Digital Notice Board And Lab Automation Using Raspberry Pi

Akash Pandya[1],   Sushrut Ahire[2],   Prof. Sumita Gupta[3]

[1,2] *Student, Department OF Electronics Engineering, K.C. College Of Engineering And Management Studies And Research , Kopri, Thane (E).*

[3] *Department OF Electronics Engineering, K.C. College Of Engineering And Management Studies And Research, Kopri, Thane (E).*

Abstract - Notice boards are really common things seen in many public and private institutions like colleges, malls, railway stations, public libraries etc. But updating these manual notice boards by sticking new notices and removing outdated notices is a difficult job. A separate person is needed to take care of this notices display. This project is about digital (Advance) noticeboards. The project is built around raspberry-pi which is the centre of the system. Wi-Fi is used for Data transmission. At any point the user has the ability to add or remove the notices that are either to be displayed or notice board or are already displayed on notice board. A transmitter authorized PC/mobile is used for sending notices. Raspberry Pi is connected to the internet using Ethernet cable. NodeMCU ESP8266 acts as a client while raspberry pi is the broker of this project. Several relays are connected to MCU, these relays are interfaced with other devices such as printers, RFID door lock systems for the purpose of full lab automation. Receiver which is the Raspberry Pi module only receives messages only if they are sent by the authorised user. Wireless has become a popular technology allowing electronic devices to exchange data wirelessly using a computer network that includes high speed wireless connections. The data is received only from authenticated users. Then it sends to the raspberry pi.

1. Introduction

Automation includes all the electronic components, middle wares, and electronic devices that can be interconnected to have centralized control in a workplace or house. These components and devices include heaters, temperature and humidity sensors, lights, RFID door locks and printers that are interoperable and can be interconnected or interfaced with one another or/and central user using high speed wired/wireless internet connection and different internet protocols. Home automation is used to provide solutions to meet the needs such as energy management and lighting optimization
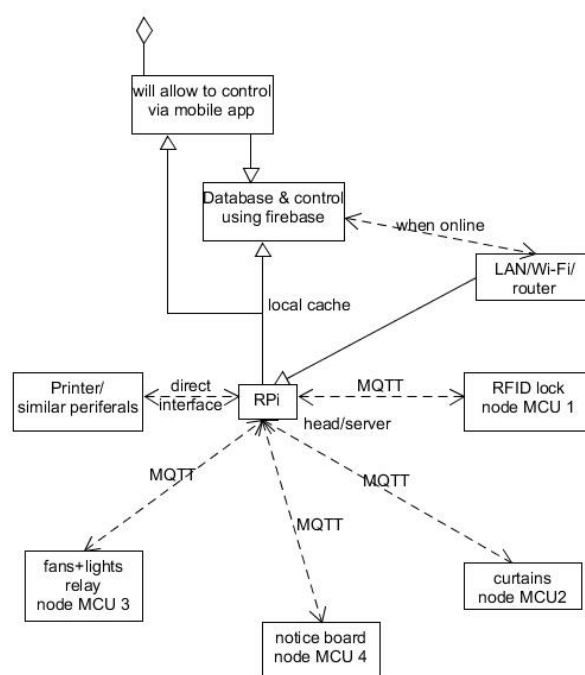
1.1 Block Diagram

Fig.1: Block Diagram

2. Problem Definition

The RPi can be accessed by accessing its IP address using the same WiFi to which RPi is connected. The RPi can be accessed by mobile using an E-Cell automation app designed in android studios. The main objective of this project/system is to develop a fully automated Laboratory which can only be operated by the authorized user in such a way that it is simple, comfortable and does not require any direct wired connection between automation components/devices (printer, LCD display, lights and fans, curtains) and

RPi itself. Since the wired connections are to be avoided, different protocols are to be used to wirelessly control these devices and also to establish connection between RPi and components itself.

2.1 Goals and Objectives

1. The main goal is to provide Exciting new innovative ways to Interact with the different objects in the laboratory.
2. The main objective of this system is to develop a fully automated Laboratory in which things like lights, fans, door locks and digital notice boards can be accessed and controlled remotely using an android application.

3. Hardware Requirements

3.1 Hardware Specification

3.1.1 Wi-Fi Module

The Wi-Fi module is the connecting link between user and RPi.. The Wi-Fi module uses the latest 802.11n wireless technology. The Wi-Fi module also supports data rate upto 150Mb/s.

3.1.2 LCD Monitor

The LCD monitor will be used to display the notices. Once the user uploads the documents to be put on notice board the RPi will display those documents on the LCD Monitor.
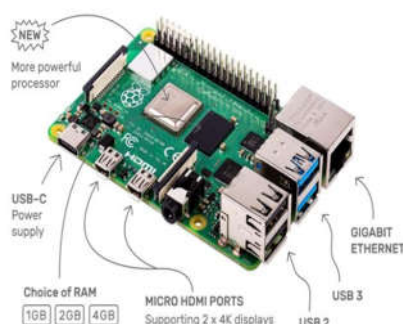
3.1.3 Raspberry-Pi

Fig.2: RPi 4 Card

Raspberry Pi or RPi is a very powerful ARM based microcontroller. In this project we use the RPi 4 version of the RPi model which is the latest among all of them. The RPi 4 comes with Ethernet port, a really powerful processor, USB 3, and HDMI ports which makes it a really useful central component when it comes to automation. RPi is basically like a minicomputer. In this project we establish a connection between RPi and node MCU (Microcontroller Unit) to carry out or perform different objectives and make a fully automated laboratory.

3.1.4 Node MCU ESP8266 (Microcontroller Unit)

Node MCU is a low cost open source IoT platform. We establish the connection between RPi and Node MCU. The RPi and MCU exchange information using MQTT protocol. MCU is the platform where all the different nodes and relay connections lie. We use different nodes for different operations. A node is allocated for a stepper motor which can be controlled by the user to close or open curtains. We also give a node to the RFID sensor which is used to enter the lab through the door lock which means the door will only unlock when the person is keycard holder. Furthermore we can also use this for attendance and visiting records in which the keycard holders credentials will be saved in the database. We give relay connection to the lights and fans to turn them ON/OFF accordingly. All these devices are controlled through an E-Cell android application in which these are considered as topics.

4. Software Requirement

4.1 JSON

JSON (JavaScript Object Notation) is a data structure format. The data are considered as objects with properties and sub-properties. This formalism is close enough and is based on XML and JavaScript.

4.2 MQTT protocol (Message Queue Telemetry Transport)

MQTT is an open OASIS and ISO standard lightweight, publish-subscribe network protocol that transports messages between devices. MQTT provides

publish-subscribe architecture in contrast to HTTP with its request/response paradigm which is really useful in small workplace automation projects. MQTT broker is in charge of dispatching all messages between sender and rightful receiver. The MQTT broker is RPi.

4.3 Google Firebase

Firebase is a mobile application development platform. We use this for real time synchronization of JSON data as well as to build serverless android applications. We can also execute backend code that responds to the events in our database using cloud function.

5. Conclusion

Thus raspberry-pi being a small yet powerful device can work efficiently in automated laboratories. Hence we can develop an automated lab to interact with different aspects and objects present in the lab in innovating ways using an android application.

References

[1]   Li, J., Da-You, L., and Bo, Y., "Smart home research,"Proceedings of the Third International Conference on MachineLearning and Cybernetics, vol. 2, pp. 659– 663, Shanghai, 26–29 August 2004.

[2] https://firebase.google.com/?gclid=CjwKCAjwt-L2BRA_EiwAacX32TRLb2rITyW7Eh4W7MBZ7A EMRpEx2gVGyQPY8op5Qui-S7hF5HkVTRoCiCMQAvD_BwE

[3] Setting up your Raspberry Pi - Connect your Pi.

[4] Kumar, Abhijeet, and Apoorva Sharma. "Internet of Life (IOL)." (2015). ISBN 978-93-5156-328-0

[5] Yuan, Michael. "Getting to know MQTT". *IBM Developer*. Retrieved 13 October 2019.