Palestine Polytechnic University

College Of Engineering

Electrical Department
Department of Communication and Electronics Engineering

Smart TV System

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Smart TV system

Project Team

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By the guidance of our supervisor, and by the acceptance of all members in the testing committee, this project is delivered to department of electrical engineering in the college of engineering, to be as a partial fulfillment of the requirement of the department for the degree of Bsc.

Supervisor signature

The head of department signature

جامعة بوليتكنك فلسطين

كلية الهندسة

دائرة الهندسة الكهربائية

Smart TV system

فريق المشروع

ألاء عيد **جلال الحروب** **يوسف حريز**

بناء على نظام كلية الهندسة وإشراف ومتابعة المشرف المباشر على المشروع وموافقة أعضاء اللجنة المناقشة , تم تقديم هذا العمل إلى دائرة الهندسة الكهربائية. وذلك للوفاء بمتطلبات درجة البكالوريوس في هندسة الاتصالات والالكترونيات.

توقيع المشرف

توقيع اللجنة المناقشة

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توقيع رئيس الدائرة

الإهداء

بسم الله الرحمن الرحيم

قال تعالى :

(قل إعملوا فسيرى الله عملكم ورسوله والمؤمنون)

صدق الله العظيم

إلهي لا يطيب الليل إلا بشكرك ولا يطيب النهار إلا بطاعتك ... ولا تطيب اللحظات إلا بذكرك ... ولا تطيب الآخرة إلا بعفوك ... ولا تطيب الجنة إلا برؤيتك .

إلى من بلغ الرسالة وأدى الأمانة, ونصح الأمة ... إلى نبي الرحمة ونور العالمين .... سيدنا محمد صلى الله عليه وسلم .

إلى من استقيت منه دروس الحياة في أي لحظة من لحظات عمري إلى من رووني من ينابيع الفضيلة ,واخذوا بيدي إلى منهل المعرفة ... وأظلوني بشجرة الإيمان ... أهلي الأعزاء أمي الرؤوم ,التي بدفئها حضنتني ,وبفيض حنانها غمرتني ... وعلمتني أن الشمعة لا تحترق لتذوب ,بل تذوب لتتوهج...

إلى والدي ،الذي كلله الله بالهيبة والوقار والذي استلهمت منه قيم الإنسانية ،و كان مثالاً يحتذى للمضي في الحياة ...

إلى شاطئي عندما أضيع، ومنبع الحنان عندما تقسو الأيام، وقلبي الكبير عندما أفقد كل القلوب... الروح لجسدي، والماء لصحرائي... أخوتي وأخواتي...

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كلمة الشكر

الحمد لله الذي أنار لنا درب العلم والمعرفة وأعاننا على أداء هذا الواجب ووفقنا إلى انجاز هذا العمل .

نتوجه بجزيل الشكر والامتنان إلى كل من ساعدنا من قريب أو من بعيد على انجاز هذا العمل وفي ما واجهناه من صعوبات، ونخص بالذكر المشرف الدكتور مراد أبو صبيح مشرف مشروع التخرج ومشرف تخصص هندسة الاتصالات والالكترونيات الذي لم يبخل علينا بتوجيهاته ونصائحه القيمة التي كانت عونا لنا في إتمام هذا المشروع فله منا كل الاحترام والتقدير, ولا ننسى ذكر المهندس سعدي التميمي مشرف مختبر الاتصالات المتقدمة الذي لم يبخل لتقديم المساعدة لنا فله كل الاحترام والتقدير, وأيضا المهندس انس أبو تبانة الذي قام بإعطائنا فكرة مشروع التخرج.

Abstract:

In this report, we design and implement an external, remotely-controlled device, compatible with any display screen that supports HDMI (High Definition Multimedia Interface) interface, for utilizing the available display screens to access many websites and applications. The device will be designed using microcontroller(raspberry pi), router, IR device, HDMI cable and TV screen. This makes the screen interacting with the user instead of being just used for displaying. The system can be controlled using icons on the screen as well as remote control. Furthermore, a wireless keyboard and mouse can be used to control the icons and browsing the internet .

And can watch the video clips on the screen, whether stored on the same processor (SD-Card) or by adding an external memory stick (USB).

The device was programmed with using python programming language in order to give some special features such as : web browsing that can be used in many application specially in education, home, biasness, etc….

الملخص

هذا التقرير لمشروع يتعلق بجهاز خارجي يتم التحكم فيه عن بعد ، متوافق مع أي شاشة عرض تدعم HDMI، وتستخدم في شاشات العرض المتاحة للوصول إلى العديد من المواقع والتطبيقات في جعل تلك الشاشة تتفاعل مع المستخدم بدلا من أن تكون تستخدم للعرض فقط, هذا الجهاز يستخدم المعالج الدقيق والراوتر وجهاز تحكم عن بعد وشاشة عرض.نعرض على الشاشة بعض الرموز يمكن فتحها عن طريق استخدام جهاز التحكم عن بعد, ويمكننا أن نضيف لوحة المفاتيح والماوس سواء كانت سلكية أو لاسلكية للتحكم في الرموز والتصفح في الانترنت .

ويمكن مشاهدة مقاطع الفيديو على الشاشة سواء كانت مخزنة على نفس المعالج(SD-Card) أو عن طريق إضافة فلاشة خارجية (USB).

تمت برمجة الجهاز باستخدام لغة البايثون ,وهذا الجهاز سيكون قادر على القيام بتصفح مواقع الانترنت ويتم الاستفادة من هذه الخاصية في عدة مجالات منها التعليم والمنازل والعمل وغيرها .....

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List of Abbreviation

ABBREVIATION	STAND
HDMI	**High Definition Multimedia Interface**
GPIO	**General Purpose Input / Output**
TV	**Television**
IR	**Infrared**
I/O	**Input and Output**
Wi-Fi	**Wireless Fidelity**
DMA	**Direct Mummery Access**
CPU	**Central Processing Unit**
PWM	**Pulse Width Modulation**
MMU	**Memory Management Unit**
FLOSS	**Free Libre' and Open Source Software**
GUI	**Graphical User Interface**
VGA	**Video Graphics Array**
LAN	**Local Area Network**
WAN	**Wide Area Network**
ISP	**Internet Service Provider**
ICMP	**Internet Control Message Protocol**
MAC	**Media Access Control**
WPA	**Work Projects Administration**
PC	**Personal Computer**
IEEE	**Institute of electrical and electronics engineers**
WEP	**Wired Equivalent Privacy**
SPI	**Service Provider Interface**
SCI	**Sensitive Compartmented Information**
DVI	**Digital Visual Interface**

Chapter One

Introduction

1.1 Overview

This chapter provides a brief description of the smart TV system. It starts with the motivation that needs to be achieved by this project. Then, it describes the hardware and software requirements, and discusses the challenges of building the system prototype. Finally, the approach and scenario of the project is presented.

1.2 Motivation

Smart TV is a very important device that is used by many people like in homes, offices, business purposes, educational institutions to solve some problems in educational system like data show and for different purposes.

1.3 Project Objectives:

The project main goals are:

First to design a smart TV system that is able to provide the internet access for a TV screen, to produce an easy to use system, to produce the smart TV system as a final product, and finally to provide the customers a product that is less expensive than other products.

1.4 Related Work

Although it is a big industrial step to design and implement the intended system, two close systems are found. In this section, they are going to be described in detail. Related technical information will also be provided..

- Samsung smart TV.
- Apple TV.

1.4.1 Samsung Smart TV

The new smart TVs launched by Samsung feels fun and excellence and it is the first smart TV in the world that work by touch and signal Hand .It has been issuing five new TVs for 2013 on the high technique varying sizes [1] .

TV specifications Samsung 40-inch Full HD LED TV

Accuracy 1,920 × 1,080

Optimized technology and large-scale additional colors

Digital noise filter available

Clear movement rate of 100

HDMI 3 port

2 port USB

Headphones for each port

Dolby Digital Plus / Dolby Pulse Technology

High-fidelity sound stage SRS Theater Sound HD Technology

10 W × 2 audio outputs (RMS)

Speakers addressed down + full range

Balancing auto volume available [2]

TV features Samsung 40-inch Full HD LED TV

Three-dimensional converter Available.

Connect Share (USB 2.0) film (HDD).

It provides a three-dimensional feature of Samsung.

The display language on the screen: local languages.

Automatic setup provides three-dimensional HDMI 1.4.

Provides visual information (TTXT).

Samsung TV Accessories 40-inch Full HD LED TV

Active three-dimensional glasses included SSG-5100GB x 2 for each device.

Remote control unit TM1240.

Power cable embedded.

Built-in user guide.

Electronic guide Available.

Support is available to the holder of the small wall installation.

Batteries (and remote control) embedded [3].

1.4.2 Apple TV

It is an integrated electronic system for receiving and storing media, it is task reception that media such as movies, music, images, the stored media and its own, hard disk capacity which is 40 GB.

The device is based on the idea for the process of receiving information in accordance with the principle of packets. In addition, the contact with the wired sources or wireless to take the information and made it available to the user through the display on the same high resolution screen. The advantage of the sound spatial advantages of visual screens so the user can dispense tablets DVD and be able to show films or sound on high-resolution screens wirelessly through this device.

PC is often the normal system that (Apple TV) system gets him on his information in the beginning to be stored within a hard disk. Can wireless or wired (through a local Wi-Fi networks) with personal computer system, then it can download any information and present it to the store for a long time. It is worth mentioning that (Apple TV) can keep in contact permanently with media sources to happen or holds what is in the sources are automatic without user intervention. This in turn allows the descent of the latest information from the source on the middle shelf in the (Apple TV).

The (Apple TV) giving an average of 50 hours a capital of video and 9,000 songs. The basic functionality that people use the computer for which is to work and information processing, but when the user wants to watch any movie or cut video, or even hear the audio, then he has IN this case to resort on the TV, watch or advanced audio devices and to hear the sounds (especially when they want to hear the voice of my free). However, Apple has changed this function through the announcement of the innovation system that links between the two devices (i.e. computer and television) together without wires [4].

Connects to (Apple TV) with the TV through the exits (HDMI) or via the "cable components" as well as audio in the two wires. It has wireless connectivity that exists between each of the (Apple TV) and a computer on a new technology called for "super-fast 802.11" in the process of updating or data transfer is fast from any computer[5].

1.4.3 Relation between Proposed System and Relevant

Compared to other previous systems, the proposed system differs in the followings:

The system used python operating system. It is controlled by IR remote control or mobile and has several outlets as it is in other devices. One for HDMI, one for Ethernet, four for USB. For storage it supports external device (USB), micro SD card up to 32GB (SD card), Quad core (900MHz) for processor. It is the price is cheaper than apple and Samsung device.

Table 1.1 shows a comparison of Samsung TV and apple TV.

Table 1.1 Comparison between three systems

Models	Samsung TV	Apple TV
Processor	Quad core	Single core
Memory	256MB	512 MB
Storage	500GB external hard drive	8 GB NAND Flash for cache
Connectivity	2 HDMI , 2 USB , 1ETHERNET	Bluetooth, Micro-USB (reserved for service.), HDMI, infrared receiver, optical audio
Networking	Built-in Wi-Fi (Wi-Fi Direct)	Wi-Fi (802.11a/b/g/n), 10/100 Ethernet
Price	200$	150$
Power	Power Supply (V) is AC110-120V 60Hz Typical Power consumption equal 37W	Built-in universal 6W power supply
Initial operating System	Android	Apple TV Software 5.2 (based on IOS 6.1)

1.5 Requirements

In order to determine the specific requirements, first plot the system block diagram in Figure 1.1. From this Figure, it show the hardware requirements.

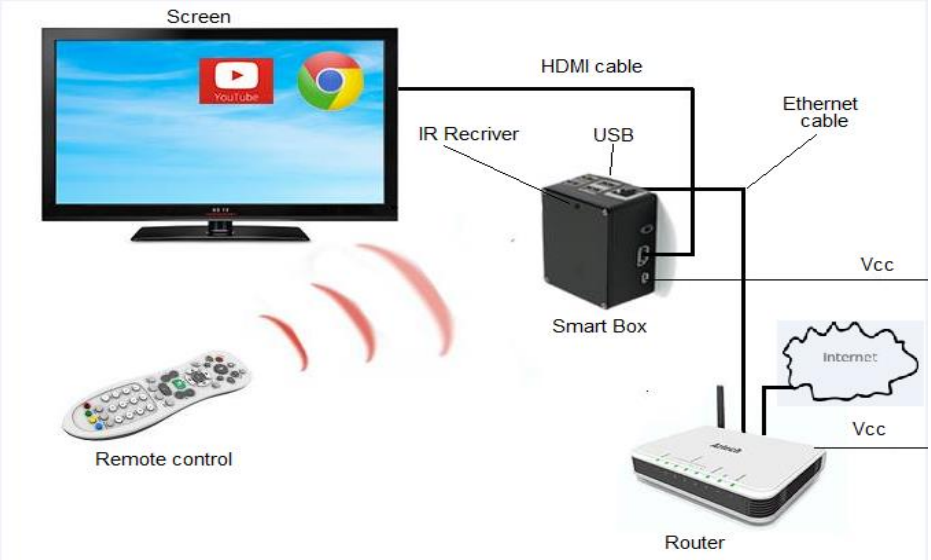

Figure 1.1 General system design

1.5.1 Hardware

The hardware requirements are:

1. High definition television (HD-TV).
2. HDMI (High-Definition Multimedia Interface).
3. Router.
4. Infrared (IR) transmitter and receiver.
5. Microcontroller (Raspberry pi).

1.5.2 Software

The programming language of the microcontroller is (python). It is a high-level, interpreted, interactive and object-oriented scripting language, which was designed to be highly readable that uses English keywords frequently where as other languages use punctuation.

1.6 Expected Result

It is expected to achieve the most significant results of the system. Smart TV system that works as a screen for viewing and internet. This Internet TV also enables users to browse the web and enjoy Internet enabled applications that can run in the TV. By using the Smart TV, user can discover the new world of web-connected TV entertainment. Smart TVs also allow users to easily search for movies, TV shows, web, explore apps, chat with friends and find many other types of new interactive TV content.

1.7 Budget

The system cost is provided in Table 1.2.

Table 1.2 Project Budget

Component description	**Number of required items**	**Estimated cost for one**
Microcontroller (Raspberry pi)	1	300 NIS
IR device (remote and receiver)	1	35 NIS
HDMI cable	1	15 NIS
Router	1	0 NIS (advance comm. Lab.)
HD TV screen	1	0 NIS (advance comm. Lab.)
Total	The general cost will be about 350 NIS in average.	

1.8 Time plan

Table 1.3 and 1.4 specifies the time plan of the project (for two semester).

Table 1.3 time plan for second semester (2014/2015)

Week / Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Select the idea															
Preparing for the project and collecting information															
Project analysis															
Determine the project equipment and requirement															
Design and analysis															
Submit the report to electrical engineering department															

Table 1.4 time plan for first semester (2015/2016)

Week / Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Buy all components															
Connect all components together															
Start to write the codes															
Make a many tests															
Start applying the code in raspberry pi and solve the problems															
Rewrite the first four chapter and write chapter five and six															

Chapter Two

Technical Background

2.1 Router

2.1.1 Wired and Wireless Routers

2.1.2 Wireless Routers

2.1.3 The Wireless Standards

2.2 IR device

2.2.1 Infrared Radiation:

2.2.2 Applications

2.2.3 IR Remote Controls:

2.3 Microcontroller

2.3.1 Introduction

2.3.2 Raspberry Pi

This chapter demonstrates relevant information about all components use in the project, including software and hardware. It is also provides background in order to understand the system operation and the theory part.

2.1 Router

A router is a device as shown in Figure 2.1 that forward data along networks. It is connected to at least two networks, commonly two LANs, WANs or a LANs and it is ISP's network. Routers are located at gateways, the places where two or more networks connect, and are the critical device that keeps data flowing between networks and keeps the networks connected to the Internet.

When data is sent between locations from one network or another network, the data is always seen and directed to the correct location by the router. The router accomplishes this by using headers and forwarding tables to determine the best path for forwarding the data packets, and they also use protocols such as ICMP to communicate with each other and configure the best route between any two hosts.

The Internet itself is a global network connecting millions of computers and smaller networks.

Figure 2.1 CISCO router

2.1.1 Wired and Wireless Routers

Wireless broadband routers look much same as a wired router, with the obvious exception of the antenna on top and the lack of cable running from the PCs to the router when it is all set up.

Creating a wireless network adds a bit more security concerns as opposed to wired networks, but wireless broadband routers do have extra levels of embedded security.

Along with the features found in wired routers, wireless routers also provide features relevant to wireless security such as Wi-Fi Protected Access (WPA) and wireless MAC address filtering.

Additionally, most wireless routers can be configured for "invisible mode" so that the wireless network cannot be scanned by outside wireless clients. Wireless routers will often include ports for Ethernet connections as well. For those unfamiliar with WiFi and how it works, it is important to note that choosing a wireless router may mean the need to beef up Wi-Fi knowledge-base. After a wireless network is established, may possibly need to spend more time on monitoring and security than one would with a wired LAN.

Wired, wireless routers and the resulting network can claim pros and cons over each other, overall they are somewhat equal in terms of function and performance. Both wired and wireless routers have high reliability as well as reasonably good security (without adding additional products). Generally, going wired will be cheaper, but setting up the router and cabling in the computers is a bit more difficult than setting up the wireless network. Mobility on a wired system is very limited while wireless offers outstanding mobility features

2.1.2 Wireless routers

A wireless router is actually two devices, an access point and a router.

- Access point – allows wireless devices to connect the network.
- Router – does the following:
  - Directs data going to and from devices connected to the network
  - Allows network-connected devices to share a single connection to the Internet (through a cable, DSL, or FiOS modem)
  - Allows network-connected devices to communicate with each other.

When using a wireless router, network is called a "wireless infrastructure network". The wireless router is the main component for home network. the wireless router is like a cordless phone base

station. Other wireless devices on the network, such as computers and printers, are like the wireless phone. All communication on the wireless network runs through the wireless router, allowing the connected devices that talk to others as well as the outside world. Many wireless routers have a built-in firewall to keep out unwanted access to the network.

Many wireless routers also allow devices to connect the network using a wired Ethernet cable. So the home network with a wireless router may have both wired and wireless devices connected to the home network.

All devices that connect to the wireless router, whether wirelessly or through an Ethernet cable. They have access to the same network and can communicate with each other. For example, a desktop computer connected by Ethernet can easily print to a wireless printer as long as they are connected to the same wireless router.

2.1.3 The wireless standards

802.11 is a set of standards that address wireless network computer communication. They are created and maintained by the Institute of Electrical and Electronics Engineers (IEEE). The versions of the 802.11 standard most commonly supported in today's wireless routers are:

- 802.11b – established in 1999, this standard is all but obsolete today. It is slow and its only security is WEP, which is easy to break and makes the network insecure. If WEP is used, the 'Open' mode is more secure than the 'Shared' mode. Although this standard is supported in most modern routers, the only reason to use it is when there is an older device that only operates on 802.11b. 802.11b operates in the 2.4 GHz band, making it susceptible to interference from microwave ovens, Bluetooth devices, baby monitors and cordless telephones [6].
- 802.11g – established in 2003, this standard is in wide use today. It is much faster than 802.11b and supports the most modern security standards (WPA and WPA2). In fact, 802.11g is faster than most cable, DSL and FIOS Internet connection networks to which they attach. Like 802.11b, 802.11g devices suffer interference from other products operating in the 2.4 GHz band [7].
- 802.11n – established in late 2009, the most modern wireless networking standard is the fastest and least prone to interference. Like 802.11g, it supports the most modern security standards (WPA and WPA2). 802.11n can operate in either the 2.4 GHz band or the less interference-prone 5.0GHz band. A device operating at 802.11n 2.4 GHz, can not connect to another device operating at 802.11n 5.0 GHz [8].

2.2 IR Device

2.2.1 Infrared Radiation:

A spectrum is the intensity of a mixture of electromagnetic waves as the function of the wavelength (λ) or frequency. All types of electromagnetic radiation follow similar principles of diffraction, refraction, reflection and polarization. This range of wavelengths corresponds to a frequency range of approximately 300 GHz to 400 THz, and includes most of the thermal radiation emitted by objects near room temperature. Their expansion speed corresponds to the light speed under normal conditions [9].

The result of multiplying wavelength with frequency is constant:

$$C = \lambda \cdot f \tag{2.1}$$

The infrared radiation covers a very limited part in the whole range of the electromagnetic spectrum: It starts at the visible range of about 0.78 μm and ends at wavelengths of approximately 1000 μm.

Infrared (IR) radiation is the part of electromagnetic spectrum, refers to the portion of the spectrum that begins just beyond the red portion of the visible region, theIR region include wavelength from 0.76 to 1000 μm.

The infrared region can be further segmented into three portions as shown Figure 2.2:

- Far-infrared, from 300 GHz (1 mm) to 30 THz (10 μm).
- Mid-infrared, from 30 to 120 THz (10 to 2.5 μm).
- Near-infrared, from 120 to 400 THz (2,500 to 750 nm).

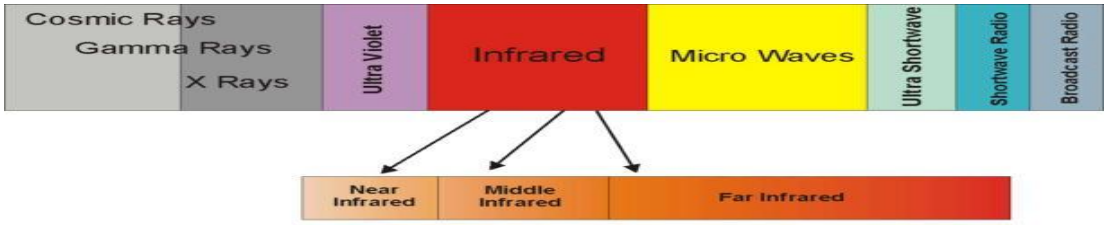

Figure 2.2 Electromagnetic radiation spectrum

Warm objects, such as the human body, produce large amounts of infrared [10].

2.2.2 Applications

Infrared radiation is used in a number of applications and in many fields, such as communication, industry, and remote sensing from space. The most common use is remote controls.

The most common use of infrared in everyday life is remote controls. These work by sending pulses of infrared that spell out a message to an electronic device. This device could be a television.

When talk about IR radiation, the main topic that focus on the IR remote controls, because it is the tool for controlling in the system and when use IR remote controls.

There is a need for the IR receiver, so the main part of the project is IR transmitter and IR receiver.

2.2.3 IR Remote Controls:

It is an electronic device, that has the ability of sending digitally-coded pulses of infrared radiation to control functions to the IR receiver via Transmitting IR led.

Since infrared (IR) remote controls use light, they require line of sight to operate the destination device.

Figure 2.3 Transmitting IR LED

Transmitting IR light-emitting diode (LED) which is an electronic device which emits light when a suitable voltage is applied.

IR receiver: it is an electronic device that receives the signals coming from the transmitter.

Figure 2.4 Receiving IR photo sensor

The main component in IR receiver is a photodiode that is an electronic device which converts the light into a current.

So the transmitter generates the signal by using some protocols and codes, then the signal transfer the space when the receiver received the signal, the signal will be convert to current by the receiver , then forwarding it to the controlling unit , the arrival signal contains controlling information.

IR radiation is simply light that we cannot see, which makes it great for communication. The sun, light bulbs, or any anything with heat is very bright in the IR spectrum. When use TV remote, an IR LED is used to transmit information to TV. So, how does the IR receiver in TV pick out signals from remote among all of the ambient IR? The answer is that the IR signal is modulated. Modulating a signal is like assigning a pattern of the data, so that the receiver knows to listen.

A common modulation scheme for IR communication is something called 38 kHz modulation. There are very few natural sources that have the regularity of a 38 kHz signal, so an IR transmitter sending data at that frequency would stand out among the ambient IR. 38 kHz modulated IR data is the most common, but other frequencies can be used.

Pressing h a key on the remote, the transmitting IR LED will blink very quickly for a fraction of a second, transmitting encoded data to that appliance.

Using an oscilloscope up to TV remote's IR LED, to see a signal similar to the one above. This modulated signal is exactly what the receiving system sees. However, the point of the receiving device is to demodulate the signal and output a binary waveform that can be read by a microcontroller. Reading the OUT pin with the wave from above, the output looks like this:

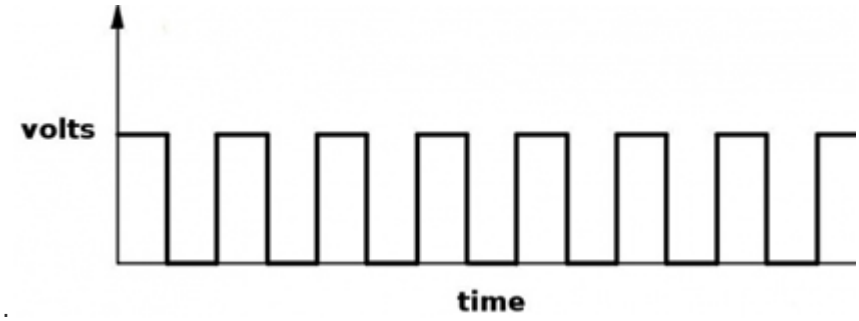

Figure 2.5 Output pin of IR remote

By controlling the spacing between the transmitted modulated signals, the waveform can be read by an input pin on a microcontroller and decoded as a serial bit stream [11].

2.3 Microcontroller

In this part, talk about the microcontroller, first explain the general microcontroller mean and other section talk about the microcontroller used in the project, the name of microcontroller is raspberry pi.

2.3.1 Introduction

Microcontroller: A computer on one chip, computer contains a microprocessor (CPU), microcontroller already contains all components which allow it to operate standalone, and it has been designed in particular for monitoring and/or control tasks. In consequence, in addition to

the processor it includes memory, various interface controllers, one or more timers, an interrupt controller, and last but definitely not least general purpose I/O pins which allow it to directly interface to its environment.

Microcontrollers also include bit operations which allow to Change one bit within a byte without touching the other bits.

a) A microcontroller is small, low-cost computer on a chip which usually includes:
   - An 8 or 16 bit microprocessor (CPU).
   - A small amount of RAM.
   - Programmable ROM and/or flash memory.
   - Parallel and/or serial I/O.
   - Timers and signal generators.
   - Analog to Digital (A/D) and/or Digital to Analog (D/A) conversion.

b) Often used to run dedicated code that controls one or more tasks in the operation of a device or a system.

c) Also called embedded controllers, because the microcontroller and support circuits are often built into embedded in the devices they control.

d) Microcontrollers usually must have low-power requirements (~. 05 - 1 W as opposed to ~10 - 50 W for general purpose desktop CPUs) since many devices they control are battery-operated [12].

Its development, which increases the performance demands even more. For small 8-bit controllers, however, only the application has to be considered. Here, rough estimations can be made for example based on previous and/or similar projects. The basic internal designs of microcontrollers are pretty similar. Figure 2.6 shows the block diagram of a typical microcontroller. The components are connected via an internal bus and are all integrated on one chip. The modules are connected to the outside world via I/O pins [13].

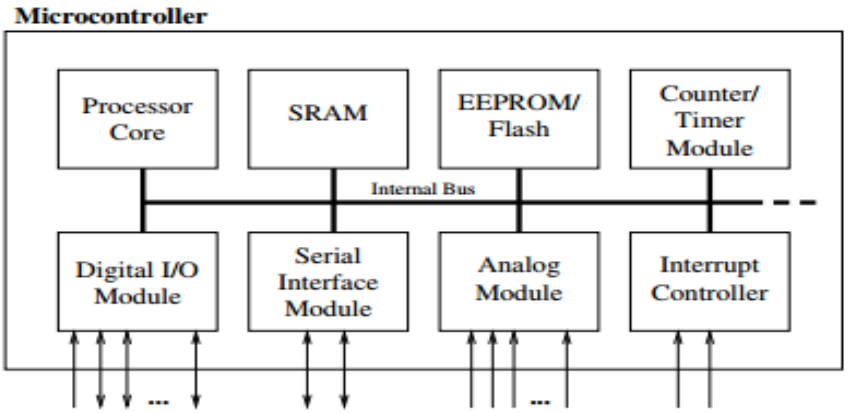

Figure 2.6 Basic layout of a microcontroller.

The following list contains the modules typically found in a microcontroller:

Processor Core: The CPU of the controller. It contains the arithmetic logic unit, the control unit, and the registers (stack pointer, program counter, accumulator register, register file...) [14].

Memory: The memory is sometimes split into program memory and data memory. In larger controllers, a DMA controller handles data transfers between peripheral components and the memory [14].

Interrupt Controller: Interrupts are useful for interrupting the normal program flow in case of (important) external or internal events. In conjunction with sleep modes, they help to conserve power [15].

Timer/Counter: Most controllers have at least one and more likely 2-3 Timer/Counters, which can be used to timestamp events, measure intervals, or count events.

Many controllers also contain PWM (pulse width modulation) outputs, which can be used to drive motors or for safe breaking (antilock brake system, ABS). Furthermore the PWM output can, in conjunction with an external filter, be used to realize a cheap digital/analog converter [16].

Digital I/O: Parallel digital I/O ports are one of the main features of microcontrollers. The number of I/O pins varies from 3-4 to over 90, depending on the controller family and the controller type [17].

Analog I/O: Apart from a few small controllers, most microcontrollers have integrated analog/digital converters, which differ in the number of channels (2-16) and their resolution (8-12 bits). The analog module also generally features an analog comparator. In some cases, the microcontroller includes digital/analog converters [17].

Interfaces: Controllers generally have at least one serial interface which can be used to download the program and for communication with the development PC in general. Since serial interfaces can also be used to communicate with external peripheral devices, most controllers offer several and varied interfaces like SPI and SCI.

Many microcontrollers also contain integrated bus controllers for the most common (field) busses. IIC and CAN controllers lead the field here. Larger microcontrollers may also contain PCI, USB, or Ethernet interfaces [18].

Watchdog Timer: Since safety-critical systems form a major application area of microcontrollers, it is important to guard against errors in the program and/or the hardware. The watchdog timer is used to reset the controller in case of software (crashes).

Debugging Unit: Some controllers are equipped with additional hardware to allow remote debugging of the chip from the PC. So there is no need to download special debugging software, which has the distinct advantage that erroneous application code cannot overwrite the debugger [16].

Contrary to processors, (smaller) controllers do not contain a MMU (memory management unit), have no or a very simplified instruction pipeline and have no cache memory, since both costs and the ability to calculate execution times (some of the embedded systems employing controllers are real-time systems, like X-by-wire systems in automotive control) are important issues in the microcontroller market [18].

To summarize, a microcontroller is a (stripped-down) processor which is equipped with memory, timers, (parallel) I/O pins and other on-chip peripherals. The driving element behind all this is cost: Integrating all elements on one chip saves space and leads to both lower manufacturing costs and shorter development times. This saves both time and money, which are key factors in embedded systems. Additional advantages of the integration are easy upgradability, lower power

consumption, and higher reliability, which are also very important aspects in embedded systems. On the downside, using a microcontroller to solve a task in software that could also be solved with a hardware solution will not give you the same speed that the hardware solution could achieve. Hence, applications which require very short reaction times might still call for a hardware solution. Most applications, in particular that require some sort of human interaction (microwave, mobile phone), do not need such fast reaction times, so for these applications microcontrollers are a good choice.

2.3.2 Raspberry pi

The raspberry pi is a series of credit card sized single board computers developed in the UK by the raspberry pi foundation with the Internet of promoting the teaching of basic computer science in schools [19].

The raspberry pi is a credit card sized computer that runs the freely available Linux Operating System. Can recommend using the Model B version, as shown in Figure 2.7. Since it is more powerful and not much more expensive than Model A. 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 milli-amps [20].

Figure 2.7 Raspberry Pi with connectors

When anybody buy a Raspberry Pi, essentially buying an assembled printed circuit board. It does not even include a power supply or operating system. The recipes in this chapter are concerned with getting the Raspberry Pi set up and ready for use.

Because the Raspberry Pi just uses standard USB keyboards and mice, most of the setup is pretty straightforward, so there can be concentration on those tasks that are specific to the Raspberry Pi [21].

Selecting a Model of Raspberry Pi

There are two models of Raspberry Pi, A and B.

If there is a need for a Raspberry Pi for general use, then can a model B bought, revision 2(the latest). With twice as much memory, it will cope with most tasks much better than the model A.

If, on the other hand, can embedding a Raspberry Pi in a project for a single purpose, then using a model A and saving a few dollars may well be an option.

(a) (b)

Figure 2.8 Raspberry Pi (a) model A (b) model B

As shown in Figure 2.8, both are using the same circuit board, but model A has a single USB socket and no RJ45 Ethernet socket. The bare solder pads behind the USB socket can also be seen where the Ethernet controller chip should be.

The differences between the models are summarized in Table 2.1. This table also includes the original model B, revision 1 board, which was soon updated with revision 2.

Table 2.1. Raspberry Pi models

Model	RAM	USB sockets	Ethernet port
A	256 MB	1	NO
B (revision 1)	256 MB	2	YES
B (revision 2)	512 MB	4	YES

The Raspberry Pi does not come with an enclosure unless buy one as part of a kit. This makes it a little vulnerable, as there are bare connections on the underside of the circuit board that could easily short if the Raspberry Pi is placed on something metal. It is a good idea to buy some protection for Raspberry Pi in the form of a case. There is a vast array of case styles to choose from, including:

- Simple, two-part, click-together plastic boxes
- VESA mountable boxes (for attaching to the back of a monitor or TV)
- Lego-style boxes
- 3D printed box designs
- Laser-cut, snap-together acrylic designs

The basic electrical specification for a power supply suitable for a Raspberry Pi is that it supplies a regulated 5V DC (direct current) and can supply a current of up to 700 mA. It must also have a micro USB plug on the end of the lead.

A Wi-Fi dongle can be used, or other USB peripherals that consume significant amounts of power, then a power supply capable of 1.5 A or even 2 A can be obtained. Also beware of very low cost power supplies that may not provide an accurate or reliable 5 V.

The power supply and connector are actually the same as those found in many smart phone chargers. If there is a micro USB plug, then there must certainly be 5 V (but check).The only question, can power supply enough current. If not, then a few bad things can happen:

• They may get hot and be a potential fire risk.

• They may just fail.

• At times of high load (say, when the Pi is using a Wi-Fi dongle), the voltage may dip, and the Raspberry Pi may reset itself. So, choose a power supply that says it can supply 700 mA or more. If it specifies a number of watts (W) rather than mA, then divide the number of watts by 5 to get them A figure. So, a 5V 10W power supply can supply 2A (2,000 mA).

Using a power supply with, say, a maximum current of 2 A will not use any more electricity than a 700 mA power supply. The Raspberry Pi will just take as much current a sit needs.

SD cards especially a 4 GB SD card, which is recommended for most distributions are not expensive, so get a few and try out a few distributions. If do this, it is a good idea to keep own files on a USB flash drive so there is no need to keep copying them onto each SD card.

Note that if using one of the upcoming recipes, to write in the SD card, then need to either have a computer that has an SD card slot (many laptops do) or buy an inexpensive USB SD card reader.

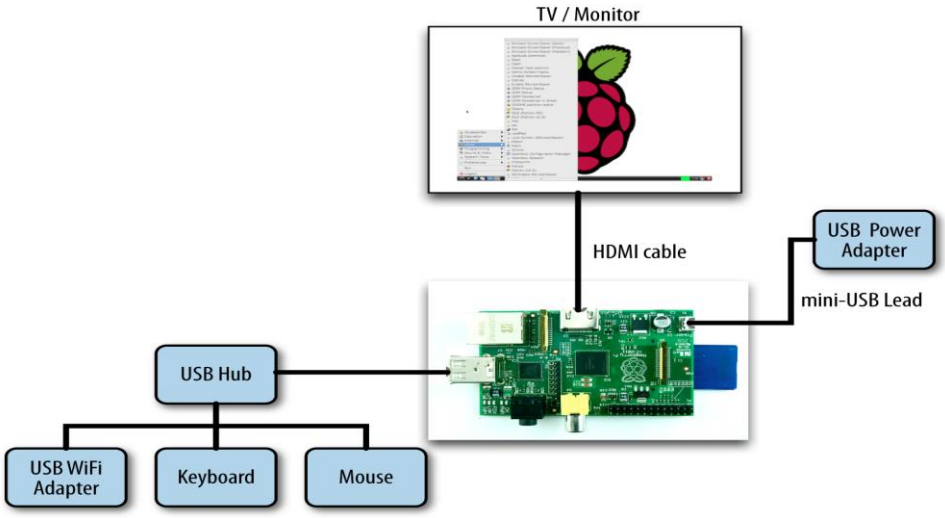

Figure 2.9 A typical Raspberry Pi system

If a wireless keyboard/mouse combination is used with a single USB dongle, then the other free USB socket (assuming Raspberry Pi model B) could be used for a Wi-Fi dongle. However, in all likelihood a USB hub is going to be useful when attaching an external USB disk or USB flash drive.

The Raspberry Pi is perfectly happy with pretty much any keyboard or mouse, wired or wireless. The exception to this is Bluetooth wireless keyboards and mice, which will not work with the Raspberry Pi.

Many people have been caught out by this problem. Fortunately, it is possible to buy adapters for monitors with a DVI or VGA input, but not HDMI connectors.DVI adapters are the simplest and cheapest.
Using VGA adapters is more complex, as they require some electronics to convert the signal from digital to dialog, so beware of leads that do not contain these. The official converter is called Pi-View and is available wherever the Raspberry Pi is sold. Pi-View has the advantage of having been tested and found to work with Raspberry Pi.

Chapter Three

Conceptual Design

3.1 System Functions and Block Diagram

3.2 Hardware

3.3 Software

This chapter contains the design concepts of the system. First start to explain the main system block diagram. After that, will explain the system sub-blocks and describe the interaction among sub-blocks.

3.1 System Functions and Block Diagram

The system consists of several subsystems as shown in Figure 3.1:

HD TV screen, router, microcontroller(raspberry pi), and (remote ,mouse, keyboard, or mobile) for controlling.

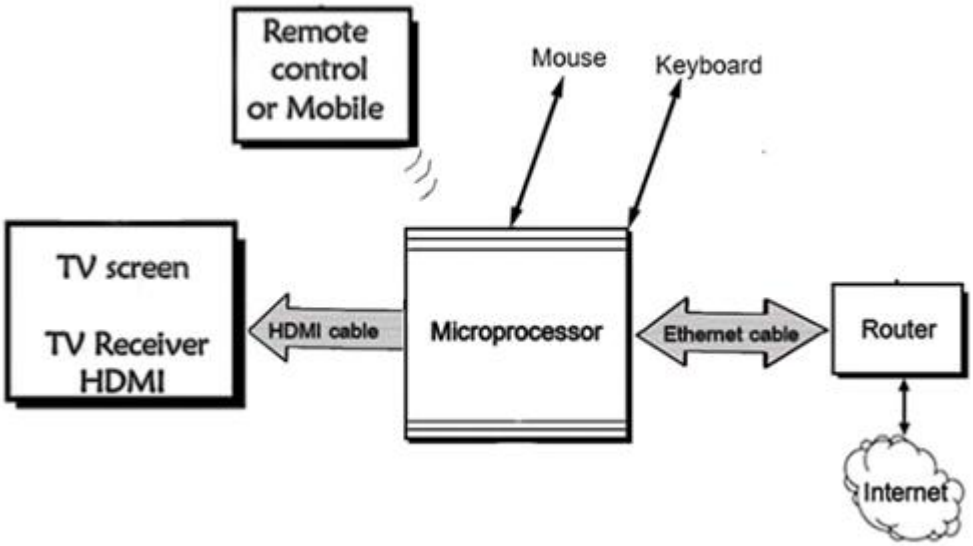

Figure 3.1 General block diagram

In previous block diagram, that explain how does the components connected to each other, here the HDMI cable connects the smart microcontroller and the HD screen, there are an Ethernet port on the raspberry chip that used to connect it with the router .

Remote Control or Mobile:

This system can communicate and interact with it in several ways, which making it easy to interact by users.

How to interact with the system:

1 – IR Remote:

IR remote is available in every house, for this reason it has been used in the project, so after programming the remote it can be able to interact with developed system.

An IR remote has a receiver connected with the GIOP pins, that receiving the coming signal and pass it for microcontroller. Every button on IR transmitter have a different code from other button , so it is important to programming a microcontroller to understand which button is clicked to translate it and execute the task .

2- Mobile:

Another option to control, using a mobile phone to control the system , by make it work as remote control , by saving the codes on mobile and using an application that supports that, so the mobile can be used as remote control .

3 – Keyboard and Mouse:

Here keyboard and mouse used to make the system more flexible, this component can connect to the system wired or wireless, so it can connect wired to USB interface, or wireless by using wireless dongle, the system programmed to support the two methods, so this make the system more and more flexible.

Figure 3.2 Wireless dongle

TV Screen:

There are many types of TV screen for this system it has been chosen carefully, the screen support HDMI, the important purpose to build the system is make the project small, the HDMI

interface Compared to VGA interface is small, VGA cables were designed to carry only video signals from a device to display. The HDMI standard allows for the transfer of both digital video and audio signals via the same interface (port) and cable, capable of providing high definition video at resolutions of 1,920 X 1,200 pixels and 8 audio channels simultaneously.

Microcontroller:

The microcontroller contains or associated with all parts of the system and connects all component together. Figure 3.3 show the parts of microcontroller(Raspberry Pi).

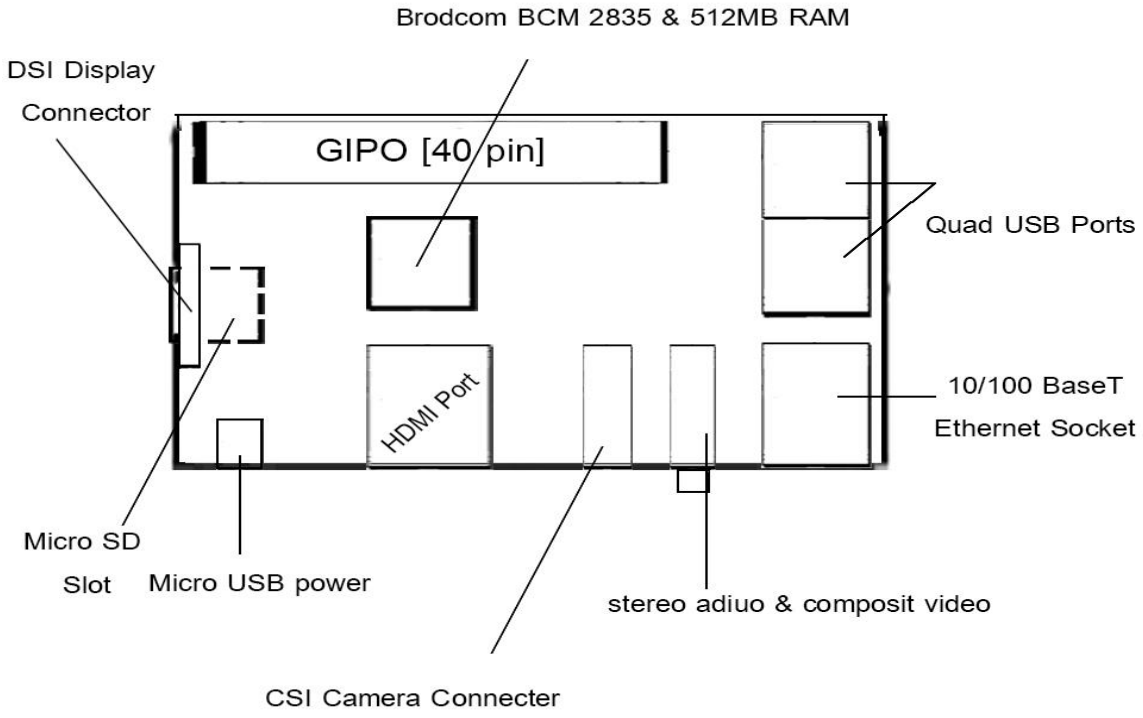

Figure 3.3 Microcontroller (Raspberry pi)

The microcontroller support SD card and slotted it on the ship, also can support a USB flash, so can displays on the screen from SD card or flash memory.

How does it work?

After programming the microcontroller, first connect the microcontroller to the TV screen, the browsing icons will be appear, and can choose how many icons will use it in the system can, five icons is enough for the first prototype of this project .

3.2 Hardware

The hardware requirements are:

1. High Definition Television (HD-TV):

A new type of television that provides a high resolution and it is a digital TV that broadcasts pictures with more details and quality than other types of TV.

2. HDMI (High-Definition Multimedia Interface):

Interface for transferring high definition video and high quality digital audio. HDMI is a digital replacement for analog video standards. In this system, the cable is used to connect the smart TV system (box) to TV screen.

3. Router:

A network device that forwards data packets from one network to another, based on the address of the destination network in the incoming packet and an internal routing table.

4. Infrared (IR) Transmitter and Receiver:

The transmitter flashes an infrared light in a particular pattern, which the receiver picks up and translates into an instruction. Here the receiver receives the IR transmitted signal and forwards the signal to the microcontroller.

5. Microcontroller (Raspberry pi):

Raspberry pi is the controller which intend to use in this project. The Raspberry pi is a credit card sized computer that runs the freely available Linux Operating System. The Model B version will be used (raspberry pi 2 model B), since it is more powerful and it is available with affordable price. It is powered by a typical mobile phone charger using a micro USB connector**.**

In Figure 3.4 shows the description of design in this project.

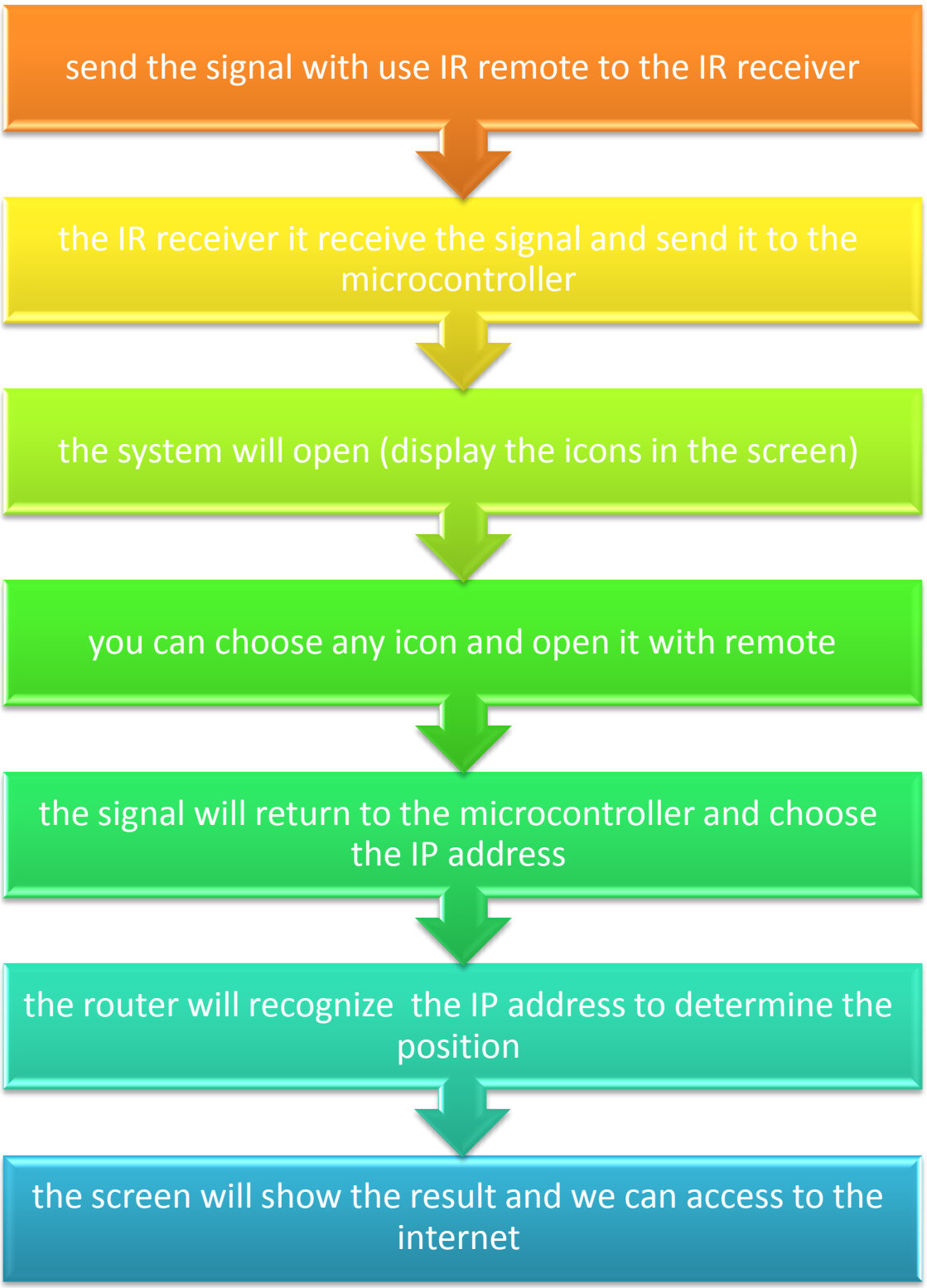

Figure 3.4 The design description

In Figure 3.4 describes the system and how it work. First the IR remote transmit a signal to the IR receiver, after receiving the signal by receiver, it go to the microcontroller, the signal have an information about what does the microcontroller has to do.

The microcontroller have the ability to analysis the received signal, it decides what is the function and processing that the received signal contains, by remote control can chose what icon that need to brows .

After connecting the router to the system via utilizing Ethernet cable and Ethernet interfaces we have the ability to retch the internet access. The Ethernet cable transfer the signal from the microcontroller to the router and reverse, after display the icons to the screen can choose any icon by using the remote control or wired mouse and keyboard or wireless mouse and keyboard.

For example choose Google icon ,the microcontroller analysis this signal and understand what you want ,then microcontroller know the IP of this site and use the router to open this site in the internet ,finally display the brows page in the screen, in other icons happen the same step .

3.3 Software

Programming language is an important component of this project. In this part, explain the modules needed for system operation.

The main module of the system, as mentioned in section is the microcontroller (raspberry pi). It is the brain of the system. It does not work without operation program. The operation program gives the microcontroller the ability to decide what to do (process, send, receive, etc.). The programming language that used to programming the raspberry is called (python).

Another needed module is the IR receiver and transmitter. The IR system is used for controlling the system display. The remote control is the transmitter. It tells the system what to do. A function is assigned for each icon. The last module is needed for allowing the system to be able to deal with applications are browsers.

The programming language of the microcontroller is (python). Python is a high-level, interpreted, interactive and object-oriented scripting language; it was designed to be highly readable which uses English keywords frequently where as other languages use punctuation [22].

Python has many features such as:

- Easy to learn: Python has relatively few keywords, simple structure, and a clearly defined syntax.
- Easy to read: Python code is much more clearly defined.
- Easy to maintain: Python's success is that its source code is fairly easy-to-maintain.
- A broad standard library: One of Python's greatest strengths is the bulk of the library which is very portable and cross-platform compatible on UNIX, Windows and Macintosh.

- Interactive mode: Support for an interactive mode in which can enter results from a terminal right to the language, allowing interactive testing and debugging of snippets of code.
- Portable: Python can run on a wide variety of hardware platforms and has the same interface on all platforms.
- Extendable: low-level modules can add to the Python interpreter. These modules enable programmers to add to or customize their tools to be more efficient.
- Databases: Python provides interfaces to all major commercial databases.
- GUI Programming: Python supports GUI applications that can be created and ported to many system calls, libraries and windows systems, such as Windows MFC, Macintosh and the X Window system of UNIX.

Scalable: Python provides a better structure and support for large programs than shell scripting [23].

In this section we define some definition of the code, the definition are :

1- from tkinter import * and from tkinter importttk
used to define the graphical interface in order to add anything in graphical box such as text, label, command, chick box, audio select, ……etc

2- import webbrowser
used to define the website and open the files, which can calls the all web page for example Google, Facebook, Email, PPU, …….etc

3- import RPi.GPIO as GPIO
used to define the input and output pin in raspberry pi, RPi mean raspberry pi and GPIO mean general purpose input output .

4- root = Tk()
root is any name, it could be name, and this command used to build as well as appear the main graphical box .

5- root.mainloop()
mainloop() used to call the main code. The main code is contain the instructions to be excite, parameter of the system, so it is a system of rules to convert information root.mainloop() mean appear the graphical in the raspberry pi ,the graphical can not appear if do not use this definition .

6- **def** : (Defining a Function)
Used to define functions to provide the required functionality. Function blocks begin with the keyword **def** followed by the function name and parentheses (( )).and the code block within every function starts with a colon (:) and is indented. Below example is used it in the project :

```
defshow_entry_fields():
if (entry1.get() == 'jalal') and (entry2.get() == 'jalal'):
root.destroy()
   show_entry_fields1()
```

This code to check the true password, the password is jalal, and entry1, get to read the text in text box, while the if statement was used in this code.

7- Entry

The entry widget is used to enter text strings. This widget allows the user to enter one line of text, in a single font. The below example is used it in the project :

entry = ttk.Entry(root ,width =30)

entry.pack()

entry.pack() to appear the text box in graphical box .

Chapter Four

Design and Flowcharts

4.1 Hardware Design

4.2 Flowcharts

4.2.1 Flowchart of IR Remote

4.2.2 General Flowchart

This chapter provides detailed on the design system and the flowchart of IR remote and the general system. First, it start by explaining the hardware design. Then, the explanation the flowchart of the system is provided.

4.1 Hardware Design:

In this section, contain explain the hardware design:

The hardware design of project as a block diagram shown in Figure 4.1:

Figure 4.1 Hardware design

According to Figure 3.4, it show the components of the system, where the microcontroller is the brain of the system, which has interfaces that connects with cables to connect the components.

Connect the IR Sensor to the Raspberry Pi

In this section, the main purpose is to connect the IR receiver with the microcontroller. The microcontroller has a built in unit it is called a GPIO, which is used for take output from microcontroller or give it an input, so this unit will be used for connecting the IR receiver to the chip, but there are challenge in this step, because after connecting the IR receiver, it is need to program, to know what is the coming signal from IR transmitter mean, as shown in Figure 4.2 , it is explain the general purpose input/output(GPIO).

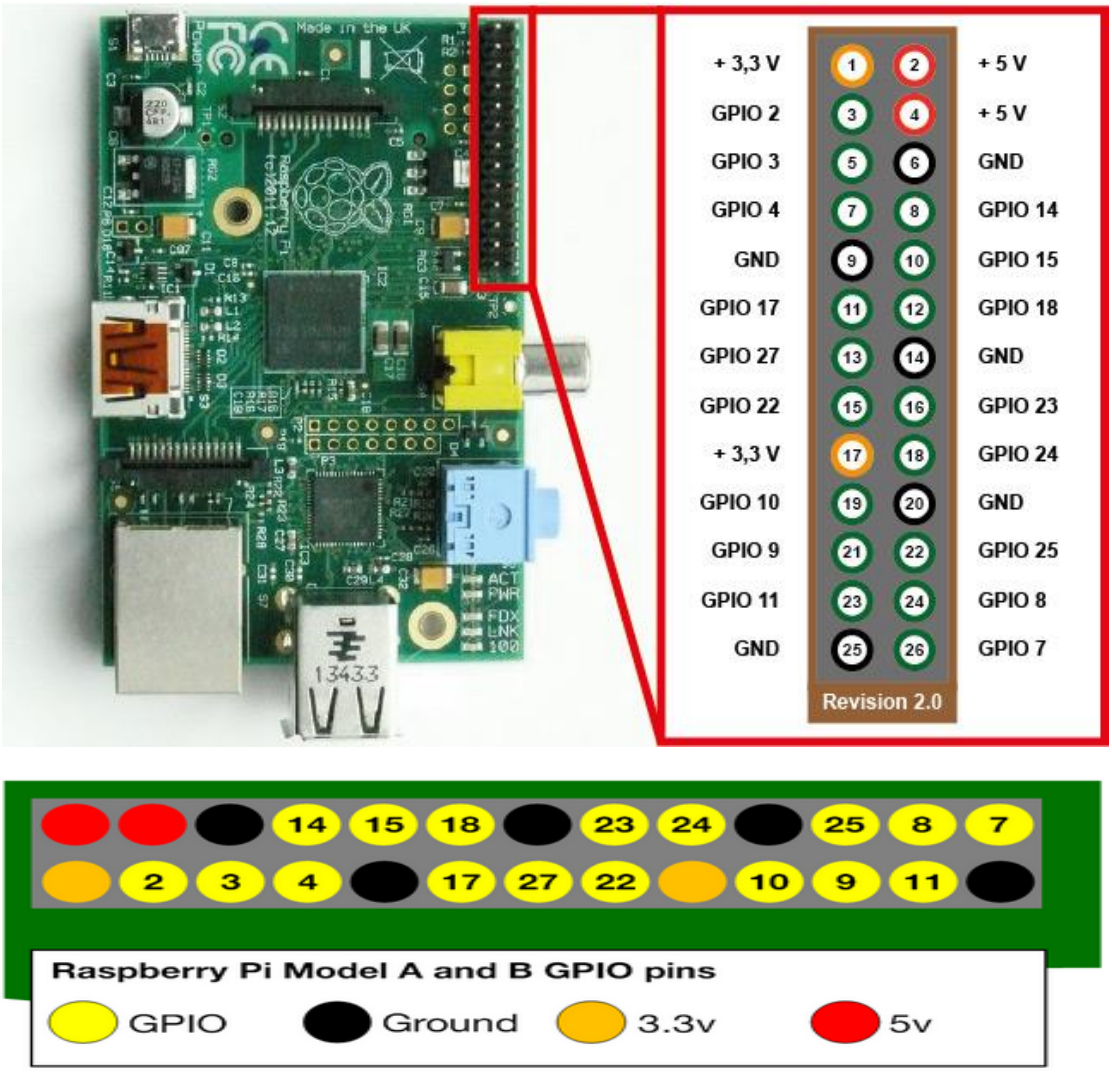

Figure 4.2 GPIO

The IR sensor has just three pins, GND, 3.3V and Output. The output connect to GPIO 18. To do the connection it may use female to female jumper leads. These make a good reliable connection. IR sensor chip needs to be operated at 3.3V not 5V when used with the Raspberry Pi.

The IR sensor pins:

- Pin 1 is the output.
- Pin 2 is the ground.
- Pin 3.3 is VCC, connect to 5V.

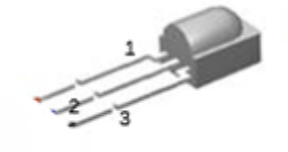

Figure 4.3 IR receiver

This pins respectively connect to :

- Pin 1 is DATA, goes to RPi pin 12 (GPIO 18);
- Pin 2 is GND, goes to RPI pin 6 (GROUND)
- Pin 3 is POWER, goes RPi pin 1 (5V)(GPIO 1)

Figure 4.4 IR with raspberry pi connection

After implement the designed block diagram, and program it, the system is able for many task. The most important one is to open the internet browsers and display the results on the screen. The system can be controlled by using remote control which is another task. Furthermore, the system can be controlled via using the keyboard and mouse.

4.2 Flowcharts

4.2.1 Flowchart of IR Remote

For setup flowchart IR control depend on remote type, first initialize the code of the IR remote that use. Every bottom of the IR remote control has much hexadecimal code depends on the angle and distance. So in this part, the experiment is about take every bottom code. Then the codes storage by programming the microcontroller. It is not difficult while it is compatible for any remote control. It is easy to take the code for any remote control and store it on the microcontroller . If a new user has a remote controller and its code undefined on microcontroller, it is easy to take the code and store it to be defined. For future work, the system will support every remote control, by storing all the codes to microcontroller as well as only the user want to determine remote device type, the code will be ready and the remote will work, refer to Figure 4.5.

The Table 4.1 shows some of code for remote control, in order to check all codes refer to the appendix.

Table 4.1 Codes of remote control

1	**FF6897**	**C101E57B**
2	**FF9867**	**97483BFB**
3	**FFB04F**	**F0C41643**
4	**FF30CF**	**9716BE3F**
5	**FF18E7**	**3D9AE3F7**

4.2.2 General Flowchart

Figure 4.6 shows the general flowchart for the system, which describes the system in general. It is important to make a secure system, open the system require to enter a user name and password, if password and user name are correct the system will open and it is ready to receive commands.

The received command decide what to do opening a web browsing or watching video, web browsing then choose what to open, watching the video maybe store in SD card or USB flash, this system support the two types .

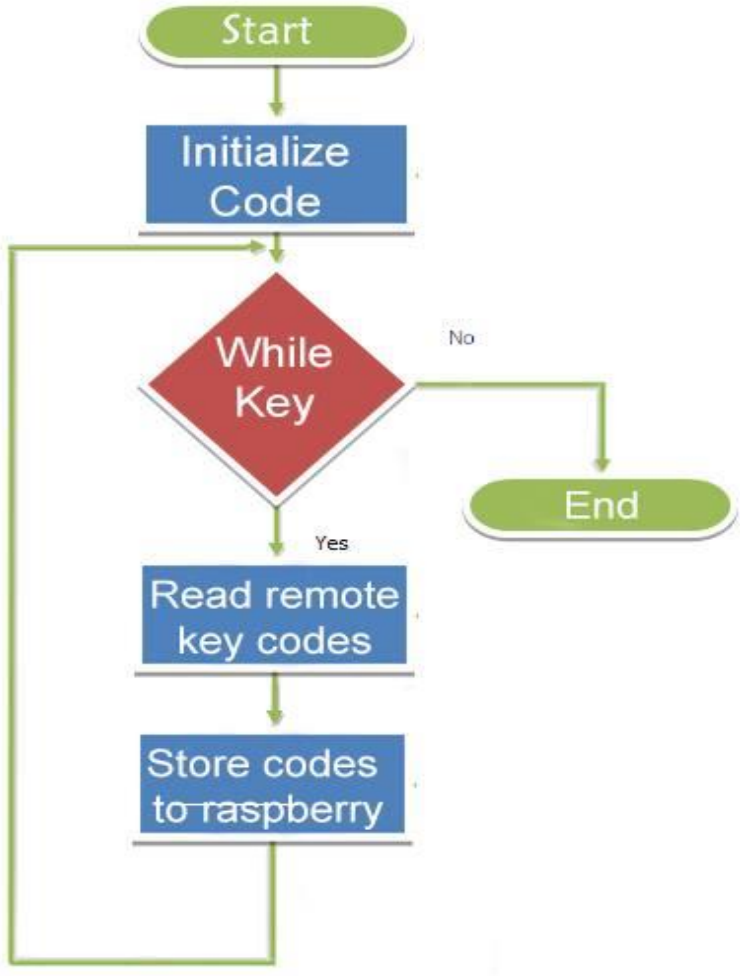

Figure 4.5 Flowchart of IR remote

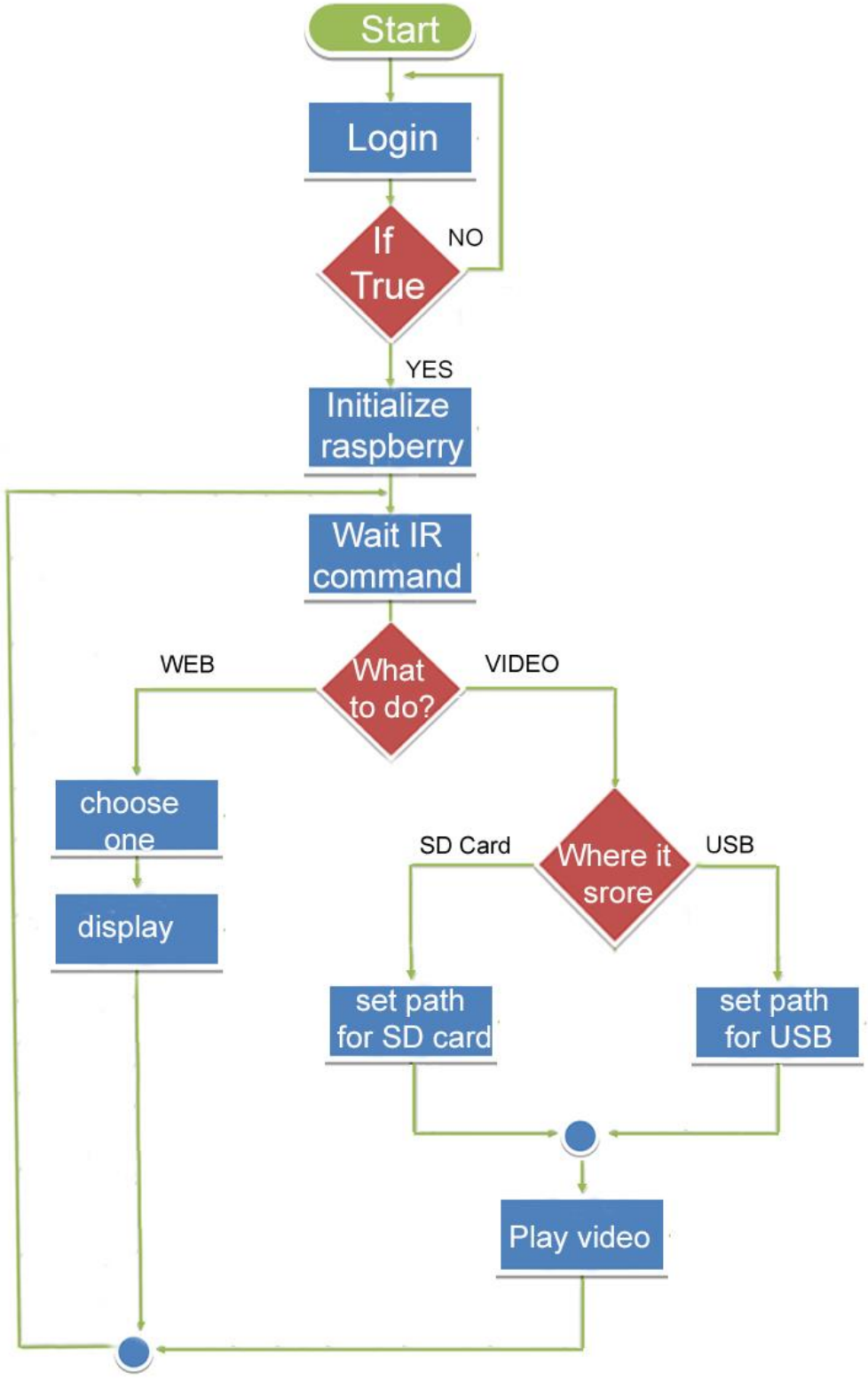

Figure 4.6 General flowchart of the system

Chapter Five

Implementations and Testing

5.1 Implementations

5.2 Testing

This chapter provides implementations and testing of the system. First explain implementation of the project, second explain the testing in this project.

5.1 Implementations

To run the system, turn on the power in microcontroller (raspberry pi), then the username and password interface will appear, refer to Figure 5.1

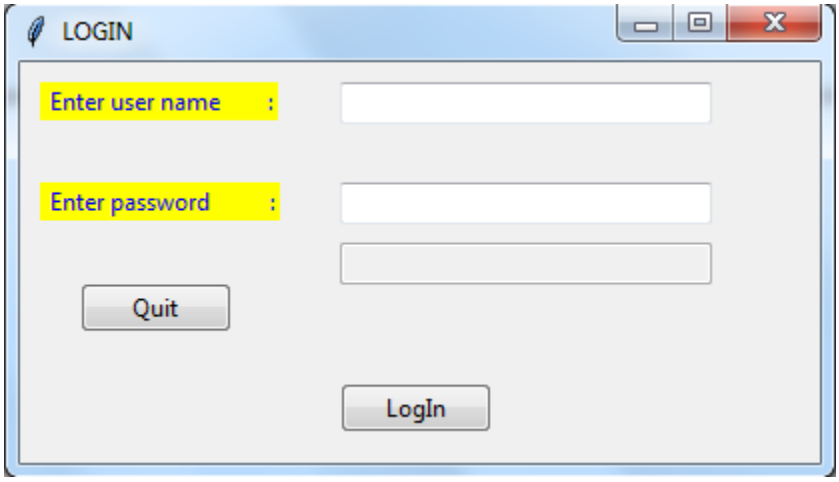

Figure 5.1 Login interface

To open the system, put username and password correctly. The username is jalal and the password is jalal, if the username or password is wrong then the message "Error in Username OR Password " will appear, look Figure 5.2

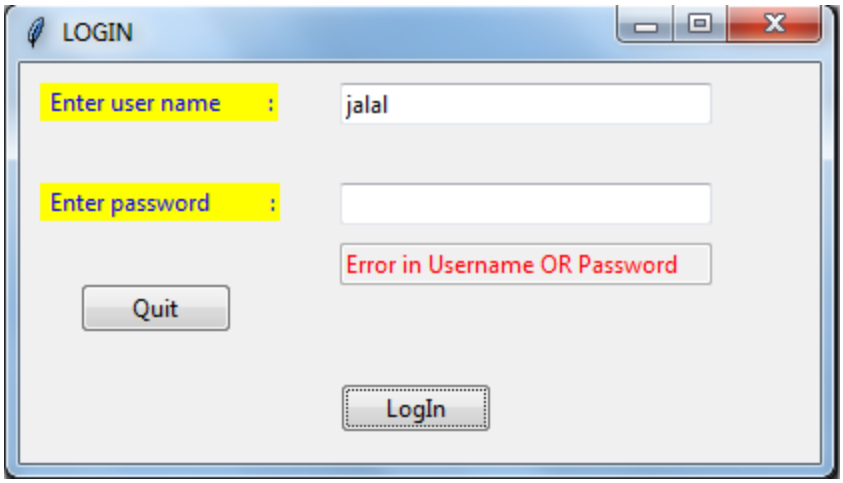

Figure 5.2 Login if make an error

Quite use to sign out of the system in each block interface.

After login in the system, then the new interface is appear and contain two choices, first to login to web-site interface and other to open the video with store in the file inside the SD card in raspberry pi, refer to Figure 5.3

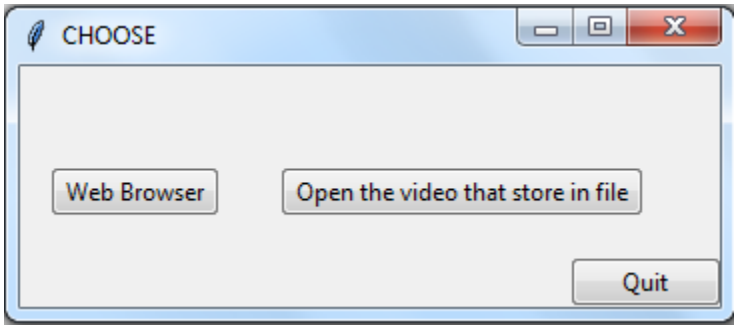

Figure 5.3 Choose web site of turn on of video

If choose open the video that store in file, then turn on the video and can watch the video and to seek the video and stop it.

If choose web browser, then the new interface will appear and contain five choices, and five choices are google, youtube, Email, facebook, and PPU, refer to Figure 5.4

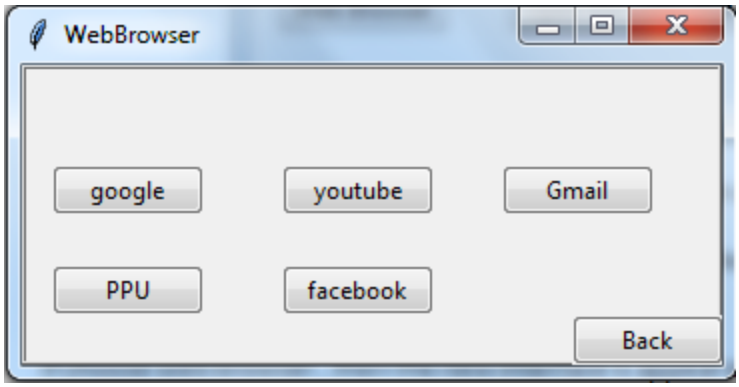

Figure 5.4 Web browser interface

If choose Google, then open the page of Google ,refer to Figure 5.5

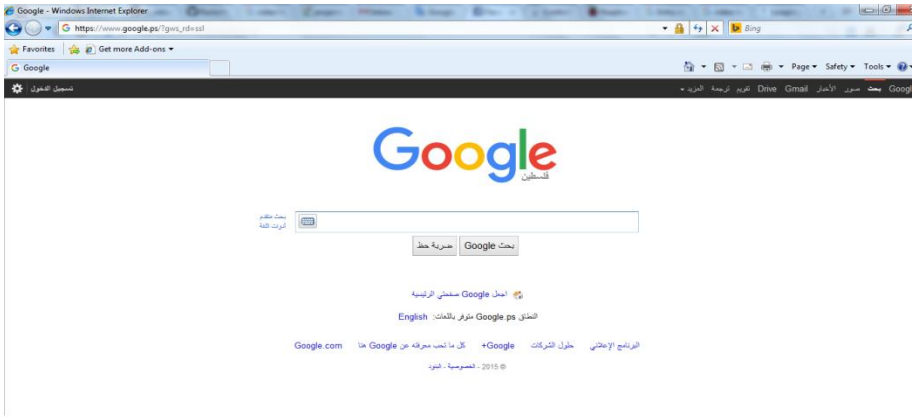

Figure 5.5 Google page

If choose another web, such as YouTube, Email, Facebook or PPU web site, then the system will open the page. After that users can browse, search …etc.

Figure 5.6 Sequence diagram

5.2 Testing

To give a user good product, it is important to test the product before offer itas a final product, so this section about testing the project testing is work correctly, it has a problem to solve it , it work correctly, it work a long time.

It is important to do many test to give a user a good product, in this project many problems was appear, but it solved, the most difficult one how to display video and how to deal with it, how to stop a video how to exit from it, by edit the code and make many tests the problem is solve.

Another problem how display the graphical into to raspberry pi, by editing the code and make tests the problem is solved.

Another important aspect to user how much the speed of system and the responses of the system, the raspberry pi has a fast CPU 900MHz so it's fast, for example its response for IR signal takes less than one second to do the operation.

This tests and results, show that the system has good speed and it meets users requirements.

The Table 5.7 shows, explain the different between the three system Samsung, Apple and the smart TV system.

Table 5.1 Comparison between three systems

Models	Samsung TV	Apple TV	Smart TV System
Processor	Quad core	Single core	Quad core
Memory	256MB	512 MB	512 MB
Storage	500GB external hard drive	8 GB NAND Flash for cache	External device (USB)
Connectivity	2 HDMI , 2 USB , 1ETHERNET	Bluetooth, Micro-USB (reserved for service.), HDMI, infrared receiver, optical audio	1 HDMI , 4 USB , 1 Ethernet
Networking	Built-in Wi-Fi (Wi-Fi Direct)	Wi-Fi (802.11a/b/g/n), 10/100 Ethernet	External
Price	200$	150$	110$
Power	Power Supply (V) is AC110-120V 60Hz Typical Power consumption equal 37W	Built-in universal 6W power supply	Output:5V, 2000mA
Initial operating System	Android	Apple TV Software 5.2 (based on IOS 6.1)	Python

In Table 5.1 compare the three system, the first two system are explained in chapter one, in this section will explain the smart TV system.

The smart TV system is more cheaper than two system, the internal memory as like as Apple TV but it better than Samsung, it better than two system has contain four USB but in Samsung contain two USB and Apple no USB, and the processor is quad core in the smart TV as like as Samsung but single core in Apple. The smart TV system is open source unlike the two system, that it better for start to market the project, open source mean is any device can connect in the system, but the Apple and Samsung just connect in the same source, Samsung connect with Samsung, Apple connect with Apple, that mean the two company are closed source.

Chapter Six

Challenges, Conclusion and Future Works

6.1 Challenges and Solutions

6.2 Conclusion

6.3 Future Works

This chapter provides three section. First talk the challenge in the project, after that talk about the conclusion the system, and finally talk the future work, future works are any work can added in the system.

6.1 Challenges and Solutions

In this section contain a challenges and problem see it with making the problem and contain the solves of problems. The problems and solves are:

1- The first challenge is the programming language (python) because you learn this language by yourself, we solve it by learn the language by read books and watch many videos in YouTube .

2- To read the codes in many remote control, we solve it by using many step in raspberry pi, and we try many experiment to know the true remote code.

3- To appear the graphical interface in raspberry pi, we solve it by adding some code in the general code.

4- The availability of components in the market, we wait three week to arrive the all components.

6.2 Conclusion

The smart TV is remotely controlled device, compatible with any display screen that supports HDMI interface, the purpose of this project can open the web page in the screen with use microcontroller (raspberry pi) and control the system with use remote control. We made the system, can open the web page and control it by using the remote control ,and we added in the system ,can open the video in the screen, can watch the video that store in microcontroller (SD-card in raspberry pi) or store in USB flash and add the flash in microcontroller, when made the system we seen many problems, but we solve this problems and few problems we cannot solve it. Finally can add a many application in the system, refer to chapter six and read the future word, in the future work can anyone make an application and added it to the system.

6.3 Future Work

1- Add more applications in hand phone to control the developed system.

2- Add more web-sites.

3- Control the system with using the voice or use gestures via using camera.

4- Add another applications not just to browse the internet.

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Appendix

Appendix A

IR Remote

1	**FF6897**	**C101E57B**
2	FF9867	**97483BFB**
3	FFB04F	**F0C41643**
4	FF30CF	**9716BE3F**
5	FF18E7	**3D9AE3F7**
6	FF7A85	**6182021B**
7	FF10EF	**8C22657B**
8	FF38C7	**488F3CBB**
9	FF5AA5	**449E79F**
0	FF4AB5	**1BC0157B**
*	FF42BD	**32C6FDF7**
#	FF52AD	**3EC3FC1B**
→	FFC23D	**20FE4DBB**
←	FF22DD	**52A3D41F**
↑	FF629D	**E3515885**
↓	FFA857	**A3C8EDDB**
Ok	FF02FD	**64014DE18**

TV Remote

HDMI		**C4B4779A**
POWER		**2307B446**
MENU		**65A52F28**
VOLUME	UP	**76EC43A2**
	DOWN	**69CE021D**
INPUT		**A888E157**
→		**A6974989**
←		**1AB874DC**
↑		**ACB7B6A0**
↓		**8BCCC675**

Appendix B

The code

```
'''
.....
  .....SMART TV SYSTEM.....
.....


'''


from tkinter import*
from tkinter import ttk
import webbrowser


def show_entry_fields():
if (entry1.get() == 'jalal') and (entry2.get() == 'jalal'):
root.destroy()
show_entry_fields1()
else:
entry3.state(['!disabled'])
entry3.delete(0 ,END)
entry3.insert(0 ,'Error in Username OR Password' )
entry3.state(['disabled'])
entry3.config(foreground='red',background ='blue')
entry2.delete(0 ,END)
def show_entry_fields1():
```

```
root = Tk()
root.config(height =120, width =350)
root.config(relief = RIDGE)
root.title('CHOOSE')

def show1():
root.destroy()
show4()

def show2():
root.destroy()
show5()

def show3():
root.destroy()
show6()

def show4():
root1 = Tk()
root1.title('WebBrowser')
frame = ttk.Frame(root1)
frame.config(height =150, width =350)
frame.config(relief = RIDGE)
frame.pack()
```

```
button1 = ttk.Button(root1,text="google")
button1.place(x =15 ,y =50)
ur1= "www.google.com"

button2 = ttk.Button(root1,text= "youtube" )
button2.place(x =130 ,y =50)
ur2 = "www.youtube.com"

button3 = ttk.Button(root1,text= "Gmail" )
button3.place(x =240 ,y =50)
ur3 = "http://site.safqaonline.com/1010/gmail/gmail.com"

button4 = ttk.Button(root1,text= "PPU" )
button4.place(x =15 ,y =100)
ur4= "http://reg.ppu.edu/?AspxAutoDetectCookieSupport=1"

button5 = ttk.Button(root1,text= "facebook" )
button5.place(x =130 ,y =100)
ur5= "www.facebook.com"

def callback1():
webbrowser.open(ur1,new =2)
button1.config(command =callback1)

def callback2():
```

```
webbrowser.open(ur2,new =2)
button2.config(command =callback2)

def callback3():
webbrowser.open(ur3,new =2)
button3.config(command =callback3)

def callback4():
webbrowser.open(ur4,new =2)
button4.config(command =callback4)

def callback5():
webbrowser.open(ur5,new =2)
button5.config(command =callback5)

button4 = ttk.Button(root1, text= " Back" )
button4.place(x =275 ,y =125)

def callback6():
root1.destroy()
show_entry_fields1()
button4.config(command =callback6)

def show5():
root1 = Tk()
```

```
root1.title('Files')
frame = ttk.Frame(root1)
frame.config(height =120, width =350)
frame.config(relief = RIDGE)
frame.pack()

button1 =ttk.Button(root1, text= " Qur'an file" )
button1.place(x =15 ,y =50)

button2 = ttk.Button(root1, text= " film File" )
button2.place(x =130 ,y =50)

button3 = ttk.Button(root1, text= " Play File" )
button3.place(x =240 ,y =50)

ur1="file://C:/Users/HP/Desktop/القران"
ur2="file://C:/Users/HP/Desktop/افلام ومسرحيات/ افلام عربية"
ur3="file://C:/Users/HP/Desktop/افلام ومسرحيات/مسرحيات"

def callback1():
webbrowser.open(ur1,new =2)
button1.config(command =callback1)

def callback2():
webbrowser.open(ur2,new =2)
```

```
button2.config(command =callback2)

def callback3():
webbrowser.open(ur3,new =2)
button3.config(command =callback3)

button4 = ttk.Button(root1, text= " Back" )
button4.place(x =275 ,y =95)

def callback4():
root1.destroy()
show_entry_fields1()
button4.config(command =callback4)

button1 =ttk.Button(root, text= " Web Browser ",command = show1)
button1.place(x =15 ,y =50)

button2 = ttk.Button(root, text= " Storage File ",command = show2)
button2.place(x =130 ,y =50)

button3 = ttk.Button(root, text= " Televsion ",command = show3)
button3.place(x =240 ,y =50)

button4 = ttk.Button(root, text= " Quit ",command = root.destroy)
button4.place(x =275 ,y =95)
```

```
root = Tk()
root.config(height =200, width =400)
root.config(relief = RIDGE)
root.title('LOGIN')

label1 =ttk.Label(root, text= " Enter user name: "  )
label1.place(x =10 ,y =10)
label1.config(foreground= 'blue', background = 'yellow')

label2 = ttk.Label(root, text= " Enter password:  " )
label2.place(x =10 ,y =60)
label2.config(foreground='blue', background ='yellow')

entry1 = ttk.Entry(root ,width =30)
entry1.pack()
entry1.place(x =160 ,y =10)
entry1.get()

entry2 = ttk.Entry(root ,width =30)
entry2.pack()
entry2.place(x =160 ,y =60)
entry2.get()
entry2.config(show = '*'  )
```

```
entry3 = ttk.Entry(root ,width =30)
entry3.pack()
entry3.place(x =160 ,y =90)
entry3.state(['disabled'])



button1 = ttk.Button(root, text='Quit', command=root.destroy)
button1.place(x =30 ,y =110)

button2 = ttk.Button(root, text='LogIn' ,command = show_entry_fields)
button2.pack()
button2.place(x =160 ,y =160)



root.mainloop()



'''
.....
  .....THE END.....
.....

'''
```

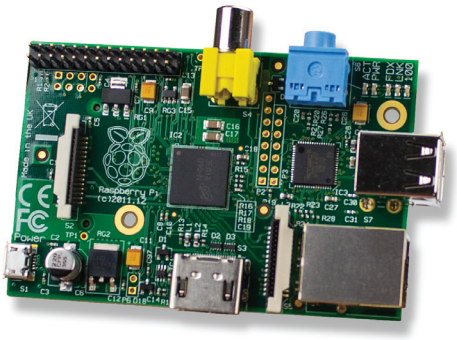
Appendix C

Datasheet of Raspberry Pi models

Appendix D

Datasheet of IR Receiver

Raspberry Pi



MODEL B

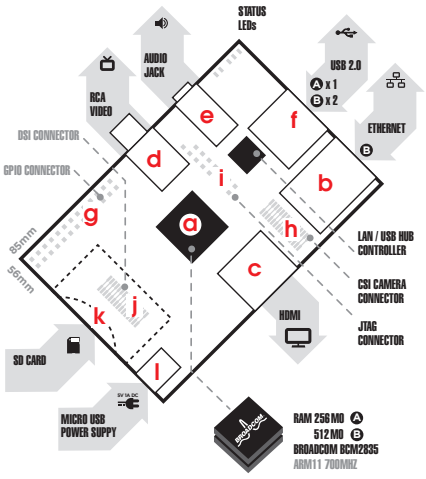
Product Name	**Raspberry Pi Model B**
Product Description	The Raspberry Pi is a small, powerful and lightweight ARM based computer which can do many of the things a desktop PC can do. The powerful graphics capabilities and HDMi video output make it ideal for multimedia applications such as media centres and narrowcasting solutions. The Raspberry Pi is based on a Broadcom BCM2835 chip. It does not feature a built-in hard disk or solid-state drive, instead relying on an SD card for booting and long-term storage.
RS Part Number	**756-8308**

Specifications

Chip	Broadcom BCM2835 SoC (a)
Core architecture	ARM11
CPU	700 MHz Low Power ARM1176JZFS Applications Processor
GPU	Dual Core VideoCore IV® Multimedia Co-Processor Provides Open GL ES 2.0, hardware-accelerated OpenVG, and 1080p30 H.264 high-profile decode Capable of 1Gpixel/s, 1.5Gtexel/s or 24GFLOPs with texture filtering and DMA infrastructure
Memory	512MB SDRAM
Operating System	Boots from SD card, running a version of the Linux operating system
Dimensions	85.6 x 53.98 x 17mm
Power	Micro USB socket 5V, 1.2A (l)

Connectors:

Ethernet	10/100 BaseT Ethernet socket (b)
Video Output	HDMI (rev 1.3 & 1.4) (c); Composite RCA (PAL and NTSC) (d)
Audio Output	3.5mm jack (e), HDMI
USB 2.0	Dual USB Connector (f)
GPIO Connector	26-pin 2.54 mm (100 mil) expansion header: 2x13 strip. Providing 8 GPIO pins plus access to I²C, SPI and UART as well as +3.3 V, +5 V and GND supply lines (g)
Camera Connector	15-pin MIPI Camera Serial Interface (CSI-2) (h)
JTAG	Not populated (i)
Display Connector	Display Serial Interface (DSI) 15 way flat flex cable connector with two data lanes and a clock lane (j)
Memory Card Slot	SDIO (k)

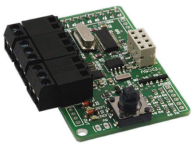


Accessories

▲ Camera Module
775-7731

▲ International power supply
765-3311

▲ 8GB SD card pre-programmed with NOOBS - **779-6770**



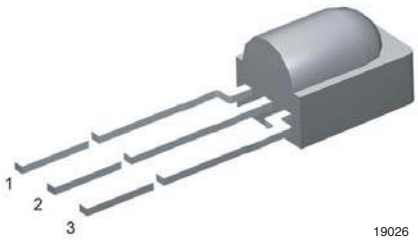
▲ Expansion board
772-2974

▲ WiFi dongle
760-3621

▲ 10400mAh Li-Ion battery pack
775-7517

▲ Raspberry Pi user guide
768-6686

IR Receiver Modules for Remote Control Systems



FEATURES

- Very low supply current
- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Improved shielding against EMI
- Supply voltage: 2.5 V to 5.5 V
- Improved immunity against ambient light
- Insensitive to supply voltage ripple and noise
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

HALOGEN FREE

GREEN (5-2008)

MECHANICAL DATA

Pinning for TSOP382.., TSOP384..:

1 = OUT, 2 = GND, 3 = V_S

DESCRIPTION

These products are miniaturized IR receiver modules for infrared remote control systems. A PIN diode and a preamplifier are assembled on a leadframe, the epoxy package contains an IR filter.

The demodulated output signal can be directly connected to a microprocessor for decoding.

The TSOP382.. and TSOP384.. are optimized to suppress almost all spurious pulses from energy saving lamps like CFLs. The AGC4 used in the TSOP384.. may suppress some data signals. The TSOP382.. is a legacy product for all common IR remote control data formats. Between these two receiver types, the TSOP384.. is preferred. Customers should initially try the TSOP384.. in their design.

These components have not been qualified according to automotive specifications.

PARTS TABLE			
AGC		**LEGACY, FOR LONG BURST REMOTE CONTROLS (AGC2)**	**RECOMMENDED FOR LONG BURST CODES (AGC4) [1]**
Carrier frequency	30 kHz	TSOP38230	TSOP38430
	33 kHz	TSOP38233	TSOP38433
	36 kHz	TSOP38236	TSOP38436 [2][3][4]
	38 kHz	TSOP38238	TSOP38438 [5][6]
	40 kHz	TSOP38240	TSOP38440
	56 kHz	TSOP38256	TSOP38456 [7][8]
Package		Minicast	
Pinning		1 = OUT, 2 = GND, 3 = V_S	
Dimensions (mm)		5.0 W x 6.95 H x 4.8 D	
Mounting		Leaded	
Application		Remote control	
Best remote control code		[2] RC-5 [3] RC-6 [4] Panasonic [5] NEC [6] Sharp [7] r-step [8] Thomson RCA	

Note

[1] We advise try AGC4 first if the burst length is unknown

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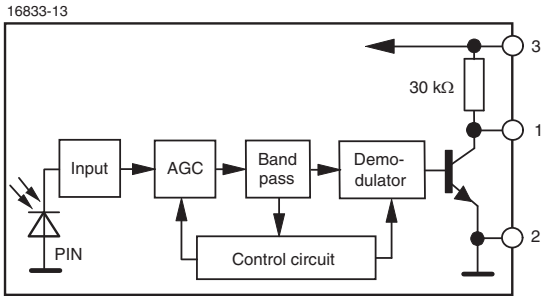
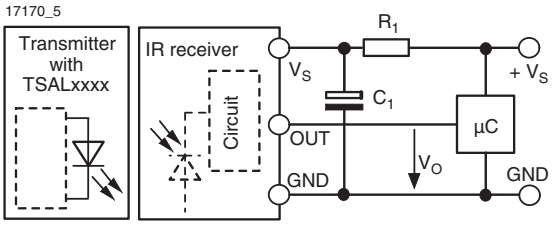
BLOCK DIAGRAM



APPLICATION CIRCUIT



R_1 and C_1 are recommended for protection against EOS. Components should be in the range of 33 Ω < R_1 < 1 kΩ, C_1 > 0.1 µF.

ABSOLUTE MAXIMUM RATINGS

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Supply voltage		V_S	-0.3 to +6	V
Supply current		I_S	3	mA
Output voltage		V_O	-0.3 to (V_S + 0.3)	V
Output current		I_O	5	mA
Junction temperature		T_j	100	°C
Storage temperature range		T_{stg}	-25 to +85	°C
Operating temperature range		T_{amb}	-25 to +85	°C
Power consumption	T_{amb} ≤ 85 °C	P_{tot}	10	mW
Soldering temperature	t ≤ 10 s, 1 mm from case	T_{sd}	260	°C

Note

- Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect the device reliability.

ELECTRICAL AND OPTICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply current	E_v = 0, V_S = 3.3 V	I_{SD}	0.27	0.35	0.45	mA
	E_v = 40 klx, sunlight	I_{SH}		0.45		mA
Supply voltage		V_S	2.5		5.5	V
Transmission distance	E_v = 0, test signal see fig. 1, IR diode TSAL6200, I_F = 200 mA	d		45		m
Output voltage low	I_{OSL} = 0.5 mA, E_e = 0.7 mW/m², test signal see fig. 1	V_{OSL}			100	mV
Minimum irradiance	Pulse width tolerance: $t_{pi} - 5/f_o < t_{po} < t_{pi} + 6/f_o$, test signal see fig. 1	$E_{e\ min.}$		0.12	0.25	mW/m²
Maximum irradiance	$t_{pi} - 5/f_o < t_{po} < t_{pi} + 6/f_o$, test signal see fig. 1	$E_{e\ max.}$	30			W/m²
Directivity	Angle of half transmission distance	$\varphi_{1/2}$		± 45		deg

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

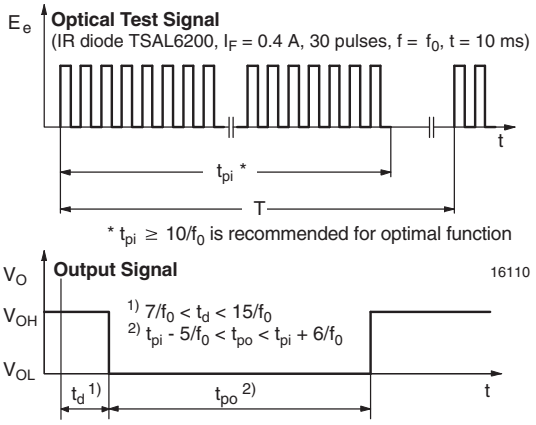


Fig. 1 - Output Active Low

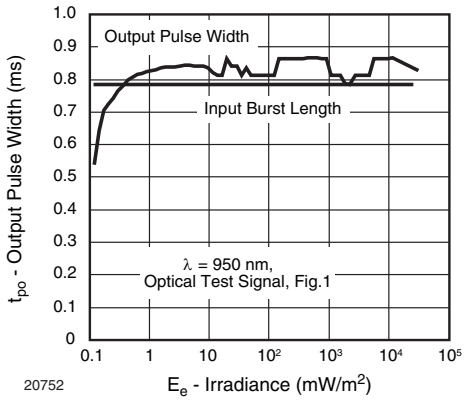


Fig. 2 - Pulse Length and Sensitivity in Dark Ambient

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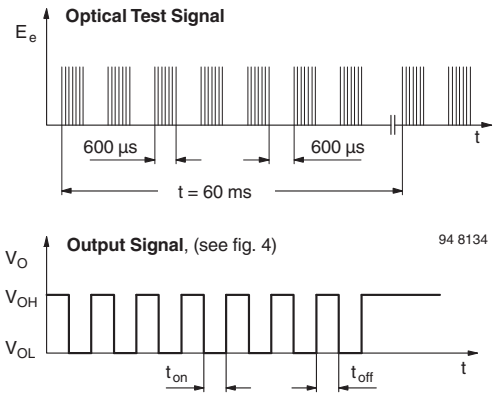

Fig. 3 - Output Function

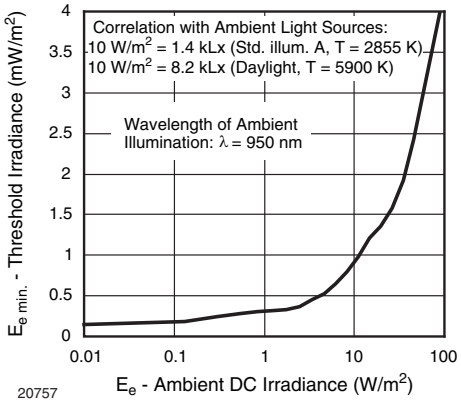

Fig. 6 - Sensitivity in Bright Ambient

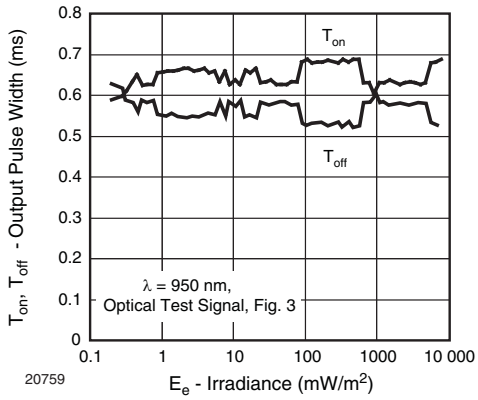

Fig. 4 - Output Pulse Diagram

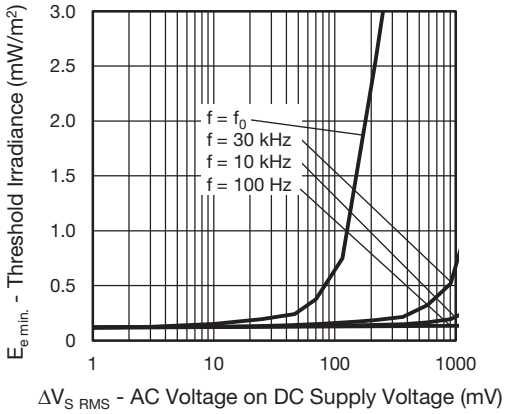

Fig. 7 - Sensitivity vs. Supply Voltage Disturbances

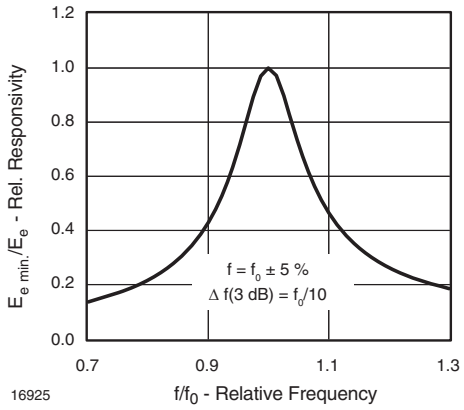

Fig. 5 - Frequency Dependence of Responsivity

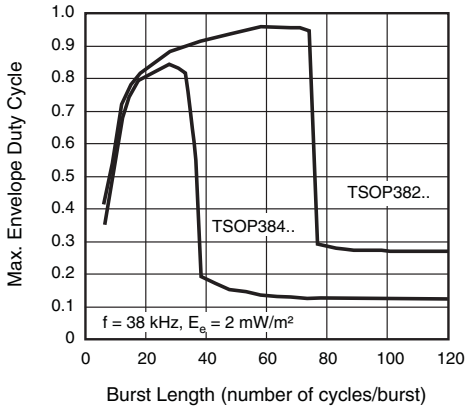

Fig. 8 - Max. Envelope Duty Cycle vs. Burst Length

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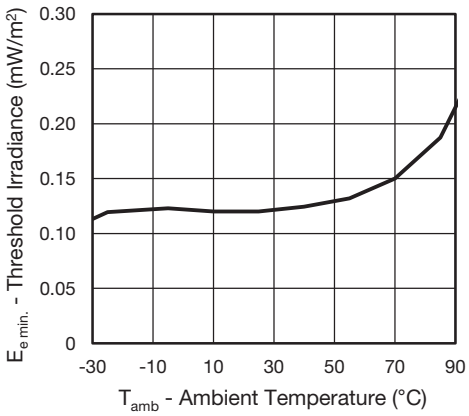

Fig. 9 - Sensitivity vs. Ambient Temperature

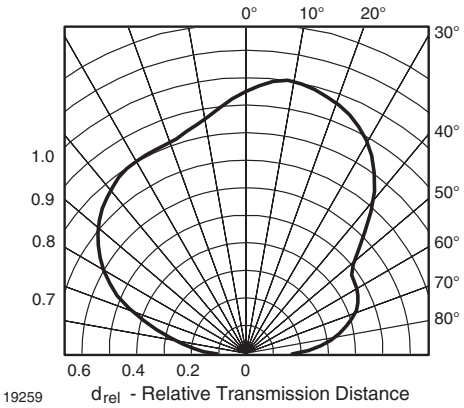

Fig. 12 - Vertical Directivity

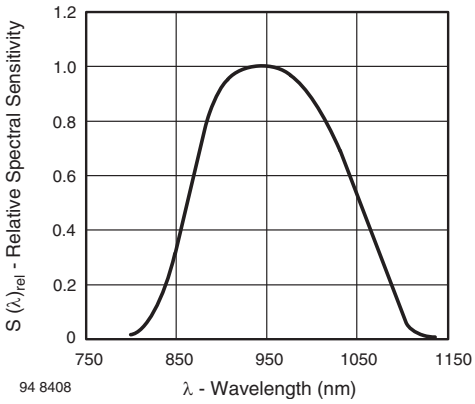

Fig. 10 - Relative Spectral Sensitivity vs. Wavelength

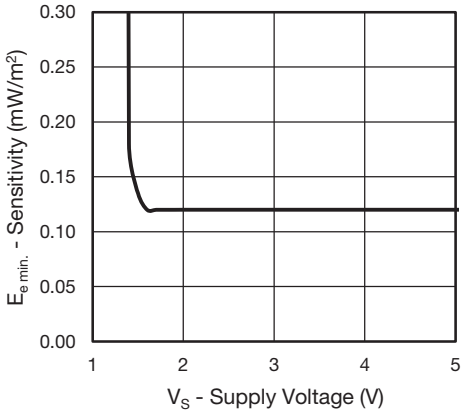

Fig. 13 - Sensitivity vs. Supply Voltage

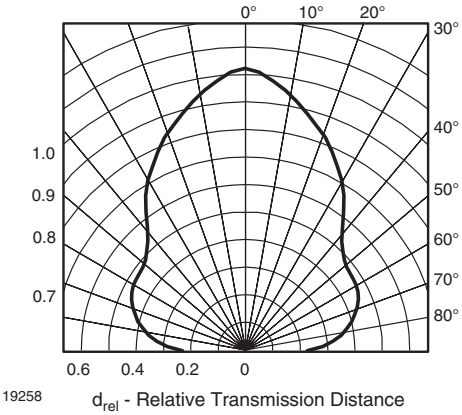

Fig. 11 - Horizontal Directivity

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SUITABLE DATA FORMAT

This series is designed to suppress spurious output pulses due to noise or disturbance signals. The devices can distinguish data signals from noise due to differences in frequency, burst length, and envelope duty cycle. The data signal should be close to the device's band-pass center frequency (e.g. 38 kHz) and fulfill the conditions in the table below.

When a data signal is applied to the product in the presence of a disturbance, the sensitivity of the receiver is automatically reduced by the AGC to insure that no spurious pulses are present at the receiver's output.

Some examples which are suppressed are:

- DC light (e.g. from tungsten bulbs sunlight)
- Continuous signals at any frequency
- Strongly or weakly modulated patterns from fluorescent lamps with electronic ballasts (see figure 14 or figure 15).

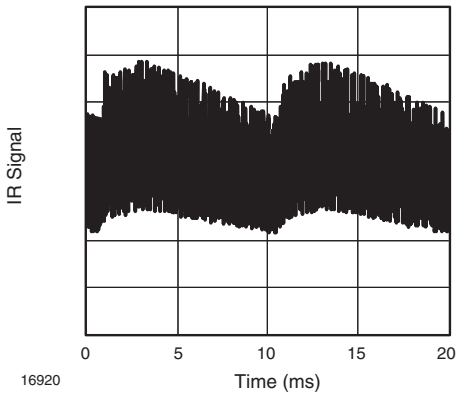

Fig. 14 - IR Disturbance from Fluorescent Lamp with Low Modulation

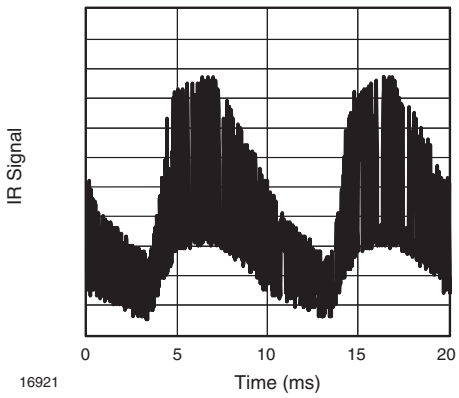

Fig. 15 - IR Disturbance from Fluorescent Lamp with High Modulation

	TSOP382..	TSOP384..
Minimum burst length	10 cycles/burst	10 cycles/burst
After each burst of length a minimum gap time is required of	10 to 70 cycles ≥ 10 cycles	10 to 35 cycles ≥ 10 cycles
For bursts greater than a minimum gap time in the data stream is needed of	70 cycles > 4 x burst length	35 cycles > 10 x burst length
Maximum number of continuous short bursts/second	1800	1500
NEC code	yes	preferred
RC5/RC6 code	yes	preferred
Thomson 56 kHz code	yes	preferred
Sharp code	yes	preferred
Suppression of interference from fluorescent lamps	Most common disturbance patterns are suppressed	Even extreme disturbance patterns are suppressed

Notes

- For data formats with short bursts please see the datasheet for TSOP383.., TSOP385..
- Best choice of AGC for some popular IR-codes:
  - TSOP38436: RC-5, RC-6, Panasonic
  - TSOP38438: NEC, Sharp, r-step
  - TSOP38456: r-step, Thomson RCA
- For Sony 12, 15, and 20 bit IR-codes please see the datasheet of TSOP34S40F, TSOP32S40F

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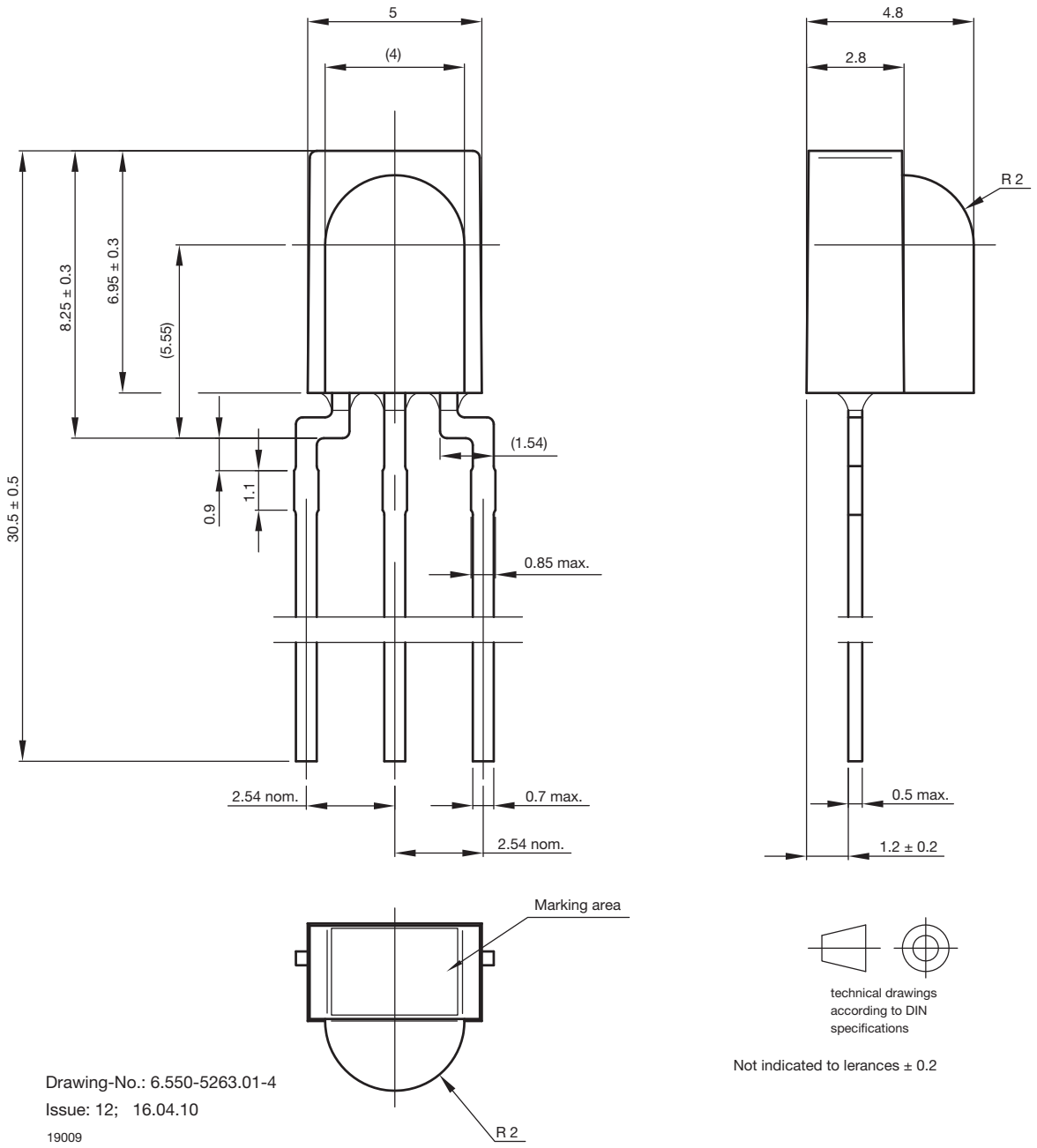
PACKAGE DIMENSIONS in millimeters



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