

SMART PARKING PROJECT

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CONTENT

- 01** ABOUT US
- 02** SMART PARKING
- 03** BUSINESS MODEL
- 04** CLOUD & FOG POINT
- 05** OUR PRODUCT
- 06** PROJECT TIMELINE
- 07** WEBSITE AND GITHUB

ABOUT US



Mission

- To create and deploy a cutting-edge smart parking IoT project for users with the goal of revolutionizing the way we park.
- We are dedicated to developing a parking system that is efficient, user-friendly, and sustainable, therefore simplifying the parking procedure and improving the overall user experience.

- To create smart parking that combines IoT technology, data analytics, and user-centric design to deliver a stress-free and comfortable parking experience for users.
- Our smart parking IoT project envisions a future in which users can quickly identify and book parking spots in real-time, travel to their destinations with ease, and conduct payment transactions efficiently, all through a single integrated platform.



SMART PARKING

- 
- Smart parking is an innovative parking system that uses sensors, cameras, and other technologies to provide real-time information about available parking spots.
 - By leveraging advanced technologies like sensors, cameras, and cloud computing, we can create a more efficient and effective parking system that benefits both drivers and parking lot operators.
 - Additionally, smart parking systems can optimize parking space utilization, making it easier for parking lot operators to manage their resources effectively.

BUSINESS MODEL



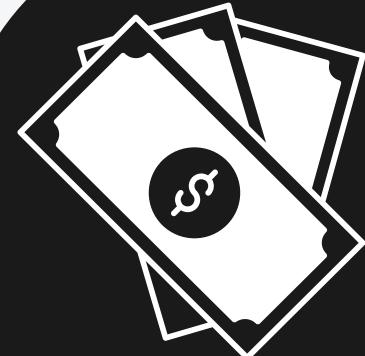
Establish partnerships with technology providers, parking lot operators, and local governments to ensure the success of the system.

KEY PARTNERSHIP



The cost structure will depend on factors like the number of sensors and cameras needed, the cost of cloud computing services, and maintenance expenses.

COST STRUCTURE



For revenue streams, we can consider charging fees for parking, selling advertising space on digital displays, or offering premium services like valet parking.

REVENUE STREAMS

Possible partnership in mind

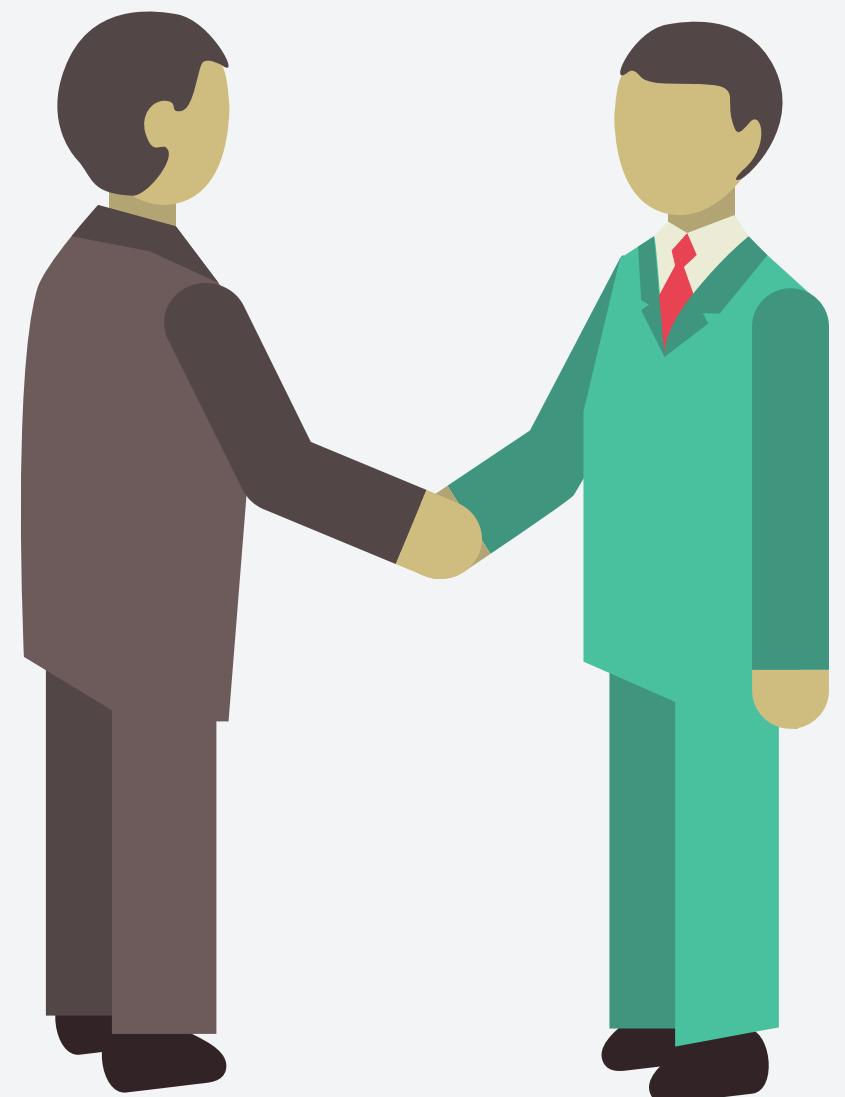
SmartCard Payment Corp.



Technology Provider.

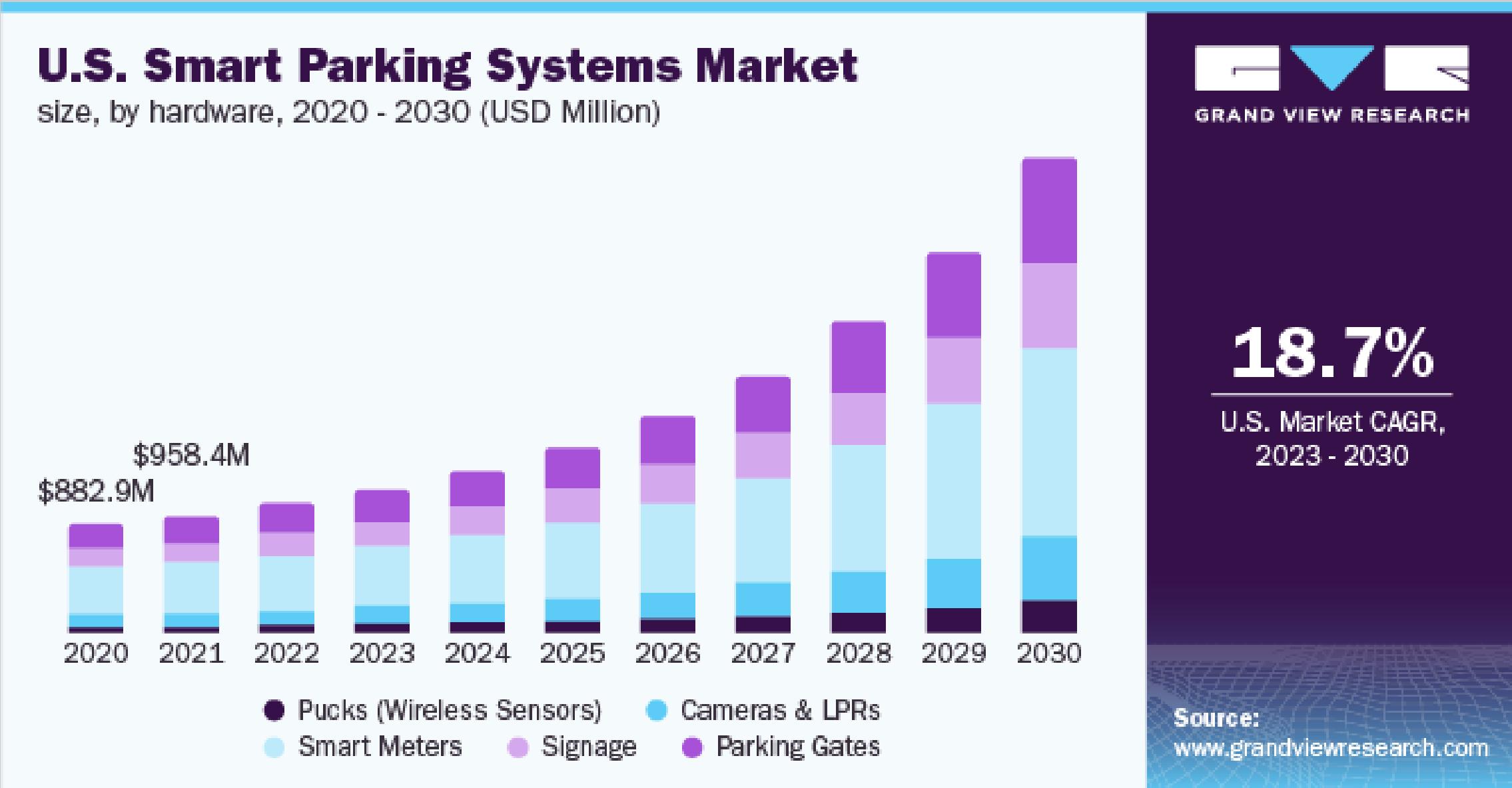


City Authorities

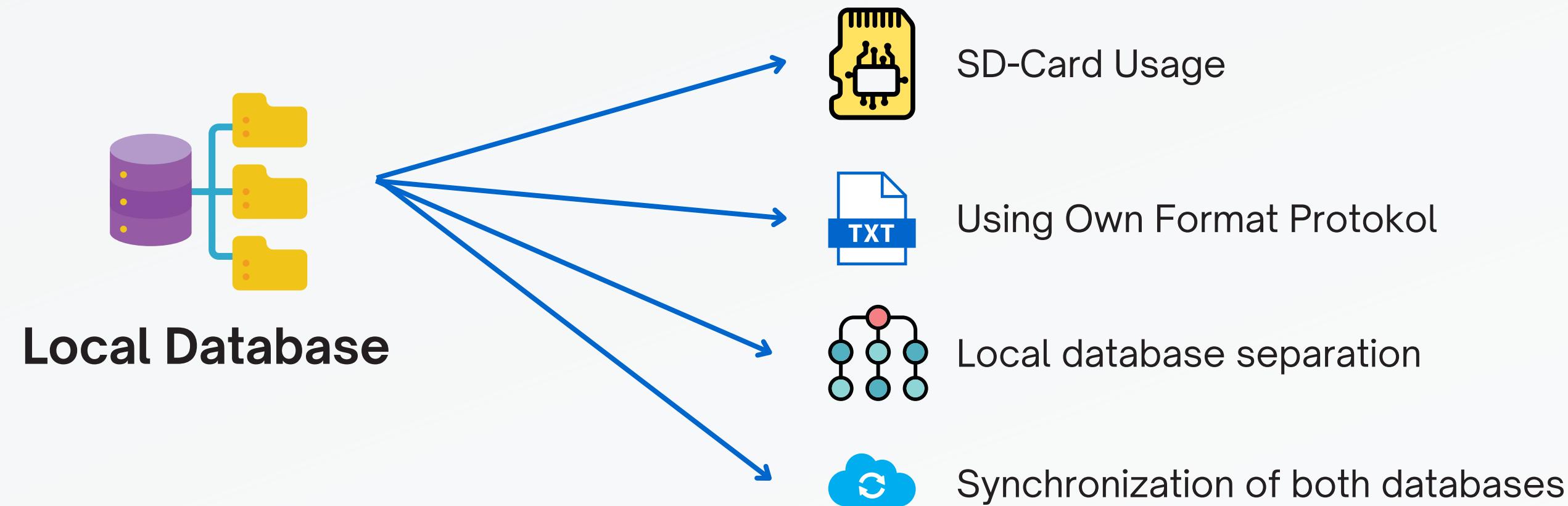
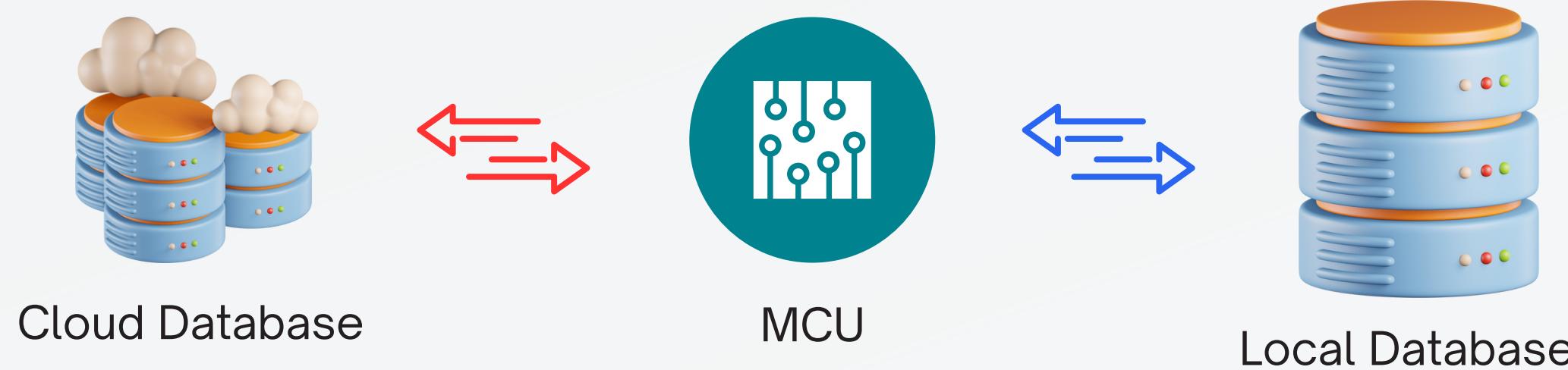


MARKET GROWTH

These trends indicate a positive growth trajectory for the smart parking market, driven by the need for efficient parking management, technological advancements, and the increasing adoption of smart city initiatives. As urbanization continues, and cities face parking challenges, the demand for innovative and intelligent parking solutions is expected to grow, presenting opportunities for companies operating in the smart parking industry.

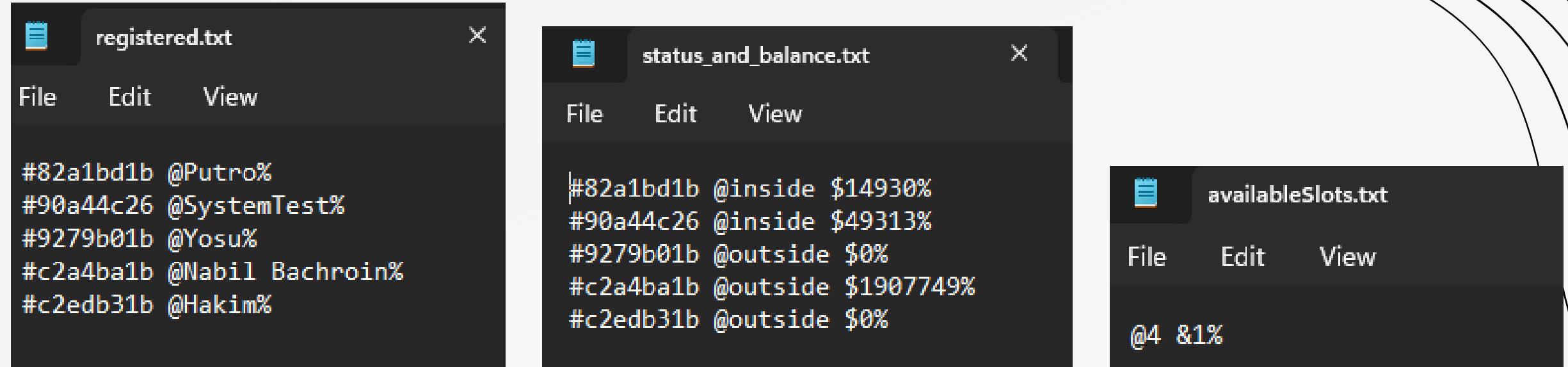


FOG POINT



FOG POINT

- registered.txt
- status_and_balance.txt
- availableSlots.txt



```
void readDatabase(fs::FS &fs, const char * registeredPath, const char * statusPath, const char * slotPath)
{
    // read registered.txt
    File registeredFile = fs.open(registeredPath);
    cardCount = 0;
    while(registeredFile.available())
    {
        String line = registeredFile.readStringUntil('%');
        line.trim();
        String uid = line.substring(line.indexOf('#') + 1, line.indexOf('@') - 1);
        uid.trim();
        String name = line.substring(line.indexOf('@') + 1, line.indexOf('%') - 1);
        name.trim();
        cardDatabase[cardCount].UID = uid;
        cardDatabase[cardCount].name = name;
        Serial.println("Read card data: " + uid + " @" + name);
        cardCount++;
    }
    registeredFile.close();
```

FOG POINT

what are the write rules on the local database?

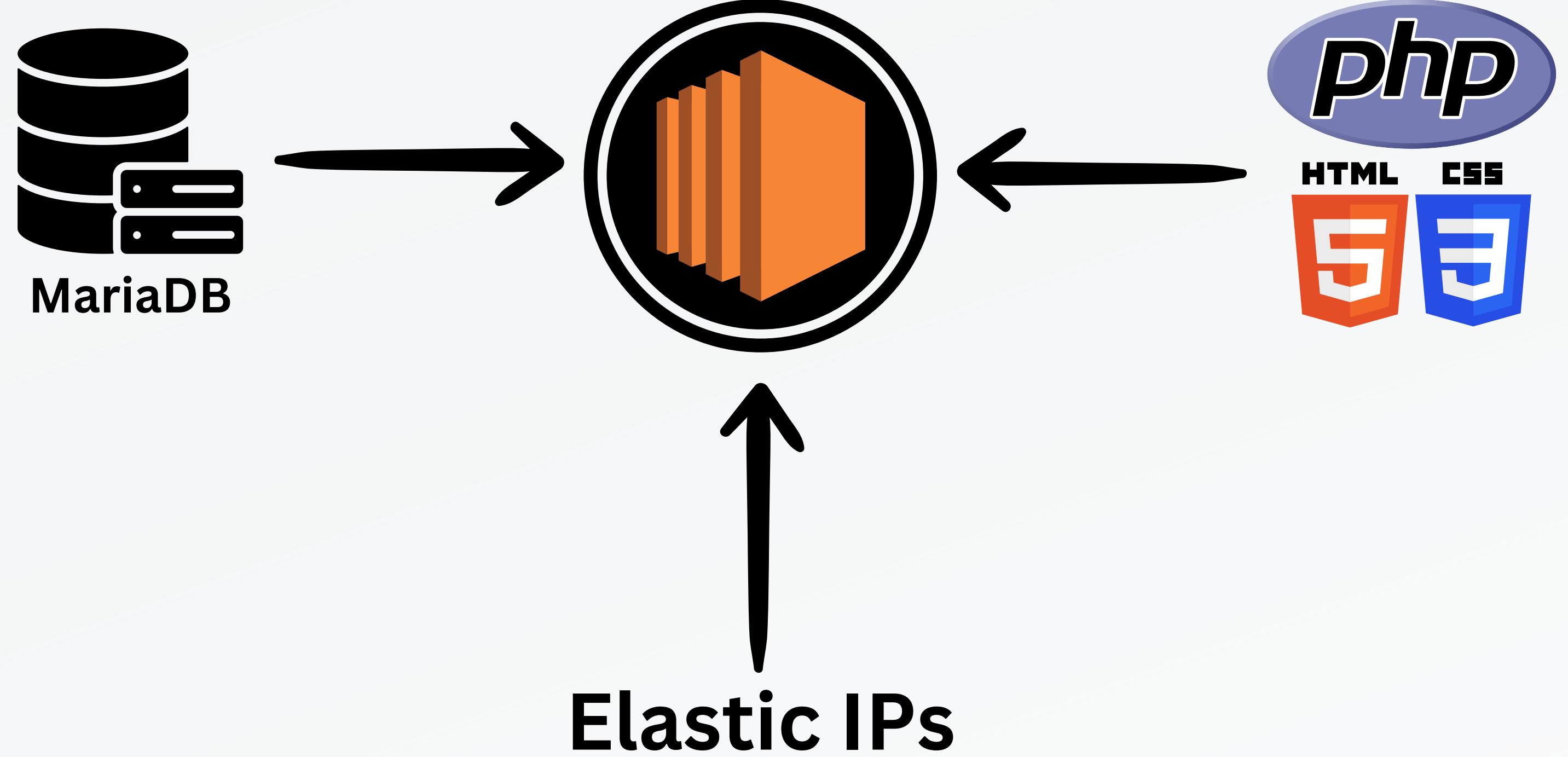
```
void writeDatabase(fs::FS &fs, const char * registeredPath, const char * statusPath, const char * slotPath)
{
    // write registered.txt
    File registeredFile = fs.open(registeredPath, FILE_WRITE);
    for(int i = 0; i < cardCount; i++)
    {
        if(i==cardCount-1 && i!=0) registeredFile.print("#" + cardDatabase[i].UID + "@" + cardDatabase[i].name + "%");
        else registeredFile.println("#" + cardDatabase[i].UID + "@" + cardDatabase[i].name + "%");
    }
    registeredFile.close();

    // write status_and_balance.txt
    File statusFile = fs.open(statusPath, FILE_WRITE);
    for(int i = 0; i < cardCount; i++)
    {
        if(i==cardCount-1 && i!=0) statusFile.print("#" + cardDatabase[i].UID + "@" + cardDatabase[i].status + " $" + String(cardDatabase[i].balance) + "%");
        else statusFile.println("#" + cardDatabase[i].UID + "@" + cardDatabase[i].status + " $" + String(cardDatabase[i].balance) + "%");
    }
    statusFile.close();

    // write availableSlots.txt
    File slotFile = fs.open(slotPath, FILE_WRITE);
    slotFile.print("@" + String(slotData.parkingSlots) + " &" + String(slotData.electricChargingSlots) + "%");
    slotFile.close();
    checkRelay();
    sendDataToServer();
}
```



CLOUD



CLOUD



Elastic IPs

An Amazon EC2 instance is a virtual server in Amazon's Elastic Compute Cloud (EC2) for running applications on the Amazon Web Services (AWS) infrastructure.

Elastic IPs is used to make ip public of EC2 is static. Because if we do not use Elastic IPs, public IP of EC2 will be changed every time we try to turn on the service.

CLOUD



Send data to hardware server such as amount of balance and user identity

- 1. Save data from fog**
- 2. Save user data from website**

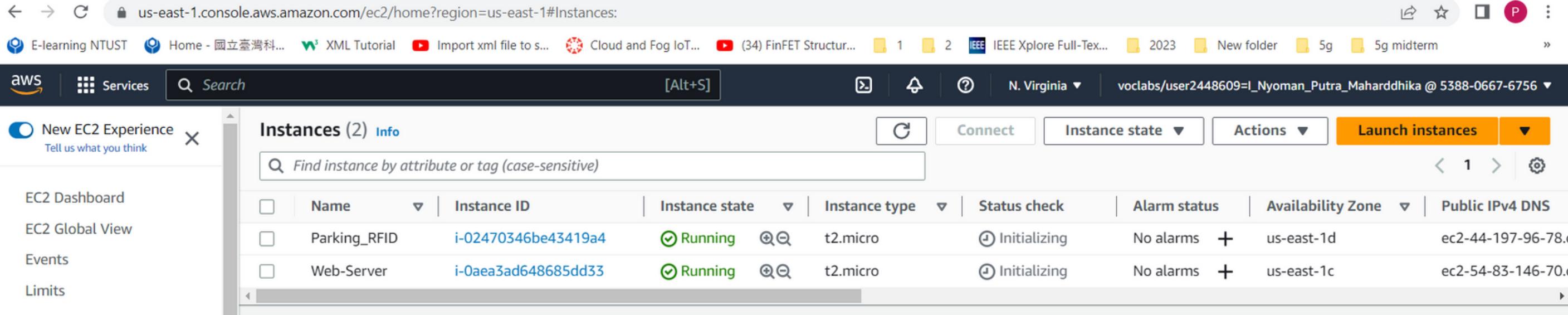
MariaDB is an open source relational database management system (DBMS). A database is a structured collection of data. In our project, we use MariaDB to put and call customer data.

CLOUD



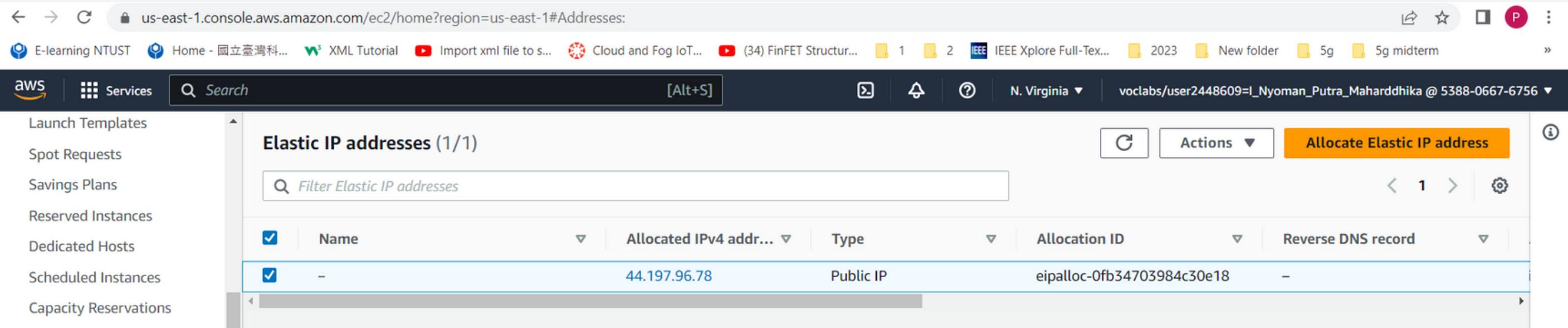
PHP, HTML, and CSS are used to develop web applications or websites. We used PHP to talk to database server and HTML & CSS are used to design web applications or websites.

CLOUD



The screenshot shows the AWS EC2 Instances page. There are two instances listed:

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4 DNS
Parking_RFID	i-02470346be43419a4	Running	t2.micro	Initializing	No alarms	us-east-1d	ec2-44-197-96-78.c
Web-Server	i-0aea3ad648685dd33	Running	t2.micro	Initializing	No alarms	us-east-1c	ec2-54-83-146-70.c



The screenshot shows the AWS Elastic IP addresses page. One elastic IP address is listed:

Name	Allocated IPv4 addr...	Type	Allocation ID	Reverse DNS record
-	44.197.96.78	Public IP	eipalloc-0fb34703984c30e18	-

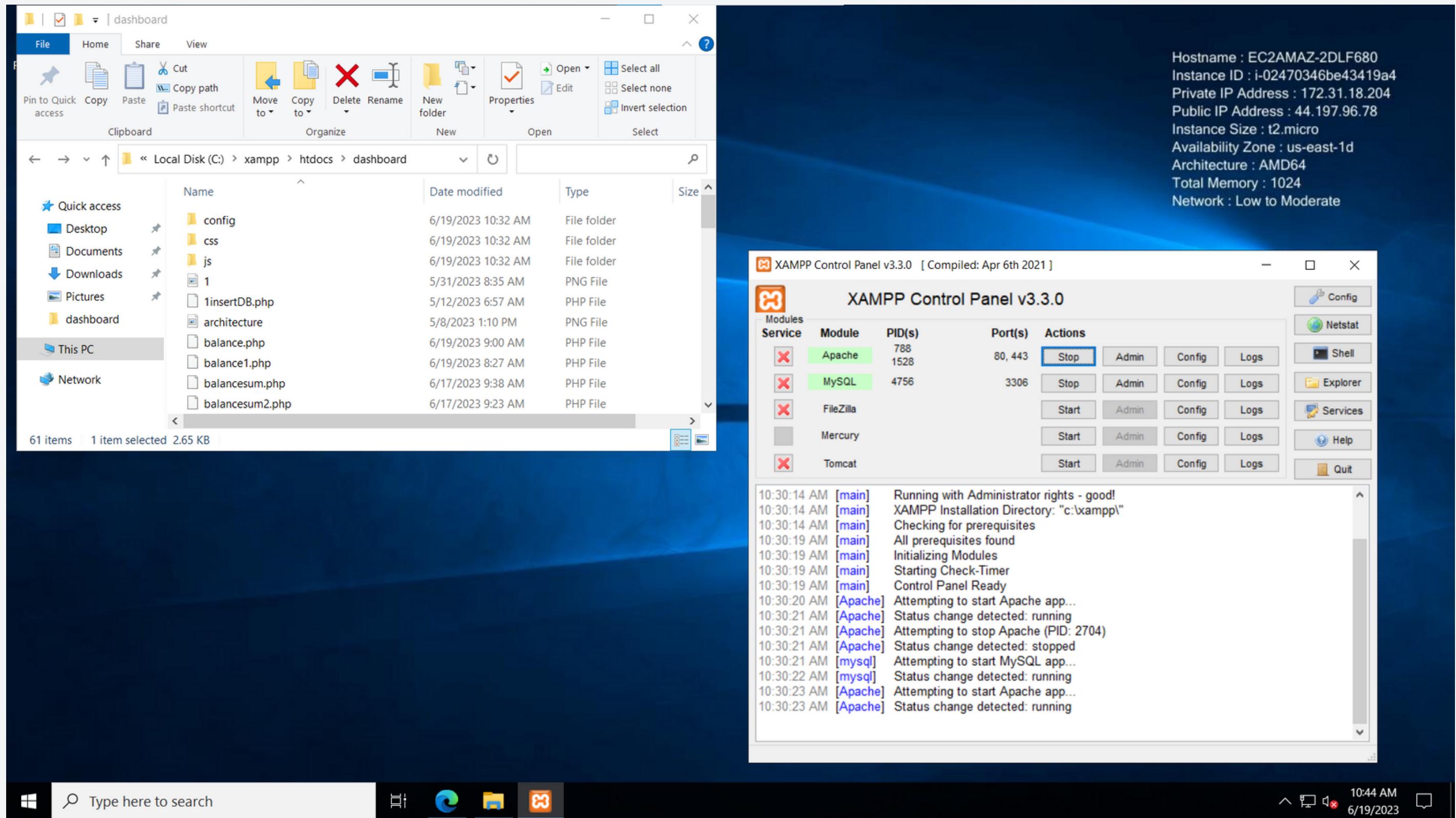
CLOUD

EC2 > Instances > i-02470346be43419a4

Instance summary for i-02470346be43419a4 (Parking_RFID) Info		
Updated less than a minute ago		
Instance ID	Public IPv4 address	Private IPv4 addresses
i-02470346be43419a4 (Parking_RFID)	44.197.96.78 open address	172.31.18.204
IPv6 address	Instance state	Public IPv4 DNS
-	Running	ec2-44-197-96-78.compute-1.amazonaws.com open address
Hostname type	Private IP DNS name (IPv4 only)	Elastic IP addresses
IP name: ip-172-31-18-204.ec2.internal	ip-172-31-18-204.ec2.internal	44.197.96.78 [Public IP]
Answer private resource DNS name	Instance type	AWS Compute Optimizer finding
IPv4 (A)	t2.micro	Opt-in to AWS Compute Optimizer for recommendations.
Auto-assigned IP address	VPC ID	Learn more
-	vpc-07f872733e9415085	
IAM Role	Subnet ID	Auto Scaling Group name
-	subnet-0b694ffbf54f5f4b5	-
IMDSv2		
Optional		

[Details](#) | [Security](#) | [Networking](#) | [Storage](#) | [Status checks](#) | [Monitoring](#) | [Tags](#)

CLOUD



CLOUD

localhost / 127.0.0.1 / team4 / table_rfid

localhost/phpmyadmin/index.php?route=/table/structure&db=team4&table=table_rfid

Server: 127.0.0.1 » Database: team4 » Table: table_rfid

Table structure

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	id_session	int(11)	utf8mb4_general_ci		No	None	AUTO_INCREMENT		Change Drop More
2	username	varchar(50)	utf8mb4_general_ci		No	None			Change Drop More
3	password	varchar(255)	utf8mb4_general_ci		No	None			Change Drop More
4	created_at	datetime			Yes	current_timestamp()			Change Drop More
5	name	varchar(100)	utf8mb4_general_ci		No	None			Change Drop More
6	id	varchar(100)	utf8mb4_general_ci		No	None			Change Drop More
7	gender	varchar(100)	utf8mb4_general_ci		No	None			Change Drop More
8	email	varchar(100)	utf8mb4_general_ci		No	None			Change Drop More
9	car	varchar(100)	utf8mb4_general_ci		No	None			Change Drop More
10	usertype	varchar(20)	utf8mb4_general_ci		No	user			Change Drop More
11	status	int(5)			No	None			Change Drop More

Information_schema

mysql

performance_schema

phpmyadmin

team4

New

table_rfid

temporary_register

test

Recent Favorites

Table structure

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	id	varchar(20)	utf8mb4_general_ci		No	None			Change Drop More
2	name	varchar(50)	utf8mb4_general_ci		No	None			Change Drop More
3	status	varchar(10)	utf8mb4_general_ci		No	None			Change Drop More
4	balance	int(10)			No	None			Change Drop More

Information_schema

mysql

performance_schema

phpmyadmin

team4

New

table_rfid

temporary_register

test

Recent Favorites

CLOUD - WEBSITE

Sign up

Please fill this form to create an account

Username

email

Password

Repeat Password

ID

Please Tag your Card

Name

Gender
Male

Car

Already have an account? [Login here.](#)

Change Password

Change Your Password

Password

Repeat Password

Smart Parking

Edit User Data

ID
82a1bd1b

Name
Putro

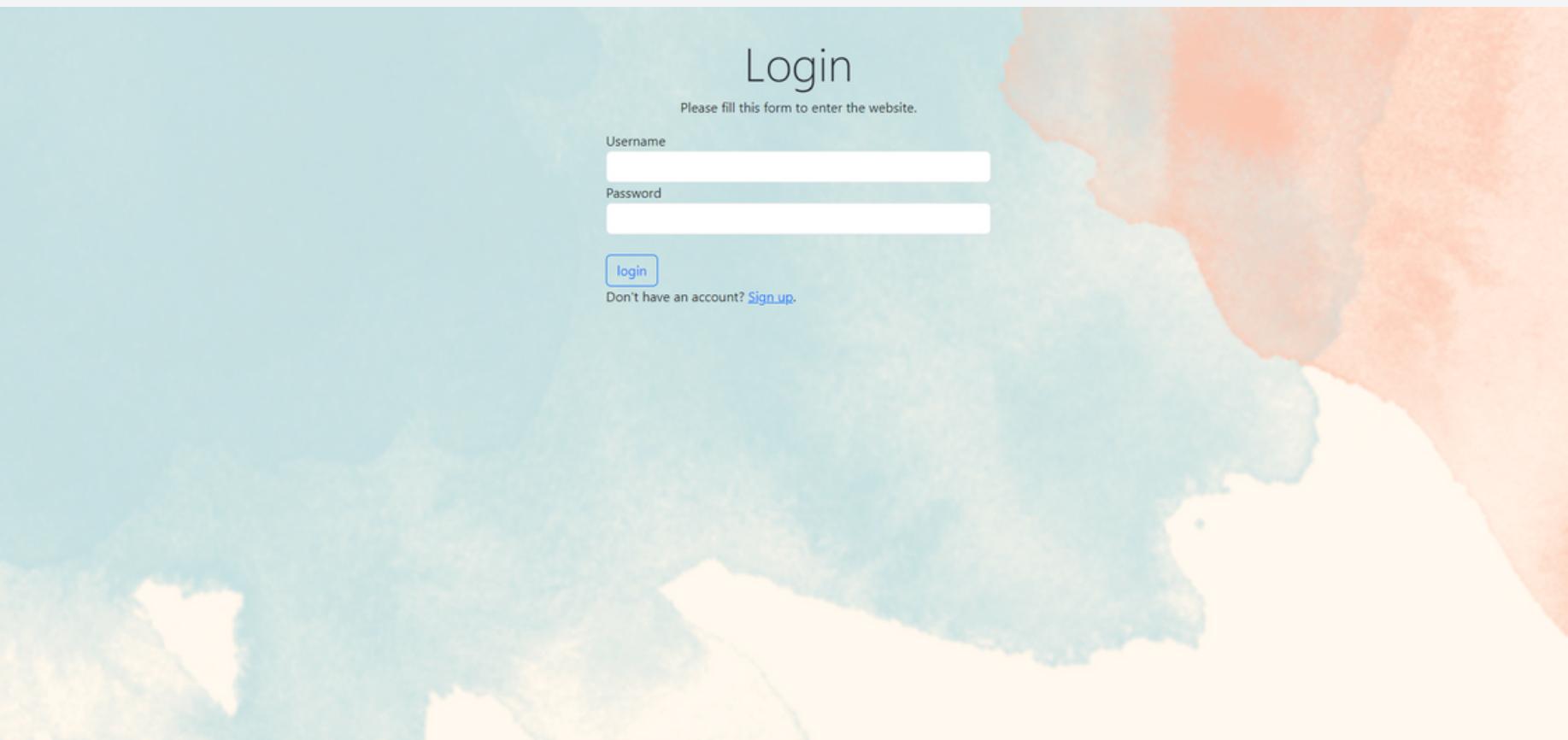
Gender
Male

Email Address
putroo@gmail.com

Car Type
Audi

CLOUD - WEBSITE

Admin



Smart Parking

Home User Data Status Tracking Top Up Balance Help

USER DATA TABLE

Name	ID	Gender	Email	Car Type	Status	Balance (\$)	Action
Hakim	c2edb31b	Male	musabake@gmail.com	Mclaren	outside	0	Edit
Putro	82a1bd1b	Male	putroo@gmail.com	Audi	inside	15000	Edit
Yosu	9279b01b	Male	yosu7013@gmail.com	Avanza	outside	0	Edit

Parking Slots : 4 Electric Charging Slots : 0

Parking NO 1 Parking NO 2 Parking NO 3 Parking NO 4 Parking NO 5 Parking NO 6

Green : Available | White : Not Available | Parking NO 6 : Electric Charging

Smart Parking

Username : admin Home User Data Status Tracking Top Up Balance Help

Welcome to Team 4 Project "Smart Parking"

Welcome admin

Change Password Sign Out

Status Tracking

ID	Name	Status	Balance
82a1bd1b	Putro	inside	14900
9044c26	SystemTest	outside	49313
9279b01b	Yosu	outside	0
c2a4ba1b	Nabil Bachroin	inside	1907739
c2edb31b	Hakim	outside	0

CLOUD-WEBSITE

Admin

Smart Parking

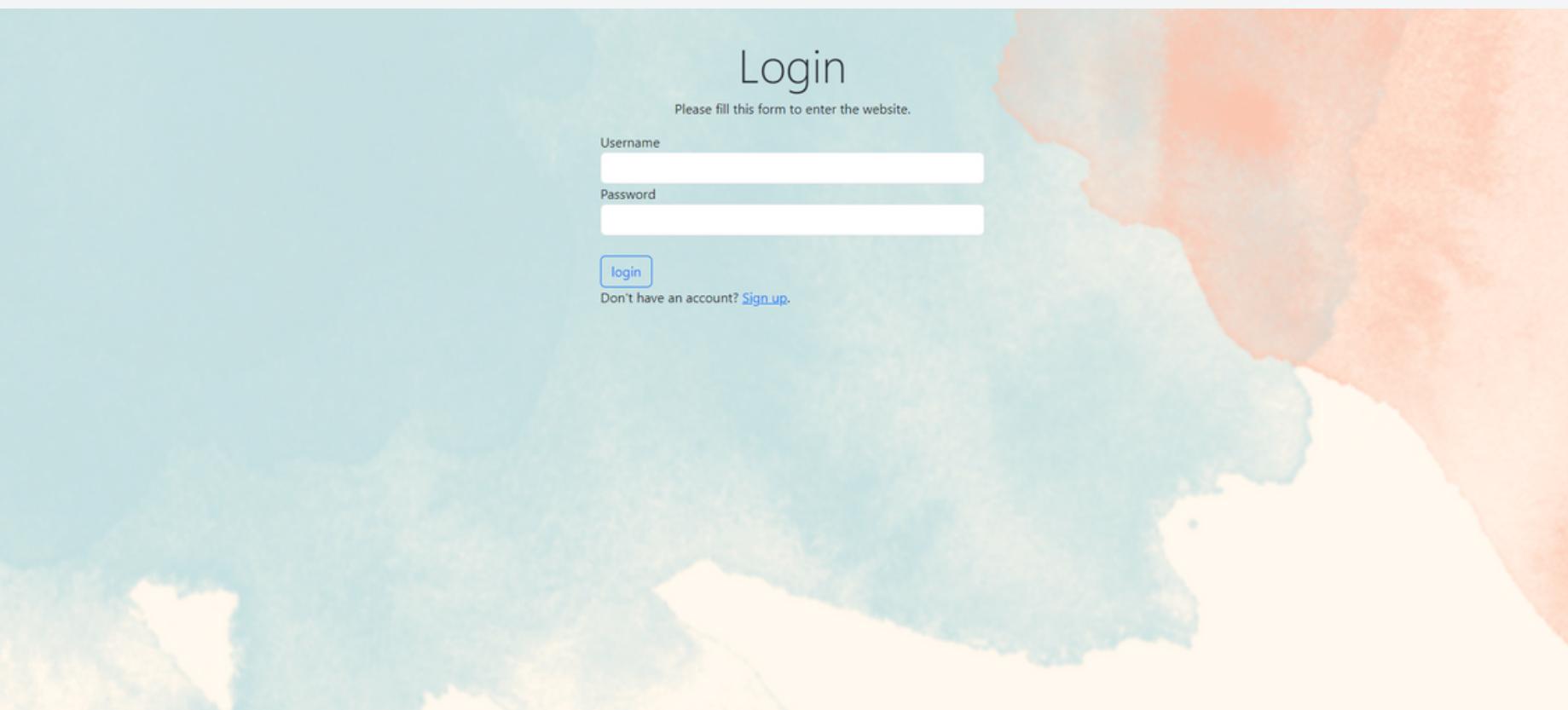
The screenshot shows a "Smart Parking" website interface. At the top, there is a navigation bar with links: Home, User Data, Status Tracking, Top Up Balance (which is highlighted in green), and Help. Below the navigation bar, there is a form titled "BALANCE". The form contains four input fields: "Username", "Name", "Balance", and a "Save" button. The background of the page features a blurred image of a landscape with mountains and water.

Smart Parking

The screenshot shows a "Smart Parking" website interface. At the top, there is a navigation bar with links: Home, User Data, Status Tracking, Top Up Balance (highlighted in green), and Help. Below the navigation bar, there is a section titled "ANNOUNCEMENT" which contains a list of eight items, all of which are radio buttons followed by the text "THERE IS NO ANNOUNCEMENT YET". At the bottom left, there is a "Contact Us" section with the text "Tel : +886954022477". At the bottom right, there is a "Our Social Media" section with icons for various social media platforms: Facebook, Twitter, Google+, LinkedIn, YouTube, and Instagram.

CLOUD - WEBSITE

User



Smart Parking

USER DATA TABLE

Name	ID	Gender	Email	Car Type	Status	Balance (\$)	Action
Putro	82a1bd1b	Male	putroo@gmail.com	Audi	inside	15000	Edit

Parking Slots : 4 Electric Charging Slots : 0

Parking NO 1 Parking NO 2 Parking NO 3 Parking NO 4 Parking NO 5 Parking NO 6

Green : Available | White : Not Available | Parking NO 6 : Electric Charging

Smart Parking

Welcome to Team 4 Project "Smart Parking"

Welcome putro

Change Password Sign Out

Smart Parking

ANNOUNCEMENT

- THERE IS NO ANNOUNCEMENT YET

Contact Us
Tel : +88695402477

Our Social Media

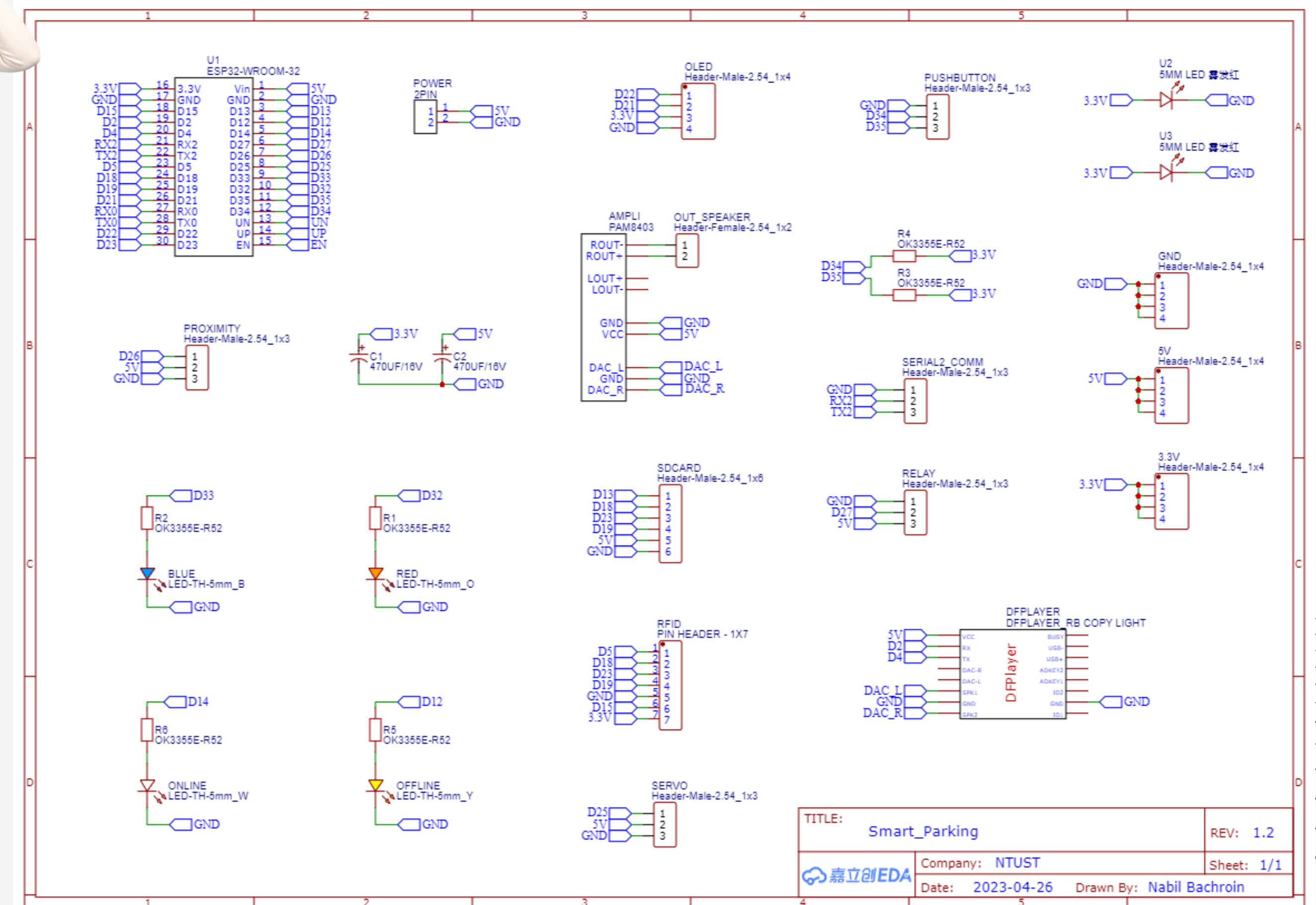
f t G in b @ o

Schematic design



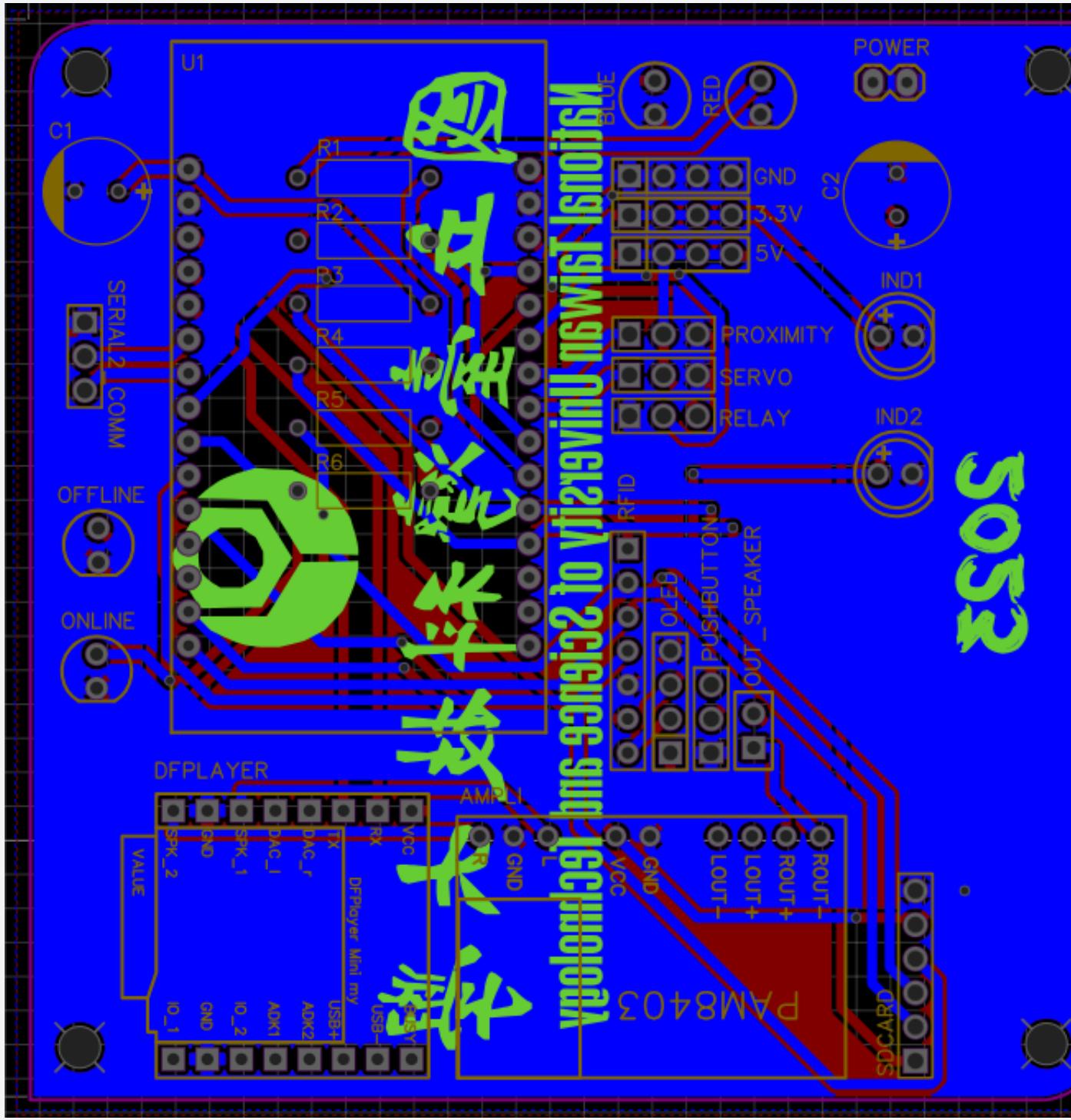
Prototype

HARDWARE



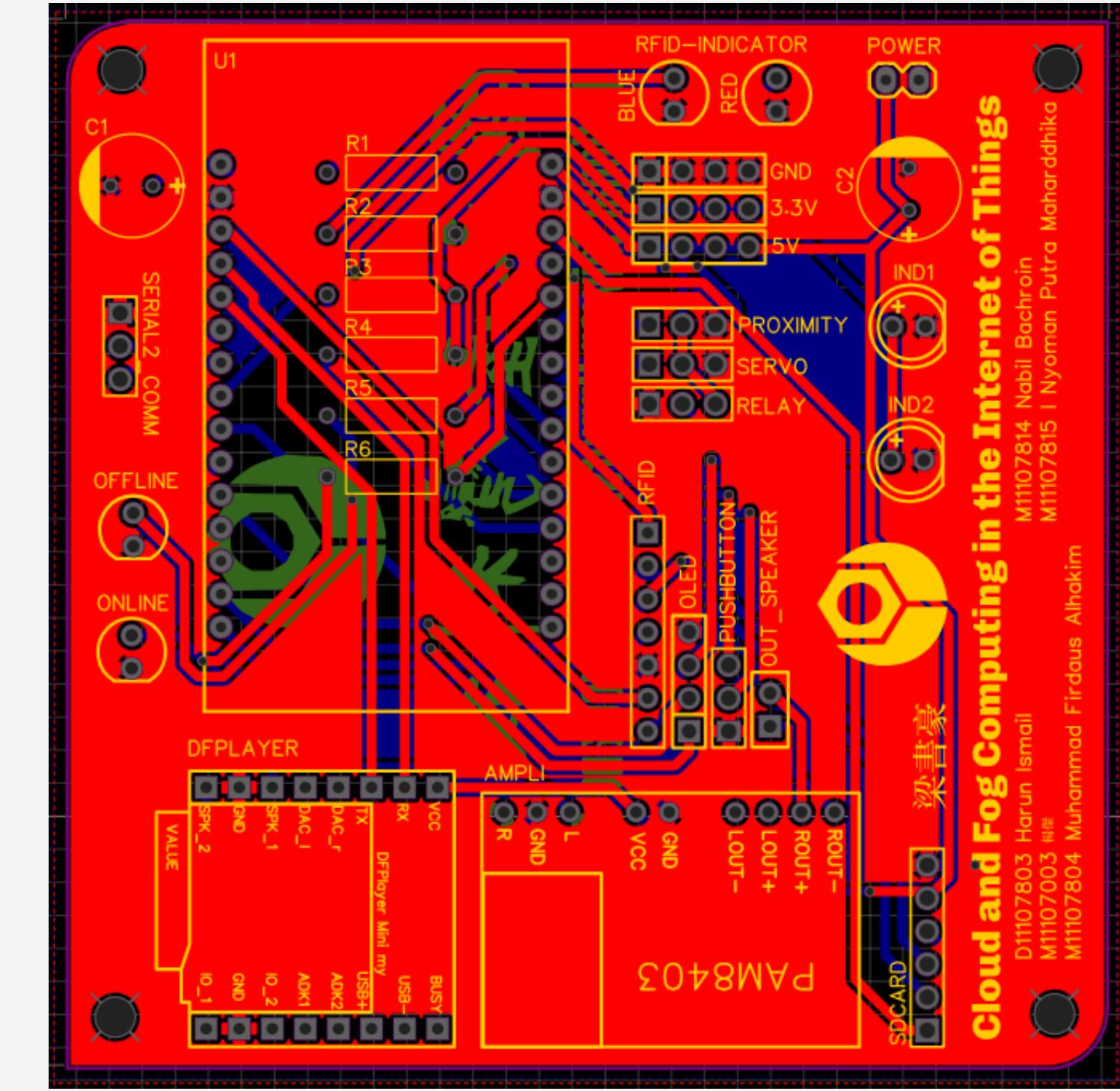
HARDWARE

BOTTOM VIEW



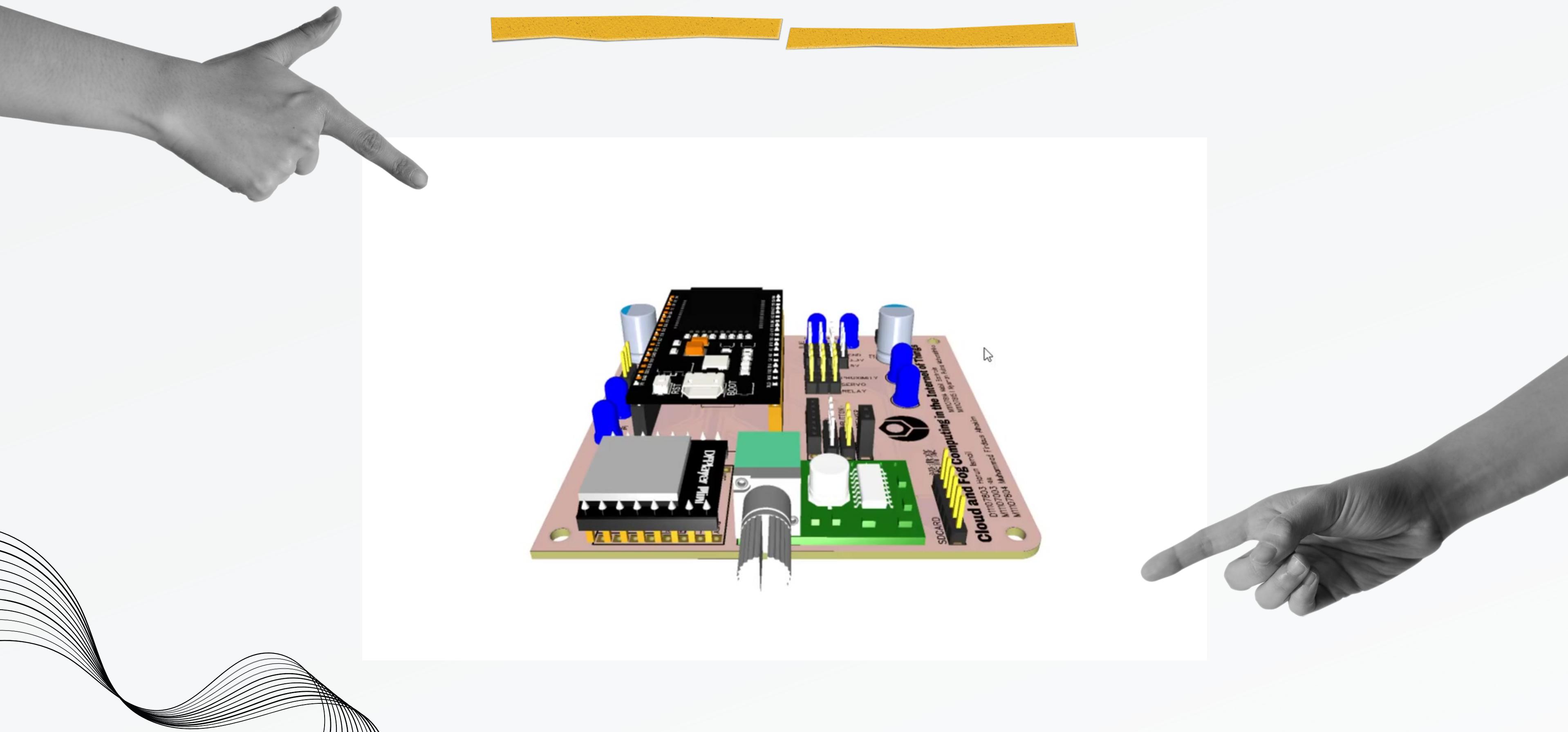
LAYOUT DESIGN

TOP VIEW



HARDWARE

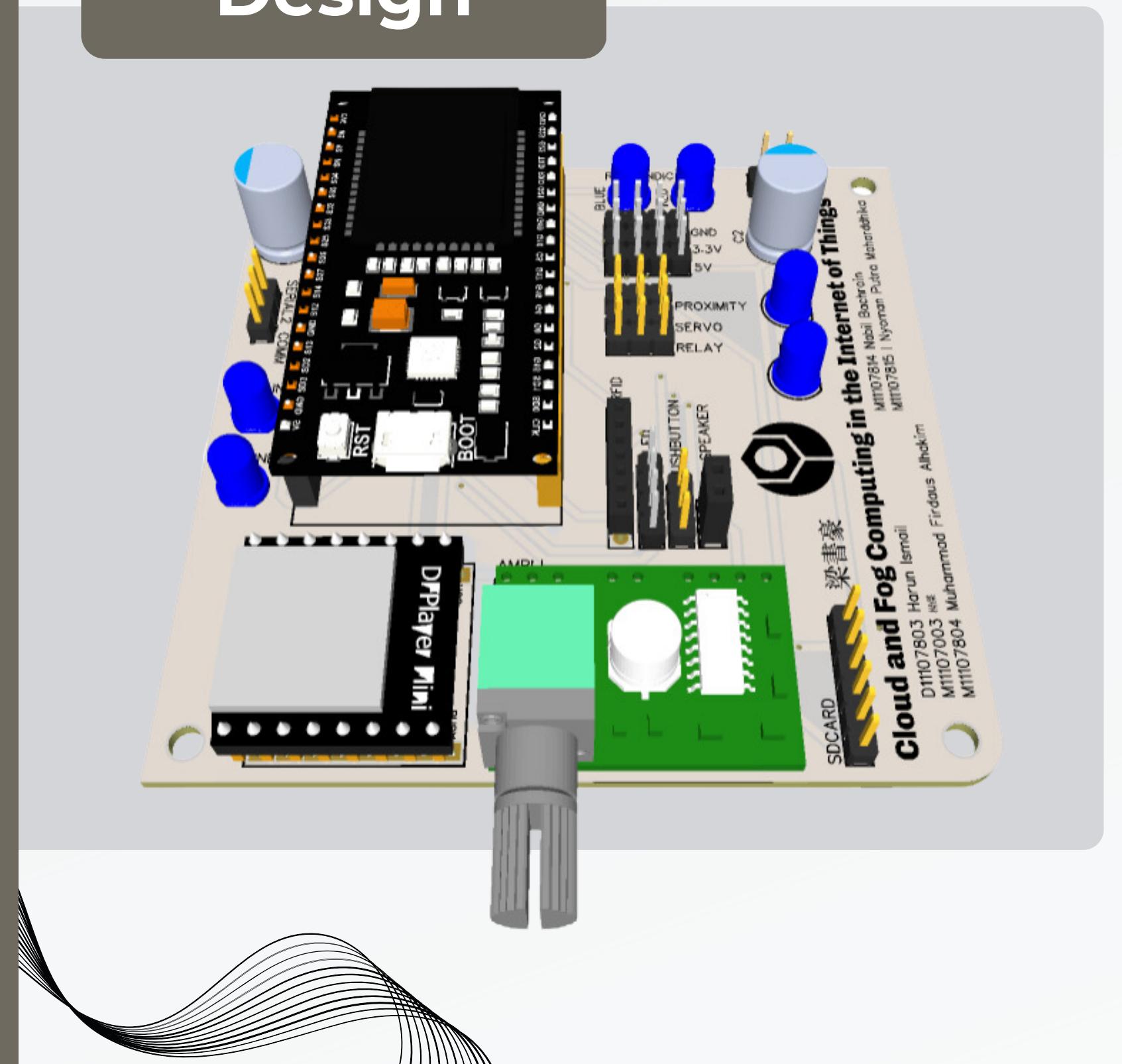
PROTOTYPE OF OUR PRODUCT



PROTOTYPE

OUR PRODUCT

Design

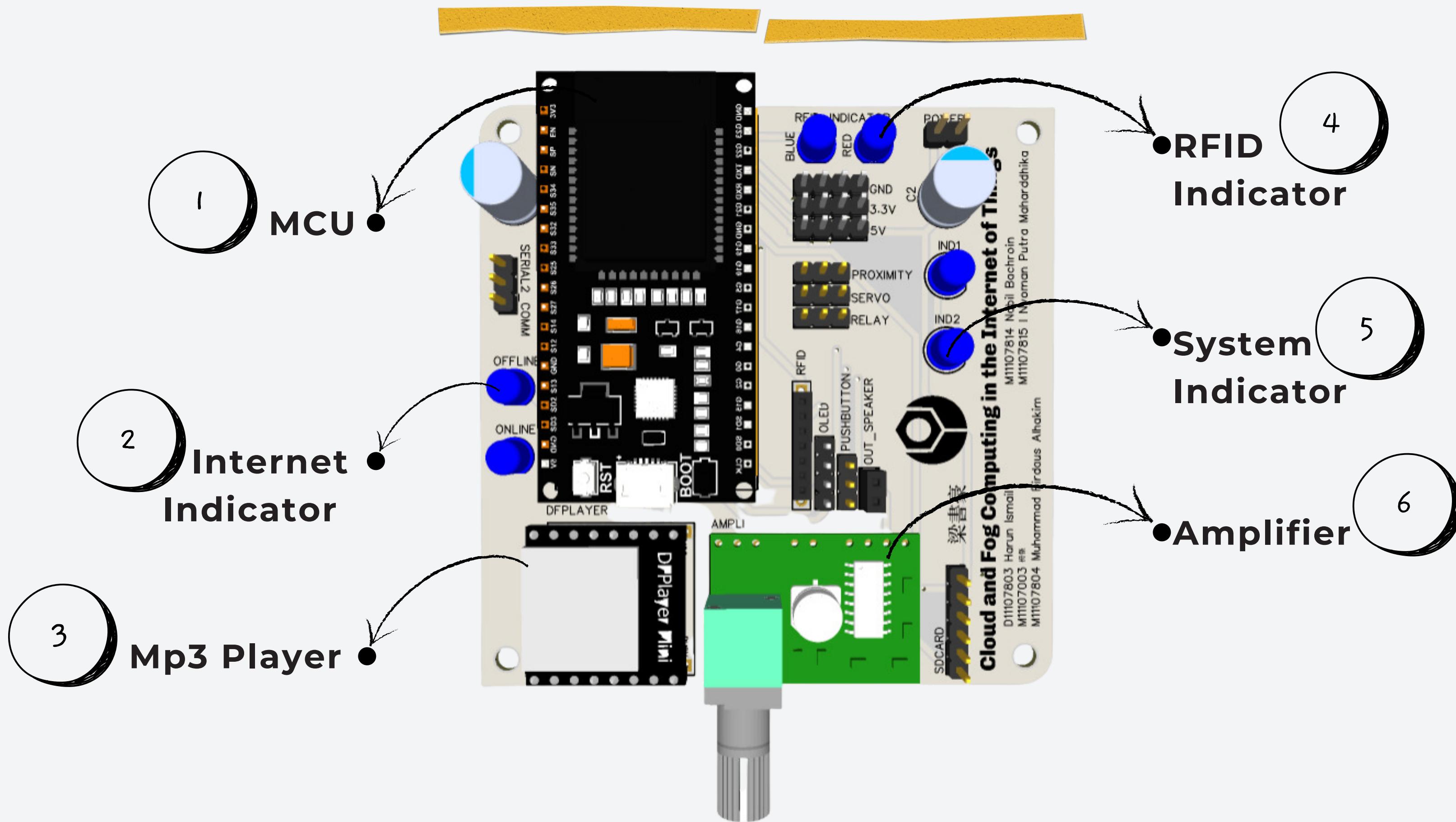


Hardware



HARDWARE

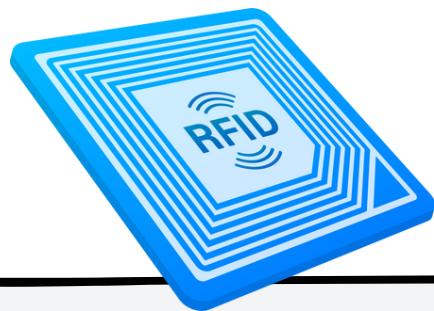
COMPONENTS OF PROTOTYPE



HARDWARE

What Feature do we have?

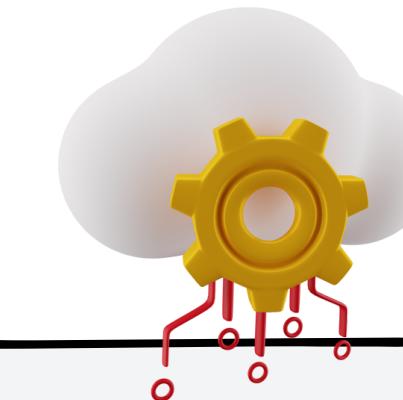
RFID Reader



Balance



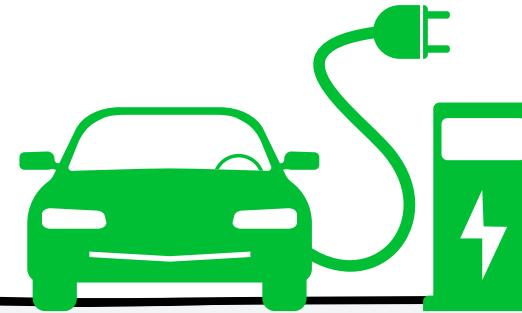
Fog Computing



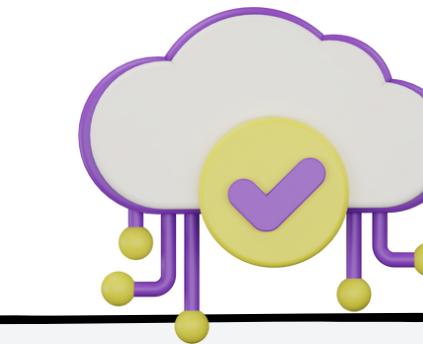
Easy Registration Process



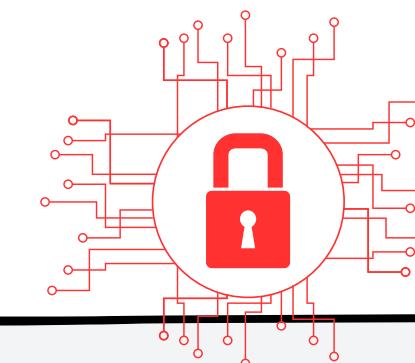
Electric car charging slot



Cloud Computing



Stability System



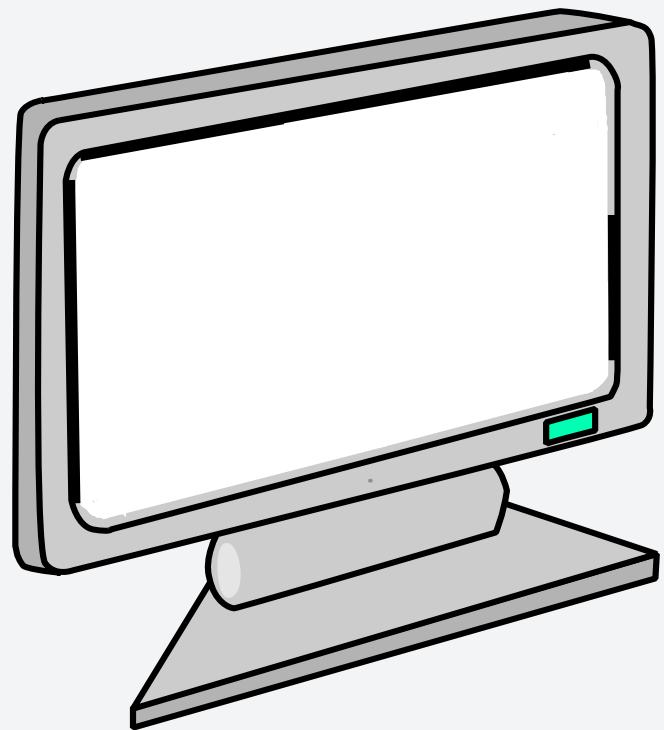
Easy maintenance



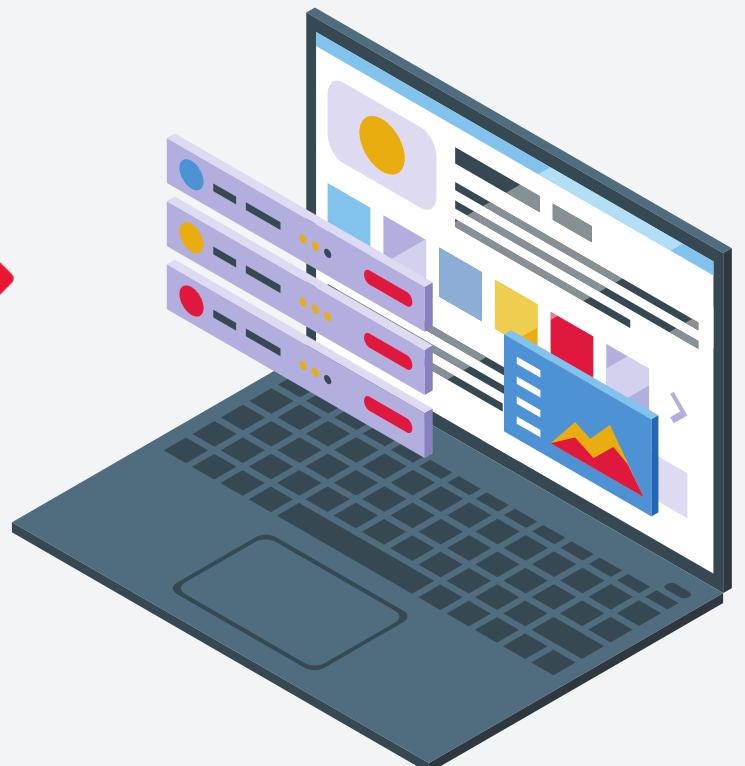
HARDWARE

Registration Process

Oled Display



Website User Interface

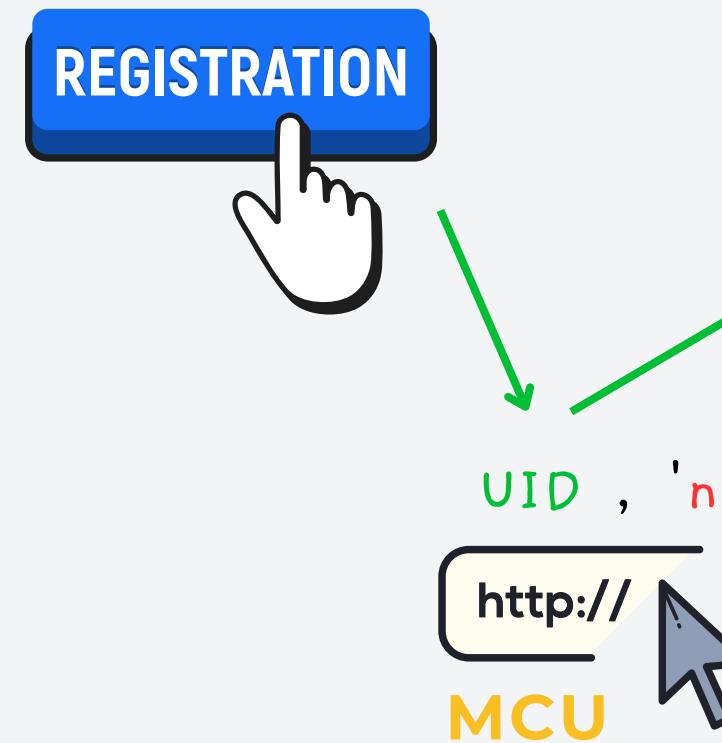


SCAN ME!

HARDWARE

Registration Process

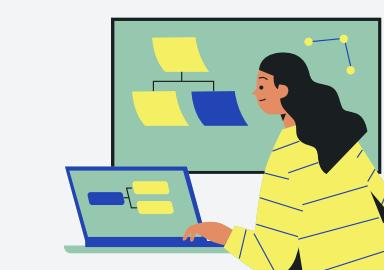
Click Registration on the Hardware and Tap the card



Temporary Table



UID , 'Nabil'



Website UI

Cloud Database



UID , 'no-name'

compare UID
and name.



UID
'Nabil'

MCU
write to fog
database



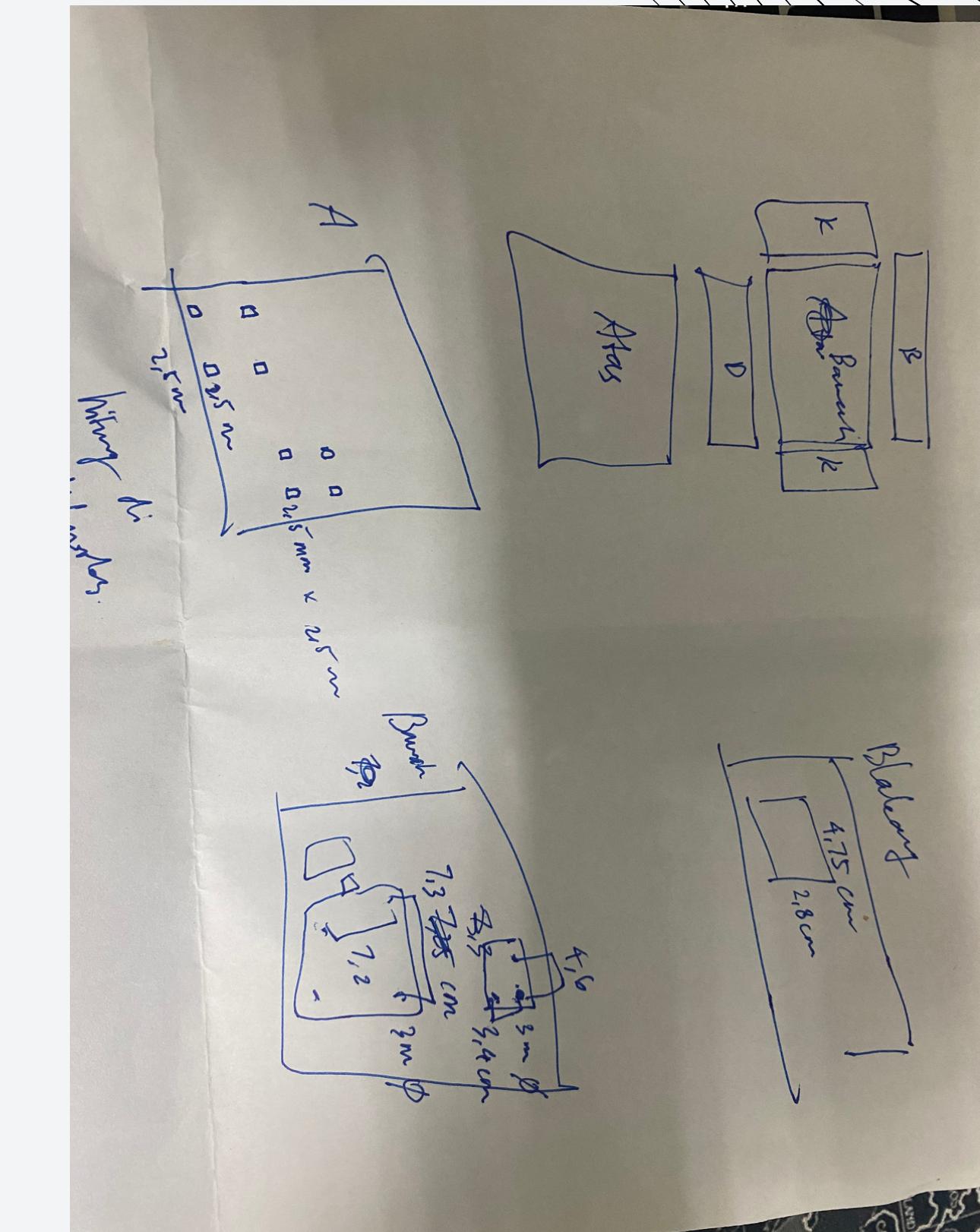
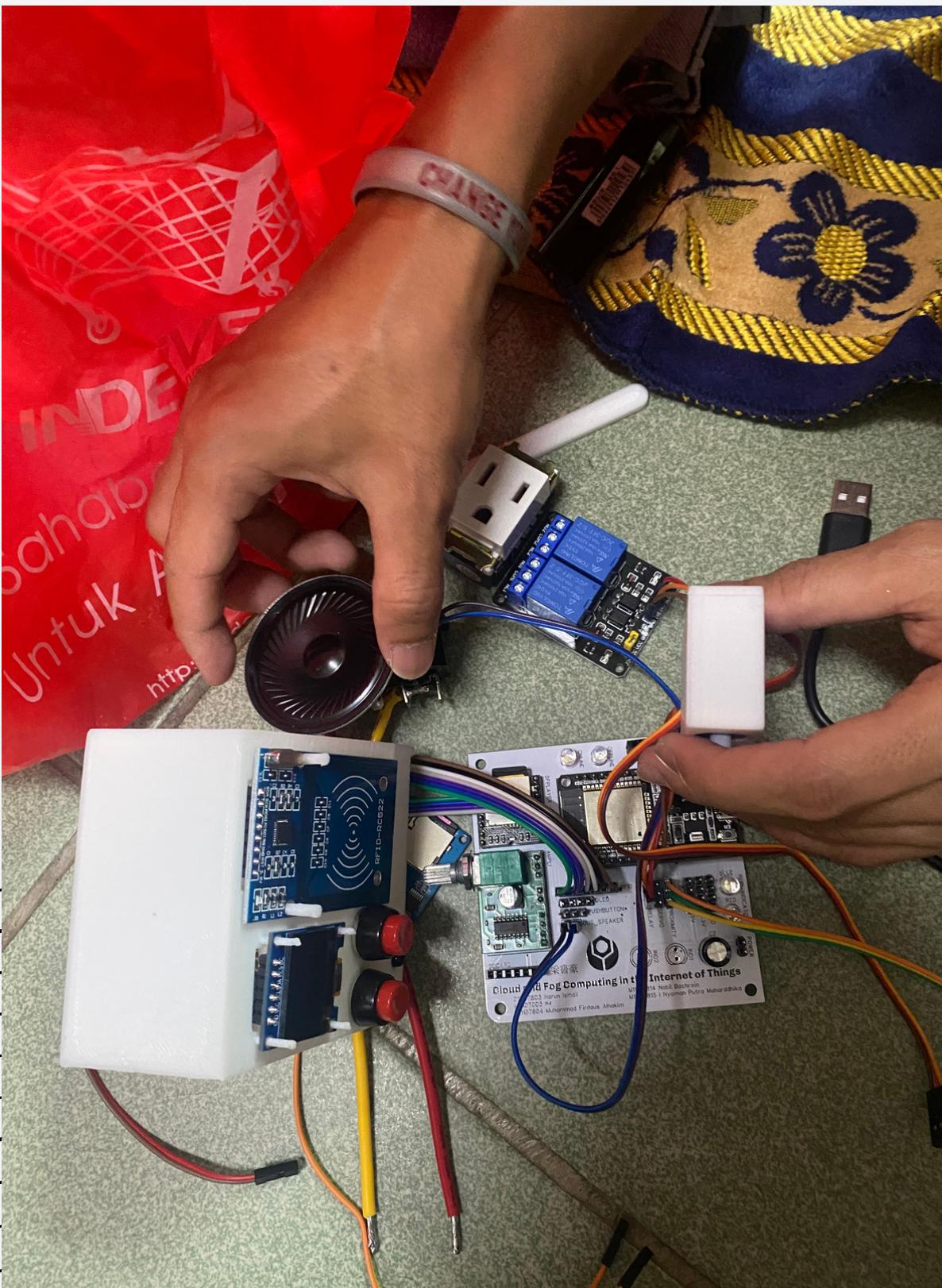
What have we prepared in terms of hardware features?

- We have tried to provide a money balance feature on our system
- We have designed an easy registration process, with a long process because we need to synchronize the User Interface and Hardware at the same time.
- We have created a program to always monitor internet connections, so that our database can be managed properly and correctly. And we provide an indicator led on the MCU to find out if the MCU is offline or online.
- We design a stable system, so when the system is not connected to the power supply, if we are charging the car, the charging will automatically turn on when the MCU first gets power supply.
- Even though the usual/standart parking lots are full, for example, only an electric parking lot remains. So our system still offers this parking space by notifying the Oled Display.
- Security on local database writes
- Security on the IR sensor, if the barrier is moving and then the sensor reads that an object is passing through it, the barrier will return to its standing position again and then close again, and so on.
- If the user has registered on the local database (MCU) but the user still has not filled in their personal data on the website, the system will announce it on the Oled Display.
- If the user has registered on the website, but the internet connection in the system is still disconnected (so the local database is still not updated), then our system can make an announcement that the current position has an internet connection inference.
- Those are all very good considerations.

And there are still a number of features that we provide on the Website user interface.

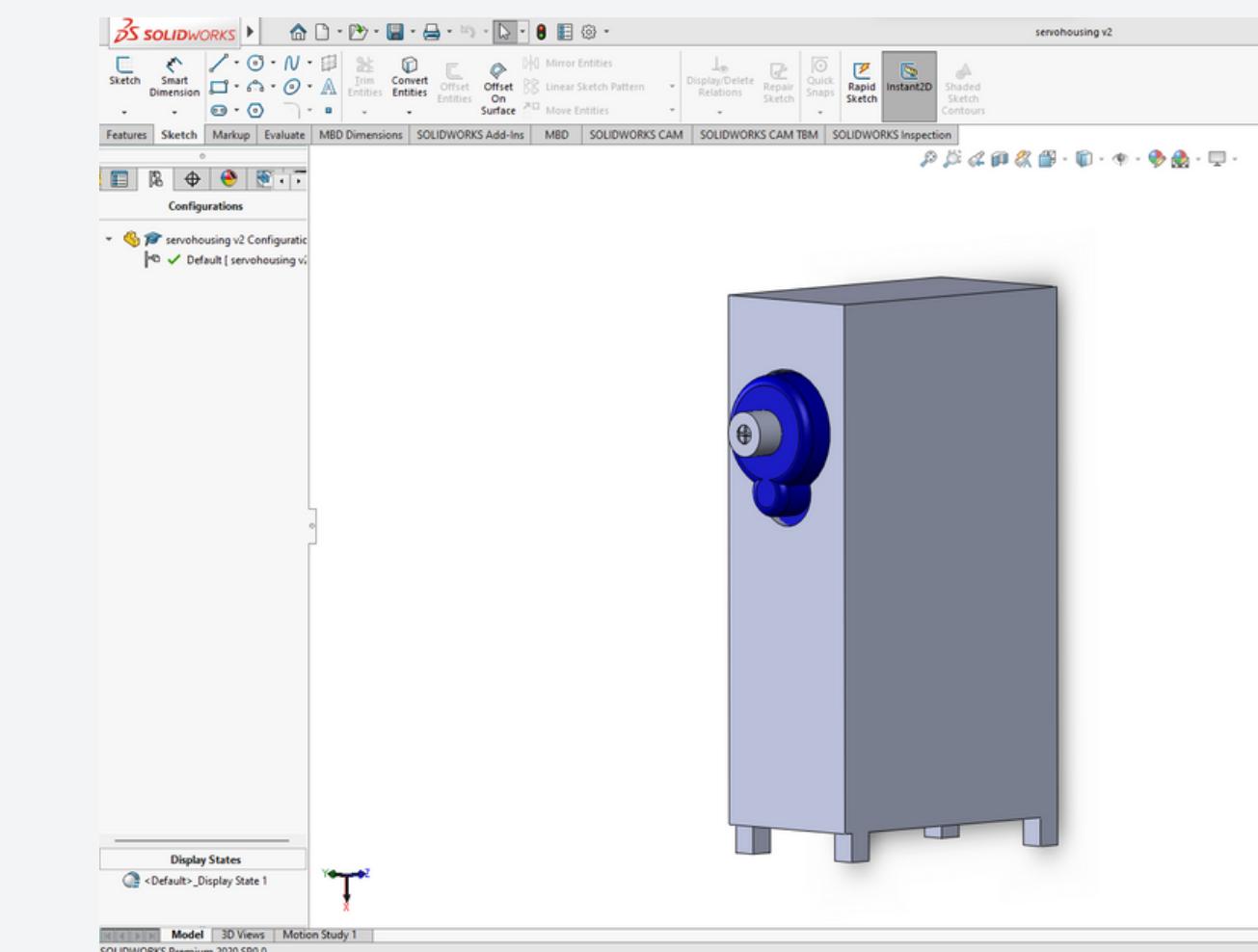
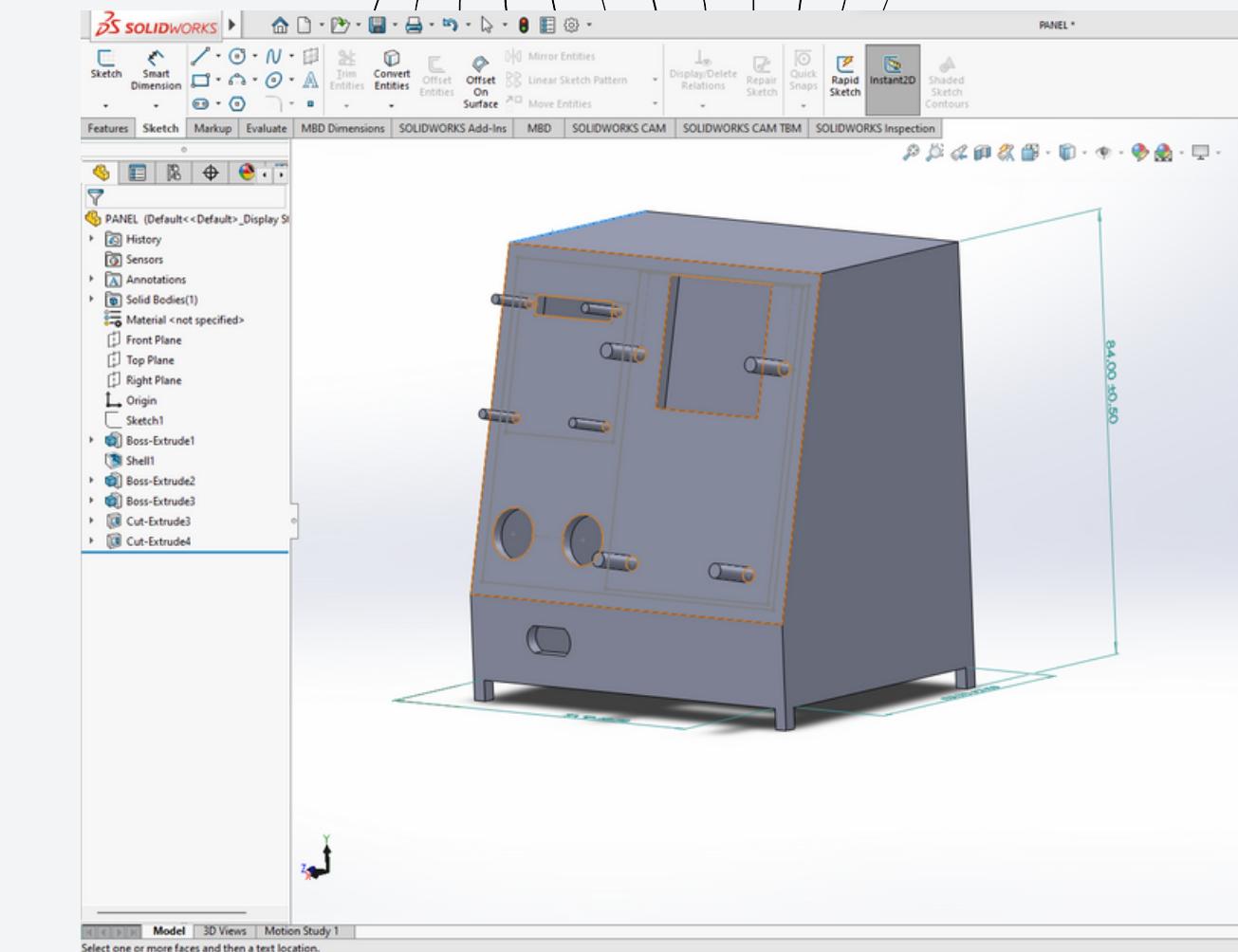
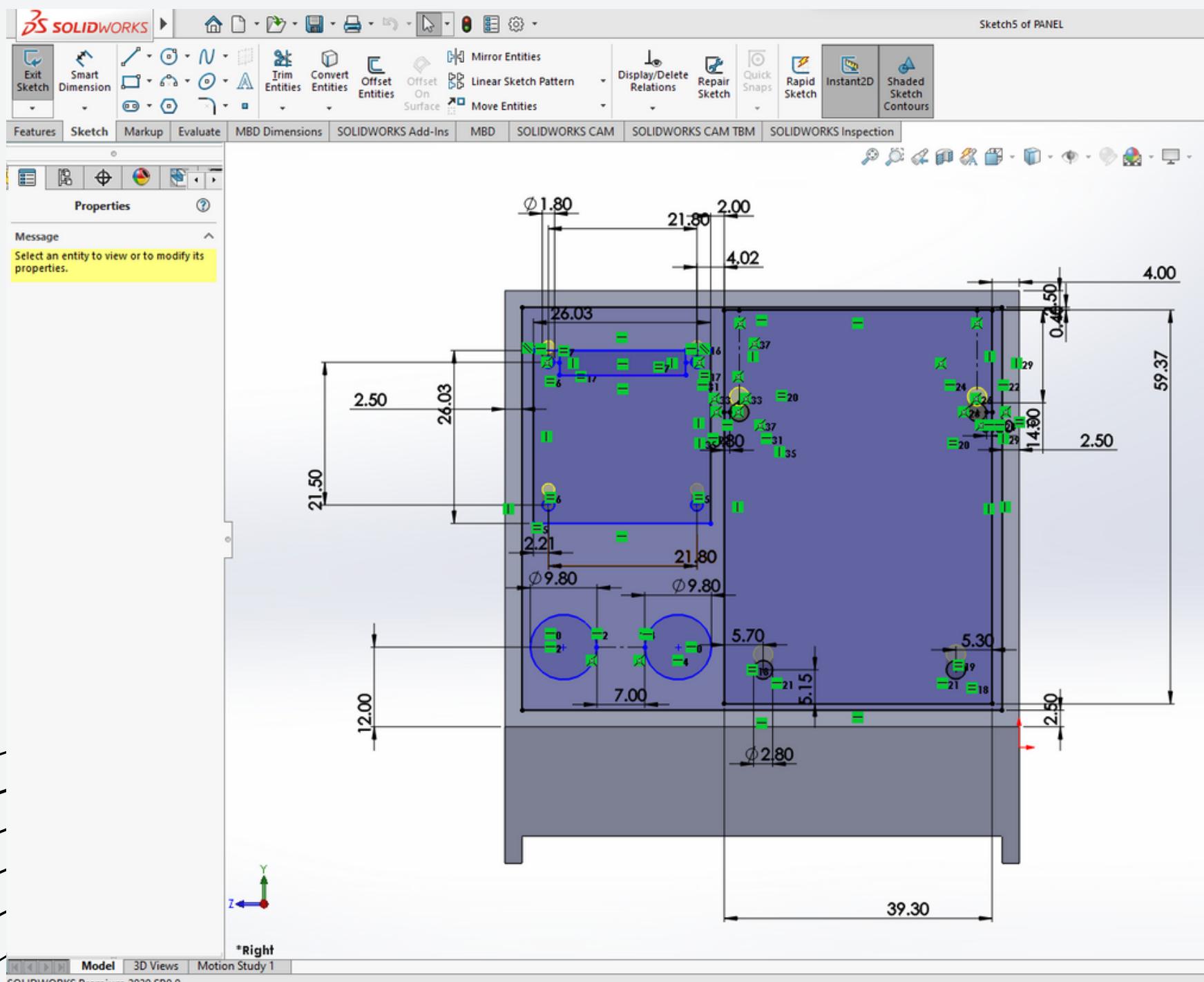
PRODUCT DESIGN

PLACEMENT LAYOUT



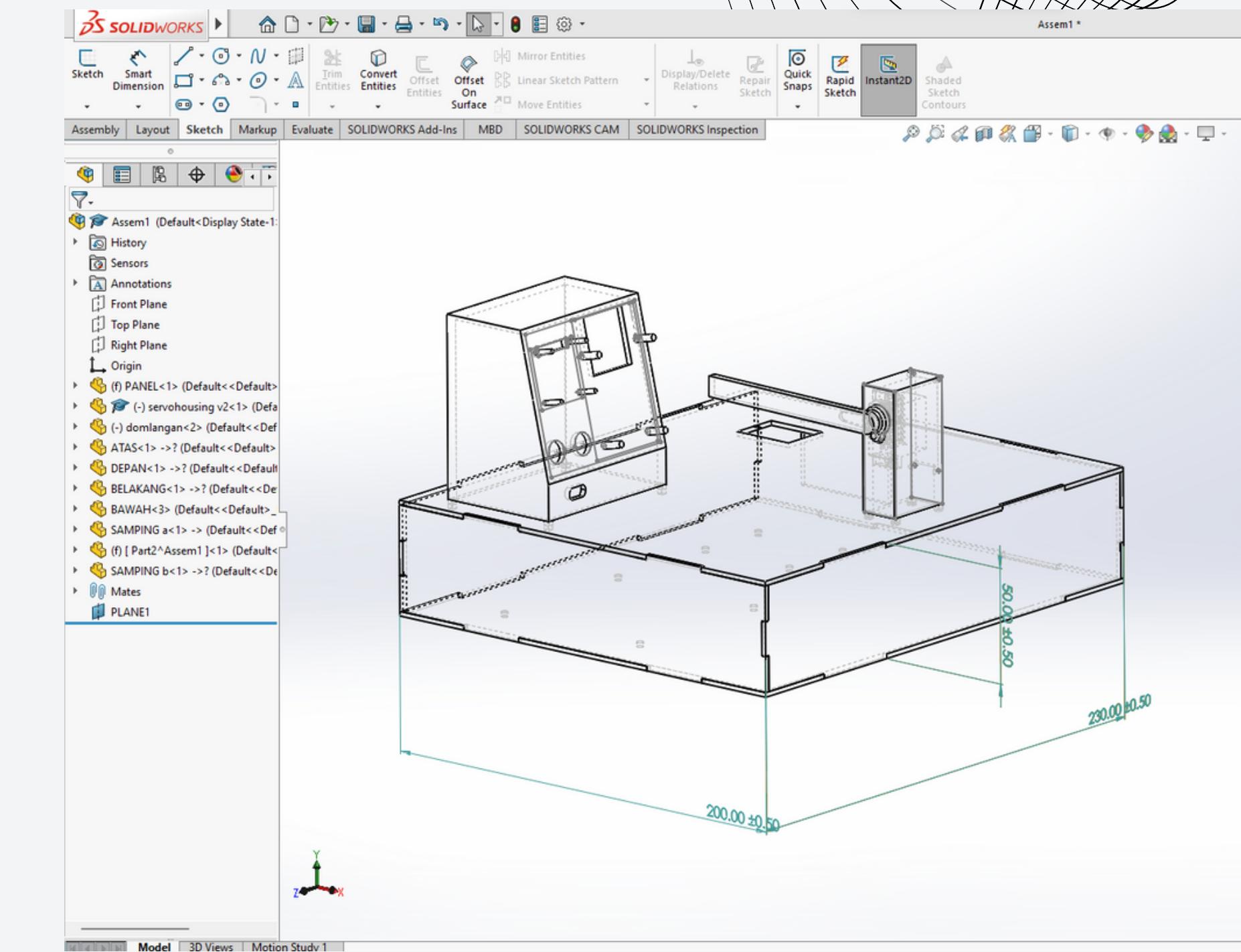
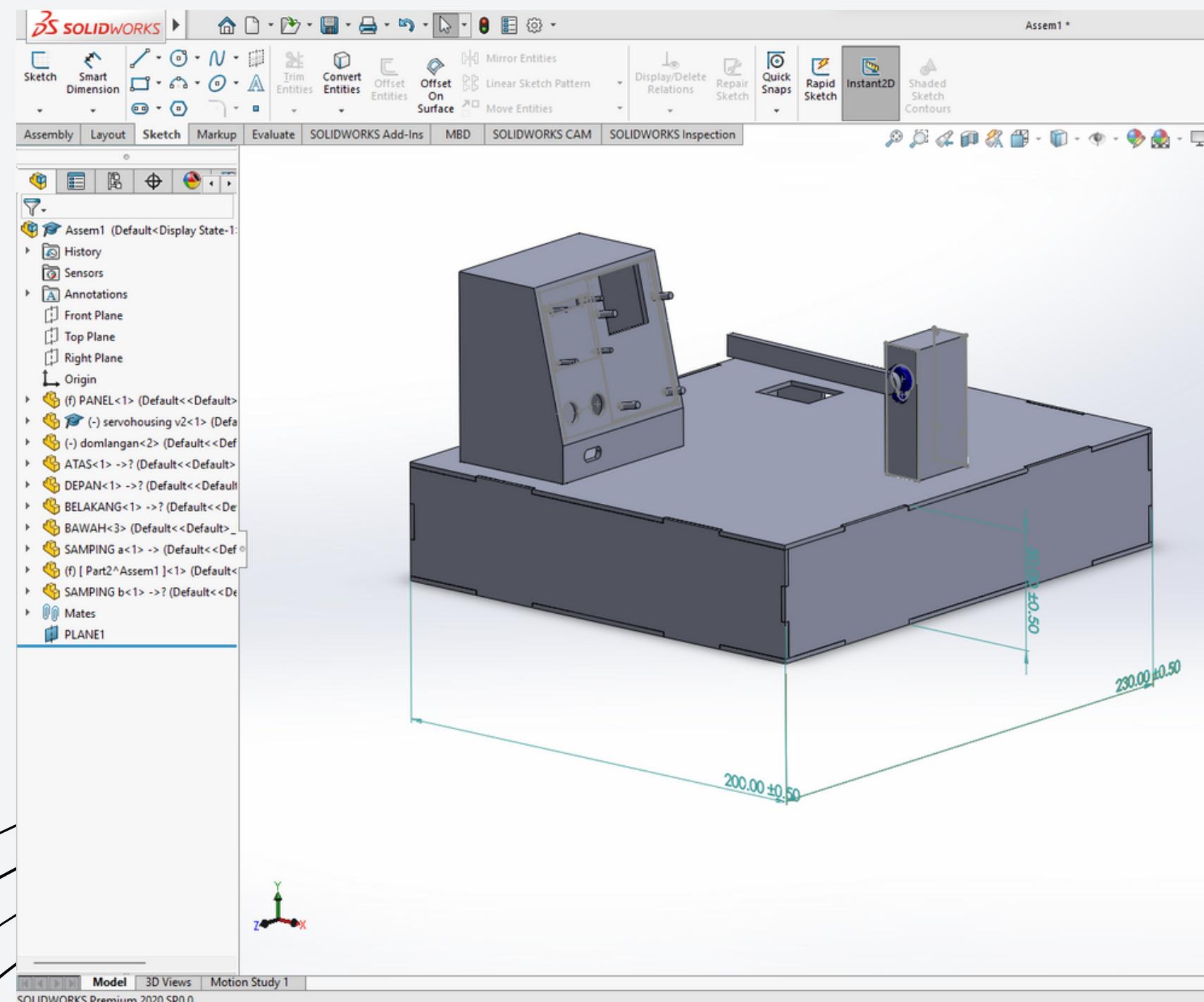
PRODUCT DESIGN

3D PRINTING DESIGN



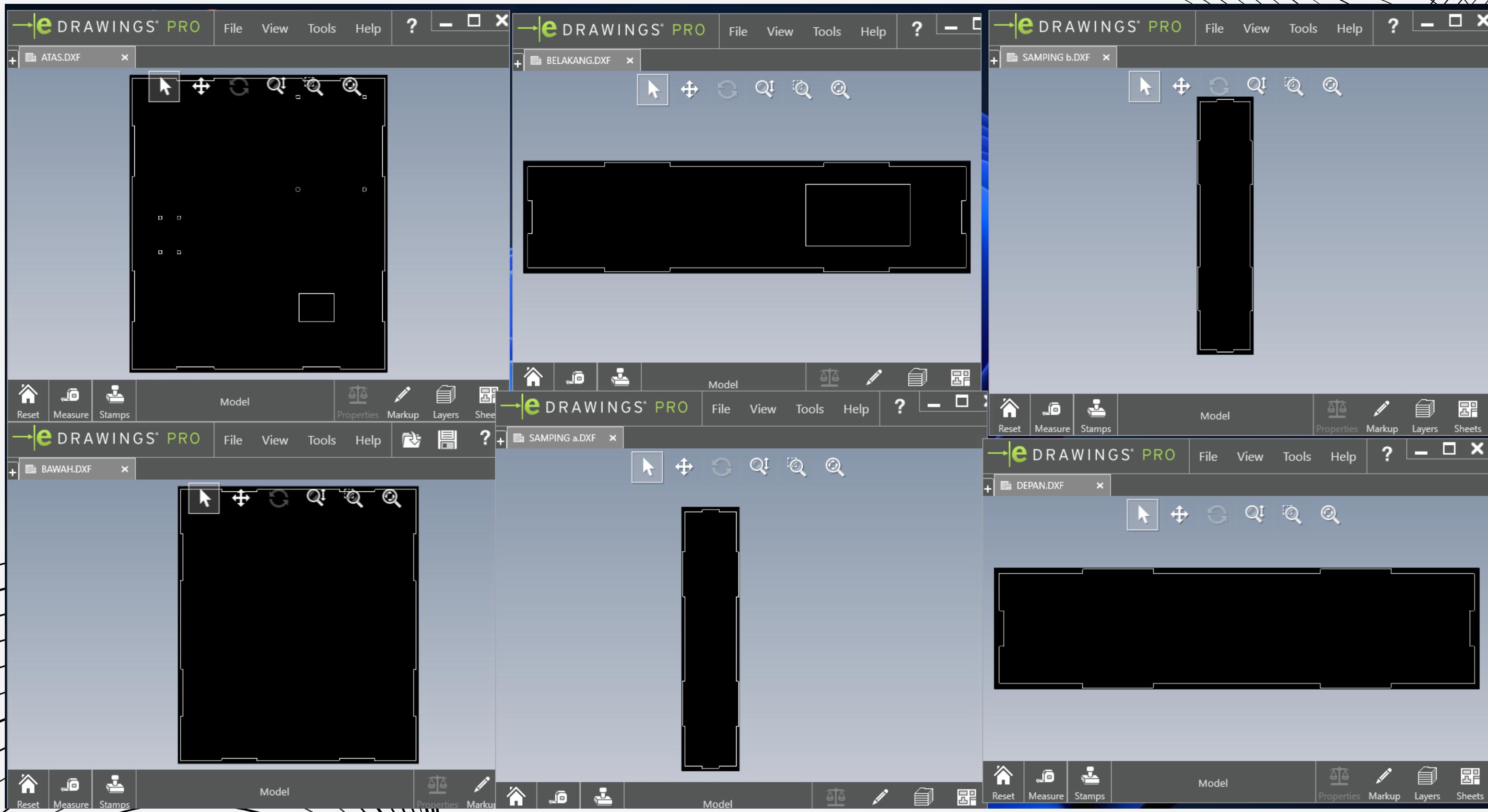
PRODUCT DESIGN

DESIGN PROCESS - PRODUCT MODELING



PRODUCT DESIGN

DESIGN PROCESS - LASER CUTTING



HARDWARE

VISUALISATION

wokwi.com/projects/364803610504784897

WOKWI SAVE SHARE iot project

sketch.ino diagram.json libraries.txt Library Manager

Simulation 00:24.560 75%

```
1 #include <Wire.h>
2 #include <Adafruit_GFX.h>
3 #include <Adafruit_SSD1306.h>
4 const int SDA_PIN = 21;
5 const int SCL_PIN = 22;
6 Adafruit_SSD1306 display(128, 64, &Wire, -1);
7 void setupDisplay();
8
9
10 void setup() {
11     Serial.begin(9600);
12     Hello();
13 }
14
15 void loop(){
16 }
17 void Hello()
18 {
19     Wire.begin(SDA_PIN, SCL_PIN);
20     display.begin(SSD1306_SWITCHCAPVCC, 0x3C);
21     display.clearDisplay();
22     display.setTextColor(WHITE);
23     display.setTextSize(2);
24     display.setCursor(16, 12);
25     display.println("HELLO...");
26     display.setTextSize(1);
27     display.setCursor(16, 38);
28     display.println("Team 4, CFC IoT");
29     display.display();
30 }
31
32
33
```

WEBSITE AND GITHUB



Website:

<https://musabake.wixsite.com/startitup>



Github:

https://github.com/nabilbachroin/CFC_IoT

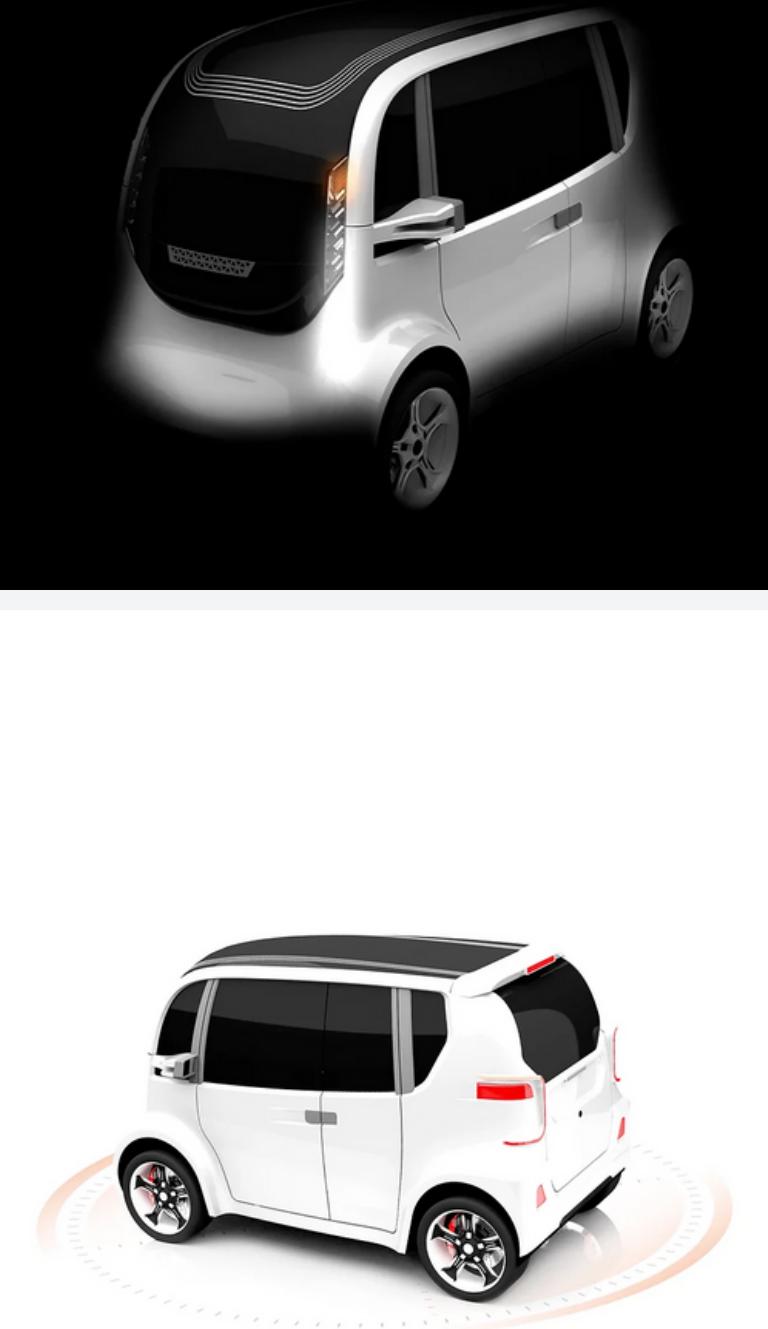
WEBSITE

WIX

Website:
<https://musabake.wixsite.com/startitup>



Homepage contains feature and advantage of our product, and why you should have this solution for your business



The image displays a dark-themed website layout for a smart parking project. On the left, a vertical sidebar features the word "VISION" at the top, followed by the text "We're Changing the Way the World Thinks About Parking". Below this is a bulleted list of project goals. To the right of the sidebar, the main content area has a section titled "SERVICES" with the text "We Deliver Exceptional Products and Services Around the World". Further down, there is a section titled "SMART PARKING" with a brief description of the technology and a "Read More" button. The overall design includes a large, stylized image of a white car on the right side.

VISION

We're Changing the Way the World Thinks About Parking

- To create smart parking that combines IoT technology, data analytics, and user-centric design to deliver a stress-free and comfortable parking experience for users.
- Our smart parking IoT project envisions a future in which users can quickly identify and book parking spots in real-time, travel to their destinations with ease, and conduct payment transactions efficiently, all through a single integrated platform.

SERVICES

We Deliver Exceptional Products and Services Around the World

SMART PARKING

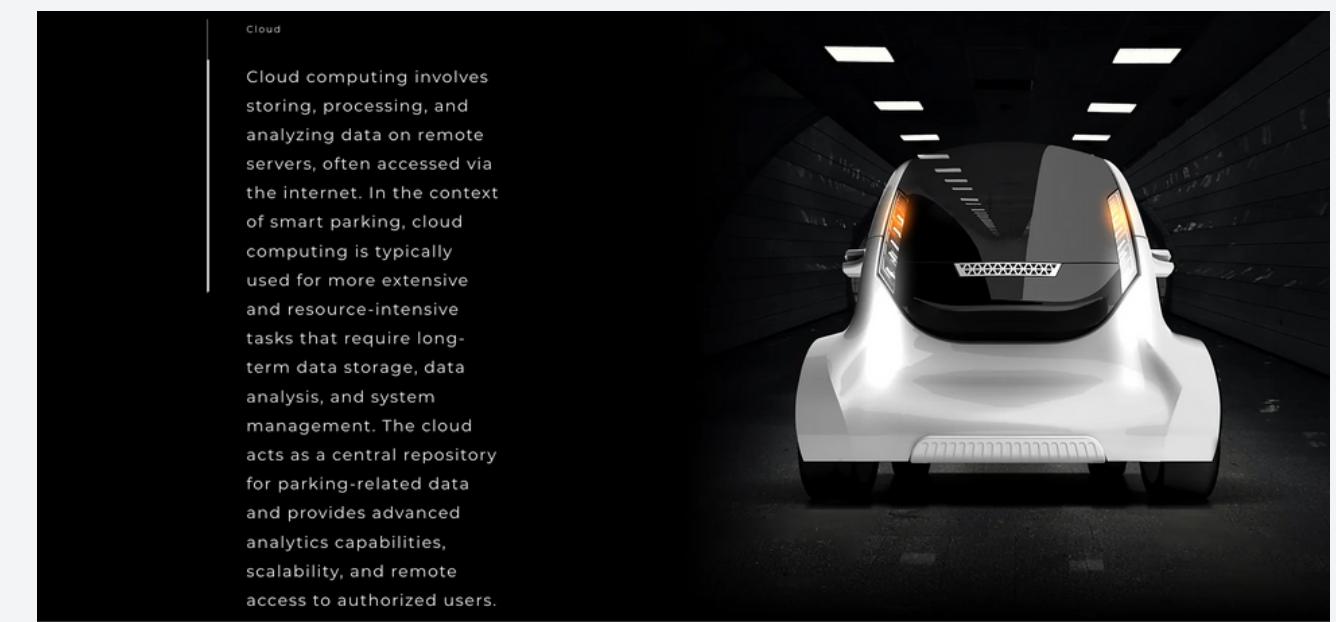
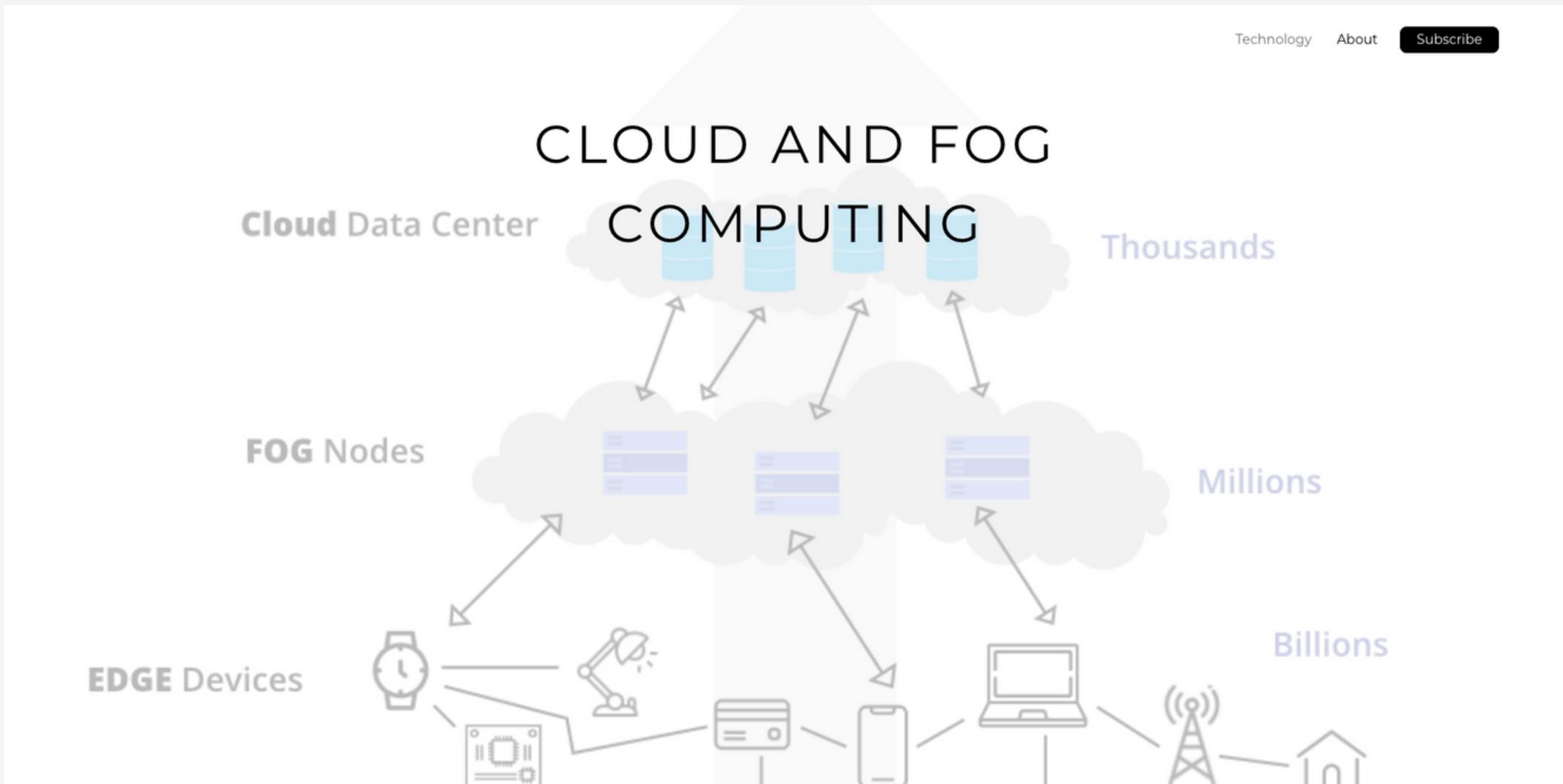
Smart parking is an innovative parking system that uses sensors, cameras, and other technologies to provide real-time information about available parking spots.

[Read More](#)

WEBSITE

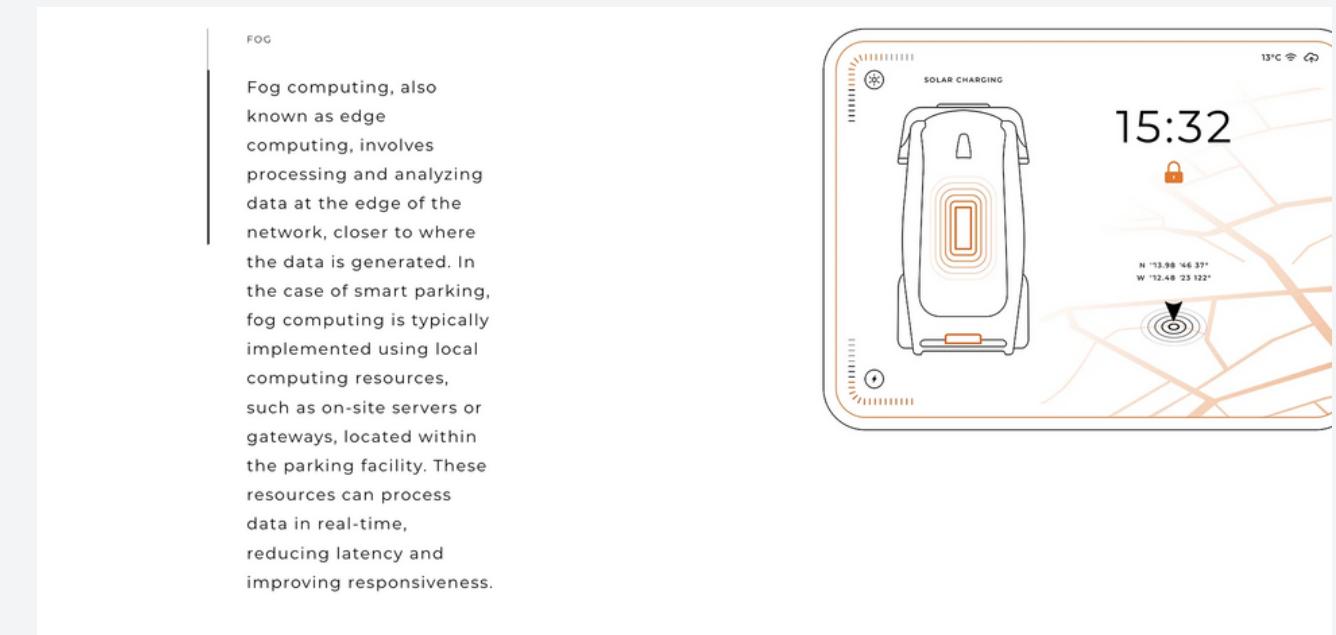


Website:
<https://musabake.wixsite.com/startitup>



Cloud

Cloud computing involves storing, processing, and analyzing data on remote servers, often accessed via the internet. In the context of smart parking, cloud computing is typically used for more extensive and resource-intensive tasks that require long-term data storage, data analysis, and system management. The cloud acts as a central repository for parking-related data and provides advanced analytics capabilities, scalability, and remote access to authorized users.



FOG

Fog computing, also known as edge computing, involves processing and analyzing data at the edge of the network, closer to where the data is generated. In the case of smart parking, fog computing is typically implemented using local computing resources, such as on-site servers or gateways, located within the parking facility. These resources can process data in real-time, reducing latency and improving responsiveness.

Technology page contains the technology we used in our solution.

WEBSITE



Website:
<https://musabake.wixsite.com/startitup>

Technology About [Subscribe](#)

OUR MISSION

Redefining the Way
We Move

I'm a paragraph. Click here to add your own text and edit me. It's easy. Just click "Edit Text" or double click me to add your own content and make changes to the font. I'm a great place for you to tell a story and let your users know a little more about you.

This is a great space to write a long text about your company and your services. You can use this space to go into a little more detail about your company. Talk about your team and what services you provide.



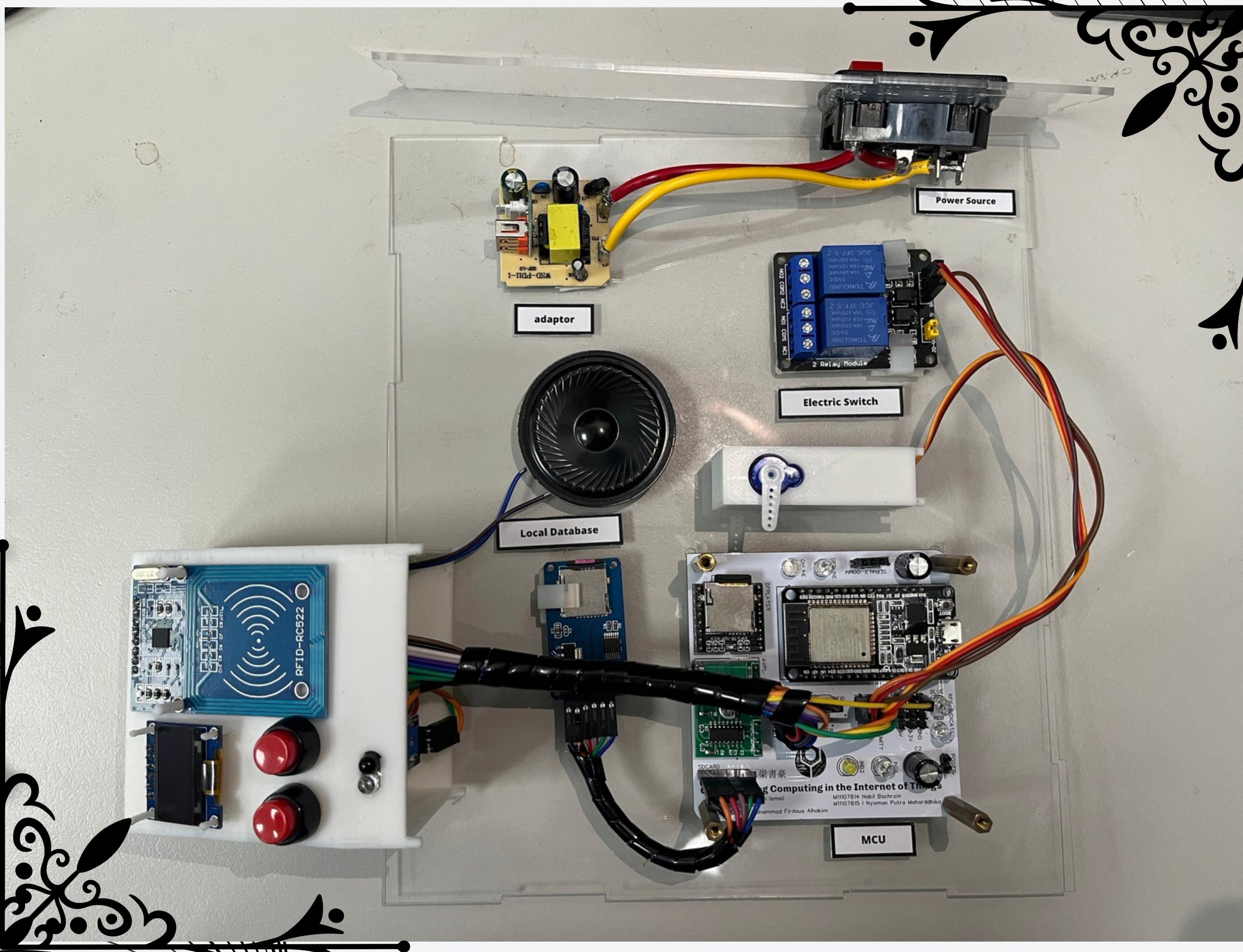
Project Member

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About	Email: M11107804@mail.ntust.edu.tw	Sign up to receive SPP solution news and updates.
		Email *
		<input type="button" value="Subscribe"/>

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About page mainly contain our teams background and what is our role in this project.

SIMPLE VIEW OF THE SYSTEM



PROJECT TIMELINE

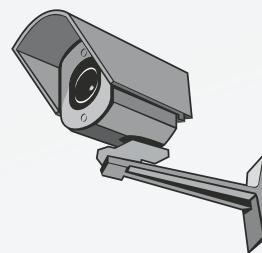


WHAT NEXT?



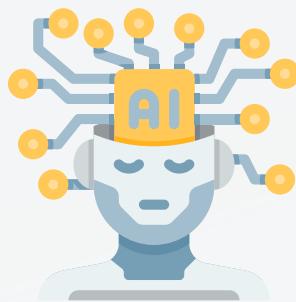
EMPLOY SSE FOR DATA ENCRYPTION

- By utilizing SSE encryption, organizations can enhance the security of their data stored in the cloud, protecting it from unauthorized access, data breaches, and other security threats.



ADD CAMERA SENSOR

- Camera sensors in smart parking systems enable accurate vehicle detection, occupancy monitoring, license plate recognition, enhanced security, and data-driven insights.



IMPLEMENT AI FOR LICENSE PLATE RECOGNITION

- AI for license plate recognition offers numerous benefits, including enhanced accuracy, real-time processing, automatic data extraction, integration with existing systems, high throughput, improved security and safety, data analytics, and customization.



MAKING APPLICATIONS FOR USERS AND FOR MAINTENANCE

- So we want to add wifi connection settings with the admin application, so we can change the desired wifi connection using advertising mode with BLE on ESP32 so that it will make it very easy for us to maintain the system.
- We also want to add a measurement of the electric power used in electric car charging, so that the rates will be according to the power used.

PAPER SUBMISSION

JOURNAL

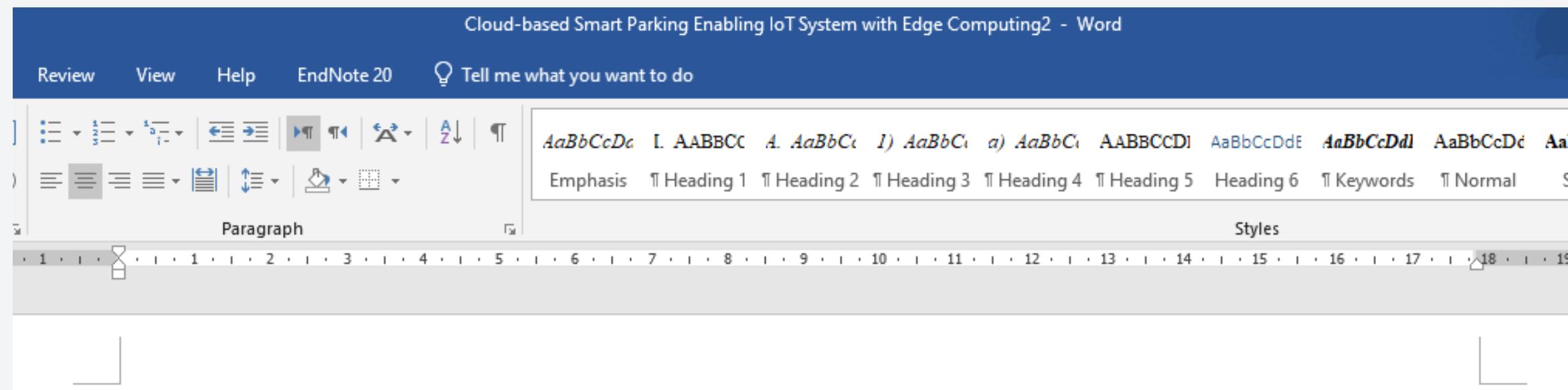
- IEEE Sensors Journal
- Impact Factor: 4.325
- Quartile: Q1

TIMELINE

- Submission: June
- Review Time: 2 months
- Publish: October

The screenshot shows the IEEE Xplore digital library interface. At the top, there are links for IEEE.org, IEEE Xplore, IEEE SA, IEEE Spectrum, and More Sites. The IEEE Xplore logo is prominently displayed, along with navigation options for Browse, My Settings, and Help. A logo for National Taiwan University of Science and Technology is shown, indicating access provided by the university. On the right, there are links for Sign Out and Advanced Search. Below the header, there is a search bar with dropdown menus for 'All' and 'Search within Publication'. The main content area displays the IEEE Sensors Journal page. It features the journal's name in green, along with submission and alerting options. Below this, there are tabs for Home, Popular, Early Access, Current Issue, All Issues, and About Journal. Key metrics are highlighted: Impact Factor (4.325), Eigenfactor (0.03684), Article Influence Score (0.636), and CiteScore (7). To the right, a vertical sidebar for the IEEE Sensors Journal lists it as being in the Q1 quartile for Electrical and Electronic Engineering, with an SJR 2022 score of 0.99. The sidebar also credits scimagojr.com.

LET'S TAKE A LOOK AT A BRIEF PROJECT PAPER



Cloud-based Smart Parking Enabling IoT System with Fog Computing

*Note: Sub-titles are not captured in Xplore and should not be used.

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THANK'S FOR WATCHING

"Unlock the boundless possibilities of IoT and let your project soar to new heights. Embrace innovation, harness technology, and create a future where connectivity transforms lives. Thank you for being a part of this inspiring journey"

