RFID Based IoT enabled Event Management System

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Abstract:

RFID stands for Radio frequency identification, It is a very simple and inexpensive piece of technology that can be used to make applications such as RFID Based door lock, RFID Based attendance system.

To change the trend, we thought of building an RFID based IoT Enabled Event Management System that not only monitors the entry log, but with the help of IoT technology it can also sends the log and entry data directly to the dedicated servers that can handle all the authentication, authorization and management makes whole process seamless.

Keywords: Internet of Things, RFID, NodeMCU, I2C Module

1. Introduction:

To build an RFID Based IoT Enabled Event Management System that not only monitors the entry log but with the help of IoT technology.It can also send the Log and Entry data directly to a dedicated server that can handle all the authentication, authorization and management making the hole process seamless.

The existing conventional event management system requires workers to manual sign in the attendance sheet every time they attend a event. As common as it seems, such system lacks automation where number of problems may arise. Having a system that can automatically capture workers attendance by flashing their cards at the RFID reader can really save all the raised problems. This is the main motive of our system in addition having online system accessible from anywhere.

2. Literature Review:

RFID (Radio Frequency Identification) technology is one of the types of Automatic Identification and Data Capture (AIDC) method. As AIDC methods automatically identify objects, collect data about them, gets that data directly into computer system, with little or no human involvement. RFID technology uses radio frequency electromagnetic fields to transfer information from an RFID tag to RFID reader using 13.56MHz electromagnetic field for identification purpose.

RFID system comprises of RFID reader, RFID tags and antenna, is used to transmit and receive information through radio waves at a distance without wires. RFID reader can be grouped into three categories: low frequency, high frequency and ultra-high frequency. As per need, RFID tags maybe active or passive tags.

Compare with barcode - RFID provides fast identification, no line of sight, reusable to rewrite or update, higher data storage, higher read rate, multiple reading, durable, maximum distance reading without interference.

In comparison with other identification technologies - RFID technology offers quality, security, supply chain optimization, Better individual identification, better storage flexibility, real time information and better ergonomics.

The IoT is a developing innovation that permits client to control hardware contrivances. IoT is utilized to control the home and industrial gadgets, via computerizing through the web. Raspberry Pi inserted controller is interfaced with a Wireless Local Area Network (WLAN) modulator to get client orders over the web or android application.

NodeMCU is an open source firmware and development board with ESP8266 helps to build IoT products. ESP8266 WIFI module is a low-cost microcontroller with WIFI capability and full TCP/IP stack to make easier IoT platform. NodeMCU have built-in support for wireless networks compared to Arduino and Raspberry Pi.

3. Hardware Requirements

To Build our propsed system RFID Based IoT Enabled Event Management System we need Hardware components.The Hardware Requirements are:

3.1. NodeMCU ESP8266

Fig: NodeMCU ESP8266

NodeMCU is an open source Lua based firmware for the ESP8266 WiFi SOC from Espressif and uses an on-module flash-based SPIFFS file system. NodeMCU is implemented in C and is layered on the Espressif NON-OS SDK.

The firmware was initially developed as is a companion project to the popular ESP8266-based NodeMCU development modules, but the project is now community- supported, and the firmware can now be run on *any* ESP module.

3.2. I2C Module

I2C Module has a inbuilt PCF8574 I2C chip that converts I2C serial data to parallel data for the LCD display.

These modules are currently supplied with a default I2C address of either 0x27 or

0x3F. To determine which version you have check the black I2C adaptor board on the underside of the module. If there a 3 sets of pads labelled A0, A1, & A2 then the default address will be 0x3F. If there are no pads the default address will be 0x27.

The module has a contrast adjustment pot on the underside of the display. This may require adjusting for the screen to display text correctly. Block Diagram of I2C Module is shown below.

3.3. EM18 Reader Module:

Fig: EM18 Reader module

EM18 is a RFID reader which is used to read RFID tags of frequency 125 kHz.After reading tags, it transmits unique ID serially to the PC or microcontroller using UART communication or Wiegand format on respective pins.EM18 RFID reader reads the data from RFID tags which contains stored ID which is of 12 bytes.

Basically, RFID systems categorised as active and passive based on how they are powered and their range.

3.4. RFID cards:

RFID stands for radio-frequency identification. RFID cards are used for applications where tracking or identifying personnel is important or where access control is required. Various RFID frequency bands are utilized in cards today, including 125 kHz low frequencyproximity, 13.56 MHz high frequency smart card and 860-960 MHz ultra-high frequency (UHF).

Fig: Diagram of RFID cards

Proximity cards and smart cards are often referred to simply as "RFID cards." The type of RFID frequency band used depends on the application, factoring in security level, read range and data transfer speed requirements.

4. Software Requirements

To Implement our proposed system RFID Based IoT Enabled Event Management System requires Thingspeak and Arduino IDE softwares.

4.1. Thingspeak:

ThingSpeak™ is an IoT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak. With the ability to execute MATLAB® code in ThingSpeak you can perform online analysis and processing of the dataas it comes in. ThingSpeak is often used for

prototyping and proof of concept IoT systems that require analytics.

Get Started:

Learn the basics of ThingSpeak

Configure Accounts and Channels:

Information on ThingSpeak channels, users, and licenses

Write Data to Channel:

Use the REST and MQTT APIs to update channels with software or devices

Read Data from Channel:

Use the REST and MQTT APIs to read channels using software or devices

Prepare and Analyze Data:

Filter, transform, and respond to data in MATLAB

Visualize Data:

Transform and visualize data in MATLAB

Act on Data:

Use ThingSpeak apps to trigger an action or transform and visualize data.

Specialized Analysis with MATLAB:

ThingSpeak examples that show use of the advanced tools available in add-on toolboxes.

API Reference:

Use the REST and MQTT APIs to update ThingSpeak channels and to chart numeric data stored in channels

5. System Implementation

For Developing the proposed project, RFID Based IoT Enabled Event Management System, the steps required to implement is discussed in this section.

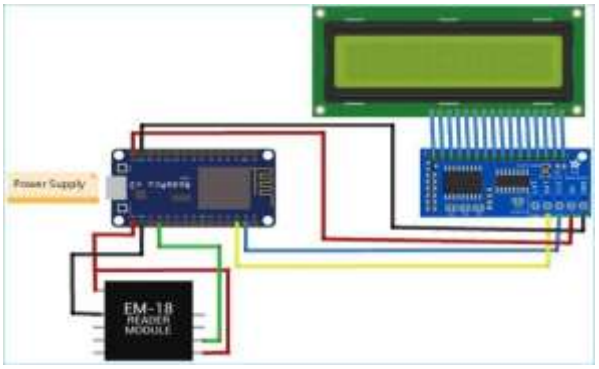


Fig: Circuit Diagram of RFID Based Event Management System

As you can see from the circuit diagram, we have connected the EM-18 module with the NodeMCU with the help of the UART. We have provided power to the board from the Node MCU board as the EM-18 Reader module draws 50mA peak current, the onboard power supply is sufficient enough to drive the module. Similarly, we have connected the I2CLCD with the help of the I2C pins of the NodeMCU and we are also powering the LCD from the NodeMCU module.

6. Circuit connections:

EM 18 reader module to NodeMCU:

- ❖ Connect the vcc pin EM 18 reader module to vin of nodemcu.
- ❖ Connect the TX pin of EM 18 reader module to RX pin of NodeMCU.
- ❖ Connect ground of EM 18 reader module to Ground of NodeMCU.

NodeMCU to I2C module :

- ❖ Connect vin pin of nodeMCU to the +5v supply of I2C module.
- ❖ Connect ground of nodeMCU to the Ground of I2C module.
- ❖ Connect D2 pin of nodeMCU to the SDA pin of I2C module.
- ❖ Connect D1 pin of nodeMCU to the SCL pin pf I2C module.

I2C module to LCD Display:

Connect all pins of I2C module to LCD display in organized manner.

7. Proposed System:

Fig: Block diagram of Proposed System

From the above proposed system, When we place a RFID card near to the EM-18 RFID reader module, the reader module access the data from the card and senses the 12- digit unique code which is already given to the RFID cards. The sensed data will be send to the node MCU to process the data. The node MCU sends the data to the I2C module to display the data on the lcd display.

At the same time, the node MCU performs another operation that the data will be also sends to the cloud storage of thingspeak in the form of Excel sheet. In this way we are implemented our new system based on IoT.

8. System design:

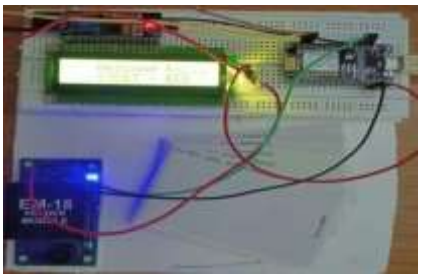
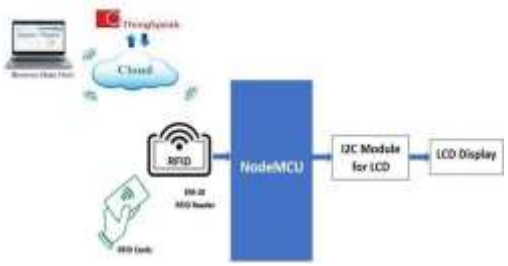


Fig: Over all setup of a proposed system



9. Applications:

The following are the applications where the proposed system can be used.

(i) Factory data collection: The factory data collection (FDC) system consists of the various paper documents, terminals, and automated devices located throughout the plant for collecting data on shop floor operations, plus the means for compiling, and processing the data.

(ii) Used in schools,colleges,industries,etc: RFID attendance system provides wireless identification of stakeholders when they fall in the radiofrequency range of the RFID attendance reader. To mark the attendance automatically, the students or staff need to carry the RFID tag that contains unique information about them such as name/ID number/class/section.

(iii) Object identification and Tracking: Object tracking refers to the ability to estimate or predict the position of a target object in each consecutive frame in a video once the initial position of the target object is defined. On the other hand, object detection is the process of detecting a target object in an image or a single frame of the video.

10. Advantages:

- Keeping track of assets and materials is a challenge for most organisations – whether it is components on a production line, finished products being despatched, industrial containers that need returning, or tools, laptops and other high-value equipment that often go missing. RFID systems offers a fast and reliable way to track them without having to count each

individual item.

- Because data is being collected and uploaded electronically, RFID also avoids transcription errors, duplication of data and “missed items” when used to collect data on large numbers of items simultaneously. The use of cloud-based systems allows everyone in the organisation to see up-to-date data on the whereabouts or status of items. Data can also be shared with customers.

- EM18 RFID reader reads the data from RFID tags which contains stored ID which is of 12 bytes. EM18 RFID reader doesn't require line-of-sight. Also, it has identification range which is short i.e. in few centimetres.

11. Disadvantages:

- Privacy is a concern with the use of RFID on products as it can be easily tapped or intercepted.

- RFID devices need to be programmed which requires enough amount of time. Use of RFID technology at inventory control and for other such applications lead to loss of job.

- The external electromagnetic interference can limit the RFID remote reading. The coverage range of RFID is limited which is about 3 meters.

12. Results:

To test the project, Initially turn ON the NodeMCU and make sure that the Wi-Finetwork is available, to which the NodeMCU will get connected.

After this, a message will be displayed on the LCD showing "Wi-Fi connected". If itis not showing then perform "Diagnostic Check".

Fig: LCD showing Wi-Fi connected

After Wi-Fi connected, you will be prompted with a welcome message viz., SJCET-ECE

Fig: LCD showing Welcome Message

After that, Swipe the card on the RFID reader upon which you will be prompted with a Welcome Message(including person's name & visitors count) on the LCD as shown below. Repeat this process for various RFID cards.

The test results are:

Fig: Display test cases for various RFID cards

Finally, RFID cards data, that is stored can be downloaded from theThingSpeak cloud.

Fig: Data Import/Export wizard from Thingspeak

Data will be downloaded in the Excel sheet with .csv format.

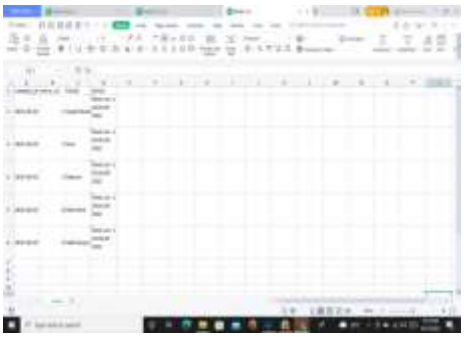


Fig: RFID cards Data in Excel sheet

13. Conclusion:

RFID Based IoT Enabled Event Management System is a prototype that not only monitors the entry log, but with the help of IoT technology, this system can also send the log and data entry directly to the dedicated server that can handle all the authentication, authorization and management making the whole process seamless.

14. Future Enhancement:

With the integration of GPS receiver, futher the project can be extended byincluding location of the user, indicating Latitude Longitude information.

Camera can also be included, so that the RFID cards user can be capturedensuring the safety & providing better sort of authentication.

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