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Intranet Based Multiple Equipment Controller with Text Panel

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ABSTRACT

Nowadays internet is a basic need for all. More smart devices are emerging to fulfill our modern needs. We depend on them. Due to security vulnerabilities of internet we have to take necessary precautions to avoid any undesirable actions. The emergence of smart IOT devices requires internet to communicate and anyone can breach our devices at any time over internet. If server down occurs then it affects us. So here we explain how to control wireless electrical appliances and wireless text display from distant position by making use of the WIFI technology throughout the Intranet (Local Area Network). We are using UDP (User Datagram Protocol) to broadcast messages through the local area network using a microcontroller (nodeMCU). This is received by multiple microcontrollers to process messages and takes necessary actions. Thus we can control devices in real time (low latency) over entire subnet even without internet connectivity. This project combines the use of embedded hardware, high level software programming and the IEEE 802.11 standard protocol for wireless communication (WIFI). With a single message we can control a specific microcontroller or a group of microcontroller or all microcontrollers in a campus.

Keywords: *UDP, Broadcast, LAN, WIFI, Subnet, Intranet.*

1. Introduction

This is highly unwanted to use internet since we can achieve same thing with intranet with high efficiency. Do not confuse with internet. Intranets are private, secured networks that are used to share information effectively within a company. The goal of an intranet is to ease document sharing for people within an organization. Key Differences between Internet and Intranet. The Internet provides unlimited information which can be viewed by everyone whereas, in Intranet, data circulates within the organization. The Internet provides access to everyone. An intranet is a private network that belongs to a firm or an institution. Examples for intranet services like Microsoft SharePoint, Huddle, Igloo, and Jostle. While some services are open source and free of charge, most intranet solutions require a monthly fee. The cost is usually related to the number of users within the intranet. Since we are creating our own service from the scratch for intranet, we are reducing the cost for subscribing to the existing intranet service.

We have a server and it will send commands to the clients over the entire subnet, whereas client will listens to server continuously.

2. Methodology

Broadcasting is the method we use to send commands to the clients. It is the distribution of required content to a dispersed audience via any electronic mass communication medium. So all audience get the content, but the intended audience will use the content and others discard them. It is an established set of rules that determine how data is transmitted between different devices in the same network.

UDP is a communication protocol used across the Internet for especially time-sensitive transmissions such as video playback or DNS lookups. It speeds up communications by not requiring what's known as a "handshake", allowing data to be transferred before the receiving party agrees to the communication. This allows the protocol to operate very quickly. It is connectionless and unreliable protocol. We use UDP protocol to broadcast strings from server to client.

3. Location Based Naming Scheme

To identify multiple devices, we are proposing naming schemes instead of MAC id. This seems to be more convenient than using MAC id in our project, since we are in need to control a group of devices with same name at the same time.

3.1 Location Based

There are 7 characters are used for location-based naming. On that first five characters are used to specify building(s). 6^{th} character is used for specifying floor(s) in that building(s) and 7^{th} character is used for specifying room(s) in that building(s) in that floor(s) at which we are going to keep our devices. The range become supports up to 10 floors including ground floor (0 to 9 – 6^{th} characters). Supports up to 52 rooms in a floor (A to Z and a to z – 7^{th} characters). Supports any number of combinations of characters for first 5 characters to name buildings.

4. Proposed System

Routers and Extenders are used to provide wireless connectivity throughout the campus area Our clients and server are connected together through the routers and extenders.

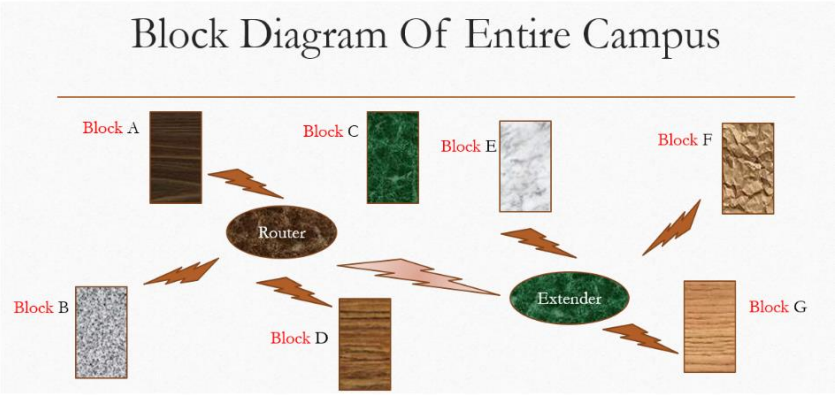


Fig.1 Campus block diagram with routers and extenders

This diagram is resembles the entire campus where we are placing our NodeMCU. It will act as clients and server. We are placing each client NodeMCU on each required location (One per room) and a server NodeMCU on the hands of a responsible person who controls them.

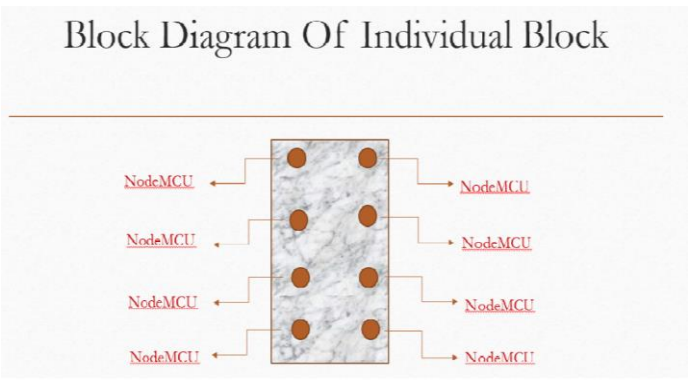


Fig.2 Diagram of Individual Building

4.1 Transmitter (Server)

Used to broadcast a string over a particular subnet or multiple subnets. This server is connected to a router using Wi-Fi connectivity. And the router coverage is extended over the entire campus as different subnets. At first we have to create message based on naming schemes we have discussed earlier.

4.2 Receiver (Client)

Receive messages from transmitter (server) and decode them to get control and location data and act accordingly. If the location information decoded by a device and the location information given to that device differs, then it will discard the message, else it will make required actions. The transmitter and receiver use same naming schemes as we specified earlier.

5. Results

NodeMCU (Microcontroller) is coded as client and server. Arduino UNO (Microcontroller) is coded to interface noticeboard. 3.3v to 5v logic conversion is done by using Arduino UNO to control 5v relay since nodeMCU is 3.3v logic. These are entirely coded using Arduino IDE. Hence we have successfully completed the project and now it is working as intended.

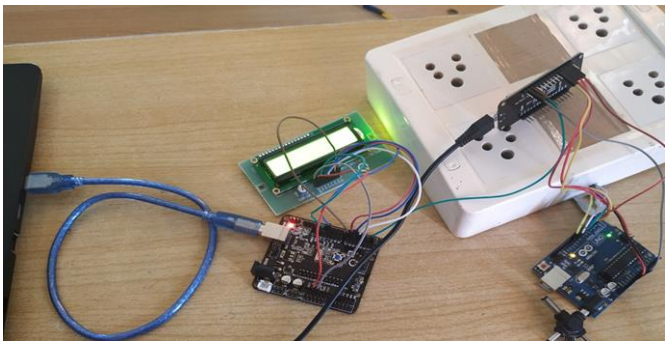
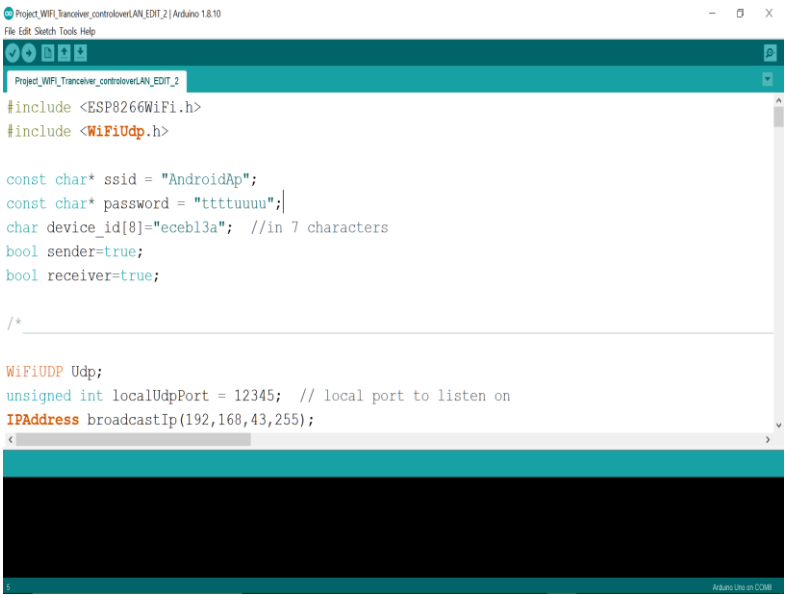


Fig.3 Project Wiring

Here is the program for nodeMCU

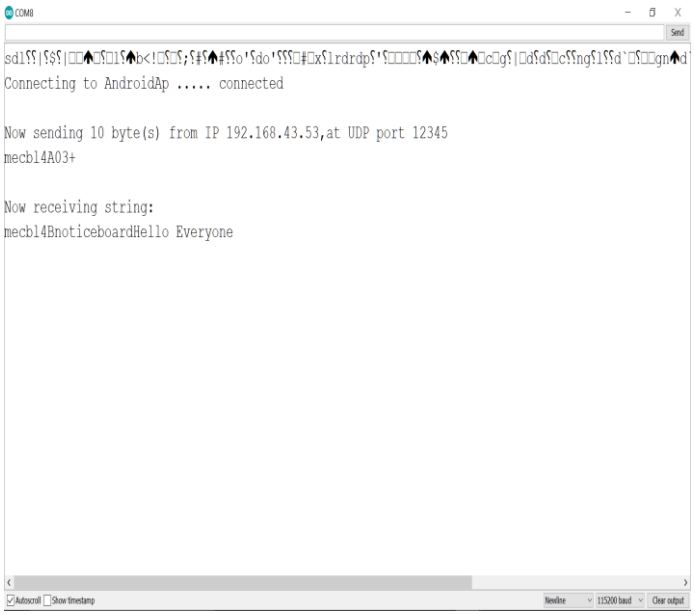


In the above picture, we are giving our network's SSID and password. Then we are providing name to the device based on location of device and then we have to specify whether it should work as sender (client) or receiver (server) or both (sender and receiver). We also can configure port and IP address to use.

Device configuration setup in Program

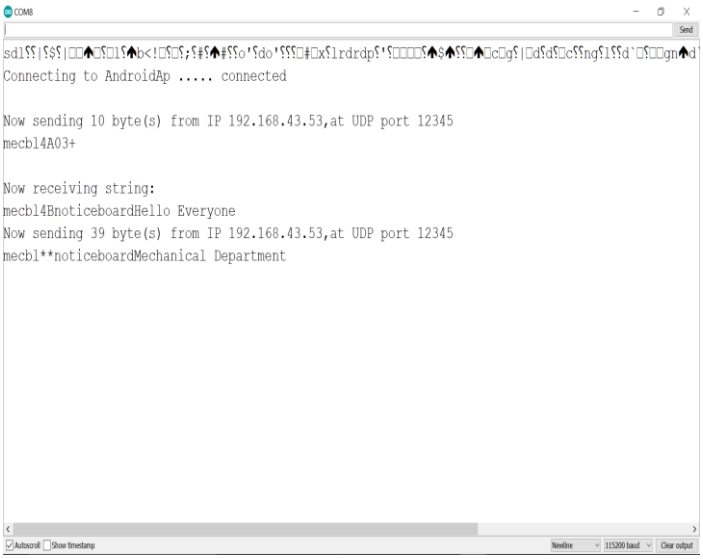
Here NodeMCU is configured as both sender and receiver so it is capable of sending messages to other NodeMCU modules on same network. At the same time it receives messages and act accordingly to them.

In the below picture we are sending a string "mecbl4A03+" from this device. This message affects device(s) in location "mecbl" (mechanical block), "4" (4th floor), "A" (classroom). "03+" (It is used to turn on third electrical appliance connected to the affected device).



Output in serial monitor

In the received string, the first 7 characters "mecbl4b" contains location information. That matches with device's location "mecbl4b".

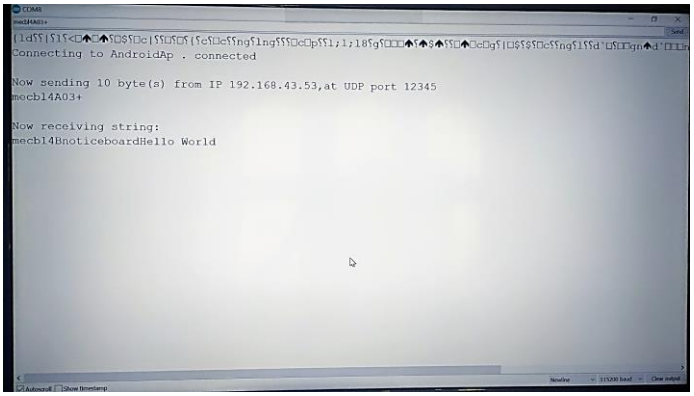


So the device will react to the command. Next 11 characters "noticeboard" is used to shift control to noticeboard. Remaining characters specifies text to be displayed in noticeboard (i.e. "Hello Everyone").

Other than mecbl4b this device will also react the same way if the received string contains first 7 characters as "mecbl*b", "mecbl4*", "mecbl**", "*****4b", "*****4*", "mecbl*b", "*******".

Output in serial monitor

In the above picture we are again sending a string "mecbl**noticeboard Mechanical Department" with this device. The first 7 characters have location information. This will affect devices in location "mecbl" (Mechanical block), "*" (all floor), "*" (all class room)" So all devices in mechanical block is affected. Next 11 characters shifts control to noticeboard. Remaining string specifies message to be displayed in noticeboard connected to all affected devices (i.e. "Mechanical Department").



This shows how data transfer occurs among nodeMCU modules

6. Conclusion

This project describes the overall view of controlling equipments over LAN using NodeMCU and Arduino. NodeMCU (Microcontroller) is programmed as client as well as server. Arduino UNO (Microcontroller) is programmed to interface noticeboard. 3.3v to 5v logic conversion is done by using Arduino UNO to control 5v relay since nodeMCU is 3.3v logic. 3.3v relay is also available in stores. These are entirely coded using Arduino IDE. With a single message we can able to control large group of devices. In future we have idea to make this project as simple as possible with less amount of hardwares to cut down the cost. We need to invest on a NodeMCU, a 3.3v Relay Module and a notice board (optional) per room. Hence we have successfully completed the project and now it is working as intended.

Declarations

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Competing Interests Statement

The authors declare no competing financial, professional and personal interests.

Consent for publication

We declare that we consented for the publication of this research work.

Code availability

The programming code that we have used for this research is available and authors are willing to share when it is required.

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