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Two Way Wireless Mesh Network Data Sharing between ESP8266 without Internet

Sujay A. Alaspure[1], Rahul N. Borse[2], Prof. Vikramsingh R. Parihar[3]

U.G Students, Department of Electrical Engineering, PRMCEAM, Amravati, India[1,2]

Assistant Professor, Department of Electrical Engineering, PRMCEAM, Amravati, India[3]

Abstract: Internet of Things is one of the hottest topics in both industry and academia of the communication engineering world. On the other hand, wireless mesh networks, a network topology that has been discuss for decades that haven't been put into use in large scale, can make a difference when it comes to the network in the IoT world today. This paper gives insight into how IoT networking is a unique combination of wireless personal area networks. This paper discusses the design of an automatic wireless mesh networking which can run without any base server or an internet connectivity. These devices are capable of creating its own Wi-Fi hotpots of radius of 100 meter. The aim of this technology is to gather the traffic data, environmental data within a city locally without the cost of any networks.

Keywords: ESP8266, Internet of Things, IOT Networking, PIR motion sensor, Wireless Mesh Network

I. INTRODUCTION

In an IoT Network, some of the major technologies are wireless personal area network viz. 6LoWPAN, ZigBee, Bluetooth. In addition, on a slightly larger wireless network scale, Wi-Fi, wireless LAN technology, is going to be used and needs to be supported. Today, most of the research of the IoT enabled devices is mainly of the data collecting and processing units namely creating new sensors. However, the network that integrating the IoT devices to the Internet is usually left untouched by simply using existing computer network solutions such as WLAN or Bluetooth. These computer networks are not designed for low-powered devices such as remote sensors even these IoT devices are considered to be mini computers. The single point of failure nature of these Network makes the entire system extremely vulnerable when it comes to disasters or even difficult environment as the sensors may need to be deployed into some hardly reachable locations. Also most of these remote IoT devices are small, and the devices are usually battery powered, so the power-hungry network options such as using cellular network or satellite are also not ideal for most of the remote scenarios in the IoT networks.

A Wireless Mesh Network (WMN) is a communications network made up of radio nodes organized in a mesh topology instead of star topology used in most of the networks, according to Akyildiz, X. Wang in the book of Wireless Mesh Networks. [1] The distributed network nature of the wireless mesh network with its simple configuration is ideal for be implement in the IoT networks to take advantage of its expanded range as well as keep the hardware design minimal using smaller network module. Such networks also are more robust in the harsh environment as the network are distributed with no single central point of failure. In this paper author will discuss the research done in WMN by using ESP8266 Wi-Fi device module and data transfer between the nodes. We have used 5 different devices to communicate with each other through Wi-Fi. These devices create its own access point for the other nodes. Each node is connected with each nearest node. One node can be connected to 8 diffident devices and so on the connection will increase in the multiple of number eight as shown in fig 1.

II. WIRELESS MESH NETWORKS

The main difference between WMNs and star networks WMNs are wireless networks, which have the ability of dynamically self-organizing and self-configuration, and with mesh connectivity automatically establishing among nodes in the network while the conventional star network has a star topology which means all the terminal nodes are connected to a single central point which connects to the upper level of the network. The Fig. 1 illustrated the topology of two networks.

The existing mesh networking are using a large size of router and devices. These also require a server controller and routers. Which has high cost.

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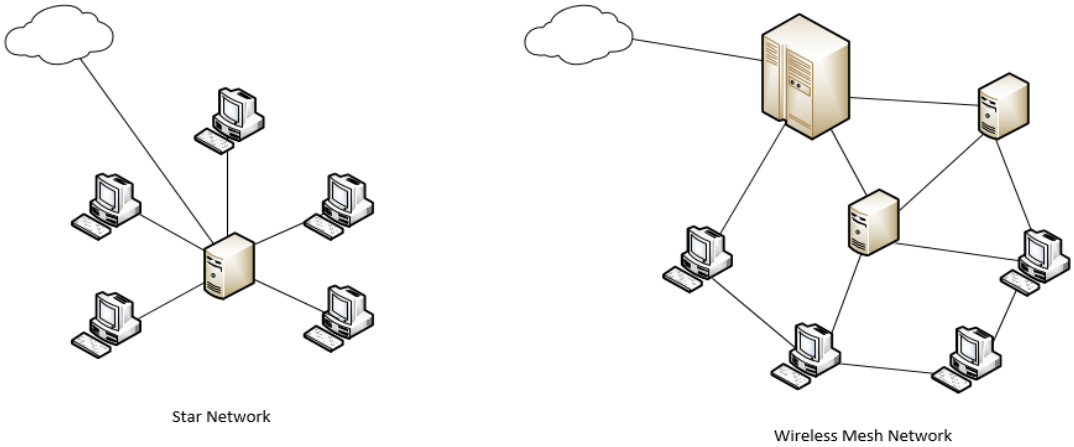

Fig. 1: Difference Between Star and Mesh Network

III. OUR APPROACH

The aim of this proposed approach is to design an automatic wireless mesh networking which can run without any base server or an internet connectivity. These devices are capable of creating its own Wi-Fi hotpots of radius of 100 mtr. The aim of this technology is to gather the traffic data, environmental data within a city locally without the cost of any networks.

The procedure to gather the data is as follows:
True ad-hoc networking easyMesh is a true ad-hoc network, meaning that no-planning, central controller, or router is required. Any system of 1 or more nodes will self-organize into fully functional mesh. The maximum size of the mesh is limited (i think) by the amount of memory in the heap that can be allocated to the sub-connections buffer… and so should be really quite high.

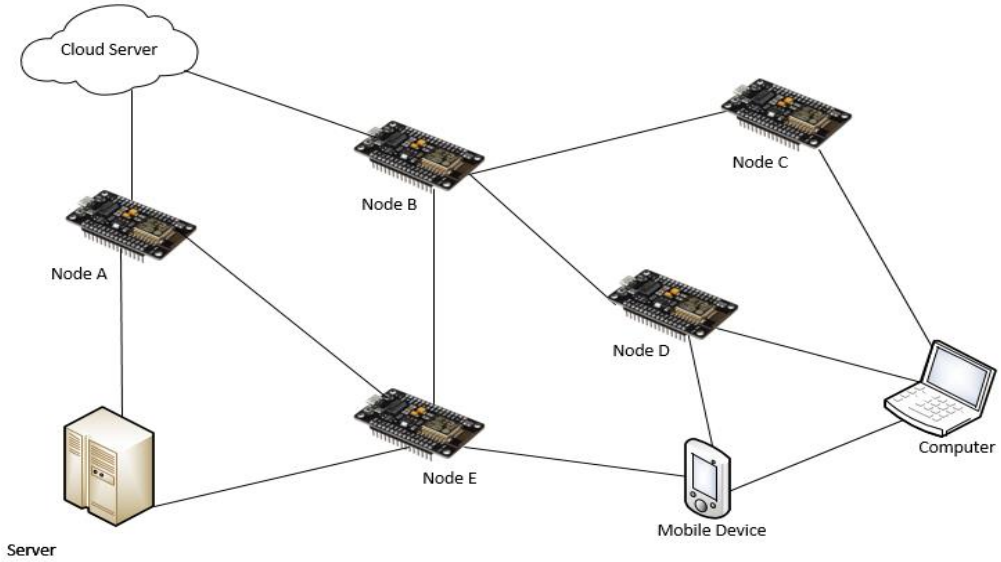

Fig. 2: Network formation of ESP8266

1. The devices creates its own network sphere, now the other devices which are within the range of this sphere get connected to each other and in such a way each and every devices get connected to each other and for a network.
2. Then each of the device get the value from the various sensors which are attached to it.
3. After getting the values each device make a broadcast and share the values to the network in the encrypted format.
4. So in this way each device broadcast its own value to the network along with its chipID.
5. Now any authorized person within the city will have a login credentials. The person will connect hes device to the network using that credentials and can watch the broadcast data from each device along with the location where the data is coming from.

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Design Features of ESP8266:

Espressif Systems' Smart Connectivity Platform (ESCP) is a set of high performance, high integration wireless SOCs, designed for space and power constrained mobile platform designers. It provides unsurpassed ability to embed WiFi capabilities within other systems, or to function as a standalone application, with the lowest cost, and minimal space requirement.

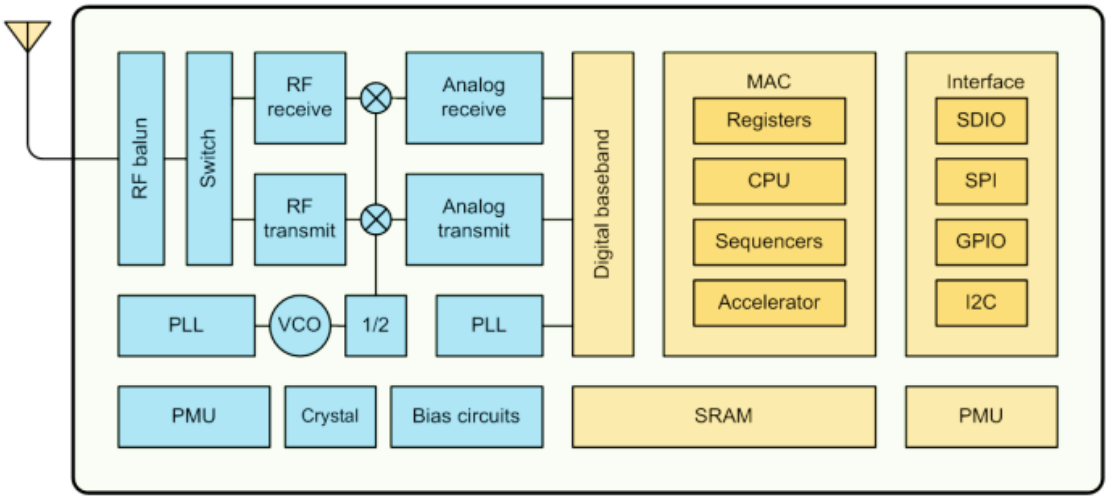

Fig. 3: Internal Block structure of ESP8266

It works on protocol 802.11 b/g/n, WiFi 2.4 GHz, support WPA/WPA2. it has Integrated low power 32-bit MCU, Integrated 10-bit ADC. [2]

Frequency range of about 2.4G-2.5G (2400M-2483.5M) [2]

Circuit Diagram:

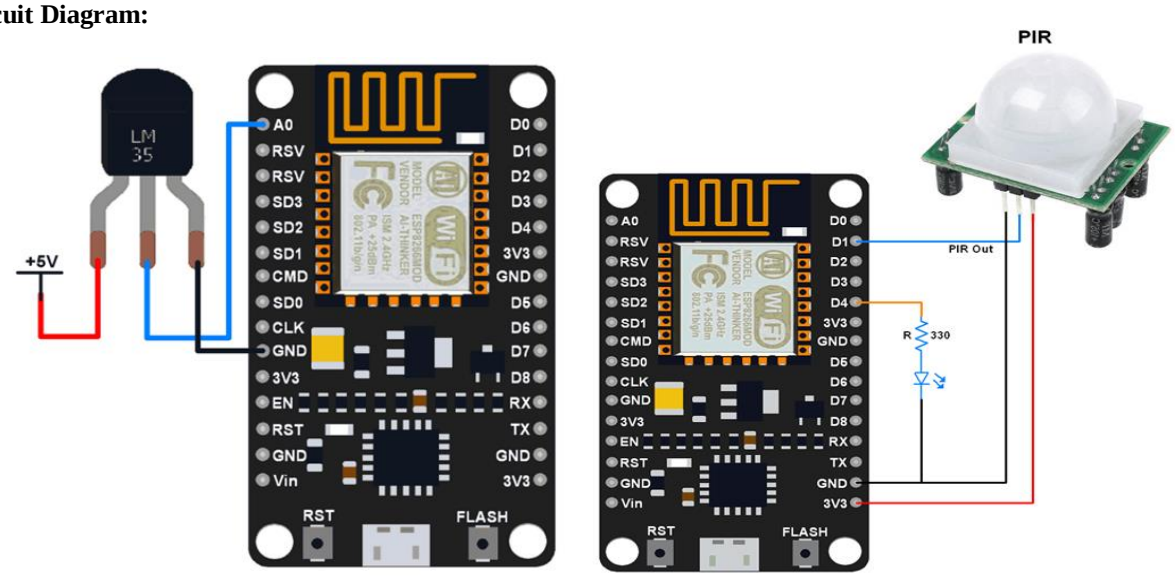

Fig. 4: Circuit Diagram

IV. RESULTS

The proposed method uses a small prototype module of ESP8266. all the modules generate its own Wi-Fi field of diameter around 100 mtr. And every module also connected with the nearby devices. In such a manner each and every devices get connected to each other using Wi-Fi. By this devices can share the data between them without using any internet connection. If we have to plot the data over the website or over any cloud server. We have to connect just one module to the internet and all of the data of every device will be shared to the cloud.

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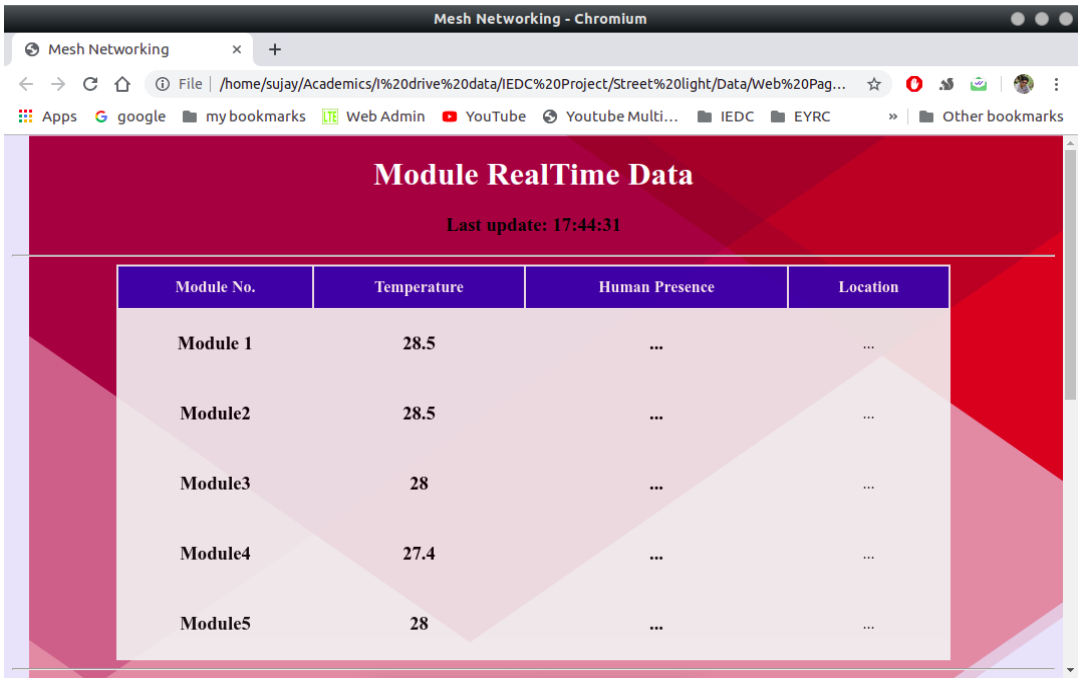

Fig. 5. WebApp

V. CONCLUSION

In this paper we discussed the wireless mesh topology for IOT system with the use of ESP8266. The main approach is to broadcast the environmental data in the network to analyse and correct prediction within the city without use of any separate internet service. The methodology discuss in this paper is very cheap as compared to the existing technology and having almost zero transmission cost. Future expansion of this technology can be done for increasing the number of sensors and data speed. Also deep learning algorithm can be used to automatic prediction of the activities

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BIOGRAPHIES

Sujay A. Alaspure is an Electrical Engineer. He has received the B.E degree in Electrical & Electronics from Sant Gadge Baba Amravati University, India, in 2019. His domain of research includes Electrical Engineering, Digital Image Processing, Machine learning, Electronics, AVR.

Prof. Vikramsingh R. Parihar is an Assistant Professor in Electrical Department, PRMCEAM, Badnera-Amravati having 7 years of experience. He has received the B.E degree in Instrumentation from Sant Gadge Baba Amravati University, India, in 2011 and the M.E degree in Electrical and Electronics Engineering, Sant Gadge Baba Amravati University, India, in 2014. He is editorial board member of more than 25 prestigious and recognized journals and life member of ISTE, HKSME, ICSES, IJCSE, the IRED Engineering New Zealand and IAENG. His domain of research includes Electrical Engineering, Instrumentation, Electrical Power Systems, Electrical and Electronics Engineering, Digital Image Processing, Neuro Fuzzy Systems and has contributed to research in a commendable way by publishing more than 50 research papers in National/International Journals including 4 papers in IEEE Conferences. He has written 8 book chapters and also authored 2 books.