IoT based Wireless Notice Board Using Raspberry Pi

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Abstract. Information dissemination using digital notice board plays an imperative role in this digital world. This work is primarily aimed at developing a wireless information board for displaying and broadcasting the announcements and notices that the user sends from the Internet using the IOT technology. By providing a sufficient power supply, the Raspberry Pi, node MCU and LED display work properly and the display is controlled by the android application. The application can be used by connecting it to the internet and this enables the admin to send the information from wherever in the planet and could be visualized in a matter of seconds. The admin uses the app by setting the correct username and password for WIFI. For sending information, PC or mobile phone are utilised and at recipient end, raspberry Pi is connected to the Web. The admin can send the data in the form of text or voice, which in turn would be displayed on the distant noticeboard. The LED display is to display the text/voice that the user has sent and the speaker is to announce the received text message. The displaying text would be scrolling in the display. By using the text to speech software, announcement the text that is scrolling on the LED screen become possible. Earlier the Wi-Fi notification board had been used and thereby experiencing a limit on coverage. In this proposed method, the Internet is used as a means of communication and no coverage problem exists.

1. Introduction

Information board plays a vital role in displaying information in all educational institutions and most of the offices. Compared to the conventional type information display methods which are paper based with a digital information board, we can make sure that data/information passes to everyone. The issues challenged through the inexpressive wooden or formal form information boards can be curtailed by the enactment of our digital information board. Due to the acclaim of the most modern technologies, being hi-tech, like internet, we choose the internet as a source for relocating data. The title Internet of things (IoT) is developed out of two words "internet" and "things". Internet is a wide system of the computer networks to serve large number of people around the globe. Things can be anything embedded with electronics like household items, vehicles. IoT allows interconnecting and data sharing between these things. The integrated Computing architecture and the capacity to interoperate within current internet networks are plain distinguished for any computer present in the IoT network. In order to ensure security, login credentials would be provided where a username may be email address or any name, and password type is alphanumerical, which competes the drawbacks of previous noticeboards especially in the authentication mechanism. The only one person who is
authorized to send data through vice pr text is the admin. The output monitor unit, P10 LED display is interfaced with Raspberry Pi, which makes it possible to visualize the texts in large screens. This is not only an electronics development but also a method to attract people to pay attention to the important things happening inside the college, schools, or companies and it also plays an important way in getting the information reached to the people in just fraction of seconds. Because of the merits of Internet, the sender would deliver a reply worldwide. There are no restrictions on information sharing in terms of range or distance. Even though there are many advancements in the field of digital notice board using Bluetooth, Zigbee, GSM and so forth, there are many drawbacks associated with this and it could be overcome only with the newest technology called Internet of Things.

2. Related Works
In the year 2020, few researchers along with Dr. Surendiran [1] worked with internet-based display and has developed an IoT-based Message Scrolling LED Display. The proposed system is to design displaying message using ATMega8 microcontroller and IoT. Internet is used for transferring the message from the user to microcontroller. They developed a wireless information board that displays messages sent from the user mobile application. But that is not secured, anyone can misuse that application.

In the year 2019 [2] C. Preethibha M.E, Dhanasekar. L, John Rencinapreethi, S. Madhan Kumar, Swetha.S, has developed a Wireless Notice Board using Raspberry Pi. In this they used a Raspberry Pi for displaying message on led display by using an android application. In this proposed system it can only display the message but cannot announce it. In the year 2016, Neeraj Khera, Divya Shukla, [3] has developed a wireless advisory board based on Automaton (Android). The targeted model aims to show a message in the display using an Arduino Uno microcontroller. The mode of transferring data in this is through either Bluetooth or WIFI. In this proposed system the data can passed only when the user connected to the Bluetooth or WIFI of the microcontroller. So, the data can only pass when the user is nearby the setup.

In the year 2016, Abhishek Gupta along with few researchers [4] have developed the GSM based wireless notice board. GSM technology, Raspberry Pi technology and LCD monitor are used in this project. The mode of transferring information is through GSM technology. But the GSM technology is not reliable in transferring information. In the year 2016, advanced version of notice board was developed by A. Meenachi and other researchers [5], by using the state-of-the-art technologies like Wi-Fi / Bluetooth Technology. They have used an Arduino microcontroller. The mode of transferring data is through either WIFI or Bluetooth. In this the information can be passed only when the mobile is connected to the same WIFI network or Bluetooth. In other words, the information can only pass when the user is near the notice board.

In the paper [6] GSM technology is used for transferring the message but there arises a drawback of delayed transmission of message. LED display is used for displaying the message. In the year 2015, Darshankumar C, Dalwadi, Yash Teckchandani.et al has developed a Large Screen Wireless Notice Display System. Raspberry Pi is used to display the message. The messages were conveyed used SMS. In this method they did not provide any authentication so it can be misused by anyone.

In the year 2015, using the Bluetooth and ZigBee technology, compact and short-range wireless notice board has been developed and it was an outbreak for the conventional notice board. The ATmega32 microcontroller is the heart of this system. The LCD displays is used to display the received message. In the year 2015, Jaiswal Rohit et.al., has developed an advanced digital Notice Board using GSM technology that can control the display board and also plays vital role to handover the data from authenticated user by using the mobile technology. The heart of this scheme is the Atmel AT89S52. The text the consumer sends to the microcontroller is sent by the prevailing technology at that time called GSM technology. The main drawback associated with GSM is the delay in message display and that deprives the emergency instructions to be reached to the people on time.
3. Methodology

3.1. Proposed System
This paper proposes an IoT based wireless notice board. The operation of this system is to display and announce the text message received in the Raspberry Pi which is sent by the user from the mobile application and the message is passed to the display through node MCU. The android application is created using java language. A web link is created to establish the connection between the Android Application and LED display. The GPIO pins are used for the connection between the LED display, Raspberry Pi and node MCU. Speakers are connected using 3.5mm audio jack port in the raspberry pi.

The proposed system consists of Raspberry Pi [7], node MCU, LED display, speaker, Cloud Server Figure 1.

3.2. IoT Technology
It is an advanced technology that helps different objects to be interconnected and can be operated remotely in real time with different sensors. It is one of the fast-growing sectors and it is also one of the technologies used in industry 4.0. The thing in the IoT can be anything like an Air Conditioner which is assigned with an IP address or anything which has been assigned with an IP address and have the ability transfer and receive data without any help of human & intervention. IoT works assigning an IP address to the desired device and connecting to other devices through internet.

Figure 1 shows the data transmission of IoT in which an air conditioner is connected to the internet through a modem. An IP is assigned for the AC and the AC is connected to the cloud server by using this IP. The cloud URL is connected to the mobile IoT application [8]. The AC can be controlled through the application from anywhere at any time around the world because it is connected to the internet. The operations performed by the user through the app and data which are all collected by the air conditioner are stored in the cloud which can be viewed for future purposes.

![Figure 1. IoT data transmission](image-url)
3.3. Transmitter Section
The application can be using by connecting it to the internet and it must be connected to both node MCU also. The admin can use the app by setting the correct username and password for WIFI. The transmitter section consists of two. They are

- Android Application.
- App Cloud.

**Android application**: An android application is developed and used for controlling the wireless notice board. It requires the internet to convey the messages. The application created using java language. The IDE used is android studio. [9]

**App Cloud**: The android application is integrated with app cloud. It is a cloud platform which is used to store previous messages. The user can see the list of previous messages which are transferred through the android application by the use of app cloud.

3.4. Receiver Section
The node MCU automatically connects to the WIFI if the admin sets the correct username and password. Then type the desired text which should be displayed on the board and touch send button. The message is communicated to the raspberry pi using the app cloud. The message is first sent to the board named node MCU from the raspberry pi. Node MCU is used because raspberry pi needs to rerun the program whenever it turns off and it needs many requirements to operate like external monitor, mouse, keyboard and power supply. In other words, laptop or computer needed to operate whenever the raspberry pi turns off. The microcontroller is connected to LED display. The LED display is to display the text that the user has sent and the speaker is to announce the received text message. The displaying text would be scrolling in the display.

The receiver section consists of four. They are

- Raspberry Pi 2 Model B
- Node MCU
- P10 LED display
- Speakers
Raspberry Pi: It acts as a mini computer with a small and compact embedded board established by the Raspberry Pi Foundation in partnership with Broadcom. It is first manufactured in the United Kingdom. The main aim of the company was to encourage the education of fundamental knowledge of computer science in schools and in non-industrial nations.

**Raspberry Pi Model 3B:** It is a microprocessor. It has the following specifications – Processor 64-bit quad-core with a speed of 1.4 GHz and a memory of 1GB RAM, Bluetooth 4.2, and USB & HDMI ports and also supports Wi-Fi. It has 40 GPIO pins. In this project Raspberry Pi 2B microprocessor is used to convert the text to speech announcement through a speaker and to display it in LED display. Since it has 2 HDMI ports, we can connect two displays at the same time. It can be programmed using Raspbian OS.

**Node MCU:** Node Microcontroller Unit (Node MCU) is a microcontroller. It can be used for all IoT systems. It has WIFI module in it. It is a low-cost microcontroller. It can be programmed using Arduino IDE. [10]

**P10 LED Display:** It is a 32*16, high brightness & low power consumption LED [11] of red colour display. It has a totally of 512 LEDs. The dimension of the display is 320(W) x 160(H) x 14(D). P10 LED Display module is the simplest way to combine any size of Outdoor or Indoor LED display board. The display can be extended by adding displays horizontally and vertically.

**Speaker:** It is connected through a 3.5mm audio jack to the microprocessor. Text-to-speech software is applied to the message received in the Raspberry Pi. Which converts the text message into audio format and audio is given to the speaker to announce.

**Raspbian OS:** It is a Debian based OS. It is specially developed for operating raspberry pi.

**eSpeak:** It is a text-to-speech software used for converting the text into audio.
4. Experimental Results

The user can access the application by providing the correct username and password and the node MCU will automatically connect to it. The user can give the input by typing or by using voice input method. The sent message is transferred to the microprocessor through the node MCU. The microprocessor the text is transferred to the LED display to display it. Then from the microprocessor converts the received message into audio format [12] by using eSpeak software and the audio message goes to the speaker.[13]
5. Conclusion
In this digitized world, it is vital to implement most modern digital notice boards which outweigh the traditional paper-based notice boards. The key concept of this proposed work is to develop a display board wirelessly that exhibitions the information sent from the mobile application used by the user. Thus, the project gives the easiest approach of sending and displaying information in necessary places like schools and colleges. By using the text to speech software, announcement the text that is scrolling on the LED screen become possible. Earlier the Wi-Fi [14] notification board had been used and thereby experienced a limit on coverage. In this proposed method, the Internet is used as a means of communication and no coverage area problem exists.

As a future work, solar panels can be included as a renewable source of energy, which enables the digital notice board to work even there is a power shut down. It can be an alternate source of power. If the power goes off it will automatically take power from the solar panel charged batteries.
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