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Design And Development Of Rf Power Monitoring Unit

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Abstract: It aims an inventive plan to formulate a system based on AVR micro controller that is applied for observing the voltage, current and temperature of a distribution transformer in a substation and to guard the system from the rise in mentioned parameters. Affording the security to the distribution transformer can be achieved by closing down the whole unit with the assist of the Radio frequency Communication. Additionally the system exhibits the same on a PC at the central station which is at a remote place. it is capable of recognizing the break downs caused due to overload, high temperature and over voltage. The blueprint generally comprises of two units, one in the substation unit, called as transmitter and display unit, and another in the Main station called as controlling unit.

Keywords: PMU, U/VHF, RF, LAN, UDP

I. INTRODUCTION

Radio frequency (RF) is a rate of oscillation in the range of about 3 kHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals. RF itself has become synonymous with wireless and high-frequency signals, depicting anything from AM radio between 535 kHz and 1605 kHz to computer local area networks (LAN) at 2.4 GHz. However, RF has traditionally determined frequencies from a few kHz to roughly 1 GHz. If one takes microwave frequencies as RF, this range extends to 300 GHz. The mode of communication for wireless technologies of all kinds, considering cordless phones, are all around us. RF waves are electromagnetic waves which propagate at the speed of light, or 186,000 miles per second (300,000 km/s). The frequencies of RF waves, however, are slower than those of visible light, making RF waves imperceptible to the human eye. The frequency of a wave is decided by its oscillations or cycles per second. One cycle is one hertz (Hz), 1,000 cycles is 1 kilohertz (KHz). A station on the AM dial at 980, for example, broadcasts using a signal that oscillates 980,000 times per second or has a frequency of 980 KHz. A station a little further down the dial at 710 broadcasts using a signal that oscillates 710,000 times a second, or has a frequency of 710 KHz. With a slice of the RF pie licensed to each broadcaster, the RF range can be neatly divided and utilized by multiple parties.

1.1 PREFACE TO NAVAL TELECOMMUNICATIONS

When the wireless (radiotelegraph) was invented, the Navy saw a possible use for it. It could be employed for communications from shore stations to ships along the coast. In 1899, the beginning official naval radio message was sent from ship to shore. It only travelled a distance of 20 miles but that was a start. The next advance was in 1916 when the Navy first used radiotelephone between ships. Three years later the first airborne radio was used to communicate with a ground station. In the early years, communications was not the best because of poor tuning techniques. Receivers often did not pick up the signal. This problem was almost eliminated in 1931 when the first super heterodyne receivers were installed in the fleet. In1944, another significant event took place. The first victorious radio teletypewriter transmissions between ships were completed. The first successful use of radiophoto (facsimile) occurred in 1945 with the transmission of the surrender document signing that ended World War II. Naval communications has grown tremendously in size and complexity since then.

1.2 PREFACE TO POWER MONITORING UNIT

PMU is a part of the project of an advanced communication system for the Indian Naval Forces. The communication system provides quick and reliable ship to ship, ship to shore and ship to air communications over MF, HF, VHF and UHF bands. It also provides intercom for within ship communication with full signaling facility. Its centralized control and monitoring system allows remote logging of radio equipment, monitoring of radio usage, radio status and radio power. The system is made highly flexible so that it is configurable for all classes of ships and submarines. This system kept evolving along with the advancement in telecom and networking. The PMU enables any user connected to a network to access and monitor the forwarded and reflected power of the radio signals. Measuring RF power in a field environment can be a simple task which can be accomplished accurately and inexpensively. It can also involve a great deal of care and proper training to ensure equipment is accurately measured. Either way accurate field power measurements will ensure transmitting equipment is operating properly. This will guarantee broadcast coverage is being utilized to its full potential. The PMU is used to measure power signals in broadcast systems. It is used directly in line with the system being tested. Its output provides a linear DC voltage output from 0 to 5 volts allowing for a wide variety of interface options. Its in-line calibration capability allows for greater accuracy in a single application (with an accurate power reference) and its integrated non-directional coupler allows for signal analysis in minimal space requirements. A typical RF Power Monitoring and Overload Protection System comprises of Dual Directional Couplers to sense the Forward and Reflected Power, Detectors to convert the sampled power to proportionate dc voltage, signal conditioning and electronics to display the power in local and remote mode.

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II. PROPOSED SYSTEM

Majority of Naval communications are carried out through V/UHF and HF radios. For the communication to be successful, it has to be made sure that, voice from source end has reached the destination end. This is possible by tuning another radio with the same frequency as the sender and finding the output. But a better solution than this is to monitor the power from all radios and do the necessary steps so that the communication is successful. Also power monitoring is necessary when the communication is through the restricted areas. By monitoring the power, the frequencies used for communication are found out and the necessary steps to maintain secrecy and to avoid conflicts with other bands can be taken. So there is a great requirement for monitoring the power of the V/UHF and HF radios used in the communication system. Also people sitting anywhere in the network should be able to access the monitored power. For the same the data has to be send to the Ethernet.

2.1 METHODOLOGY

The proposed approach focuses on taking the analog signals from the radio, converting into digital form and sending the digital data serially out and further encapsulating it in UDP datagrams so that it can be accessed from anywhere in the network. Now in order to send it to the Ethernet, the serial data has to be encapsulated in User Datagram Protocol (UDP). For the same the serial data coming through the RS232 serial communication device is converted into UDP with the help of LABVIEW. One LabVIEW application will be running in the sender side and other in the receiver side. In the sender side through the program serial port is opened and the data is read from it and is written to a buffer. Next the UDP socket is opened and the data read from the port is written to the socket and afterwards the socket is closed after sending the datagram to the network. Now in the receiver this data is received. We only require those 16 bytes with start and stop bytes as 7Eh (where 7Eh is the start and end of the packet). So in the program this condition is checked and for the true cases the data is altered accordingly so that the power variations of 16 radios can be viewed through16 gauge meters anywhere in the network where the receiver Lab VIEW application is running.

III. SYSTEM DESIGN

The PMU enables any user connected to a network to monitor the forwarded and reflected power of the radio signals. It is capable of converting power in its Analog form into a Digital data and then to transform this data in such a form that it is available in a network.

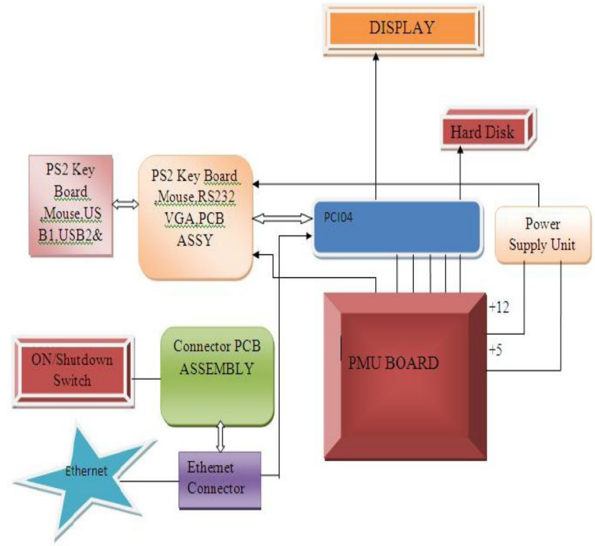

Figure 3.1: Block Diagram of RFPM

The Figure 3.1 shows the basic block diagram of RFPMU. The vital part of the unit is the PMU board. It includes ADC0816, P89V51RD2, MAX232, Line drivers and buffers. The power supply unit supplies the power to the entire system. PMU board is connected with PC104 which provides a software platform for UDP encapsulation, storing and sending the data to an IP based network and displaying it. The PC104 is connected to I/O devices such as keyboard, mouse, RS232 and also with Ethernet.

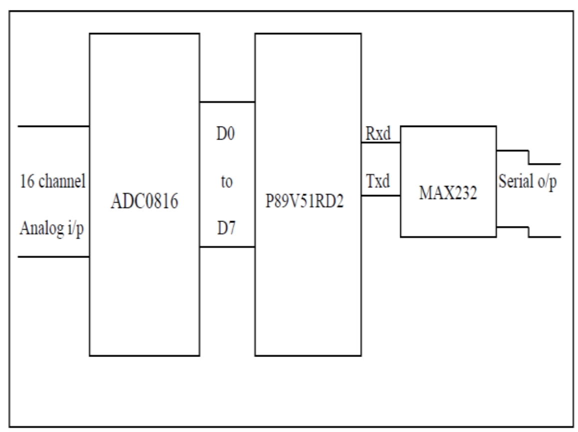

Figure 3.2: PMU Board

The figure 3.2 shows PMU board, where 16 channel analog inputs are given to ADC0816 after giving a voltage drop, ADC convert the analog signal to digital form. The digital value of the ADC is compared and corresponding error signal is generated. It is then fused into the microcontroller using Flash Magic the serial data coming through the RS232 serial communication device is converted into UDP with the help of LABVIEW and the serial output can be checked using the hyper terminal. The PMU is a part of an advanced communication system for the Indian Naval Forces. The communication system provides quick and reliable ship to ship, ship to shore and ship to air communications over bands.

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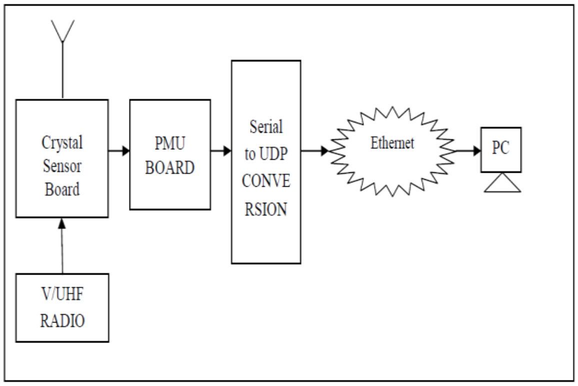

Figure 3.3: Work Flow of PMU

The figure 3.3 shows the work flow of RF Power Monitoring Unit RF power to be measured is sensed by the crystal sensor and sensor output is given to ADC.ADC converts the analog signal to digital form. The digital value of the ADC is compared. The program is developed and compiled using Kiel IDE tool software. Here we have used assembly language to write the program. It is then fused into the microcontroller using Flash Magic and the serial output can be checked using the hyper terminal. Now in order to send it to the Ethernet, the serial data has to be encapsulated in User Datagram Protocol (UDP). For the same the serial data coming through the RS232 serial communication device is converted into UDP with the help of LABVIEW. One Lab VIEW application will be running in the sender side and other in the receiver side. In the sender side through the program serial port is opened and the data is read from it and is written to a buffer. Next the UDP socket is opened and the data read from the port is written to the socket and afterwards the socket is closed after sending the datagram to the network. Now in the receiver this data is received. We only require those 16 bytes with start and stop bytes as 7Eh. So in the program this condition is checked and for the true cases the data is altered accordingly so that the power variations of 16 radios can be viewed through16 gauge meters anywhere in the network where the receiver Lab VIEW application is running.

IV. FUTURE ENHANCEMENT

- Features like remote programmability can be incorporated in future designs.
- Instead of 8 bit microcontroller we can use ARM processor which is a high speed processors and it also supports RTOS.
- Sharp Eye Radar Control can be incorporated which allows operator to select the frequency of operation, the range mode ,Helicopter control mode and the power mode which can be used when the system is operating in short range.

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