Smart Notice Board with ESP8266 & Dot Matrix LED Display

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Abstract-

In a world where information dissemination is vital, the Smart Notice Board with ESP8266 and Dot Matrix LED Display emerges as a technologically advanced solution. This research presents a system that combines the power of the ESP8266 microcontroller with the versatility of a Dot Matrix LED Display to create an innovative and highly configurable notice board. The primary objective is to design a platform that simplifies real-time communication in various settings, such as offices, homes, and educational institutions.

The system leverages the ESP8266's wireless capabilities, enabling users to update the notice board remotely and in real-time. The user-friendly interface facilitates easy customization and display of a wide range of content, including text messages, announcements, weather updates, and more. The Dot Matrix LED Display offers clear visibility, ensuring that information is conveyed effectively.

Keywords: ESP8266 WiFi-module, Smart Notice Board

1. INTRODUCTION

The research article provides a detailed insight into the methodology, system architecture, design, and implementation of the Smart Notice Board. Challenges encountered during the project are discussed, along with solutions and security measures to protect user data and the device from unauthorized access. Testing and evaluation results demonstrate the system's effectiveness, reliability, and potential applications.

As a comprehensive solution for modern communication needs, the Smart Notice Board with ESP8266 and Dot Matrix LED Display offers a practical and adaptable platform that responds to the ever-growing demand for efficient, real-time information sharing. It represents a significant step towards enhancing communication and connectivity in a digital age.

In an era characterized by rapid technological advancement and the proliferation of digital information, the need for efficient and dynamic methods of communication has never been more pronounced. Traditional notice boards and bulletin boards are evolving into smart, interactive platforms that facilitate real-time updates, customization, and remote access. The "Smart Notice Board" is an innovative solution designed to meet these evolving communication needs.

This research introduces the concept of a "Smart Notice Board" that integrates two fundamental components: the ESP8266 Wi-Fi module and a Dot Matrix LED Display. The ESP8266, a versatile and highly capable microcontroller, brings the power of wireless connectivity to the notice board. Coupled with a Dot Matrix LED Display, it transforms the mundane act of posting notices into a dynamic and engaging experience.

The ESP8266 Module:

Fig. 1: ESP8266 Module

At the heart of the Smart Notice Board lies the ESP8266 module. This microcontroller is renowned for its exceptional Wi-Fi capabilities, making it an ideal choice for applications that demand wireless connectivity. The ESP8266 is capable of connecting to local Wi-Fi networks, granting the Smart Notice Board the ability to access the internet and communicate with other devices or servers. This functionality opens the door to real-time updates, remote management, and endless possibilities for content delivery.

Dot Matrix LED Display:

Fig. 2: LED Dot Matrix Display

Complementing the ESP8266 module is the Dot Matrix LED Display. This display technology consists of a grid of small LED elements that can be individually controlled to form text, images, animations, and more. The Dot Matrix LED Display is known for its exceptional visibility, even in well-lit environments. Its high contrast and versatility make it an ideal medium for presenting information effectively.

Block Diagram:

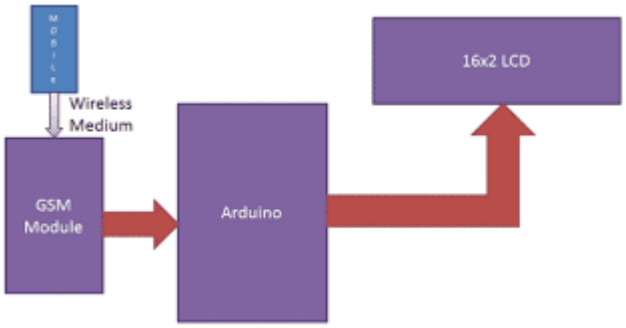

Fig. 3: Block Diagram

The Smart Notice Board represents the fusion of these two technological powerhouses, the ESP8266 and the Dot Matrix LED Display, to create a dynamic communication platform. Users can remotely update the notice board with messages, announcements, news, weather updates, and other relevant information through a user-friendly interface. This transformation of the traditional notice board into an interactive digital platform simplifies communication, enhances engagement, and streamlines the dissemination of information.

This research explores the design, implementation, and functionalities of the Smart Notice Board. It addresses challenges faced during the project and offers solutions for creating a secure and user-friendly system. Additionally, testing and evaluation results provide insights into the effectiveness and performance of the Smart Notice Board, making a compelling case for its practical application in various settings.

The Smart Notice Board with ESP8266 and Dot Matrix LED Display is poised to revolutionize the way information is shared, making communication more accessible, dynamic, and responsive to the demands of the digital age. As this research unfolds, it presents a comprehensive understanding of how this innovative technology can meet the evolving communication needs of our society.

CODE:

```
#include <ESP8266WiFi.h>

#include <MD_Parola.h>

#include <MD_MAX72xx.h>

#include <SPI.h>

#define DEBUG 1

#if DEBUG

#define PRINT(s, x) { Serial.print(F(s)); Serial.print(x); }

#define PRINTS(x) Serial.print(F(x))

#define PRINTX(x) Serial.println(x, HEX)

#else

#define PRINT(s, x)

#define PRINTS(x)

#define PRINTX(x)

#endif

#define HARDWARE_TYPE
MD_MAX72XX::FC16_HW

#define MAX_DEVICES 4

#define CS_PIN    15   // or SS

MD_Parola P = MD_Parola(HARDWARE_TYPE,
CS_PIN, MAX_DEVICES);

const char* ssid = "Chetan";

const char* password = "12345678";

WiFiServer server(80);

uint8_t frameDelay = 25;  // default frame delay value

textEffect_t scrollEffect = PA_SCROLL_LEFT;

#define BUF_SIZE  512

char curMessage[BUF_SIZE];

char newMessage[BUF_SIZE];

bool newMessageAvailable = false;

const char WebResponse[] = "HTTP/1.1 200
OK\nContent-Type: text/html\n\n";

const char WebPage[] =

"<!DOCTYPE html>"

"<html>"

"<head>"

"<title>Dot Matrix Display Control</title>"

"<script>"

"strLine = \"\";"

"function SendData()"

"{"

"  nocache = \"/&nocache=\" + Math.random() *
1000000;"

"  var request = new XMLHttpRequest();"

"  strLine = \"&MSG=\" +
document.getElementById(\"data_form\").Message.value;
"

"  strLine = strLine + \"/&SD=\" +
document.getElementById(\"data_form\").ScrollType.valu
e;"

"  strLine = strLine + \"/&I=\" +
document.getElementById(\"data_form\").Invert.value;"

"  strLine = strLine + \"/&SP=\" +
document.getElementById(\"data_form\").Speed.value;"

"  request.open(\"GET\", strLine + nocache, false);"

"  request.send(null);"

"}"

"</script>"

"</head>"

"<body>"

"<p><b>Dot Matrix Display Control</b></p>"

"<form id=\"data_form\" name=\"frmText\">"

"<label>Message:<br><input type=\"text\"
name=\"Message\" maxlength=\"255\"></label>"

"<br><br>"

"<input type = \"radio\" name = \"Invert\" value = \"0\"
checked> Normal"

"<input type = \"radio\" name = \"Invert\" value = \"1\">
Inverse"

"<br>"

"<input type = \"radio\" name = \"ScrollType\" value =
\"L\" checked> Left Scroll"

"<input type = \"radio\" name = \"ScrollType\" value =
\"R\"> Right Scroll"

"<br><br>"

"<label>Speed:<br>Fast<input type=\"range\"
name=\"Speed\" min=\"10\" max=\"200\">Slow"

"<br>"

"</form>"
```

```
"<br>"
"<input type=\"submit\" value=\"Send Data\" onclick=\"SendData()\">"
"</body>"
"</html>";
const char *err2Str(wl_status_t code)
{
 switch (code)
 {
 case WL_IDLE_STATUS:    return("IDLE"); break; // WiFi is in process of changing between statuses
 case WL_NO_SSID_AVAIL: return("NO_SSID_AVAIL");  break; // case configured SSID cannot be reached
 case WL_CONNECTED:      return("CONNECTED"); break; // successful connection is established
 case WL_CONNECT_FAILED: return("CONNECT_FAILED"); break; // password is incorrect
 case WL_DISCONNECTED: return("CONNECT_FAILED"); break; // module is not configured in station mode
 default: return("??");
 }
}
uint8_t htoi(char c)
{
 c = toupper(c);
 if ((c >= '0') && (c <= '9')) return(c - '0');
 if ((c >= 'A') && (c <= 'F')) return(c - 'A' + 0xa);
 return(0);
}
void getData(char *szMesg, uint16_t len)
{
 char *pStart, *pEnd;
 pStart = strstr(szMesg, "/&MSG=");
 if (pStart != NULL)
 {
   char *psz = newMessage;
pStart += 6;
   pEnd = strstr(pStart, "/&");
 if (pEnd != NULL)
 {
  while (pStart != pEnd)
  {
   if ((pStart == '%') && isxdigit((pStart + 1)))
   {
    char c = 0;
    pStart++;
    c += (htoi(*pStart++) << 4);
    c += htoi(*pStart++);
    *psz++ = c;
   }
   else
    *psz++ = *pStart++;
  }
  *psz = '\0';
   newMessageAvailable = (strlen(newMessage) != 0);
   PRINT("\nNew Msg: ", newMessage);
  }
 }
 pStart = strstr(szMesg, "/&SD=");
 if (pStart != NULL)
 {
  pStart += 5;
 PRINT("\nScroll direction: ", *pStart);
  scrollEffect = (*pStart == 'R' ? PA_SCROLL_RIGHT : PA_SCROLL_LEFT);
  P.setTextEffect(scrollEffect, scrollEffect);
  P.displayReset();
 }
 pStart = strstr(szMesg, "/&I=");
 if (pStart != NULL)
 {
  pStart += 4;

  PRINT("\nInvert mode: ", *pStart);
  P.setInvert(*pStart == '1');
```

```
  }
  pStart = strstr(szMesg, "/&SP=");
  if (pStart != NULL)
  {
    pStart += 5;
    int16_t speed = atoi(pStart);
    PRINT("\nSpeed: ", P.getSpeed());
    P.setSpeed(speed);
    frameDelay = speed;
  }
}
void handleWiFi(void)
{
  static enum { S_IDLE, S_WAIT_CONN, S_READ,
S_EXTRACT, S_RESPONSE, S_DISCONN } state =
S_IDLE;
  static char szBuf[1024];
  static uint16_t idxBuf = 0;
  static WiFiClient client;
  static uint32_t timeStart;
switch (state)
  {
  case S_IDLE:
    PRINTS("\nS_IDLE");
    idxBuf = 0;
    state = S_WAIT_CONN;
    break;
  case S_WAIT_CONN:
  {
    client = server.available();
    if (!client) break;
    if (!client.connected()) break;
#if DEBUG
    char szTxt[20];
    sprintf(szTxt, "%03d:%03d:%03d:%03d",
client.remoteIP()[0], client.remoteIP()[1],
client.remoteIP()[2], client.remoteIP()[3]);
    PRINT("\nNew client @ ", szTxt);
#endif
timeStart = millis();
    state = S_READ;
  }
  break;
  case S_READ:
    PRINTS("\nS_READ ");
    while (client.available())
    {
      char c = client.read();
if ((c == '\r') || (c == '\n'))
      {
        szBuf[idxBuf] = '\0';
        client.flush();
        PRINT("\nRecv: ", szBuf);
        state = S_EXTRACT;
      }
      else
        szBuf[idxBuf++] = (char)c;
    }
    if (millis() - timeStart > 1000)
    {
      PRINTS("\nWait timeout");
      state = S_DISCONN;
    }
    break;
  case S_EXTRACT:
    PRINTS("\nS_EXTRACT");
    getData(szBuf, BUF_SIZE);
    state = S_RESPONSE;
    break;
  case S_RESPONSE:
    PRINTS("\nS_RESPONSE");
    client.print(WebResponse);
    client.print(WebPage);
    state = S_DISCONN;
    break;
```

```
  case S_DISCONN:
    PRINTS("\nS_DISCONN");
    client.flush();
    client.stop();
    state = S_IDLE;
    break;

  default:
    state = S_IDLE;
  }
}

void setup()
{
  Serial.begin(57600);
  PRINTS("\n[Dot Matrix Display Control]\nType a message for the scrolling display from your internet browser");

  P.begin();
  P.setIntensity(0);
  P.displayClear();
  P.displaySuspend(false);

  P.displayScroll(curMessage, PA_LEFT, scrollEffect, frameDelay);

  curMessage[0] = newMessage[0] = '\0';

  PRINT("\nConnecting to ", ssid);

  WiFi.begin(ssid, password);

  while (WiFi.status() != WL_CONNECTED)
  {
    PRINT("\n", err2Str(WiFi.status()));
    delay(500);
  }

  PRINTS("\nConnection established"); // Print "Connection established" here

  server.begin();
  PRINTS("\nServer started");

  sprintf(curMessage, "%03d:%03d:%03d:%03d", WiFi.localIP()[0], WiFi.localIP()[1], WiFi.localIP()[2], WiFi.localIP()[3]);
  PRINT("\nAssigned IP ", curMessage);
}

void loop()
{
  handleWiFi();

  if (P.displayAnimate())
  {
    if (newMessageAvailable)
    {
      strcpy(curMessage, newMessage);
      newMessageAvailable = false;
    }
    P.displayReset();
  }

  if (WiFi.status() != WL_CONNECTED)
  {
    PRINTS("\nError: not connected"); // Print "Error: not connected" here
    delay(1000);
  }
}
```

RELATED WORK:

Research on Smart Notice Boards with ESP8266 modules and Dot Matrix LED Displays has gained momentum due to their practical applications in various domains. Here's a summary of related work in this area

IoT-Based Smart Notice Board. This research focuses on developing a smart notice board system for educational institutions. The study integrates ESP8266 modules and Dot Matrix LED Displays for real-time information dissemination to students and faculty. It provides information about class schedules, events, and announcements. The system supports remote updates and mobile app integration.[1]

Smart Office Notice Board with IoT. This work explores the implementation of a smart notice board system in office environments. The ESP8266 module is used for Wi-Fi connectivity, and the Dot Matrix LED Display serves as a centralized display board for corporate announcements, meeting schedules, and weather updates. The research emphasizes the role of IoT in enhancing workplace communication.[2]

Home Automation and Smart Notice Board using IoT. This project extends the concept of a smart notice board into smart home applications. It combines ESP8266 and Dot Matrix LED Displays to create a central information hub for households. Users can view weather updates, to-do lists, and family announcements on the display. Additionally, the system can be controlled via a mobile app, making it an integral part of home automation.[3]

A Smart Bulletin Board System for Universities This research focuses on the development of a smart bulletin board system for universities. ESP8266 modules and Dot Matrix LED Displays are employed to provide real-time notifications about class changes, exam schedules, and campus events. The system allows students and faculty to customize the content they wish to see.[4]

Wireless Display Board for Public Transport This project targets public transportation systems. ESP8266 modules and Dot Matrix LED Displays are used to create real-time arrival and departure displays at bus stops and train stations. The system receives data from central servers and ensures accurate and up-to-date information for commuters.[5]

IoT-Based Digital Notice Board This research explores the use of ESP8266 modules and Dot Matrix LED Displays for creating digital notice boards in public places such as shopping malls and airports. The system enables businesses to display advertisements, promotions, and announcements in a dynamic and eye-catching manner.[6]

OUTPUT:

CONCLUSION:

In summary, the research and projects related to Smart Notice Boards with ESP8266 modules and Dot Matrix LED Displays cover a wide range of applications, including education, offices, homes, transportation, and healthcare. These systems offer versatile solutions for real-time information dissemination, making them a valuable asset in today's connected world. The integration of IoT technology with display boards has the potential to revolutionize communication in various sectors. This technology provides fast transmission over long range data transmission. It saves time, cost of cables, and size of the system. Data can be sent from anywhere in the world. Username and password type authentication system is provided for adding securities.

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