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INDUCTION OF RADIO COMMUNICATION IN INDIAN RAILWAY FOR SMOOTH RUNNING DURING FOG CONDITION

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Abstract:-
In winter season due to low visibility our railway system not work smoothly. To remove the problem for this season we are going to design a railway driving system which can act in fog independently without seasonally variation. For this communication, we will use RF communication. So, control room personnel will be aware of the railway traffic as well as the drivers will also be aware so without visibility can run smoothly. So, RF communication is any of the electromagnetic wave frequencies that lie in the range spreading from around 3 kHz to 300 GHz, which include those frequencies used for communications or radar signals. RF mainly refers the electrical rather than mechanical oscillations. In RF communication basic elements are used that are:
- *Transmitter and modulation*
- *Antenna*
- *Propagation*
- *Receiver and demodulation*

Keywords: *Radio Frequency, Transmitter, Receiver, Modulation, Demodulation*

I. INTRODUCTION

Radio frequency is a term that having alternating current characteristics such that, if the current is input to an antenna, an electromagnetic field is generated suitable for wireless broadcasting and communications. These frequencies cover a significant portion of the electromagnetic radiation spectrum, extending from nine kilohertz ,the lowest allocated wireless communications frequency, to thousands of gigahertz.

When an RF current is supplied to an antenna, it produce an electromagnetic field that propagates through space. This field is sometimes called an RF field; in less technical terminology it is a "radio wave." RF field has a wavelength that is inversely proportional to the frequency. In the atmosphere or in outer space, if f is the frequency in megahertz and *s*is the wavelength in meters, then $s = 300/f$

The frequency of an RF signal is inversely proportional to the wavelength of the electromagnetic field to which it resembles. At 9 kHz, the free-space wavelength is approximately 33 kilometers or 21 miles. At the highest radio frequencies, the electromagnetic wavelengths measure approximately 1mm. As the frequency is increased beyond that of the RF spectrum, EM energy takes the form of infrared , visible, ultraviolet , x rays, and gamma rays. Many types of wireless devices make use of RF fields. Cordless and cellular telephone, radio and television broadcast stations, satellite communications systems, and the two-way radio services all are operate in the RF spectrum. Some wireless devices operate at visible-light frequencies, whose electromagnetic wavelengths are shorter than RF fields. Examples include most television-set remotecontrol boxes, some cordless computer keyboards and mice, and a few wireless hi-fi stereo headsets.

II. Property

- The energy in an RF current can emit off a conductor into space as electromagnetic waves , this is the basis of radio technology.
- RF currents applied to the body often do not cause the painful sense of electric shock as do lower frequency currents. This is because the current changes direction too rapidly to start depolarization of nerve membranes.
- Another property is the ability to appear to flow through paths that contain insulating material, like the dielectric insulator of a capacitor.

III. Radio communication

To receive radio signals an antenna must be used. However, since the antenna will pick up thousands of radio signals at a time, a radio tuner is necessary to tune into a particular frequency . This is typically done via a resonator – in its simplest form, a circuit with a capacitor and an inductor form a tuned circuit. The resonator amplifies oscillations within a specific frequency band, while reducing oscillations at other frequencies outside the band. Another method to isolate a particular radio frequency is by over sampling and picking out the frequencies of interest, as done in software defined radio.

The distance over which radio communications is useful depends on things rather than wavelength, such as transmitter power, receiver quality, type, size, and height of antenna, mode of transmission, noise, and interfering signals. Ground waves, tropospheric scatter and sky waves can all achieve greater ranges than line-of-sight propagation. The study of radio propagation allows estimates of useful range to be made.

Radio is the radiation of electromagnetic energy through space. The biggest use of radio waves is to carry information, such as sound, by changing some property of the radiated waves, such as their amplitude, frequency, phase, or pulse width. When radio waves strike an electrical conductor, the oscillating fields induce an alternating current in the conductor. The information in the waves can be extracted and transformed back into its original form.

Radio systems need a transmitter to modulate some property of the energy produced to impress a signal on it, for example using amplitude modulation or angle modulation . Radio systems also need an antenna to convert electric currents into radio waves, and vice versa. An antenna can be used for both transmitting and receiving. The electrical resonance of tuned circuits in radios allow individual stations to be selected. The electromagnetic wave is interrupted by a tuned receiving antenna. A radio receiver receives its input from an antenna and converts it into a form usable for the consumer, such as sound, pictures, digital data, measurement values, directional positions, etc. Radio frequencies occupy the range from a 3 kHz to 300 GHz, although important uses of radio use only a small part of this spectrum.

A radio communication system sends signals by radio. The radio equipment involved in communication systems includes a transmitter and a receiver, each having an antenna and appropriate terminal equipment such as a microphone at the transmitter and a loudspeaker at the receiver in the case of a voice-communication system.

IV. Process

Radio communication having following elements:

Transmitter

In electronics and telecommunications a **transmitter** or radio **transmitter** is an electronic device which, with the aid of an antenna, produces radio waves. The transmitter itself generates a radio frequency alternating current, which is applied to the antenna. When excited by this alternating current, the antenna radiates radio waves. In addition to their use in broadcasting, transmitters are necessary component parts of many electronic devices that communicate by radio Each system contains a transmitter, This consists of a source of electrical energy, producing alternating current of a desired frequency of oscillation. The transmitter contains a system to modulate some property of the energy produced to impress a signal on it. The transmitter sends the modulated electrical energy to a tuned resonant antenna, this structure converts the rapidly changing alternating current into an electromagnetic wave that can move through free space .

Modulation

Frequency modulation varies the frequency of the carrier. The instantaneous frequency of the carrier is directly proportional to the instantaneous value of the input signal. FM has the "capture effect" where by a receiver only receives the strongest signal, even when others are present. Digital data can be sent by shifting the carrier's frequency among a set of discrete values, a technique known as frequency-shift keying. FM is commonly used at Very high frequency radio frequencies for high-fidelity broadcasts of music and speech . Analog TV sound is also broadcast using FM.

Angle modulation alters the instantaneous phase of the carrier wave to transmit a signal. It may be either FM or phase modulation .

Antenna

An antenna is an electrical device which converts electric currents into radio waves, and vice versa. It is usually used with a radio transmitter or radio receiver. In transmission, a radio transmitter supplies an electric current oscillating at radio frequency to the antenna's terminals, and the antenna radiates the energy from the current as electromagnetic waves (radio waves).

Propagation

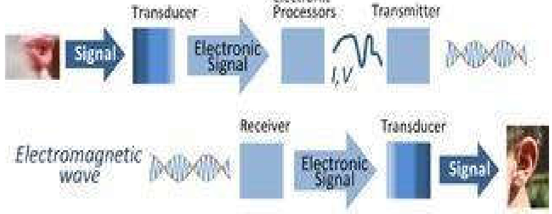
Once generated, electromagnetic waves travel through space either directly, or have their path changed by reflection, refraction or diffraction. The intensity of the waves reduces due to geometric scattering some energy may also be absorbed by the intervening medium in some cases. Noise will generally alter the desired signal, this electromagnetic interference comes from natural sources, as well as from artificial sources such as other transmitters and accidental radiators. Noise is also produced due to the intrinsic properties of the devices that are used. If the magnitude of the noise is large enough, the desired signal will no longer be distinct, the signal-to-noise ratio is the fundamental limit to the range of radio communications.

Receiver and demodulation

The electromagnetic wave is intercepted by a tuned receiving antenna; this structure captures some of the energy of the wave and returns it to the form of oscillating electrical currents. At the receiver, these currents are demodulated, which is conversion to a usable signal form by a detector subsystem. The receiver is "tuned" to respond differently to the desired signals, and reject undesired signals.

Early radio systems relied entirely on the energy collected by an antenna to produce signals for the operator. Radio became more useful after the invention of electronic devices such as the vacuum tube and later the transistor, which made it possible to amplify weak signals. Now a days radio systems are used for applications from walkie-talkie children's toys to the control of space vehicles, as well as for broadcasting, and many other applications.

A radio receiver receives its input from an antenna, uses electronic filters to separate out the wanted radio signal from all other signals carry by this antenna, amplifies it to a suitable level for further processing, and finally converts through demodulation and decoding the signal into a form that usable for the consumer, such as sound, pictures, digital data, measurement values, navigational positions, etc.



Transducing information such as sound into an electromagnetic pulse signal, which is then sent as an electromagnetic radio wave from atransmitter. A receiver intercepts the radio wave and extracts the information-bearing electronic signal, which is converted back using another transducer such as a speaker.

Division multiplexing as alternatives to the classical FDM stratagem. These systems offer different tradeoffs in supporting multiple users, beyond the FDM stratagem that was ideal for broadcast radio but less so for applications such as mobile telephony.

V. Communication system

A radio communication system sends signals by radio. Types of radio communication systems depend on technology, standards, regulations, radio spectrum allocation,user requirements, service positioning, and investment.

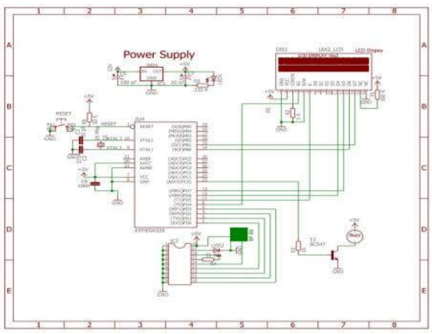
The radio equipment involved in communication systems includes a transmitter and a receiver, each having an antenna and appropriate terminal equipment such as a microphone at the transmitter and a loudspeaker at the receiver in the case of a voice-communication system.

The power consumed in a transmitting station differs depending on the distance of communication and the transmission conditions. The power received at the receiving station is usually only a tiny section of the transmitter's output, since communication depends on receiving the information, not the energy, that was transmitted.

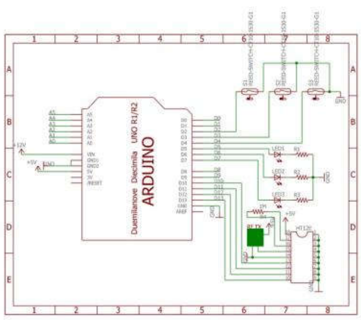
Classical radio communications systems use frequency division multiplexing as a strategy to splitting up and share the available radio-frequency bandwidth for use by different parties communications concurrently. Modern radio communication systems having those that divide up a radiofrequency band by time-division multiplexing and codeone way. For example, in broadcasting a single transmitter sends signals to many receivers. Two stations may take turns sending and receiving, using a single radio frequency; this is called "simplex." By using two radio frequencies, two stations may constantly and simultaneously send and receive signals - this is called "duplex" operation.

VI. Circuit diagram:

Recevier:



Transmitter:



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