Abstract

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Chapter 1: Introduction

Communication is a must process for the transfer of information. Communication is the process of sending information from one place and receiving it in another place and receiving it in another place by using or without using connecting wires. Communication can be done in two ways- the conventional analog communication which includes amplitude modulation, frequency modulation etc and digital communication.

In this project, we focused on working with digital communication system. As we know, the conventional methods of communication used analog signals for long-distance communications, which suffer from many losses such as distortion, interference, and other losses including security breach.

In order to overcome these problems, the signals are digitized using different techniques. Because, the effect of distortion, noise, and interference is much less in digital signals as they are less affected, digital circuits are more reliable and are easy to design and cheaper than analog circuits, the hardware implementation in digital circuits, is more flexible than analog,the configuring process of digital signals is easier than analog signals,Digital signals can be saved and retrieved more conveniently than analog signals. Thus the digitized signals allow the communication to be more clear and accurate without losses.

In this project, we encrypt a digital signal using an encoder and also decrypt it using a decoder. This process gives a secured transmission as well as provides privacy to our users.

Chapter 2: Theoretical Explanation

2.1 Source

The source provides our input for digital communication. This source can be an analog signal. To use this input in digital communication we have to convert it into a discrete time digital signal and to do this we need to go through three basic operations described in the following sections of 2.3,2.4 and 2.5.

2.2 Low Pass filter

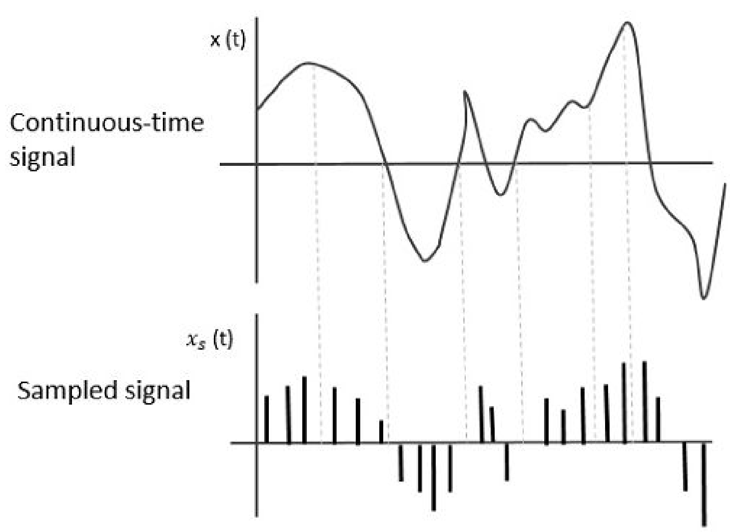
In signal processing and related disciplines, aliasing is an effect that causes different signals to become indistinguishable when sampled. It also often refers to the distortion or artifact that results when a signal reconstructed from samples is different from the original continuous signal.

Aliasing is generally avoided by applying low pass filters or anti-aliasing filters (AAF) to the input signal before sampling and when converting a signal from a higher to a lower sampling rate. Suitable reconstruction filtering should then be used when restoring the sampled signal to the continuous domain or converting a signal from a lower to a higher sampling rate

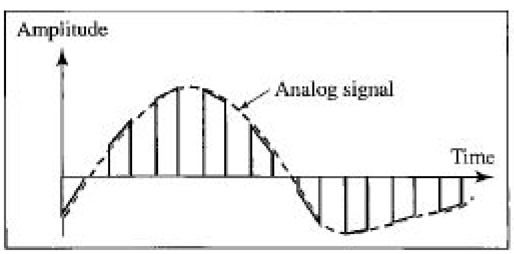
2.3 Sampling

Sampling is defined as, "The process of measuring the instantaneous values of continuous-time signal in a discrete form." A sample is a piece of data taken from the whole data which is continuous in the time domain. When a source generates an analog signal and if that has to be digitized, having 1s and 0s i.e., High or Low, the signal has to be discretized in time. This discretization of analog signal is called as Sampling. A theoretical ideal sampler produces samples equivalent to the instantaneous value of the continuous signal at the desired points.

The following figure indicates a continuous-time signal x (t) and a sampled signal xs (t). When x (t) is multiplied by a periodic impulse train, the sampled signal xs (t) is obtained.



This type of sampling is not practical. There are two types of practical sampling- i) natural sampling and ii)flat-top sampling.



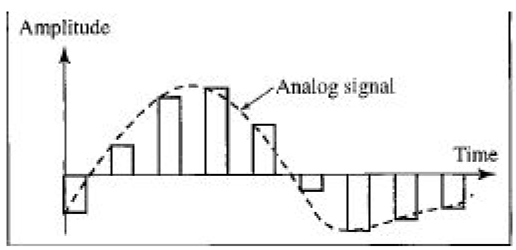


Fig: Natural Sampling

Fig: Flat top Sampling

2.4 Quantization

Quantization, in mathematics and digital signal processing, is the process of mapping input values from a large set (often a continuous set) to output values in a (countable) smaller set, often with a finite number of elements. Rounding and truncation are typical examples of quantization processes. Quantization is involved to some degree in nearly all digital signal processing, as the process of representing a signal in digital form ordinarily involves rounding.

The difference between an input value and its quantized value (such as round-off error) is referred to as quantization error. A device or algorithmic function that performs quantization is called a quantizer. An analog-to-digital converter is an example of a quantizer.

2.5 PCM

Pulse-code modulation (PCM) is a method used to digitally represent sampled analog signals. It is the standard form of digital audio in computers, compact discs, digital telephony and other digital audio applications. In a PCM stream, the amplitude of the analog signal is sampled regularly at uniform intervals, and each sample is quantized to the nearest value within a range of digital steps.A PCM stream has two basic properties that determine the stream's fidelity to the original analog signal: the sampling rate, which is the number of times per second that samples are taken; and the bit depth, which determines the number of possible digital values that can be used to represent each sample.

2.6 Encryption

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2.7 ASK Modulation

Amplitude-shift keying (ASK) is a form of amplitude modulation that represents digital data as variations in the amplitude of a carrier wave. In an ASK system, the binary symbol 1 is represented by transmitting a fixed-amplitude carrier wave and fixed frequency for a bit duration of T seconds. If the signal value is 1 then the carrier signal will be transmitted; otherwise, a signal value of 0 will be transmitted.

Any digital modulation scheme uses a finite number of distinct signals to represent digital data. ASK uses a finite number of amplitudes, each assigned a unique pattern of binary digits. Usually, each amplitude encodes an equal number of bits. Each pattern of bits forms the symbol that is represented by the particular amplitude.

The simplest and most common form of ASK operates as a switch, using the presence of a carrier wave to indicate a binary one and its absence to indicate a binary zero.

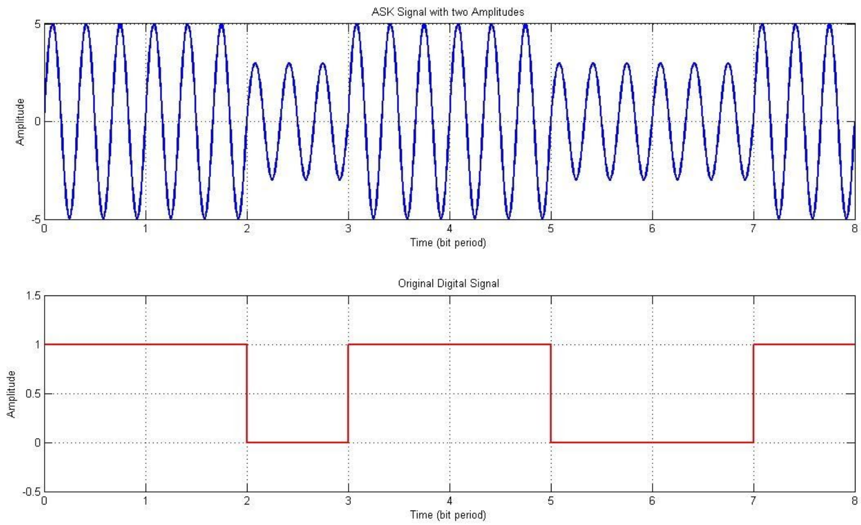


Fig: ASK modulation

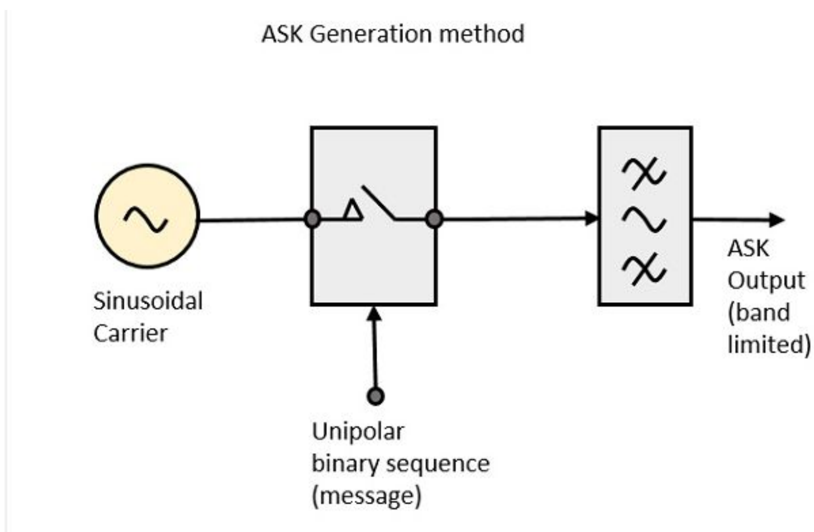
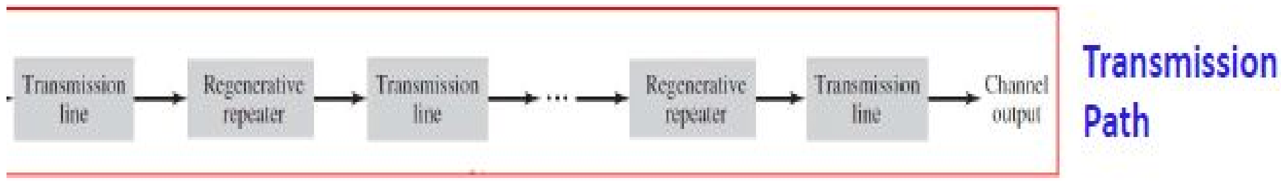


Fig: ASK Modulator ckt

2.8 Transmission

The transmission process happens in a channel. This whole process can be expressed in a block diagram as shown below:

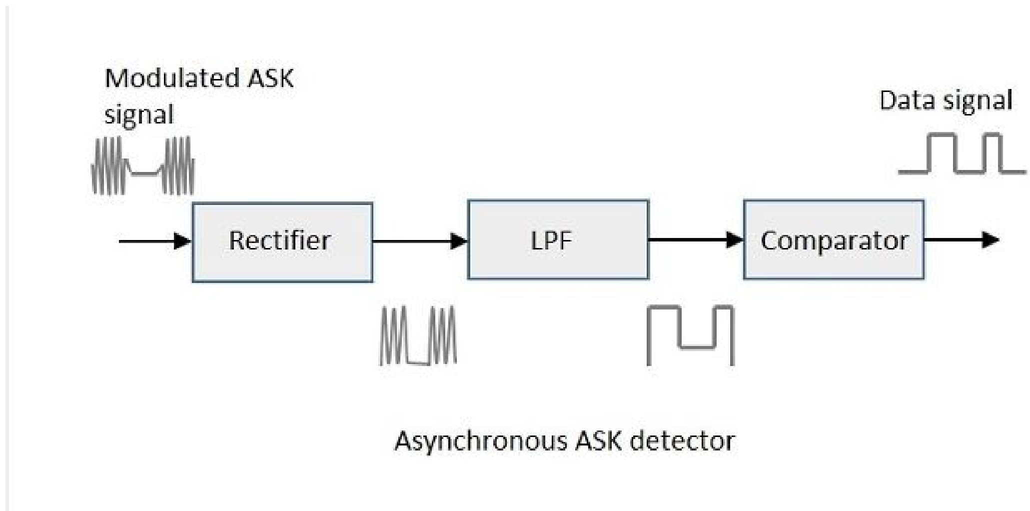


Here, repeaters are used to avoid the limitations of data rate for transmission.

2.9 Demodulation

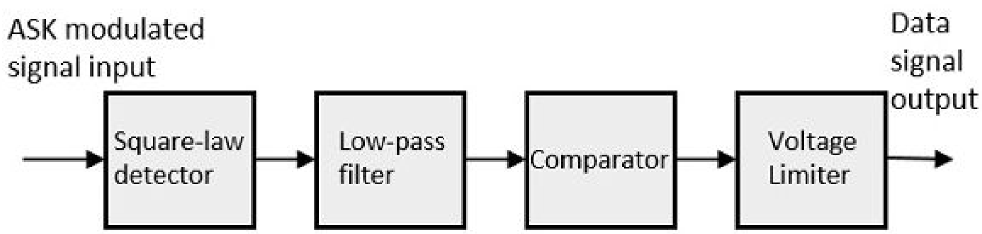
There are two types of ASK Demodulation techniques. They are-Asynchronous ASK Demodulation/detection,Synchronous ASK Demodulation/detection.

The Asynchronous ASK detector consists of a half-wave rectifier, a low pass filter, and a comparator. The following is the block diagram for the same.



The modulated ASK signal is given to the half-wave rectifier, which delivers a positive half output. The low pass filter suppresses the higher frequencies and gives an envelope detected output from which the comparator delivers a digital output.

Also, the Synchronous ASK detector consists of a Square law detector, low pass filter, a comparator, and a voltage limiter. Following is the block diagram for the same.



Synchronous ASK detector

2.10 Decryption

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2.11 Reconstructing LPF

In a mixed-signal system (analog and digital), a reconstruction filter is used to construct a smooth analog signal from digital input, as in the case of a digital to analog converter (DAC) or other sampled data output device.

The output of a DAC requires a low-pass analog filter, called a reconstruction filter - because the output signal must be bandlimited, to prevent imaging (meaning Fourier coefficients being reconstructed as spurious high-frequency 'mirrors').

2.12 Receiver

This is the last block, this is where we can find the output which is produced after the whole process.

Chapter 3: Equipments

3.1 OPM ua741

The IC 741 operational amplifier looks like a small chip. The representation of 741 IC op-amp is given below that comprises of eight pins. The most significant pins are 2,3 and 6, where pin2 and 3 are pin 2 and 3 denote inverting & non-inverting terminals and pin6 denotes output voltage.

Fig: opm ua741

3.2 555 timer

The 555 timer IC is an integrated circuit (chip) used in a variety of timer, pulse generation, and oscillator applications. The 555 can be used to provide time delays, as an oscillator, and as a flip-flop element.

Fig: 555 timer

3.3 LM 324n

The LM324 IC consists of 14-pins with four independent op-amps in one package. These electronic voltage amplifiers are available in high gain with differential input as well as a single output. The voltage difference among the input terminals of the IC is very less than the output voltage. These comparators operate with a single power supply and need of dual supply is removed. These ICs can be utilized as comparators, oscillators, amplifiers, rectifiers, etc. By using this IC several applications can be implemented very easily.

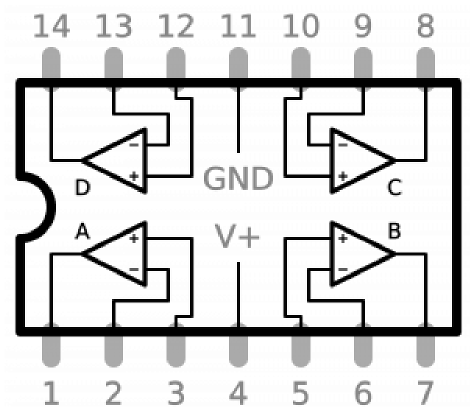

Fig: LM 324n pin configuration

3.4 IC 386D

The Lm386 integrated chip is a low power audio frequency amplifier, which uses low level power supply like batteries in electronic circuits. It is designed as 8 pin mini DIP package. This provides voltage amplification of 20. By using external parts voltage gain can be raised up to 200. When it operates from a 6 volt power supply, quiescent power will be 24 milliwatts, which makes LM386 for ideal battery operation.

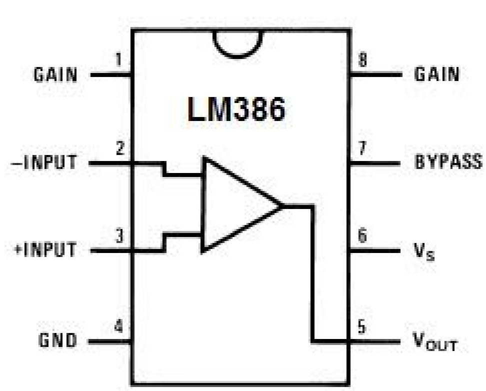

Fig :LM 386 pin diagram

3.5 ht12e

HT12E is an encoder integrated circuit of 212 series of encoders. They are paired with 212 series of decoders for use in remote control system applications. It is mainly used in interfacing RF and infrared circuits. The chosen pair of encoder/decoder should have same number of addresses and data format. Simply put, HT12E converts the parallel inputs into serial output. It encodes the 12 bit parallel data into serial for transmission through an RF transmitter. These 12 bits are divided into 8 address bits and 4 data bits.

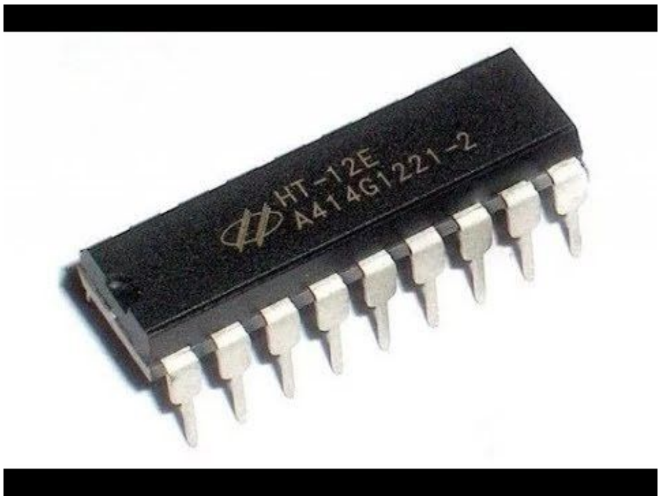

Fig: ht12e

3.6 breadboard

A breadboard is a solderless device for temporary prototype with electronics and test circuit designs. Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate.

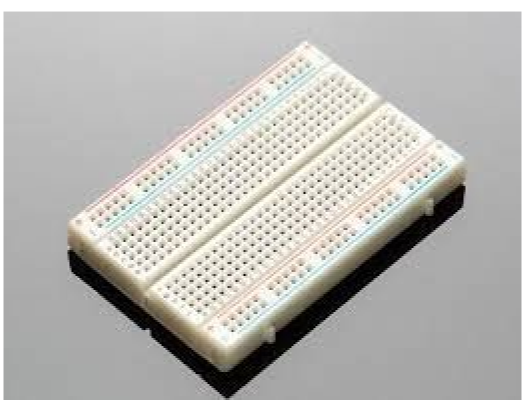

Fig: breadboard

3.7 DC supply

A DC supply was used to provide dc voltages to the ic we used in this project. The image of it is given below.

3.8 Signal Generator

A signal generator is an electronic device that generates repeating or non-repeating electronic signals in either the analog or the digital domain.

Fig: A Signal generator

3.9 Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins(of which 6 can be used as PWM outputs),6 analog inputs, a 16MHz ceramic resonator, a USB connector, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller, simply connects it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it doesn't use the FTDI USB to serial driver chip. Instead , it features the Atmega16U2 programmed as a USB to serial converter. The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

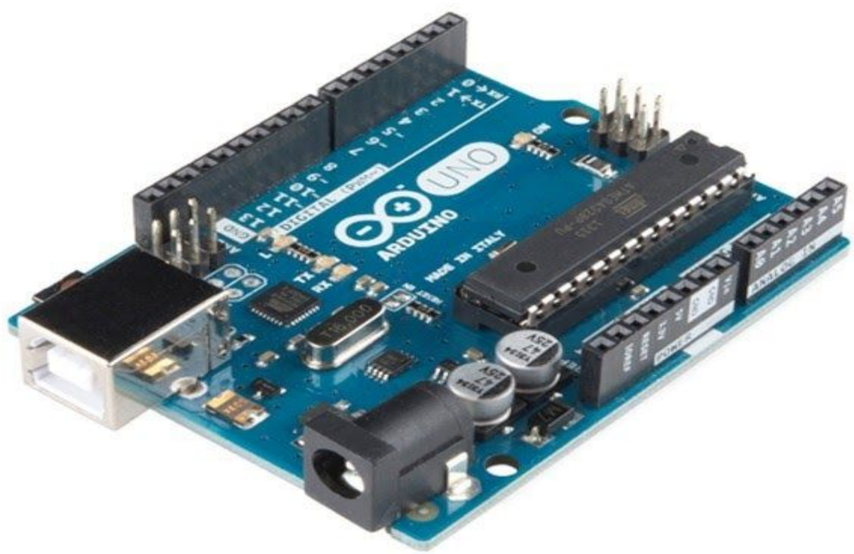

Fig: Arduino Uno

Discussion