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Radio Station using Raspberry PI

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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.[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 communitybased FM radio station is 89.7 MHz, offering flexibility for potential adjustments within the permissible range of 88MHz to 108MHz.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.

KEYWORDS: Song recognition, audio fingerprint, IoT devices, KMeans clustering, MongoDB database, Cloud Services, FM radio,monitoring

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 Alternate to 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.

II. LITERATURE REVIEW

The development of community radio stations has been widely studied in the context of education, cultural exchange, and local engagement. Several research studies have highlighted the impact of college-based FM stations on fostering student involvement, community participation, and real-time information dissemination. This section reviews relevant studies on community radio, the role of college radio stations in education, technical aspects of FM broadcasting, regulatory frameworks, and the impact of radio on local communities.

1. Role of College and Community Radio Community radio has been recognized as a powerful tool for local engagement, information dissemination, and cultural representation. Studies indicate that community radio fosters local identity and civic participation (Gumucio- Dagron, 2001; Pavarala & Malik, 2007). It offers diverse programming that caters to local languages, traditions, and social issues, making it an inclusive communication platform (Lewis & Booth, 1989).

College Radio as an Educational Platform College-based radio stations serve as a learning tool for students interested in media production, journalism, and broadcasting (Sharma et al., 2014). Research on Anna University's FM station (90.4 MHz) in Chennai highlights its role in promoting student-driven programming, awareness campaigns, and local community engagement (Bajpai, 2019).

2. Technical Aspects of FM Broadcasting The success of a radio station depends on signal clarity, transmission reliability, and frequency stability. FM transmitters utilize frequency modulation techniques to reduce noise interference and enhance sound quality (Schramm, 2013). Selecting the appropriate broadcast frequency within the 88–108 MHz range is crucial to avoid adjacent-channel interference (Rajesh & Kumar, 2018).

3. 4. Regulatory Framework for Community Radio in India

The Indian Broadcasting Council (IBC) and the Ministry of Information & Broadcasting regulate community radio licensing in India. The Community Radio Policy (2011) allows educational institutions to operate FM stations with specific power limitations (100W ERP) and content guidelines (Singh & Mehta, 2021). Compliance with these regulations ensures smooth operations and prevents signal interference.

5. Impact of College Radio on Local Communities

Studies have shown that college radio strengthens universitycommunity relationships by providing a platform for discussion, public awareness, and information sharing (Buckley, 2008). Patel & Nair (2022) found that well- managed college radio stations contribute to community development, student leadership, and local governance engagement.

III. PROBLEM STATEMENT

1.1 Existing System:

Currently, most colleges lack an organized platform for student-driven media engagement. Information dissemination primarily relies on traditional methods such as notice boards, emails, and social media, which may not effectively reach all students and the broader community. Additionally, there is a communication gap between the academic institution and the surrounding local community, limiting cultural exchange and engagement opportunities. Existing community radio stations outside campus environments often do not focus on studentrelated content or do not provide a space for direct student participation. The lack of a dedicated FM station means that students miss out on valuable experiences in broadcasting, journalism, and real-time media production.

1.1.1 Limitations:

- 1. Limited Outreach:**
- Traditional methods such as printed notices and emails do not effectively reach the entire student body and local community.
- 3. Lack of Real-Time Information Sharing:** Urgent updates on campus activities, emergency alerts, and local news are not efficiently disseminated.
- 4. Absence of Student Engagement in Media Production:** Students have limited opportunities to gain hands-on experience in broadcasting and journalism.

1.2 Proposed System

The proposed college radio station will serve as a dynamic media hub, enabling students and faculty to share insights, engage in discussions, and stay updated on relevant events. The station will feature diverse programming, including academic discussions, interviews, cultural shows, and community announcements. A robust FM transmitter operating at

89.7 MHz will ensure clear and uninterrupted broadcasting, with the possibility of adjusting frequencies within the 88–108 MHz spectrum.

1. **Enhanced Student Involvement:** Students will actively participate in content creation, gaining practical experience in media production.
2. **Bridging the Communication Gap:** The station will facilitate real-time news dissemination, campus updates, and community interactions.
3. **Compliance with Broadcasting Regulations:** The system will adhere to the licensing and operational guidelines set by regulatory authorities.

IV. 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.

Key Technologies Used

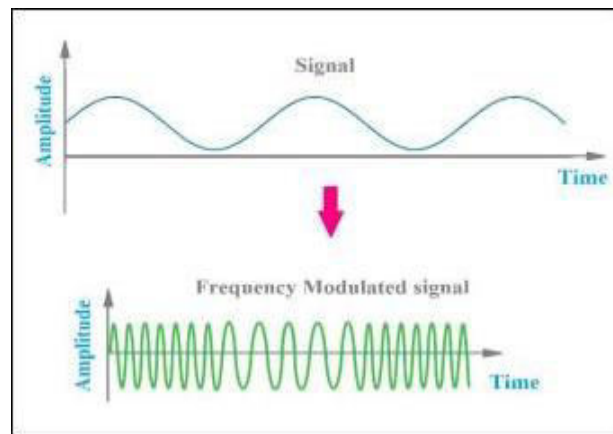
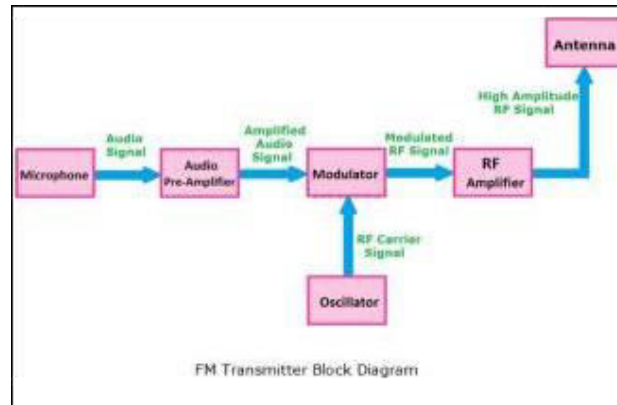
- **FM Broadcasting Technology:** Utilized for highquality audio transmission over a designated frequency.
- **Audio Processing Software:** Tools for recording, editing, and mixing content to ensure professionalquality broadcasts.
- **Signal Modulation Techniques:** Frequency modulation (FM) to minimize signal distortion and interference.

1.3 System Components

1. **FM Transmitter Development:** Implementation of a low- power FM transmitter for signal distribution.
2. **Regulatory Compliance:** Ensuring adherence to licensing and operational guidelines.
3. **Community Participation Model:** Encouraging involvement from students, faculty, and local stakeholders.

1.4 Implementation Plan

1. **Frequency Allocation & Technical Setup:** Selection of an interference-free frequency within the 88–108 MHz range.
2. **Infrastructure Development:** Installation of antennas, transmission equipment, and a dedicated studio.
3. **Content Development:** Formulation of a structured broadcast schedule.



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.

Building the project

Step 1: Define Your Project: Clearly outline the goals and functionalities of your project.

Step 2: Choose Your Platform and Components: Select the appropriate hardware and software components based on your project requirements.

Step 3: Assemble Your Hardware: Connect the components and build the physical system.

Step 4: Write Your Code: Develop the software to control the IoT devices and manage the data.

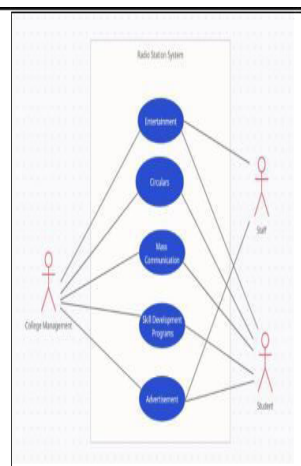
Step 5: Connect to the Internet: Establish a network connection for remote access and data transmission.

Step 6: Visualize and Analyze Your

Data: Develop a way to display and analyze the data collected by the IoT devices.

FM broadcast circuit

The electrical component should be connected as illustrated in the following FM transmitter diagram.



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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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