

# Running Text Information System Design Internet-Based for Small Outlets

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**Abstract**— Currently, there are many small business outlets that have opened branches in many places. With the spread of outlets that are far apart, it becomes a problem for the owner to be in a certain place on a display board that is installed at a height in each of his outlets. Display boards that are commonly used as promotional media and usually show product prices/interesting information are running text boards. In some studies there are those who make ESP as an access point, so that it can only be accessed within the range of the access point. So it cannot be accessed remotely. To facilitate this information, in this study, we designed an internet-based mobile text information system using the ESP32 Microcontroller and the Message Queuing Telemetry Transport (MQTT) protocol, as well as a display board (DMD LED Panel P10). By using an android-based mobile device that is owned by almost everyone and then equipped with the MQTT application, it is hoped that information will no longer be constrained by distance and the absence of a computer device, as well as the limited number of computer operators.

**Keywords**—MQTT, Microcontroller ESP32, DMD P10

## 1. Introduction

Submission of information is getting faster so that the growing information media is more innovative and interesting. In delivering information, creativity is needed so that the recipient of the information can easily catch the information conveyed. Running Text is a medium for delivering electronic information based on Light Emitting Diode (LED). Running text can be controlled with a PC/Laptop computer and is usually placed in a high place. For small outlets, they are usually not equipped with computer equipment and do not have IT experts. Under these conditions, small outlets will have difficulty updating information on running text.

Wireless Fidelity or commonly called WiFi is a technology that utilizes electronic equipment to exchange data wirelessly (via radio waves) as a data transfer medium on digital devices [1][2][3]. The use of WiFi technology is an alternative solution to these problems. Because it does not require cables, it is also easy to operate by many people. By using the WiFi module as a device that connects WiFi on a cellular phone with a microcontroller

One of the studies that has been made is a prototype for controlling running text using voice and Arduino Uno via Android smartphones. As well as many other studies that use this running text for various purposes, including the Design of Running Text Led Display Prayer Time Schedules Based on Arduino Uno as Information Media [4].

Another research is to develop a system that has been successful in sending data using the MQTT protocol which is applied to monitoring hemodialysis devices that are made according to the design. In the design there are publisher, broker, and subscriber elements. ESP32 microcontroller as a publisher, the broker used is a local MQTT broker. So that these elements can be used in the implementation of the

Internet of Things concept using the MQTT protocol in the hemodialysis monitoring system [5].

The use of IoT is growing in a short time, this is due to the development of information technology. This causes the involvement of many devices that are interconnected with sensors installed in the environment. With so many devices, it causes interoperability problems for each device. To overcome this requires a gateway or protocol that is able to bridge the interoperability [6]. MQTT itself is a machine to machine (M2M) connectivity protocol designed to transmit data very lightly using TCP/IP architecture. MQTT itself has the advantage that it can transmit data with light bandwidth, low electricity consumption, and very high connectivity.

Based on the needs analysis, this research focuses on designing an internet-based running text/running text information system using an ESP32 microcontroller and the Message Queuing Telemetry Transport (MQTT) protocol, as well as a display board (Panel LED Display P10).

## 2. Theory and Research Methods

### 2.1. Microcontroller

Microcontroller is a microprocessor system in which there is already a CPU, Read Only Memory (ROM), Random Access Memory (RAM), input-output interface (I/O interface), clock, and other internal devices that are interconnected and organized. Properly by the manufacturer and packaged in a chip that is ready to use. Thus, the contents of the ROM can be programmed directly according to the rules of use by the manufacturer who made it.

The ESP32 microcontroller is one of the microcontrollers that has a relatively cheap price, but has several advantages, including being able to be used to control devices and also equipped with an internet

connection. The ESP32 Internet of Things (IOT) module has a board shape resembling an Arduino board, making it easier for the IOT circuit prototyping process using the Wemos D1 R32 ESP32 in Figure 1. The ESP32 module has integrated RF antenna and balun, power amplifier, low-noise amplifier, filter, and power management module. The ESP32 has dual-mode Wi-Fi and a bluetooth chip that is safe, reliable, and can be used for a variety of applications. Frequency 240 MHz

- Working Voltage: 3.3V DC
- Input Voltage : 5V - 12V DC
- Wifi: 802.11 b/g/n/e/i (802.11n up to 150 Mbps)
- Bluetooth : v4.2 BR/EDR and BLE
- Memory : 520KB Flash: 32Mb (4M bytes)
- Current : 250mA (max)
- Current : 0.15mA (sleep)
- Current : 20mA (ON but no wifi)



Figure 1. Wemos D1 R32 ESP32

### 2.2 Message Queuing Telemetry Transport (MQTT)

MQTT is a lightweight publish/subscribe messaging protocol. MQTT is one of the main protocols for IoT (Internet of Things) deployment. In the MQTT protocol all subscribed devices are called clients. All clients can spread the message, the message comes from the broker. In MQTT there are several terms that are commonly used, namely:

- MQTT Client : A client application that connects to the internet and implements MQTT on top of TCP/IP to send or receive messages
- MQTT Topic : Identification of messages used to mark, classify messages in hierarchical concepts.
- Publisher : MQTT Client that sends data over the network.
- Subscriber : MQTT who subscribes (requests) certain topics on the MQTT network
- MQTT Broker : The broker is primarily an application server that controls the MQTT client with connectivity, authentication, message sending and message receiving
- Message : Data that is being raised (Publish), Connectivity, authentication, sending messages and receiving messages Message Data that is being raised (Publish).

### 2.3 Running Text Panel

Running text or also known as running text is one of the electronic media that is very useful for conveying messages and information that can also be used as a means of advertising. In its development, the running text display is now present not only showing a series of running texts, but also being able to display images or logos.

Dot matrix display (often shortened to DMD) is an LED display designed with a size of 16x32 that can be used both indoors and outdoors. This display can be connected to other P10 displays in parallel or in series. This display can be used to input from the power supply or from Arduino directly connected to a PC. The use of this display is widely used for running text. In Figure 2 and Figure 3, the DMD P10 front view and rear view.



Figure 2. P10 Dot Matrix Display (DMD) Panel Front View



Figure 3. Panel Dot Matrix Display (DMD) P10 Rear View

### 2.4 Research Method

The stages in this research are:

- a. Requirements (Needs Analysis)
  - Requirement is the process of analyzing or collecting data related to the system created.
- b. Design System
  - The design stage produces a document called Software Requirements which is the basis for programmers in creating application codes.
- c. Implementation (Work)
  - This stage is the stage of making applications using certain programming language codes. The process of writing application code (coding) refers to the previous analysis.
- d. Verification
  - The verification stage includes system integration and also testing the applications that have been made. In this stage, it is tested whether it is in accordance with the specified specifications or there are errors / errors in the system before being repaired again.

e. Maintenance

This stage generally includes the stages of software installation and application testing. The steps of this research refer to the waterfall method as shown in Figure 4.

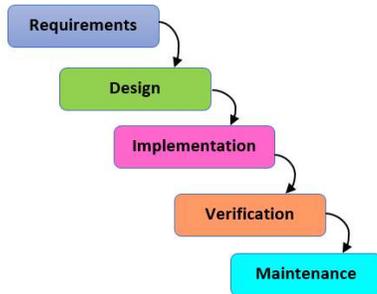


Figure 4. Research Stages

3. Hardware and Software Development

The running text design generally uses a program that has been embedded in the display control module so that changing the display requires a PC or using a remote control whose range is limited to change information.

3.1 System Development

In this research, a system is designed that can control characters with an android smartphone on a prototype running text. This system is designed so that the characters on the Dot Matrix Display Panel P10 can shift from right to left.

The system development design consists of mobile devices, internet networks, access points, microcontrollers, and P10 LED panels.



Figure 5. System Development Design

3.2 Hardware Design

The schematic design of the equipment is shown in Figure 6. The hardware used is:

- a. Mobile devices in the form of cellphones that function to send messages that are displayed and have the MQTT application installed.
- b. Internet Network
- c. Access point that connects the microcontroller to the internet
- d. The microcontroller, in this case the ESP32 is used, which functions to connect the control to the MQTT, and also functions to control messages on the P10 DMD panel.

- e. The DMD P10 panel functions as a message/text display that is displayed.

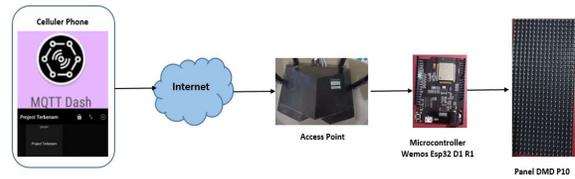


Figure 6. Hardware System

3.3 Software Development

Design Software development can be illustrated in Figure 7.

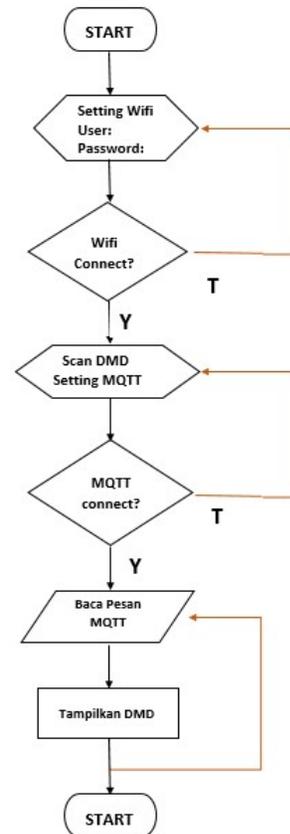


Figure 7. Flowchart Design

Description:

- Define/setting of wifi, related to the access point user id and password.
- Test wifi connection
- DMD scan settings
- MQTT settings
- MQTT connection test
- Read messages from MQTT
- Show on DMD scrolling
- Repeat appearance

4. Results and Discussion

4.1 Hardware Circuit Results

The pins on the ESP32 are connected to the DMD P10 panel according to the pins shown in Figure 7.

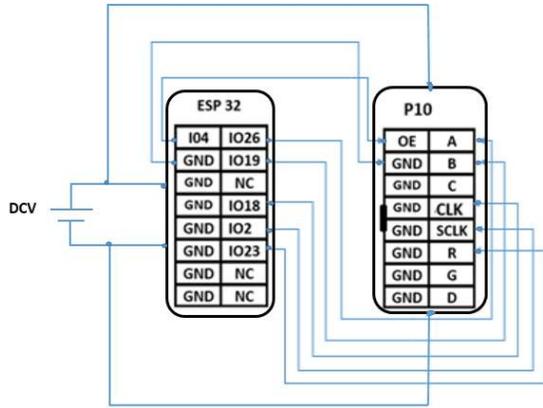


Figure 7. ESP32 Pin with P10 DMD Panel

Pin Description on P10:  
 OE : Output Enable for on/off all LED  
 A, B : Select the active column  
 CLK : SPI clock  
 SCLK : Latch Data Register  
 Data : Serial Data SPI

Pin Description on ESP32:  
 IO2, IO4 : GIOP Analog  
 IO26 : GIOP Digital  
 IO18, IO19: GIOP SPI  
 IO23 : GIOP SPI

4.2 Result of Information Submission

Information transmission is carried out via mobile devices equipped with the MQTT application as a protocol for sending information.

The information sent via the mobile device is received by MQTT Broker and forwarded to the ESP microcontroller. The ESP controls the DMD P10 to display messages.

The ESP32 hardware circuit, access point, and DMD P10 panel is shown in Figure 8.

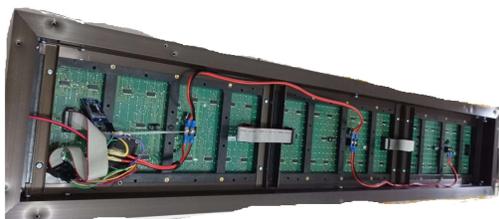


Figure 8. Hardware Circuit

The results on one of the displays, which have sent information via a mobile device equipped with the MQTT application can be shown in Figure 9.



Figure 9. Result of Display Information on DMD P10

Table 1. Device Test Results

No	Condition	Result	Description
1	The running speed of each character/text	< 1 s	conditioned on the program
2	The maximum number of characters is	100 characters	
3	Update information	as sent on the mobile device	the text is displayed after the previously finished text is displayed
4	Typeface / font Arial	Arial 16 font	according to the library in the program

5. Conclusion

The design of a running text information writing system for small outlets and remotely controlled using an Android-based mobile device has been successfully implemented and tested. The device can display running posts sent from a mobile device equipped with the MQTT dash application, on a P10 DMD board using the ESP32 microcontroller and the MQTT Protocol. The power source for this device can use a 12 volt battery that is lowered using a regulator to 5 Volt DC or use 220 Volt AC power with an adapter. With this result, small outlets can change the information on their display boards, without being constrained by distance, computer equipment, or computer experts, by using a mobile device equipped with the MQTT dash application.

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