Role of analog communication in daily life computer science

This term paper is based on the analog communication and its role in daily life. Analog communication is performed on continuous signal.

In electronics, a signal is an electric current orA electromagnetic fieldused to convey data from one place to another.

Signal Sampling Quantizer Encoder Output

Sampling: Quantising: Encoding:

Signal is divided into two parts:

Analog or Continuous signal: AA continuous signalA is a varying quantity whose domain, which is often time, is aA continuum. The function itself need not beA continuous.

Digital or Discrete signal: AA discrete signalA is aA time seriesA consisting of aA sequenceA of quantities. In other words, it is a time series that is a function over aA domainA of discrete integers. A

2. Communication:

Communication is a process of transferring information from one entity to another. A

Information source transmitter channel receiver

Noise destination

Block Diagram of communication system

modulating signal transducer electrical amplifier modulation

Output signal demodulator receiver channel

noise

Block Diagram of analog communication systemBasics of communication:

Channel is of two types:

Guided or wired

Non-guided or non-wired

Guided is of three types:

Twisted pair

Coaxial cable

Optical fibre

Non-guided is divided into two parts:

Microwave

Satellite

Modes of Communication:

Simplex

Half-duplex

Full-duplex

Elements of communication system:

Modulation:

Change in one of the parameter of carrier wave in proportion to the instantaneous value of the modulating signal.

Continuous Signal

Amplitude modulation Angle modulation

Frequency modulation Phase modulation

Modulation Index:

TheA modulation index of a modulation scheme describes by how much the modulated variable of the carrier signal varies around its unmodulated level. It is defined differently in each modulation scheme.

m= Em/Ec

where ‘ m’ is the modulation index.

Em=(Vmax-Vmin)/2

Ec=(VMax+Vmin)/2

Amplitude Modulation (AM):

Change in amplitude of the carrier wave in proportion to the instantaneous value of the amplitude of the modulating signal.

Amplitude modulationis a method used in electronic communication which is most usually used in transmitting information by means ofradio carrier wave. AM works by changing the power given to the transmitted signal in the message being sent. Example, changes in the signal strength can be used to reproduce the sounds to be reproduced by a speakeror to specify the light strength of television pixels. Compare it withA frequency modulationwhich is also commonly used for sound broadcasting in which thefrequencyA is variable; and phasemodulation often used inA remote controls in which theA phaseA is variable.

AM is often used to refer to themedium waveA broadcastband. In telecommunications, A frequency modulationA (FM) conveyssine formationA over acarrierwaveA by varying itsA frequencyA compare this withA amplitude modulation, in which theamplitudeA of the carrier is varied while its frequency remains constant. InA analogapplications, the instantaneous frequency of the carrier is directly proportional to the

instantaneous value of the input signal. A

Advantages of Amplitude Modulation:

There are several advantages of amplitude modulation

It is very easy to implement

it can be demodulated using a circuit containing of very few apparatuses

AM receivers are very inexpensive as no particular components are required.

AM has benefits of ease, though it is not the most effectiveway to use, both in terms of the quantityof space or spectrum uses and the way in which it uses the power that is transmitted. This is the reason why it is not extensively used these days both for broadcasting and for two way radio communication. Even the long, medium and short wave broadcasts will eventuallychange because of the truth that amplitude modulation is subject to much higher levels of noise than other modes. Its easiness and its wide usage means it will be hard to change rapidly and it will be in use for many years to come.

Frequency Modulation (FM):

It is the process of variation in frequency of the carrier wave in proportion to the instantaneous value of the amplitude of the modulating signal.

While changing the amplitude of a radio signal is the best method to modulate it, it is not the only way. It is also possible to vary the frequency of a signal to give frequency modulation. Frequency modulation is widely used on frequencies above 30 MHz, and it is mainlyknown for its use for VHF FM broadcasting.

It is not easy as amplitude modulation; however frequency modulationdeals with some dissimilarbenefits. It is able to provide immediate interference free response and this is the reason it isassumed for the VHF sound broadcasts. These transmissions could offer high fidelity audio, and this is the reason, frequency modulation is much more prevalent than the older transmissions on the long, medium and short wave bands.

In addition to its extensive use for high superiority audio broadcasts, FM is also used for a variety of two way radio communication systems where amplitude modulation is a failure. Whether for fixed or mobile radio communication systems or for use in moveable applications, FM is widely used at VHF, mobile radio.

Advantages of frequency modulation, FM:

FM is used for a number of reasons and there are numerousbenefits of frequency modulation. Some of the benefits of frequency modulation are as under:

Resilience to noise: Frequency modulation has elasticity to signal level variations. The modulation is carried as there are disparities in frequency. This means that any signal level variations will not disturb the audio output, on condition that that the signal does not fall to a level where the receiver cannot handle. As a result it makes FM perfect for mobile radio communication applications including more general two-way radio communication or movable applications where signal levels are likely to vary much. The additionalbenefit of FM is its elasticity to noise and interference. It is for this reason that FM is used for high superiority broadcast communications.

Easy to apply modulation at a low power stage of the transmitter: A A Frequency modulation is linked with the transmitters. It is probable to relate the modulation to a low power stage of the transmitter and it is not essential to use a direct form of amplification to escalate the power level of the signal to its ultimate value.

It is possible to use efficient RF amplifiers with frequency modulated signals: A A It is possible to use non-linear RF amplifiers to amplify FM signals in a transmitter and these are more effective than the linear ones required for signals with any amplitude disparities. This means that for a given power yield, less battery power is necessary and this makes the use of FM more possible for portable two-way radio applications.

Frequency modulation is widely used in various areas of radio technology including broadcasting and fields of two way radio communication. In these applications its specificbenefits can be used to good consequence. In spite of these changes, FM will continue to be in use for many years to come as there are many advantages of frequency modulation for the areas in which it has addedaimportanthold in recent years.

Phase Modulation (PM):

Change in the phase of the carrier wave in accord to the instantaneous value of the amplitude of the modulating signal.

Advantages of phase modulation:

Phase modulation & demodulation is less complicated as compared to Frequency modulation.

Phase modulator is used in shaping velocity of moving target by removing Doppler information. Doppler information needs steady carrier which is probable in phase modulation but not in frequency modulation.

Role of analog communication:

Analog communication plays a very vital role. Either in the form of AM, FM or PM.

It is used in audio, video, telephony, wireless communication, radar, emergency services, etc.

Audio

AM broadcast radio which sends voice or music in the Medium Frequency Radio Spectrum which ranges from 0. 3MHz to 3MHz. AM broadcast uses amplitude modulation in which high sounds at the microphone roots wide variations in the transmitter power while the transmitter frequency remains constant. Transmissions are regularlyaffected by static since lightening and other some sources of radio add their radio waves to the one upcoming from the transmitter.

AM radio stations are the original broadcasting stations. They are aform of connection of radio waves by changing the amplitude of the carrier signal in proportion to the instantaneous value of the amplitude of the transmitted signal.

AM’s simple signal can be detected with simple apparatus which turns into sound. If a signal is strong enough then there is no necessity of power source, Another advantage to AM is that it uses a narrow bandwidth than FM.

FM broadcast radio transmits voice and music with high fidelity than AM broadcast radio. In frequency modulation loud sounds at the microphone causes the frequency of the transmitter to varyfurther than the transmitter power stays persistent. FM is transmitted in the Very High Frequency radio

spectrum ranging from 30MHz to 300MHz. FM needs extra radio frequency zone than AM and at high frequency more frequencies are accessible and there are additional stations each one sending more information to the station. And when shorter VHF radio waves usually act like light which travels in straight line so the response range is usually limited to 50 to 100 miles. During higher atmospheric situation, FM signals are echoed back to Earth by the ionosphere layer which outcomes in Long distance FM response. FM receivers are subject to capture outcome which causes radio to receive the strongest signal when many signals are on the similar frequency. FM receivers are reasonablyprotected to lightening and spark interference.

Aviation voice radios use VHF AM. AM is used so as to obtain multiple stations on the same channels. Aircrafts fly high adequately so that their transmitters can be received thousands of miles away. It uses VHF.

Marine voice radios use narrowband FM in the VHF spectrum for very smaller ranges and use AM in the shortwave HF radio spectrum extending from 3MHz to 30MHz for very long distances.

FM Subcarrier services areminor signals transmitted associated along with the main program. Special receivers are necessary to operate these services. Analog channels may comprisesubstitute programming, such as reading services for the blind, background music or stereo sound signals. In some countries, FM radios automatically retune themselves to the matching channel inanother district by using sub-bands.

Government, police, fire and commercial voice facilities use narrowband FM on distinct frequencies. Fidelity is sacrificed to use a lesser range of radio

frequencies, typically five kilohertz of aberration rather than the 75 used by FM broadcasts and 25 used by TV sound.

Civil and military HF voice services useA shortwaveA radio to communicate withships at sea, aircraft and remote settlements. Most useA single sidebandA voice which uses a smaller amount of bandwidth than AM. SSB sounds like ducks quacking on an AM radio. This also makes the transmitter about three times more influential, because it doesn’t need to communicate the unused carrier and sideband.

Telephony

Cell phones transmit to a native cell transmitter/receiver which associates to the public service telephone system through an optic fibre or microwave radio. When the phone leaves the cell radio’s zone, the central computer shifts the phone to a new cell. Cell phonesinitially used FM.

There are many cellphone service providers in India nowadays. The main among them are:

BSNL

Airtel

Vodafone

Idea

Aircel

Videocon

Tata Docomo

Tata Indicom

MTNL

MTS

Satellite phones come in two types: A INMARSATA andA Iridium. Both types provide world-wide coverage. INMARSAT uses geosynchronous satellites, with directed high-gain antennas on the vehicles. Iridium provides cell phones, except the cells are satellites in orbit. Satellite phone communication is not available in public domain in India. It is used by the defence services. The main companies that provide the satellite phones in India are:

Motorola

Siemens

GE

Satellite phone communication can be provided in the public domains as the media persons in the remote areas etc. But it needs a special licence from TRAI.

Video

Television transmits the picture as AM and the sound as FM on the identical radio signal.

Digital television encrypts three bits as eight strengths of AM signal. The bits are directed out-of-order to cutdown the effect of gusts of radio noise. Even if any data could be transmitted, the standard is to useA MPEG-2A for video, and five CD-quality (44. 1 kHz) audio channels (centre, left, right, left-back and right back). With all this, it takes only half of the bandwidth of an analog TV signal because the video data is generallycompressed.

India saw the advent of satellite communication in 1995. But it was limited to cable operators till 2007. But then, satellite communication stepped up inot DIRECT TO HOME channels. These providers are:

DishTV

Reliance BIG TV

Airtel Digital TV

Tata Sky.

Videocon d2h

Navigation

AllA satellite navigationA systems use satellites with accuracy clocks known as precision clocks. The satellite communicates its position and the time of the broadcast. The receiver listens to four satellites and can figure out its location as being on a line that is tangent to a circular shell around each

satellite, determined by the time-of-flight of the radio signals from the satellite.

LoranA systems also used time-of-flight radio signals, but from radio stations on the ground.

VORA systems (used by aircraft), have two transmitters. A directional transmitter scans or spins its signal like a lighthouse at a fixed rate. When the directional transmitter is facing north, an Omni-directional transmitter pulses. An aircraft can get readings from two VORs, and locate its position at the intersection of the two beams.

Radio direction-finding is the oldest form of radio navigation. Before 1960 navigators used movable loop antennas to locate industrial AM stations near cities. In some cases they used marine radiolocation beacons, which share a range of frequencies just above AM radio with amateur radio operators.

GPS i. e. Global Positioning System is in use from past decade. Vehicles using navigation with the help of GPS. GPS is being installed in recent luxury cars and in many business class vehicles. It relies on high frequency radio signals from satellites in space. Vehicles having GPS navigation systems can travel in some situations where they may lose the signal for some time. It usually provides accurate navigation information.

The companies that provide the Navigation systems in India are:

Map My India

Nokia OVI maps

Garmin GPS systems.

Radar (Radio Detection and Ranging)

Radar detects things at a distance by bouncing back radio waves from them. The delay caused by the echo measures the distance. The direction of the beam determines the direction of the reflection. The polarization and frequency of the return can sense the type of surface.

Navigational radars scan a wide 2 to 4 times per minute. They use very short waves that reflect back from earth and even stone. They are common on commercial ships and long-distance commercial aircraft.

General purpose radars generally use navigational radar frequencies, however modulate and polarize the pulse so that the receiver can decide the type of surface of the reflector. The best general-purpose radars distinguish the rain of heavy storms, as well as land and vehicles. Some can superimpose sonar data and map data fromGPSA position.

Search radars scan a wide area with pulses of short radio waves. They usually scan the area 2 to 4 times a minute. Sometimes search radars use theA Doppler EffectA to separate moving vehicles from confusion.

Targeting radars use the same principle as search radar but scan a much smaller area.

Weather radars resemble search radars, however use radio waves with circular polarization and a wavelength to reflect from water droplets. Some weather radar use theA DopplerA to measure wind speeds.

This is how radar screen looks

Emergency services

Emergency position-indicating rescue beacons (EPIRBs), A emergency locating transmitters orA personal locator beacons are small radio transmitters that satellites can use to locate a person or vehicle need rescue. Their purpose is to help and free people in the first day, when survival is possible.

Data (digital radio)

Pioneers such as Marconi used the oldest form of digital broadcast which was Spark Gap Telegraphy. The operator could send messages in Morse coding just by reviving a rotating communicating spark gap b pressing the key. Simple spark gap generates a hiss when rotating commutator generates a tone in the receiver, same from the static. Spark gap transmitters are now banned because their transmissions span is several hundred MHz which is a waste of both radio frequencies and power. It’s just inefficient and uneconomical. The next progress is to use continuous wave telegraphy (CW) in which pure radio frequency is produced by a vacuum tube electronic oscillator which is switch on and off by a key. A receiver having a local oscillator will heterodyne with pure radio frequency creating a whistle like audio tone. Less than 100Hz of bandwidth is used by CW. Amateur radio operators still use CW. On-off keying of a carrier should be known as “ Interrupted Continuous Wave” or ICW.

Radio teletypes usually run on short-wave (HF) and are much acceptable by the military since they generate written information with no skilled operator. They convey a bit as one of two tones. Groups of five or seven bits turn into a character printed by a teletype. From about 1925 to 1975, radio teletype was how on the whole commercial messages were sent to less industrial countries. These are still used by the military and weather services.

Aircraft use a 1200 Band radio teletype service over VHF to send their ID, altitude and position, and get gate and connecting-flight data.

Microwave dishes on satellites, telephone exchanges and TV stations frequently useA quadrature amplitude modulationA (QAM). QAM sends data by altering both the phase and the amplitude of the radio signal. Engineers like QAM because it packs the most bits into a radio signal. Usually the bits are sent in " frames" that repeat. A special bit pattern is used to position the beginning of a frame.

Systems that need consistency or which allocate their frequency with other services may use " corrected orthogonal frequency-division multiplexing" orA COFDM. COFDM breaks a digital signal into countless several hundred slower sub-channels. The digital signal is frequently sent as QAM on the sub-channels. Modern COFDM systems use a small computer to make and decode the signal withA digital signal processing, which is more flexible and far less expensive than older systems that implemented separate electronic channels. COFDM resists fading and ghosting because the narrow-channel QAM signals can be sent bit by bit. An adaptive system or one that sends error-correction codes can also defy interference, because most interference

can change only a few of the QAM channels. COFDM is used forA Wi-Fi, someA cell phones, A Digital Radio Mondiale, A Eureka 147, and many other local area network, digital TV and radio standards.

Most new radio systems are digital, DigitalA Satellite Radio, A Digital Audio Broadcasting.

Heating

Radio-frequency energy generated for heating of objects is generally not intended to radiate outside of the generating equipment, to prevent interference with other radio signals.

For heating food and other eatables, microwave ovens use strong radio waves. It is a general misconception that the radio waves are tuned to the resonant frequency of water molecules. The microwave frequencies used are actually about a factor of 10 below the resonant frequency.

DiathermyA equipment is used in surgery for sealing of blood vessels.

InductionA furnaces are used for melting metal forA casting.

Mechanical Force

Tractor beams: There is a small electrostatic and magnetic force being exerted by radio waves which is enough for the performance of station-keeping in microgravity environment.

Spacecraft propulsion: Propulsion method for an interstellar probe called Starwisp is proposed with the help of powerful radio waves which has a

radiation pressure. Since the radio waves are long so the probe could be very light weighted metal mesh and hence it attains high accelerations.

Other

Amateur radioA is a pastime where enthusiasts who purchase or build their own equipment and use radio for their own enjoyment. They may also provide an emergency and public-service radio service. This can be of large use, saving lives in many instances. Radio amateurs are able to use frequencies in a big number of finebands all over the radio spectrum. Radio amateurs use all forms of programming including outdated and new ones. Several forms of radio were pioneered by radio amateurs and afterwards became commercially significant including FM, SSBAM, and digital packet radio and satellite repeaters.

Individual radio services such asA Citizens Band Radio, A Family Radio Service, A Multi-Use Radio ServiceA and others offer simple, short range message for persons and small groups without the simplicity of licensing.

Wireless energy transfer: Many schemes have been proposed which transmits power using microwaves and its techniques have been confirmed. These schemes consist ofsolar powerA stationsA in orbit beaming energy down to worldwide users.

Radio remote control: Radio waves are used to transmit data to remote point as is done in some early forms of guided missile, TV remotes and a range of model boats, cars and airplanes. Remote controlled equipments which are used in large industries mostly use digital radio techniques for safety

purposes and reliability. Such equipments are cranes and switching locomotives.

Conclusion:

From the one-way communication analog communication has now reached to two-way communication. From wired system to wireless communication.

With the help of analog system one can find direction easily.

It helps in spacecraft propulsion.

Analog systems are inexpensive in many cases.

It uses less bandwidth.

Accuracy of analog systems is more.

As the world is leaving from Wires to Wireless, The technology and swiftness or speed of wireless communication is also going leaps and bounds. The wired set-up often goes too crowded and offers obstruction to mobility needs of the users i. e. the wired system is not portable. If at all it is then it is very complicated.

With wired Networks, although security characteristics and speed are however not matched by the wired networks, nevertheless the incapability to being flexible is what causes the wireless mediums to gain additional public awareness.

Analog communication plays a vital role in our day to day life. It is used in many fields today and is growing each day. Its multi-tasking made the work easier. Just by changing the frequency range, it can be used differently. With the help of analog signals, the boom of communications is rising.