IOT Based Home Automation System & Digital Signage

Major Project Report

Submitted in fulfillment of the requirements
for the degree of

Master of Technology
in
Electronics & Communication Engineering
(Embedded Systems)

By

Amit Chavan
(14MECE01)

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Declaration

This is to certify that

a. The thesis comprises my original work towards the degree of Master of Technology in Embedded Systems at Nirma University and has not been submitted elsewhere for a degree.

b. Due acknowledgment has been made in the text to all other material used.

- Amit Chavan

Disclaimer

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Certificate

This is to certify that the Major Project entitled **"IOT Based Home Automation System & Digital Signage"** submitted by **Amit Suhas Chavan (14MECE01)**, towards the partial fulfillment of the requirements for the degree of Master of Technology in Embedded Systems, Nirma University, Ahmadabad is the record of work carried out by him under our supervision and guidance. In our opinion, the submitted work has reached a level required for being accepted for examination.The results embodied in this major project, to the best of our knowledge,haven't been submitted to any other university or institution for award of any degree or diploma.

Date: Place: Ahmedabad

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- Amit Suhas Chavan

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Abstract

Digital Signage project is a system which is used to deliver rich media content like audio,video (local video as well as youtube video), time-table of any organization, advertisement ,live streaming, rss feeds, power point presentation to a public audience.

In this it will display these content through display devices like LCD , Personal Computer etc. It will display weather information as well as map of any geographic area by writing some scripts .In this system there is server through which admin can prepare layouts ,update these layout and send these layout to particular device having client installed at that device.

The IOT based home automation system uses the portable devices as a user interface. User can communicate home automation network through Internet gateway by means of communication protocol such as TCP/IP. User can control home appliances via Ubidots cloud web interface using TCP/IP as a communication protocol and Raspberry Pi as an internet gateway.

The user here will move directly with the system through a web-based interface over the cloud,whereas home appliances like lights and fan are remotely controlled through easy web interface over the cloud. User can also monitor room temperature .It can also detect light in the room & movable object in front of the Door .The Raspberry Pi will be interfaced with the relay hardware circuits that control high voltage appliances running at home.

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Chapter 1

Introduction

1.1 Background

In this project is to make a digital signage system which is used to deliver rich media content like video (local video as well as youtube video), time-table of any organization, advertisement ,live streaming, rss feeds to a public audience. It will also display weather information as well as map of any geographic area .

In this we will make server through which we can send this media files to particular device. Also we will make client system which would be on particular display device so media files can be played on display device.In this Admin can update this media files and these media files can be managed by using content management system (CMS).Server delivers dynamic content on the right location, on the right time, targeted to the right audience.

In this project is to make low cost home automation system using Internet of Things.Here we will monitor temperature and other parameters related to home appliances.Also we can control home appliances through cloud based web portal and analyse data of other parameters. Accordingly we can take action.

1.2 Problem Statement

The main goal of this project is to develop a digital signage system through which we can deliver rich media content like live news,video,images,rss feeds and weather information among multiple pc as well as we can show it on LCD screen without any delay.
The main goal of this project is to develop a IOT based home automation system which will connect to the Internet via Internet gateway such as Raspberry Pi2.It will send sensor data to the Internet cloud using communication protocol.It will also display current status of home appliances and we can control home appliance via Internet cloud from remote location which will increase power saving.

1.3 Thesis Organization

The rest of the thesis organized as follows.

Chapter 2 deals with brief description of Digital Signage system.It covers literature review of the project ,tools and technology used for hardware and software design of system.

Chapter 3 deals with system analysis of the Digital Signage and Home Automation system . It covers functional ,non-functional requirements of the systems , feasibility study,features of new systems and list of main modules of New System.

Chapter 4 deals with system design,testing and Hardware design of the Digital Signage System . It covers data structure design and Input/Output interface design of the system. It also covers testing of Xibo digital signage software with various test cases.

Chapter 5 deals with system design and testing of IOT based Home Automation System.It also covers system testing of Home Automation System.

Chapter 6 concludes this report regarding Digital Signage and Home Automation System with future scope.

Chapter 2

Literature Survey

This chapter gives the brief overview of Digital Signage system and IOT based home automation system Architecture. It also give brief about Operating System used , languages used for frontend and backend development , softwares used for digital signage home automation implementation.It also give brief overview about hardware design of Digital Signage client , hardware components used for board designs and tools used for drawing hardware layouts.It also gives hardware used for home automation system and software used for programming,displaying and analysing data.

2.1 Literature Review

2.1.1 Digital Signage

Operating Systems : Windows 7,Windows 8, Linux ,Android OS

Front end : PHP ,HTML ,Java script

Back end : Microsoft SQL

Hardware Board : Raspberry Pi 2 ,Panda board

Hardware Design Tools : OrCAD Capture , Allegro

Digital Signage Software : Xibo

- **PHP**
  - PHP is a powerful tool for making dynamic and interactive Web pages.
  - PHP is the widely-used, free, and efficient alternative to competitors such as Microsofts ASP.
  - The PHP (Hypertext Pre-processor) permits web designers to make element content that cooperates with databases. PHP applications are regularly found on Linux servers and in conjunction with MySQL databases. It provides those servers with functionality similar to that provided to the Windows platform by Active Server Pages technology.
  - **Features of PHP**
    * Built-in webserver
    * Relatively fast for an interpreted language.
    * PHP was originally designed for web use lots of functions for common web-development task.
    * Support for MySQL, Oracle, dbm, DB2, PostgreSQL
    * Can connect to any database which provides an ODBC driver
- **Java Script**
  - JavaScript is an object-oriented scripting language used to enable programmatic access to objects within both the client application and other applications. Albeit Also in different applications, it is fundamentally utilized as a part of the type of customer side JavaScript, implemented as a major aspect of a web browser, giving upgraded user interfaces and dynamic websites.
  - JavaScript is a dialect of the ECMAScript standard and is described as a dynamic, feebly wrote, weakly typed, prototype-based language with

first-class functions.JavaScript was influenced by many languages and was intended to look like java, however to be simpler for non-developers to work with.

- **HTML**
  - HyperText Markup Language, commonly referred to as HTML, is the standard markup language used to create web pages. Along with CSS, and JavaScript, HTML is a cornerstone technology, used by most websites to create visually engaging webpages, user interfaces for web applications, and user interfaces for many mobile applications.
  - Web browsers can read HTML files and render them into visible or audible web pages. HTML portrays the structure of a website semantically alongside signs for presentation, making it a markup language, instead of a programming language.
  - HTML components frame the building blocks of all websites. HTML permits pictures and objects to be embedded and can be utilized to make intelligent forms. It gives a way to make structured documents by indicating structural semantics for content, for example,headings, paragraphs, lists, links, quotes and other items.
  - HTML can embed scripts written in languages, such as JavaScript which influence the behavior of HTML web pages. Web browsers can also refer to Cascading Style Sheets (CSS) to characterize the look and format of content and other material.

2.1.2 IOT based home automation system

Operating Systems : Thingbox

Software Language: Python

Internet Cloud: Ubidots

Hardware Board : Raspberry Pi 2

Sensors: IR Sensor , Temperature Sensor , Ambient light Sensor

Home Appliances: Light, Fan

- **Thingbox**
  - The ThingBox is a set of software already installed and configured.
  - It allows anyone to graphically create new unlimited applications interacting with connected objects from a simple web-browser.
  - It can be used by non-technical people to take advantage of the IOT.
- **Python**

  Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language. It was created by Guido van Rossum during 1985- 1990.
  - **Features of Python:**
    - **Easy-to-learn:** Python has few keywords, simple structure, and a clearly defined syntax. This allows the student to pick up the language quickly.
    - **Easy-to-read:** Python code is more clearly defined and visible to the eyes.
    - **Easy-to-maintain:** Python's source code is fairly easy-to-maintain.
    - **A broad standard library:** Python's bulk of the library is very portable and cross-platform compatible on UNIX, Windows, and

Macintosh.

* **Interactive Mode:** Python has support for an interactive mode which allows 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:** You can add low-level modules 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.

- **Ubidots**

  Ubidots is a free cloud used for taking data from sensor and for controlling the home appliances.Ubidots supports several devices such as Arduino , Raspberry Pi , Electric Imp, Spark Core, Microchip WCM.

  - **Data Capture:** It is used for capturing data from the Digital Sensors connected to the embedded board.
  - **Analysis and Visualization:**

    * **Live Dashboards:** It displays sensor data through custom widgets like line charts, gauges, multi-line charts, scatter plots or maps. It customizes the looks of the dashboard through simple drag-n-drop

gestures, or changing the size of your widgets.

* **Share your Insights:**All of the widgets can be shared through a public URL, or embedded in external web or mobile applications.These widgets can also update in real-time.
* **Compute Data from Different Sources:** It performs calculations and minimizes the device code.

– **Trigger Actions:**

It configures actions and alerts based on real-time data.

* **Create Custom Triggers:** It is used to define data thresholds and triggers alert accordingly.
* **Send SMS or Emails :** Once an event is triggered, a specific action can be executed. In most cases an Email or SMS alerting someone about a specific event.
* **Control Things Remotely:** Sometimes it is not feasible to wait for a trigger to happen ,here we can create "ON/OFF" widgets on dashboard and control things remotely.

– **A Powerful API:**

* **Robust and Flexible API:** API simplifies the storage and retrieval of sensor data across multiple hardware platforms.
* **Save Development Time:** API clients are installed on the embedded boards.It has Python, Java, C, PHP, Node and Ruby libraries to focus on building great projects, cutting down development time.
* **Data Analysis:** It compute operations through API.It retrieves any dataset from an arbitrary date range, or calculate statistical figures over any time period.

2.2 Hardware Board

- **Raspberry Pi2**

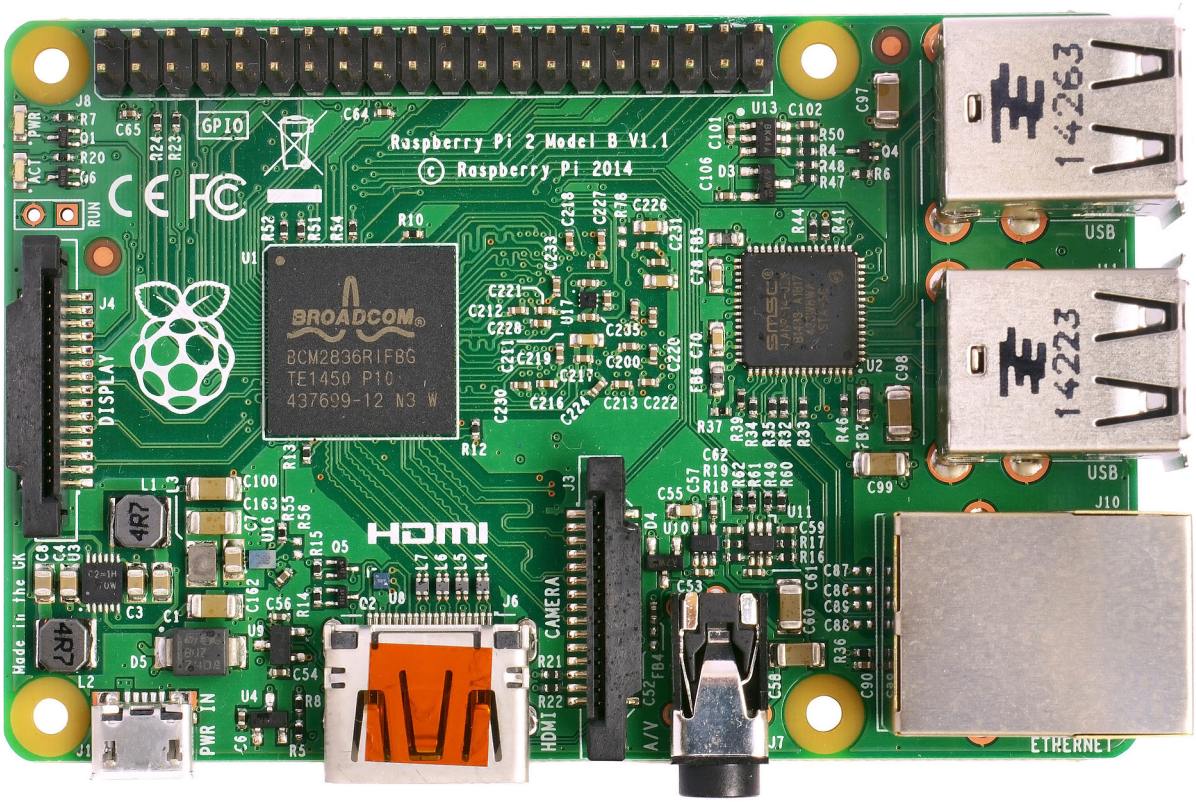

Figure 2.1: Raspberry Pi2 [2]

The Raspberry Pi 2 Model B is the second generation Raspberry Pi.

- **Specification of Raspberry Pi2**
  - A 900MHz quad-core ARM Cortex-A7 CPU
  - 1GB RAM
  - 4 USB ports
  - 40 GPIO pins
  - Full HDMI port
  - Ethernet port
  - Combined 3.5mm audio jack and composite video

* Camera interface (CSI)
* Display interface (DSI)
* Micro SD card slot
* VideoCore IV 3D graphics core

- **Panda Board**

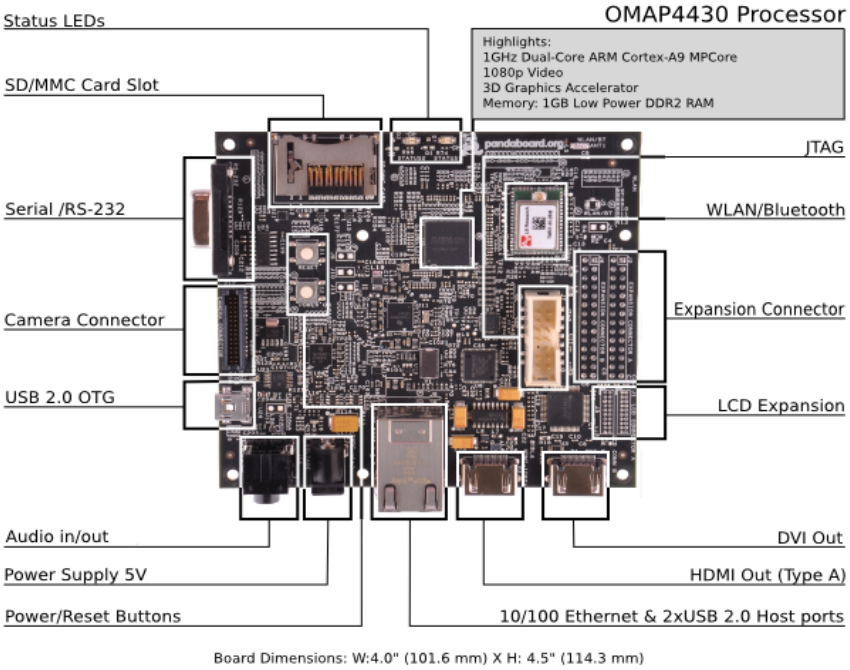

Figure 2.2: Panda Board[3]

– **Core Logic OMAP4430 applications processor**

* Dual-core ARM Cortex-A9 MPCore with Symmetric Multiprocessing (SMP) at 1 GHz each. Allows for 150 % performance increase over previous ARM Cortex-A8 cores.
* Full HD (1080p) multi-standard video encode/decode
* Imagination Technologies POWERVR SGX540 graphics core supporting all major API's including OpenGL ES v2.0, OpenGL ES v1.1, OpenVG v1.1 and EGL v1.3 and delivering 2x sustained performance compared to the previous SGX530 core

    - Low power audio

- **Memory**
    - 1 GB low power DDR2 RAM
    - Full size SD/MMC card cage with support for High-Speed & High-Capacity SD cards
- **Connectivity**
    - Onboard 10/100 Ethernet
- **Expansion**
    - 1x USB 2.0 High-Speed On-the-go port
    - 2x USB 2.0 High-Speed host ports
    - General purpose expansion header (I2C, GPMC, USB, MMC, DSS, ETM)
    - Camera expansion header
    - LCD signal expansion using a single set of resistor banks
- **Display**
    - HDMI v1.3 Connector (Type A) to drive HD displays
    - DVI-D Connector (can drive a 2nd display, simultaneous display; requires HDMI to DVI-D adapter)
    - LCD expansion header
- **Audio**
    - 3.5" Audio in/out
    - HDMI Audio out
- **Wireless Connectivity**
    - 802.11 b/g/n (based on WiLink 6.0)
    - Bluetooth v2.1 + EDR (based on WiLink 6.0)

- **Debug**
  - JTAG
  - UART/RS-232
  - 2 status LEDs (configurable)
  - 1 GPIO Button

2.3 Hardware Design Layout Tools

- **OrCAD** [4]
  - OrCAD Capture empowers quick and instinctive schematic design entry for PCB development or analog simulation utilizing PSpice. The component information system (CIS) integrates with it to automatically synchronize and validate externally sourced part data.
  - Simple to-utilize and effective, Cadence OrCAD Capture is the most generally utilized schematic design solution, supporting both flat and hierarchal outlines from the least complex to the most complex.
  - Seamless bi-directional integration with OrCAD PCB Editor empowers data synchronization and cross-examining/placing between the schematic and the board design.
  - OrCAD Capture permits designers to backannotate layout changes, make gate/pin swaps, and change part names or values from board design to schematic utilizing the feedback process. It additionally accompanies an extensive library of schematic symbols and can export netlists in a wide variety of formats.
  - OrCAD Capture CIS incorporates the OrCAD Capture schematic design application with the added capabilities of a component information system (CIS). The CIS permits designers to search, recognize, and populate the design with preferred parts. With simple access to component databases and part information,designers can decrease the amount of time spent researching required parts.
  - **Features/Benefits of OrCAD**
    - Boosts schematic editing efficiency with complex designs through hierarchical and variant design capabilities

* Integrates with a robust CIS that promotes the utilization of preferred, current parts to quicken the design process and lessen project costs
* Grants access to more than two million parts with Cadence ActiveParts, offering more flexibility when picking design components

2.4 Digital Signage Software

- **Xibo [1]**
  - Xibo is a complete digital signage solution comprised of a web based content management system (CMS) and choice of Windows or Android signage players.
  - Xibo supports the simple stuff and the complex stuff all in one package. New modules can be written to add support for new items.
  - **Features of Xibo**
    - **Media**

      Xibo supports most types of media you might want to use and we have made it as easy as possible to add.
      - **Library Media:** Media that exists in the Library is media that you have uploaded into the CMS, such as Video or Image files. You can access the library at any time and get a clear list of files you have uploaded.
      - **Layout Media:** Some media only exists on a Layout, for example a RSS Ticker or piece of text.
    - **Layouts**

      Layouts represent the design of your content and typically consist of a background image overlaid with one or more Regions. Each Region holds a Timeline which is a list of media that should be played.
      - **Preview:** Layouts can be previewed directly in the CMS so you can see how your Layout will look before releasing it to any Display clients.
      - **Campaigns:** Layouts can be grouped into Campaigns for easy management.

* **Scheduling**

  Layouts are scheduled to Displays for playback. Scheduling in Xibo only requires a from date, a to date and a tick next to the Display that should show the Layout. Priority schedules can be set to override other content.

  - **Repeating events:** Events can be repeated at predefined intervals - choose from hourly to yearly repeats.
  - **Schedule Now:** Want to quickly schedule something to run now? Schedule Now is accessible from the Layout or Display management and only needs a duration.

* **Permissions**

  Xibo Permissions can be as simple or as complex as required. A system can be run to that everyone sees everything, or so that every item is under lock and key.Permissions can be assigned to individual users.

  - **User Types:** Each user has a user type which automatically gives them more or less permissions.
  - **User Groups:** Users can be put into groups for even more flexibility. There is a special "Everyone" group to assign permissions to all users.

2.5 Summary

This chapter gives details about literature review of Digital Signage and IOT based Home Automation System project.Also the tools used for hardware and software for the system are listed out. It include brief introduction about Raspberry Pi2 and Panda board.

Chapter 3

System Analysis

This chapter gives analysis of current requirement ,study of previous system , functional and non functional requirement of the system.It also covers feasibility study , activity and process , features of new system , Use case Diagram and Sequence Diagram of the system.

3.1 System Requirements Study

3.1.1 User Characteristics

The user who are dealing with system are the development team, the project managers, design team , testers and documentation writers and other members of organization who provides guidance as well as the audience.

3.1.2 Hardware and Software Requirements

- **Hardware :**
  - Minimum Requirement of Hardware for Server:
    - Processor: Intel core i3
    - RAM: 2 GB

  - Hardware Requirement at Client:
    - Raspberry Pi2 / Panda board
    - LCD display

- **Software :**
  - Xibo
  - Netbeans
  - Adobe Dreamweaver
  - SQL management studio
  - XAMPP server

3.1.3 Assumptions and Dependencies

There are some assumptions we have followed. These are following :

- Internet Connection is must at device and Personal Computer.
- Database: SQL Management studio.
- XAMPP server must be installed.
- Browser compatibility for Google chrome will be supported by web application.
- .net framework must be installed in Personal Computer.
- Windows media player must be installed.
- Microsoft power point must be must be installed.

3.1.4 Study of Current System using Screenly OS

- The digital signage system previously made is working correctly.

- It is also supporting the images ,local video , time-table of any organization as well as ppt in very good manner.
- It can also display at client side at a given timing.

3.1.5 Problem and Weaknesses of Current System using Screenly OS

- The current system was not dealing with live news .
- It was not supporting the rss feeds.
- In that if any changes occur then one had to deal with the update manually.
- In that system there some delay occurs.
- It does not support multiple layouts.

3.2 Requirements of New System

3.2.1 Functional Requirements

Table 3.1: Functional Requirementof Digital Signage_1

Term	Description
REQ ID	RQ01
Purpose	To display media files on display device
Access Restrictions	Not Yet
Input(s)	server send media file to intended pc
Output(s)	Client display on LCD device
Mandatory Fields	Internet Connection Available
Testability with respect to test environment (Yes/No)	Yes

Table 3.2: Functional Requirement of Digital Signage_2

Term	Description
REQ ID	RQ02
Purpose	Test Case For showing updated data
Access Restrictions	Not Yet
Input(s)	Admin update the data and send to intended pc through server
Output(s)	Display device shows updated data
Mandatory Fields	Internet Connection Available
Testability with respect to test environment (Yes/No)	Yes

3.2.2 Non Functional Requirements

- **Performance**

  The system should be interactive and the delays involved should be less .So in every action-response of the system, there should be no immediate delays. In case of opening layouts ;the operation should be performed in less than 2 seconds for opening . While connecting to the client the delay is based on the

Table 3.3: Functional Requirement of Digital Signage_3

Term	**Description**
REQ ID	RQ03
Purpose	To run live news
Access Restrictions	Not Yet
Input(s)	Admin add some script for running live news
Output(s)	Client display on LCD device
Mandatory Fields	Internet Connection Available
Testability with respect to test environment (Yes/No)	Yes

Table 3.4: Functional Requirement of Digital Signage_4

Term	**Description**
REQ ID	RQ04
Purpose	Test Case For live rss feeds
Access Restrictions	Not Yet
Input(s)	Admin add script for rss script
Output(s)	Display device shows updated data
Mandatory Fields	Internet Connection Available
Testability with respect to test environment (Yes/No)	Yes

distance between the 2 systems and the configuration between them so there is high probability that there will not be a successful connection in less than 20 seconds for sake of good communication.

- **Safety**

  Information transmission between server and client should be secure without any changes in information.

- **Reliability**

  The system should provide the right tools for discussion, problem solving it must be made sure that the system should be reliable in its operations and for securing the sensitive details.

Table 3.5: Functional Requirement of Digital Signage_5

Term	**Description**
REQ ID	RQ05
Purpose	To display media content on more than one pc
Access Restrictions	Not Yet
Input(s)	Server send media file to intended pc
Output(s)	Client display on media file on more than one pc
Mandatory Fields	Internet Connection Available, client must be installed
Testability with respect to test environment (Yes/No)	Yes

Table 3.6: Functional Requirement of Digital Signage_6

Term	**Description**
REQ ID	RQ06
Purpose	Test Case For showing weather information
Access Restrictions	Not Yet
Input(s)	Admin add script at server side
Output(s)	Display current weather based on geolocation
Mandatory Fields	Internet Connection Available
Testability with respect to test environment (Yes/No)	Yes

- **Usability**

  The system should easy to handle and navigates in the most expected way with no delays. In that case the system program should reacts accordingly and transverses quickly between its states.

- **Availability**

  The services provided by the system should be available as and when required.

- **Efficiency**

  The system should be efficient to handle the large network traffic and work normally under heavy load.

- **Error Message Design**

The design of error messages is an important part of the user interface design. As user is bound to commit some errors or other while designing a system the system should be designed to be helpful by providing the user with information regarding the error he/she has committed.

3.3 Feasibility Study

The system has been built with respect to the scope of the project. This system is feasible in terms of:

- Operational feasibility
- Technical feasibility
- Financial and Economic feasibility

3.3.1 System contribution to the overall objectives of the organization

The users of the client organization should be able to operate the software easily, for whom the software is developed. This requests good user interface. Amid the software development process prototypes of the application are created at first and are shown to customer, so the customer can suggest changes according to their working environment. As the product is created and changed according to the remarks of the clients, there is very little possibility that there will be resistance from end users.

3.3.2 Technical Feasibility

The Technical Feasibility test involves questions like

- Is the current Computers configuration adequate for Usage?
- Is the selected technique sufficient for future enhancements?
- Is the skill set available with proper manpower for development and maintenance?

Digital signage uses php for development of applications. It is a powerful technology suitable

- **Financial and Economic Feasibility** The questions put forward in economic feasibility are:
  - Are there sufficient cost benefits in creating the system?
  - Are the costs of implementation of current system so great that the task of project development is required?
- **Hardware-Software Cost:**
  This feasibility is of paramount importance in development of any software for any particular company. Hardware cost includes the cost of the raspberry pi processor required for client to display layouts on LCD.
- **Maintenance Cost:**
  This includes application and database maintenance cost as well as the maintenance of the LCD and raspberry pi.
- **Schedule Feasibility:**
  Time evaluation is the most important consideration in the development of project. The time schedule required for the developed of this project is very important since more development time effect machine time, cost and cause delay in the development of other systems.

3.3.3 Backup Compatibility

Whether an organisation has an existing formal system or no formal system, it can adopt the system engineering approach to management system development, ie design a system top-down to fulfil a specific objective. The benefits are that one coherent system can be built which serves business needs and does not tie the organisation to a particular standard. The steps which follow on from this are as follows:

- Model the business

- Deploy functions to the model and form process development teams
- Analyze business processes using flow charts, standards and failure mode analysis techniques
- Formulate operational policies which will govern the processes
- Develop procedures to control each business process which define who does what where, when and how
- Capture existing documentation
- Identify documentation needs by linking the existing documents to the control procedures
- Develop document development plan
- Document the system
- Implement the new practices

With this approach, existing descriptions of processes, tasks etc are in use when they serve the process objective.

3.4 Activity/Process In New System

For login Activity

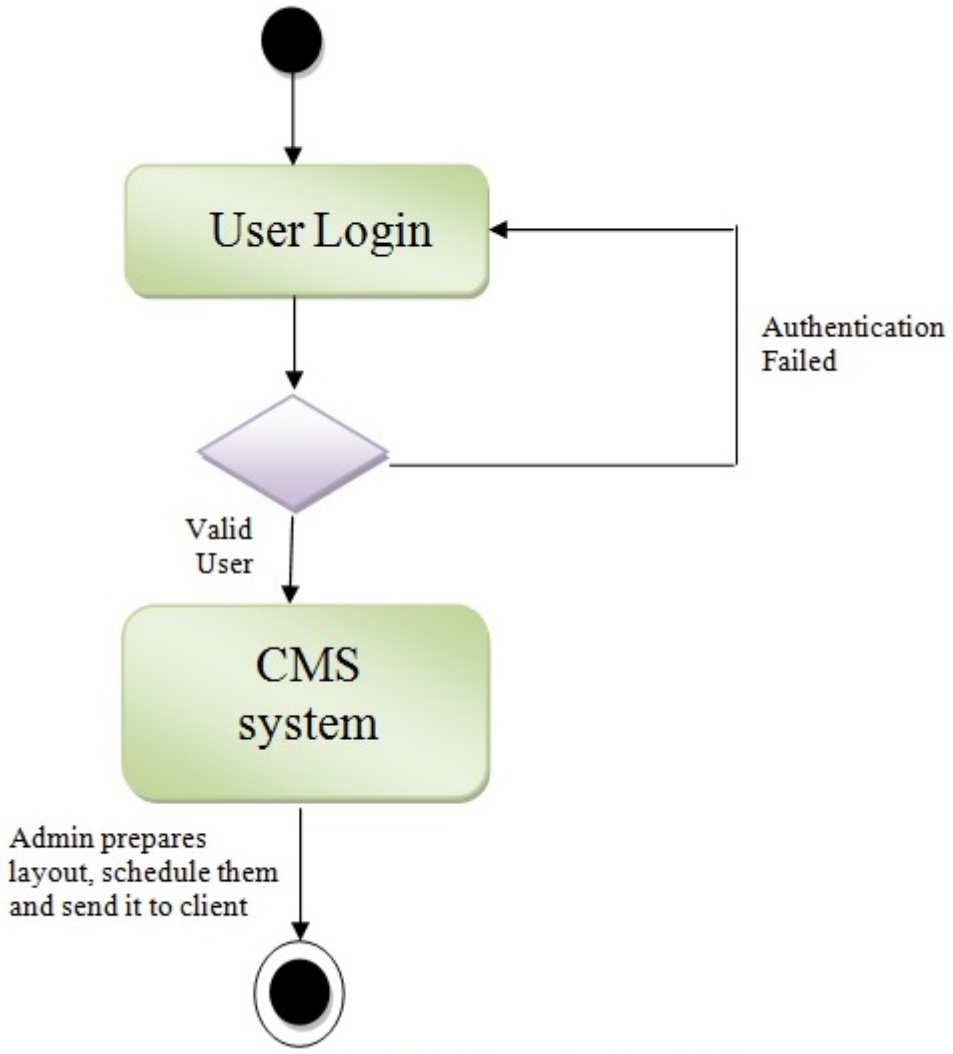

Figure 3.1: Login Activity

In figure 3.1 there is flow of the system .In that first we have to login with correct username and password for opening of system. If user enters the wrong username / password then it will not open.After successful login admin can prepare the layouts and can schedule them.

For Display Activity

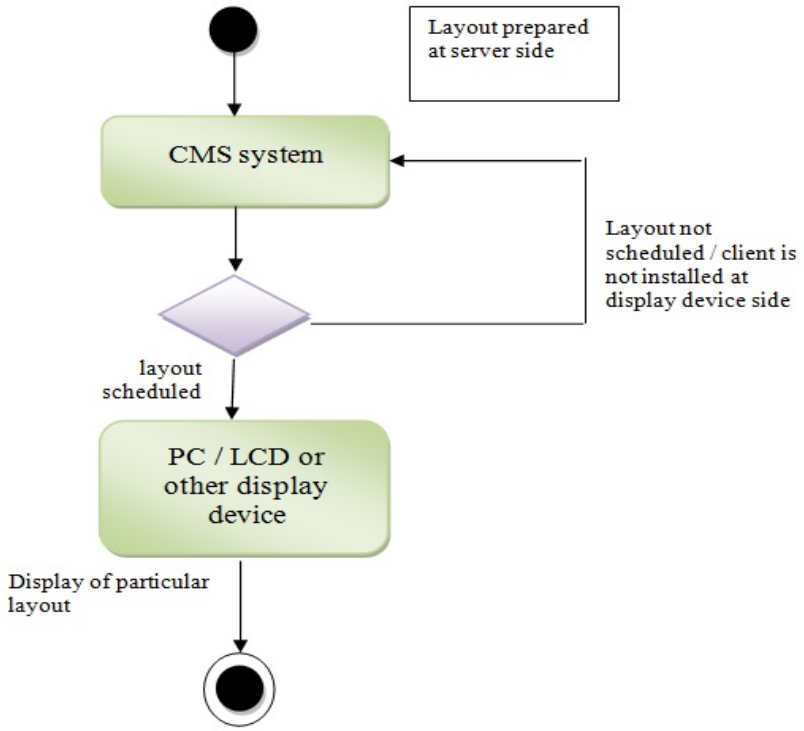

Figure 3.2: Display Activity

In figure 3.2 after preparing layouts admin had to schedule them for display.

- If the layout has not been scheduled then at the client side it will not be displayed.
- If client is not installed at display device it will not be able to display.
- If layout is scheduled and client is installed at display device then it will display the particular layout.

3.5 Features Of New System

Features of the new system is following :

- In this system admin can prepare the layout by entering the correct username and password.
- In this system admin can prepare the layout having facilities like displaying images ,local video as well as youtube video by doing some javascript and HTML.
- In this system admin can display live news at client side by entering some javascript and HTML.
- It can also displays rss feeds related to any area of field like sports, entertainment ,politics and others.
- It can also displays clock, calendar , map of current location and weather at client side by doing coding in HTML and javascript.
- It can display these more than layouts at display devices like pc (including operating system like windows, linux and android) and LCD device.

3.6 Use Case Diagram

A use case diagram shows the relationship between the user and the different use cases in which the user is involved.It identifies the different types of users of a system and the different use cases also includes other types of diagrams as well.

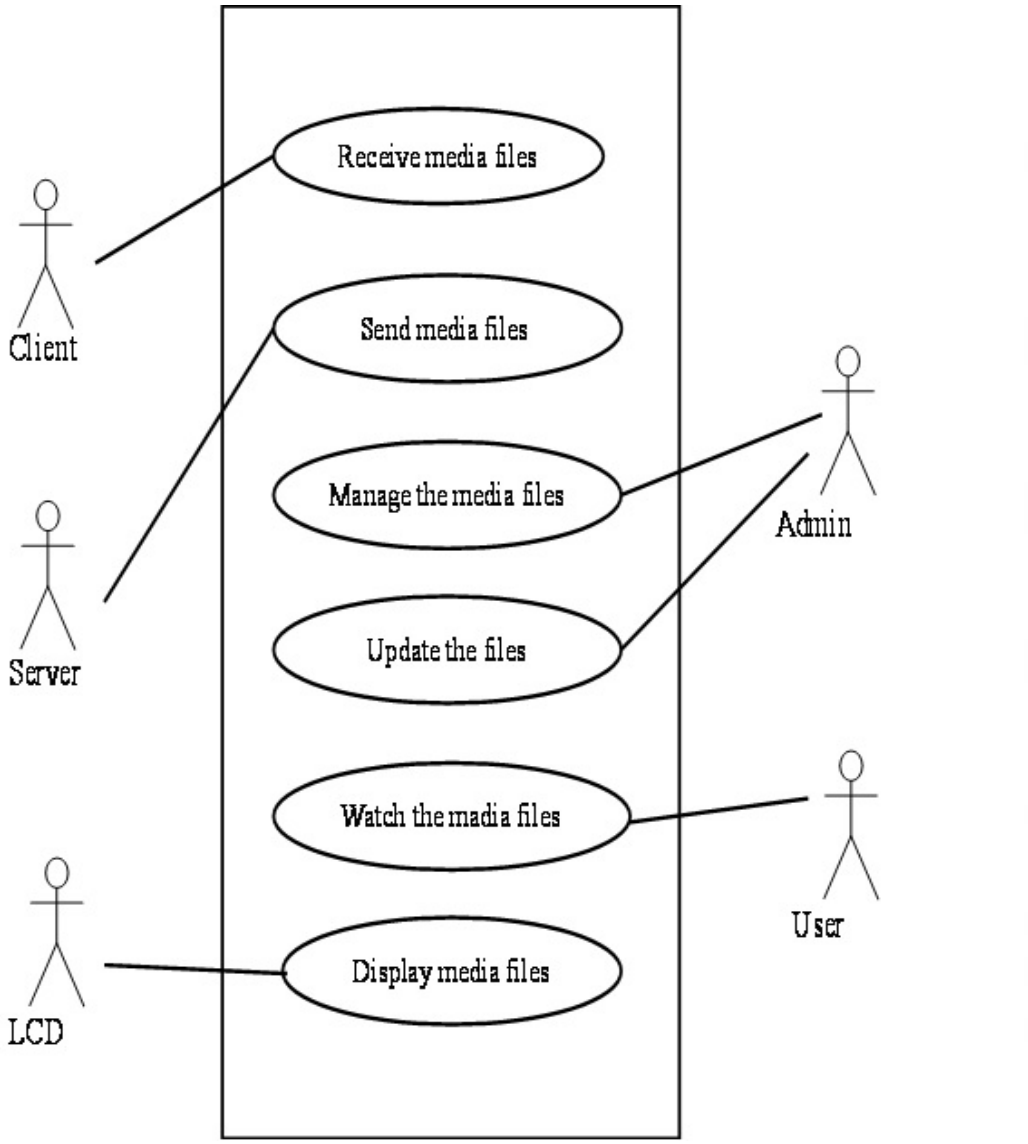

Figure 3.3: Use Case Diagram

3.7 Sequence Diagram

A Sequence diagram shows how processes operate with one another and in what order. It shows object interactions arranged in time sequence.

- **Sequence Diagram**

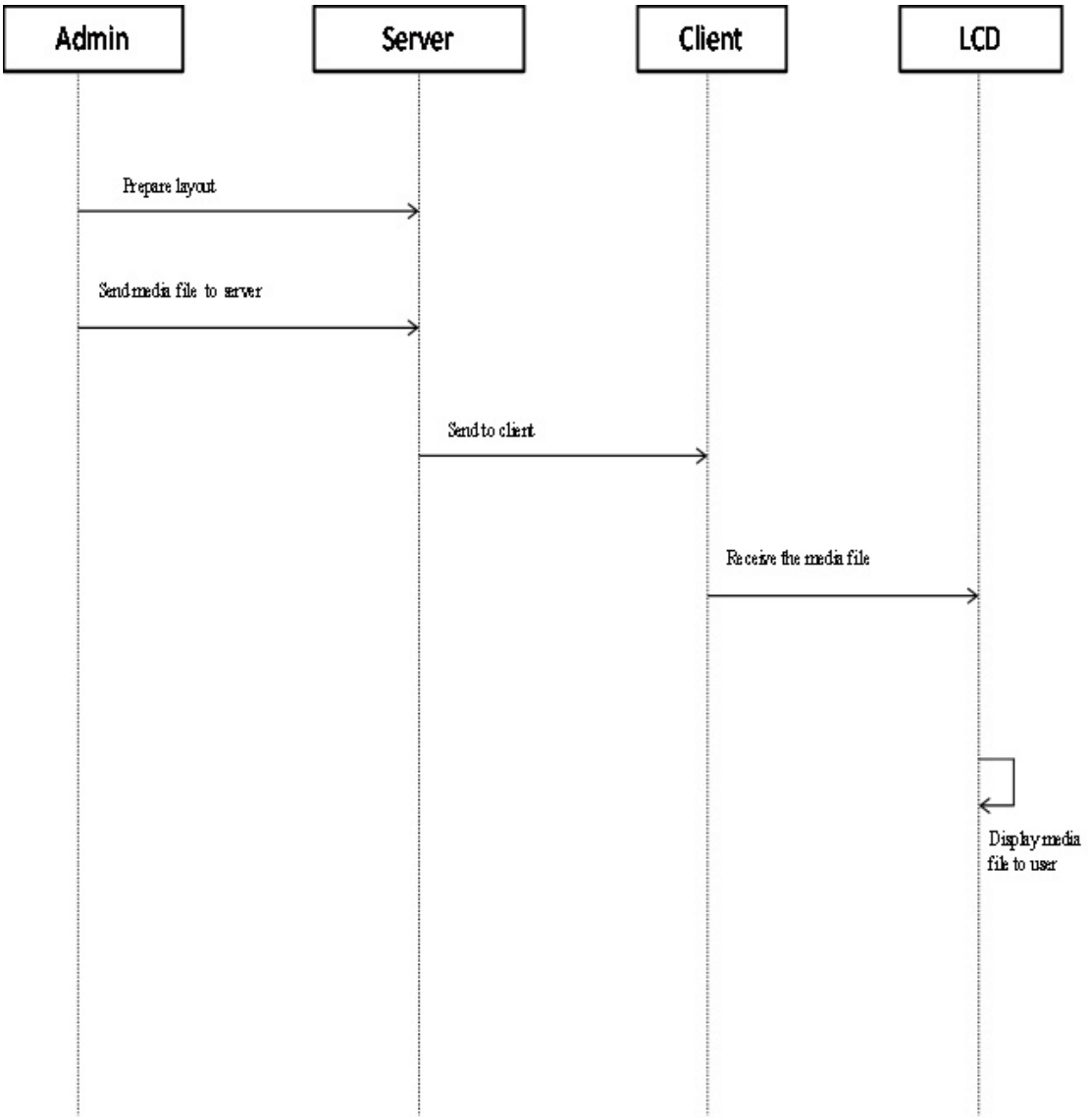

Figure 3.4: Sequence Diagram

- **Sequence Diagram for updated files**

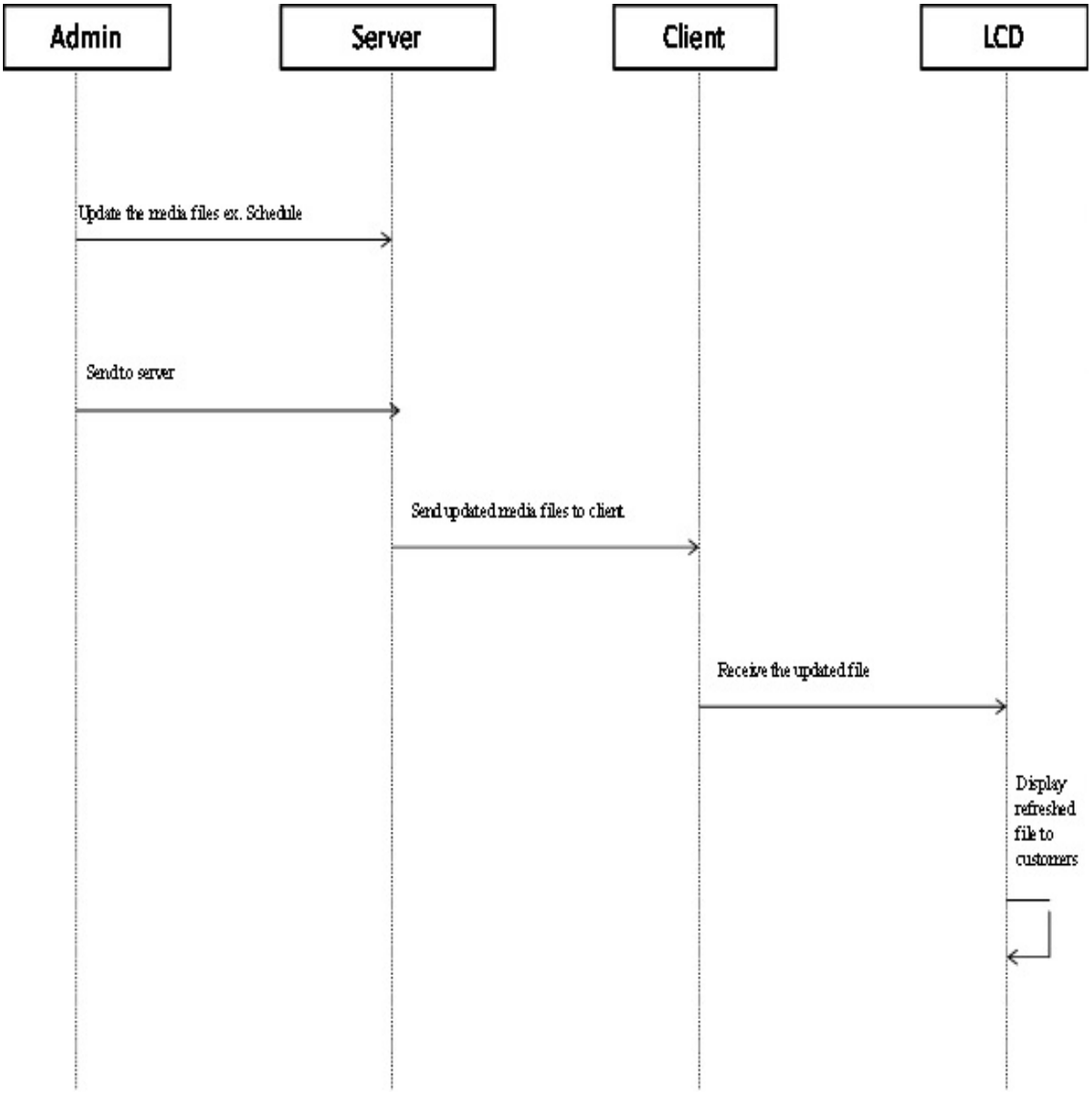

Figure 3.5: Sequence Diagram for updated files

3.8 List of Main Modules of New System

List of modules are following:

- **Font module**

  The font module allows extra fonts to be added to the CMS and display clients. The font module is a library based module and requires fonts to be added from the library page. It is also having one editor in which we can give different effects to font.

- **RSS feed module**

  This module displays updated rss feeds of any field like sports, politics, entertainment, religion ,world etc at client side.

- **Forecast input/output module**

  This module shows the temperature of current location based on the longitude and latitude of particular location. It shows the weekly temperature by using the forecast input/output.

- **Image/Video module**

  This module displays the image as well as video at client side. It displays the images based on the timing.

- **Live streaming module**

  This module displays the live streaming of any field like sports ,politics, entertainment etc without any delay at client side. For displaying of live streaming the media player must be installed at client side.

3.9 System Requirement Study for IOT based Home automation System

We have studied requirement of home automation system and finalized components accordingly.

3.9.1 Hardware and Software Requirements

- **Hardware:**

  Here we choose Raspberry PI 2 over Arduino because of we need to store images captured in the SD card.Also we have prepared database file which is stored in the SD Card. We also have used below sensors:

  - **IR Sensor:**

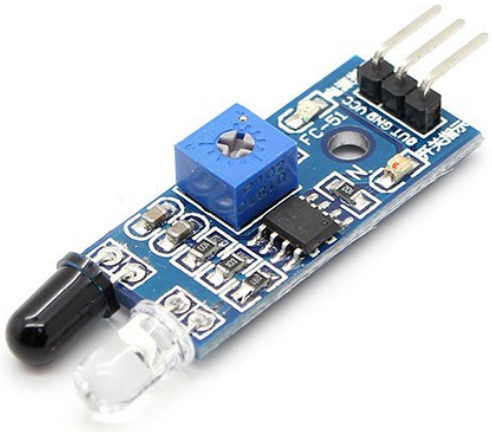

Figure 3.6: IR Sensor

An infrared sensor is an electronic device which emits in order to sense some aspects of the surroundings. It can also measure the heat of an

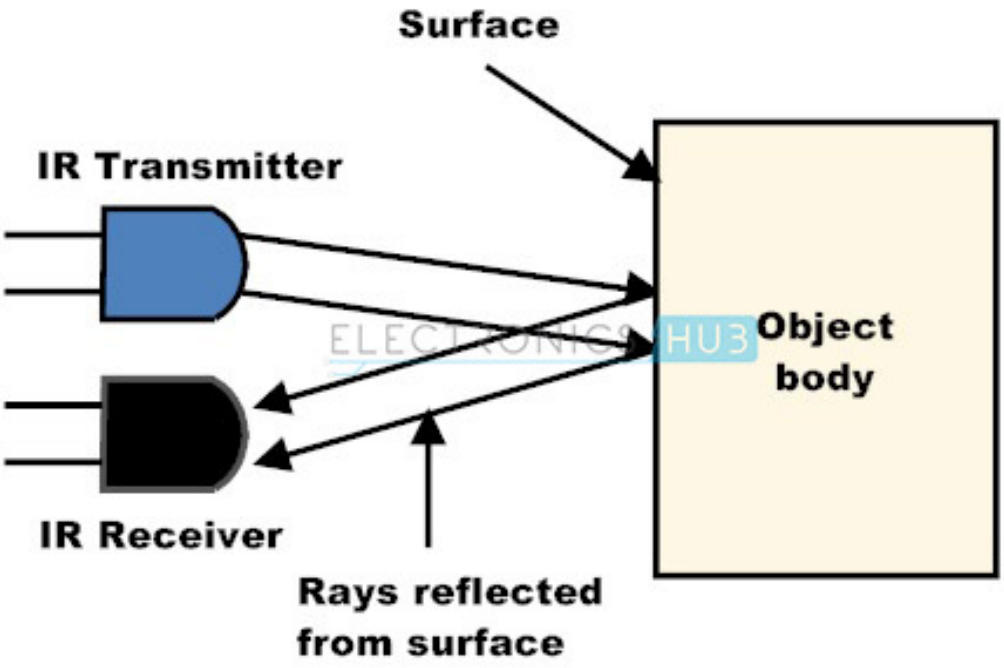

Figure 3.7: Working Principle of IR Sensor

object as well as motion detection. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These radiations are invisible to our eyes which can be detected by an infrared sensor which is simply IR LED as emitter and detector is IR photo-diode which is sensitive to IR light of the same wavelength as that emitted by the IR LED.When IR light falls on the photodiode, The resistances and these output voltages, change in proportion to the magnitude of the IR light received.

– **Temperature Sensor:**

The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed).

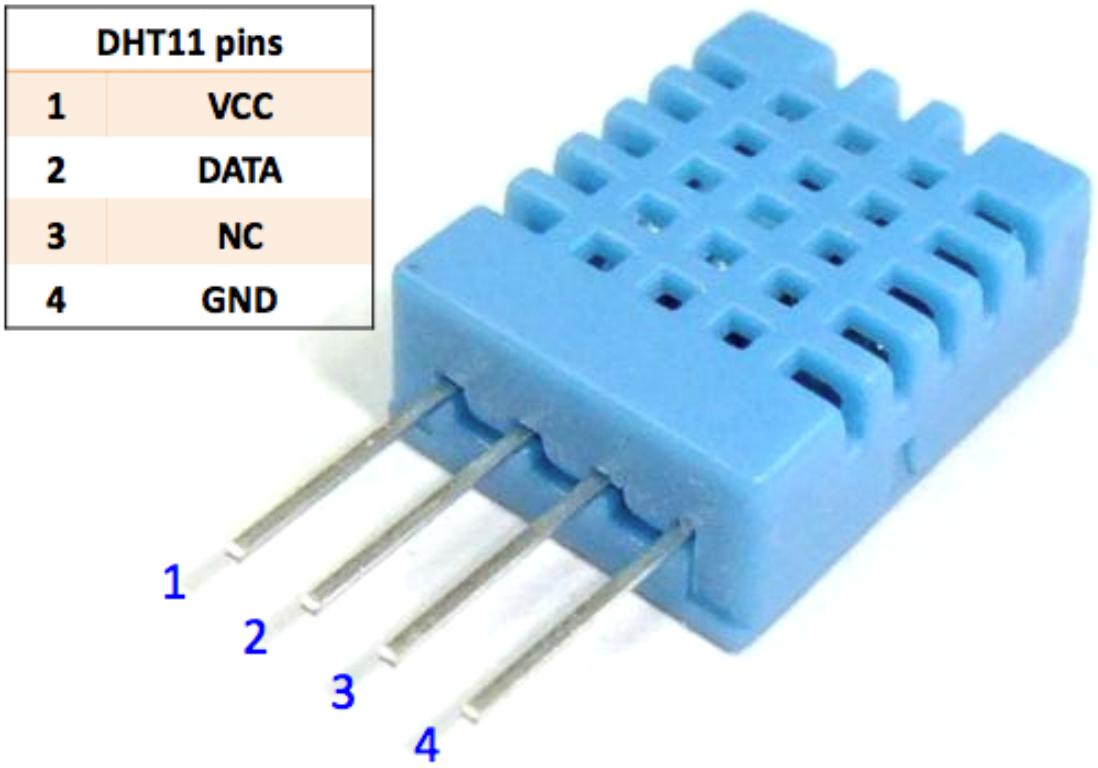

Figure 3.8: Temperature Sensor

Specifications

* **Power Supply** 3.3-5.5V DC
* **Output** 4 pin single row
* **Measurement Range** Temperature 0-50

– **Ambient Light Sensor:**

Ambient light sensor approximate the human eye response to light under a variety of lighting conditions.

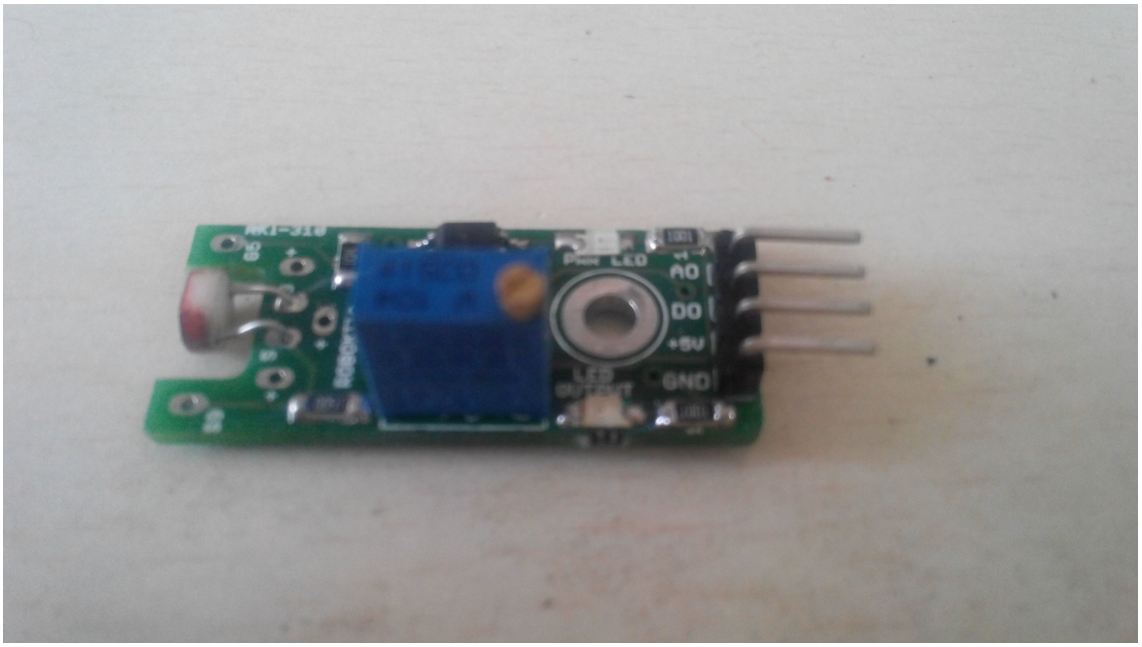

Figure 3.9: Ambient Light Sensor

Features

* Uses photosensitive resistance sensor sensitive type.
* Working Voltage:3.5V-5V.
* Output form:Digital Switch show (0 and 1).

3.10 Summary

This chapter includes system requirement study of Digital Signage and Home Automation system.It covers brief description about sensors used in the system. It covers functional and non functional requirement of the

system. Features of the new system, Usecase diagram ,Sequence diagram and Main modules of the system are also listed out.

Chapter 4

Digital Signage

4.1 System Design

4.1.1 Data Flow Design

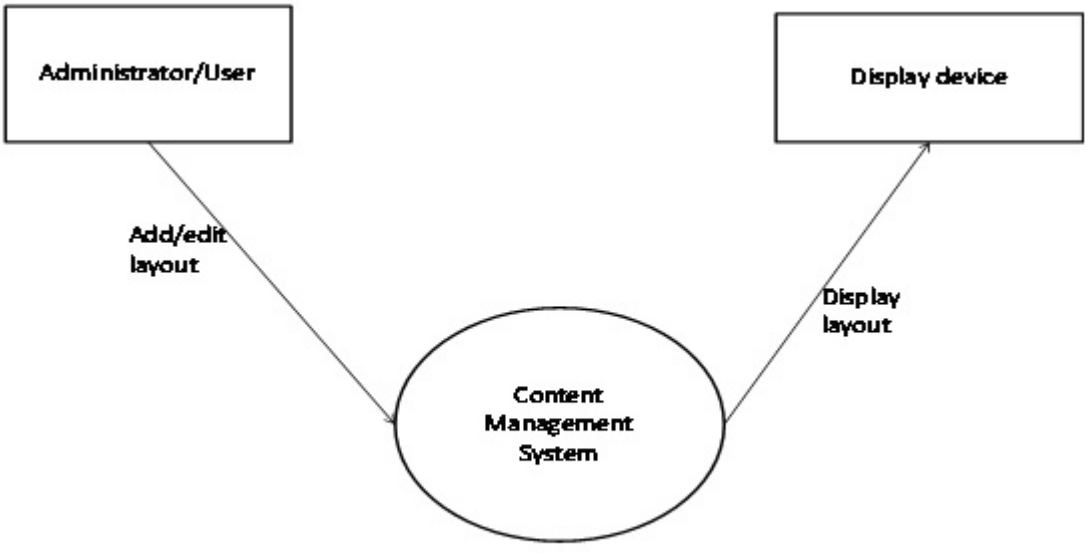

Figure 4.1: Level -0 Data Flow Diagram

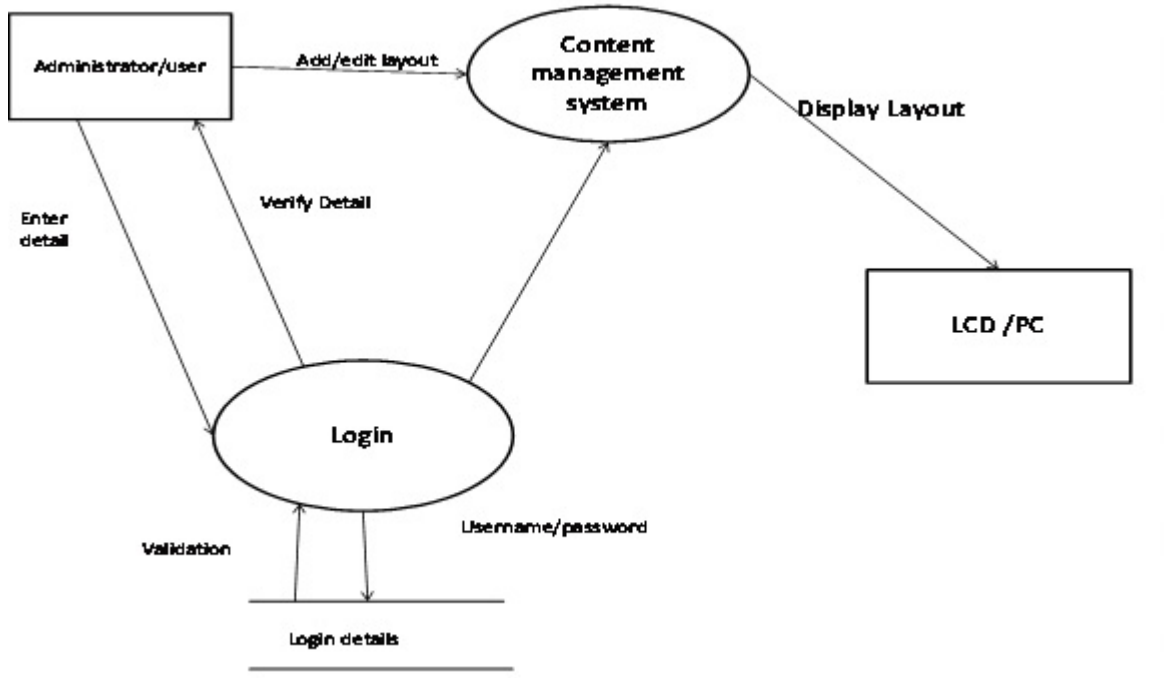

Figure 4.2: Level-1 Data Flow Diagram

The Fig 4.1 and 4.2 above shows data flow design of Digital Signage system.

4.1.2 Input/Output and Interface Design

1 **Login Page**

Figure 4.3: Login Page [3]

In Fig 4.3 there is login page of xibo server in that user have to enter the username /password .If it is correct then the cms page will be displayed.

2 Xibo CMS

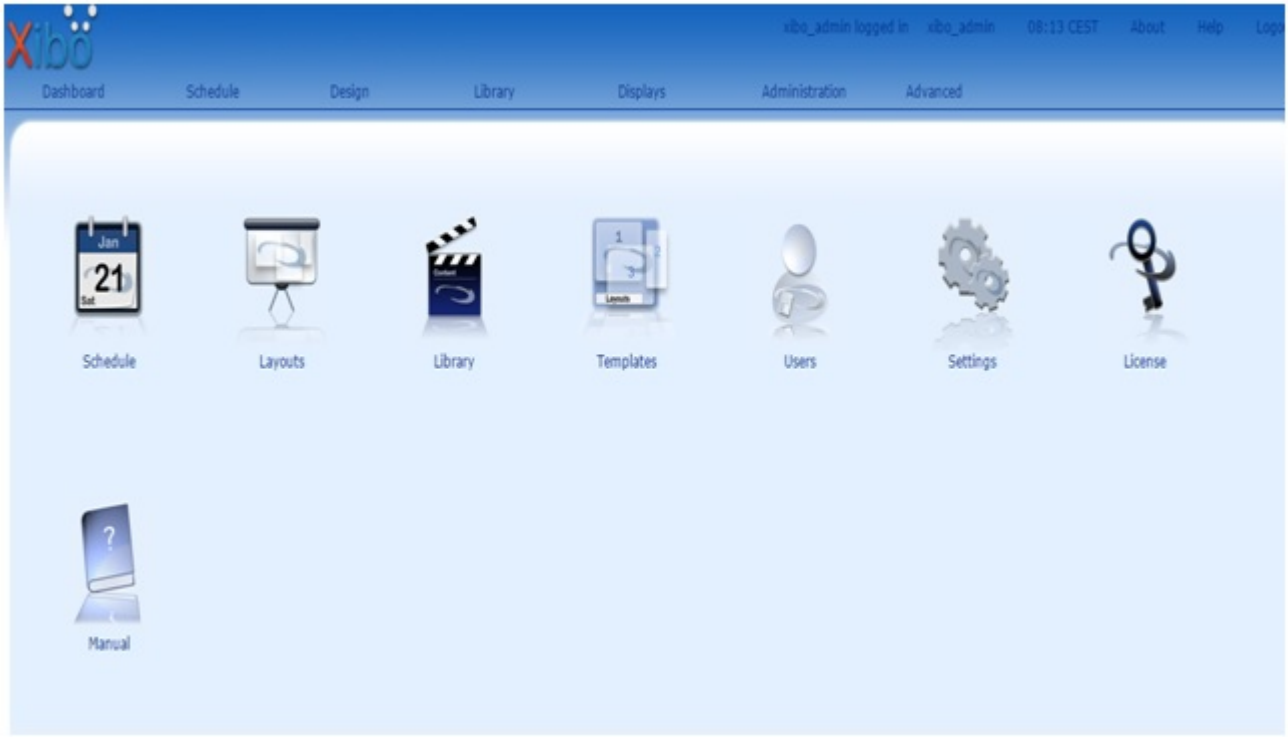

Figure 4.4: Xibo CMS [1]

The CMS Icon Dashboard is intended as a "Launcher" into other areas of the system for standard users. The icons in the dashboard are shown / hidden according to the menu permissions of the user. Icon Dashboard is the default dashboard for all new users.

3 **Schedule Layout**

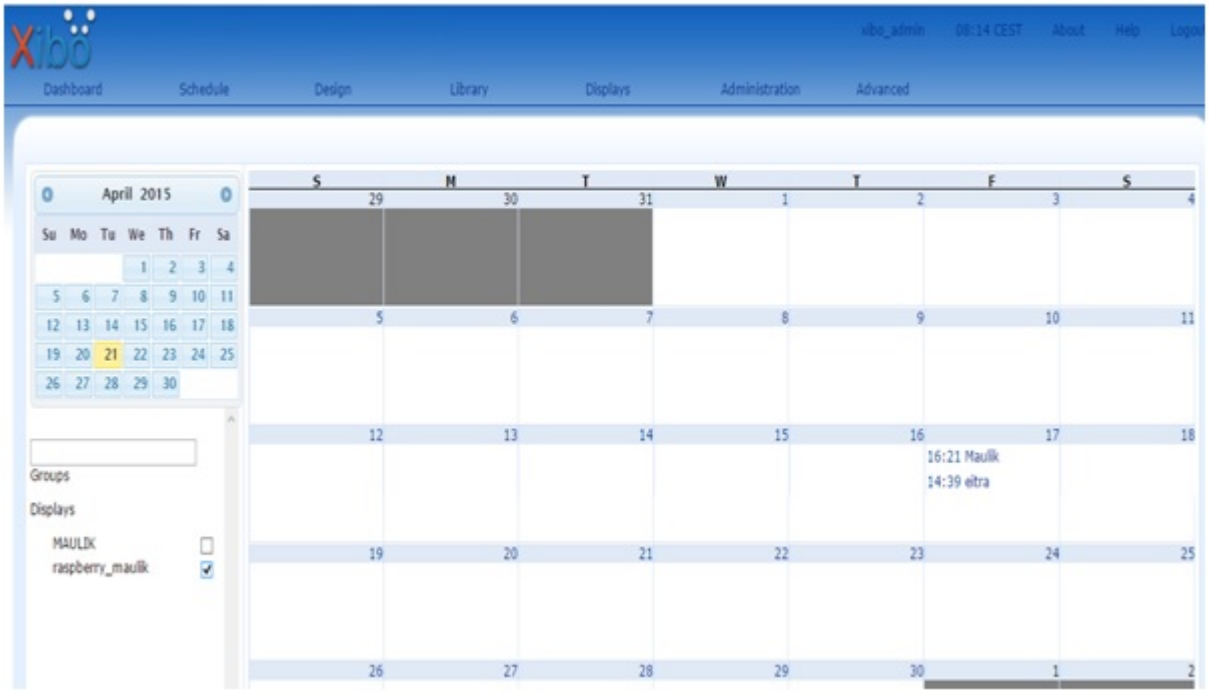

Figure 4.5: Schedule Layout [1]

Once displays are registered, media content is uploaded and Layouts are designed it is time to put them all together and Schedule Layouts onto the Displays. Each Display will check for new Scheduled content periodically, and download Scheduled Items in advance of playback.. Each Display has a Default Layout that will be shown when nothing else is Scheduled.

4 **Design Layout**

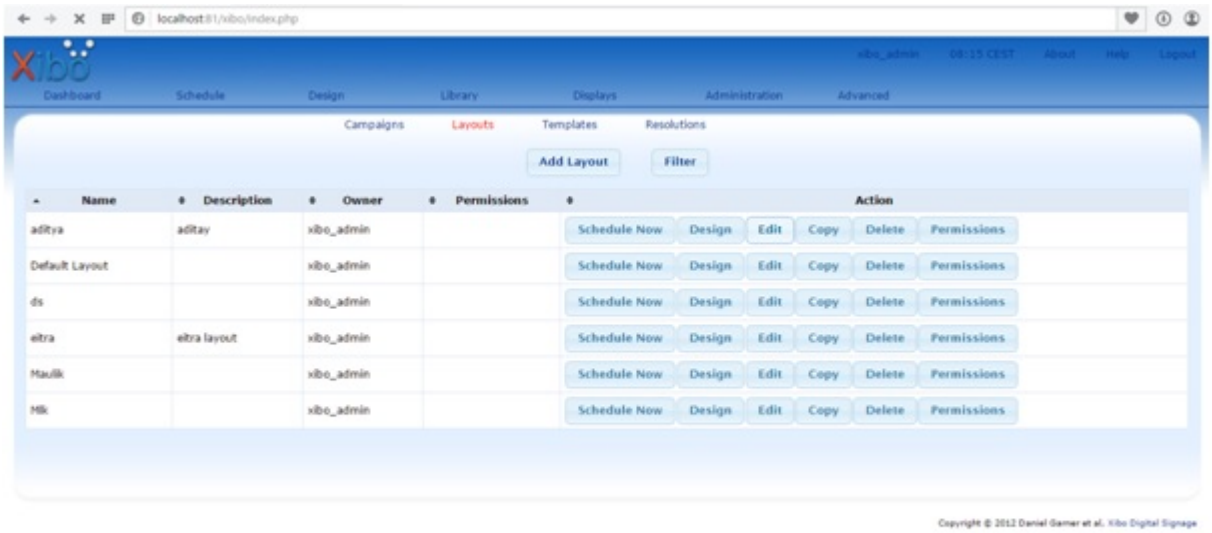

Figure 4.6: Design Layout [1]

In Fig 4.6 , admin can prepare more than one layouts and do editing in that and also schedule them.

5 **Edit Layout**

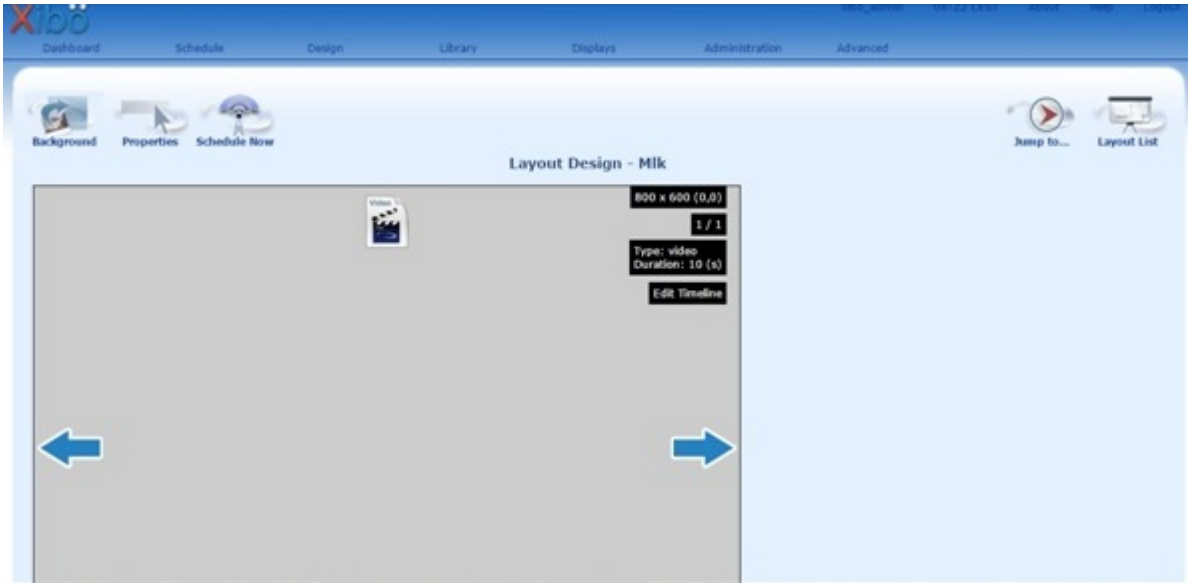

Figure 4.7: Edit Layout [1]

These are the design that is seen on the screen. It allows you to split the screen up into different Regions, each containing their own Timeline of media to play. A layout itself remains on screen until all the Timelines have finished playing through once, then an entirely fresh Layout can be loaded with different positioning and size of Regions, with different Timelines.

6 **Library**

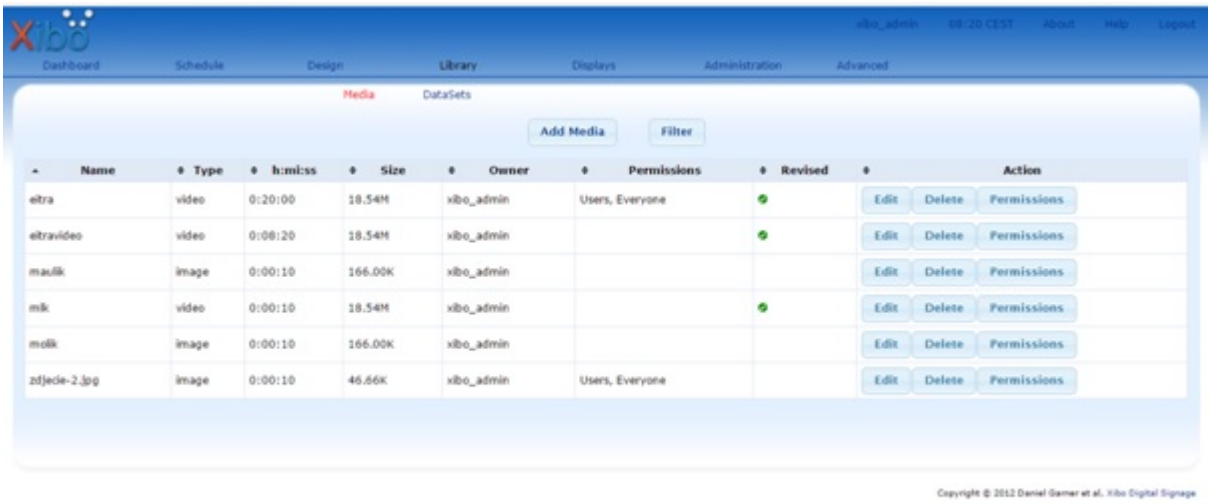

Figure 4.8: Library Media [1]

Media content is the core of it and many different types of content are supported. These are generally split into two categories. File based media that is uploaded and stored in the Library and Layout based media that doesn't have an associated file but is configured directly on a layout instead. An image or video would be Library Media and a RSS feed or some free Text would be Layout based media.

7 **Displays**

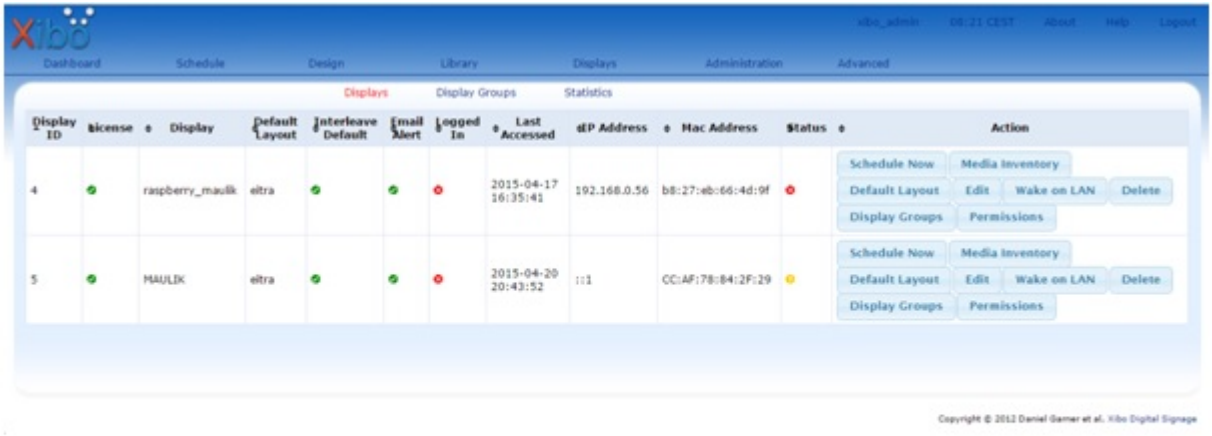

Figure 4.9: Displays [1]

In above figure ,admin enters the ip address of display device on which admin want to display those layouts.Display Administration which is used to show the user the Displays they have permission to view and the status of those Displays.

8 **Add media**

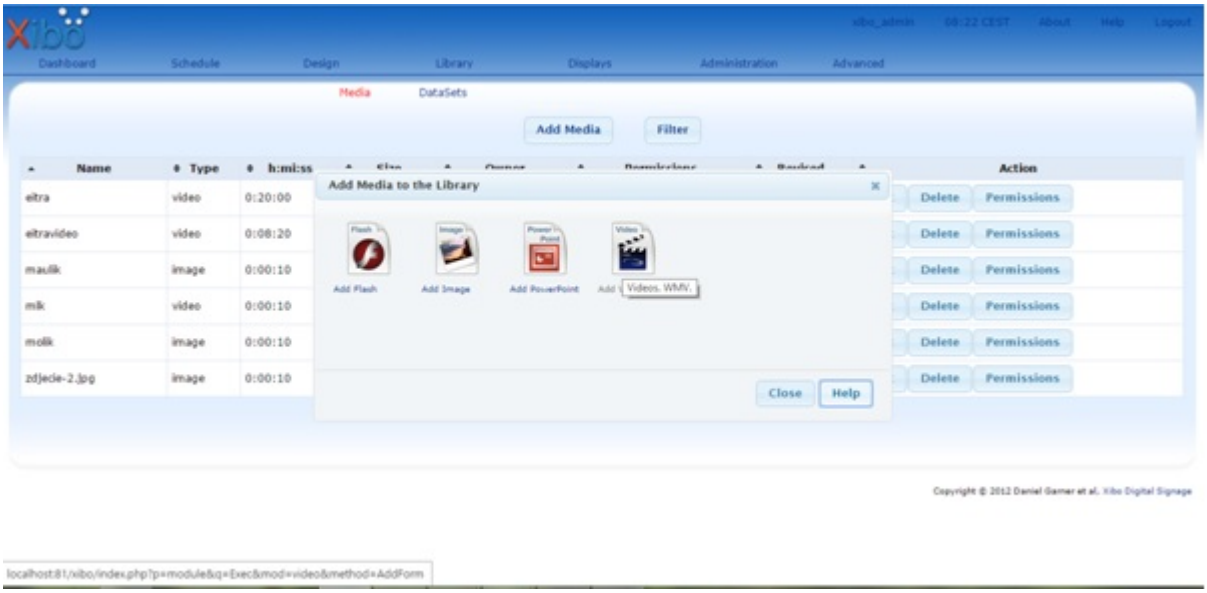

Figure 4.10: Add Media [1]

Library Media is file based media that is uploaded and stored in the CMS Library for use on one or more Layouts. Layout media is created and stored directly on a Layout. This is for media that is not commonly reused, exists on only 1 Playlist and is specific to the Layout.

4.2 System Testing

Testing is the process carried out on software to detect the differences between its behavior and the desired behavior as stipulated by the requirements specifications. Testing is advantageous in several ways.

- Firstly, the defects found help in the process of making the software reliable.
- Secondly, even if the defects found are not corrected, testing gives an idea as to how reliable the software is.
- Thirdly, over time, the record of defects found reveals the most common kinds of defects, which can be used for developing appropriate preventive measures such as training, proper design and reviewing.

4.2.1 Testing Plan

The testing sub-process includes the following activities in a phase dependent manner:

- Create Test Plans.
- Create Test Specifications.
- Review Test Plans and Test Specifications.
- Conduct tests according to the Test Specifications, and log the defects.
- Fix defects, if any.
- When defects are fixed continue from activity.

4.2.2 Testing Methods

BLACK-BOX AND WHITE-BOX TESTING

In black-box testing a software item is viewed as a black box, without knowledge of its internal structure or behavior. Possible input conditions, based on the specifications (and possible sequences of input conditions), are presented as test cases.
In white-box testing knowledge of internal structure and logic is exploited. Test cases are presented such that possible paths of control flow through the software item are traced. Hence more defects than black-box testing are likely to be found. The disadvantages are that exhaustive path testing is infeasible and the logic might not conform to specification. Instrumentation techniques can be used to determine the structural system coverage in white box testing. For this purpose tools or compilers that can insert test probes into the programs can be used.

4.2.3 Test Case

A test case in software engineering is a set of conditions or variables under which a tester will determine whether an application or software system is working correctly. The mechanism for determining whether a software program or system has passed or failed such a test is known as a test oracle. In some settings, an oracle could be a requirement or use case, while in others it could be a heuristic. It may take many test cases to determine that a software program or system is considered sufficiently scrutinized to be released. Test cases are often referred to as test scripts, particularly when written. Written test cases are usually collected into test suites.

Test Case ID	Test name	Test Case Description	Test Step			Pass/Fail
			Step	Excepted	Actual	
1	Login	Enter username and password blank	First open xamp control panel and start apache server and my sql. Then go to web browser and run localhost/xibo	It will display usemame /password Incorrect .	It will display username /password incorrect.	Pass
2	Login	Enter correct username and password	First open xamp control panel and start apache server and my sql. Then go to web browser and run localhost/xibo	It will display admin panel of xibo.	It will display admin panel of xibo.	Pass
3	Password	Enter username and password as admin	First open xamp control panel and start apache server and my sql. Then go to web browser and run localhost/ xibo.	It will open xibo CMS	It will open xibo CMS	Pass
4	Validation	Enter blank server key	First open the client and then enter the common key shared between client and server.	Saving with CMS.ple ase wait …invalid URI..	Saving with CMS.plea se wait …invalid URI..	Pass
5	Validation	Enter the correct server key	First open the client and then enter the common key shared between client and server.	It will launch the client .	It will launch the client.	Pass
6	Layout	Prepare layout for media files like images ,video, clock ,calendar	First open cms server and do some scripting for preparing layouts and schedule them and send to	It will display that layout.	It will display that layout.	Pass

Figure 4.11: TestCasePart1

7	Layout	Prepare layout for media files like images,video, clock ,calender	First open cms server and do some scripting for preparing layouts and schedule them and send to client	It will display that layout.	It will not display that layout if it is not scheduled correctly or client address is not given.	Fail
8	Layout	Prepare layout for live news and rss feeds	First open cms server and do some scripting for preparing layouts and schedule them and send to client	It will display the live news and rss feeds at client with updates	It will display the live news and rss feeds at client with updates	Pass
9	Layout	Prepare layout for live news and rss feeds	First open cms server and do some scripting for preparing layouts and schedule them and send to client	It will display the live news and rss feeds at client with updates	It will not display the live news and rss feeds at client with updates if internet connection is not available.	Fail
10	Display	Schedule layout	First prepare layout and schedule it and send it to more than one client	It will display that layout at more than one display device.	It will display that layout at more than one display device.	Pass
11	Display	Schedule layout	First prepare layout and schedule it and send it to more than one client	It will display that layout at more than one display device.	It will not display that layout at more than one display device if client is not installed at that device.	Pass

Figure 4.12: TestCasePart2

4.3 Hardware Design

In this chapter, we will cover hardware design of Digital Signage player which will direct connect to the LCD/LED device through HDMI connector . Internet connectivity is enabled through WiFi Module.

4.3.1 Board Design

We have used RK3188 SoC for hardware board design for Digital Signage player. RK3188 is a low power, high performance processor for mobile phones, personal mobile internet device and other digital multimedia applications, and integrates quad-core Cortex-A9 with separately NEONand FPU coprocessor.

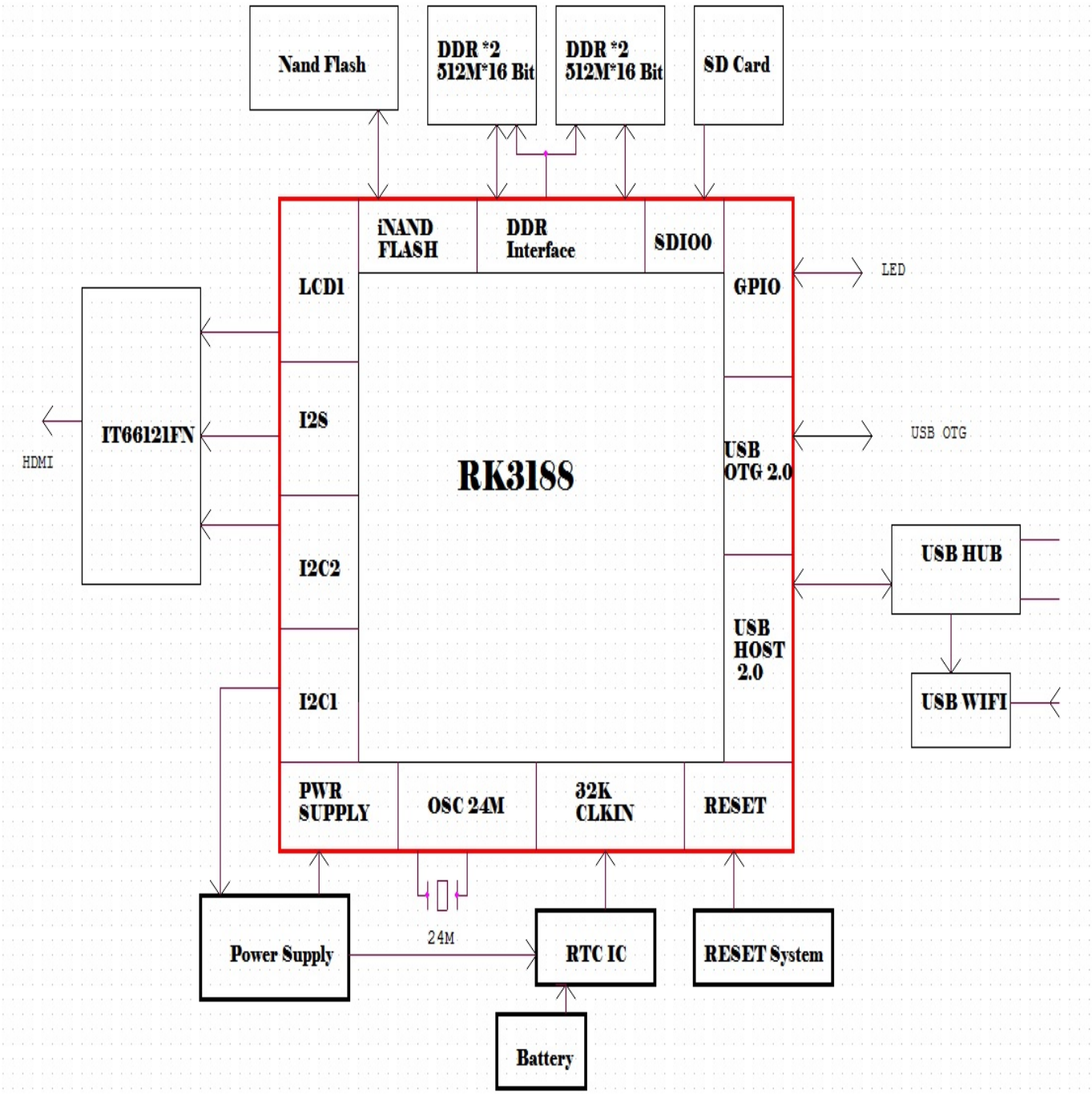

Figure 4.13: Functional Block Diagram Hardware Module

4.3.2 RK3188 SoC

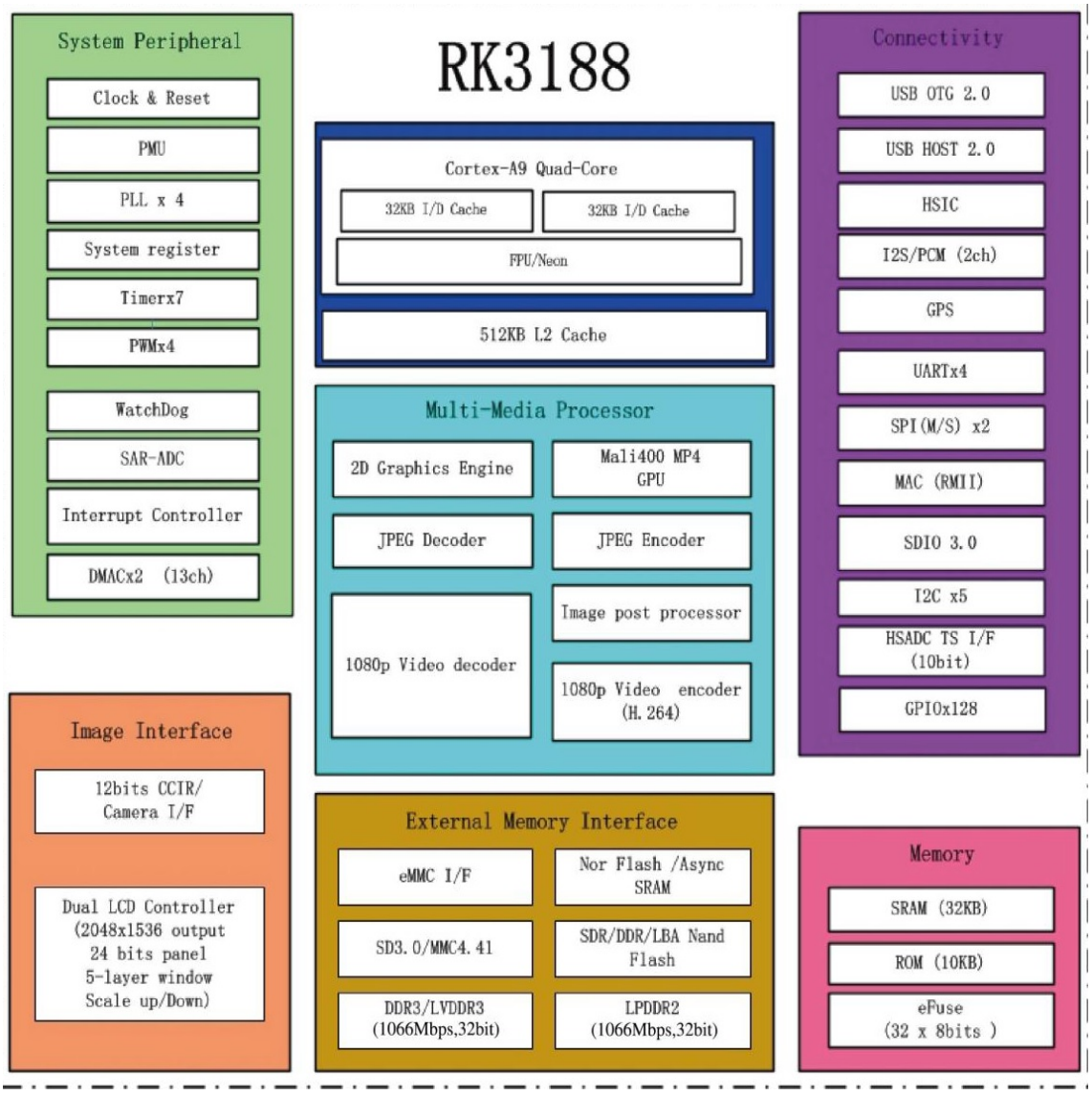

Figure 4.14: RK3188 Block Diagram [4]

RK3188 is a low power, high performance processor for mobile phones, personal mobile internet device and other digital multimedia applications, and integrates quad-core Cortex-A9 with separately NEONand FPU coprocessor. Many embedded powerful hardware engines provide optimized performance for high-end application. RK3188 supports almost full-format video decoder by 1080p@60fps, also support H.264/MVC/VP8 encoder by 1080p@30fps, high-quality JPEG en-

coder/decoder, special image preprocessor and postprocessor. Embedded 3D GPU makes RK3188 completely compatible with OpenGL ES2.0 and 1.1, OpenVG 1.1. Special 2D hardware engine with MMU will maximize display performance and provide very smoothly operation. RK3188 has high-performance external memory interface(DDR3/LPDDR2/LVDDR3) capable of sustaining demanding memory bandwidths, also provides a complete set of peripheral interface to support very flexible applications as follows :

- banks, 8bits/16bits Nor Flash/SRAM interface
- banks, 8bits/16bits async Nand Flash,LBA Nand Flash and 8bits sync ONFI Nand Flash, allup to 60bits hardware ECC
- Totally 2GB memory space for 2 ranks, 16bits/32bits DDR3-1066, LPDDR2-1066, LVDDR3-1066
- Totally 3-channels SD/MMC interface to support MMC4.41, SD3.0, SDIO3.0 or eMMC
- Dual-channels TFT LCD interface with 4-layers , 2048x1536 maximum display size
- One-channels, 8bits BT656 interface, 16bits BT601 DDR interface and 10bits/12bits raw data interface with image preprocessor
- Audio interface: one 2ch I2S/PCM interface and SPDIF tx interface
- One USB OTG 2.0 and one USB Host2.0 interface and HSIC interface
- 10M/100M RMII ethernet interface
- GPS interface
- High-speed ADC interface and TS stream interface
- Lots of low-speed peripheral interface : 5I2C, 4UART, 2SPI,4 PWM

4.4 Power Management Unit

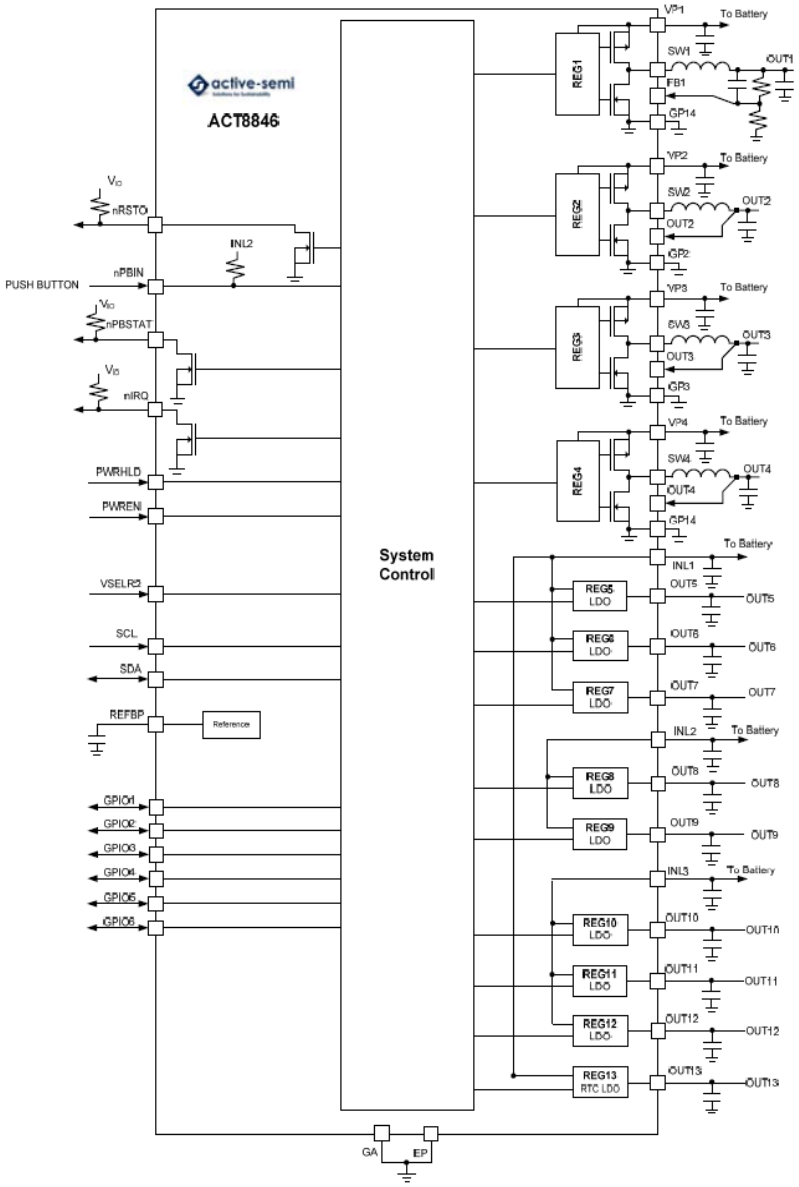

Figure 4.15: Power Management Unit [5]

The ACT8846 is a complete, cost effective, and highly-efficient ActivePMUTM power management solution optimized for the power, voltage sequencing and control requirements of Rockchip RK3066 application processor family.

The ACT8846 features four fixed-frequency, current-mode, synchronous PWM step-down converters that achieve peak efficiencies of up to 97frequency of 2.25MHz, minimizing noise in sensitive applications and allowing the use of small external components. These buck regulators supply up to 2.8A of output current and can fully satisfy the power and control requirements of the multi-core application processor. Dynamic Voltage Scaling (DVS) is supported either by dedicated control pins, or through I2C interface to optimize the energy-pertask performance for the processor. This device also include eight low-noise LDOs (up to 350mA per LDO), one always-on LDO and an integrated backup battery charger to provide a complete power system for the processor.

The power sequence and reset controller provides power-on reset, SW-initiated reset, and power cycle reset for the processor. It also features the watchdog supervisory function. Multiple sleep modes with autonomous sleep and wake-up sequence control are supported.

The thermal management and protection subsystem allows the host processor to manage the power dissipation of the PMU and the overall system dynamically. The PMU provides a thermal warning to the host processor when the temperature reaches a certain threshold such that the system can turn off some of the non-essential functions, reduce the clock frequency and etc to manage the system temperature.

The ACT8846 is available in a compact, Pb-Free and RoHS-compliant TQFN66-48 package.

Features of ACT8846

- **INTEGRATED POWER SUPPLIES**
  - Four DC/DC Step-Down (Buck) Regulators
    - 2 x 2.8A, 2 x 1.5A
  - Five Low-Noise LDOs
    - 2 x 150mA, 3 x 350mA
  - Three Low-Input Voltage LDOs
    - 1 x 150mA, 2 x 350mA
  - One Low IQ Keep-Alive LDO
  - Backup Battery Charger
- **SYSTEM CONTROL AND INTERFACE**
  - Four General Purpose I/O with PWM Drivers
  - I2C Serial Interface
  - Interrupt Controller
- **SYSTEM MANAGEMENT**
  - Reset Interface and Sequencing Controller
    - Power on Reset
    - Soft / Hard Reset
    - Watchdog Supervision
    - Multiple Sleep Modes
  - Thermal Management Subsystem

Applications of ACT8846

- Tablet PC
- Mobile Internet Devices (MID)
- E-books
- Personal Navigation Devices
- Smart Phones

4.5 IOT based Home Automation System

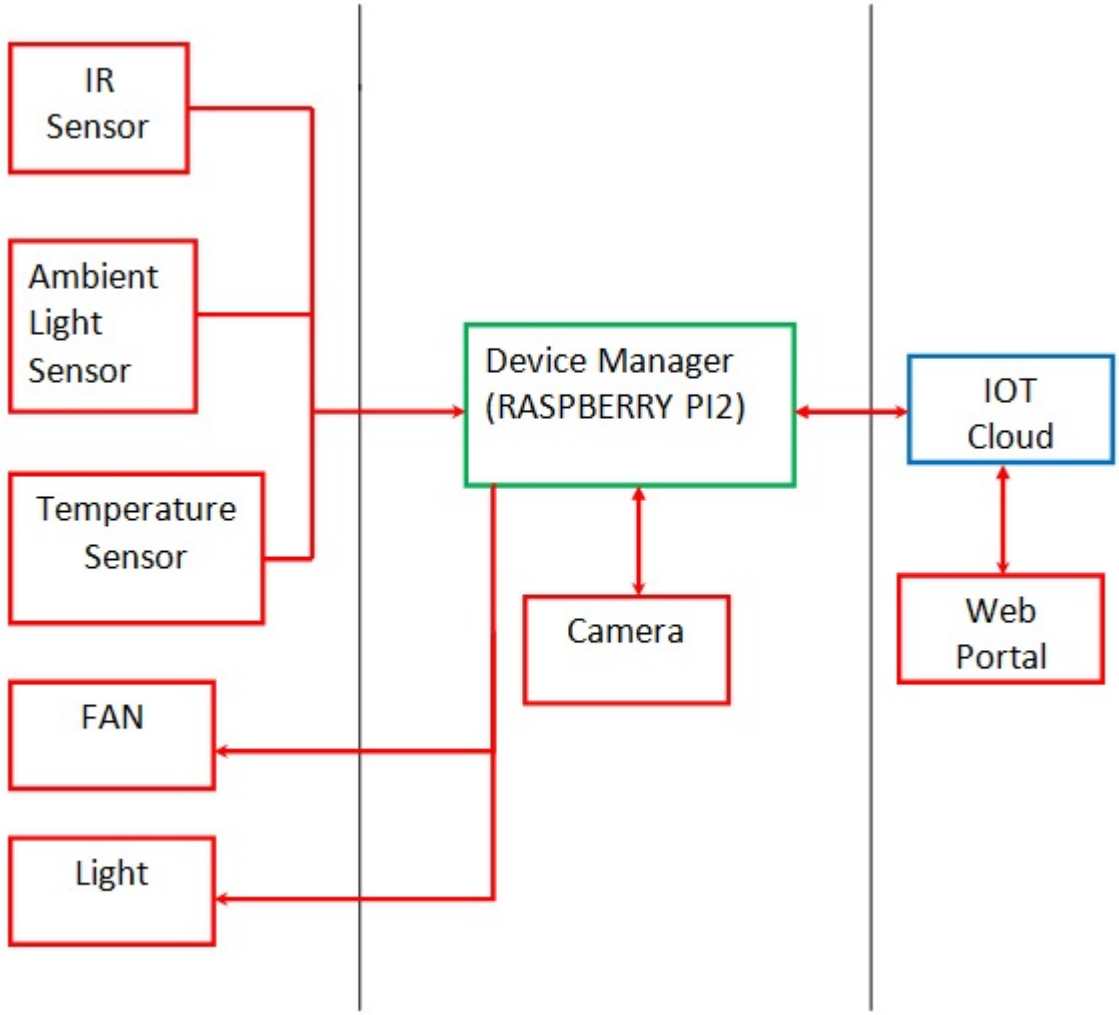

Figure 4.16: IOT Architecture

The block diagram of proposed system is shown in Fig. 4.11.The Infrared sensor (IR) is a low cost infrared object detection unit that we can be applied at home using IR LEDs. It gets trigred when light is detected. When the sensor is sensed it sends a signal to raspberry pi. From the raspberry pi, it triggers webcam to capture the image of the person and stored it on the raspberry also we have integrated GSM module which gives miss call to users cell phone. Ambient light sensor is used to detect light. Temperature sensor DHT11 is used for room temperature

monitoring. The lights and fans can be controlled by ubidots cloud based web interface in personal computer or mobile.

4.6 Summary

This chapter covered system design ,system testing and hardware design of Digital Signage system. It includes Input/Output and Interface design of Xibo application.It covers flow diagram of Digital Signage system data flow.It includes different test cases for Xibo System in different test environment setup.It also covers theory about testing plan and testing strategy.It also includes functionality of hardware module of digital signage client.It also include functionality of Rk3188 and its various interfacing modules.

Chapter 5

IOT based Home Automation System

5.1 Internet of things(IoT)

The Internet of Things (IoT) is the network of physical objects or "things" embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data. The Internet of Things allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration between the physical world and computer based systems, and resulting in improved efficiency, accuracy and economic benefit. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Experts estimate that the IoT will consist of almost 50 billion objects by 2020[9].

British entrepreneur Kevin Ashton first coined the term in 1999 while working at the Auto-ID Labs (originally called Auto-ID centers - referring to a global network of Radio-frequency identification (RFID) connected objects)[9]. Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine communications (M2M) and covers a variety of

protocols, domains, and applications. The interconnection of these embedded devices(including smart objects),is expected to usher in automation in nearly all fields, while also enabling advanced applications like a Smart Grid, and expanding to the areas such as smart cities.

5.2 IOT based Home Automation System

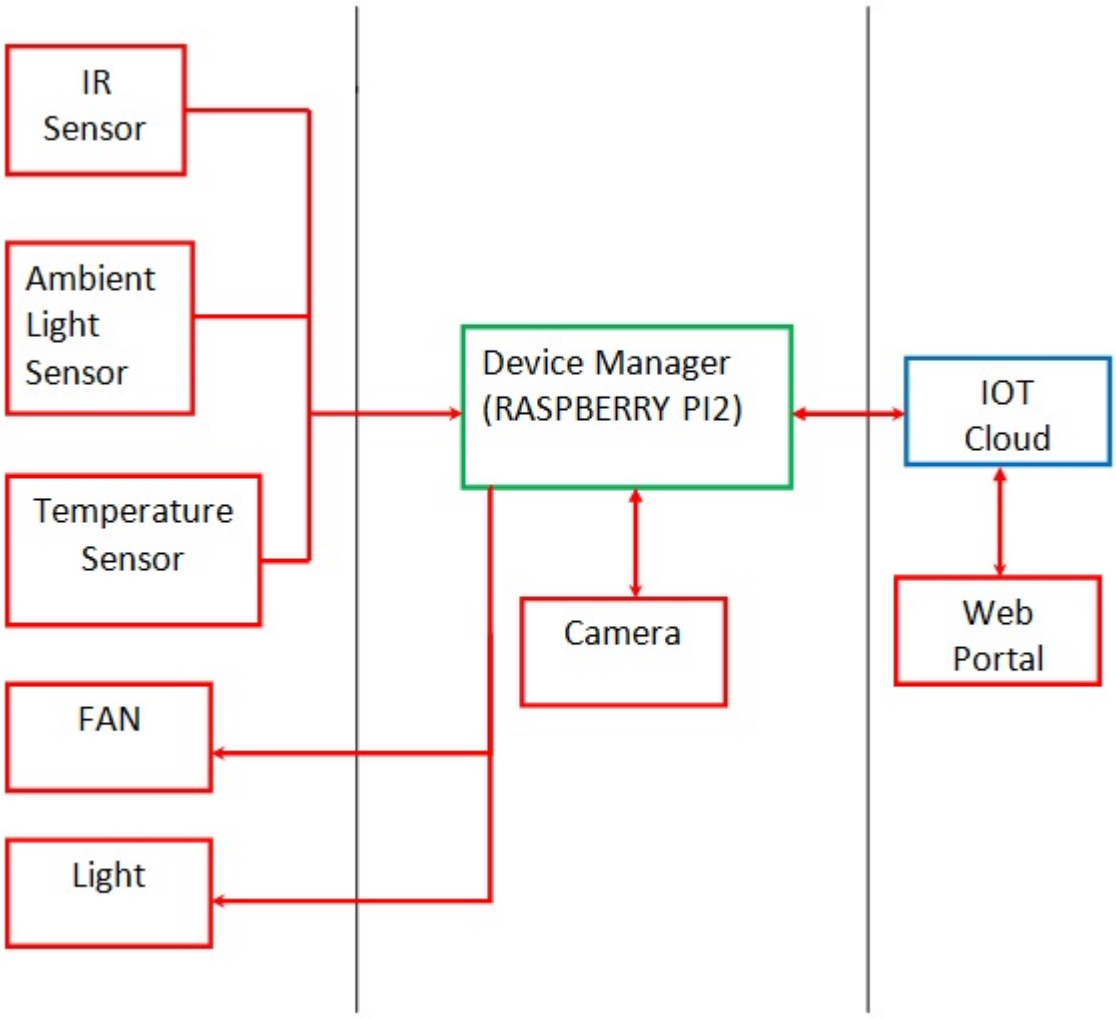

Figure 5.1: IOT Architecture

The block diagram of proposed system is shown in Fig.5.1 .The Infrared sensor (IR) is a low cost infrared object detection unit that we can be applied at home using IR LEDs. It gets triggered when light is detected. When the sensor is sensed it sends a signal to raspberry pi. From the raspberry pi, it triggers webcam to capture the image of the person and stored it on the raspberry also we have integrated GSM module which gives call to the user cell phone. Ambient light sensor is used to detect light. Temperature sensor DHT11 is used for room temperature monitoring. The lights and fans can be controlled by ubidots cloud based web interface in personal computer or mobile.

5.3 System Testing

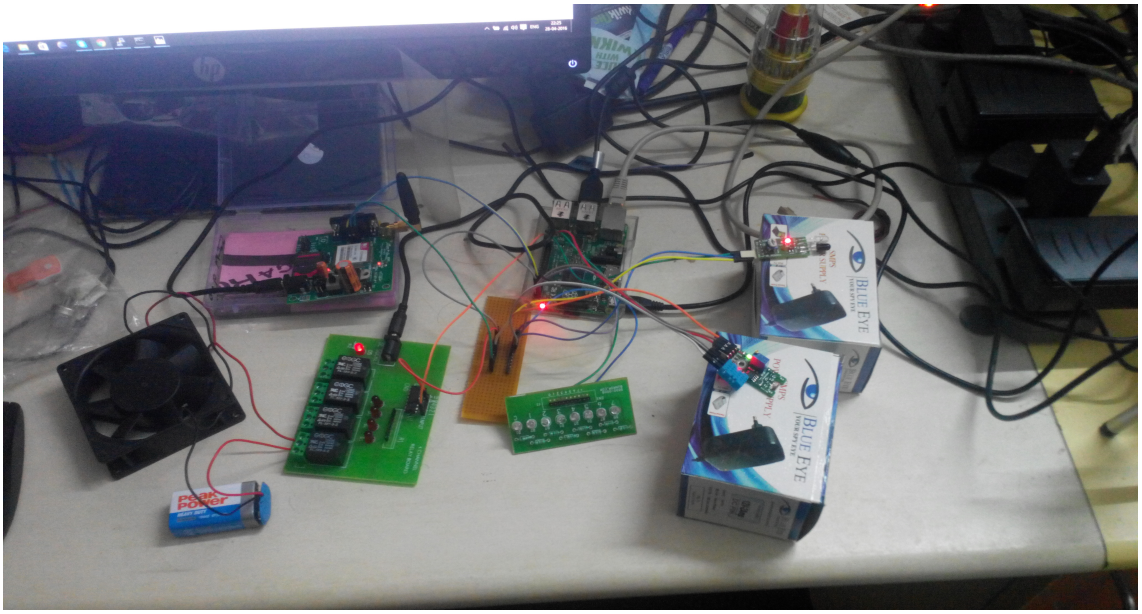

Figure 5.2: IOT Test Setup

Fig 5.3 displays Ubidots cloud web portal which shows status of IR and Light sensor .It displays varying value of room temperature through DHT11 sensor.It also provides switches for fan and LED which displays current status of fan and light. User can turn on/off LED and fan through these buttons.

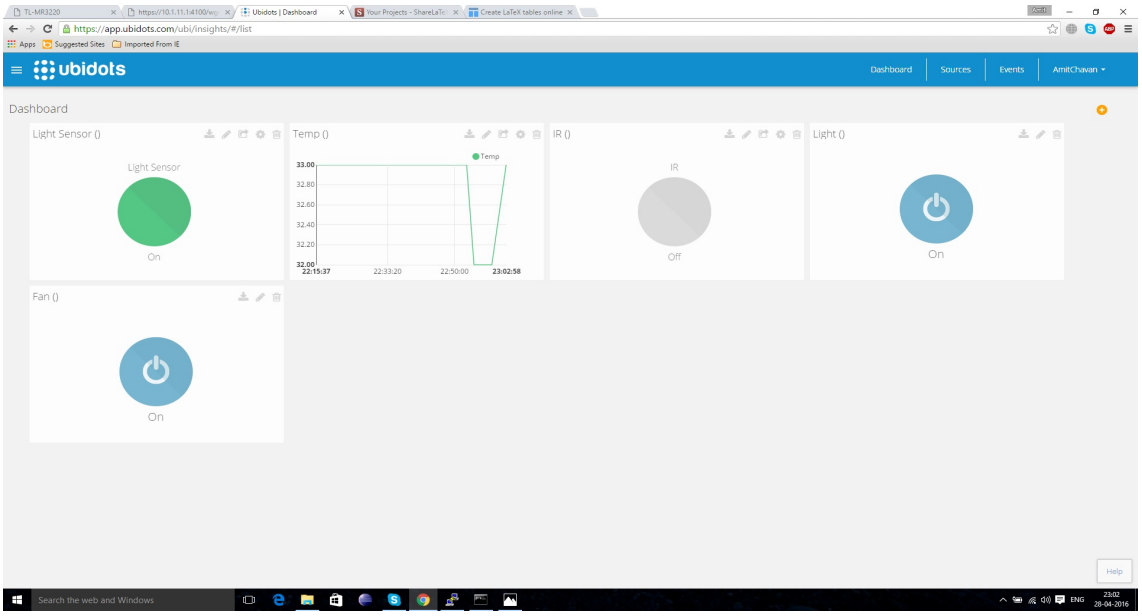

Figure 5.3: Ubidots Web Portal

5.4 Summary

This chapter includes system design and testing of IOT based home automation system.

Chapter 6

Conclusion And Future Scope

In this chapter, conclusion of the project work is described.

6.1 Conclusion

In this report, Detailed analysis on Digital Signage System is done based on both software and hardware parameters.We have tested this system in different test scenarios using various test cases.This system can be used to deliver rich media content like video , schedule of any organization ,live streaming, rss feeds to audience. It also able to display weather information as well as map of any geographic area .Through the server side we can manage contents to be displayed on each LCD connected through the Area.

We have developed IOT based home automation system in which we can monitor and control home appliances and can take action accordingly.We can also analyse data and trigger alert to the user.These home appliances are controlled from cloud based web portal.

6.2 Future Work

We can integrate many sensor nodes wirelessly using protocol such as MQTT.Also we can integrate many sensors and actuators in the IOT in order to control other home appliances and devices.

Appendix A

Code Snippets

```
#!/usr/bin/python
import RPi.GPIO as GPIO
import serial
from datetime import datetime
import sys
import Adafruit_DHT
from ubidots import ApiClient
import time
import os
ser = serial.Serial ("/dev/ttyAMA0")    #Open named port
ser.baudrate = 9600                     #Set baud rate to 9600
fo = open("file.txt", "a+")
GPIO.setwarnings(False)
GPIO.setmode(GPIO.BOARD)
GPIO.setup(35, GPIO.IN, pull_up_down=GPIO.PUD_UP)    #Light Sensor
GPIO.setup(36, GPIO.IN, pull_up_down=GPIO.PUD_UP)        #IR Sensor
GPIO.setup(40, GPIO.OUT)          #light
GPIO.setup(38, GPIO.OUT)          #fan
```

```
GPIO.output(40,False)
#Here use client unique id for authentication
api = ApiClient("a86a542dedd834002498fe586dc25f66f4df519b")
#Create a "Variable" object
# temperature
test_variable = api.get_variable("57190ece7625421ed5e072b9")
# IR
test_variable1 = api.get_variable("5719176d7625425fc0adb921")
#light sensor
test_variable2 = api.get_variable("571cec4a7625424799a345b6")
#Light
valve = api.get_variable('571918bd76254269065871d0')
#Fan
valve1 = api.get_variable('57191b3d7625427ac74946bb')
# Parse command line parameters.
sensor_args = { '11': Adafruit_DHT.DHT11,
'22': Adafruit_DHT.DHT22,
'2302': Adafruit_DHT.AM2302 }
humidity, temperature = Adafruit_DHT.read_retry(11, 4)
while True:
        if humidity is not None and temperature is not None:
                test_value  = temperature
                print(temperature)
#               print('Temp={0:0.1f} '.format(temperature))
                test_variable.save_value({'value':test_value})
                fo.write('At: %s\n' %datetime.now())
                str  = "%.1f"%temperature
                print(str)
                fo.write('Temp: %s ' %str)
```

```
else:
        print('Failed to get reading. Try again!')
        sys.exit(1)
input_state = GPIO.input(36)
if input_state == True:
        test_value1 = 1
        fo.write("Object Present ")
        filename1 = 'myfile-%s.jpg'%datetime.now().
        strftime('%Y-%m-%d-%h-%m-%s')
        print('Capturing image')
        ser.write("ATD8460491511;\r\n")
        #Send back the received data
        time.sleep(1)
        os.system('fswebcam "'+ filename1 + '"')
        time.sleep(7)
        ser.write("ATH\r\n")
else:
        test_value1 = 0
        fo.write("Object Absent ")
test_variable1.save_value({'value':test_value1})
input_state = GPIO.input(35)
if input_state == True:
        test_value2 = 0
        print('Light \r\n')
        fo.write("Light \r\n")
        time.sleep(1)
else:
        test_value2 = 1
        print('Dark\r\n')
```

```
                fo.write("Dark \r\n")
        test_variable2.save_value({'value':test_value2})
        lastValue = valve.get_values(1)
        #Get the last value of valve from Ubidots
        for a in lastValue:
#               print lastValue
                print a['value']
                if(a['value']):
                #Turn on or off the relay
                        print "Light ON"
                        GPIO.output(40,True)
                else:
                        print "Light OFF"
                        GPIO.output(40,False)
        lastValue1 = valve1.get_values(1)
        #Get the last value of valve from Ubidots
        for a1 in lastValue1:
#               print lastValue1
                print a1['value']
                if(a1['value']):
                #Turn on or off the relay
                        print "Fan ON"
                        GPIO.output(38,True)
                else:
                        print "Fan OFF"
                        GPIO.output(38,False)
```

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