JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

RADIO STATION FOR COLLEGE CAMPUS

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Abstract: This abstract outline the proposal for establishing a radio station on a college campus. The objective of this initiative is to bridge the gap between the college community and the surrounding towns, fostering cultural exchange and disseminating important information. The radio station will serve as a platform to close cultural gaps by offering diverse programming that promotes understanding and appreciation of various cultures. It will also act as a conduit between the college and the local community, informing residents about campus events and providing college students with updates on local news and events.[1] To comply with regulations set by the Indian Broadcasting Council, a trustworthy FM transmitter will be developed to ensure seamless signal transfer and adjustable broadcasting frequency. The proposed frequency for the community-based FM radio station is 89.7 MHz, offering flexibility for potential adjustments within the permissible range of 88MHz to 108MHz.[2]By establishing a radio station on campus, the college aims to create a vibrant media outlet that engages and connects the college community with the wider society. The radio station will play a vital role in fostering a sense of unity, enhancing communication, and promoting cultural awareness among students, faculty, and the local community.

I. INTRODUCTION

In an era of ever-evolving media platforms, the establishment of a radio station on a college campus presents a unique opportunity to bridge gaps, foster cultural understanding, and enhance communication within the college community and the surrounding towns. This introduction outlines the history, motivation, objective, and potential contributions of this initiative.
FM radio was created in 1933 by Edwin Armstrong. It was initially created as an analysis to address the problems that plagued AM radio, such as static and sky surge inhibition, which transformed into the foundation of a completely new radio transmitting system. However, progress was stymied by the Great Depression at that time by David Sarnoff, director of RCA and NBC and a former friend of Neil Armstrong who later became a fierce rival who felt demoralized by Armstrong's juvenile FM radio system. The application of public radio lines provided by AT&T ahead of time long understood a system that could be transferred ever in shining clean, impeccably clear high devotion around also and to anyone could without any backing destroy his entire realm. Sarnoff's entire NBC organize was based on AM radio [4]. Numerous other AM radio stations, like collective and CBS, felt similar, as an example as a result, they quickly severed all ties to Edwin Armstrong and pushed the FCC to implement dramatic changes to FM radio, specifically to slow down the essential open response if FM ever gained a strong enough base and especially during World War II. In an instant, all of the operations for new radio and television stations were established. After World War II, the FM radio frequency was changed from 42 to 50 MHz to 88-106 MHz, which is roughly how recently it is now at 88-108 MHz [2] The motivation behind the creation of a radio station for the college campus stems from the recognition of the need for effective communication channels that transcend traditional boundaries. While social media and online platforms have gained prominence, radio remains a powerful medium that can reach diverse audiences, particularly those who may not have access to other forms of media. By harnessing the potential of radio, the college aims to connect and engage its community in meaningful ways. The main objective of establishing a radio station on the college campus is to facilitate cultural exchange, bridge gaps between different communities, and serve as an informative platform for both college students and residents of neighboring towns. The radio station will act as a catalyst in closing cultural disparities by offering diverse programming that showcases various cultural perspectives and encourages dialogue. It will also serve as a vital source of information, updating residents about college events, and keeping college students informed about local news and events.

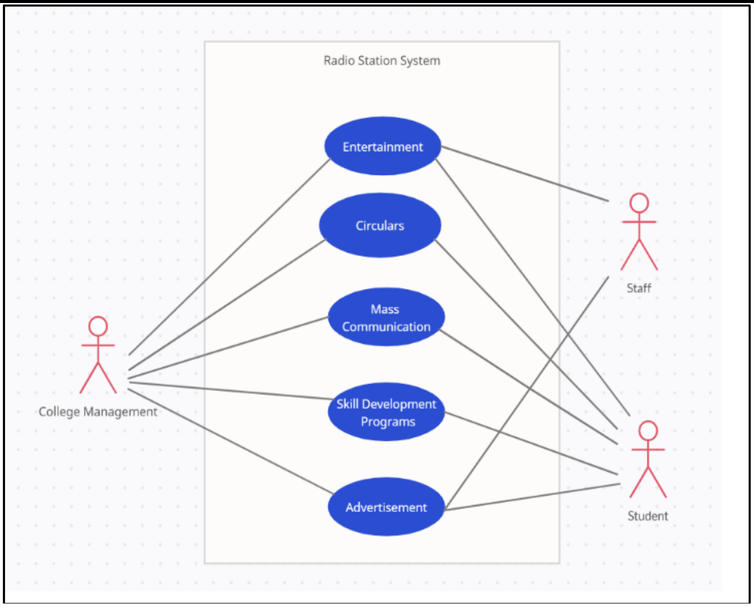

Fig 1: Use Case of System

As we can see in Fig 1, the system can be managed by the college management to perform various activities explained below in objectives of the system.

Objective of the system:

1. Keeps Students Informed: FM radio can keep students informed on campus events, news, and other important information.
2. Provides Entertainment: FM radio can provide entertainment to students and faculty alike. It can be used to play music, talk shows, sports games, or other programming.
3. Connects Campus Life: FM radio can connect campus life by providing a platform for students to express themselves. It can be a great way to get students involved in their campus community.
4. Enhances Learning: FM radio can be used to enhance learning by providing educational programming and other informational content.
5. Fosters Interaction: FM radio can foster interaction between students and faculty on campus. It can be a great way to create a sense of community.
6. Promotes Student Involvement: FM radio can be used to promote student involvement in campus activities and events. It can be a great way to get students more involved in their college experience.

II. METHODOLOGY

The proposed methodology for establishing a radio station on a college campus involves designing and implementing an FM transmitter with a block diagram that encompasses the audio source, audio processor, PLL, frequency modulator, RF amplifier, and antenna. The FM waveform is generated through frequency modulation, enabling the transmission of audio content with high quality and reliability. Numerous universities in India already have radio stations on their campuses that are operated by students for students. Important announcements and events are broadcast on FM for student information and entertainment. This is accomplished by building a transmitter with a transmission range of about 300 meters, which is sufficient to cover the entire campus. As a PLL grounded transmitter, the transmitter may transmit in a variety of colors. Network radio often consists of a short-lived, non-profit radio station or channel that meets the informational needs of people who reside in a particular home in the cants and configurations that are best appropriate for the local environment. By announcing difficulty spots, easing distributed shows with competitors, or playing the campaign radio jingles and melodies, network radio stations might be gathered for clashes. The flag can be received using a collector or a mobile phone, which supports FM radio.

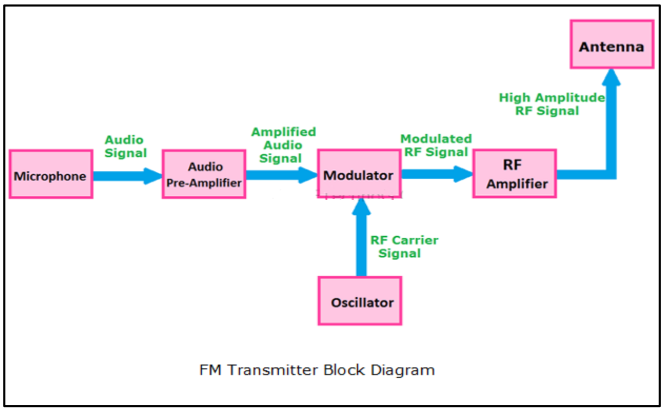

Fig 2: FM Transmitter Block Diagram

The audio modulator receives the output of the audio amplifier. Simply said, modulation is a widely utilised procedure in communication systems that transmits a low-frequency message signal using a very high-frequency carrier wave while retaining all of the information included in the original message signal. Since we require a low power output, we prefer using a class A power amplifier with LC tank circuit at the output. The values of the tank circuit components are same as that in oscillator circuit.

The frequency generating block receives the modulated audio. A radio-frequency system is made up of an electrode-supported RF generator, which converts electrical energy into radio frequency waves, and the product. The buffer/driver amplifier block is connected to the frequency generator's output. To stop the signal source from being impacted by any currents that the load may create, a buffer amplifier transforms the electrical impedance from one circuit to the other. An AM transmitter's master oscillator produces a steady sub harmonic carrier frequency. Noise from a circuit can be filtered using low pass filters. High frequency signals make up "noise." A low pass filter removes the majority of the noise, leaving behind a clean sound. treble-cut or high-cut filters. The antenna is also used to broadcast FM frequencies as shown in Fig. 2. A radio station transmits its signal across great distances by converting the radio frequency emitted by the transmitter into electromagnetic waves using an FM antenna.

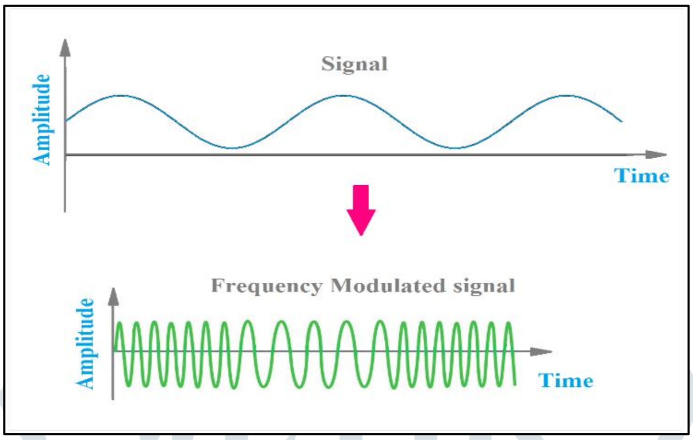

Fig 3: FM Waveform

In FM modulation, the frequency of the carrier wave is changed in proportion to the amplitude of the modulating signal. This means that the higher the amplitude of the modulating signal, the greater the frequency of the carrier wave is changed. This makes FM signals more resistant to noise and interference than other forms of modulation. The FM waveform looks like a sinusoidal wave with two peaks and two troughs. The two peaks and two troughs represent the two halves of the wave cycle. The two halves of the wave cycle represent the two states of the modulating signal, which are the positive and negative amplitudes. The two halves of the wave cycle alternate between these two states. This creates a waveform that looks like a sine wave as shown in Fig. 3 of FM waveform. A phase-locked loop (PLL) is a type of electronic circuit that continuously modifies its voltage- or voltage-driven oscillator's frequency to match that of an input signal. In "noisy" communications channels when data transmission has been stopped, PLLs are used to produce, stabilize, modulate, demodulate, filter, or recover a signal [1].In wireless or radio frequency (RF) devices like Wi-Fi routers, broadcast radios, walkie-talkie radios, televisions, and mobile phones, PLLs are frequently utilized.

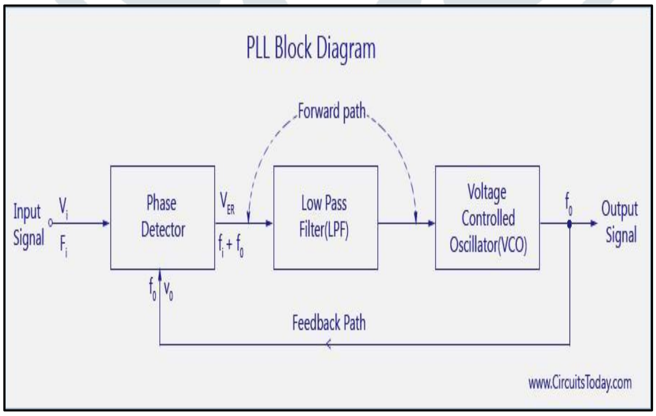

Fig 4: PLL Block Diagram

Synchronizing the output oscillator signal with a reference signal is the PLL's primary objective. The peaks and troughs of the two signals may not be in the same location even though they have the same frequency. To put it simply, they do not arrive at the same spot on the waveform simultaneously. This is quantified as the angle between the signals and is referred to as the phase difference. Signals with different frequencies will always have different phase differences, which means that one signal will either lag or lead the other by a different amount [2]. The essential elements of a phase-locked loop PLL is made up of these three essential parts as shown in Fig 4:

1)phase detector (also known as a phase comparator or mixer): Two signals are compared for their phases, and a voltage is produced based on the phase difference. It multiplies the voltage-controlled oscillator output and the reference input.

2)Voltage-controlled oscillator: produces a sinusoidal signal whose frequency closely resembles the low-pass filter's center frequency.

3)Low-pass Filter: a type of loop filter that reduces the input signal's high-frequency alternating current (AC) component in order to flatten and smooth the signal and make it more like DC.

A PLL's fundamental workings depend on the phase difference between two signals. This discrepancy is recognized, and a feedback mechanism is provided to change the voltage-controlled oscillator frequency.

The voltage-controlled oscillator signal is compared to the input/reference signal by the PLL. The PLL can identify both frequency and phase changes between the two signals since it is frequency and phase sensitive.

The phase difference between the signals is used to generate an error signal. The low-pass filter uses this difference to remove any high-frequency components and convert the error signal to a changing direct current (DC) level. The voltage-controlled oscillator is subsequently subjected to this "feedback signal" in order to regulate its frequency.

Frequency Modulation (FM) transmissions, which are the main use for phase-locked loops in wireless communication, allow for the demodulation of high-quality audio from an FM signal. They are also used in transmissions that use Phase Modulation (PM).

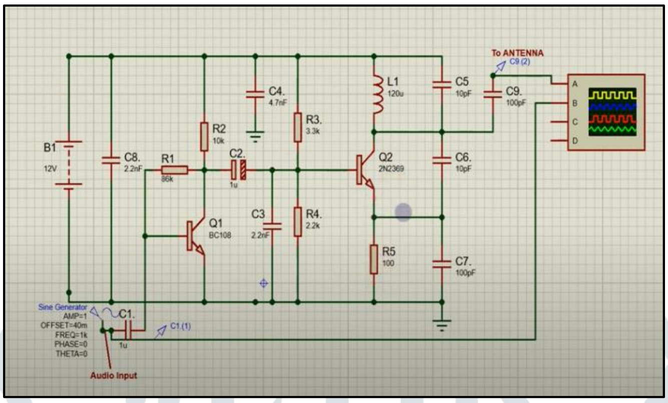

Fig 5: Circuit Diagram.

For simulation for the FM transmitter, we will be using the proteus software for simulation. As shown in Fig 5 various components are used in FM transmitter circuit to get the output. As seen sine wave generator is used as audio input in this circuit during simulation. We can give various audio input using different wave generators. The input at C1 is given as sine wave which is connected to the channel B and output is taken from C9 and connected to channel A of the digital oscilloscope.

Components used in above fig 5 Circuits Diagram are:

1) Battery: 9 V
2) Transistor Q1: BC108
3) Transistor Q2: 2N2369
4) Inductor L1: 120uH
5) Capacitors values:1u,2.2nF,4.7F,120u,10pF,100pF
6) Resistors values: 86k,10k,3.3k,2.2k,100ohm.

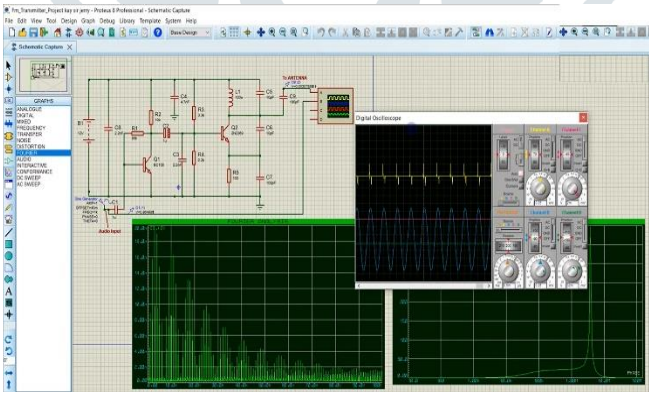

Fig 6: Simulation result

After designing the circuit using required components, now to get the final output waveform simulation is needed. Digital Oscilloscope is used the get the input and output signals using channel A and channel B as seen in above Fig 6. Channel A represent the output FM signal generated at C9 that is output signal and channel B is referred as audio input in the form of sinewave. We can also see the frequency response graph and Fourier transform signals at various points.

Table No.1: Specifications of the System

S. No	Parameters	Values
1	Operating Frequency	89.7 MHz
2	Operating Voltage	Pure DC 9V Battery
3	Operating Frequency Range	88 MHz to 108 MHz
4	Distance covered	up to 1 km
5	Antenna	30 inches
6	frequency stability	+ - 0.01 MHz
7	Output impedance	50 ohms
8	Working current	750 mA, 1 A
9	Environment temperature	10 ‘C ~ 45 ‘C
10	Audio distortion	Clean, clear, quit on battery on eliminator 0.2 %

III. RESULTS AND DISCUSSION

The FM transmitter designed for the college campus radio station operates within the VHF radio frequency range of 88 MHz to 108.0 MHz’s For our signal transmission, we have selected the specific frequency of 89.7 MHz’s The chosen frequency falls within the allocated range and provides a suitable platform for broadcasting. One significant advantage of the FM transmitter is its ability to achieve a greater range with minimal power consumption. The circuit is designed to operate efficiently with just 9 volts of power. This energy-efficient operation ensures optimal performance while minimizing power requirements. By utilizing the FM transmitter, we can effectively cover a considerable distance on campus. The maximum range achievable with the transmitter designed for our campus-based radio station is approximately 300 meters. This transmission range is sufficient to cover the entire campus, ensuring that students, faculty, and staff can access the radio station's programming within the campus premises. The successful implementation of the FM transmitter within the designated frequency range and its ability to cover the entire campus area are significant achievements. These outcomes allow for widespread access to the radio station's content, facilitating communication, and creating a sense of community within the college.

Fig 7: Output Image

It is important to note that the range of an FM transmitter can be affected by various factors such as terrain, obstructions, and interference from other electronic devices. Therefore, conducting periodic signal strength tests and addressing any potential obstacles can help ensure consistent and reliable transmission throughout the campus. Overall, the FM transmitter designed for the college campus radio station demonstrates its capability to provide a reliable and efficient means of broadcasting within the designated frequency range. This technology plays a crucial role in connecting the college community, disseminating information, and fostering a vibrant radio culture on campus.

IV. CONCLUSION

In conclusion, establishing a radio station on a college campus requires careful consideration of the FM transmitter's range and operating frequency. With a maximum range of approximately 300 meters, an FM transmitter can effectively cover the entire campus. By utilizing an operating frequency of 89.7MHz, a PLL-based transmitter can transmit at various frequencies within the range of 88 to 108 MHz, providing flexibility and portability.

The choice of a PLL-based transmitter ensures stable and reliable signal transmission while requiring less operational voltage. However, it's important to note that the broadcasting capacity of a community-based transmitter is limited. Nonetheless, within the restricted range, the transmitter can serve as a valuable medium for sharing information, news, entertainment, and promoting campus activities.

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