CHAPTER 1

INTRODUCTION

This chapter discusses the introduction of Digital Circular and the process involved in text to audio conversion. It include wireless medium for audio conversion.

1.1 INTRODUCTION TO WIRELESS DIGITAL CIRCULAR

In the era of growth of digital technology, people are becoming habitual to easy access to information. Usually innovation has come as a key factor to help to make administrative work much easier, field executives are using new and improved versions of existing technologies to get better control of administrative activities. Circulars and Notification template is normally used to circulate the important information to all students/employees in each class/department. In the current scenario the circulars in a variety of institutions are managed manually and are required to update the information day-to-day. This process is tedious to pass the information at all the time where it wastes a lot of resources like paper, printer ink, man power and also brings about loss of time. The importance of circulars in every academic is well known to us, every time the information changes iteratively which have to be done manually.

The main aim of the project is to design a Digital circular system, which can replace the current method of using printed paper method. The method of delivering the information through LCD screens is also being followed. No doubt it was a good System with some glimpse of evolving technology but it failed to display the circular in attractive manner. As the number of characters were limited and the display was too small, the system and could not be used for regular use. Our proposed methodology is to overcome these drawbacks and to develop a wireless transmission of the information via a simple audio toolkit, which is easy to install and a user friendly system. The text is converted to audio format and transmitted via wireless medium. Some features like acknowledgement

message to sender's phone, alert signal like buzzer were further added to make our system more reliable. User can send messages to a selected group of classes or to a single department/classroom or the whole organization/institution.

The information is sent via Telegram from personal computer and is received by Google Text to Speech (GTTS), a python library which is duly interfaced to the Raspberry Pi. The Raspberry Pi is made to speak and read some text aloud, by using audio software packages that need to be installed on the Raspberry Pi processor. The grouping function helps to ensure information is only sent to the recipients for whom it is intended, while also reducing the time and labour required to send messages to multiple people. There are two methods of message delivery: Interrupt and Schedule. Interrupt messages are delivered to the class immediately where schedule messages can be scheduled beforehand to appear at a certain date and time. Its operation is predicated on Raspberry Pi programmed in Python programming language. The audio file is thus fetched into the Raspberry Pi and the converted audio is audible in speakers, which is connected to the audio jack of the Raspberry Pi.

1.2 SUMMARY

By implementing digital circular system the time consumption and usage of paper are reduced.

CHAPTER 2

LITERATURE REVIEW

This chapter discuss about the existing methods for delivering the circulars/notices using wireless medium and receiver units.

2.1 EXISTING METHOD

In our institution information are passed in the way of text which are need to be carried out by a person and there is a need of verification sign from respective authorities to ensure that the information has been passed.

2.1.1 DELIVERING INFORMATION THROUGH DISPLAY UNITS

Nowadays mostly all the information/messages are shared with others in digital format. The existing method of transmitting the data is done through wireless medium and it is displayed on the LCD display in the corresponding places. It can be seen in any malls, railway stations, working areas, educational institutions etc. The transmitter side is the higher authority and he can send the information to the receiver using pc or mobile and then the received message is displayed on the LCD screen. Mostly GSM and Wi-Fi is used as the transmitting medium for displaying the information. In the existing system, the memory is low that it cannot able to send large information. Here security has been not allocated, by using this unsecured circular system possibilities for fake messages may occur. Certain information would be specific to some receivers and those messages cannot be sent to every system which is connected with it. As the number of characters were limited and the display was too small, the system and could not be used for regular use.

2.2 PROPOSED METHOD

No doubt it was a good system with some glimpse of evolving technology but it failed to display the circular/information in attractive manner. This proposed methodology introduces a new way for sending circulars by text and converting it into voice for conveying information. This method of passing the information is comfortable where a person is not needed to carry the sheets. They can ensure that the information has been passed successfully by viewing the acknowledgement from telegram application. This is a useful method of conveying information which is a time saving one. Selection of the receivers is done through the respective commands such as class 1, class 2 etc., before selection, authentication has been accomplished so the authorized user can only send the information through the bot. Using the GTTS the text to speech has been done and the converted voice information is delivered through the speakers.

2.3 SUMMARY

In this chapter, difficulties that are faced during conveying information using conventional display units were studied.

CHAPTER 3

SMART CIRCULAR SYSTEM

This chapter presents the hardware configuration of digital circular and brief explanation of the block diagram of the process.

3.1 BLOCK DIAGRAM DESCRIPTION OF THE PROJECT

In this project, initially a circular is received from principal office in the form of mail. The text from the mail is copied into the telegram text box. The text undergoes voice synthesis process in Raspberry pi wherein the text is scanned and synthesised. The speakers are attached to Raspberry pi through a relay module and fixed in class rooms. The converted speech is audible in speakers and hence the circular is received. Figure 3.1 represents the block diagram of digital circular.
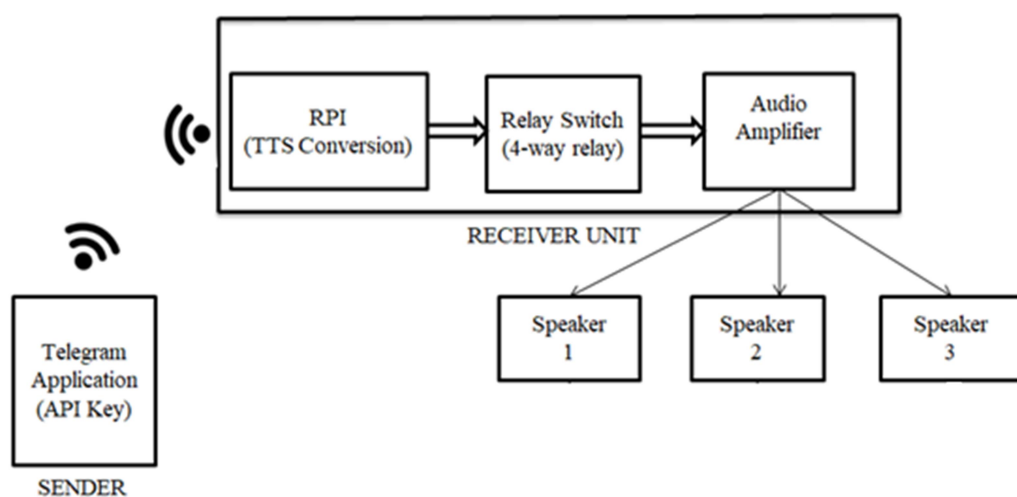

Figure 3.1 Block diagram of Digital Circular

3.2 POWER SUPPLY

The first, recommended and easiest way to power the Raspberry Pi and the amplifier is via the step down transformer, where the voltage is rectified and given to the developed kit. For Raspberry pi the recommended input voltage is 5V, and the recommended input current is 2A. A separate 5V regulator is used to produce this input voltage.

3.3 AUDIO PROCESSING KIT

1-MASTER VOLUME CONTROL
2-SPEAKER 1 VOLUME CONTROL
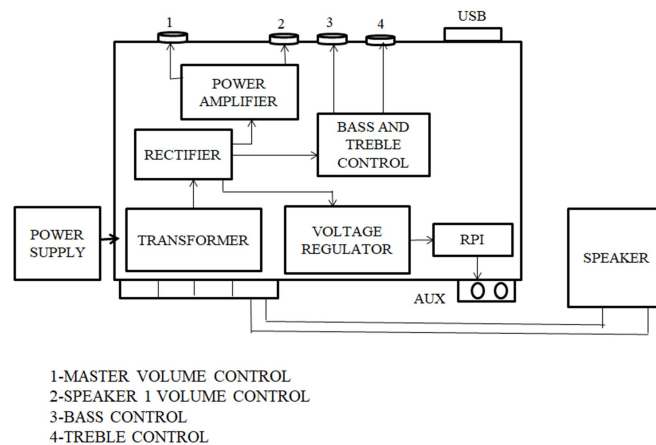3-BASS CONTROL
4-TREBLE CONTROL

Figure 3.2 Audio Processing Kit

Figure 3.2 is the developed audio processing module of the project which is placed in the head of the department. It contains components designed for power supply, amplification, relay and the processor. In the amplification process two step of amplification is done, first in bass treble control (pre-amplification) followed in power amplifier. These amplifiers were chosen based on its load i.e., ohm specification and power rating of the speakers connected with it. The Bass treble control is a transistor based amplifier board used to control the signal frequencies, transistor BC547 is used with VCEO of 45 V and Ic of 100mA. The advantage to use the transistor based is it has lower noise than IC types and the accessories are easy to find when defected. The power amplifier is IC based, TDA2030A IC is used which has output power of 18W at Vs = $\pm$22V/4Ω with 0.5 % distortion. The advantage of using this class AB amplifier is it has high output current, very low harmonic and crossover distortion and it has an internal short circuit protection with thermal shutdown.

3.4 4-WAY RELAY

This is a 5V 4-channel relay interface board, and each channel needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It is equipped with high-current relays that work under AC 250V 10A or DC 30V 10A. It has a standard interface that can be controlled directly by any controllers.

3.5 TEXT-TO-SPEECH CONVERSION PROCESS

The Raspberry Pi's network interface settings are configured according to desired Wi-Fi network connection with router present in the network, mostly enterprise area networks through gateway (router). These network have certain settings and to connect them with Raspberry Pi, they must be configured accordingly. All the interface networks like local loop, Ethernet, Wi-Fi interfaces are defined inside the network directory. The static IP address assigned for the Raspberry Pi 3 is used for matching IP address, Netmask and gateway of the network.

The Bot father created in the telegram application is searched in the system and the circular from our mail is copied and pasted in telegram bot. Before sending the circular required classes are to be selected in the bot. For each command provided in the telegram, acknowledgement is obtained from the cloud. The text is synthesised and converted into speech. The speakers are connected with the selector switch through which the respective speakers are selected according to the commands provided and the text is audible in speakers which is fixed in the class rooms.

3.6 SOFTWARE USED

To execute this project three types of software have been used and they are as follows:

- Raspbhain Wheezy

- Python

- VNC viewer

3.5.1 Raspbian Wheezy

Raspbian is a Debian-derived free OS optimised specially for the Raspberry Pi hardware. Raspbian mostly uses a Linux kernel also popular as the Debian GNU/Linux distribution. It comes along with over 35,000 packages and precompiled software bundled in a format that is easy for installation on the Raspberry Pi. The "wheezy-raspbian.Zip"OS file can be directly downloaded from Raspberry Pi's official website. After downloading this ZIP file it is necessary to extract the OS image file into the SD memory card, for that purpose an image writer application "win32diskimagerv0.9-binary" can be used. This software is used to write a raw disk image to a removable memory device. It is useful for any embedded development because the source code can be branched and modified as per the requirement.

3.5.2 Python Programming

Python is a high-level language. This means that Python code is written in largely recognizable English, providing the Pi with commands in a manner that is quick to learn and easy to follow. This is in marked contrast to low-level languages, like assembler, which are closer to how the computer thinks but almost impossible for a human to follow without experience. The high-level nature and clear syntax of Python make it a valuable tool for anyone who wants to learn to program. It is also the language that is recommended by the Raspberry Pi Foundation for those looking to progress from the simple Scratch to more hands-on programming. Python is published under an open-source license, and is freely available for Linux, OS X and Windows computer systems. This cross-platform support means that software written using Python on the Pi can be used on computers running almost any other operating system as well except where the program makes use of Pi-specific hardware such as the GPIO Port. This can be configured to all external devices by using python languages also change their setting as per our requirement.

3.5.3 VNC Viewer

VNC (Virtual Network Computing) works on a client/server model: A VNC viewer (or client) is installed on the local computer and connects to the server component,

which must be installed on the remote computer. The server transmits a duplicate of the remote computer's display screen to the viewer. The below figure 3.2 shows the view of VNC Viewer.

Figure 3.3 VNC Viewer

3.6 SPEAKER

The speaker connects to the audio jack on the Raspberry Pi, and can be used to play voice and alerts. The speaker has a rich and loud sound. It has its own power supply that can be charged with the USB port. The volume can be controlled with a button on the speaker, or from the Raspberry Pi. The processor with speaker is fixed in a class room.

3.7 SUMMARY

In this chapter, the entire working mechanism of wireless voice transmission is presented.

CHAPTER 4

TTS CONVERSION USING TELEGRAM APPLICATION

This chapter discusses about the features and functions of telegram application and text to speech conversion process in detail.

4.1 TELEGRAM

Telegram is a cloud based instant messaging and voice over IP service telegram client apps are available for Android , iOS ,WindowsPhone, WindowsNT, mac OS and Linux. Users can send messages and exchange photos, videos, stickers, audio and files of any type. Telegram's client side code is open source software but the source code for recent versions is not always immediately published, whereas its server-side code is closed source and proprietary. The service also provides APIs to independent developers.

4.1.1 TELEGRAM BOTS

Bots are third-party applications that run inside telegram. Users can interact with bots by sending them messages, commands and inline requests. The bots are controlled using HTTPS requests to the bot API. A bot can act as a smart newspaper, sending relevant content as soon as it's published. A bot can enrich telegram chats with content from external services. BotFather is the one bot to rule them all. It is used to create new bot accounts and manage the existing bots.

4.1.2 TYPES OF BOT

• Gmail Bot : This bot is an email client that works right inside telegram. connecting our gmail account to receive emails as instant messages on Telegram, compose new emails and

replies right from the chat, as well as delete or mark emails as spam all these features are done using this bot .

• Image Bot : This simple bot can fetch images and GIFs upon user request in the telegram.

• IMDB bot : This bot automatically works in all our chats and groups, no need to add it anywhere. Simply type @imdb in any chat. By using this bot one can access movie files, television programs, home videos, streaming contents etc.,

• Wiki bot : This bot searches the user's content in the Wikipedia and provides number of search results to them.

• Music bot : This bot can help us to find different class of musics as same as in many other musical channel application.

• Youtube bot **:** This bot can help us to find and share the YouTube videos.

• GitHub bot : To get notifications about events in our public GitHub repositories and post comments directly from telegram this bot is used.

• Demo Shop Bot : This bot used for money transaction purposes without actually paying anything.

• Sticker bot : This bot will help you find new relevant stickers for your favorite emoji same as like in whatsapp messengers.

• Vote bot : This bot will help you create polls and share them with friends.

• Like bot : A cool bot to create posts with emoji-based like buttons.

• GameBot : It is demo bot for the telegram gaming platform. It can get you a few fun sample games to play.

4.1.3 WORKING OF BOT

At the core, Telegram Bots are special accounts that do not require an additional phone number to set up. Users can interact with bots in two ways:

• Send messages and commands to bots by opening a chat with them or by adding them to groups. This is useful for chat bots or news bots like the official TechCrunch bot.

• Send requests directly from the input field by typing the bot's @username and a query. This allows sending content from inline bots directly into any chat, group or channel.

Messages, commands and requests sent by users are passed to the software running on your servers. The intermediary server handles all encryption and communication with the Telegram API. The communication with this server is via a simple HTTPS-interface that offers a simplified version of the Telegram API.

4.1.4 CREATION OF BOT FATHER

The BotFather will ask for a name and username, then generate an authorization token for our new bot. The name of the bot is displayed in contact details and elsewhere. The Username is a short name, to be used in mentions and telegram.me links. Usernames are 5-32 characters long and are case insensitive, but may only include Latin characters, numbers, and underscores. The token is string along the lines of 110201543:AAHdqTcv CH1vGWJxfSeofSAs0K5PALDsaw that is required to authorize the bot and send requests to the Bot API.

4.1.5 ADVANTAGES OF TELEGRAM

It has high security as it provides more security than any other messenger apps, and the secret chat using encryption technique is an example for security and privacy. It has the self-destruction mode that enables all the chats to work flawlessly with very stable and reliable performance and the messages are delivered without delay, so, it is one of the fastest messenger apps available. We can send and receive video files up to 1024 MB and we could share multiple images and photos. The users are able to send the pictures, audio and video as part of their messages, it is highly reliable, and we will not lose a huge amount of data. It has unlimited cloud storage, it stores the data on the cloud, we will never lose the data that we shared, and we can access the same from more than one device. It keeps our messages safe from the hacker attacks, we can connect from most remote locations, we can coordinate groups up to 200 members, and we can synchronize our chats across all our devices.

4.1.6   DISADVANTAGES OF TELEGRAM

It does not have multiple selections, when we want to send more than one file at once, it is not possible. It has no voice or video chat feature, and there is no option for video/audio chatting, while other services provide this facility.

4.2 TTS CONVERSION

TTS stands for Text-to-Speech (also written as Text to Speech) – a form of speech synthesis that converts text into voice output. Text-To-Speech software basically takes the text you write and turns it into speech files that you can use. Text-to-speech (TTS) is a type of speech synthesis application that is used to create a spoken sound version of the text in a computer document, such as a help file or a Web page. TTS can enable the reading of computer display information to be audible in speaker which is fixed in class room. Speech synthesis is a artificial or computer generated human speech.

Current TTS applications include voice-enabled e-mail and spoken prompts in voice response systems. TTS is often used with voice recognition programs. Like other modules the process has got its own relevance on being interfaced with, where Raspberry Pi finds its own operations based on image processing schemes. So once image gets converted to text and thereby it could be converted from text to speech. Character recognition process ends with the conversion of text to speech and it could be applied anywhere.

4.2.1   MECHANISM BEHIND TEXT TO SPEECH CONVERTER

Text-to-speech device consists of two main modules, the image processing module and voice processing module. Image processing module captures image using camera, converting the image into text. Voice processing module changes the text into sound and processes it with special physical characteristics so that the sound can be understood. OCR (Optical Character Recognition) is a technology that automatically recognizes the character through the optical mechanism.

This technology imitates the ability of the human senses of sight, where the camera becomes a replacement for eye and image processing is done in the computer engine as a substitute for the human brain. Tesseract OCR is a type of OCR engine with matrix matching. E-selection of Tesseract engine is because of its flexibility and extensibility of machines and the fact that many communities are active researchers to develop this OCR engine and also because Tesseract OCR can support 149 languages. In this project we are identifying English alphabets. Before feeding the image to the OCR, it is converted to a binary image to increase the recognition accuracy. Image binary conversion is done by using Image-magick software, which is another open source tool for image manipulation. The output of OCR is the text, which is stored in a file. The figure 5.1 shows the process and block diagram of text to speech conversion.
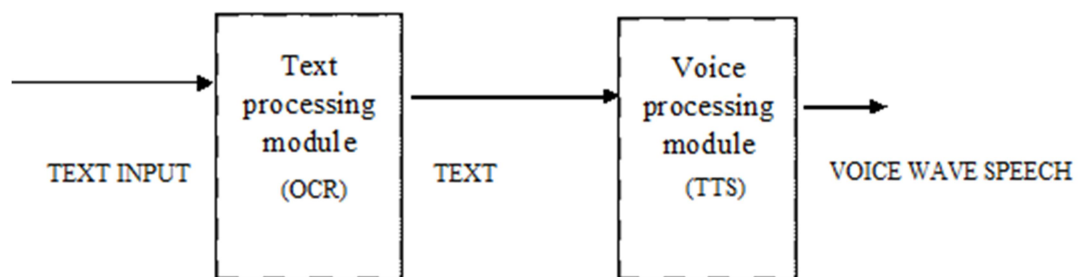
Figure 5.1 Block Diagram of Text to Speech Conversion

4.2.2 SPEECH SYNTHESIS

A Text-To-Speech (TTS) synthesizer is a computer-based system that should be able to read any text aloud, when it is directly introduced in the computer by an operator. It is more suitable to define Text-To-Speech or speech synthesis as an automatic production of speech, by 'grapheme to phoneme' transcription. A grapheme is the smallest distinguishing unit in a written language. It does not carry meaning by itself. Graphemes include alphabetic letters, numerical digits, punctuation marks, and the individual symbols of any of the world's writing systems. A phoneme is "the smallest segmental unit of sound employed to form meaningful utterances".

4.2.3 SPEECH SYNTHESIZER TECHNOLOGY

The most important qualities of a speech synthesis system are naturalness and ineligibility. Naturalness describes how closely the output sounds like human speech, while intelligibility is the ease with which the output is understood. The ideal speech synthesizer is both natural and intelligible. Speech synthesis systems usually try to maximize both characteristics. The primary technologies for generating synthetic speech are

- Concatenative synthesis
- Domain-specific synthesis

4.2.4 CHARACTER –TO- VOICE

Let us start text to speech synthesis with a simple character to voice conversion. The database required for character to voice conversion is recorded alphabets (a-z), digits (0-9) in the form of wave files. The next step in converting text to speech is to create a text file. Once the file is created, it is opened and read in URL page of Google chrome. In Google chrome all the data is stored in the form of a matrix. For every element read, corresponding wave file is played so as to output the sound of that character. We can read as big file as possible but only character wise.

4.2.5 APPLICATIONS

Synthesized speech can also be used in many situations. It can be programmed for special tasks like spelling and pronunciation teaching for different languages. It can also be used with interactive educational applications. The newest applications in speech synthesis are in the area of multimedia. Synthesized speech may also be used to speak out short text messages (sms) in mobile phones or computer.

4.2.6   DRAWBACKS OF SPEECH SYNTHESIS

The sound quality and naturalness were lacking and concatenating the sounds depending on the word was slight difficult. Creating the logic for accurate pronunciation of all the words are difficult.

4.3   SUMMARY

In this chapter, speech synthesis process and text to audio conversion using telegram application are discussed.

CHAPTER 5

FEATURES AND SPECIFICATIONS OF THE PROCESS COMPONENTS

This chapter discusses about the specifications of the components of digital circular and its specifications.

5.1 RASPBERRY PI

The Raspberry Pi is a credit-card-sized computer. It's available anywhere in the world, and can function as a proper desktop computer or be used to build smart devices. The SD card inserted into the slot of the board acts as a hard drive for the Raspberry Pi. It is powered by USB and the video output can be hooked up to a traditional RCA TV set, a more modern monitor, or even a TV using the HDMI port. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.

The Raspberry Pi comes in two models, they are model A and model B. The main difference between model A and model B is USB port. Model A board will consume less power and that does not include an Ethernet port. But, the model B board includes an Ethernet port. The raspberry pi comes with a set of open source technologies, i.e. communication and multimedia web technologies.

5.1.1   HARDWARE SPECIFICATION OF PI

The raspberry pi board comprises a program memory (RAM), processor and graphics chip, CPU, GPU, Ethernet port, GPIO pins, Zigbee socket, UART, power source connector and various interfaces for other external devices. It also requires mass storage,

for that we use an SD flash memory card. The raspberry pi board will boot from this SD card similarly as a PC boots up into windows from its hard disk. The below figure 5.1 shows the hardware circuit of Raspberry pi.
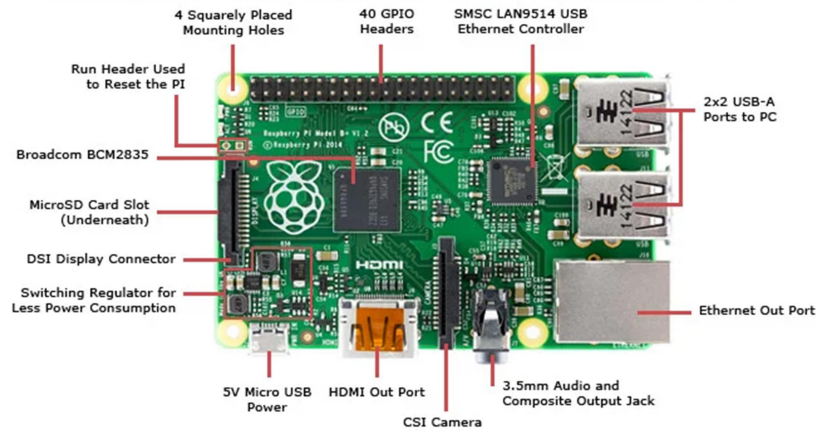

Figure 5.1 Hardware of Raspberry Pi

5.1.2 PIN CONFIGURATION

The Raspberry Pi 3 has general purpose IO pins, 4 PWM- capable pin and several buses (SPI, I2C and UART). It does not have analog input or output pins. The Raspberry Pi has a green activity LED next to the red power LED near the USB connector. The below figure 5.2 represents the pin configuration of Raspberry Pi 3.

Figure 5.2 Pin Diagram of Raspberry Pi 3

5.1.3 FEATURES OF RASPBERRY PI 3

- 512 MB SDRAM memory.
- Broad-com BCM2835 SoC full high definition multimedia processor.
- Dual core video core IV multimedia co-processor.
- Single 2.0 USB connector.
- HDMI (rev 1.3 and 1.4) Composite RCA (PAL & NTSC) Video Out.
- 3.5 MM Jack, HDMI Audio Out.
- On board 10/100 Ethernet RJ45 jack.
- MMC, SD, SDIO Card slot on board storage. Linux Operating system.

5.1.3   SPECIFICATION OF RASPBERRY PI 3

Table 5.1 Specifications of Raspberry pi 3

SPECIFICATIONS	Raspberry pi 3 B+
CPU type/ Speed	ARM Cortex-A53 1.4GHz
RAM Size	1GB SRAM
Integrated Wi-Fi	2.4GHz and 5GHz
Ethernet Speed	300Mbps
Bluetooth	4.2
PoE	Yes

5.1.4   ADVANTAGES OF RASPBERRY PI 3

Raspberry Pi is a fully a functioned computer, a system-on-chip (SoC). Capable of doing multitask at a time like a computer. It has the built in Ethernet port, through which you can directly to the networks. Main advantage is that OS can be easily switched on to the single Raspberry Pi board.

5.1.5   DISADVANTAGES OF RASPBERRY PI 3

The memory of the Raspberry Pi is more limited with just 512MB or 256MB available. It requires a bit of technical knowledge and desire to "tinker" Knowledge of basic electronics, and programming language like Python. It doesn't work out of the box and an assembly is required. The basic assembly itself is simple, but any more than that requires more technical knowledge and parts.

5.2   RELAY MODULE

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal.

5.2.1 TYPES OF RELAY

- Coaxial relay
- Contactor
- Electromechanical relay
- Force guided contact relay
- Latching relay
- Pole and throw

5.2.2 ELECTROMECHANICAL RELAY

The electromechanical relay is an electrically operated switch that completes or interrupts a circuit by physical movement of electrical contacts into contact with each other. It consists of various parts such as movable armature, movable contact & stationary contact or fixed contact, spring, electromagnet (coil), the wire wrapped as coil with its terminals represented as 'C' which are connected to form electromechanical relay. The figure 5.3 represents the four channel relay module.
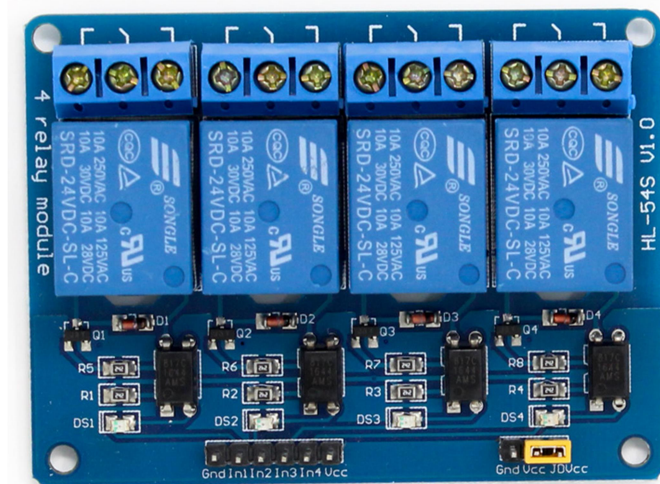

Figure 5.3 Relay Module

5.2.3 ADVANTAGES

Electromagnetic relays have fast operation and fast reset. They can be used for both ac and dc systems for protection of ac and dc equipment. Electromagnetic relays operating speeds which has the ability to operate in milliseconds are also can be possible. They have the properties such as simple, robust, compact and most reliable.

5.3   AMPLIFIER

An audio amplifier is an electronic device that increases the strength of an audio signal that pass through it. An audio amplifier amplifies low power audio signals to a level

which is suitable for driving loudspeakers. Audio power amplifiers are found in all manner of sound systems including sound reinforcement, public address and home audio systems and musical instrument amplifiers like guitar amplifiers. It is the final electronic stage in a typical audio playback chain before the signal is sent to the loudspeakers. One of the key features of a good amplifier is that it will increase volume without increasing distortion at the same time. If any distortion is observed at the desired volume level, it probably needs an amplifier.

5.3.1   WORKING PRINCIPLE OF AMPLIFIER

The Small Signal Amplifier is generally referred to as a "Voltage" amplifier because they usually convert a small input voltage into a much larger output voltage. The power amplifier works on the basic principle of converting the DC power drawn from the power supply into an AC voltage signal delivered to the load. The figure 5.4 represents the working mechanism of audio amplifier.
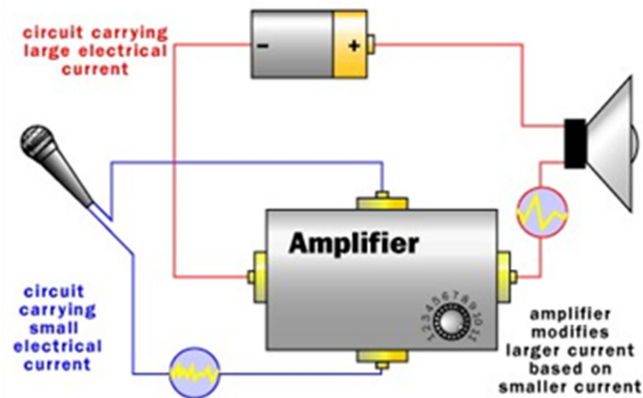

Figure 5.4 Working mechanism of Audio Amplifier

5.3.2   CHARACTERISTICS OF AMPLIFIER

The quality of an amplifier is measured by a series of specifications called figures of merit. They are as follows:

Bandwidth: The frequency range at which the amplifier can operate.

Noise: The amount of unwanted extra information included in the output.

Skew Rate: The maximum rate of change of output.

Gain: Perhaps the most important, the ratio between the magnitudes of input and output signals.

Stability: The ability to provide constant and reliable output.

Linearity: The degree of proportionality between input and output signals.

Efficiency: Another very important characteristic, it is the ratio between the output power and power consumed.

Output Dynamic Range: Ratio between the largest and smallest useful output levels.

5.3.3   CLASSIFICATION OF AMPLIFIER

There are several types of amplifiers categorized by their operation, application or characteristics. Some of them are:

- Power Amplifiers
- Operational Amplifiers (Op-Amps)
- Transistor Amplifiers
- Instrument Amplifiers
- Distributed Amplifiers

5.3.4   POWER AMPLIFIER

There are many forms of electronic circuits classed as amplifiers, from Operational Amplifiers and Small Signal Amplifiers up to Large Signal and Power Amplifiers. The classification of an amplifier depends upon the size of the signal, large or small, its physical configuration and how it processes the input signal that is, the relationship between input signal and current flowing in the load. The table 5.2 represents the classification of power amplifier.

Table 5.2 Classification of Power Amplifier

Types of signal	Type of Configuration	Classification	Frequency of Operation
Small signal	Common Emitter	Class A Amplifier	Direct Current(DC)
Large signal	Common Base	Class B Amplifier	AudioFrequencies (AF)
	Common Collector	Class AB Amplifier	RadioFrequencies (RF)
		Class C Amplifier	VHF, UHF and SHF Frequencies

5.3.4.1 TDA2030A

The TDA2030A is a monolithic integrated circuit in the Pentawatt package, intended for use as a low frequency class-AB amplifier. Typically it provides 14 W output power at 14V/4 Ω. At ±14 V or 28 V, the guaranteed output power is 12W on a 4 Ω load and 8W on an 8 Ω. The TDA2030A provides high output current and has very low harmonic and crossover distortion. Furthermore, the device incorporates an original short-circuit protection system comprising an arrangement for automatically limiting the dissipated power so as to keep the operating point of the output transistors within their safe operating range. A conventional thermal shutdown system is also included. The figure 5.5 represents the TDA2030A IC .
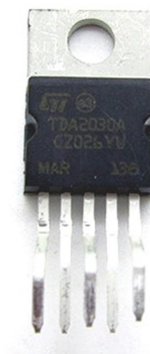
Figure 5.5 TDA2030A

The TDA2030 is a powerful audio amplifier IC. An audio amplifier is nothing but one that has the capability to amplify the audio signals from any audio source such as mobile phone jack or microphone so that volume is increased when the audio is played in a speaker. Audio amplifier circuits can also be made using simple op-amps, but if you need higher volume that is loud enough for a room then this power audio amplifier is will be the best choice. This IC can deliver up to 20W of output power, so you can run a 4Ω speaker at 12W or a 8Ω speaker at 8W.

5.3.4.2 FEATURES

- Low frequency class AB amplifier most suited for audio amplification
- Can provide up to 20 Watts as output power
- Wide range of power supply from 6V to 36V
- Short circuit and thermal protection is available
- Breadboard friendly
- Available in 5-pin TO220 package

5.3.4.3 PIN CONFIGURATION

The pin description of the power amplifier TDA2030A is shown in the figure 5.6
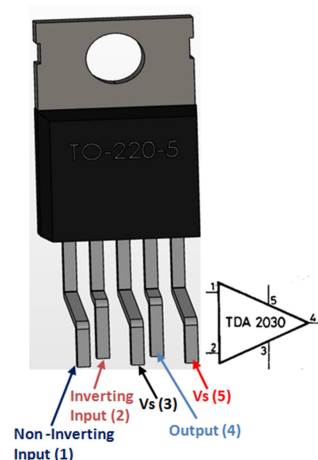

Figure 5.6 Pin Configuration

5.3.4.4 APPLICATIONS

- Used for Audio signal Amplification
- Suitable for high power amplification
- Capable of operating on dual/split power supply
- Can be used to cascade audio speakers

5.3.5 TRANSISTOR AMPLIFIER

It is a well-known type of amplifier which is a multi-configuration high output amplifier that uses transistors as the working base. These include bipolar junction transistors (BJTs) and metal oxide semiconductor field-effect transistors (MOSFETs). A Transistor acts as an amplifier when operating in active region. It can amplify power, voltage and current at different configurations. Some of the configurations used in amplifier circuits are

- Common emitter amplifier
- Common collector amplifier
- Common base amplifier

Of the above types common emitter type is the mostly used configuration. A preamplifier is an electronic amplifier that converts a weak electrical signal into an output signal strong enough to be noise-tolerant and strong enough for further processing, or for sending to a power amplifier and a loudspeaker. Without this, the final signal would be noisy or distorted. In an audio system, they are typically used to amplify signals from analog sensors to line level. The second amplifier is typically a power amplifier. The preamplifier provides voltage gain (e.g., from 10 mV to 1 V) but no significant current gain. The power amplifier provides the higher voltage necessary to drive loudspeakers.

5.3.5.1 BC547

BC547 is a NPN transistor hence the collector and emitter will be left open (Reverse biased) when the base pin is held at ground and will be closed (Forward biased) when a signal is provided to base pin. BC547 has a gain value of 110 to 800, this value

determines the amplification capacity of the transistor. The maximum amount of current that could flow through the Collector pin is 100mA, hence we cannot connect loads that consume more than 100mA using this transistor. To bias a transistor we have to supply current to base pin, this current (IB) should be limited to 5mA. The figure 5.7 represents the BC547 transistor.
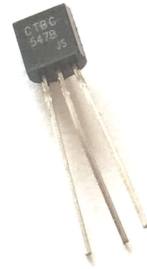

Figure 5.7 BC547 Transistor

5.3.5.2 FEATURES

- Bi-Polar NPN Transistor
- DC Current Gain (h_{FE}) is 800 maximum
- Continuous Collector current (I_C) is 100mA
- Emitter Base Voltage (V_{BE}) is 6V
- Base Current(I_B) is 5mA maximum
- Available in To-92 Package

5.3.5.3 PIN CONFIGURATION

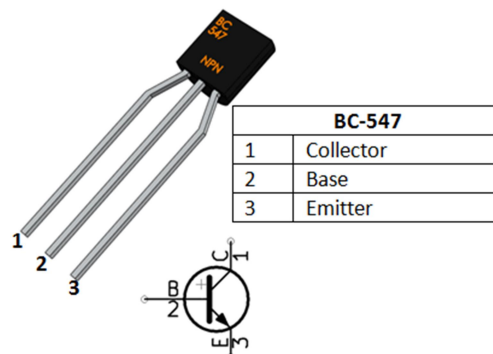The pin description of the pre amplifier BC547 is shown in the figure 5.8

BC-547	
1	Collector
2	Base
3	Emitter

Figure 5.8 Pin configuration

5.3.5.4 APPLICATIONS

- Driver Modules like Relay Driver, LED driver etc..
- Amplifier modules like Audio amplifiers, signal Amplifier etc..
- Darlington pair

5.4 SPEAKERS

Speakers are transducers that convert electromagnetic waves into sound waves. It is one of the most common output devices used with computer systems. The speakers receive audio input from a device such as a computer or an audio receiver. This input may be either in analog or digital form. Analog speakers simply amplify the analog electromagnetic waves into sound waves. Since sound waves are produced in analog form, digital speakers must first convert the digital input to an analog signal and then it generates the sound waves. The sound produced by speakers is defined by frequency and amplitude. The frequency determines how high or low the pitch of the sound is. Amplitude or loudness is determined by the change in air pressure created by the speakers sound waves.

5.4.1 WORKING OF SPEAKERS

Speakers work by converting electrical energy into mechanical energy (motion). The mechanical energy compresses air and converts the motion into sound energy or sound pressure level (SPL). When an electric current is sent through a coil of wire, it induces a magnetic field. In speakers, a current is sent through the voice coil which produces an electric field that interacts with the magnetic field of the permanent magnet attached to the speaker. Like charges repel each other and different charges attract. As an audio signal is sent through the voice coil and the musical waveform moves up and down, the voice coil is attracted and repelled by the permanent magnet. This makes the cone that the voice coil is attached to move back and forth. The back and forth motion creates pressure waves in the air that we perceive as sound. The figure 5.9 represents the internal parts of the speaker.
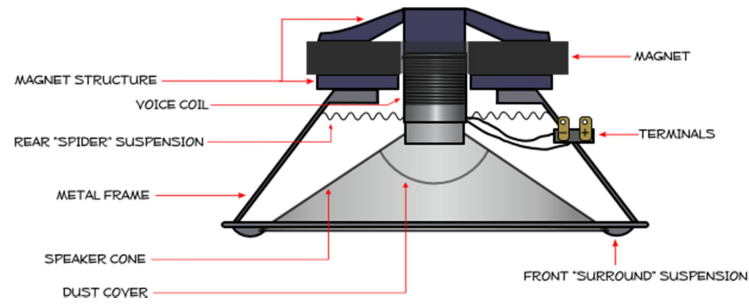
Figure 5.9 Internal parts of speaker

5.4.2   4-OHM SPEAKER

Like resistance, impedance is a restriction of the flow of electrical current in a circuit. Resistance and impedance are similar, although impedance changes for different audio frequencies and resistance is generally constant. Impedance comes from the interaction of the speaker's voice coil and other electronic components. A 4-ohm speaker requires more power from an amplifier than an 8-ohm speaker to produce the same loudness of sound. This is due to the relationship between voltage, current and resistance in electronic circuits. As to advantages, a 4-ohm speaker presents less resistance to the flow of current from an amplifier compared to an 8-ohm speaker, so the more current that flows, the more power is pulled out of the amplifier.

5.5 SUMMARY

In this chapter, the hardware components of digital circular system and its specifications were discussed.

CHAPTER 6

RESULT AND DISCUSSION

6.1 RESULT

The project Digital Circular has been successfully implemented by interfacing additional speakers with raspberry pi and the voice clarity has been improvised by using google voice assistant. It has been tested to receive the audio in several class rooms using multiple speakers. The Bot father named @kongueie_bot has been created and here the required circular is copied from the mail and entered in the telegram bot. The required class rooms are selected by providing respective commands and the speakers get selected accordingly. Before selection as mentioned earlier, authentication has been developed so only the authorized person is allowed to send the information through the bot. The information converted to voice is audible through the speakers in class rooms. The below figure 6.1 represents the text to voice conversion.
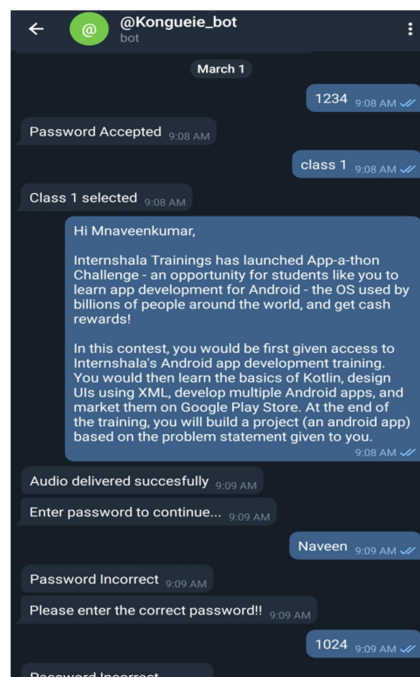

Figure 6.1 Process of Text to Voice conversion

6.2 COMPARITIVE STUDY

Table 6.1   Comparison table

Operation	Manual circular	Wireless circular
Time to convert the mail into circular/message	1 - 2 min	30 – 60 sec
Time to convert the circular/message to voice	10 – 15 min	5 – 10 sec
Time to reach the receiver/speakers	20 – 30 min	10 – 20 sec
Total (approx.) time	30 – 45 min	0.75 – 1.5 min

The table 6.1 presents the comparison analysis of manual circular and wireless circular. The proposed method reduces time consumption.

6.3 DISCUSSION

The digital circular is improved by interfacing multiple speakers. The time consumed to circulate the circular is reduced. It takes only few minutes to circulate the circular. The interference during class hours is also avoided and the wastage of papers were also reduced.

CHAPTER 7

CONCLUSION AND FUTURE SCOPE

7.1 CONCLUSION AND FUTURE SCOPE

In this phase digital circular has been implemented in several class rooms. In the proposed system, circulars can be sent by the users to any location with high data speed. In future, the project can be implemented everywhere in schools, workplaces, malls, railway stations etc. In addition to that voice messages and buzzer can be included to indicate the arrival of new circulars in our institution.

APPENDIX I

PROGRAM

```python
import sys
import time
import telepot
import RPi.GPIO as GPIO
from gtts import gTTS
from pygame import mixer
mixer.init()
language = 'en'
code = '1234'
mytext = ""
GPIO.setwarnings(False)
#LED
def on(pin):
    GPIO.output(pin,GPIO.LOW)
    return
def off(pin):
    GPIO.output(pin,GPIO.HIGH)
    return
# to use Raspberry Pi board pin numbers
GPIO.setmode(GPIO.BCM)
# set up GPIO output channel
GPIO.setup(14, GPIO.OUT)
GPIO.setup(15, GPIO.OUT)
GPIO.setup(18, GPIO.OUT)
def handle(msg):
    global a
    global b
    global p
    chat_id = msg['chat']['id']
    command = msg['text']
    mytext = command
    print('Got command: %s' % command)
    if len(mytext) >= 2 and a == '1' and b == '1':
        myobj = gTTS(text=mytext, lang=language, slow=False)
        myobj.save("welcome.mp3")
        mixer.music.load('welcome.mp3')
        mixer.music.play()
        bot.sendMessage(chat_id,text="Audio delivered succesfully")
        mytext=""
        command=""
        a='0'
        b='0'
        p='0'
        time.sleep(1.5)
        bot.sendMessage(chat_id,text="Enter password to continue...")
```

```python
if command == code and p == '0' and b == '0':
    b='1'
    p='1'
    bot.sendMessage(chat_id,text="Password Accepted")
if len(mytext) >= 1 and command != code and p == '0' and b == '0':
    b='0'
    p='0'
    bot.sendMessage(chat_id,text="Password Incorrect")
    time.sleep(1.5)
    bot.sendMessage(chat_id,text="Please enter the correct password!!")
if len(mytext) == 1 and a == '1' and b == '1':
    bot.sendMessage(chat_id,text="Please enter some sentence and send.")
    mytext=""
if command == 'class 1' and b == '1':
    a='1'
    bot.sendMessage(chat_id,text="Class 1 selected")
    on(14)
    off(15)
    off(18)
elif command =='class 2' and b =='1':
    a='1'
    bot.sendMessage(chat_id,text="Class 2 selected")
    off(14)
    on(15)
    off(18)
elif command == 'class 3' and b == '1':
    a='1'
    bot.sendMessage(chat_id,text="Class 3 selected")
    off(14)
    off(15)
    on(18)
elif command == 'class 1,2' and b == '1':
    a='1'
    bot.sendMessage(chat_id,text="Class 1,2 selected")
    on(14)
    on(15)
    off(18)
elif command == 'class 1,3' and b == '1':
    a='1'
    bot.sendMessage(chat_id,text="Class 1,3 selected")
    on(14)
    off(15)
    on(18)
elif command == 'class 2,3' and b == '1':
    a='1'
    bot.sendMessage(chat_id,text="Class 2,3 selected")
    off(14)
    on(15)
    on(18)
elif command == 'class all' and b == '1':
    a='1'
    bot.sendMessage(chat_id,text="All class selected")
    on(14)
    on(15)
    on(18)
```

```python
    elif command == 'cancel' and b == '1':
        bot.sendMessage(chat_id,text="No class selected")
        b='0'
        p='0'
        off(14)
        off(15)
        off(18)
p = '0'
b = '0'
a = '0'
bot = telepot.Bot('954539960:AAGDsuHIbOfqIKPxzwjv_LePtNGUa5HwDoU')
bot.message_loop(handle)
print('I am listening...')
while 1:
    try:
        time.sleep(10)
    except KeyboardInterrupt:
        print('\n Program interrupted')
        GPIO.cleanup()
        exit()
    except:
        print('Other error or exception occured!')
        GPIO.cleanup()
```

APPENDIX II

Appendix II.1 Working model of the project

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