Wireless-Remote Monitoring and Control for Navigational Aid Systems

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***Abstract*- This paper presents the transferring of data from various navigational aid systems through wireless communication network. The Navigational system that are used in AAI has to be monitored simultaneously (i.e.) Real time monitoring. The serial data from the remote systems are collected with the help of RS 232 and is converted to Ethernet in terms of TCP/IP packets. These packets are assigned with individual local IP addresses and ports using Virtual COM port Software. The advantage of this process is that, IP addresses can be accessed from anywhere in remote areas. Based on the allocation of ports they are connected to the multiport network switch which forms a computer based network. Thus, these are forwarded to the destination with the help of RF (Radio frequency) link which uses wide frequency range radio signals to communicate.**

***Index Terms*-** TCP/**IP, RF, AAI, CNS, TFT.**

I. INTRODUCTION

The wireless technology has made the communication simple and fast in our daily life. Navigational aid systems in remote areas have to be monitored and controlled periodically at the receiver end. Hence, this method is carried using Ethernet, arduino, switch, converter and RF link. Firstly, the navigational systems such as DVOR, ILS and GMT, are integrated and converted to Ethernet using RS232 converter.

RS232 to Ethernet converters (commonly referred to as Device Servers) are used for transmitting serial data across an IP network. The term RS stands for Recommended slandered and the number 232 specifies the latest version. A network switch (also called bridging hub) is a computer networking device that connects systems together using packet switching to receive, process, and forward data to the destination device. Switches for Ethernet are the most common form of network switch. For accessing the data of different systems, local IP addresses are assigned and then fed to the switch. With the help of this, status of the data can be accessed by any departments and monitored at ease. Now, from the switch, an output is taken from the multiplexer switch and is fed to the RF link. The RF link termed as radio frequency link, has a frequency range of 2MHz transfers the multiplexed data signal wirelessly to the receiver end. The Receiver end receives the incoming data signal from the RF link and sends to the demultiplexer switch. This switch identifies the respective data signal with the help of IP addresses and convert them using Ethernet to rs232 converter. Hence, these converted data are given as input to the CNS (Communication Navigation and Surveillance) equipment's for further monitoring and controlling processes.

II.EXISTING SYSTEM

A. WIRED COMMUNICATION FOR REMOTE MONITORING AND CONTROL

The existing system is basically a wired communication. Here the equipment placed in various locations are communicated through copper wires. These copper wires are cheaper than the other ones which could be used for this communication.

DRAWBACKS

Now a day's legacy network equipment is becoming obsolete and tele-communication operator are terminating legacy network and migrated to IP based network. However the two wire modems are obsolete in the market and increasingly expensive to maintain the legacy network. The companies are looking for alternatives that eliminate their dependency on legacy network while maintaining their existing network and disruptive for customers that rely on legacy networks.

B. DESIGN OF EQUIPMENT FOR NAVIGATIONAL AID SYSTEMS

The equipment specially designed to NAVIGATION AID SYSTEM for remote monitoring and control. The important Navigational Aid Systems -DVOR, DME, LLZ, GP, LPDME, NDB-OM and NDB-OL. These equipments are installed remotely from Air Traffic Control building. The above equipments working performances are monitored and controlled by RCSU-(Remote Control and Status Unit) from the CNS central monitoring room. This equipment is connected by two wire copper connection.

DRAWBACKS

The open architecture of the system, additional functions can be integrated into the workstations besides just the ground lighting system.

They include the operation and monitoring of docking systems, video monitoring, illumination systems, as well as an overview of the traffic situation within the scope of a surface movement guidance and control system. It goes without saying that an overview of other systems, such as weather reports and flight plans, can easily be integrated into the system.

New technologies, such as individual lamp control and monitoring, can quickly increase the number of individually switchable lighting elements at an international airport to several thousand. It is proper to assume that operating these systems using traditional button technology is no longer possible.

C. ROLE OF CONTROL SYSTEMS

This allows the air traffic controller to switch on the taxiway lighting in the proper direction simply by entering a starting and an ending point. In order to reduce the controller's workload, the current traffic situation, weather conditions, and any taxiway closures are automatically taken into consideration. Membrane keyboards and color monitors with or without touch-sensitive areas are used as the standard display and operating equipment. Other display and operating equipment, such as pen activation, can be integrated into the system upon request.

Extremely bright, high-contrast flat panel displays (TFT) with touch-sensitive areas are also available. These displays are integrated into the air traffic controllers' desk. Through direct access to a layered and hierarchically organized virtual operating area, operating functions as well as picture and text displays are accessible that can normally only be implemented using large control desks separate from the controller's section.

DRAWBACKS

Using a control system find complex to operate, even large amounts of informations are displayed slowly. Forexample, when a particular lighting station is selected; all information regarding the control units and lamps installed in that station is displayed with delay.

III.PROPOSED SYSTEM

The wireless remote monitoring and control system overcomes the important problems from the existing systems and provides a tool for these solutions as follows:

1. Ethernet and IP based communication.
2. Periodic maintenance through serial wireless communication.
3. Multiplexing and demultiplexing of various systems for real time monitoring.

This system promotes wireless transmission and reception kit with the help of RF links. The Radio Frequency link consist a form of electromagnetic radiation of a frequency range of 3 KHz to 300GHz. This wide range of frequency helps in faster communication of signals. This keeps the monitoring and control processes alive without delay and eliminates the error.

This link consists of an Ethernet port which receives the multiplexed signal as an input having a common local IP address which are capable of being accessed at the reception end or anywhere using the cloud computing.

IV. SCHEMATIC REPRESENTATION

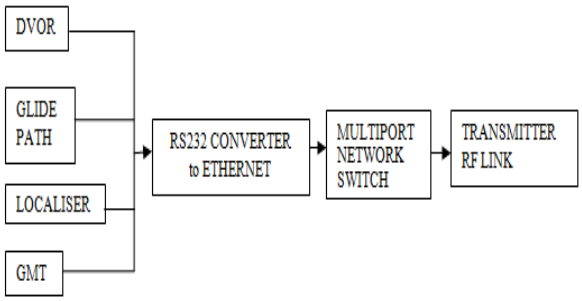

Fig: 1. a) Transmitter

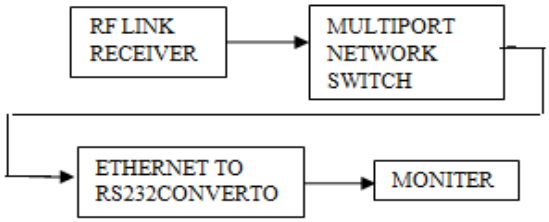

Fig: 1 b) Receiver

The signals, from the various navigational systems have individual local IP address which provides individual status. These signals are combined with the help of multiport network switches used at both the ends. The status provided by the systems is sent in serial manner. The serial communication allows a bit data transferred at a time. Thus, this is achieved with the help of RS 232. The RS232, being a standard interfacing device which are used as connectors for modem, UPS etc. have short cable length and large standard connectors help systems for conversion to Ethernet.

A. SERIAL DATA FROM NAVIGATIONAL AID SYSTEMS

The navigational aid systems consist of various equipment which includes ILS, DVOR. The ILS Abbreviated as Instrumentation landing system which consists of localizer and glide path.

The signals from this consist of frequency ranges and glide slope. The DVOR which is known as Omni directional radio range which provides the position of the air craft. These data signals are considered as individual inputs along with GMT (Greenwich Mean Time) data signal are given as serial data to RS 232 to Ethernet converter. In serial communication only one bit of data is send at a time.

Fig: 2. DME Equipment.

B. RS 232 TO ETHERNET CONVERTER OR VICE-VERSA

The RS stands for Recommended Standard 232, which is considered as a standard device for serial communication, receives the input data and convert them into Ethernet IP/TCP packets or vice-versa. The main advantages in this device are, it can be monitored, controlled and communicated remotely to the central monitor.

Fig: 3. RS 232 to Ethernet converter

C. ASSIGNING OF IP ADDRESSES

In this, the serial to Ethernet converters has its own IP address, which can be used as a server. For assigning IP addresses for various serial data, virtual COM port drivers has to be installed before connection the connector to the computer. When the driver is installed, connect the hardware simply with the Ethernet and serial cable along with the power supply. The COM port can be accessed from the computer's Device Manager through configuring the settings. This converter automatically finds out the serial interface, the baud rate, data rate and other data settings.

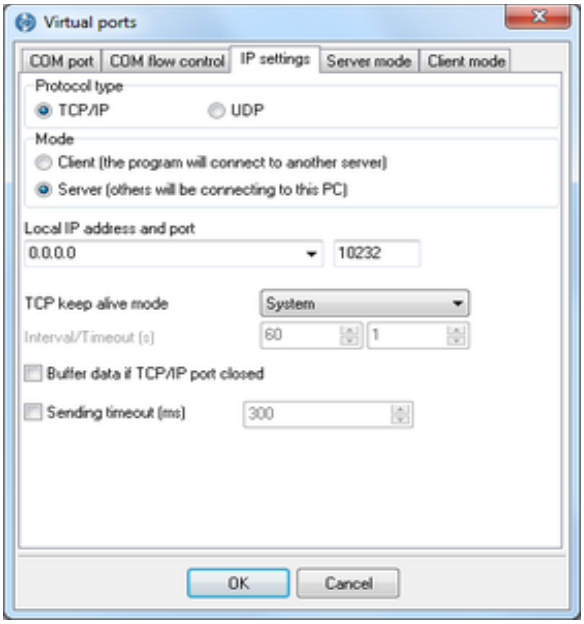

Fig: 4. Assigning IP

When the virtual ports dialogue box opens, under the COM port section, choose the desired COM port from the drop down dialogue box. Then, under the IP setting section choose the protocol type as TCP/IP, mode as server or client based on the transmission and finally assign the local IP address and port. Finally, click ok.

D. MULTIPORT NETWORK SWITCH

It is also called as switching hub which is mainly a device for Ethernet, act as multiplexer and demultiplexer circuits at the transmitter and receiver ends respectively. This networking device connects devices together in order to receive process and transmit data to the destination.

Fig: 5. Multiport Network Switch.

D. RADIO FREQUENCY LINK

The Radio Frequency is one of the electromagnetic waves which have a range of over 200 KHz to 300 GHz, which uses antenna for radio communication. The antenna used has an Ethernet port which has network connections with the Switching hub. When the radio signals are transmitted; antenna pick up multiple signals and a simple resonator is used to tune the radio signals. It is achieved by increasing the oscillations at particular frequency band and reducing at other frequencies.

Fig: 6. RF link Antenna

V. CONCLUSION

Using an Ethernet based network system find easy to operate and even the large quantity of information's are displayed faster. For example, when a particular station is selected; all information regarding the control units and temperature installed in that station is displayed with shorter intervals of time without any delay. This project also overcomes the difficulties of wired communication with the help of RS 232 converters and RF link in order to provide a wireless bridge over navigational systems. Thus, onitoring and maintaining of systems becomes easier and efficient.

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