

Faculty of Engineering & Applied Science



SOFE 4610U
Design & Analysis of IoT

Project Final: Architectural Design

Group#: 2

First Name	Last Name	Student Number
Nivetha	Gnaneswaran	100695935
Rodaba	Ebadi	100708585
Munazza	Fahmeen	100701595

Project Description

This project is aimed to make the process of attendance easier and more efficient. The goal is to make an IoT-based RFID Attendance System using the Arduino Board, Adafruit.io platform using the MQTT broker, RFID Module and RFID Cards. Arduino and RFID scanner will work together with the MQTT broker and the Adafruit.io platform to connect and display the attendance data. RFID is Radio Frequency Identification which can then be analyzed from the platform. This eliminates the need for paper attendance which can not be easily manageable. The RFID reader and Tag is also a newly developed mechanism that can be used within this project making it an IoT-based project.

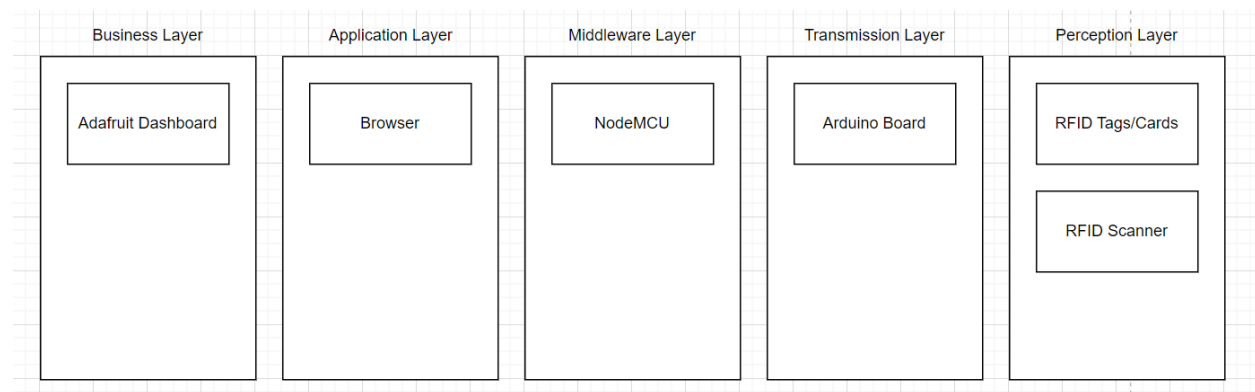
Use Cases

The use cases we will primarily be focusing on is UC-3 and UC-4. For UC-3 our main priority is to make sure that when a card is being scanned, the data is being transferred from the Arduino to the NodeMCU so that it can be logged onto the Adafruit dashboard. UC-4 is similar as in order to view the attendance on the Adafruit dashboard the information must be transmitted successfully.

Use Case	Description
UC-1: Create class session	Instructor will be able to create the class session. This will hold all important information on the class like the meeting times, meeting place, class list etc.
UC-2: Create student profile	When a student's card is read a student profile will be made, which holds their first name, last name, student id and any other additional important information the instructor will need.
UC-3: Log student attendance	When a student's card is read their attendance to the open class session will be recorded. This will hold their student profile and the time of arrival.
UC-4: View student/class attendance	The instructor will be able to view the student's attendance and the total class attendance. There will be a summary report for this, weekly reports can be made.

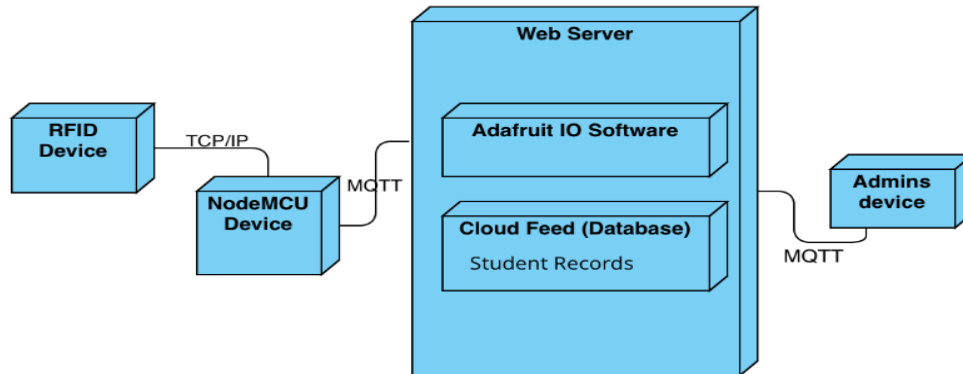
UC-5: Absentee Notification	The instructor will receive a notification when a student who is absents card is not read within the class time.
UC-6: Search student	The instructor will be able to search for a particular student.

Application logical architecture



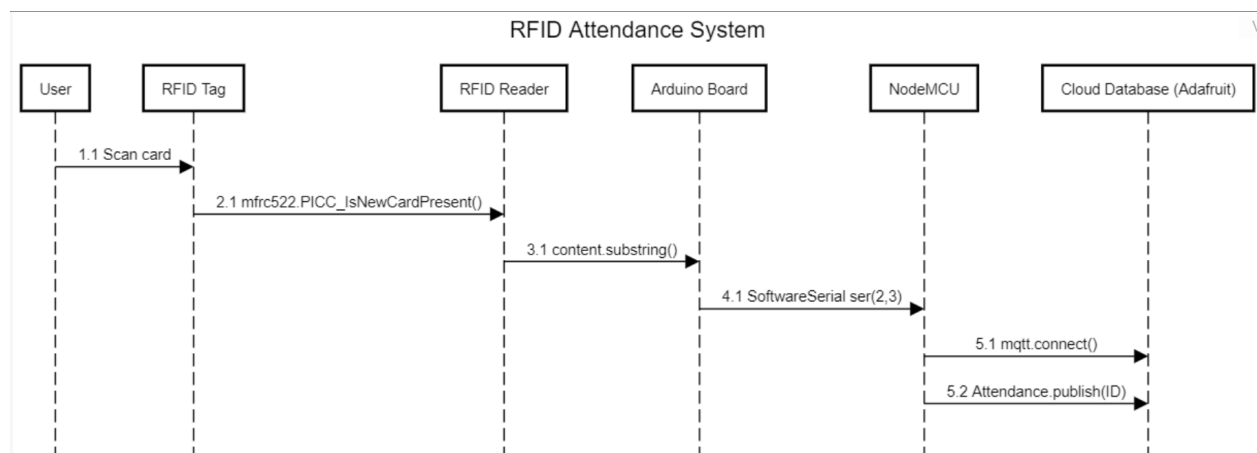
The logical architecture structure consists of five tiers. In the perception layer we have any physical modules apart of the system that the user must interact with, we have the RFID tags/cards that the students will be using and the RFID scanner that will be scanning the cards. In the transmission layer we have the Arduino board because it will transfer the data emitted from the scanner in the perception layer to the NodeMCU in the middleware layer. In the middleware layer we have the NodeMCU as this is where the data received from the Arduino is being transferred to the cloud database. Once a packet is received from the Arduino with the data, that data packet is then sent to the application layer through the wifi shield. Our application layer is the connection with the wifi shield and the browser. Lastly the business layer consists of the dashboard itself which contains the data that was transmitted to the cloud database.

Deployment diagram



This deployment diagram for the attendance system displays the physical architecture applied for the IoT system to function. The UML deployment diagram shown above illustrates how the developed software and hardware components are to be deployed. It clarifies the communications between the nodes which assist the system to work accordingly it was designed to. The nodes in the system's deployment diagram are shown by boxes. These boxes are either software or hardware components and are connected by the type of connection they have with the other components. The nodes are the RFID device and arduino hardware system, the nodemcu wifi module, the web server which includes the online adafruit io software and the cloud database and then the admins device. The adafruit IO software holds the details and information of the attendance system.

Sequence diagram



The sequence diagram covers the use cases we chose to focus on (UC-3 and UC-4). The user will first scan their card, the data from the RFID tag is then read by the RFID reader. The reader will check to see if a new card is present and to read its UID. The RFID reader will then output the necessary information belonging to that specific cards UID onto the Arduino board. The Arduino board will make connection with the NodeMCU through RX and TX. The NodeMCU will then ensure it is connected to the cloud database, once it is securely connected the NodeMCU will publish the attendance onto Adafruits dashboard.