

CHAPTER THREE

METHODOLOGY

3.1 Design Consideration

The proposed RFID Smart Card Reader is a software – hardware hybrid, that detects student ID cards as input, sends this input to the server and return a true or false (red or green lights), depending on what operation was done. The hardware consists of:

- Node MCU ESP8266 Microcontroller
- MRC522 RFID Sensor and its Tags
- A Buzzer
- 9V Batteries
- I/O Switch
- LED's (Red, Green, Yellow, Blue)

The software is a web application hosted on an Apache hosting service built with:

- HTML
- CSS
- PHP
- JavaScript
- MySQL

At the end of development, the hardware should be able to read a student's ID card, send this info to the server, and get a true or false response.

3.2 Summary of Project Methodology

After coupling all the hardware parts and making sure the Wi-Fi connects successfully, the software/web app should be built and the correct API endpoints setup. The hardware should be able to read a student's ID card, send this info to the server, the server

confirms if he or she has performed a task like paying school fees, paying departmental/faculty fees and returns a true or false reply. The hardware device displays this as either Red(false) or Green(true).

3.3 Data Source/Collection

1. **Manual Registration/Entries:** The web app is built to allow Staff and Students to register. This includes assignment of individuals to unique ID cards
2. **Mockaroo Test Data:** Mockaroo is an online service that allows users create mock data, up to 1000 rows, in many formats including: JSON, CSV, SQL and so on.
3. **Usage:** With every card scan, data is stored. The users name, context of use, date, time and so on.

3.4 Hardware Requirements

1. Power supply of 9 to 12 Volts is recommended for the Node MCU Microcontroller
2. The Wi-Fi hotspot name (SSID) and its password, must be set to what is specified for the device to connect successfully
3. A stable internet connection on the Wi-Fi hotspot enabled device.
4. A working RFID tag
5. **Arduino IDE:** This is a free and open source Integrated Development Environment(I|DE) used for programming Arduino based microcontrollers and building IoT devices.

3.5 Software Requirements

1. **VS Code IDE:** This is a free and open source Integrated Development Environment(I|DE) used for programming vast amounts of programming languages through its publicly available extensions.

2. Apache Web Server: This is a free and open source web server that powers a very high percentage of the web. It contains support for multiple programming languages (PHP, Rust) and multiple Database Management Systems (SQL, Postgress)
3. Postman: This is a free and open source tool used for simulating, testing and troubleshooting web API's
4. Google Chrome: This is a popular web browser created by Google. Used for surfing the web and using our web app.

3.6 Block Diagram of Proposed System

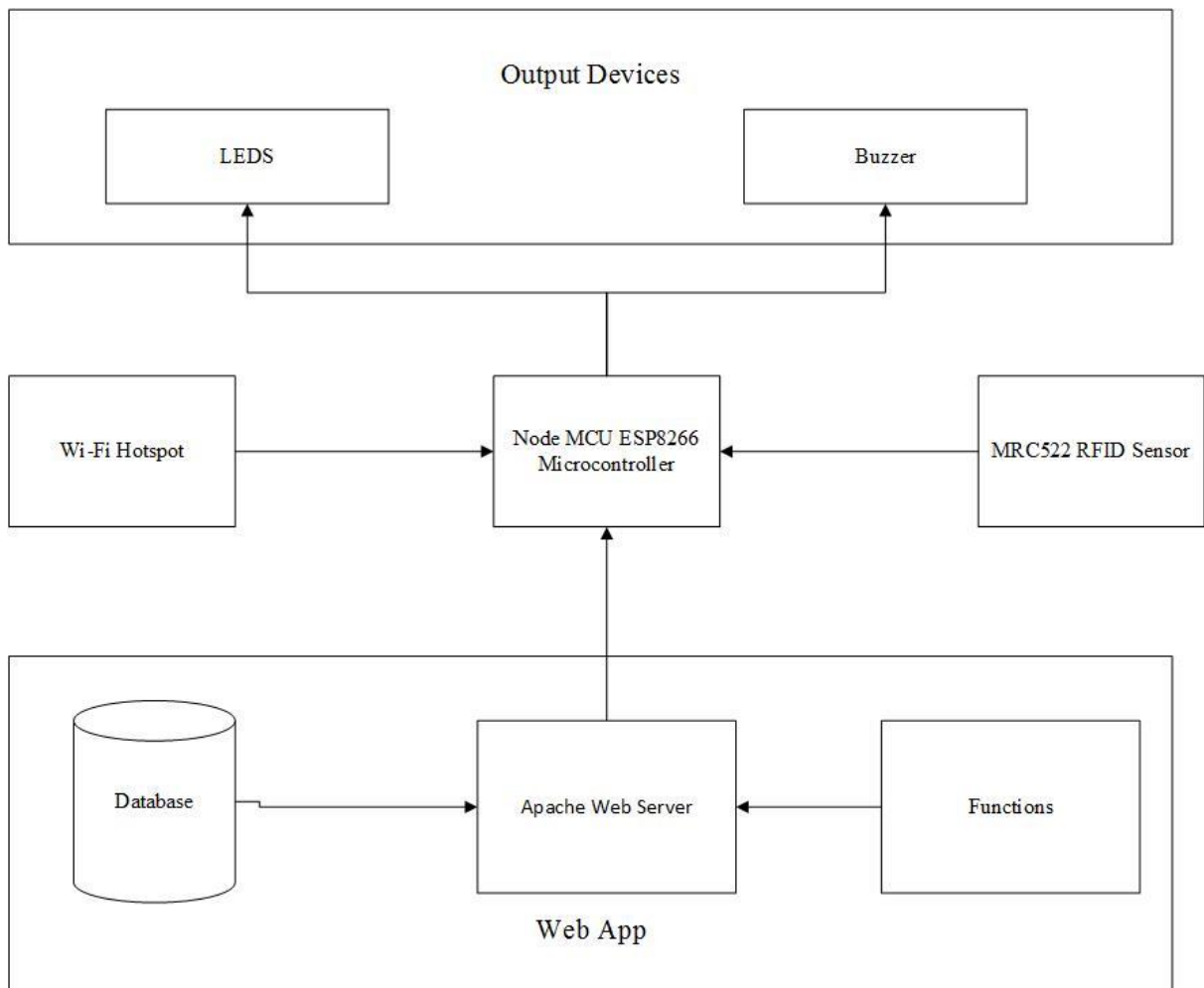


Fig X: Block Diagram of Both Hardware and Software Systems

3.7 Software Universal Modelling Language Diagrams



Fig X: UML Use Case Diagram of Smart RFID Card Reader

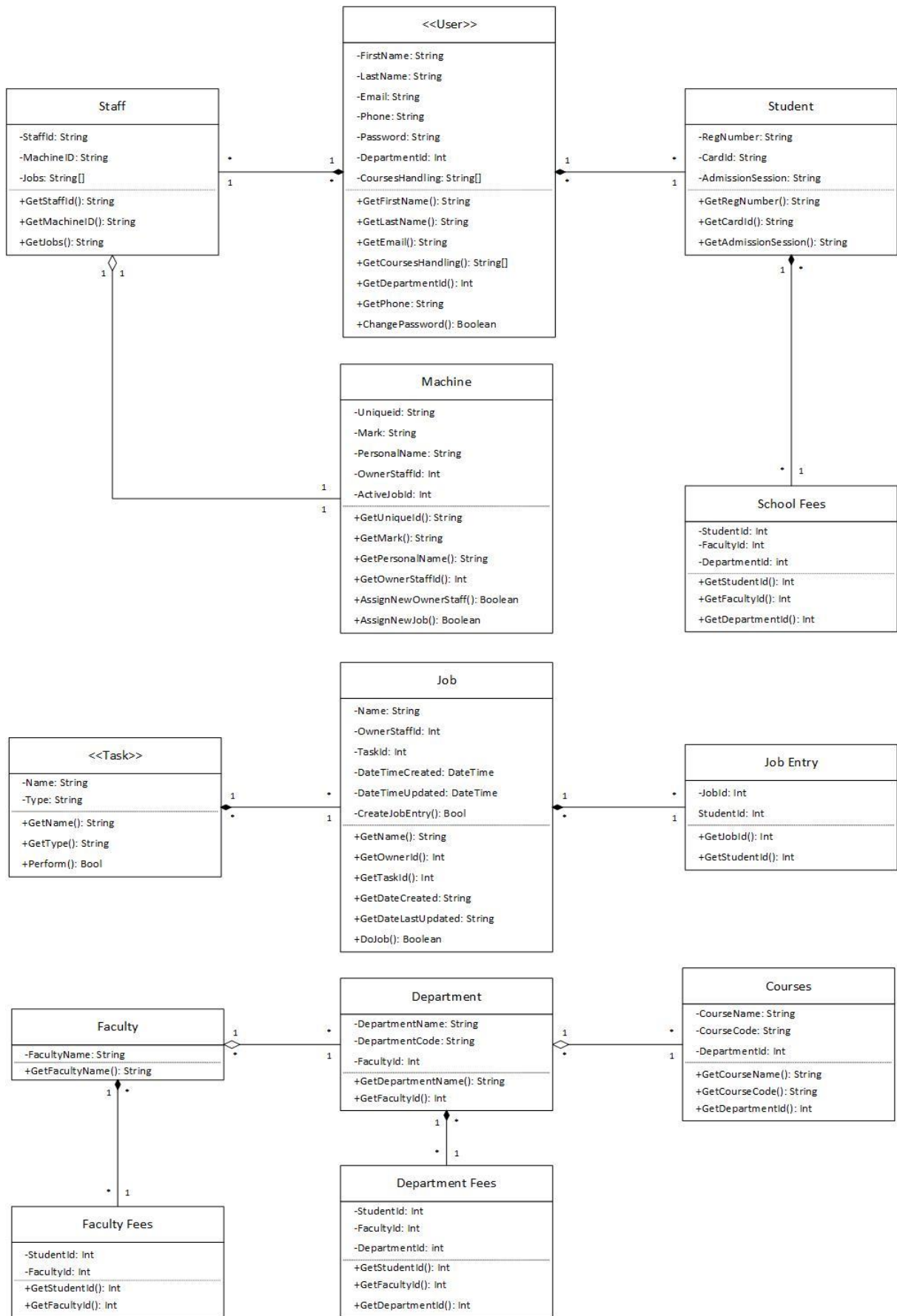


Fig X: UML Class Diagram of Smart RFID Card