

Rasp-Pi based Remote Controlled Smart Advertising of Still and Moving Images

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ABSTRACT

The paper puts on the basis of idea which focuses on cost reduction and enhancing the quality of service in the field of digital advertising technologies. This work is about a remotely managed smart advertising system designed using Raspberry pi along with python programming. The digital advertising display system designed is based on various methods of using LCD screen, as well as other display devices. This system is very efficient to provide advertising information, to those people who live in public areas but; some areas that does not convenient to build- up the other types of advertise hoarding boards for their information. The Raspberry Pi model and its web interface using Wi-Fi dongle. This proposed system aims to substitute another system interface with Raspberry Pi, which will not only drastically reduces the cost involved but also will help achieving quality of services as the system will consume a smaller amount of power and become the system smartness.

In this digital advertising system using Raspberry Pi B+ model. The multiple display screens are placed at such place having maximum people crowded areas and those areas are mostly attractive in city. The contents on the screen are made up of several images files which are continuously running having different contents. The main goal of this project is broadcasting information and remotely controls it. The broadcasting information such as, buses and bus station, train and train station, shopping malls, city square, road highways, subways, hospital, in conference hall. It is also used in educational institutes like colleges and schools for the purpose of displaying notices for students and also displaying all institutional growth and achievements information for visitors. Similarly this application for industry purpose of displaying notices, information about current technologies and market scenario; which is useful for all company's employee.

KEYWORDS

Raspberry Pi, HDMI, Seven Inch Display, Wi-Fi dongle, Audio Speaker, Python Programming

1. INTRODUCTION

Advertising methods includes traditional way and digitally modern ways. Every business wants to grow and develop a strong customer's base. Therefore advertising or promoting a business is the key for achieving growth. Traditional advertising includes print advertising such as newsletters, handbill, newspapers, big hoardings, flyers, magazines, and other media like Radio, Television broadcast and outdoor advertising. The advertising media, through traditional way is usually more expensive than other advertising techniques. The digital advertising systems can run on simple hardware facilities which are based on continuous moving images on the display screen. The digital advertising is the name of distributing digital content to different points over central

headquarters. The displaying information in the form of still images that is same like poster advertising and the moving images means same like advertising in the form videos. It is generally used for attention in heavy traffic points and internal information distribution. And the simple advantages of digital advertising solutions are; reducing expenses, being easy to reach huge amount of peoples, integrating citizens with up-to-date technologies.

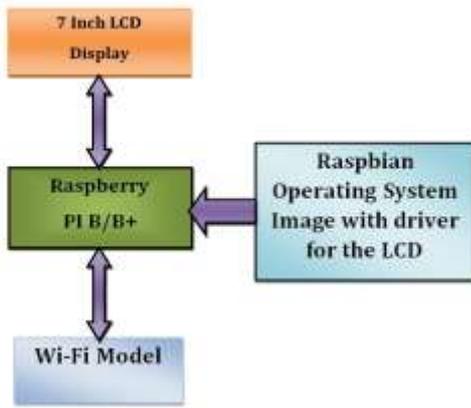


Figure 1.1: Basic block diagram of system

1.1 Problem Scenario

In existing systems, after studied about the various methodologies, related advertising messages on different display panel by interfacing, various microcontrollers and also studied about, how to access the whole system from remote distance places. In the previous display technology, it is needed to change the display panel, which is used for displaying advertising messages and for e- notice board; it's also difficult to change the input data in program memory. The many displaying technology difficult to interfacing system the various complication for programming and reprogramming display information and the main thing is that, implementation cost of whole system is mainly high and it also required more power. It having highly requirement of energy. At present, when information has to be updated in a notice board, it has to be done manually. If the same messages if the person wants to display in main centre of cities means he has to go there with laptop and changes the message by connecting in to pc these system problems face mostly in previous technology.

In many microcontroller systems facing such programing problem; that is it will require a lot of data memory or program memory space and most of the microcontroller like AT89C51 needed external RAM. The LED-based moving-message displays are used for indoors or outdoors advertising system but most of the time in display panel, single rows or columns of LED panel having a problem due to some internally damages [2]. That time whole panel not showing proper messages or images clearly as a output part, so we see that the most of the time current technologies facing many such problems related reprogramming facilities, display clarity, and difficult to interface externally, power related problems and most important part is that the lack of system smartness. So we are trying here to develop the advertising system that can help us to solve such facing problems in very smart manner.

1.2 Overview of the Proposed System

For solving, all the previous system problems which are most of the time faced in previous technologies, we developed new technology by using Raspberry pi module. The proposed system is based on the designed considering Raspberry Pi python programming language and interfacing of various required externally module such as Wi-Fi module for web accessing from remote distance place, HDMI for interfacing LCD display screen and the audio system is connected through 3.5 mm audio jack, which is available on the raspberry pi for the user listening purpose.

The system is made-up of interfacing raspberry pi module with seven inch LCD display screen for display purpose. The Wi-Fi model is connected with raspberry pi for wireless accessing system. In this system the use of display which is interface with Raspberry pi model has to be change as per the required application of the system users. The various application of file transfer protocol is freely available on internet and then selects one such application which is suitable for smartphone. The laptop is connected through internet connection and the file transfer as per the application of user. The fileZilla server client application, use for the uploading and deleting facility of file from local site to remote site.

The contents on the screen are made up of several images files and in the form of video format, the main goal of this project study is broadcasting display information and remotely control

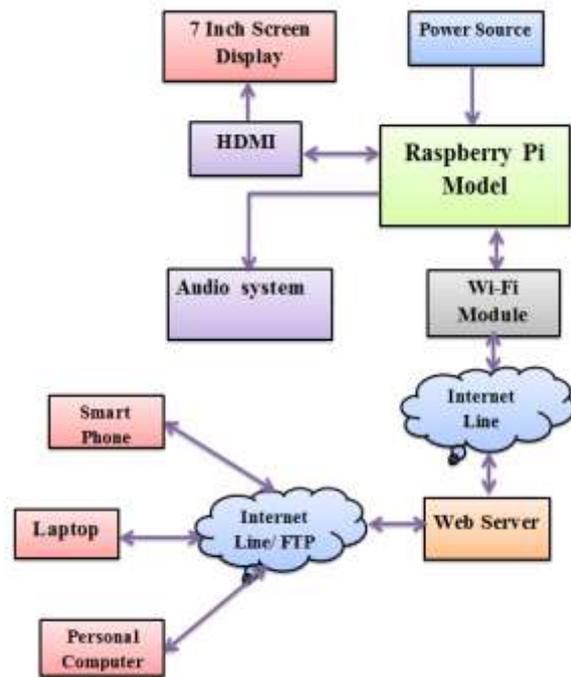


Figure 1.2: System design using Raspberry Pi.

2. Details about Hardware Design

2.1. Raspberry Pi, Model B+

The Raspberry Pi is a small, powerful and lightweight ARM based computer which can do many of the things a desktop PC can do.

Table 2.1: Hardware comparisons between Model B+, Model B and Model A

Spcification	Model B+	Model B	Model A
CHIP	Broadcom BCM 2835 SoC full HD multimedia application processor	Broadcom BCM 2835 SoC full HD multimedia application processor	Broadcom BCM 2835 SoC full HD multimedia application processor
RAM	512 MB SDRAM @ 400 MHz	512 MB SDRAM @ 400 MHz	256 MB SDRAM @ 400 MHz

STORAGE	Micro SD card	SD Card	SD Card
USB 2.0	4 USB port	2 USB port	1 USB port
POWER	600mA upto 1.8 A	750mA upto 1.2 A	600mA upto 1.2 A
GPIO	40 Pin	26 Pin	26 Pin



Figure 2.2: Seven Inch LCD display screen.

The Raspberry Pi is built using ARM11 processor. It is based on a Broadcom BCM2835 chip. It is a credit card sized computer that runs the freely available Linux Operating System. It is powered by a typical mobile phone charger using a micro USB connector, but be careful to choose a charger that can supply at least 700 mA. The Raspberry Pi can be connected to a TV using an HDMI cable although an analogue connection is also available. The powerful graphics capabilities and HDMI video output make it ideal for multimedia applications such as media centers and narrowcasting solutions.

The Raspbian is a Debian-based free operating system optimized for the Raspberry Pi hardware. The specifications are: the Raspberry Pi is based on Broadcom BCM2835 SoC processor chip. It required 5V DC power supply. And it is having CPU of 700 MHz Low Power ARM11 76JZFS Applications Processor. It having general processing unit of Dual Core VideoCore IV® Multimedia Co Processor. The capable of 1Gpixel/s, 1.5Gtexel/s or 24GFLOPs with texture filtering and DMA infrastructure. It have inbuilt 512MB SDRAM memory. The operating System Boots from SD card and a version running on the Linux operating system. SD card is expandable up to 32 GB. The Raspbian is a Debian based free operating system optimized for the Raspberry Pi hardware. Raspberry pi B+ having 4 USB connector and 3.5mm Audio jack. It is having HDMI (rev 1.3 & 1.4) composite RCA (PAL and NTSC).



Figure 2.1: Raspberry Pi B+ model.

2.2 Seven inch LCD Display

The selection of LCD display screen for interfacing, with the Raspberry pi having suitable specification is very important. The process of interfacing required same hardware connection that is firstly connects the LCD to the HDMI on the Raspberry Pi board with a HDMI cable. The selection of display screen for interfacing with Raspberry pi it's very important [5].

The above Seven inch HDMI displays having following features:

- The resolution of LCD is 800×480.
- It having HDMI interface for displaying, USB interface for touch control.
- It supports Raspberry Pi, and required driver is provided.
- It supports BB Black, comes with related images like: Angstrom.
- It is having touch control.
- It also supports Banana Pi / Banana Pro, comes with related images like: Ubuntu, Raspbian.

In fig. 2.3 shows that, the setup connection of raspberry pi as well as seven inch LCD display screen.

It clearly available the connection port for interfacing the various external devices like in Raspberry pi B+ model having the 4 USB port. The connections with keyboard, mouse, and Wi-Fi dongle such type of USB supporting devices are connecting using such USB facility [12].



Figure 2.3: Connection setup of Raspberry Pi

The reason of why selecting Wi-Fi as a network connectivity purpose is as follows.

Table 2.2: Reason of selecting Wi-Fi

Standards	Bluetooth	Zigbee	Wi-Fi
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Application Focus	Cable Replacement	Monitoring and controlling	Web-Email
Frequency Band	2.4GHz	868/915 MHz 2.4 GHz	2.4GHz 5GHz
Mix Signal Rate	1Mb/s	250Kb/s	54Mb/s
Distance Range	10 Meter	10-100 Meter	100 Meter
Channel Bandwidth	1MHz	0.3/0.6 MHz	22MHz

2.3 Wi-Fi dongle



Figure 2.4: The image of Wi-Fi dongle.

The Wi-Fi is a facility allowing computers, smartphone or other devices to connect the internet or communicate with each other wirelessly within a particular area. In our system Wi-Fi dongle used to connect the Raspberry pi for network connectivity. Wi-Fi works with no physical wired connection between sender and receiver by using radio frequency (RF) technology, a frequency within the electromagnetic spectrum associated with radio wave propagation [3]. When an RF current is supplied to an antenna, an electromagnetic field is created that then is able to propagate through space. The base of any wireless network is an access point (AP). The primary job of an access point is to broadcast a wireless signal that computers can detect and "tune" into. In order to connect to an access point and join a wireless network, computers and devices must be equipped with wireless network adapters.

3. STEPS INVOLVED IN PROPOSED SYSTEM IMPLEMENTATIONS:

First we can setup the system and this can be achieved by interfacing of micro USB power cable, 8GB SD card, USB keyboard, USB mouse, Wi-Fi dongle, Ethernet cable, the interfacing of Audio system with 3.5 mm audio jack and seven inch LCD display with HDMI cable with the Raspberry Pi. The Pi supports three different video outputs one is composite video second is HDMI video and third one is DSI video. While composite and HDMI video are readily accessible to the user, DSI video requires specialized hardware. After interfacing all devices to raspberry pi then switch on the power supply and start the setting process of system.

3.1 The process of first time setting up the Raspberry pi

To use the Raspberry Pi, an Operating System (OS) needs to be installed into an SD card. These instructions to be follows for installing the operating system in Raspberry pi. Firstly insert

the SD card that is 4GB or greater in size as per required and supportable facility [6].



Figure 3.1: Processing image of setting up the SD card.

Format the SD card by using SD card Formatter software so that the Pi can read it. The process of formatting SD card is, Firstly download the SD Association's Formatting Tool1. Then Install and run the Formatting Tool on the machine. Set "FORMAT SIZE ADJUSTMENT" option to "ON" in the "Options" menu which is in it, then check that the SD card inserted matches the one selected by the Tool and finally click on the "Format" button. Then download the New Out Of Box Software (NOOBS). The NOOBS makes setting up a Raspberry Pi for the first time much easier. The advantage of NOOBS, there is no needed network access and not need to download any special imaging software. NOOBS gives a list of Operating Systems to select from when booting for the first time. Unzip the downloaded file. Then right click on the file and choose "Extract all" in Windows. Copy the extracted files onto the SD card that was just formatted. Insert the SD card into Pi. Then the Pi will now boot into NOOBS and it should display a list of operating systems that one can choose to install [11].

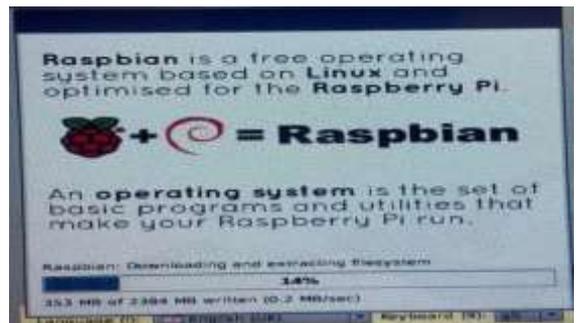


Figure 3.2: Image of downloading and extracting file system of Raspbian

If the display remains blank, one should select the correct output mode for the display by pressing one of the following number keys on the keyboard: One is HDMI mode; this is the default display mode. The next option is HDMI safe mode; selects this mode if we are using the HDMI connector and can't see anything on screen when the Pi has booted. The last one is composite PAL mode; select either this mode or composite NTSC mode if we are using the composite RCA video connector [6].

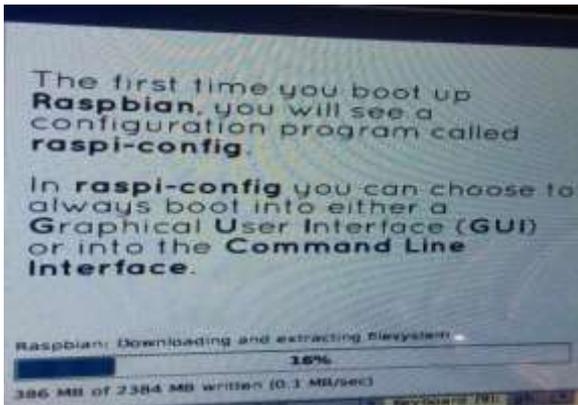


Figure 3.3: Process of first time boot up Raspbian.

3.2 The process of entering the graphical desktop

The Raspbian system boots to terminal interface by default. To make the operations simple when using with a LCD, it is recommended to set the system to boot to graphical desktop directly.



Figure 3.4: The running process of after giving the sudo reboot command.

Please follow the steps below to configure the system. Firstly enter the Raspbian system, and input the command is `sudo raspi-config`. Then Select the option Enable Boot to Desktop by using the Arrow keys, Space key or/and Enter key. Then select the option Desktop Login as user 'Pi' at the graphical desktop. When you see the prompt "Would you like to reboot now?" select the option Yes to reboot the system. The command use for reboot system is `sudo reboot`.

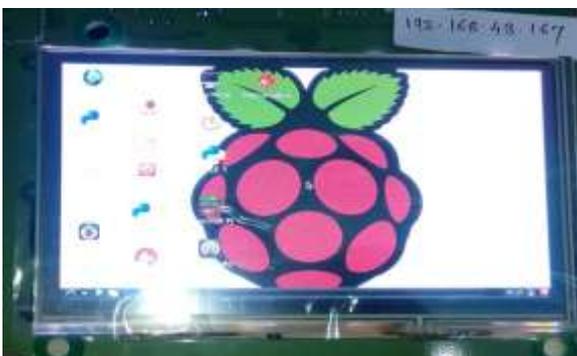


Figure 3.5: Complete process of image loading on Rasp Pi.

3.3 The process of connecting Raspberry Pi to the network

First of all, it is required that the Raspberry Pi should be connected to the LAN via Ethernet cables. The following steps will configure the Raspberry Pi over the network. On the LX Terminal, check the current network settings using 'ifconfig' then modify the current network settings. To edit the

network setting you must edit the interfaces file. The network can use a dynamic (DHCP) IP address or a static IP address. The DHCP that is Dynamic Host Configuration Protocol it is used to dynamically configure a host connected to a network so that it can use that network.

The DHCP basically assigns the host IP address, a subnet mask, a default gateway, and so on. When the Raspberry Pi will be new to the network, it will send DHCP discovery packet to the network. After encountering the packet, the DHCP server will respond by sending a DHCP offer to the Raspberry Pi. Then Edit the file. Finally set the address to the IP address you want the Raspberry Pi to occupy. And finally restart the Raspberry Pi and check the new connection by pinging the device [13].



Figure 3.6: Searching IP address through LX Terminal

3.4 The process of remote access to Raspberry Pi

The Remote desktop protocol (RDP) basically provides user for graphical interface to access the server over the network. It allows a client to communicate with a Windows server. One can run applications on a server from a remote client. To prevent traffic from intrusion, RDP uses authentication and encryption. The XRDP is present on the Raspberry Pi, and facilitates controlling the Raspberry Pi remotely from a Windows PC. Now, the RDP should be installed on PC, whereas, XRDP should be installed in Raspberry Pi. The command will install XRDP in Raspberry Pi is `sudo apt-get install xrdp`. Finally, on the local site of PC or laptop having raspberry pi desktop. In XRDP login process, it having three options first is module, this is by default selected, second is username then write pi as username and last is ask for password then, write raspberry as password and finally click on OK option.



Figure 3.7: Assigning the IP address for remote desktop connection.

Fig. 3.7 shows that, the process of remote desktop connection. In this process enter the correct IP address of system which is asses through remote place. For example the system IP is

192.168.43.167 then enter this IP in computer slot as per shown and then click on connect option.

Figure shows the complete process of login to XRDP for remote desktop connection. Write down the pi as username and raspberry as password. Finally click on OK option for further process [8].

3.5 The process of setting up Wi-Fi in Raspberry Pi

In the Raspbian operating system offers Wi-Fi configuration utility. The options for shortcut exists the process of Wi-Fi Configuration on the desktop of RPi. The process starts after clicking on the shortcut. Firstly scan for the Wi-Fi access points. A new window will open giving details about the access points. Then find the wireless access point in the list, and then double click on it.

Finally, a new window will open where in one will have to enter the password. After adding the access point, one can check the Wi-Fi connectivity in the very first window. IP address is display on Raspberry Pi. Now, the Raspberry Pi is connected to the wireless access point.



Figure 3.9: Scanning Wi-Fi access point.

Fig.3.9: shows that, the complete process of Wi-Fi configuration of raspberry pi to network. It having adapter and network option, after scanning the network and selecting required network, it gives the current statues about Wi-Fi connectivity. It having authentication that is WAP2-PSK, it shows the connection system SSID that is XOLO and it shows the IP address of system which is connected that is 198.168.43.141. After verifying all the details about network then click on connect option [7].

3.6 The process of assigning the static IP address to Raspberry Pi

The above method will assign RPi a dynamic IP address using DHCP. This automatically assigned IP address is absolutely fine. The RPi will be accessed more often, it is better to configure a static IP for the RPi. Configuring the Raspberry Pi over the Ethernet as well as Wi-Fi is done, making remote access possible; a web user interface for the client PCs or laptop for convenient access to Raspberry Pi remotely is to be designed [1].

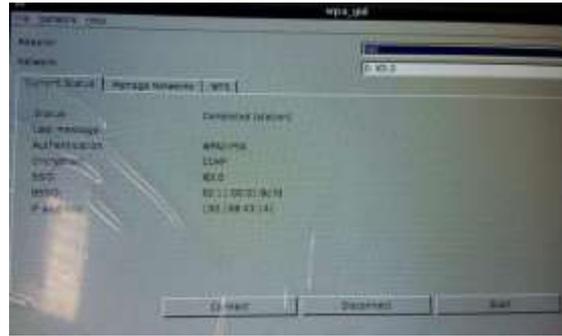


Figure 3.10: Connecting Wi-Fi to the network.

3.7 The process of configuring the Remote Control

The remote control for the Raspberry Pi will be implemented using the application 'FileZilla'. The FileZilla is a multi-platform smart phone application. The application can easily communicate with a PC, a laptop or a Raspberry Pi. The FileZilla is available on the Google play store. It is free available software. It consisting fileZilla client and fileZilla server. Clients are available for Windows, Linux, and Mac OS X. The server is available for only windows. The client support FTP and SFTP for SSH file transfer protocol. FTP means File Transfer Protocol; it is used to transfer data from one computer to another over the Internet, or through a network. Specifically, FTP is a commonly used protocol for exchanging files over any network that supports the TCP/IP protocol.

There are two computer system involved in an FTP transfer one is a server and second one is a client. The client computer, running FTP client software, initiates a connection to the server. Once connected, the client can do a number of file manipulation operations such as uploading files to the server, download files from the server, rename or delete files on the server and so on.

Fig. 3.12 shows that, the complete remote connection and uploading process of system using file transfer protocol that is FileZilla. After click on the icon of open the site manager then get the new window of site manager [14].

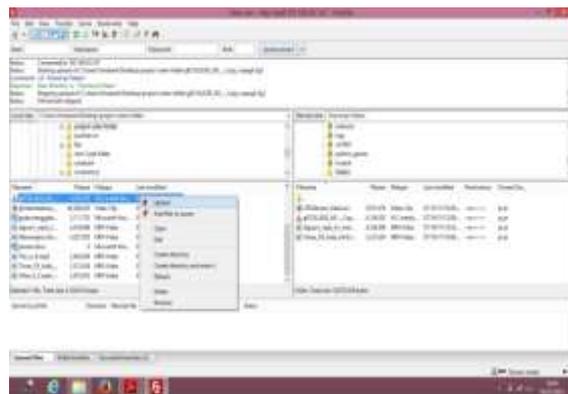


Figure 3.12: The uploading process of advertising
Fig 3.12 shows the process of uploading the advertising file from local site to remote site, and the fig. 3.13 shows that the process of deleting and the downloading advertising file of remote site by using FileZilla client application software.

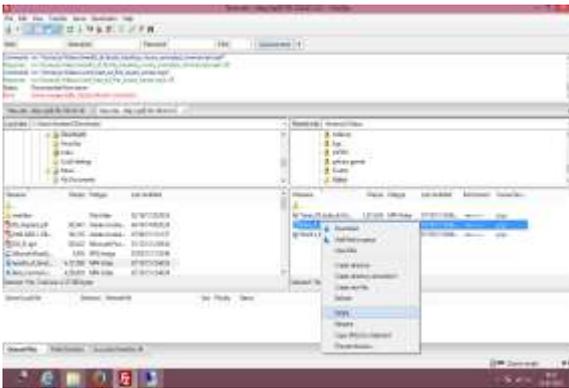


Figure 3.13: The process of downloading and deleting the advertising file.

4. Details about Software design

4.1 Details about Software Tools

Various software tools are used for development of this system are as follows.

Python: version 2.7, the Python is an easy to learn, powerful programming language. It has efficient high-level data structures and a simple but effective approach to object-oriented programming. Python's elegant syntax and dynamic typing, together with its interpreted nature, make it an ideal language for scripting and rapid application development in many areas on most platforms. Python interpreter is easily extended with new function and data types implemented in C or C++. In this project, we are using python for writing the script of output results [1].

Linux OS: Raspbian/debian wheezy, this is the main system software or master control program that runs overall system. It provides user interface, controls all the peripherals attached to system, provides and "environment" for all of the software programs that runs on the system and provides security.

MySQLdb version 3.4 the MySQL is a popular choice of database for use in web application. MySQL is a database server that provides the Python database API [4].

Putty version 0.59, the Putty is free and open source terminal emulator; serial console and network file transfer application. It supports several network protocols, including SCP, SSH, Telnet, rlogin. It can also use with local serial port connection.

Xming Version 6.9.0.31 the Xming is specially used for remote connection of Raspberry pi with personal Computer/Laptop. Xming is the leading windows system server for Microsoft windows. It is totally secure when used with SSH and optionally includes an enhanced Plink SSH client. Xming is cross compiled on Linux for Microsoft Windows.

AndFTP Application Version 4.2 the AndFTP is application software, which is freely available and convenient to install in laptop, personal computers, and smart phones also. FTP means File Transfer Protocol. It is used to transfer data from one computer to another over the Internet, or through a network. FTP is a commonly used protocol for exchanging files over any network that supports the TCP/IP protocol such as the Internet or an intranet.

FileZilla version 3.7.3 The FileZilla is free available software. It consisting fileZilla client and fileZilla server. Clients are available for Windows, Linux, Mac OS X; and server is available for only windows. The client support FTP and SFTP for SSH file transfer protocol.

4.2 System Flowchart

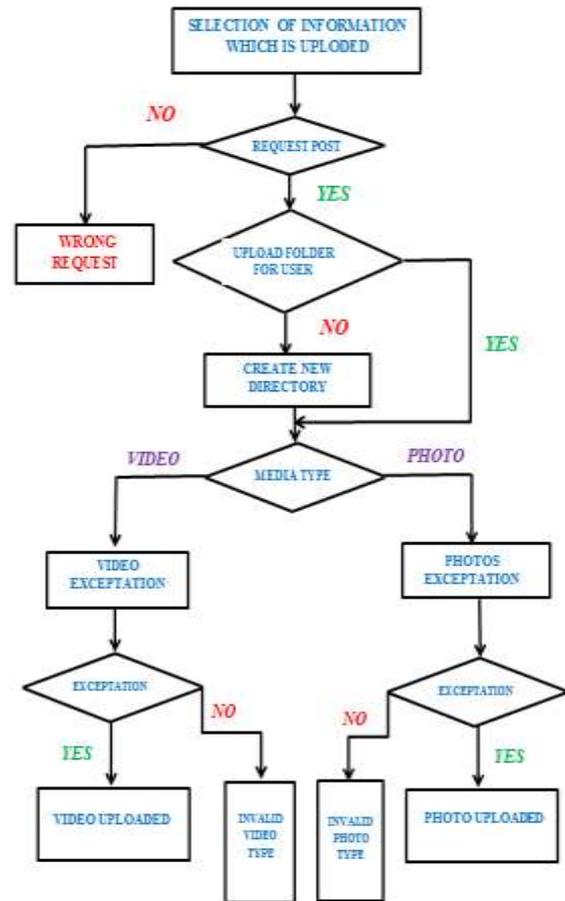


Figure 4.1: Flow chart of advertising upload.

5. EXPERIMENTAL RESULTS AND DISCUSSION

Fig. 5.1 shows the complete hardware operation of the system, it is based on Linux Operating System. The Raspberry Pi ARM11 microcontroller plays a vital role in overall system operation. And one thing is that, as an engineer, the main aim is to make life simple with the help of current growing technologies.

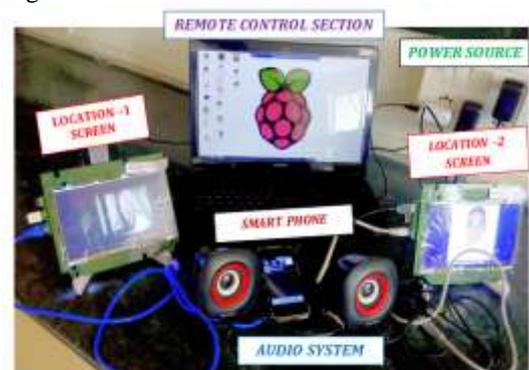


Figure 5.1: Hardware Implementation of the system

Fig. 5.2 shows that, the advertising of Godavari engineering college, Jalgaon. The display screen is located at remote distance place and this system having IP address that is 192.168.43.141. To access this system through internet connection and IP address playing very important roll. The one

step to simplify real time advertising system everything around us is becoming smart system such as now a days in market having smartphones, smart television, smart refrigerator and so many system available, so why not design the smart display board for advertising and display notices purpose in educational section, or indoor and outdoor application



Figure 5.2: Image shows the successfully uploading advertising on the server site

Fig. 5.2, shows the running advertising of GF's Godavari College of engineering, and this display screen having IP address is 192.168.43.141. The another display having different IP address that is 192.168.42.167. This result comes from after completion the process of uploading the file from local site to server site through FileZilla application.

Fig. 5.3, shows that, the complete successfully running system. It clearly show that second display screen is running advertisement of GF's Godavari college of engineering jalgaon and another first location screen is an waiting for advertisement.

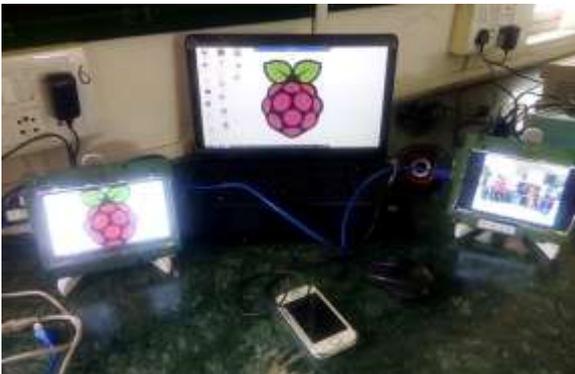


Figure 5.3: Complete running setup of system.

6. CONCLUSION AND FUTURE SCOPE

6.1 CONCLUSION

The work on "smart advertising technology using remote controlled raspberry pi" has been successfully designed and tested it by uploading and deleting of the still images and the moving images files that is in the MP4 format and also remotely access it by using Wi-Fi network from remote places. The aim of this thesis is to design and implement a digital advertising system that is remotely accessible and manageable very smart manner. The technology with Python has been implemented together on Raspberry Pi and webserver to achieve the desired result. The content management system of the digital advertising of still and moving images is designed with focus on managing the content distribution on the public

transport industry. In this system each display screen can be remotely managed and controlled via web interface. The approach of controlling the display system via a web interface over the internet could be useful for implementation of other similar applications that require remote access and monitoring. It has been developed by integrating features of all hardware components and software used. The presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced ARM11 raspberry Pi B+ board and with the help of growing technology the project has been successfully implemented.

6.2 FUTURE SCOPE

We have designed; the system for advertising purpose with full potential of digital advertising is an innovative, interactive medium, as compared to other traditional and static media.

As a part of a future work,

1) Cloud-based digital advertising:

The cloud computing has been seeing a wide area of applications in the market of digital advertising if start the advertising on the basis of payable per hour of use or number of operations. Then it becomes a reliable and cost efficient and can be deployed rapidly on digital advertising networks of any size.

2) Security:

Security is a very important part of any system, and in the digital advertising system improving the system smartness, security facility by giving the option of user login and user password for uploading the advertising on paying basis.

3) Increasing the pervasiveness and interactivity:

The way of increasing interactivity via the mobile device: with almost six billion mobile cellular subscriptions in worldwide and many of them including access to high-speed 3G services. The most of the handsets having features at least some basic interfaces, including SMS, and short-range Radio communication technologies such as Bluetooth and NFC. Then from handset it can trigger to event on the display such as uploading and deleting an advertising file.

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