

<sup>1</sup>Sangramsinh N. Damor

<sup>2</sup>Megha M. Mahida

<sup>3</sup>Pallavi K Gamit

## Analysis of IoT Enabled Scrolling Text Display Notice Board.



**Abstract:** - This paper presents the recent ongoing popularity of IOT (Internet of Things) technology and using the IOT LoLin NodeMCU v3 board a new way of scrolling text notice or advertisement on dot matrix display. The concept presented here is a smart way of scrolling text notice or advertising using the latest IoT enabled technology. The implemented design presently is used for important notice display on dot matrix display board at a common place visible to all students. Professors can send their notice/message to students by their cell phones using designed android application in MIT App Inventor 2. Any authorized person can access the notice/advertising board globally. The device is embedded with the scrolling led matrix display and controlled by IOT NodeMCU receiver. Once the IOT receiver gets connected with internet it will assign a specific IP address. The designed application sends text for advertisement using this specific IP address. IOT technology and its challenges are very concerned research topics, the presented paper and working prototype design is one of the applications of new technology. The prototype designed here with full product implementation can be used at many places. For example, Schools, Colleges, University, Playground, Bank, Railway Station, Airport, Bus Stations as well as running public vehicles.

**Keywords:** IOT, Wi-Fi, IP, Android Application, NodeMCU V3, LED matrix, MIT App Inventor 2.

### I. INTRODUCTION

The Internet of Things (IoT) is an emerging paradigm that enables communication between electronic devices and sensors through the internet to facilitate our lives. IoT use smart devices and internet to provide innovative solutions to various challenges and issues related to various business, governmental and public/private industries across the world [6]. The Internet of things means all unconventional electronic devices that exchange data via the Internet using a local or wireless network. The world is becoming more and more connected through networks. Our Smartphone can be connected to our toaster or refrigerator or washing machine and there is no denying it. That is our future which we predict based on technology. In recent years, many conventional wired communications have transitioned to wireless IoT technologies. This shift is attributed to the more effective handling of data coordination from sensing and control devices through wireless networks, as opposed to wired systems that connect sensing modules to a base station. Moreover, wireless communication systems offer dynamic mobility and eliminate relocation costs [7]. We are surrounded by technologies that are designed to make our lives better but not everything is so simple.



Fig.1 Transmitter Block Diagram

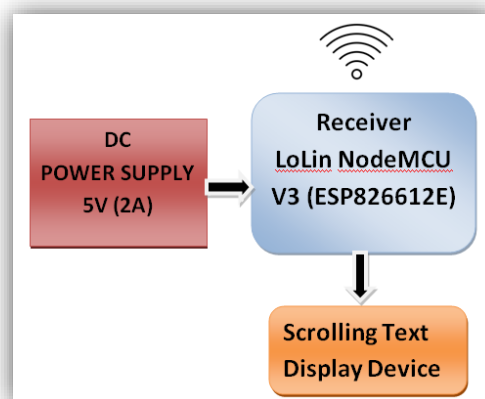


Fig.2 Receiver Block Diagram

<sup>1</sup> \*Assistant Professor, Department of Electronics and communication Engineering, Government Engineering College, Dahod Gujarat, India

<sup>2</sup> Assistant Professor, Department of Electrical Engineering, Government Engineering College Dahod, Gujarat, India

<sup>3</sup> Assistant Professor, Department of Electrical Engineering, Government Engineering College Bharuch, Gujarat, India

Here the scrolling text electronic device is connected to the internet using IoT technology. Hence it is possible to display text notice or advertisement in real time via a smart phone. As shown in Fig.1, The transmitter is a Smartphone connected to the internet. We need to install an android application which is specially designed for the presented system. In Fig.2, The receiver section is shown which is composed of DC Power supply, LoLin NodeMCU V3 and Scrolling Text Electronic Device (dot matrix display board). Our LoLin NodeMCU is connected to the internet through Wi-Fi module integrated on it. It receives the text sent by Smartphone and then communicates with scrolling text display device for displaying it. It saves text and displays continuously till we send the next text to be displayed.

## II. LITERATURE REVIEW

Zarina, A. R. N. Fazlina<sup>1</sup> and M. N. M. Shazwan Raymond, Lim and Wong [2] worked on developing wireless dot matrix display. They designed a prototype of Bluetooth based noticeboard. The paper shows their design of an android application compatible with Bluetooth interface. Also, schematic and PCB design of the controlling board is presented. The designed prototype tested for time display with RTC interface at different distance between transmitter and receiver. The typical range of Bluetooth is about 10 meters however the presented result claim that about 16 meters they communicated. The limitation of their work and other Bluetooth based systems is that they cannot communicate longer distances more than 10 meters [1].

Mrs. T. Veiluvanthal and Mr. S. Mohanraj presented in paper design of Wireless notice board based on GSM modem. GSM modems are used to receive messages displayed from a remote place. Along with GSM, a microcontroller, display Communication technology simple LCD is used. The limitation of the presented work is there is always the requirement of GSM sim card and its recharge to transfer and receive the message. Also, the coverage area for mobile networks plays a key role limiting to communicate. Another disadvantage of the prototype and its actual product implementation is that the product becomes bulky and space consuming due to GSM modem size [2].

ALUKO Oluwadare A, GANIYU Mutiu and ADEJOLA A have done research and presented the development of a microcontroller based multipurpose billboard. It is enabled with a short message service (SMS) with GSM-900 model. Also, an audio alert sound has been incorporated to alert customers for new messages. As discussed above there are limitations of Network issues and bulky products and dependency on sim cards are there. The presenters have also specified one limitation of their work that they do not have any control on unwanted some unsolicited promotional calls and messages to be displayed [3].

Shripati Vyas, Raunak Jangid, Rajat Janwa, Kunal Prajapat and Vishal Singh Dahiya presented a study of home automation system based on Bluetooth and Arduino technology. Its purpose is to enable control of home electrical appliances via Bluetooth enabled smart phones. The system is designed with a Bluetooth connectivity model, an Arduino uno board, and other sensors. The Arduino board is a microcontroller-enabled board that controls the appliances with relevant programming and interfacing with sensors. However, the work is limited to appliance control where certain numbers or codes are sent for controlling the devices and Bluetooth has limitation of range for communication [4].

Iwayemi A. a, Olokun M. S. a\* and Alalade A. O. presented IOT Based Digital Display Board. The presented work uses wifi technology to send text messages to display boards. The prototype uses a wi-fi card, Microcontroller ATMEGA32 and Light Emitting Diodes. The design first tested on simulation and then prototypes were made. The design works fine with display notices wirelessly. Some of the limitations of the work and designed prototypes are the used Wi-Fi card is external to the microcontroller unit. It makes design bulky and not energy efficient. Another drawback of the work is that they have used ATMEGA-32 IC and its designed PCB for communication that are required addition program loader and complexity of programming the board [8].

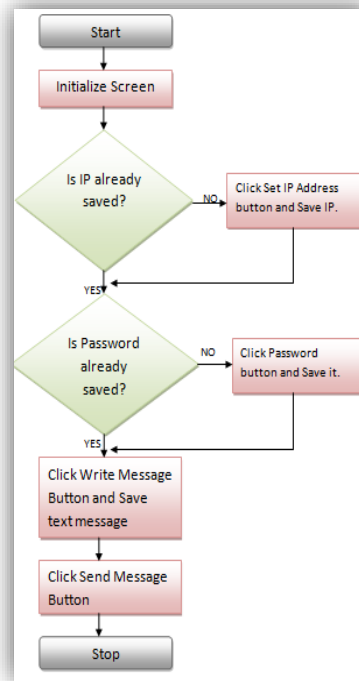
## III. DESIGN OF IOT TEXT TRANSFER ANDROID APPLICATION

MIT App Inventor is an intuitive, visual programming environment that allows everyone to build fully functional apps for Smartphones and tablets [9]. In ai2appinverter or MIT App Inventor we can choose different tools which can make applications. Total design is divided into two parts: (a) Block mode (b) Designer mode.

a. Designer mode contains button for one click event. Upon clicking the button, we can make some decisions. It also has text boxes which can be used for typing text and displaying on Smartphone. It



**Fig. 3 Sample to design Android application**



**Fig. 4 Procedure to send Text Message**

provides labels to display some text based on specific decisions. It has one tinydb tool that can be used to store IP address and password as well as previous text that has been transferred by individual.

b. In Block mode we will have Built-in blocks available regardless of which components are in our project. In addition to these language blocks, each component in our project has its own set of blocks specific to its own events, methods, and properties. Users can use these and make decision-based task execution which leads to our system for Text transmission.

Above Fig.3 shows basic front-page UI of the application that includes IP address setting, message write button, current IP address assigned and the name of App. Developer. Fig.4 shows the flow chart that indicates the procedure of how the android application works and the steps to operate the designed application. When we open the application, it shows the initialized screen as shown in Fig.3. Then follow the following steps.

1. If new user, then click on Set IP Address button and save IP is assigned to the receiver. If already saved, then go to step 2.
2. If password is not set, then enter secured password and save it. If already saved, then go to step 3.
3. Click write message button and write message then press save button.
4. Click Send Message Button if you want to send the text message to be displayed on a remote display.

#### IV. PROGRAMMING LOLIN NODEMCU V3.

The research considered has incorporated the use of an IoT-enabled board, LoLin NodeMCU, interfaced serially with a dot matrix Display device. IoT is an emerging technology which allows its users to control the hardware through the internet and easily connects to the cloud and allows easy access to use the devices remotely. [13] The advantage of choosing this board over research considered in [8] is that the Wi-Fi antenna along with ESP8266 is integrated on a single board that makes it energy efficient in terms of Power usage and provides better operating time if operated over a battery device. Also, it makes it a compact product in actual rather than a prototype if we consider its space

requirement. The Programming of LoLin NodeMCU which contains on board ESP826612E requires a) Arduino IDE and b) ESP826612E library.

a) Arduino IDE is an open-source platform available free to use and develop hardware projects. It is used for building electronics hardware projects. Many Arduino IDE (Integrated Development Environment) compatible electronic hardware and boards are available in the market. To program such Arduino

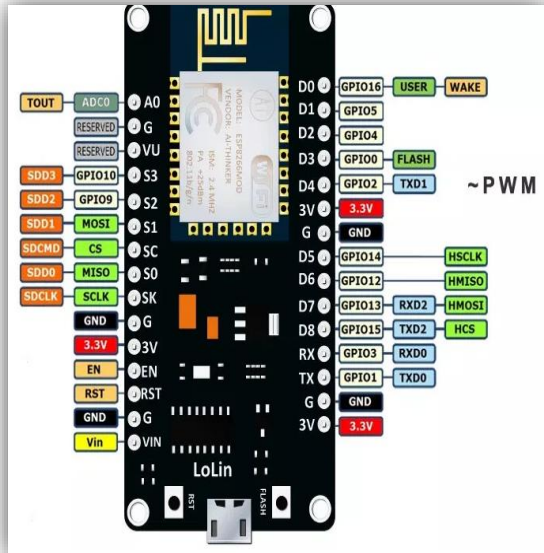


Fig. 5 Procedure how receiver coding works

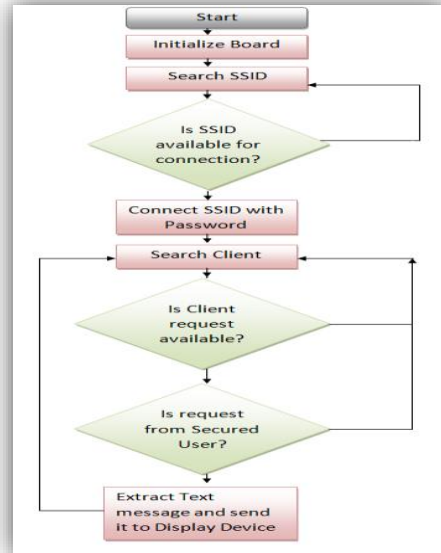


Fig. 6 Procedure how receiver coding works

compatible devices Arduino IDE runs on your computer, used to write and upload computer code to the physical board considered.

b) The library brings support for ESP8266 chips to the Arduino IDE environment. It lets us write sketches using familiar Arduino functions and libraries and run it directly on ESP8266 which is integrated on Node MCU and no external microcontroller required. The library and its useful ready-made functions are quite helpful to researchers or developers to prepare a dedicated program. ESP8266 Arduino core comes with libraries to communicate over Wi-Fi using TCP and UDP, set up HTTP, mDNS, SSDP, and DNS servers.

NodeMCU is an open-source firmware and development kit that helps to prototype our IOT product with Arduino IDE. Its advantage is that it is Arduino IDE platform compatible that makes it easy to program. The library support reduces the time required for development. This board has all facilities available to develop wireless device control and communication. The Development Kit is based on ESP8266, integrates GPIO, PWM, ADC etc. all on one board. Micro USB low-cost WI-FI that is less than about INR 500 WI-FI MCU ESP8266 integrated and easy to be prototyping development kit. NodeMCU provides the best platform for IOT application development at the lowest cost., Arduino-like hardware IO: Advanced API for hardware IO, which can dramatically reduce the redundant work for configuring and manipulating hardware.

In Fig. 6, the flowchart of the receiver side coding is shown that represents systematic steps involved in the design of code. The code is written which follows the following procedure.

1. Initializes hardware and search for predefined SSID specified in ROM and connects it. After internet connection establishment a local IP is assigned which required for communication over internet.
2. Finds continuously whether any client request is available or not. If a client request is available, the request is stored.
3. From saved client request, code checks that is it requested from specified password protected user or any random user. If secured user request, then go step 4 and if random user neglect request.

4. Extract text message interested to be display and removing other content.
5. Send it serially to scrolling text electronic device with 9600 baud rate.

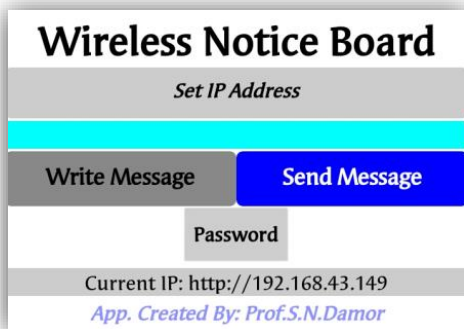
V. PERFORMANCE COMPARISON AND RESULTS

**Table-1 Performance comparison of IoT Notice board vs other.**

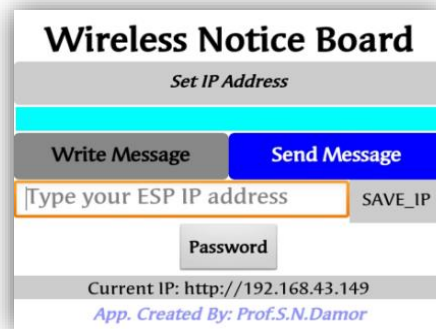
Method	Range	Hardware	Limitation/ Remarks
<b>Wired</b>	Few meters	Physical Wires used	Do not have Mobility
<b>Bluetooth (Wireless)</b> [1],[4]	Approx. 10 meters	Bluetooth Module used	Cannot used beyond 10m
<b>Wi-Fi (IoT)</b> [8]	At any distance	Wi-Fi (IoT) module used	Not Energy efficient, Bulky, Design complexity
<b>Wi-Fi (IoT) (presented)</b>	At any distance	IoT Node MCU with integrated Wi-Fi is used	Energy efficient, compact design, less design complexity

The results presented here are the actual prototype in working condition. Here some other methods of Text notice display compared with the presented IoT method of notice display. As shown in table-1 the research presented in [1] is based on bluetooth communication and worked on only appliance control. Similarly research presented in [4] have done research and developed the prototype based on bluetooth technology based wireless device control. Both research having limitation to send data over approx. 10 meters range from transmitter/sender. The research considered in [8] is also a very good implementation of wireless notice to digital display and obtained a very good results of communication. However having some limitation in terms of energy efficiency, product space requirement and design complexity. The research and analysis considered and presented in this paper is alternate and efficient solution to the problems that are available in research [8]. The presented research and implemented prototype of the wireless notice board is consuming less power due to all hardware for communication available on a single chip, compact design in terms of space requirement and reduced design complexity.

Snapshot of software designed and step by step operation it is shown here. The working hardware photos also presented where “Hello I am IoT Notice Board” text is sended and it is displaying on board.



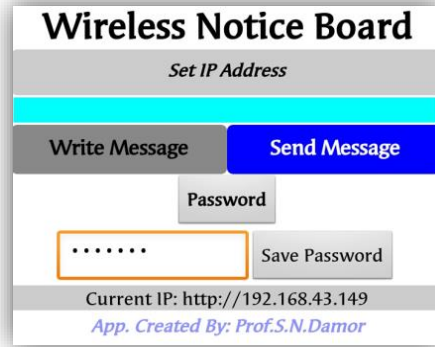
**Fig. 7 Initial Screen**



**Fig. 8 IP Address Block**



**Fig. 9 Message Typing Block**



**Fig. 10 Password Block**



**Fig. 11 Message sent Label block**



**Fig. 12 Text display on notice board.**

## VI. APPLICATIONS AND LIMITATIONS

Some wireless flexibility of text message display applications listed below.

- School and colleges Student notice board
- Railway station train arrival display
- Bus station bus arrival/departure display
- Bank customer service token number display
- Airport text message display
- Important Notice display on public places
- Running bus/train next arrival station display.

There are some practical limitations listed below and probable solutions.

1. Internet connectivity is required continuously for reliable connection and distant access.
2. If IP is dynamic, then we need to read the assigned IP each time to communicate with device. Hence a possible solution is IP assigned to NodeMCU required being static so that anyone who is authorized can access it.
3. One who knows the tricks to Jam Wi-Fi SSID can interfere the device communication.

4. Feedback here is not included because of limitation of display device which has no feature of reading message. So, we cannot have confirmation on the sender's side that whatever we sent is the same text without error displaying on display device.

## VII. CONCLUSION

IoT enabled scrolling text notice/advertisement has wide practical applications. Mainly it provides us wireless flexibility to display any text at very distant place wherever we get internet connectivity. The presented work has focused the designed prototype for student notice board for school or college use. It is presently put at E.C. department, Government Engineering College Dahod for testing and working fine. The used IoT enabled Node MCU board with inbuilt WIFI connectivity made the prototype compact. Additionally designed actual product will be very compact and energy efficient. The presented design is very economical in price to have such facility compared to other designs considered under literature review. It provides real time important notice display to students from faculties using their android smart phones.

By some modification in future, it can be possible to explore and implement feedback from receiver back to sender so that the sender can have conformation what is displaying on board. Another research can be done on timing duration of the displayed notice so that after certain time it will be discarded from the notice board.

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