to 24 MHz , the two level Program Memory Lock , the internal RAM is of 128 x 8 bit , 15number of Programmable I/O Lines , 2 number of 16-bit Timer/Counters , Six Interrupt Sources , Programmable Serial UART Channel , Direct LED Drive Outputs , the On-chip Analog Comparator unit , the Low power idle and Power down modes. The 7805 is the voltage regulator, where a semiconductor regulator can be used for a high voltage and a fixed output of 8v and 9v designs are made. The common 7805 is a 5v -1A regulator can be wired to give other voltages. In the standard circuit, the common terminal is goes straight to the ground and the output is 5v. The frequency of the AM transmitter and receiver is 433MHz. The simplest versions of SRDs are rely on an amplitude modulated transmitter and an associated regenerative receiver. The such systems are probably no longer allowed under RA specification MPT 1340. The transmitter used in the setup is consists of a one number of transistor oscillator. When

the data signal is apply to the base of the transistor then the modulation created. The frequency is determined by a single surface acoustic wave resonator element. It is biased to act as a regenerative oscillator, the received antenna signal causes the transistor to switch to high amplification, so that it automatically arrange the detection of the signal. After. The raw demodulated signal is amplified and shaped up by operational amplifiers. It produce the fairly clean digital signal at the output of the receiver. The high level logic is at about 2/3 of the supply voltage that is lie between 3V and 4.5 V.

V. ALGORITHM AND FLO W CHART

The algorithm of the process is follows

Step 1: Initialization of COM port 1
Step2 : Check the device status on/off
Step 3: Enter the number option from 1 to 4
Step 4: 1 corresponds to pump on
Step 5: 2 corresponds to pump off
Step 6: 3 corresponds to blower on
Step 7: 4 corresponds to blower off
Step 8: Stop

Initially the status of both pump and blower is checked, like whether the processor is on or not. The process operation can be reversed by means of an external option given by the PC ie, if pump is on then can be turn it off by giving option 2,if the pump is off then turn on by giving 1 , similarly option 3 or 4 is for on or off the blower in the process plant.

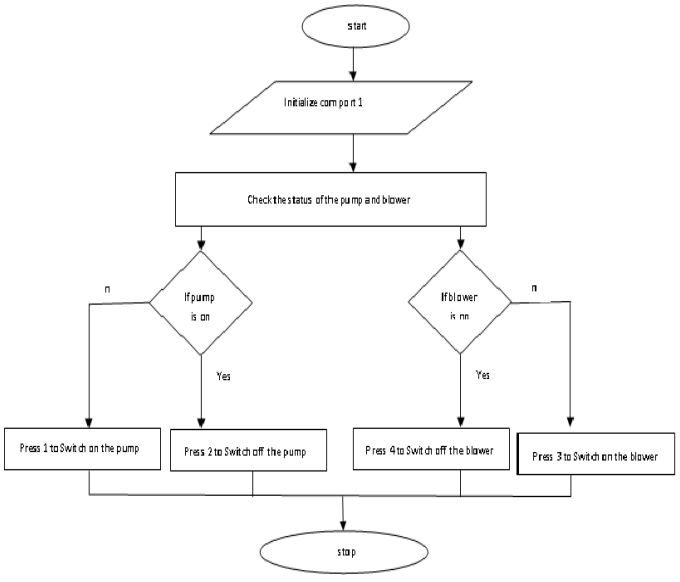

Figure 4.1 Flow chart of the process operation

VI. RESULTS AND DISCUSION

The following contents shows the results which display in the PC

Enter your choice : 1
Status :Pump is ON
Enter your choice : 2
Status :Pump is OFF
Enter your choice : 3
Status :Blower is ON
Enter your choice : 4
Status :Blower is OFF

When the PC on ,it ask for the choice, based on the status available on the screen and the data we can retain the status or change the status by entering the number between 1,2,3 or 4. The given number is transmitted using transmitter and in the other end it is received by the receiver and compared with the data entered in the program of the microcontroller. The microcontroller activate the respective port which will control the relay.

VII. CONCLUSION

Hence the wireless control of Industrial process setup that has been discussed in this project is a hand held device which consists of two circuits namely the RF transmitter module which is in control room and connect with the PC and the RF transmitter module which is placed in the process station and connect with the Electrical device. According to the requirement the transmitter is sent the character string of data, which is selected by the user by computer, the data like device 1 on,device1 off ,etc,. This data is received by the receiver and the data is compare with the data that is present in the microcontroller and the corresponding delay gets activated and it will control the processor which is connected with the relay.In the single setup itself we can control 8-10 electrical devices. With the help of this project we avoid the problems that can cause by the cable control.

REFERENCES

[1] Worapot Jakkhupana, Somjit Arch-inta, Yuefeng Lib, (2011), 'Business process analysis and simulation for the RF and EPCglobal Network enabled supply chain: A proof-of-concept approach', Journal of Networkand Computer Applications, Volume 34, Issue 3, Pages 949–957 .

[2] Wei Feng, (2011), 'Multi-product manufacturing systems with sequence-dependent setups: Performance evaluation and system properties', Automation Science and Engineering (CASE), 2011 IEEE Conference on Beijing, Pages 303-368.

[3] H Ramamurthy, X. Y. Su, B. S. Prabhu and R. Gadh, "A generic wireless transducer interface", US Patent Disclosure, UCLA Case No.2005-245-1 .

[4] H. Ramamurthy, B. S. Prabhu and R. Gadh, "Application of generic reconfigurbale wireless interface for industrial automation scenarios", US Patent Disclosure, UCLA Case No. 2006-002-1 .

[5] U.S. DOE, "Industrial Wireless Technology for the 21st Century" – Report, Technology Foresight, Winter 2004/ TF-2004-1.

[6] S. M. Khaled Reza., Shah Ahsanuzzaman Md. Tariq., and S.M. Mohsin Reza., "Microcontroller Based Automated Water Level Sensing and Controlling: Design and Implementation Issue", Proceedings of the World Congress on Engineering and Computer Science, Vol .,pp.1-7, 2010.

[7] Melaty Amirruddin., Nurhakimah M. Mukhtar., Hana A. Halim., and Nur S. Noorpi., "Microcontroller Based Water Level Indicator Using GSM Modem: Design and Application", 1st International Conference on Future Trends in Computing and Communication Technologies, pp.79-83, 2012.

[8] Yan Xijun., Lu Limei., and Xu Lizhong., "The Application of Wireless Sensor Network In the Irrigation Area Automatic System", International Conference on Networks Security, Wireless Communications and Trusted Computing, Vol.1, pp.21-24, 2009.

[9] Christian Reinisch., Wolfgang Kastner., Georg Neugschwandtner., and Wolfgang Granzer., "Wireless Technologies in Home and Building Automation", 5 th IEEE international conference on Industrial Informatics, Vol. 1, pp.93-98, 2007.