WIFI BASED HD SIGNAGE CONTROLLER

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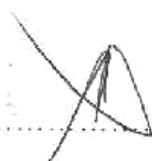
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ABSTRACT

Wi-Fi Based HD Signage Controller is a smart, effective and cheap solution to develop digital signage. A small controller board is embedded into any type of display panel such as CRT, VGA, DVI, HDMI and composite make it versatile and easier to use by connecting the display cable to the display panel. Instead of a simple architecture, this product is also an improvised version of existing digital signage products with extra features. The operation are may cover large area, using Wide Area Network (WAN) and smaller area using Local Area Network (LAN). All the data and processing are taking place in an encrypted secure channel make it safe in term of security. The system is consisting of a server (any single display panel embedded with Wi-Fi Based HD Signage Controller) that will operate remotely and local client (Windows PC) with software for user interfacing. The application software is easy to use with simple Graphical User Interface (GUI) with many functions. Users can transfer and synchronize video files, play videos and creating text videos in the single layout of software interface. One of the best features of this product that it supports High Definition (HD) video quality. Wi-Fi Based HD Signage Controller is currently a green solution for environmental pollution caused advertising materials and Cathode Ray Tube (CRT) glass. In addition, it can be an alternative to cheap and fast advertising and announcement. Wi-Fi Based HD Signage Controller is identified to have significant benefits to our lives. It is a simple and easy, green solution, affordable and yet has a high potential commercial value.

ABSTRAK

Wi-Fi Based HD Signage Controller adalah jalan penyelesaian untuk membangunkan papan tanda digital pintar, berkesan dan murah. Sebuah papan litar pengawal kecil dimuatkan ke dalam semua jenis panel paparan seperti CRT, VGA, DVI, HDMI dan komposit menjadikan ia serbaguna dan senang untuk digunakan dengan menyambungkan kabel paparan ke panel paparan. Selain daripada mempunyai senibina yang ringkas, produk ini juga adalah versi penambahbaikan kepada papan tanda digital yang sedia ada dengan pelbagai fungsi tambahan. Operasi merangkumi kawasan luas dengan menggunakan Wide Area Network (WAN) mahupun kawasan kecil dengan menggunakan Local Area Network (LAN). Semua maklumat dan pemprosesan berlaku dalam satu saluran selamat dan sulit menjadikan ianya selamat untuk digunakan. Sistem ini terdiri daripada sebuah pelayan (semua jenis paparan yang dimuatkan bersama Wi-Fi Based HD Signage Controller) yang beroperasi secara jarak jauh dan sebuah klien tempatan (Windows PC) dengan perisian yang berfungsi sebagai pemuka untuk pengguna. Perisian ini digunakan bersama Graphical User Interface (GUI) yang ringkas. Para pengguna boleh memindah, menyelaras, memainkan fail-fail video dan mencipta video teks di dalam satu halaman tunggal pada pemuka perisisan. Salah satu daripada ciri terbaik produk ini adalah ia menyokong kualiti video High Definition (HD). Wi-Fi Based HD Signage Controller pada masa ini adalah penyelesaian hijau kepada pencemaran alam sekitar yang disebabkan oleh bahan-bahan pengiklanan dan kaca Cathode Ray Tube (CRT). Sebagai tambahan, ianya boleh menjadi suatu alternatif kepada pengiklanan dan pengumuman yang murah dan cepat. Wi-Fi Based HD Signage Controller telah dikenal pasti mempunyai manfaat yang penting di dalam kehidupan. Ianya ringkas dan mudah, penyelesaian hijau, mampu milik dan mempunyai nilai pasaran yang berpotensi tinggi.

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ABBREVIATIONS

WHiBiC	Wi-Fi Based HD Signage Controller
Wi-Fe	Wi_Fi For Everything
Wi-Fi	Wireless Fidelity
SSH	Secure Shell
SFTP	Secure File Transfer Protocol
PHP	Hypertext Preprocessor
LED	Light Emitting Diode
HD	High Definition
LCD	Liquid Crystal Display
IoT	Internet of Thing
CDN	Content Delivery Network
WLAN	Wireless Local Area Network
LAN	Local Area Network
WAN	Wide Area Network
VB	Visual Basic
CPU	Central Processing Unit
RAM	Random Access Memory
OOH	Out Of Home

CHAPTER I

1.1 Project Overview

Digital signage technology has been discovered since twenty years ago. In last ten years, digital signage technology is advancing. Digital signage technology begins with LED signs that form alphabetical letters to display messages. In current technology, many application and modification has been applied to digital signage. The interface is so interactive with creative and attractive design. Some are built with larger screen to attract people looking at it. Amazingly, image processing technology is also being applied in digital signage to process information captured by the camera. Digital signage is available anywhere. We can see at shopping mall, hospital, office, sidewalks, etc. It is available in wide range of screen size depending on its application.

Most people can see only the multimedia content and sometimes can interact through the interface but with limited function. Not all people afford to buy digital signage due to its expensive price. Usually digital signage is owned by corporation and government. However it is not impossible for a public citizen to own their own digital signage. This project is about building and developing, a cheap, simple and effective digital signage solution, Wi-Fi Based HD Signage Contoller. Now, everybody can own a digital signage with this product. With digital signage, users can advertise their own products, makes announcement and use for personal purpose. Subsequently, users can promote the use of green technology product as Wi-Fi based HD Signage Controller helps to prevent environmental pollution caused by advertising tools such as poster, paper and banner. Not so many people know that the old CRT monitor and TV is not safe to be disposed. According to a research, a non-profit organization, Environmental Pollution Agency (EPA) is the one that manage to

control the disposal of CRT glass into landfills. This is because the Lead in the CRT glass is chemically hazardous to the environment. The management of waste CRT display is now uncontrolled. By recycling the old CRT display and embed it with Wi-Fi Based HD Signage Controller help to sustain our green environment and prevent from environmental pollution.

The concept of the project is simple. Everyone can own one and use it easily with full control. Although the application part is easy, but the design and development part is quite complicated. The brief explanation, procedures, testing results and discussion will be discussed in detail later in this report..

1.2 Problem Statement

The existing digital signage is not affordable by public citizen due to it's price, complexity and limited user control over the multimedia contents.

Environmental pollution become worse and unmanaged. Advertising material waste such as poster, banner, paper and dangerous chemical waste Lead are contributing to environmental pollution in the landfills.

1.3 Objectives

- To develop a prototype of cheap and simple digital signage controller that can be connected to any display panel.
- To promote the use of green technology product to prevent environmental pollution

1.4 Scope Of The Project

The scope of the work mainly relates to computer engineering field including the following tasks:

1. Hardware design involving the process of embedding controller board into the LCD display panel.

2.   Software development in VB.NET environment using variety of additional tools and extensions.

1.5   Project Significance

The project brings benefits such as follows:

- Affordable digital signage for everybody
- Promote a sustainable green environment.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

In this chapter, all the related literature reviews are provided and the fundamental concept of Wi-Fi based HD digital signage is explained briefly as well as the additional research on useful theories such as high definition (HD) controller using Raspberry Pi, Secure Shell (SSH) File Transfer Protocol (SFTP) and FFmpeg encoding. The existing technology of digital signage is introduced in the early section of this chapter and followed by theoretical studies on how to establish a client-server communication using encrypted SSH session. Then, futher studies continue on how to turn Raspberry Pi into a video advertising control system. Next, a research is conducted on ffmpeg video encoding for video encoding purpose. At the end of this chapter, all the literature reviews are summarized.

2.2 Existing Digital Signage System

In the Internet of Things (IoT) world, people convey messages or information digitally. One of the approach taken is the use of digital signage. A digital signage can be used to deliver a digital content in form of text, video and image. The purpose of content delivering maybe informative or commercial advertisement. Most digital signage systems are interactive. It supports multimedia content and provides two ways communication between users and systems. The package comes in various

shapes with different screen sizes. Advancement in network and multimedia technologies allow a large network of digital signage installation in many facilities and buildings. Digital signage helps people to convey and receive information and easily available at public places. In Montreal, Canada, a digital signage solution company namely iGotcha launched the first interactive windows display at Garage's flagship Montreal store. The interactive window signage is accessible 24/7 consists of 60-inch image projected onto an interactive touch foil affixed to the inside of the window. It displays interactive option menu that allows user to access detail of product information. Sometime it displays photos of available fashion and promotional videos[1]. Digital signage also installed at shopping malls, hospitals and buildings to provide information related to bussiness, products and services. It is widely used by corporates and advertisement provider. Sometimes it can be a government's digital city project .

According to researchers from Creative Content Research Laboratory of Electronics and Telecommunications Research Institute in Daejon, Korea, digital signage is defined as a network system of digital displays that are centrally connected and addressable for targeted information, entertainment, merchandizing and advertisement [2]. Yackey defines a digital signage as any form of business communication where a dynamic messaging device is used to take the place of, or supplement, other forms of messaging. Also a digital signage is considered as a form of Out Of Home (OOH) advertising that appears on some types of digital display. Considering its application areas, we consider it as an innovative medium for diverse service areas such as corporate, retail, large and small

business, education, hospitality, healthcare, banking, advertisement, kiosk, tourism, and so on.

Figure 2. 1: Wall-like display

2.3 Related Theoretical Review

This section present studies and research of the theoretical review on the effective measurement of Raspberry Pi and the its technologies .

2.3.1 Effectiveness Measures of Digital Signage

There are several techniques in measuring and investigating the effectiveness of digital signage. Generally, we can assume if many people looking at the digital signage, they might be attract to it. The attraction however is very subjective. People may like the content of the digital signage or maybe they only attracted with the technologies and the giant screen size displayed by the signage. Therefore, such general assumption cannot be taken as a parameter to measure effectiveness. A research conducted by a group of computer engineering students in Feng Chia University, Taiwan used data mining technique to analyze people reaction by recognize facial feature when people facing the display screen [5]. Parameters such as time consume in front of display screen and facial expression are being analyzed by using complex algorithm
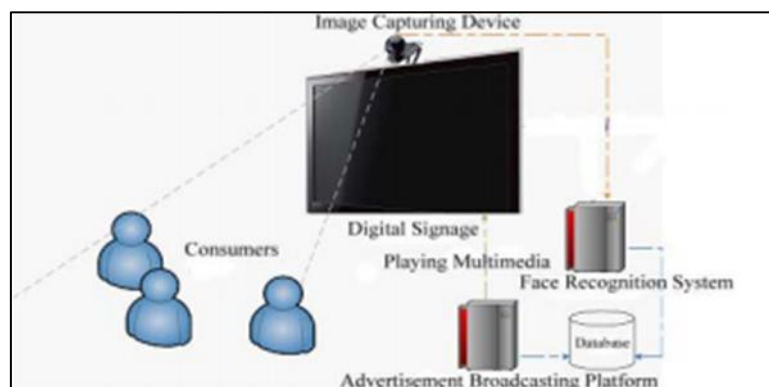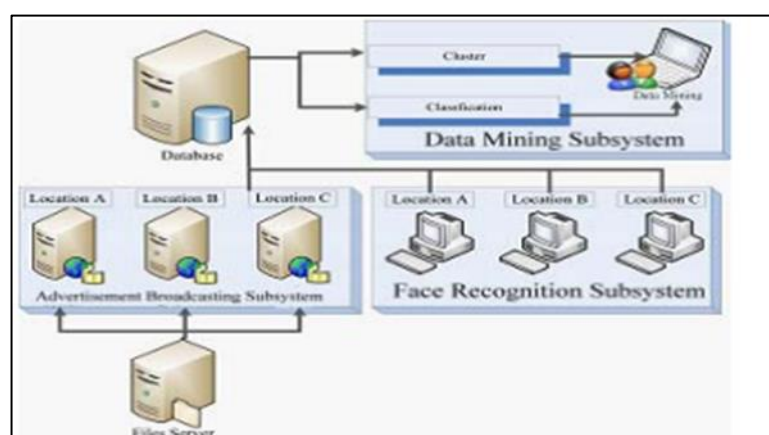
Figure 2.2: Simulated environment

Figure 2.3: System Framework

Further studies reported that high quality display resolution is the in digital signage is main attraction to public attention. People usually attracted to HD interactive user interface design rather than the signage content itself. With high speed network capability nowadays, fast data delivery to high resolution displays of 4K and 8k are possible [5]. The depreciation in display panel price like LED, LCD and plasma lead to utilization of ultra HD image and motion image in digital signage by gigantic manufacturers such as Samsung, Sony, LG and Panasonic. A design of effective digital signage system comprises of multiple panels to display high resolution contents using multiple PCs. In this study, the technique used low-priced display to produce high resolution image instead of using expensive HD display panel. Figure 2.3 shows how to display high resolution contents by using multiple PCs. Each PC has a hard disk storing the contents data and two graphic adapters controlling the contents data to display them on four panels. For example, PC (1) has two graphic adapters (1-1, 1-2). A hard disk stores the data which will be displayed on panel (1.1, 1.2, 1.3, 1.4). The graphic adapter (1-1) controls the contents to display them on

panel (1.1, 1.2). Full contents displayed on 16 panels should be totally synchronized. Figure 2.4 depicts the full contents should be separated, encoded and stored according to information of PC clustering and panel structure.
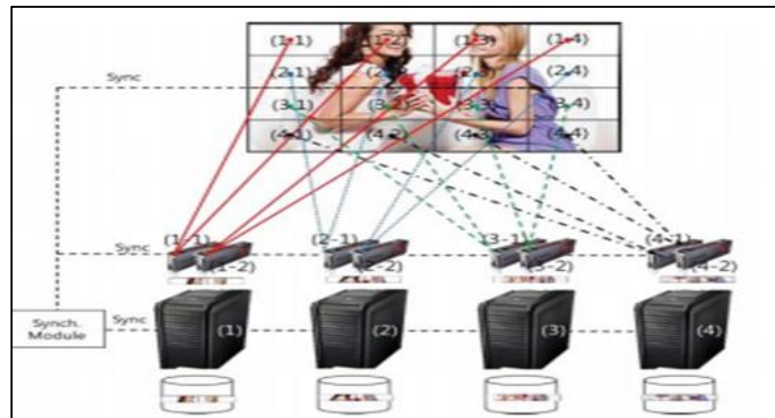

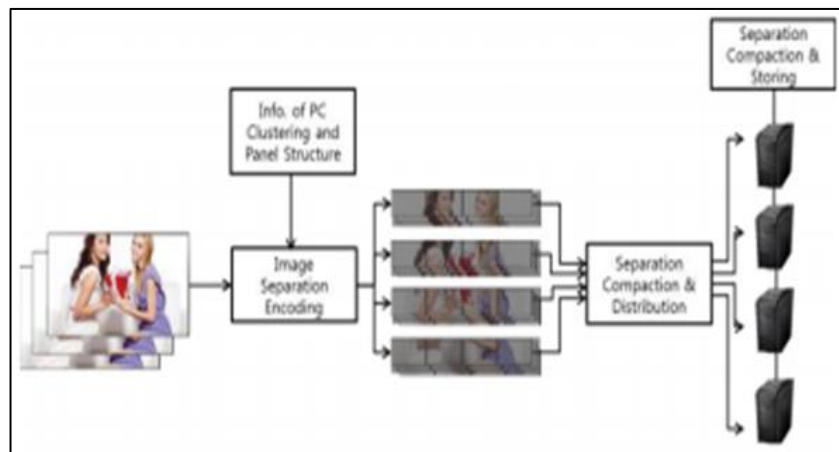**Figure 2. 4: HD contents display using PC clustering**

Figure 2. 5: Seperation and compaction

2.3.2 Digital Signage Technologies

IT technologies are used in digital signage to provide services such as:

Digital display device: The ultra HD image and moving pictures are utilized in digital signage systems because of the depreciation of display panel such as LCD, LED and Plasma display. The significant display manufacturers, such as Samsung, LG, NEC, Sony and Panasonic, are producing the display panels from small size one to over 100 inches one.

Digital content: Digital content is created with a variety of formats such as image, moving picture, flash, apps, and so on. POPAI (Point of Purchase Advertising International), the global association for marketing retail, established the standards for content formats of a digital signage.

Network: As a digital signage should efficiently deliver, update and manage the contents at the central server, the network needs to support such functions associated with the content. The network can be implemented many types, such as FTP, WebDAV, cache server, CDN (Contents Delivery Network) and cloud server.

Software solution: The role of software solution is very crucial in digital signage system. The main features of the software solution are as follows: encoding, decoding, control display schedule, interface between display device and central server, synchronization, display layout, separate display region, and so on.

2.4 Digital Signage Standard

Several organizations proposed the technical standards of digital signage system for providing the solution of interoperability. In this section, we have summarized three standards issued by POPAI (Point of Purchase Advertising International), ITU-T and W3C.

- **POPAI Standards**

The intention of POPAI standards is to deal with the need for interoperability among several providers of digital signage systems. POPAI standards define the media formats, such as audio, codec, still image, vector, video and wrapper, as well as the

reference system. Like any other industrial standards, the POPAI reference model is developed to satisfy the following requirements: adaptability, manageability, extensibility, scalability and easy implementation. POPAI standards have three major documents to define screen media format, RS-232C device and play log standards [5][6][7].

- Screen Media Formats: The aim of Screen media formats is to establish a baseline set of standard formats for digital media. They enable the terminal devices of digital signage to accurately display contents. They define the codec for audio, video, still image, vector and container formats. Today HTML 5 is considered more appropriate than POPAI screen media formats.

- RS-232 Control Standards: RS-232 control standards are intended for establishing the commands based on RS-232 to control the display device. However, as the participation of industrial companies is not clear and the display devices that do not support RS-232 has appeared in the market, the standards define the digital control commands in place of establishing protocol among devices.

- Play Log Standards: Play log is a bunch of record or information initiated from the digital signage system reflecting the content played the system performance and other data. The play log standards are represented by using XML.