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IoT BASED LED SCROLLING DISPLAY

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Abstract- With the technological advancements there have been advancements in ways of a displaying marketing and advertising of information. LED matrix display boards are used for displaying advertisements and notices. These Display boards have become a primary thing in educational institutes, shop floors (workstations) & various public places for displaying information regarding public transport timings, platforms, various advertisements regarding products, or important notices. People are now adapted to the idea of the world at its fingertips. The older version of display boards made use of wired technology for communication. Here wireless technology wi-fi is used for communication.

Information is entered through the keyboard of transmitter or as speech signal and send through wi-fi & nodemcu or wifi module at receiver end will receive it and send it to matrix display due to which the desired information will be displayed on LED matrix display.

Keywords –*Wired display boards, Wi-fi, LED matrix display.*

I INTRODUCTION

The LED Display Systems are specifically designed to be used at the colleges, universities, sharemarket etc. for displaying day-to-day updates, important notices and other information continuously. Being IOT-based system, it offers flexibility to display flash news or announcements faster than the programmable system. IOT-based display system can also be used at places like shops, bus stations, nursing homes ,factories shop floors railway stations, gardens etc. without affecting the surrounding environment. The led display system mainly consists of a Wi-Fi module as receiver and a display toolkit which can be programmed from an authorized mobile phone. It receives the data, from android Mobile through an application (App) and displays the desired information after necessary code conversion. It serves as an electronic notice display board which displays the important notices instantly avoiding unwanted delays. Being wireless, the IOT based led display it is easy to expand and allows the user to increase the number of display panels anytime and at any desired location depending on the requirement of the user. These days the use of LED Matrix Scrolling Displays has become very popular in areas like malls, movie theatres, public transports, traffic and highways signboards, etc. But major issue with these displays is to carry a personal computer, laptops or specialized keyboards for transmitting messages to these LED display boards. Carrying computational assembly or keypads every time, when the user needs to change the message on the LED display boards can be quite hectic.

II RELATED WORK

This system takes ideas from other systems which have already been implemented earlier. It merges two different project ideas into single unit. It is an extension of already existing LED scrolling display board. But here we are using speech to text technology using mobile app through Wi-Fi module. For making this LED display more portable, an android phone can be used instead of carrying a computer or keyboard every time user needs to change the messages to be displayed on the LED matrix display. A speech signal is obtained through spoken words in the mobile phone and sent to LED moving display boards by using Wi-Fi . A Wi-Fi module is connected to the LED display hardware and is used to receive the speech to text converted message and send it to the controller circuit of the LED display. Then the controller circuitry which drives the led matrix stores the received data in externally interfaced RAM and tallies the same with the lookup table stored in controller program displays the text on LED displays accordingly. By using Wi-Fi it is possible to change the message on the LED display board through speech, from any desired location in the country. This idea used in this project minimizes the total cost that is required in the traditional LED display boards and makes easier to send data to these LED display boards. The project uses a Wi-Fi at the display side to receive the speech signal. IC 8051 is the controller which drives the LED display board. Along with this, Switch mode power supplies are used for controlling microcontroller, led driver and led matrix.

III COMPONENTS

1.ESP8266 (Wi-Fi Module)

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any

microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community. This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area.

Figure 1 : ESP8266

The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces; it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts. There is an almost limitless fountain of information available for the ESP8266, all of which has been provided by amazing community support. In the *Documents* section below you will find many resources to aid you in using the ESP8266, even instructions on how to transforming this module into an IoT

2.8051 Microcontroller

It is an 8-bit microcontroller. It is built with 40 pins DIP (dual inline package), 4kb of ROM storage and 128 bytes of RAM storage, 2 16-bit timers. It consists of are four parallel 8-bit ports, which are programmable as well as addressable as per the requirement. An on-chip crystal oscillator is integrated in the microcontroller having crystal frequency of 12 MHz

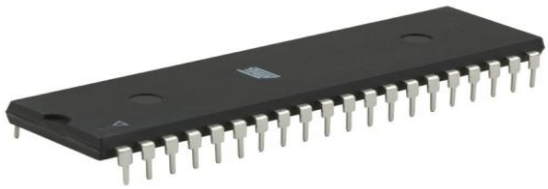

Figure 2 : 8051 Microcontroller

Features:

- 8 bit ALU: ALU or Arithmetic Logic Unit is the heart of a microcontroller. It performs arithmetic and bitwise operation on binary numbers. The ALU in8051 is an 8 – Bit ALU i.e. it can perform operations on 8 – bit data.
- 8 bit Accumulator: Accumulator is an important register associated with the ALU. The accumulator in 8051 is an 8 – bit register.
- RAM: 8051Microcontroller has 128 Bytes of RAM which includes SFRs and Input / Output Port Registers.
- ROM: 8051 has4 KB of on-chip ROM (Program Memory).
- I/O Port: 8051 has four 8 – bit Input / Output Ports which are bit addressable and bidirectional.
- Timer/Counter: 8051 has two 16 – bit Timers / Counters.
- Serial Port: 8051 supports full duplex UART Communication.
- External Memory: 8051Microcontroller can access two 16 – bit address line at once: one each for RAM and ROM. The total external memory that an 8051 Microcontroller can access for RAM and ROM is 64KB (216 for each type)

3. ATMEGA

The ATmega328 is a single-chip microcontroller created by Atmel in the megaAVR family. The Atmel 8-bit AVR RISCbased microcontroller combines 32 kB ISP flash memory with read-while-write capabilities, 1 kB EEPROM, 2 kB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channelsin TQFP and QFN /MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz.

4. 74LS138

74LS138 is a member from 74xxfamily of TTL logic gates. The chips is designed for decoding or demultiplexing application and comes with 3 inputs to 8 output setup. The design is also made for chip to be used in high performance memory decoding or data routing applications, requiring very short propagation delay times. In high performance memory systems these decoders can be used to minimize the effects of decoding. The three pins of chip reduce the need for external gates or inverters when expanding. A 24 line decoder can be implemented with no external inverters, and a 32-line decoder requires only one inverter. 74LS138 is used in de-multiplexing applications by using enable pin as data input pin. Also the chip inputs are clamped with high-performance schottky diodes to suppress line-ringing and simplify system design.

Figure 3: 74LS138 Decoder

Features:

- Designed specifically for high speed
- Incorporates three enable pins to simplify cascading.
- De-multiplexing capability
- Schottky clamped for high speed
- ESD protection
- Input accepts voltage higher than VCC
- Supply voltage 1.0V to 5.5V
- Typical propagation delays: 21ns
- Low power consumption: 32mv
- Operating temperature: -40 to+125

5. 74LS374

These 8-bit registers feature totem-pole 3-STATE outputs designed specifically for driving highly-capacitive or relatively low-impedance loads. The high-impedance state and increased high-logic level drive provide these registers with the capability of being connected directly to and driving the bus lines in a bus-organized system without need for interface or pull-up components. They are particularly attractive for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers. The eight latches of the DM54/74LS373 are transparent D-type latches meaning that while the enable (G) is high the Q outputs will follow the data (D) inputs. When the enable is taken low the output will be latched at the level of the data that was set up. The eight flip-flops of the DM54/74LS374 are edge-triggered D-type flip flops. On the positive transition of the clock, the Q outputs will be set to the logic states that were set up at the D inputs.

A buffered output control input can be used to place the eight outputs in either a normal logic state (high or low logic levels) or a high-impedance state. In the high-impedance state the outputs neither load nor drive the bus lines significantly. The output control does not affect the internal operation of the latches or flip-flops. That is, the old data can be retained or new data can be entered even while the outputs are off.

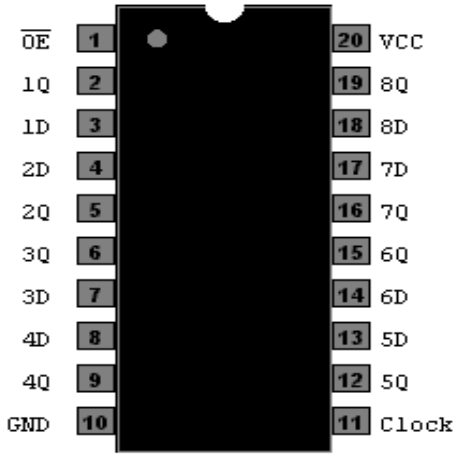

Figure 4: 74LS374

Features:

- Choice of 8 latches or 8 D-type flip-flops in a single package 3-STATE bus-driving outputs
- Full parallel-access for loading n Buffered control inputs
- P-N-P inputs reduce D-C loading on data lines

6. LED Display

An LED display is a flat panel display, which uses an array of light-emitting diodes as pixels for a video display. Their brightness allows them to be used outdoors in store signs and billboards, and in recent years they have also become commonly used in destination signs on public transport vehicles. LED displays are capable of providing general illumination in addition to visual display, as when used for stage lighting or other decorative (as opposed to informational) purposes.

7. MAX232

The MAX232 is an integrated circuit first created in 1987 by Maxim Integrated Products that converts signals from a TIA232 (RS-232) serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual transmitter / dual receiver that typically is used to convert the RX, TX, CTS, RTS signals.

The drivers provide TIA-232 voltage level outputs (about ±7.5 volts) from a single 5-volt supply by on-chip charge pumps and external capacitors. This makes it useful for implementing TIA-232 in devices that otherwise do not need any other voltages.

The receivers reduce TIA-232 inputs, which may be as high as ±25 volts, to standard 5 volt TTL levels. These receivers have a typical threshold of 1.3 volts and a typical hysteresis of 0.5 volts. The MAX232 replaced an older pair of chips MC1488 and MC1489 that performed similar RS-232 translation. The MC1488 quad transmitter chip required 12 volt and -12 volt power,[1] and MC1489 quad receiver chip required 5 volt power.[2] The main disadvantages of this older solution was

the +/- 12 volt power requirement, only supported 5 volt digital logic, and two chips instead of one.

8. POWER SUPPLY

There are 2 types of power supplies visualized :
Transformer based and SMPS
In our project we have used SMPS i.e Switched Mode Power supply
Project requires 2 SMPS
2.5V &5A (for LED MATRIX)
5V & 2.5 A (Microcontroller and LED drivers)
SMPS is a device in which DC to DC conversion takes place

INPUT SECTION

Consist of Full wave Bridge Rectifier and AC to DC Rectification process takes place at this primary section
Then Filter Capacitor is used for filtering pulsating DC
Any IGBT or MOSFET control IC is used for regulating voltage before SMPT

SMPT(Switched Mode Power Transformer)

This device works on frequency, change in frequency leads to change in voltage, voltage is adjusted on basis of frequency
It also reduces the size of SMPS

OUTPUT SECTION

Optocoupler

Takes feedback from output and does not allow the output to vary

Output Section Filtering Capacitor

For getting purest form of filtered dc output

BC547

Used for Current Control purpose i.e. for controlling excess current flowing through circuit

LED indication

To indicate working or ON state of SMPS

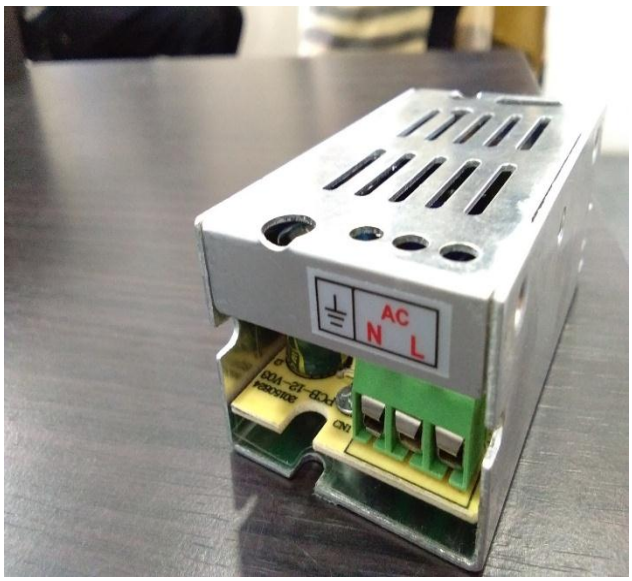

Figure 5 : Power Supply

IV WORKING PRINCIPLE

The aim of this project is that, whatever we speak on android phone should be displayed on the LED MATRIX
For the data to be displayed on the matrix , speech signal which is given as input to the android must be converted into text.

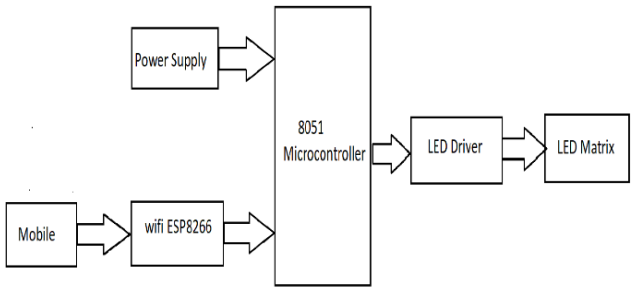

Figure 6: Working Principle of IOT based LED Matrix Display

ANDROID PHONE AND APP (Transmitter)

Thus at input section we have an android phone with a an application installed on it , we ve used ,home automation android application or we can use GUI of ai.2appinventor for S to T Conversion
This Application or GUI makes use of Google voice for S to T conversion.

NODEMCU (RECEIVER)

And this converted sound signal is given to nodemcu or wifi module esp2866 over Wifi. nodemcu is further connected to the matrix display through an usb to rs232 connector.
Here the android app acts like a transmitter and converter of sound signal to text singal and nodemcu or Wi-Fi module acts like the receiver for speech to text converted signal and sends it further to the matrix display via microcontroller 8051.The medium of communication between transmitter and receiver is Wi-Fi

8051 MICROCONTROLLER

We make use of 8051 microcontroller .Microcontroller is used for controlling the driver circuitry of the matrix Display.
Microcontroller is used to control the led driver which consists of latches and line decoders and also to control the data lines which supply the data to the controller
For lighting up the LEDS in a particular fashion so that they appear to be a word a LOOK UP TABLE is used.
The look up table decides which LEDS in respective columns and rows will glow for which particular character

LED DRIVER & LED DISPLAY

The led driver consists of latches and line decoders.
Latch 74ls374 and decoder 74ls138 is used in the project

Latches are used for connecting and controlling more no. of LED.

The word or the data that is given as input to the display is stored in the RAM IC which is interfaced externally with 8051

The DATA transmitted is send to the display line by line i.e. column by column .The column mentioned here are columns of LED.

HARDWARE

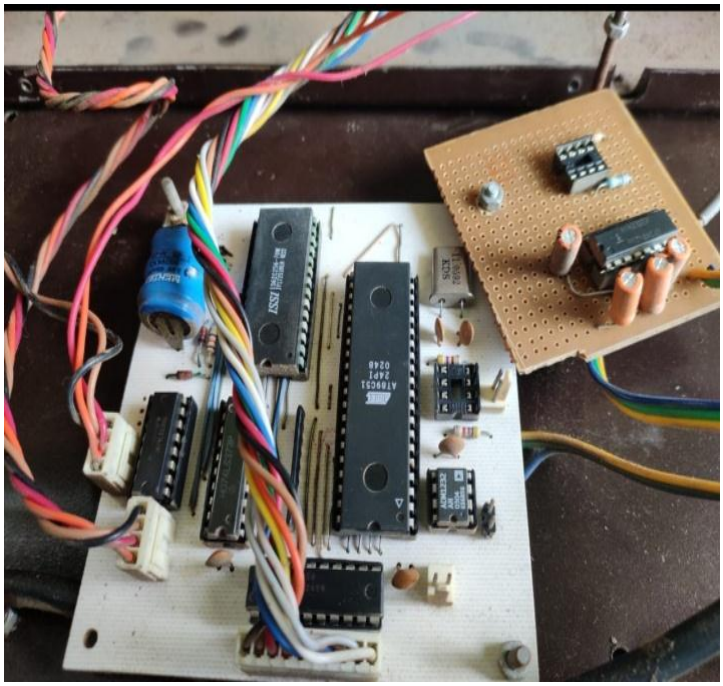

Figure 7 Hardware

Application:

1. Institutes
2. Hospitals
3. Park
4. Railway station
5. Bus station
6. Shopping mall
7. Public place
8. Score board

VI CONCLUSION

The prototype of the WI-FI based display was efficiently designed. This prototype has facilities to be integrated with a display board thus making it truly mobile/PC. It accepts the message/information, stores it, validates it and then displays it in the LED display. The message is deleted from the EEPROM each time it is read, thus making room for the next message. Only one SMS can be displayed at a time. These limitations can be removed by the use of higher end microcontrollers and extended RAM. The prototype can be implemented using commercial display boards. In this case, it can solve the problem of instant information transfer.

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