



IoT BASED SMART DIGITAL DISPLAY USING RASPBERRY Pi

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Abstract-A smart display is a simple, sophisticated approach which is useful for displaying circulars which is used for maintaining the updates and new information. Thus the motive behind this project is to automate the department in order to make the work simpler. It is IoT based SMART DISPLAY which uses Raspberry Pi 3 for displaying notifications and circulars. The main motive is to design a LCD Monitor based message display System controlled from an Android mobile phone. The proposed system makes use of wireless technology to communicate android phone to Raspberry Pi 3 display board. Automation is the most frequently spelled term in the field of electronics. Likewise, this project makes use of an onboard computer, which is commonly termed as Raspberry Pi 3 processor. Android is a software stack for mobile devices that includes an operating system, middleware and key applications.

Key words-Raspberry pi, IoT, Android application, Apache Server.

1.Introduction

In this world everyone needs a comfort living life. Man has researched different technology for his sake of life. In today's world of connectedness, people are becoming accustomed to easy access to information. Whether it's through the internet or television, people want to be informed and up-to-date with the latest events happening around the world. Wired network connection such as Ethernet has many limitations depending on the need and type of connection. Nowadays, people prefer wireless connection because they can interact with people easily and it require less time. The main objective of this project is to develop a digital display that display images sent from the user (phone) and to design a simple, easy to install, user friendly system, which can receive and display notice in a particular manner.

With respect to date and time which will help the user to easily keep the track of any information and circulars every day and each time he uses the system.

Wi-Fi is the wireless technology used.

1.2 Problem statement

The project is about displaying data sent from mobile phone over a network to the server. The server has to receive images received from client process it and displays it on LCD/LED display. The entire system shall be a standalone system with no human intervention. Digital displays are a primary thing in any institution / organization or public utility places like bus stations, railway stations and parks. Here we deal with an advanced hi-tech wireless display which helps staffs to bring to the student's notice regarding any events, circulars or any information that has to be passed immediately.

1.3 Internet of Things (IoT)

Internet of Things is a system of interrelated computing devices, mechanical and digital machines that are provided with unique identifiers and ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, virtual power plants, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure.



2. Literature survey

2.1 TCP/IP sockets

The Transmission Control Protocol (TCP) is a core protocol of the Internet protocol suite. It originated in the initial network implementation in which it complemented the Internet Protocol (IP). Therefore, the entire suite is commonly referred to as TCP/IP. TCP provides reliable, ordered, and error-checked delivery of a stream of octets between applications running on hosts communicating over an IP network. Major Internet applications such as the World Wide Web, email, remote administration and file transfer rely on TCP. Applications that do not require reliable data stream service may use the User Datagram Protocol (UDP), which provides a connectionless datagram service that emphasizes reduced latency over reliability. TCP abstracts the application's communication from the underlying networking details. TCP is utilized extensively by many popular applications carried on the Internet, including the World Wide Web (WWW), E-mail, File Transfer Protocol, Secure Shell, peer-to-peer file sharing, and many streaming media applications.

2.2 Connection establishment steps

- The host A who needs to initialize a connection sends out a SYN (Synchronize) packet with proposed initial sequence number to the destination host B.
- When the host B receives SYN message, it returns a packet with both SYN and ACK flags set in the TCP header (SYN-ACK).
- When the host A receives the SYN-ACK, it sends back ACK (Acknowledgment) packet.
- Host B receives ACK and at this stage the connection is ESTABLISHED.

2.3 Gaps in literature

The communication between server and client is obtained using Ethernet connection in order to achieve wireless connection proper configuration is to be achieved. The message sent by the user is displayed in kiosk mode. The client is to be setup on android based phone. Hands on experience in android studio is required in order to develop application which can talk to server over TCP client. A web page which reads message sent from client is to be opened in a web browser in kiosk mode which is some of the minor reviews which are to be understood and implemented. [3] discussed about an eye blinking sensor. Nowadays heart attack patients are increasing day by day. "Though it is tough to save the heart attack patients, we can increase the statistics of saving the life of patients & the life of others whom they are responsible for.

3. Hardware and Software requirements

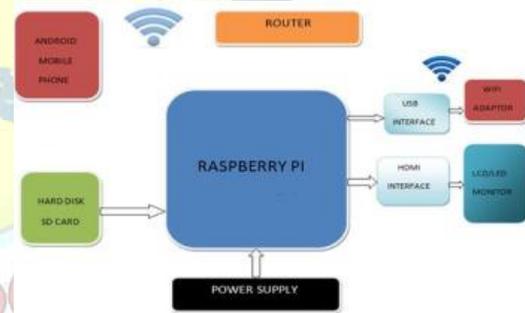
3.1 Hardware Used

- Raspberry Pi 3.
- 5V 2A AC-DC adaptor - to power Raspberry Pi 3 via micro USB.
- Micro SD Card (At least 8GB) – a micro SD Card is used to store OS and other files.
- 12V 2A AC-DC adaptor- to power display driver.
- LCD/LED screen with HDMI support.
- HDMI cable – to interface Raspberry Pi 3 with LCD.
- Android based Smart Phone.

3.2 Software Used

- Raspbian jessie os
- Apache based web server
- Feh

3.3 Basic Block Diagram



3.4 Raspberry Pi 3

Raspberry Pi 3 can be configured TCP server to listen for incoming calls. The Raspberry Pi 3 which is shown in Figure 2.2 is a series of credit card-sized single-board computers developed in England, United Kingdom by the Raspberry Pi Foundation with the intent to promote the teaching of basic computer science in schools and developing countries.

3.5 Android phone

In this Project android phone is used as client which sends text data to server from a remote place using TCP/IP Sockets.

Android is a mobile operating system (OS) currently developed by Google, based on the Linux kernel and designed primarily for touchscreen mobile devices such as smartphones and tablets. Android's user interface is mainly based on direct manipulation, using touch gestures that loosely correspond to real-



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world actions, such as swiping, tapping and Pinching, to manipulate on-screen objects, along with a virtual keyboard for text input

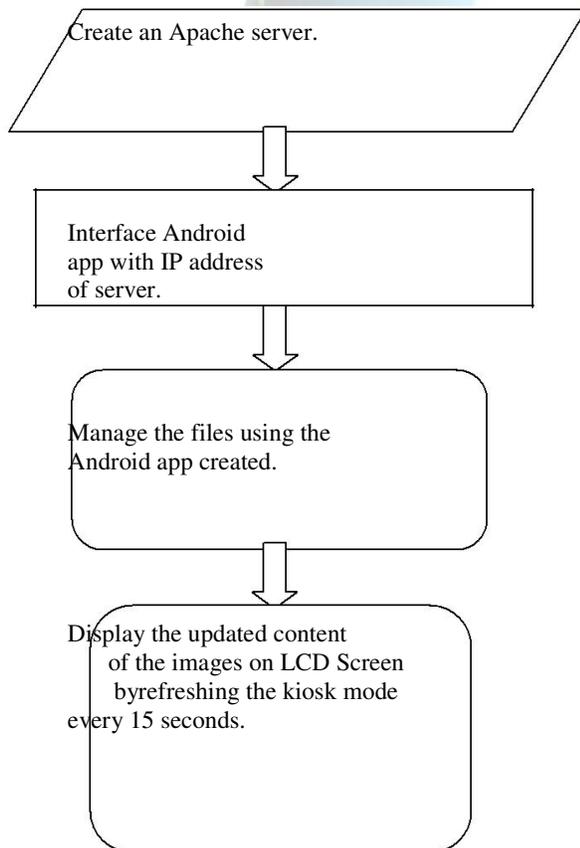
3.6 Chromium browser

Chromium browser is used as to display web pages. The web page is to be displayed in kiosk mode. The Pi would display a full screen webpage with session details taken from the database. In the event someone power cycled the Pi we wanted it to boot straight into this full screen state and straight onto the webpage we'd setup.

3.7 Android Studio

Android studio is used to integrated development (IDE) for android platform development. The IDE is developed by google. IDE is used to develop application used to configure as a TCP client. The google has provided standard API to communicate over TCP/IP.

3.8 Flowchart



The above figure 3.2 shows the software architecture implementations of the smart display . After the apache web server is created , we can add the

necessary files to be displayed in the screen. The files can also be managed using the android app. The final output is displayed in the screen at a specific time interval.

4.Process in creating the Smart Digital display.

- Client: User Mobile (Android Powered Mobile Phone).
- Server: Raspberry Pi 3.
- Raspberry Pi 3 connects to Router using a Wi-Fi adaptor.
- User enters SSID (Router Name) and Password of Router.
- Router assigns IP address to Raspberry Pi 3.

- TCP Server is created on Raspberry Pi 3 which listens for incoming calls.
- A TCP client is created on Android which connects to TCP server.
- When a connection is established the client sends message to server.
- The message sent to by the client is stored in a text file on Raspberry Pi 3 hard disk (SD card).
- The text file is read by another Program which displays the text on LCD/LED monitor connected on HDMIIInterface.

5. Conclusion and FutureWork

Smart digital display using Wi-Fi is a collaboration of Software and Hardware through which most of the complexity reduces, even cost can be reduced. This system is very efficient as anyone can send the message from remote place without any human intervention. The android application developed in this project makes the user experience great as it is very simple and easy to use. The Raspberry Pi 3 automatically boots and displays the screen which avoids any configuration when there is power cut or Raspberry Pi 3 is recycled by mistake.

Scope of future work

- Automatic scrolling of the pages if the total size of the page is very large.
- Features to upload videos on raspberry Pi server.
- Feature to store last entered messages and displaying it.
- Power Raspberry Pi using a solar panel in order to save power.



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