ASMB (Advanced Smart Media Box)

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***Abstract* -Smart TV is one which can connect to internet and can stream media from internet. Buying a brand new smart TV is a very expensive. In this project a system is introduced that can be able to turn an old CRT TV into a Smart TV. It is just like a digital photo album to do a slideshow of photos from USB storage or from an online repository like Dropbox, Picasa, Flickr etc. It can play music, videos and play some cool games from USB storage. The smart TV can be controllable by an android phone. It has many features like Screen mirroring, a mini web server, it has the ability of voice recognition and it plays like a language translator. It also acts as a DLNA server for accessing files over the DLNA supported phones. Raspberry pi is used in this project which is a credit-card sized general purpose Linux computer designed and manufactured by the Raspberry Pi Foundation. The Pi features a system-on-a-chip setup built around the Broadcom BCM2836 processor (a tiny but fairly powerful mobile processor commonly used in cell phones) that includes a CPU, GPU, audio/video processing, and other functionality all on a low-power chip.**

Key words: Smart TV, Raspberry pi,DLNA, HDMI, USB

I. INTRODUCTION

The current trend to move to web-based television has challenged the traditional television value chain by allowing any IP-based network, wired or wireless, to deliver high quality television content. Smart TV is an advanced form of legacy TV and has been discussed as one of promising devices for Post PC. Up to now, Smart TV is gradually changing its system architecture by adding functions to increase its usage and coverage. The suggested project is a new platform design to add more flexibility and to cover weak points of the previous systems. Consequently, the rapid adoption of web-based TV applications is fuelled by user demands for social and user-generated multimedia content, in addition to the traditional linear and on-demand offerings. As well, the new television is social, allowing exchange of ratings and comments between viewers.

A smart TV may also be referred to as a "connected TV". Essentially, it's a TV that's connected to the Internet. It has built-in apps to take advantage of this - for example, a smart TV would likely have apps for playing videos from Netflix and YouTube. Smart TVs generally also have other built-in apps such as a web browser, Facebook, Twitter, LinkedIn, Angry Birds, and so on. The original concept of Smart TV was started to add functions like Internet and Web2.0 Specification to legacy TV and it was believed that it would take the role of PC. Based on the fundamental Smart TV concept, legacy Smart TV system architecture consists of the server providing contents and applications, set-top box clients for home appliances, and reasonable network devices with Internet connection.

Even though it had been improved its system and functions continuously, the independent Smart TV system was requested to upgrade its overall. The system can process contents of only video and image which are already pre-defined or set as a standard. Legacy Smart TV platform was usually designed on a closed private environment and needed customization for each company. It was hard to add functions and difficult to change its structure. Recently new types of Smart TV approaches were introduced by renowned IT companies like Apple, Google, and Samsung to overcome weakness and restriction of legacy Smart TV system. Those were iTV of Apple, Android TV 2.0 of Google, and Smart HUB of Samsung. According to the advent of these brand new system architectures and infrastructures with cloud computing environment, they anticipated that Smart TV would be a core element of killer contents & applications in IT resources with gradual increase of smart devices. Android OS and iOS smart devices are very common personal devices and also have steadily growing numbers of apps of covering various genres and versatile subjects. Regarding mobile apps, iOS apps were exceeded 700 thousand in 2013 and Android apps were also exceeded 700 thousand at the same time. Each new Smart TV system targeted to be a rich-content Smart TV and to give a strong impact to the industry by providing a lot of apps for customers to feel much more added values compared to that of the legacy Smart TV system of having simple broadcasting capability [1].

The Internet has come a long way over the last 30 years. Old-fashioned IPv4 is giving way to IPv6 so that every device on the Internet can have its own IP address. Machine-to-machine communication is on the rise, enabling devices to exchange and act upon information without a person ever being involved. The scope and scale of the Internet have changed. Industry leaders predict that the number of connected devices will surpass 15 billion nodes by 2015 and reach over 50 billion by 2020. The challenge for the embedded industry is to unlock the value of this growing interconnected web of

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devices, often referred to as the Internet of Things, describing it as the ultimate tool in future surveillance. This network has the power to reshape cities [2].

The main feature of this project is home media center. It can be used as a digital photo album to do a slideshow of photos from USB storage or from an online repository like Dropbox, Picassa and Flickr. The home media center uses Kodi which is a free and open-source media player software developed by the XBMC Foundation, a non-profit technology consortium. Kodi is available for multiple operating systems and hardware platforms, with a software 10-foot user interface for use with televisions and remote controls. It allows users to play and view most videos, music, such as podcasts from the internet, and all common digital media files from local and network storage media. It also have features of an application photo booth it can able to take photos using an USB camera and it automatically post that photos on an active user defined twitter account [5].

It has a feature of Airplay, which allows to play music on TV simultaneously when music is played on a smartphone without the need of actually copying it. It also has the screen mirroring feature by which video content can be played simultaneously on a smart phone and on TV [6]. The camera attached with this system is enabled by the motion detection [4]. One of the main advantages of this system is that it can be controlled using a smart phone, the media center on the system can be controlled using a smart phone [2]. It also has the features of voice recognition and language translations. Smart TV is an advanced form of legacy TV and has been discussed as one of promising devices for Post PC. Up to now, Smart TV is gradually changing its system architecture by adding functions to increase its usage and coverage. However, previous approaches were insufficient because they were lying on the legacy broadcasting paradigm or dependent on hardware.

The Raspberry Pi offers another path encouraging experimentation by lowering the cost of accidentally breaking trying to be making. The computer was conceived of by EbenUpton, formerly a lecturer at the University of Cambridge U.K created the Raspberry Pi Foundation to make it a real product. Upton is also a veteran of several years at chip maker Broadcom, designing the kind of chips that make it possible to sell a complete computer for $35. Raspberry Pi board costs only $35 and does the work of a computer costing hundreds of dollars. Though its purpose is not to replace computers, laptops etc. but to work in supplement with them [3]. Maximum of the raspberry pi computers is used in mobile phones. It enables people of all ages to explore computing, learn programming languages like Python and can be used for many tasks that a computer does, like games, browsing internet, word processing, spreadsheets and also playing video [5]. The Raspberry Pi is manufactured in three board configurations through licensed manufacturing deals with Newark element14 (Premier Farnell), RS Components and Egoman. There are various surveillance systems such as camera, CCTV, etc. In these types of surveillance systems the person who is stationary and is located in that particular area can only view what is happening in that place. If the user is moving from one place to another can be able to keep track of what is happening in that particular place. Also another advantage is that it offers privacy on both sides since it is being viewed by only one person. The other major advantage is that it is a simple circuit and the operating system used here is Raspbian OS. Raspbian OS has to be installed so that the image can be transmitted to the smartphone [4].

II. DESIGN OVERVIEW

The general block diagram of ASMB is shown below. The core component of this project is Raspberry Pi. Many other components are added to Raspberry Pi to effectively communicate with the outer world.

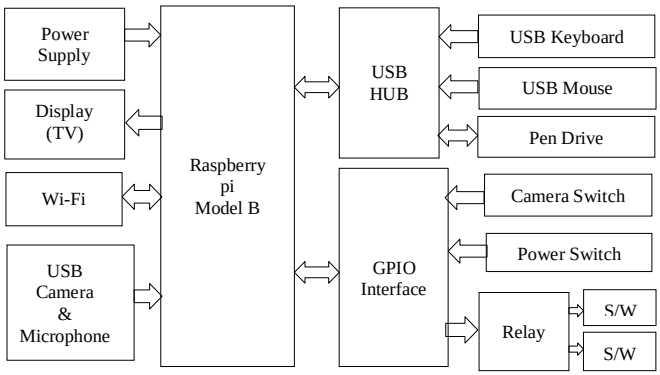

Fig. 1 Block diagram

Raspberry pi which is a credit card sized computer is used here (Raspberry pi model B revised version). It supports various Linux distributions such as Ubuntu, Open Suse etc. Many micro-USB power adapters are available in the market for powering Raspberry pi but the output of the power supply should be 5V, 2A. Raspberry pi requires a power adapter with minimum current requirement of 1.8A. In this project Bluetooth and Wi-Fi modules are used for the connectivity. The Bluetooth module is used for the application of AirPlay, it features as a wireless receiver and plays music. The Wi-Fi module is used to connect the Raspberry pi to the outer world. It brings the internet connectivity. Many features like DLNA, SSH, Screen mirroring can be achieved through Wi-Fi module. USB camera is used in this project is to take photos and it can able to print the photos instantly if printer is installed. USB Microphone is used for the Voice recognition feature

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and it also supports Voice translation. Game joysticks are used in this project to make the interface simpler. Keyboard and mouse are required only for the first time use. The details about camera interface circuit and the game joysticks are shown on the circuit diagram section.

A. First Time Setup

1) Connect the Ethernet cable from the Ethernet connector of the raspberry-pi to router. Internet connection should be working. Need to do this only first time when setup raspberry-pi, so that program can update itself to the latest version. Updates are enabled by default and can be disabled.
2) Connect the HDMI cable from the HDMI connector on raspberry-pi to the HDMI connector on TV.
3) Plug the SD card into slot on the slot on the underside of the raspberry-pi. SD card should push all the way in so that it is making a good contact with the connectors.

Plug the wireless adaptor from keyboard & touchpad media controller into a USB port on raspberry-pi. Finally, insert the micro USB power supply. This will automatically boot the raspberry pi up. It shows raspberry-pi logo after successful installation using ISE Xilinx software.

III. CIRCUIT DESCRIPTION

Relative to its size the Raspberry Pi is a power horse of a computer. It can drive HDMI displays, process mouse, keyboard, and camera inputs, connect to the Internet, and run full-featured Linux distributions. But it's more than just a small computer it's a hardware prototyping tool. The Pi has bi-directional I/O pins, which can be used to drive LEDs, spin motors, or read button presses. Driving the Raspberry Pi's I/O lines requires a bit of programming. The following is the circuit diagram for the project.

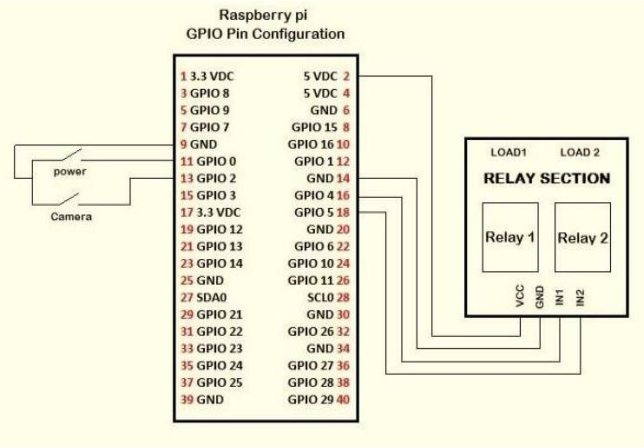

Fig. 2 Circuit diagram

It consist of three sections namely a raspberry pi section, a relay section and a power supply section for cooling fan. In the Raspberry Pi section each pin on this header has a unique "GPIO number" distinct from the order of the pins on the header. The processor in the Raspberry Pi has the ability to turn on 'internal' pull-ups so no need external pull-up resistors for the buttons. The pin out diagram for the power off and the camera interface are shown above. Only one wire of each button needs to go to GND, then each of the other goes to a different GPIO pin. The main function of the power button is it can be able to switch off the Raspberry Pi and similarly and the camera button is for taking the photos through the USB webcam. The need for the power off button is whenever the Raspberry Pi got stuck through the use of power button the user can quickly response and similarly it also the saves time for the user for the trouble shooting problems and the need for the camera button is quickly accessible to the camera interface.

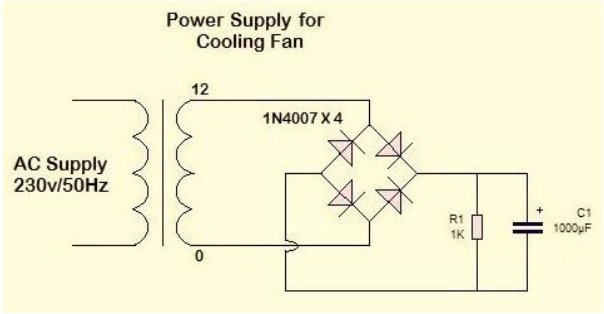

Fig. 3 Power supply for cooling fan

In the relay section the raspberry Pi is responsible for the switching action through python program can be achieved. It is possible to control or switch a high voltage through the relay module. Instead of calling python programs by manually this system switches the relay actions through the voice recognition. And in the power supply section for the cooling system for cooling the Raspberry Pi there is a need of a cooling system for that 12v cooling fan is used for powering the cooling fan the 12v power supply section is required. It converts 230V AC to an 12AC with the application of an transformer this transformer is an AC output hence there is a need to convert this AC to DC (Direct current) for that an rectifier can be used. Rectifiers are of two type's bridge rectifiers and rectifier through centre tapped transformer. Bridge rectification provides a higher efficiency than the other for the bridge rectifications there is a need of four diodes through rectification an output of 12V DC will obtain. The 12V cooling fan is connected to the 12V DC supply.

ISSN: 2278 – 1323

IV. HARDWARE DETAILS

The following components are used for this project.

TABLE I
LIST OF COMPONENTS

Serial. No	Name of the Component	Specification	No
1	Raspberry pi	Model B (Rev 2) 1GB	1
2	Wi-Fi USB adapter	EDIMAXEW-7811Un	1
3	HDMI to RCA convertor	Strolite Mini HDMI to RCA	1
5	Relay module	2 channel 5V	1
6	USB Webcam	Logitech USB Webcam C170	1
7	USB Hub	Four Port	1
8	ProtoPi Kit	ProtoPi kit for Raspberry pi	1
9	Push button	Normal type	2
10	Resistors	1k,10k	2
11	Cooling Fan	12v	1
12	Plug Socket	2 pin	2

A. Raspberry Pi

The Raspberry Pi 2 Model B is the second generation Raspberry Pi. It replaced the original Raspberry Pi 1 Model B+ in February 2014. Fig. 4 shows Raspberry Pi 2 model B. The Raspberry Pi is a series of credit card–sized single-board computers developed in the United Kingdom by the Raspberry Pi Foundation. In 2015, the Raspberry Pi Foundation launched the Compute Module, named as Raspberry pi Model B (REVISED) which packages a BCM2836 with 1 GB RAM and an eMMC flash chip into a module for use as a part of embedded systems. The new computer board is initially available only in one configuration (model B) and features a Broadcom BCM2836 with a quad-core ARM Cortex-A7 CPU and a Video Core IV dual-core GPU, 1 GB of RAM with remaining specifications being similar to those of the previous generation model B+.

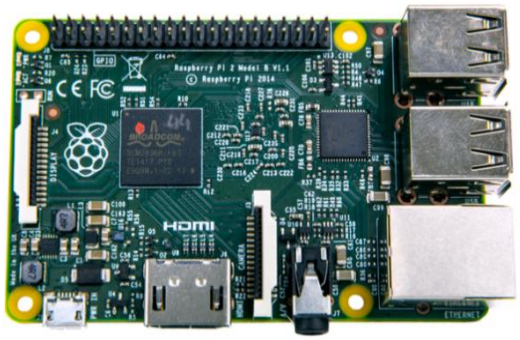

Fig. 4 Raspberry Pi

The Raspberry Pi primarily uses Linux-kernel-based operating systems. The ARM Cortex–A7 chip at the heart of the Pi (Second generation models).The current release of Ubuntu supports the Raspberry Pi 2, while Ubuntu and several popular versions of Linux do not support the older Raspberry Pi 1 that runs on the ARM11. The Raspberry Pi 2 currently also supports Raspbian, Open ELEC and RISC OS.

V. SOFTWARE DETAILS

A. Embedded Systems

Embedded systems are systems which perform a specific or a pre-defined task. It is the combinations of hardware and software. It is nothing but a computer inside a product. It is a programmable hardware design nothing but an electronic chip. A general-purpose definition of embedded systems is that they are devices used to control, monitor or assist the operation of equipment, machinery or plant. "Embedded" reflects the fact that they are an integral part of the system. In many cases their embedded may be such that their presence is far from obvious to the casual observer and even the equipment for some time before being able to conclude that an embedded control system was involved in its functioning. At the other extreme a general-purpose computer may be used to control the operation of a large complex processing plant, and its presence will be obvious.

All embedded systems are or include computers or microprocessors. Some of these computers are however very simple systems as compared with a personal computer. The very simplest embedded systems are capable of performing only single functions to meet single functions to meet a single predetermined purpose. In more complex systems an application program that enables the embedded system to be used for a particular purpose in a specific application determines the functioning of the embedded systems. The ability to have programs means that the same embedded system can be used for a variety

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of different purpose. In some cases a microprocessor may be designed in such way that application software for a particular purpose can be added to the basic software in a second process, after which it is not possible to make further changes. The applications software on such processors is sometimes referred to as firmware. The simplest devices consist of a single microprocessor (often called a "chip"), which may itself be packaged with other chips in a hybrid systems or Application Specific Integrated Circuit (ASIC). Its input comes from a detector or sensor and its output goes to a switch or an activator which (for example) may start or stop the operation of a machine or, operating a value, may control the flow of fuel to an engine.

B. Python Programming

Python is a widely used general-purpose, high-level programming language. Its design philosophy emphasizes code readability, and its syntax allows programmers to express concepts in fewer lines of code than would be possible in languages such as C++ or Java. The language provides constructs intended to enable clear programs on both a small and large scale. Python supports multiple programming paradigms. It features a dynamic type system and automatic memory management and has a large and comprehensive standard library. Python interpreters are available for installation on many operating systems, allowing Python code execution on a wide variety of systems. Using third-party tools, such as Py2.exe or Py Installer, Python code can be packaged into stand-alone executable programs for some of the most popular operating systems, allowing the distribution of Python-based software for use on those environments without requiring the installation of a Python interpreter.
CPython, the reference implementation of Python, is free and open-source software and has a community-based development model, as do nearly all of its alternative implementations. CPython is managed by the non-profit Python Software Foundation.

C. Introduction to Python IDE

An IDE (Integrated Development Environment) is one of the best tools a programmer can wield. It allows developers to work efficiently and forget about the boilerplate. While some programmers scoff at the idea of using anything more than a text editor, when you are working on a very big project consisting of many files, an IDE will have features that will make your life as a developer much easier.

D. PuTTY (SSH Client)

PuTTY is a free and open-source terminal emulator, serial console and network file transfer application. The name "PuTTY" has no definitive meaning. PuTTY was originally written for Microsoft Windows, but it has been ported to various other operating systems. Official ports are available for some Unix-like platforms, with work-in-progress ports to Classic Mac OS and Mac OS X, and unofficial ports have been contributed to platforms such as Symbian and Windows Phone. PuTTY was written and is maintained primarily by Simon Tatham and is currently beta software.

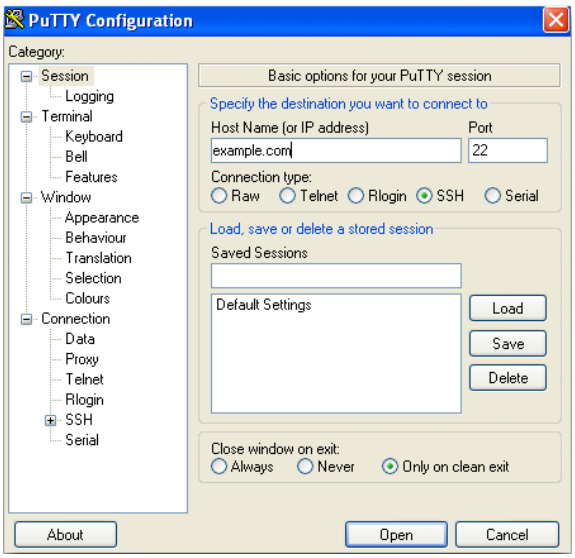

Fig. 5 PuTTY

PuTTY supports many variations on the secure remote terminal, and provides user control over the SSH encryption key and protocol version, alternate ciphers such as 3DES, Arcfour, Blow fish, DES, and Public-key authentication. It also can emulate control sequences from xterm, VT102 or ECMA-48 terminal emulation, and allows local, remote, or dynamic port forwarding with SSH. It supports several network protocols, including SCP, SSH, Telnet, rlogin, and raw socket connection. It can also connect to a serial port The network communication layer supports IPv6, and the SSH protocol supports the zlib@openssh.com delayed compression scheme. It can also be used with local serial port connections.

VI. CONCLUSIONS

Man has researched different technology for his sake of life. In today's hectic World, people are becoming accustomed to easy access to information. Whether it's through the internet or television, people want to be informed and up-to-date with the latest events happening around the world. The move to web-based television has challenged the traditional television value chain by allowing any IP-based network, wired and wireless, to deliver high quality television content. The smart television is social, allowing exchange of ratings and comments between viewers connected, with content available on many devices and via many networks and smart. In this project, a low cost system is introduced

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which convert any TV into smart TV that can be able to do as the same job as done by the high priced smart TV. It is just like a set-top box for television that offers more advanced computing ability and connectivity than a contemporary basic television set. Using the latest technologies just like DLNA, Voice Recognition, Android Compatibility.

VII. FUTURE SCOPE

In future this project can be modified using large no of external hard drives with high storage capacity can be mounted with an external power source from that we can transform the mini server into an larger one. Using a Premium quality HDMI to AV converter the received video can be improved to a High definition composite video which supports 1080p and it can able to select the NTSC or PAL modes. Using camera picture quality can be improved using Raspberry pi camera module it is a high definition camera which can able to take pictures and videos in high definition quality even in night condition the module is very small in size and it can be able to integrate it over the box and it reduces the overall size. Using the Wireless keyboard with touch pad also reduces the size and it also provide a flexibility to the user. In this project Google API free service are using it can be upgrade to the paid or premium service for the better use. It can able to improve the capability of the voice recognition and the text to speech engine and a good quality USB microphone would also provide a better result. Using a 8 channel relay or high channels can able to use in the application of home automation. Developing an app specially for the purpose of this project and enabled with a own cloud storage for user to store the files or integrating the third party cloud services would also improves the flexibility for the user. The set-top box or even TV tuner card can be integrated to our system so it provides a greater flexibility to the user through the use of a single integrated box the user can able to experience the smart TV features and able to see the broadcasting channels.

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