iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** XII **Month of publication:** December 2022

DOI: https://doi.org/10.22214/ijraset.2022.48092

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue XII Dec 2022- Available at www.ijraset.com

RFID Based Attendance System

S H V K Ashok[1], N Dishni Divya[2], Fredrick Samuel[3], Prof. Dr. Uttam Mande[4]
[1, 2, 3, 4]*Centurion University Of Technology & Management Vizianagaram,Andhra Pradesh, 535003*

***Abstract:** Most educational institutions administrators are concerned about student irregular attendance. Truancies can affect student overall academic performance. The conventional method of taking attendance by calling names or signing on paper is very time consuming and insecure, hence inefficient. Radio Frequency Identification (RFID) based attendance system is one of the solutions to address this problem. This system can be used to take attendance for student in school, college, and university. It also can be used to take attendance for workers in working places. Its ability to uniquely identify each person based on their RFID tag type of ID card make the process of taking the attendance easier, faster and secure as compared to conventional method. Students or workers only need to place their ID card on the reader and their attendance will be taken immediately. With real time clock capability of the system, attendance taken will be more accurate since the time for the attendance taken will be recorded. The system can be connected to the computer through RS232 or Universal Serial Bus (USB) port and store the attendance taken inside database. An alternative way of viewing the recorded attendance is by using HyperTerminal software. A prototype of the system has been successfully fabricated.[1]*

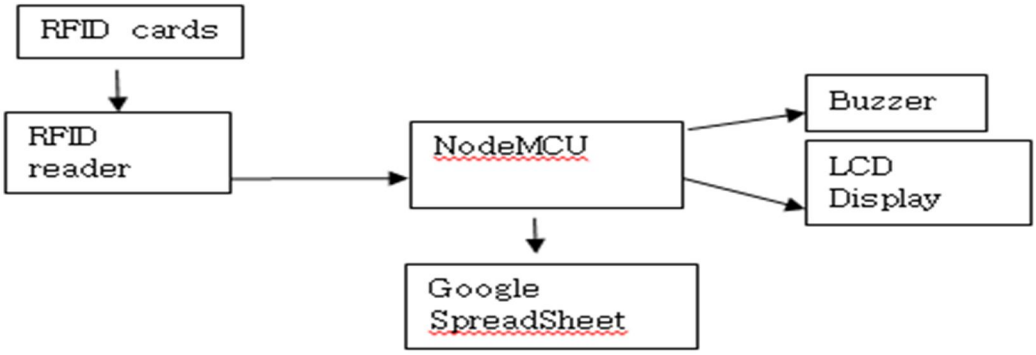
I. INTRODUCTION

RFID based attendance system through machine learning ,here we take the data of some students for our analysis and we take the attendance of that students. Students Data Analysis is mainly focused on on Data gathering and record keeping of Student at dining hall. Each Student will be given an Rfid tag embedded ID card consists of their data such as Name, Registration number, Course, Branch, Contact etc.. They must scan their card every time they come for food. The same Rfid ID card can be used for other purposes such as for IN/OUT Data Logging at Security gate and Attendance in Classroom

II. RFID BASED DIGITAL LOGBOOK

RFID based digital logbook is an advanced attendance management system that has an RFID reader, RFID Tag, LCD display, a microcontroller unit that allows the wireless communications to establish the identity of students, faculty, or any other staff.
RFID attendance system is used to take attendance for student in school, college, and university. By placing their ID cards on the reader, students or workers can immediately verify their attendance.
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. The receiver/reader of the RFID attendance system automatically registers the attendance & saves the attendance data in the Microsoft Excel sheet of ERP system. The administrator can monitor lively and anytime they can extract the data to get a summary of student attendance history & keep a tab on them as well as faculty attendance for salary & payroll management.[19]

III. BLOCK DIAGRAM

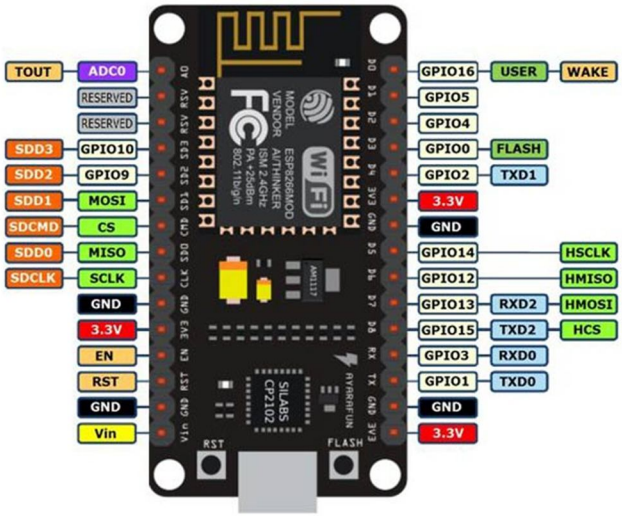


©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue XII Dec 2022- Available at www.ijraset.com

A. NodeMCU ESP8266

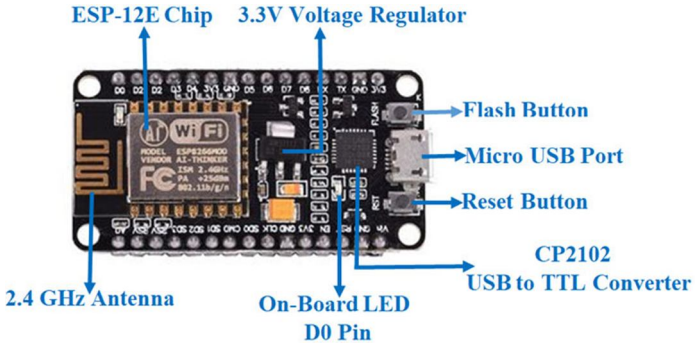
NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.[20]



B. Brief About NodeMCU ESP8266

The NodeMCU ESP8266 development board comes with the ESP-12E module containing the ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor supports RTOS and operates at 80MHz to 160 MHz adjustable clock frequency. NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects.[20]

NodeMCU can be powered using a Micro USB jack and VIN pin (External Supply Pin). It supports UART, SPI, and I2C interface.[20]



C. NodeMCU ESP8266 Specifications & Features

1) Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
2) Operating Voltage: 3.3V
3) Input Voltage: 7-12V
4) Digital I/O Pins (DIO): 16
5) Analog Input Pins (ADC): 1
6) UARTs: 1
7) SPIs: 1
8) I2Cs: 1
9) Flash Memory: 4 MB
10) SRAM: 64 KB
11) Clock Speed: 80 MHz
12) USB-TTL based on CP2102 is included onboard, Enabling Plug n Play

©IJRASET: All Rights are Reserved

13) PCB Antenna
14) Small Sized module to fit smartly inside your IoT projects.

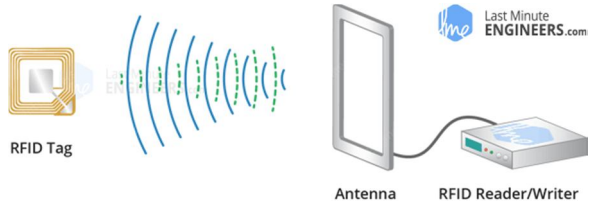
D. Applications
1) Prototyping of IoT devices
2) Low power battery operated applications
3) Network projects
4) Projects requiring multiple I/O interfaces with Wi-Fi and Bluetooth functionalities[21]

IV. RFID TECHNOLOGY

A. What is RFID technology and how does it work?

An RFID or radio frequency identification system consists of two main components, a tag attached to the object to be identified, and a reader that reads the tag.

A reader consists of a radio frequency module and an antenna that generates a high frequency electromagnetic field. Whereas the tag is usually a passive device (it does not have a battery). It consists of a microchip that stores and processes information, and an antenna for receiving and transmitting a signal.

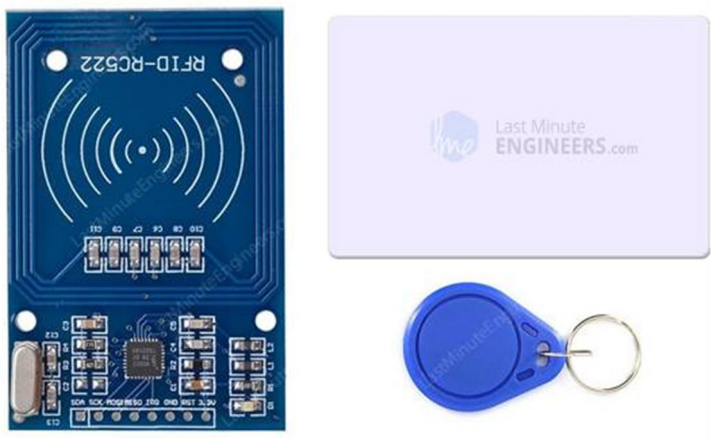


When the tag is brought close to the reader, the reader generates an electromagnetic field. This causes electrons to move through the tag's antenna and subsequently powers the chip.

The chip then responds by sending its stored information back to the reader in the form of another radio signal. This is called a backscatter. The reader detects and interprets this backscatter and sends the data to a computer or microcontroller.[4]

B. Hardware Overview

The RC522 RFID module based on the MFRC522 IC from NXP is one of the cheapest RFID options you can get. It usually comes with an RFID card tag and a key fob tag with 1KB of memory. And the best part is that it can write a tag that means you can store any message in it.



The RC522 RFID reader module is designed to create a 13.56MHz electromagnetic field and communicate with RFID tags (ISO 14443A standard tags).

The reader can communicate with a microcontroller over a 4-pin SPI with a maximum data rate of 10 Mbps. It also supports communication over I2C and UART protocols.

The RC522 RFID module can be programmed to generate an interrupt, allowing the module to alert us when a tag approaches it, instead of constantly asking the module "Is there a card nearby?".
The RC522 RFID module is a smart card reader which, among other things, allows to activate a mechanism when the right card is presented to the reader.[5]

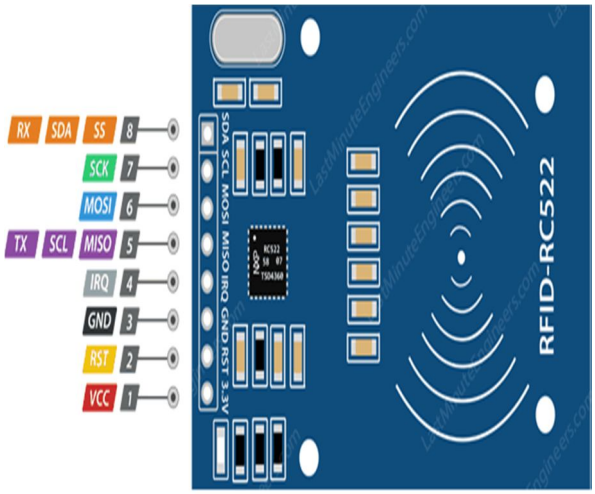
C. Technical Specifications

Here are the specifications:

Frequency Range	3.56 MHz ISM Band
Host Interface	SPI / I2C / UART
Operating Supply Voltage	2.5 V to 3.3 V
Max. Operating Current	13-26mA
Min. Current(Power down)	10µA
Logic Inputs	5V Tolerant
Read Range	5 cm

D. RC522 RFID Module Pinout

The RC522 module has a total of 8 pins that connect it to the outside world. The connections are as follows:



Vcc supplies power to the module. This can be anywhere from 2.5 to 3.3 volts. You can connect it to the 3.3V output from your NodeMCU. [6]

1) RST is an input for reset and power-down. When this pin goes low the module enters power-down mode. In which the oscillator is turned off and the input pins are disconnected from the outside world. Whereas the module is reset on the rising edge of the signal.[7]
2) GND isthe ground pin and needs to be connected to the G pin on the NodeMCU.
3) IRQ is an interrupt pin that alerts the microcontroller when an RFID tag is in the vicinity.[8]
4) MISO/SCL/TX pin acts as master-in-slave-out when SPI interface is enabled, as serial clock when I2C interface is enabled and as serial data output when the UART interface is enabled.[9]
5) MOSI/ (mater out slave in) is the SPI input to the RC522 module.[10]
6) SCK (series clock) Accepts the clock pulses provided by the SPI bus master i.e. Arduino.[11]
7) SS/SRA/Rx pin acts as a signal input when the SPI interface is enabled, as serial data when the I2C interface is enabled and as a serial data input when the UART interface is enabled. This pin is usually marked by encasing the pin in a square so that it can be used as a reference to identify other pins.[12]

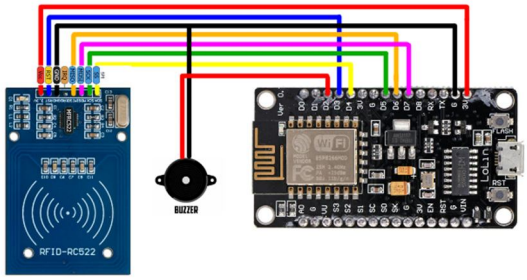
The RC522 RFID module uses the SPI protocol to communicate with the ESP8266. The SPI communication uses specific boxes on this type of microcontroller.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue XII Dec 2022- Available at www.ijraset.com

V. WIRING/CONNECTION

The pinout is as follows (left side RC522, right side ESP8266):
Vcc <-> 3V3 (or Vin(5V) depending on the module version)
RST (Reset) <-> D3
GND (Ground) <-> GND
MISO (Master Input Slave Output) <-> D6
MOSI (Master Output Slave Input) <-> D7
SCK (Serial Clock) <-> D5
SS/SDA (Slave select) <-> D4



VI. WRITING DATA TO RFID CARD USING RC522 RFID AND ARDUINO

A typical MIFARE 1K RFID tag has 1K Byte of memory organized into 16 Sectors (Sector 0 to Sector 15). Each Sector consists of 4 Blocks.[13]
Understanding memory Map of MIFARE 1K Tag
For example, Sector 0 has Blocks 0, 1, 2 and 3. Sector 1 has Blocks 4, 5, 6 and 7 and so on and finally Sector 15 has Blocks 60, 61, 62 and 63. Each Block can store 16 Bytes of data.[14]
NOTE: This numbering is just to understand the memory layout.
So, 16 Sectors * 4 Blocks * 16 Bytes = 1024 Bytes = 1K

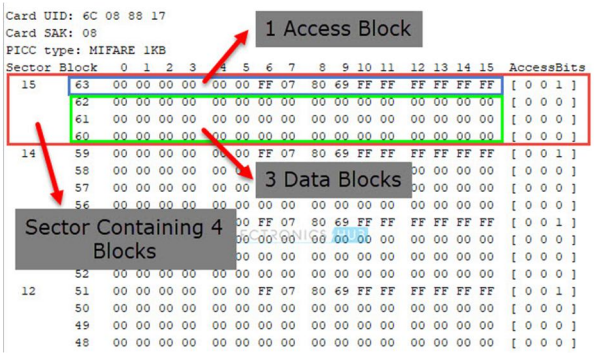
Sector	Block	Byte Number within a Block 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Description
15	3	Key A						Access Bits				Key B						Sector Trailer 15
	2																	Data
	1																	Data
	0																	Data
14	3	Key A						Access Bits				Key B						Sector Trailer 14
	2																	Data
	1																	Data
	0																	Data
:	:																	
:	:																	
:	:																	
1	3	Key A						Access Bits				Key B						Sector Trailer 1
	2																	Data
	1																	Data
	0																	Data
0	3	Key A						Access Bits				Key B						Sector Trailer 0
	2																	Data
	1																	Data
	0	Manufacturer Data																Manufacturer Block

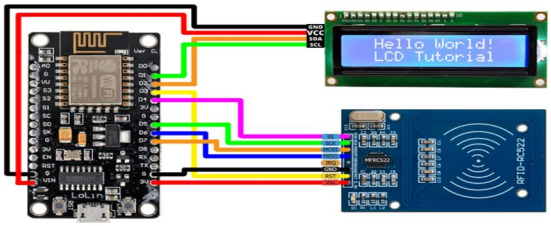
Block 0 of Sector 0 is reserved for storing Manufacturer Data. Usually, this Block contains 4 Byte UID (Unique ID) in case of MIFARE 1K Tags (and also MIFARE 4K, MIFARE Mini tags from NXP). Advanced Tags like MIFARE Plus, MIFARE Ultralight, MIFARE DESFire consists of a 7 Byte UID.[15]
Each Sector consists of three Data Blocks, which can be used for storing user data. The last Block of each Sector i.e., Block 3 in case of Sector 0, Block 7 in case of Sector 1 and so on is known as Sector Trailer.

©IJRASET: All Rights are Reserved

As there are 16 Sectors, there are 16 Sector Trailers. Each Sector Trailer consists of the following information:

1) A mandatory 6 Byte Key A.
2) 4 Bytes for Access Bits.
3) Optional 6 Byte Key B (if not used, data can be stored).





Student ID has been stored in Block 4
Name has been stored in Block 5
Course has been stored in Block 6
Branch has been stored in Block 8
Phone Number has been stored in Block 9

VII. DATA ACQUISITION

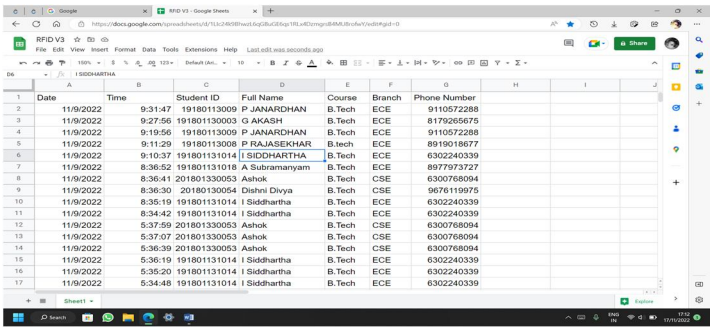
Google Apps Script

Google Apps Script is a cloud-based scripting language for extending the functionality of Google Apps and building lightweight cloud-based applications.

1) Create a New Spreadsheet in Google Sheets
2) Open its Apps Script
3) Update Script with the following & deploy

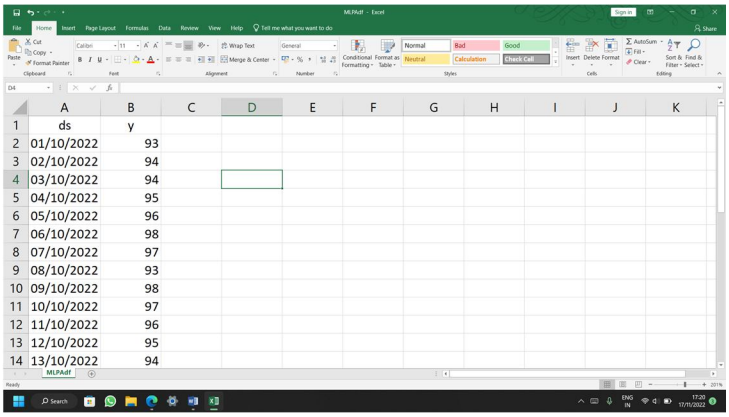
VIII. RESULT





Date	Time	Student ID	Full Name	Course	Branch	Phone Number
11/9/2022	9:31:47	19180113009	P JANARDHAN	B.Tech	ECE	9110572288
11/9/2022	9:27:56	19180130003	G AKASH	B.Tech	ECE	8179265675
11/9/2022	9:19:56	19180113009	P JANARDHAN	B.Tech	ECE	9110572288
11/9/2022	9:11:29	19180113008	P RAJASEKHAR	B.tech	ECE	8919018677
11/9/2022	9:10:37	191801131014	I SIDDHARTHA	B.Tech	ECE	6302240339
11/9/2022	8:36:52	19180113101 8	A Subramanyam	B.Tech	ECE	8977973727
11/9/2022	8:36:41	201801330053	Ashok	B.Tech	CSE	6300768094
11/9/2022	8:36:30	20180130054	Dishni Divya	B.Tech	CSE	9676119975
11/9/2022	8:35:19	191801131014	I Siddhartha	B.Tech	ECE	6302240339
11/9/2022	8:34:42	191801131014	I Siddhartha	B.Tech	ECE	6302240339
11/9/2022	5:37:59	201801330053	Ashok	B.Tech	CSE	6300768094
11/9/2022	5:37:07	201801330053	Ashok	B.Tech	CSE	6300768094
11/9/2022	5:36:39	201801330053	Ashok	B.Tech	CSE	6300768094
11/9/2022	5:36:19	191801131014	I Siddhartha	B.Tech	ECE	6302240339
11/9/2022	5:35:20	191801131014	I Siddhartha	B.Tech	ECE	6302240339
11/9/2022	5:34:48	191801131014	I Siddhartha	B.Tech	ECE	6302240339

The above Google Sheet can be downloaded and need to be manipulated accordingly for using as dataframe for Machine Learning. Label : **ds** is Date & **y** is No of Students scanned their RFID cards on that particular day



	ds	y
2	01/10/2022	93
3	02/10/2022	94
4	03/10/2022	94
5	04/10/2022	95
6	05/10/2022	96
7	06/10/2022	98
8	07/10/2022	97
9	08/10/2022	93
10	09/10/2022	98
11	10/10/2022	97
12	11/10/2022	96
13	12/10/2022	95
14	13/10/2022	94

IX. TIME SERIES FORECASTING

Time series analysis and modelling are complex procedures in the field of data science. We always find that time series modelling is a combination of different processes and time taking processes. So to reduce the time complexity in time series modelling there is always a requirement of automacy. The prophet is a toolkit that aims to provide automacy in time series modelling. In this article, we are going to discuss the prophet toolkit provided by Meta (Facebook) and how we can use it.[16]

A. Prophet

The prophet is a toolkit or library for time series analysis that is available to us as an open-source. Utilizing this toolkit we can perform time series analysis and forecasting very easily and fast. This toolkit has various features that can make our time series analysis procedure accurate and efficient. Some of the best features are automatic hyperparameter tuning, skilful and accurate forecasting. Model plotting and compatibility with R and python language. [17]

This toolkit is developed by the researcher of Facebook that is known as Meta now. The modules designed under this toolkit can be referred to as additive time series models for forecasting. One thing that the researcher of the toolkit claims is it is best with time series that have seasonal effects. This toolkit provides fully automated features to deal with messy time series data with less manual effort. Using it we can work on detecting outliers, missing data, and irrelevant changes in the time series.[17]

We can install this toolkit in our environment using the following line of codes:

!pip install prophet

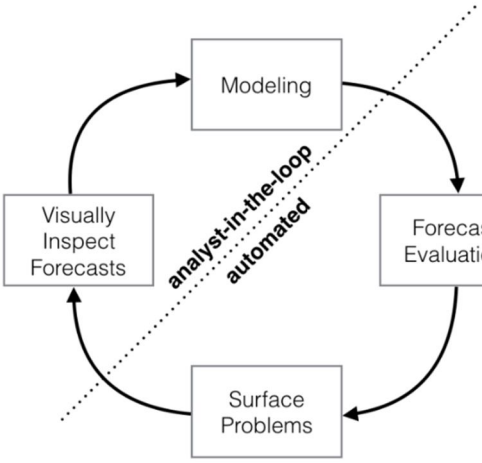
After installation, we are ready to use this toolkit for time series analysis.

B. Python API

Prophet follows the sklearn model API. We create an instance of the Prophet class and then call its fit and predict methods. The input to Prophet is always a dataframe with two columns: ds and y. The ds (datestamp) column should be of a format expected by Pandas, ideally YYYY-MM-DD for a date or YYYY-MM-DD HH:MM:SS for a timestamp. The y column must be numeric, and represents the measurement we wish to forecast.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue XII Dec 2022- Available at www.ijraset.com

As an example, let's look at a time series of the log daily page views for the Wikipedia page for Peyton Manning. We scraped this data using the Wikipediatrend package in R. Peyton Manning provides a nice example because it illustrates some of Prophet's features, like multiple seasonality, changing growth rates, and the ability to model special days (such as Manning's playoff and superbowl appearances). The CSV file is available from RFID Google sheets data [18]



First we'll import the data:

```
In [1]: # Python
        import pandas as pd
        from prophet import Prophet

In [2]: # Python
        df = pd.read_csv(r"E:\B.TECH\7th Sem\ML for PREDICTIVE ANALYSIS\MLPAdf.csv")
        df.head()
```

We fit the model by instantiating a new Prophet object. Any settings to the forecasting procedure are passed into the constructor. Then you call its fit method and pass in the historical dataframe. Fitting should take 1-5 seconds.

```
In [4]: # Python
        m = Prophet()
        m.fit(df)
```

Predictions are then made on a dataframe with a column ds containing the dates for which a prediction is to be made. You can get a suitable dataframe that extends into the future a specified number of days using the helper method Prophet.make_future_dataframe. By default it will also include the dates from the history, so we will see the model fit as well.

```
In [5]: # Python
        future = m.make_future_dataframe(periods=365)
        future.tail()
```

Out[5]:

	ds
390	2023-12-06
391	2023-12-07
392	2023-12-08
393	2023-12-09
394	2023-12-10

The predict method will assign each row in future a predicted value which it names yhat. If you pass in historical dates, it will provide an in-sample fit. The forecast object here is a new dataframe that includes a column yhat with the forecast, as well as columns for components and uncertainty intervals.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

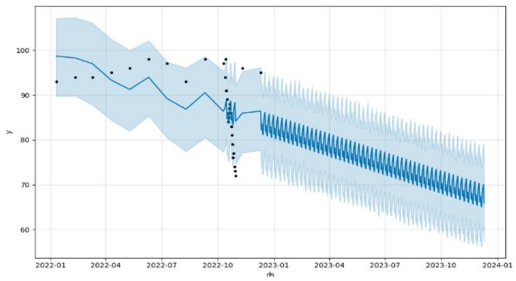
```
In [7]: # Python
forecast = m.predict(future)
forecast[['ds', 'yhat', 'yhat_lower', 'yhat_upper']].tail()
```

Out[7]:

	ds	yhat	yhat_lower	yhat_upper
390	2023-12-06	65.061170	56.220115	73.810516
391	2023-12-07	68.278479	59.310955	76.723677
392	2023-12-08	69.349508	60.139559	78.163885
393	2023-12-09	70.006691	60.675053	79.203049
394	2023-12-10	65.845150	57.059930	75.605777

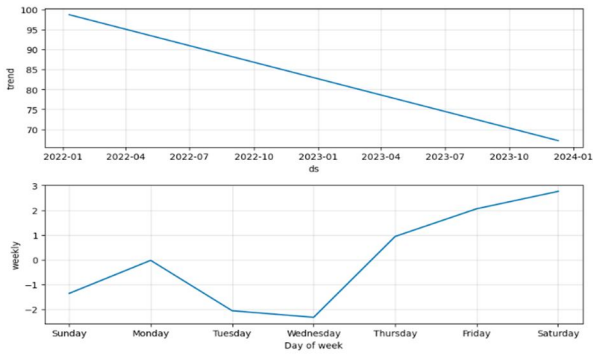
You can plot the forecast by calling the Prophet.plot method and passing in your forecast dataframe.

```
In [8]: # Python
fig1 = m.plot(forecast)
```



If you want to see the forecast components, you can use the Prophet.plot_components method. By default you'll see the trend, yearly seasonality, and weekly seasonality of the time series. If you include holidays, you'll see those here, too.[18]

```
In [9]: # Python
fig2 = m.plot_components(forecast)
```

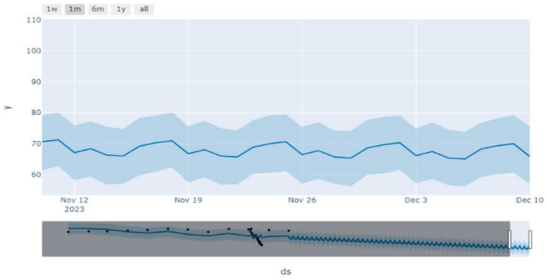


An interactive figure of the forecast and components can be created with plotly. You will need to install plotly 4.0 or above separately, as it will not by default be installed with prophet. You will also need to install the notebook and ipywidgets packages[18]

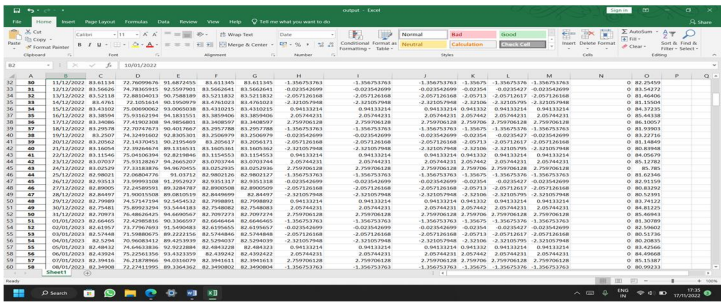
```
In [10]: # Python
from prophet.plot import plot_plotly, plot_components_plotly

plot_plotly(m, forecast)
```





X. OUTCOME



The Above Figure interprets the Prediction, where ds Column is Future Dates, Yhat is Predicted values of Y label, Yhat lower Values are expected minimum number of students present, Yhat upper Values are expected maximum number of students present.

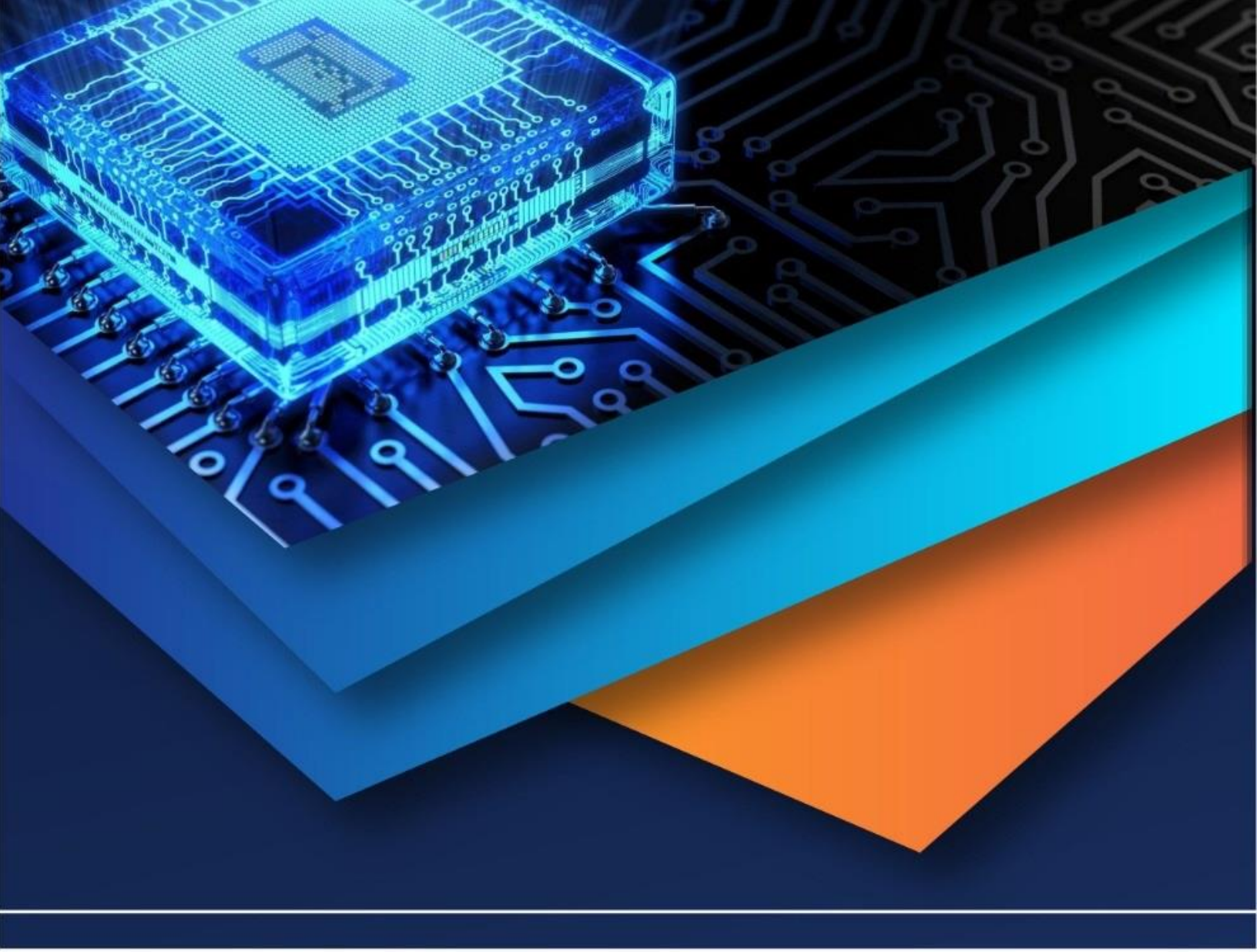
XI. CONCLUSION

And that's how developed an NodeMCU based Automated Attendance System using RFID [4]technology with the help of Arduino UNO microcontroller, Data Acqusition is done through IOT, So as soon as the student scans his ID card, Name & Number will be displayed on LCD for Attendee reference, Buzzer also make sounds on a RFID card detection[4]. And then the same student data will be sent to Google Sheets - Cloud. The data will be saved automatically Spreadsheets. After a thorough data collection i.e for about 1 month, the data has been used for Machine Learning, So based on Machine Learning generated Output.xlsx file data, Kitchen department can prepare food.

REFERENCES

[1] RFID based attendance system | IEEE Conference Publication | IEEE Xplore
[2] Food Loss and Waste Reduction | United Nations
[3] How to Calculate Food Quantities for a Buffet | eHow
[4] (PDF) RFID-Based Digital Door Locking System (researchgate.net)
[5] An Introduction to RFID. The RC522 RFID module based on MFRC522… | by Ruthu S Sanketh | AUTONOMOUS ROBOTICS | Medium
[6] RC522 RFID Module Pinout, Features, Specs & How to Use It (components101.com)
[7] RST File Extension - What is an .rst file and how do I open it? (fileinfo.com)
[8] GND - What does GND stand for? The Free Dictionary
[9] spi - Difference between MISO/MOSI and TxD/ RxD - Electrical Engineering Stack Exchange
[10] MOSI - master-out, slave-in (allacronyms.com)
[11] What is the SPI SCK Clock Output? - Networking, Protocols, and Devices - Arduino Forum
[12] avr - Why SS pin must be set to OUTPUT for SPI master? - Electrical Engineering Stack Exchange
[13] How to Write Data to RFID Card using RC522 RFID Module? (electronicshub.org)
[14] C# Blogs: Understanding the memory structure of MIFARE 1k and 4k Classic Smartcards (csharpwpfmvvm.blogspot.com)
[15] edit - How to modify block 0 / UID of a Mifare 1K tag (using a proxmark) - Stack Overflow
[16] What Are The Five Time Series Forecasting Methods? | Analytics For Decisions
[17] A guide to time series prediction using Meta's prophet toolkit (analyticsindiamag.com)
[18] Python/C API Reference Manual — Python 3.11.1 documentation
[19] Digital Logbooks | NAVTOR
[20] ESP8266 Wi-Fi Modules I Espressif
[21] Nodemcu ESP8266 Arduino IDE Board Manager URL Link Installation and First Project (electroniclinic.com)

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)