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FM Radio Station using Raspberry PI 3

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Abstract— *FM is widely used because of many advantages of frequency modulation. Although, in the ancient days of radio communications, these were not exploited because of lack of knowledge of how to benefit from FM, once this was understood, its use grew. FM is used as a powerful transmitter. FM radio band is decided for the radio transmission; any ordinary mobile or radio receiver can be used for to tune into channel without revealing any extra cost. In this project we are designing a campus FM that can cover up to the organisational level at the frequency of 105.3MHz. We can use this system in real life, suppose in an area where other means of communication are unavailable, in those areas we can install this system for communication purpose also the system has an feature of low cost. During tragic situations such as natural calamities, terrorist attacks, plane crashes, inter-operability problems are faced by military and rescue forces where radio can be used as a mode of communication. In this paper, we describe a system developed using Raspberry Pi with minimum hardware required for implementation. The system is portable, low cost and consumes less power, hence can be quickly deployed in disaster affected areas and also maintained in an organization to make announcements.*

Keywords— Campus Radio, Emergency Radio, FM Transmitter, Raspberry Pi.

I. INTRODUCTION

Now a days audio streaming plays an important role to play audio from different servers. Initially the FM radio were used to broadcast audio from different location. In FM radio the digital audio need to convert into analog signals and that signals was broadcast using frequency modulation technique. And the hardware used was FM transmitter to transmit signals. At receiver side the frequency of the station is tuned to enjoy music from that FM station. But to build own private radio station is cost effective to broadcast signals. Indian radio industry was started many years ago and provides services in various languages. FM channel has gained popularity over the years. The increased number of FM channels and 24 hours service has helped the listener with the variety and efficiency.FM station designed using Raspberry Pi has considerable range which can easily cover a large area of 40 to 50 meters. The Raspberry Pi's broadcast frequency ranges between 1 MHz and 250 MHz A Raspberry Pi FM radio transmission station is a great way to have a cheap affordable broadcasting of sound over air. Voice from the microphone can be broadcast or audio files from the Raspberry Pi can be played. This device normally works like real radio station. There was no medium for students to broadcast their views on social issues or any other relevant ideas. No medium to broadcast alerts during emergency situations, for community entertainment, for students interested in mass communication. The focus of our project is to establish a low cost and manageable broadcasting medium. This will enable students to go live and provide a two way communication between institute and students. Students could also get trained for mass communication. Almost all over the world radio acts as an aid for the community, voluntary sector, civil society, agencies, NGO's and citizens to work in partnership. Also it helps in community development, in addition to broadcasting. There is legally defined community radio used in many countries around the world.

II. DESIGN METHODOLOGY

As seen from the literature survey, faster computational speed and low cost equipment are the major reasons why FM radio stations are popular. The most important portion of the proposed system is the hardware model which makes use of raspberry-pi. The proposed system can be classified into two parts accordingly,

i. Transmitter of the FM station.
ii. Receiver of the FM station.

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2.1 Transmitter Section and Receiver Section

We present a novel design to implement a transmitter by using GPIO pins on Raspberry Pi Board, which reduce the amount of excess hardware. The FM signals are generated with the help of clock signals. The clock signals are generated on the GPIO pins with the use of hardware present on Raspberry Pi. The Raspberry Pi is used to change the frequency of output signal according to the amplitude of the audio received from the microphone. The Raspberry Pi is also capable of broadcasting the audio files which are already stored in the system. The FM signals generated are radiated by the antenna and any ordinary radio equipment can be used for reception of signals.

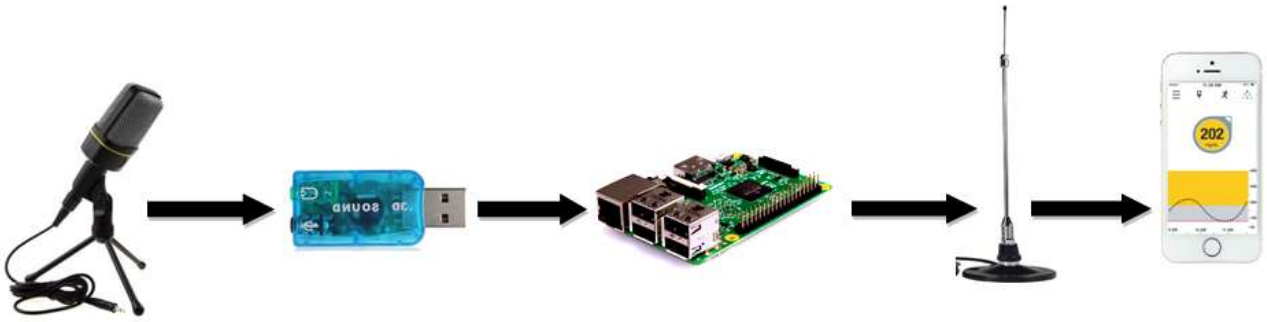

Fig.1: Transmitter and Receiver section

2.2 Operation Of The System

Input voice signal is given to the microphone which converts sound signals into electrical signals. Microphone is connected to the USB sound card which transmits the signals to Raspberry Pi 3. The Raspberry Pi is programmed using python language. The python calls C program which maps peripheral bus in physical memory to virtual address space. After that it enables the clock generator module and it sets the output on GPIO pin 4. The Raspberry Pi transmitter is fairly powerful of broadcasting signal over wide range. The radio frequency signal is output on GPIO pin 4, through which the antenna is connected and the RF signal is broadcast.

2.3 Algorithm of the Proposed System

Step 1: The input voice signal is given to the microphone which converts sound waves into electrical signals.

Step 2: These signals are given to the Raspberry Pi via the USB sound card which controls input and output of sound signals.

Step 3: The Raspberry Pi modulates the received signals and gives FM modulated signals to the transmitting pin i.e. GPIO pin 4.

Step 4: The antenna connected to pin 4 broadcasts the FM signal at the frequency of 105.3 MHz which is programmed in the Raspberry Pi.

Step 5: The FM signal can be received on any device by tuning it to the desired frequency.

III. RESULTS AND DISCUSSIONS

Using Raspberry Pi as a processing platform has resulted in significant reduction in the power consumption of the overall device. The system designed is capable of broadcasting the live audio captured with the help of microphone on desired frequency of 105.3MHz.The cost and maintenance of the system is low as compared to the existing systems. The system has been tested for a broad range of frequencies and has a high success rate. Though the resulting system is very efficient and robust and has a high success rate, it does have a few limitations as well like it cannot be accessed without any host computer, etc.

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Fig.2. Experimental setup

IV. CONCLUSION AND FUTURE SCOPE

The proposed system can be more useful in organization level and campus level. The system has number of attractive features such as being low cost, small size, easy to carry, easy to deploy. Raspberry pi as FM transmitter provides students with an opportunity to communicate with all other students and provide a wider audience and training opportunities for student interested in mass media. It is most effective and low cost FM transmitter than present FM transmitter. Use of Raspberry Pi makes the combination of microphone and speaker very easy into one single compact device using various peripherals on Raspberry Pi. The design presented in this paper demonstrates the usefulness of this system for disaster affected regions, thereby saving lives and resources.

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