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Review on Programming ESP8266 with Over the Air Programming Capability

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Abstract:
In the proposed system the first goal is to have an OTA (over the air programming) capability implemented on the gateway to configure ESP8266 nodeMCU after they are deployed in field. The node will be an embedded platform with wifi capabilities. Second goal is to have a mesh of nodes that where some nodes act as relays and some as fringe nodes. The mesh will connect to the internet via a Raspberry Pi gateway.

Keywords: ESP8266 wifi module, Raspberry pi, OTA, IoT.

I. INTRODUCTION

The ESP8266 is programmed by connecting it to the computer or laptop. If there is a need to change the functionality of the esp working in the network due to some problem or any modifications required then this has to be done by removing the esp from the network and then programming it explicitly by connecting it to the PC. This is a very tedious task. So there is a need for a smarter approach. In this paper it is suggested that while the esp is connected in the network one should be able to program it wirelessly using Over The Air (OTA) protocol. This can be done by using raspberry pi gateway. By using this approach, the working of the network is not affected or ceased and the main advantage is that one can remotely program the ESP8266 [3]. Not only program but one can add a new node (ESP) in the network or remove an existing node without disturbing the working of the network. In the second part, there is a creation of a mesh network of all the nodeMCU's in the network. Presently, all the nodes communicate with the gateway directly but now each node will communicate with every node present in the network and the node which is nearest to the gateway will communicate with the raspberry pi gateway.

II. OBJECTIVES

- **Wireless programming:** The nodeMCUs in the network should be able to be modified or updated without having the need to remove them from the network. this programming of the nodeMCUs can be done wirelessly using OTA.
- **Uninterrupted network's** the ESP8266 is programmed wirelessly over the air, undisturbed network working is achieved. As the nodes are not disconnected from the network for any modifications the consistency is maintained.
- **Reliability:** A reliable system and reliable network must be achieved. The working of the network must not be affected during addition of new nodes or removal of existing nodes. Communication between nodeMCUs and the gateway should be effective.

III. RELATED STUDY

The proposed system is based on the technlogy of Internet of Things. This technology says that any physical entity on the Earth can be connected to the internet and communicate over the network [2]. Distinctive identification of devices is provided. In IoT devices or objects can exchange information with each other wirelessly. The basic components of Internet of Things are sensors (senses the data), actuators (perform the action), software programs, electronics and network connectivity. Sensors sense the devices that are connected in the network and collect information from them. This collected information is forwarded to the actuators who actually perform the actions. Remote control over the network devices results in bringing the real world entities into the computer domain. This is beneficial in many other aspects. Connectivity over the network should be consistent and maintained for efficient and effective communication. The proposed system is implemented on the basis of Internet of Things technology. MQTT is Message Queuing Telemetry Transport. It is Client Server protocols based on publish-subscribe messaging. Basically MQTT is a protocol used for effective communication between client and server. The basic MQTT components are MQTT client, MQTT server and MQTT broker. There is no direct communication between the client and the server, MQTT broker acts as an intermediate entity. The message sender is referred as publisher and the receiver is referred as the subscriber [2]. The connection is commenced by sending two types of command messages – connect () which is sent by the client and connack() which is an acknowledgement sent by the broker as a response to the client. The mandatory fields included in the connect () message are clientID, clientSession and keepAlive and the fields included in the connack() message are sessionPresent and returnCode. 802.11 is a wireless IEEE standard for wireless local area network. WMN (Wireless Mesh Network) is created by 802.11s IEEE standard [6]. Home automation includes automation in the working of the basic household devices like lights, fan, washing machine, oven, dryers, refrigerators, ACs etc[7]. These devices can be remotely accessed from any handy device like mobile phones. The switches and sensors of these devices are connected to the gateway and this gateway is communicates with the mobile phone with the help of which these devices can be controlled

wirelessly. Home automation also has its applications in security domain for home security systems. Embedded system is a computer system which executes a single committed real time task. These tasks are implemented for achieving security and usefulness [8]. Embedded system is basically a combination of software programs and hardware. The firmwares referred to in these embedded systems are set of instructions which are present in Read-Only Memory.

IV. SYSTEM ARCHITECTURE:

The proposed system's architecture is made up of a number of ESP8266 wifi module, raspberry pi, router and a wifi network. All ESP8266 wifi modules in a network are connected to each other in a mesh topology. Raspberry pi acts as a gateway. The closest nodes communicate with the raspberry pi. Programmer can program the ESP8266 located in a network wirelessly. The figure 1 shows the system architecture.
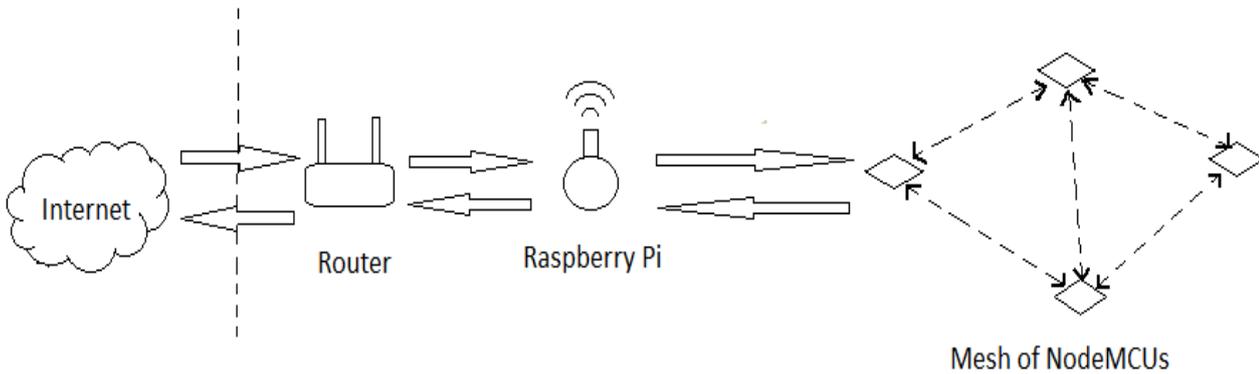

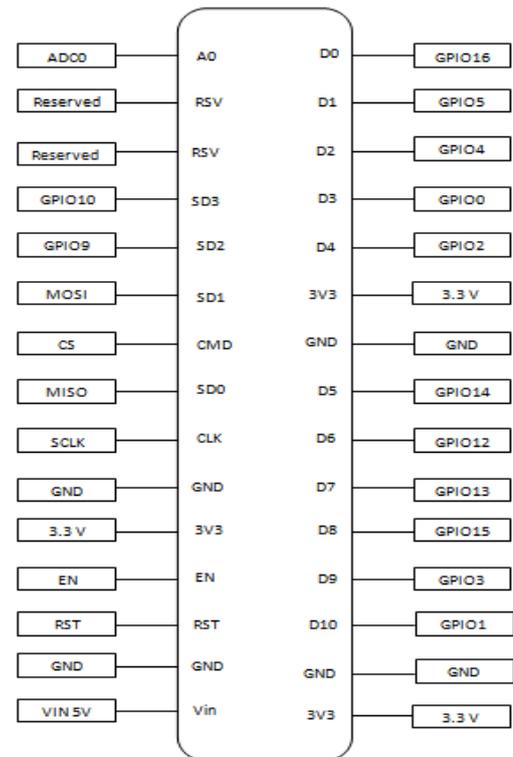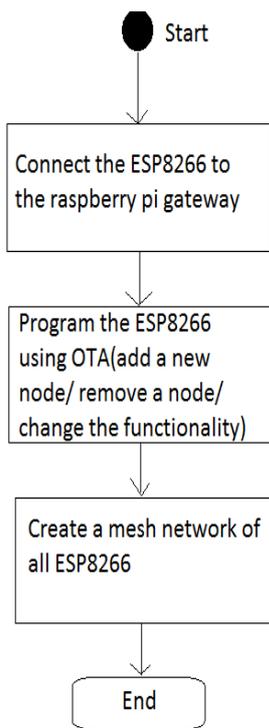**FIGURE .1. SYSTEM OVERVIEW**

IV. ARCHITECTURAL FLOW

V. COMPONENTS OF PROPOSED SYSTEM

- **ESP8266 Wifi module:** The system uses ESP8266 wifi 12E module which has 30 pins. Basically ESP8266 is a System on Chip[4]. Esp8266 wifi module consists of TCP/IP protocol stack which enables esp8266 to use the wifi network. The ESP8266 are programmed in advance with a set firmware of AT commands. This wifi module can be embedded in sensors as they provide optimum processing power and storage capacity. The figure 2 shows the pin diagram of ESP8266.

FIGURE . 2. PIN DIAGRAM OF ESP8266

- **Raspberry Pi:** The Raspberry pi is a ARM-powered computer which is small in size single board made in the UK[5]. The aim was to create a device with low cost which would improve understanding of the hardware as well as programming skills. Though the computing power of raspberry pi is not as fast as laptops, it fulfills all the functionalities at a very reasonable consumption of power. The Raspberry pi was basically created for the Linux OS. The raspberry pi is used as gateway in this paper.

VI. CONCLUSION

This article can give a smarter way to enhance the programming capabilities of ESP8266 wifi module.

This article focuses on overcoming the traditional way of programming which is inconvenient and tedious. It also suggests creating a mesh topology of all the nodes in the network so that every node will be able to convey its message to the target node directly.

VII. FUTURE SCOPE

The suggested solution to the conventional approach for programming ESP8266 can be implemented in a network consisting of a very large number of nodes. This implementation can be done in an efficient manner with minimum cost.

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