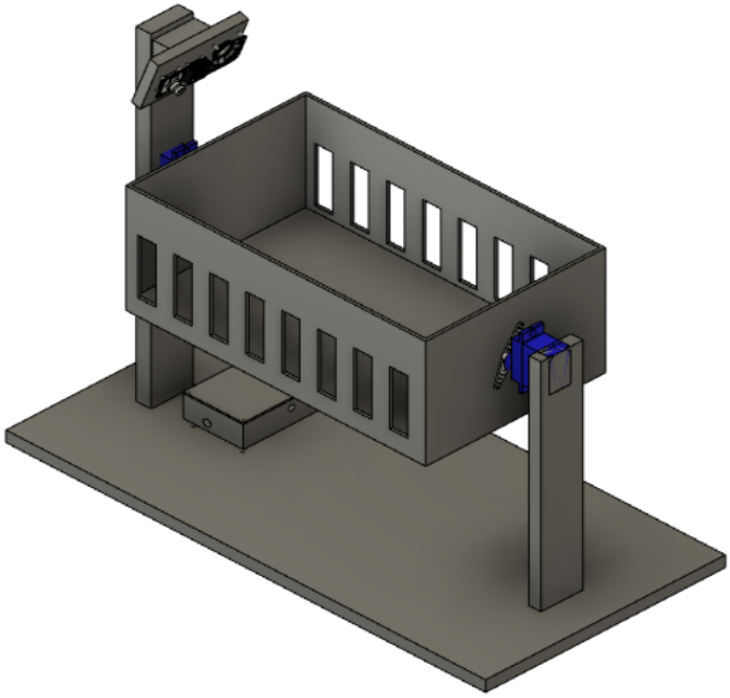
SMART CRADLE

-Because you and baby deserve care

DESIGN MANUAL



==========

3RD YEAR PROJECT

Designed By:

E/17/040 : CHANDRASENA M.M.D.

E/17/356 : UPEKHA H.P.S

E/17/407 : WIJESOORIYA H.D

==========

DESIGN MANUAL

CONTENT

1. Introduction..... 04

1.1 What is this product..... 04

1.1.1 Problem 04

1.1.2 Our Solution 04

1.2 System Overview..... 05

2. Software Development 06

2.1 User Registration 08

3.1.1 Frontend validation 10

3.1.2 Backend Validation 10

2.2 User Login 11

3.2.1 Frontend validation..... 11

3.2.2 Backend Validation..... 12

2.3 Device Selection 16

2.3.1 Frontend validation 13

2.3.2 Backend Validation..... 14

2.4 Dashboard 16

2.4.1 Monitor 17

2.4.2 Music 18

2.4.2.1 Backend Validation 19

2.4.3 Swing 20

2.4.3.1 Backend Validation 21

2.4.4 Temperature 22

2.4.5 Fan 23

2.4.5.1 Backend Validation 24

2.5 Side Menu Bar 25

2.5.1 My Devices..... 25

2.5.2 Add a Device..... 26

2.5.2.1 Backend Validation..... 27

2.5.3 Remove a Device 28

2.5.3.1 Backend Validation 28

2.5.4 Settings 31

2.5.4.1 Backend Validation..... 31

2.5.5 About 33

3. Technology for frontend development..... 34

3.1 Flutter..... 34

3.1.1 Reasons for selecting flutter 34

3.1.2 Used libraries and packages 34

4. Backend Development..... 35

4.1 Reasons for selecting NodeJS..... 35

4.2 Used Libraries and Frameworks..... 35

5. Database Management System 39

6. Communication Protocols..... 39

6.1 HTTP 39

6.2 MQTT 40

7. Software and Backend testing 43

7.1 Test Cases 43

7.2 Testing Tools 47

8. Hardware Development 48

8.1 Components 48

8.2 Circuit Diagrams 56

8.3 PCB Design 58

8.4 Schematic Design 59

8.5 3D Model 60

9. Cloud Deployment 65

10. Security ,Safety and Scalability 71

10.1 Security and Safety 71

10.1.1 Software Aspect 71

10.1.2 Hardware Aspect 71

10.2 Scalability 72

11. Resources 74

1.0 INTRODUCTION

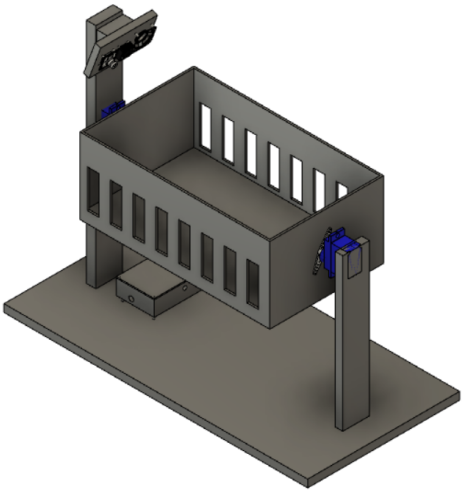
1.1 Why this Product ?

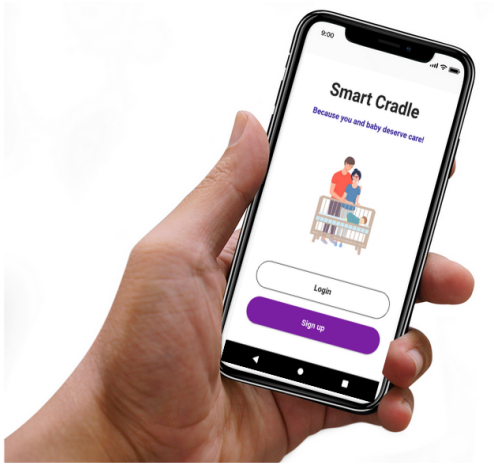
1.1.1 Problem

As we are very well familiar with the hurdles faced by Parents to nurture their infant and especially in case if both the Parents are working,to give 24 hours of time for the baby in such cases is impossible. However, they still need to look after their babies,thereby increasing workload and stress.They either send their babies to their parents or hire a baby caregiver while they are working. So we came up with a solution for this problem.

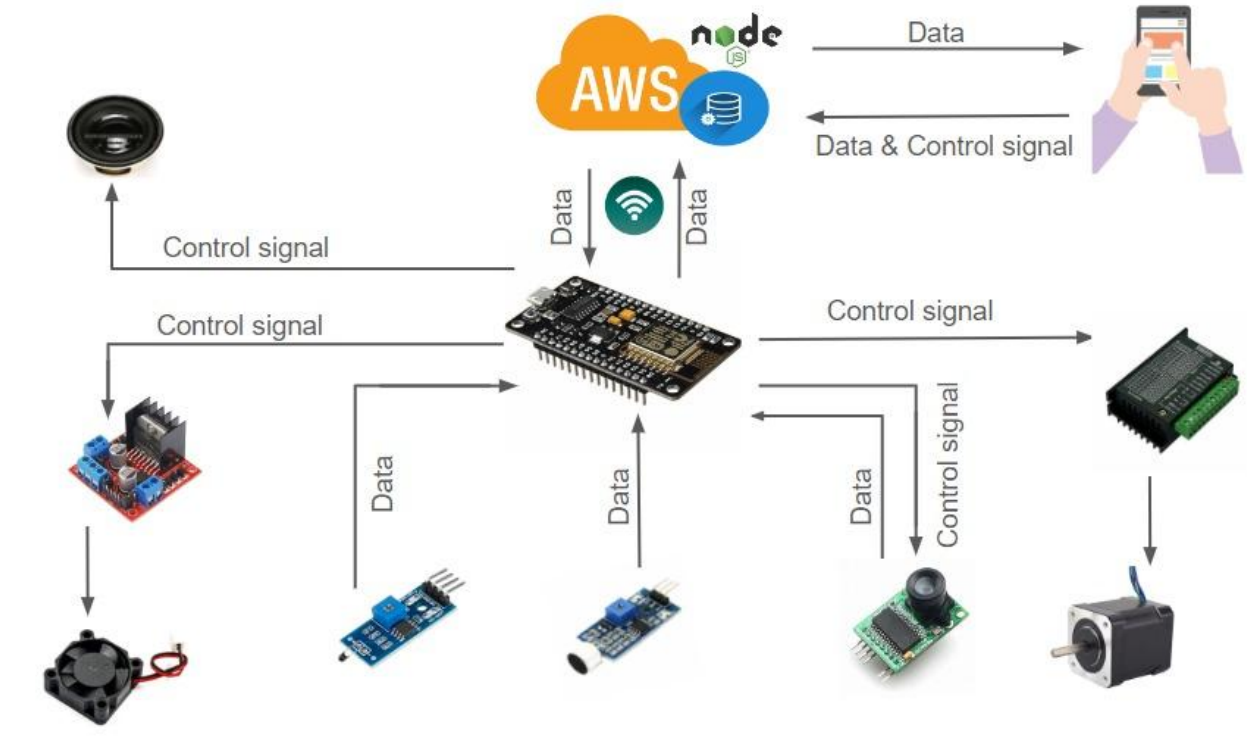
1.1.2 Solution

The proposed solution involves a smart cradle which can be controlled using the mobile application.Live monitoring of the baby,swing the cradle,playing music,switching on and off the fan ,checking the room temperature and cry detection are some of the features available in this Smart cradle.





1.2 System Overview



Central server(AWS) is used to maintain a database to keep a track of registrations and logins.Whenever the user logs to the system,the mobile application will connect to the server and verify authentications.

Sound sensors,thermal sensors,camera module,mini fan,speakers and motors are connected to the node MCU controller and controller is connected with the server through data or wifi.

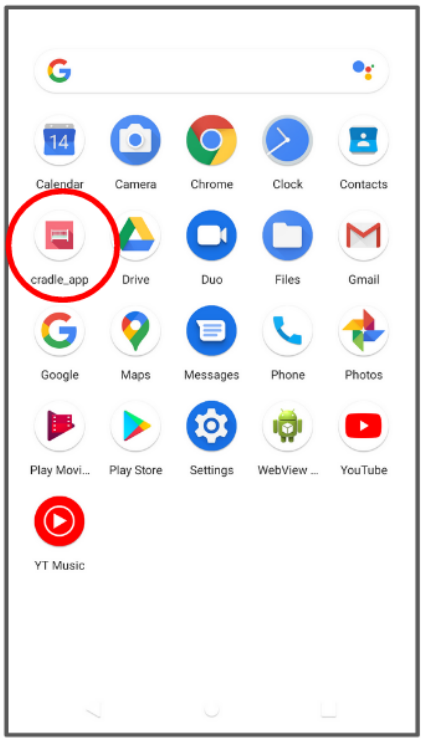
2. SOFTWARE DEVELOPMENT

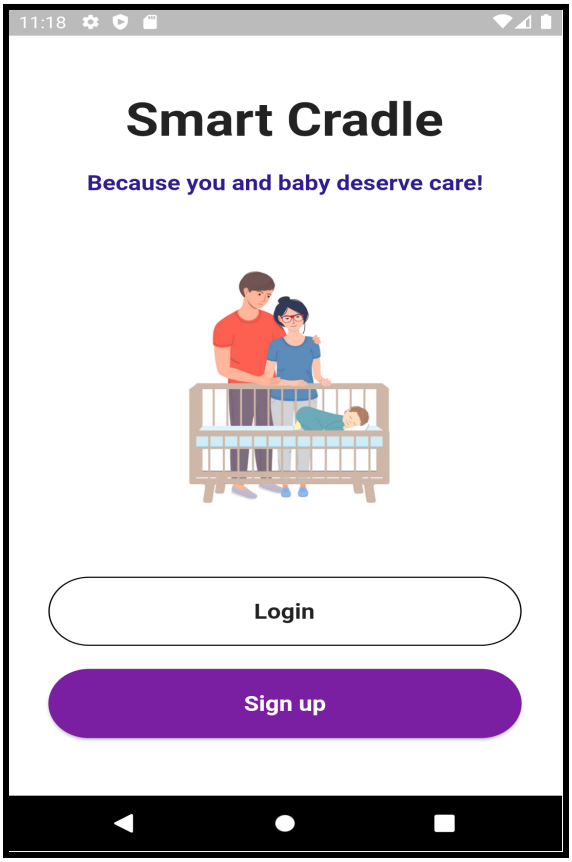
The Mobile application is designed in a more user-friendly manner.Graphics and pictures are used to represent the functionality/options of the smart cradle.This will clearly deliver the content to the user and they can easily navigate to their requirements without much frustration.

The smart cradle can be easily controlled by the mobile application.Following features are available in it.

- ➔ Live monitoring of the baby
- ➔ Playing Music
- ➔ Swing the cradle
- ➔ Turn on/off the fan
- ➔ Checking the room temperature

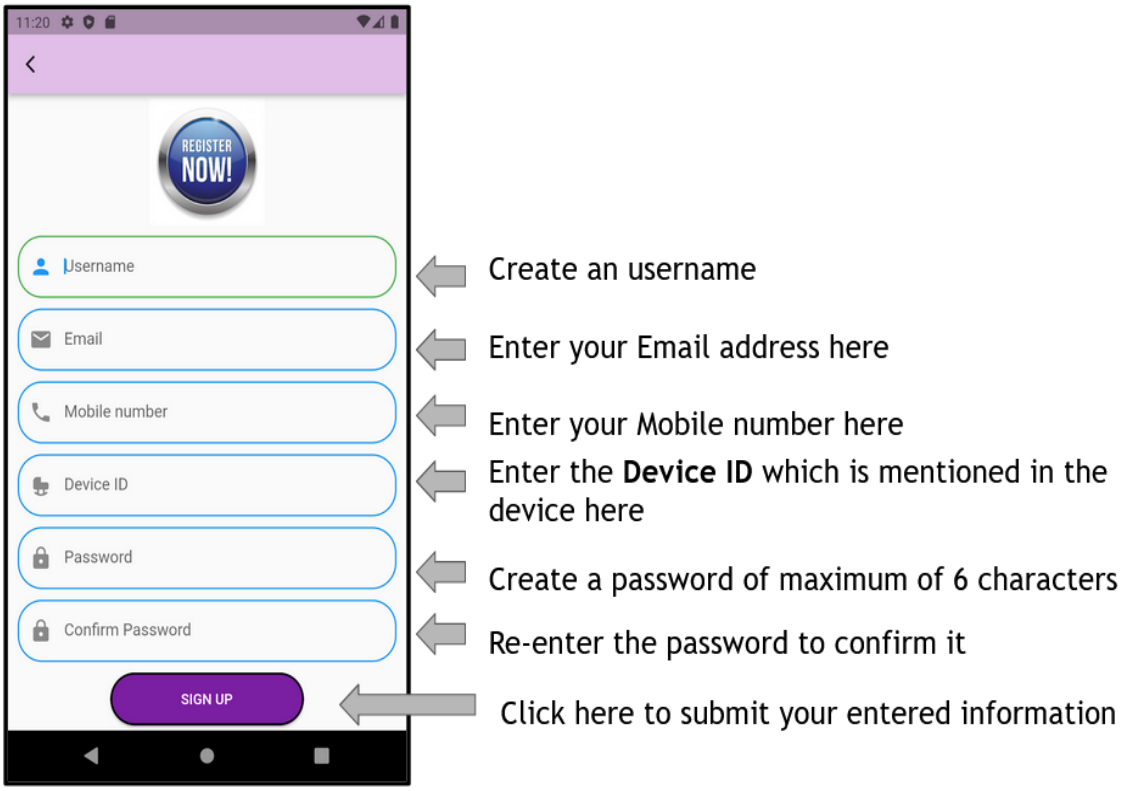
Launch the Cradle_app
Mobile application





Users need to have an account,to access the mobile application.

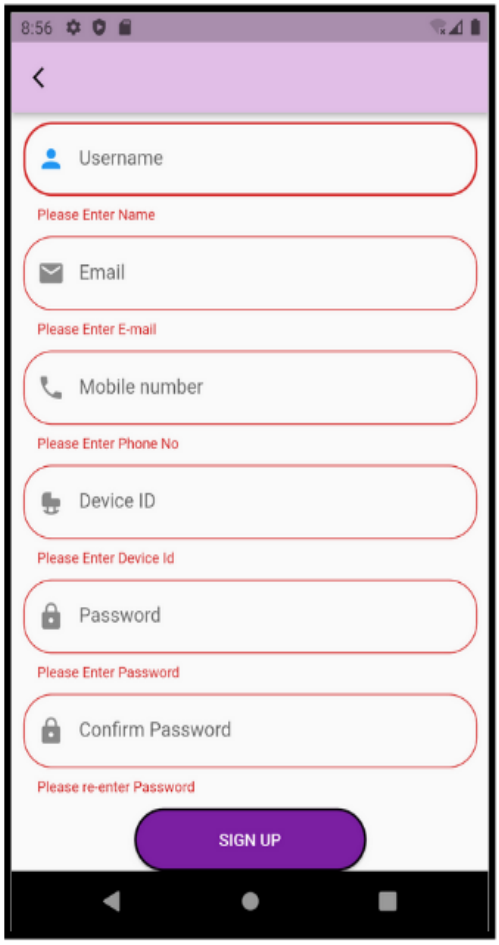
2.1 USER REGISTRATION

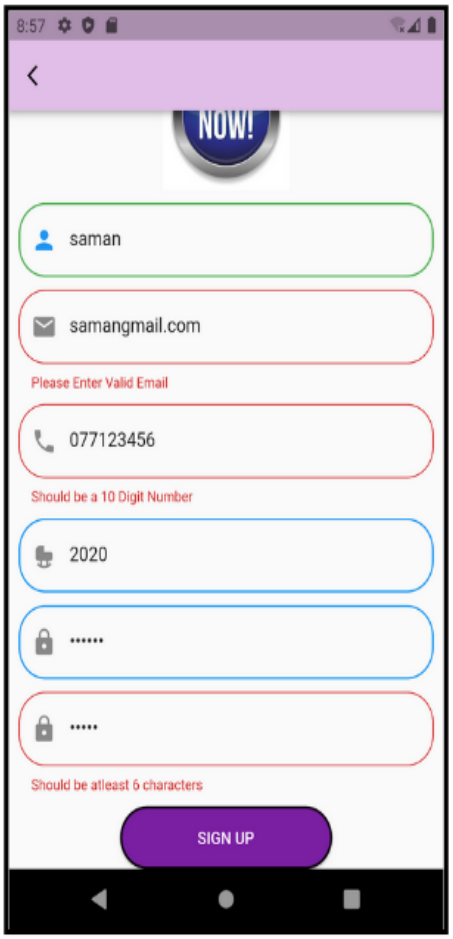


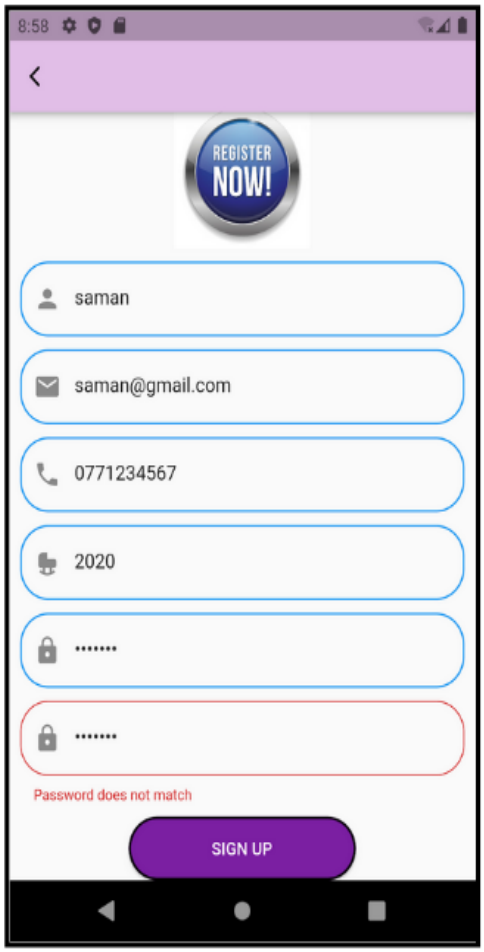
Basic user information is taken from the user during the registration process.Those data are stored in the cloud based database.

2.1.1 Front end validation at the registration process

Before sending data to the database, front end validation is done.

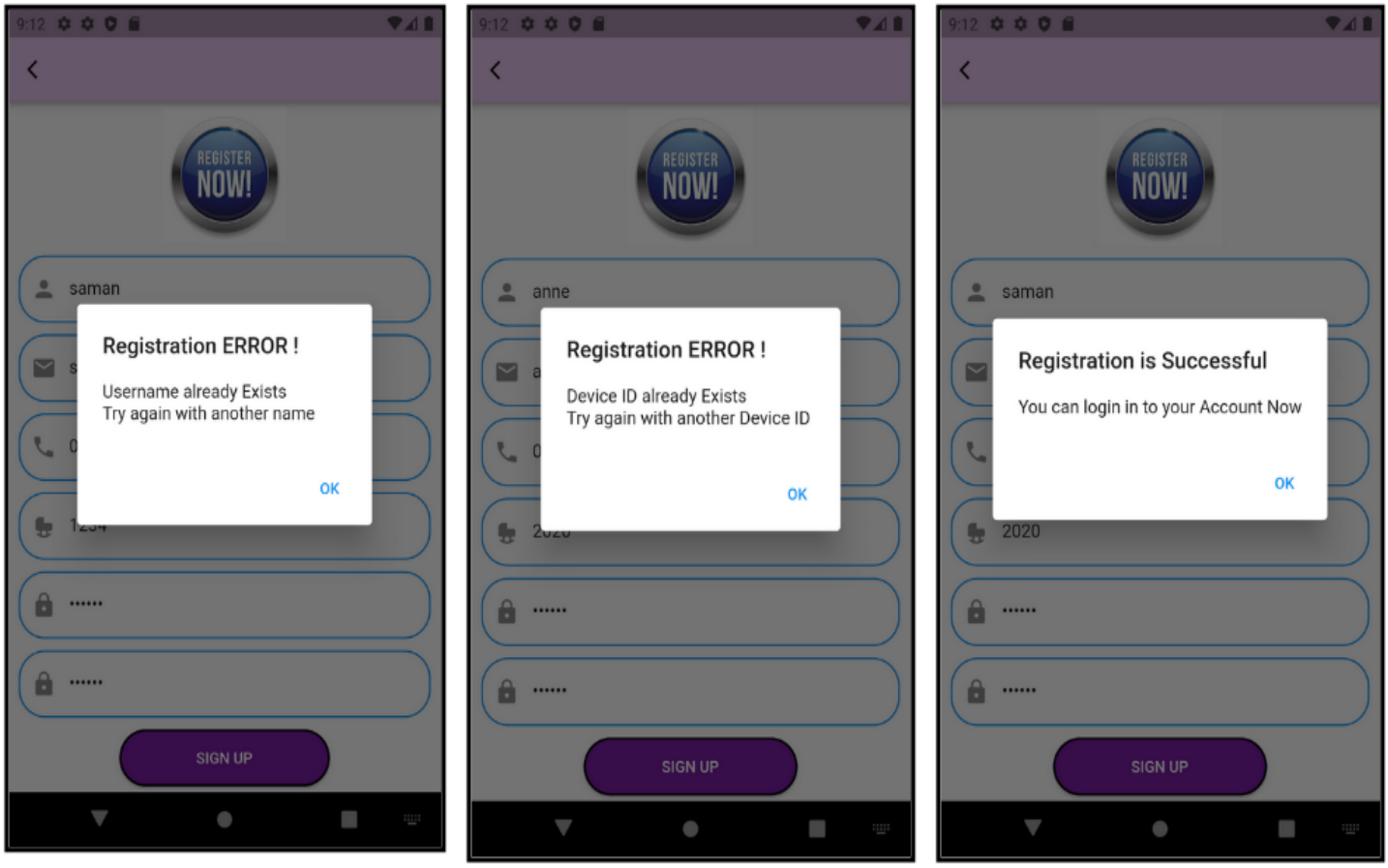






- *All the data fields* should be entered.
- ***Email,mobile number*** validation
- ***Password*** and ***confirmation password*** validation
- ***Password*** should be length 6-15

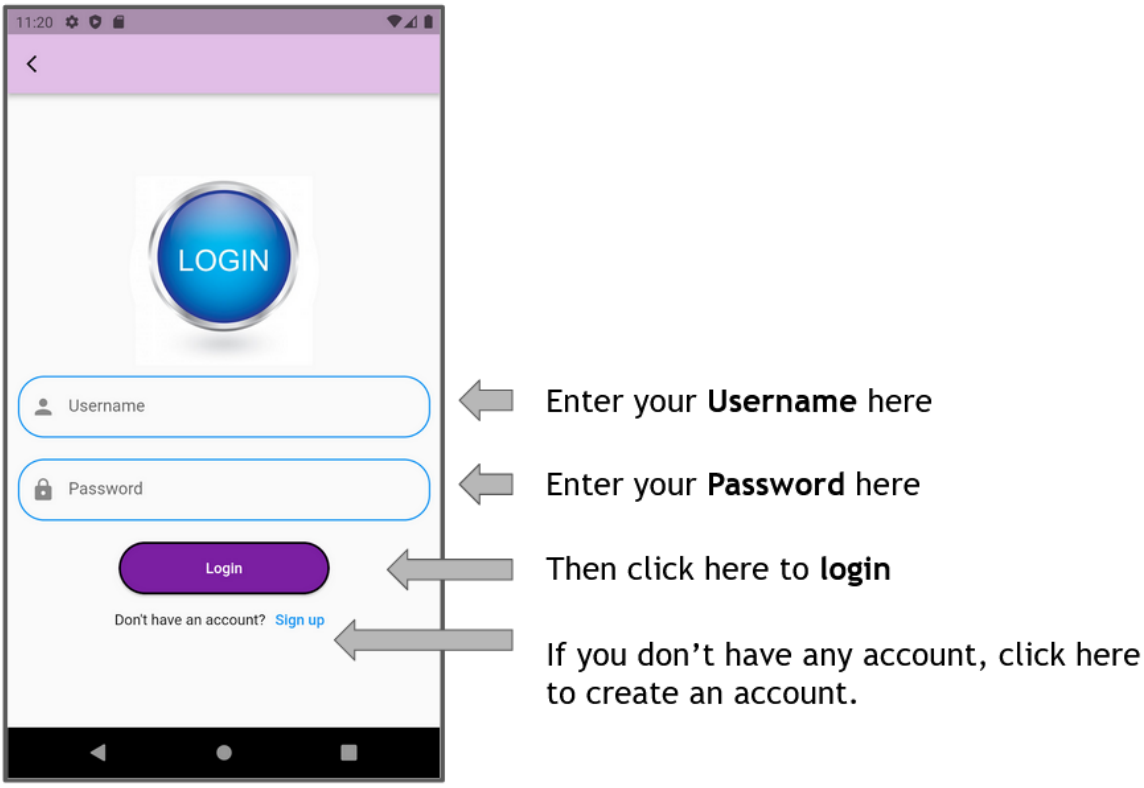
2.1.2.Backend validation at the registration process



- Checking whether the user name and and device ID already exist in the database,if so represent the error messages in alert boxes according to the status code responses received from the backend.

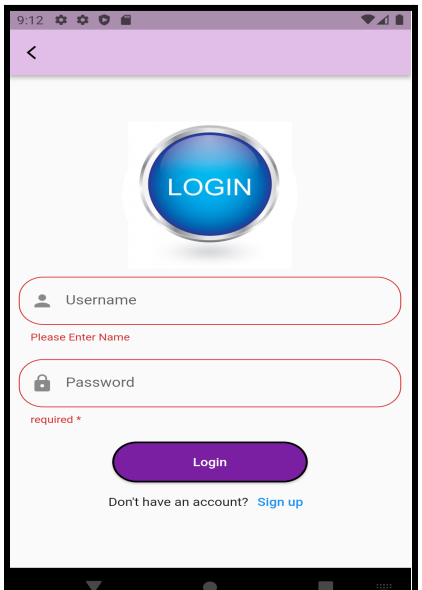
Registration Error	*Username already exists*	*Status code- 401*
	Device ID already exists	*Status code- 402*
	Invalid Inputs	*Status code- 400*
Registration Successful	*Can login to the account*	*Status code- 200*

2.2 USER LOGIN

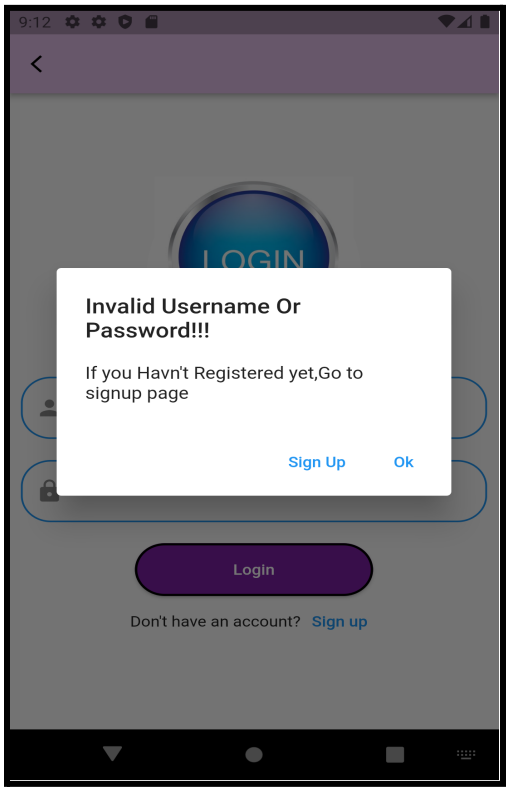


User's Username and Password is required to login into the system.At this point jwt token is created and it is used for authentication process in all the upcoming functionalities.

2.2.1 Frontend validation at the Login. - Need to enter both username and password in order to login



2.2.2 Backend validation during login process.



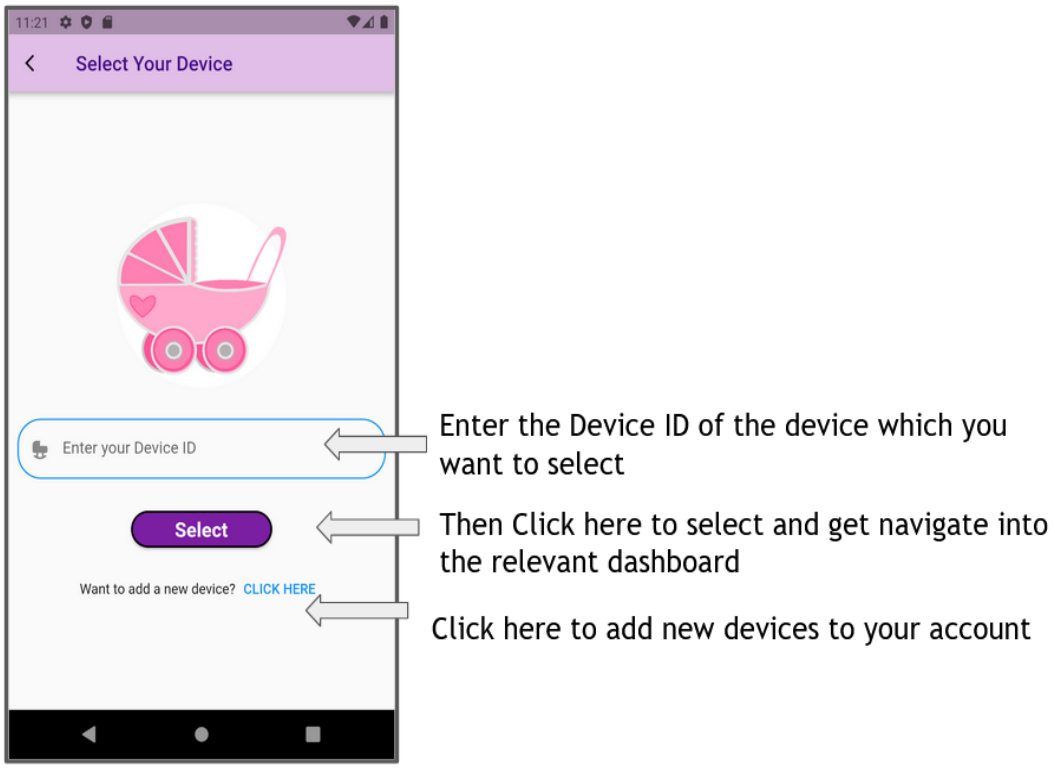
Display error message notification according to the status code responses received from the server.

Invalid Password	Status code - 403
Invalid Username	Status code - 400

- After successful login,user will get navigate into the Select Device page

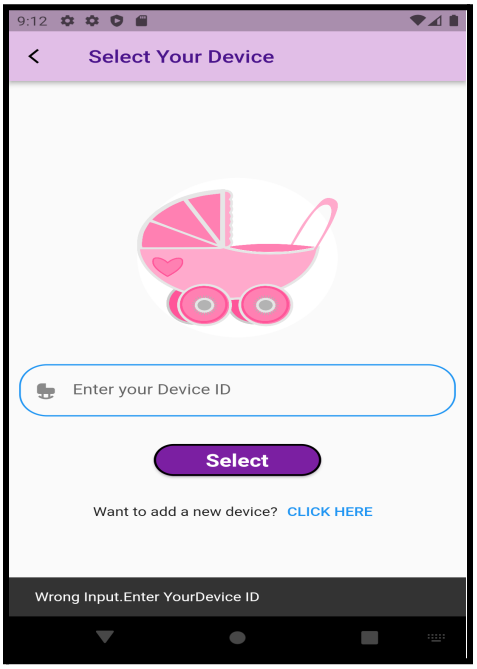
Successful Login	Status code - 200

2.3 DEVICE SELECTION



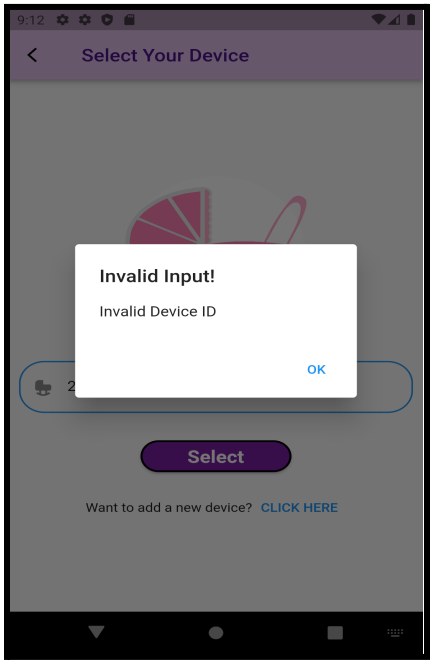
2.3.1 Front end validation -

Need to enter the Device ID

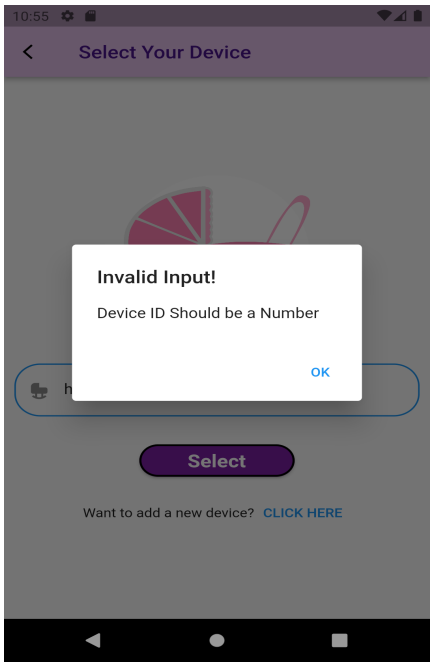


2.3.2 Backend validation

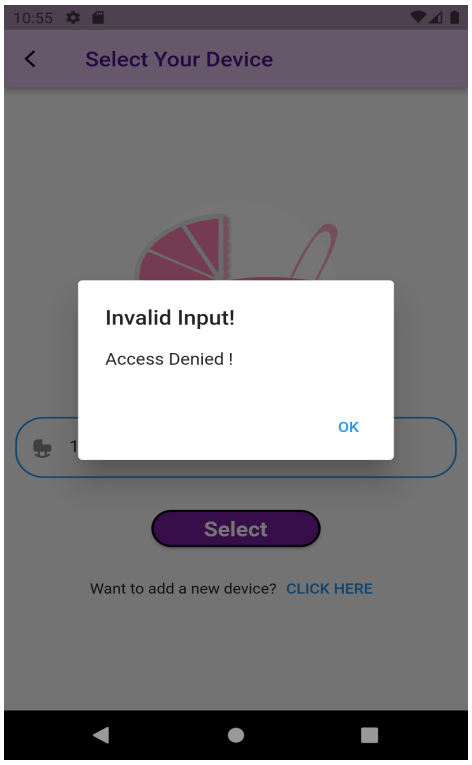
If the device ID is not registered under the user's account,it will notify the error message according to the status response codes received from the server.



Device Id should be a number



Users cannot access Devices of other accounts



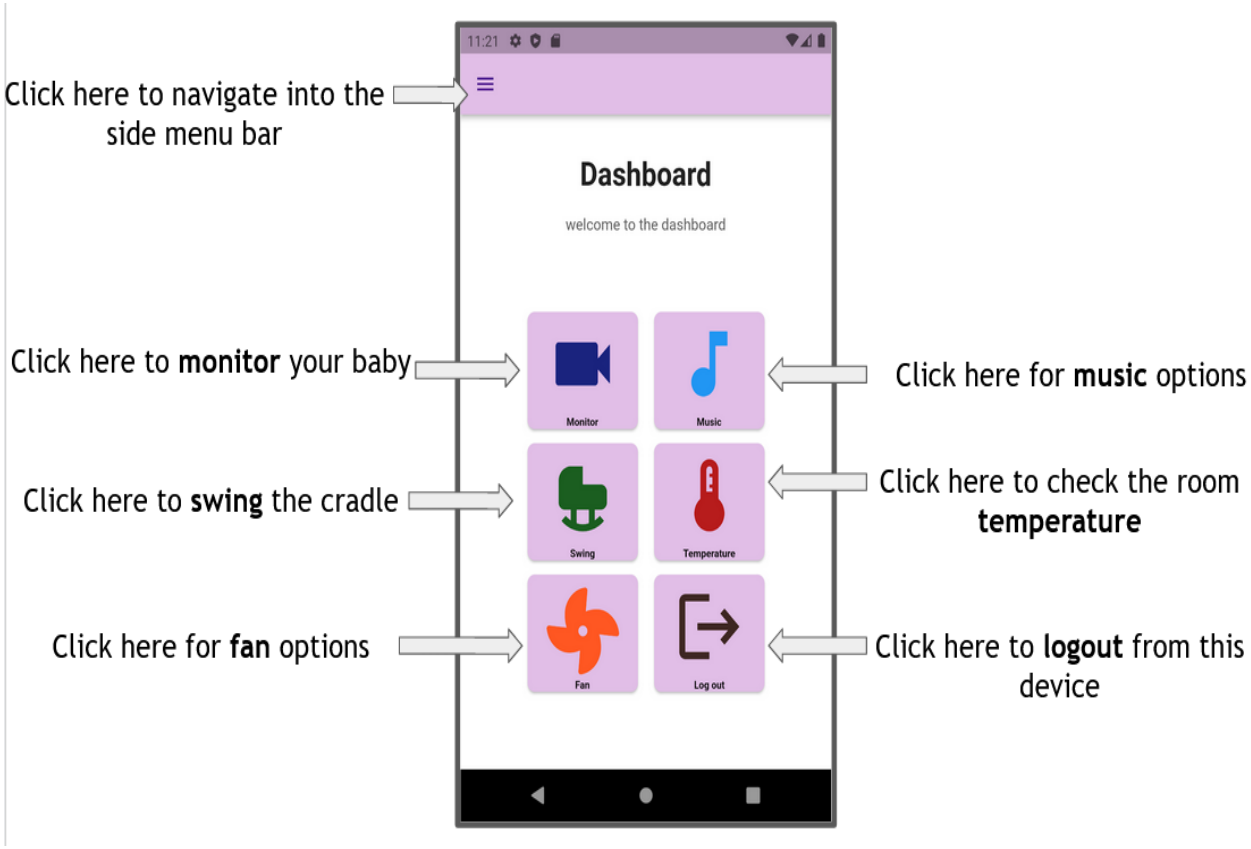
Invalid Device ID	Status code - 403
Access Denied	Status code - 400
Device ID should be a number Error	Status code - 401

After successfully selecting the device,the user can navigate into the Dashboard of the Device.

Success	Status code - 200

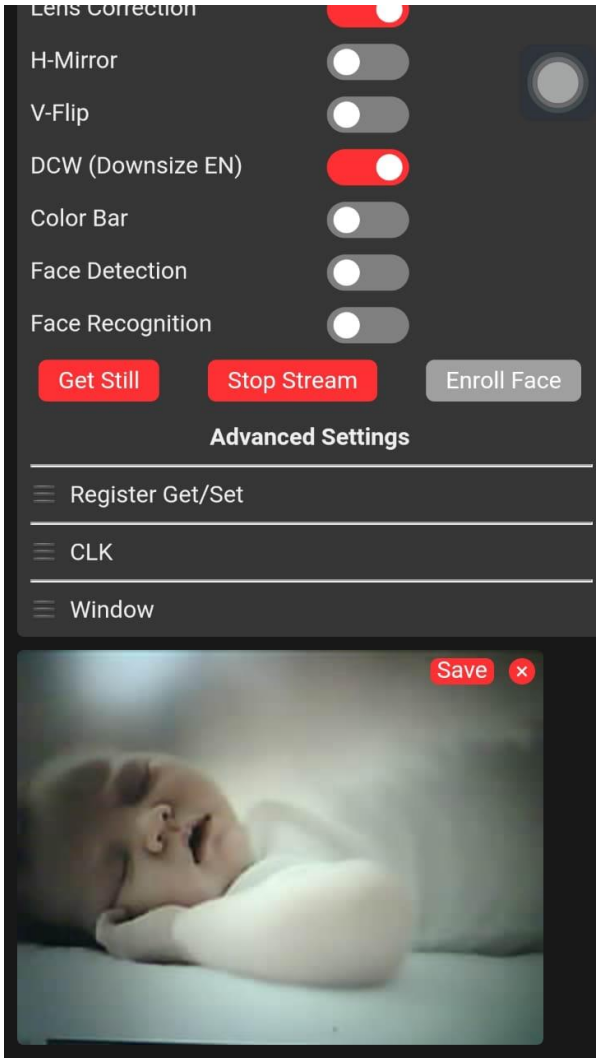
2.4 DASHBOARD

- Features of the smart cradle are indicated using icons making it easier for users to understand the functionalities.



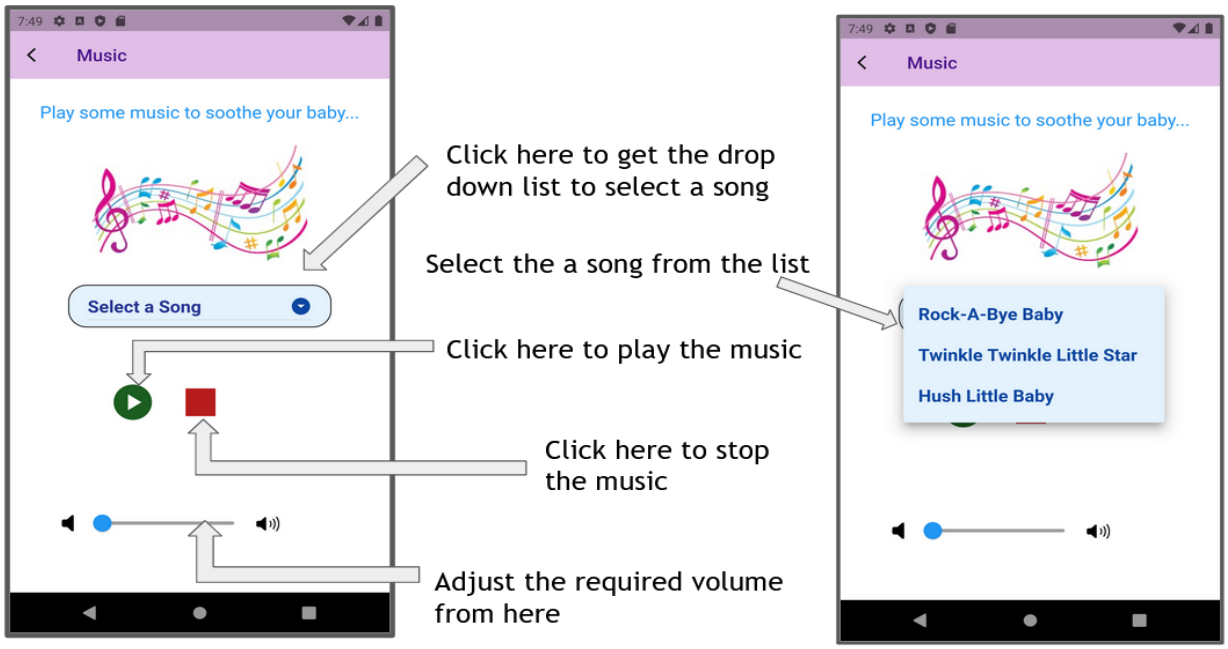
2.4.1 Monitor

- Used to get the live feedback of the baby



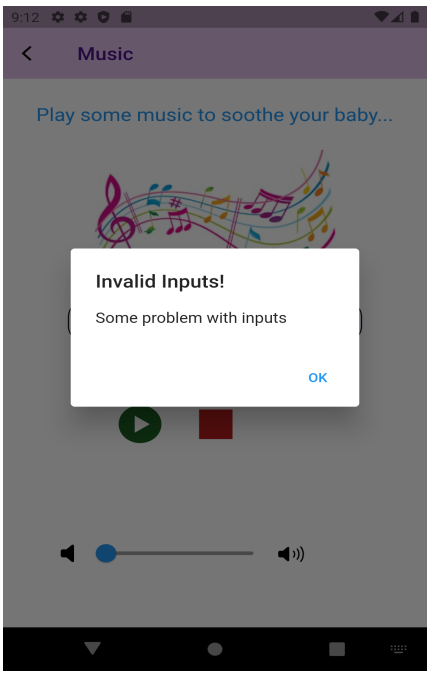
2.4.2 Music

- To play music which is selected from the drop down list.
- Play and stop options
- Adjust the volume of the music



2.4.2.1 Backend validation

Checking whether the user has correctly selected the music from the list before.Display notifications according to the status responses received from the server.



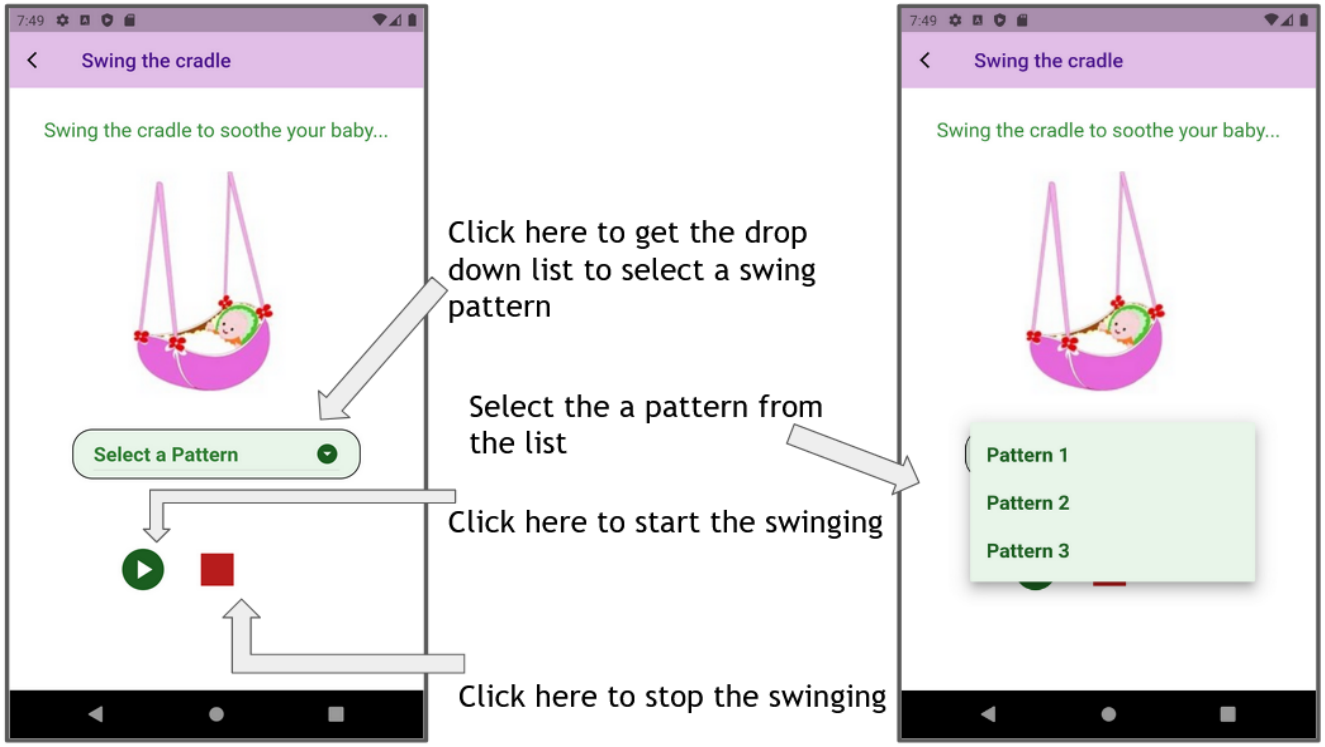
Invalid Inputs	Status code - 400

When successfully play the music,

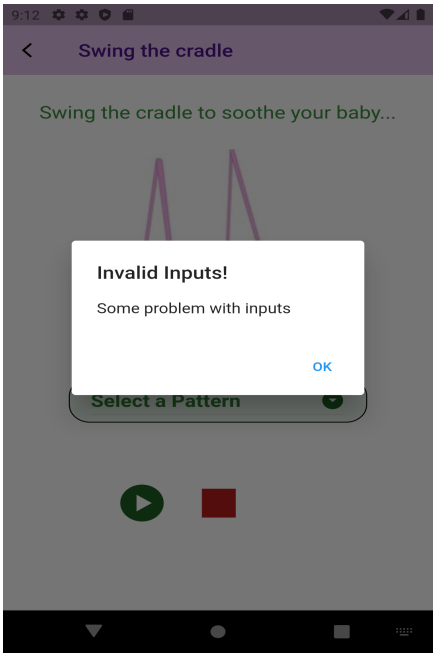
Success	Status code - 200

3.4.3 Swing

- Swing the cradle according to the selected pattern from the drop down list.
- ON/OFF the swing options



2.4.3.1 Backend validation

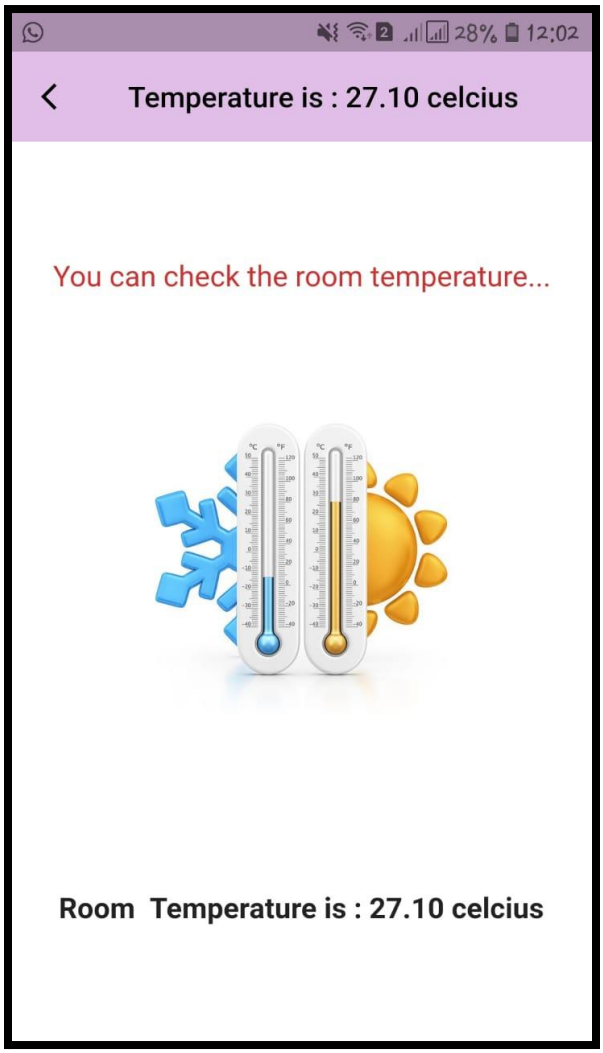


Checking whether the user has correctly selected the swing pattern from the list before.Display notifications according to the status responses received from the server.

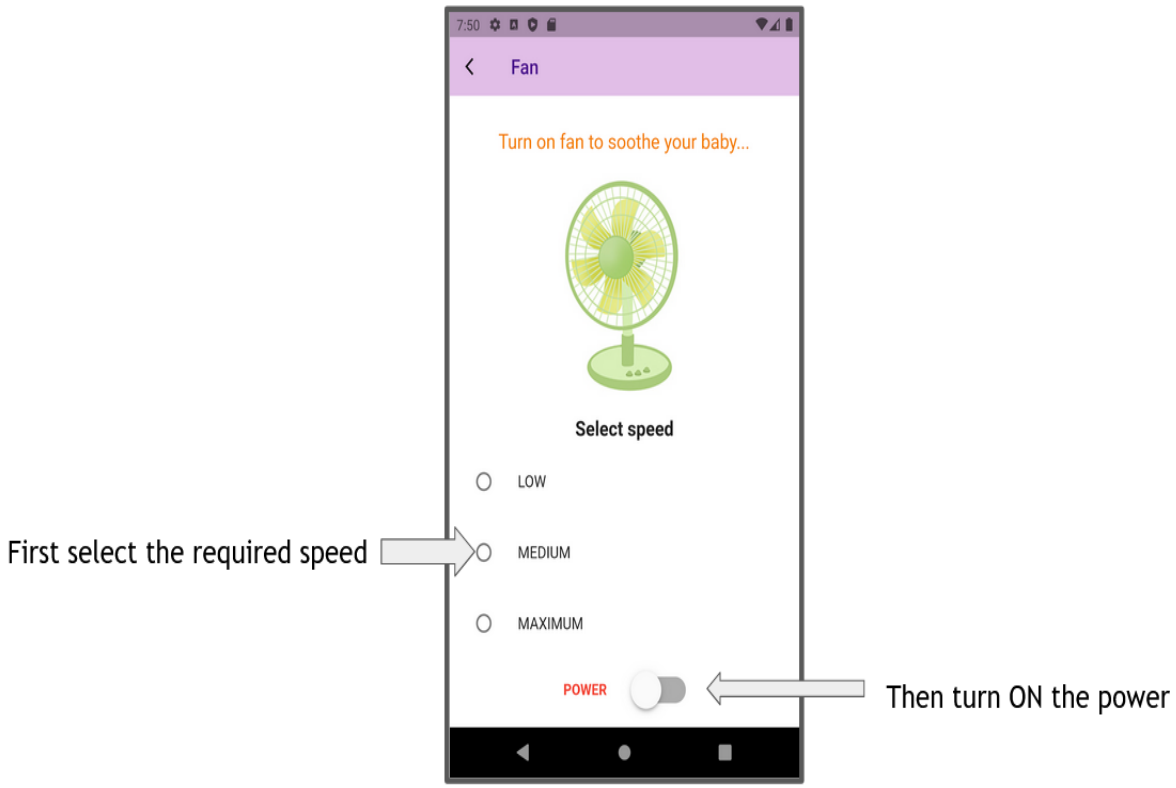
Invalid Inputs	Status code - 400
Successful swing option	Status code - 200

2.4.4 Temperature

You can check the room temperature at the place where the cradle is placed.



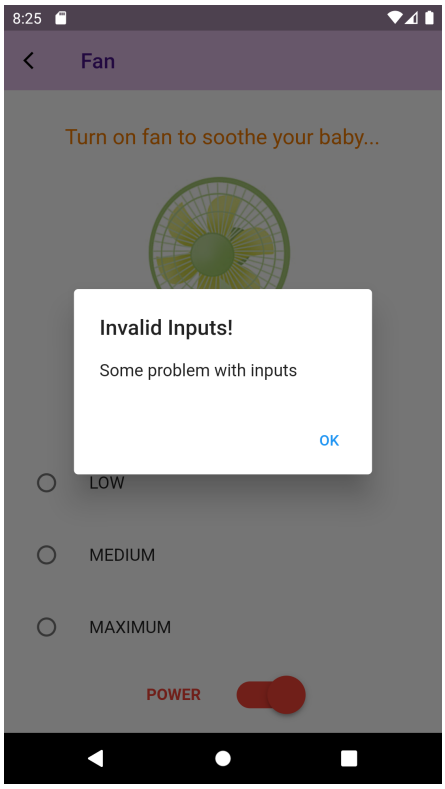
2.4.5 Fan



- To turn on and off the fan
- Control the speed of the fan

2.4.5.1 Backend Validation

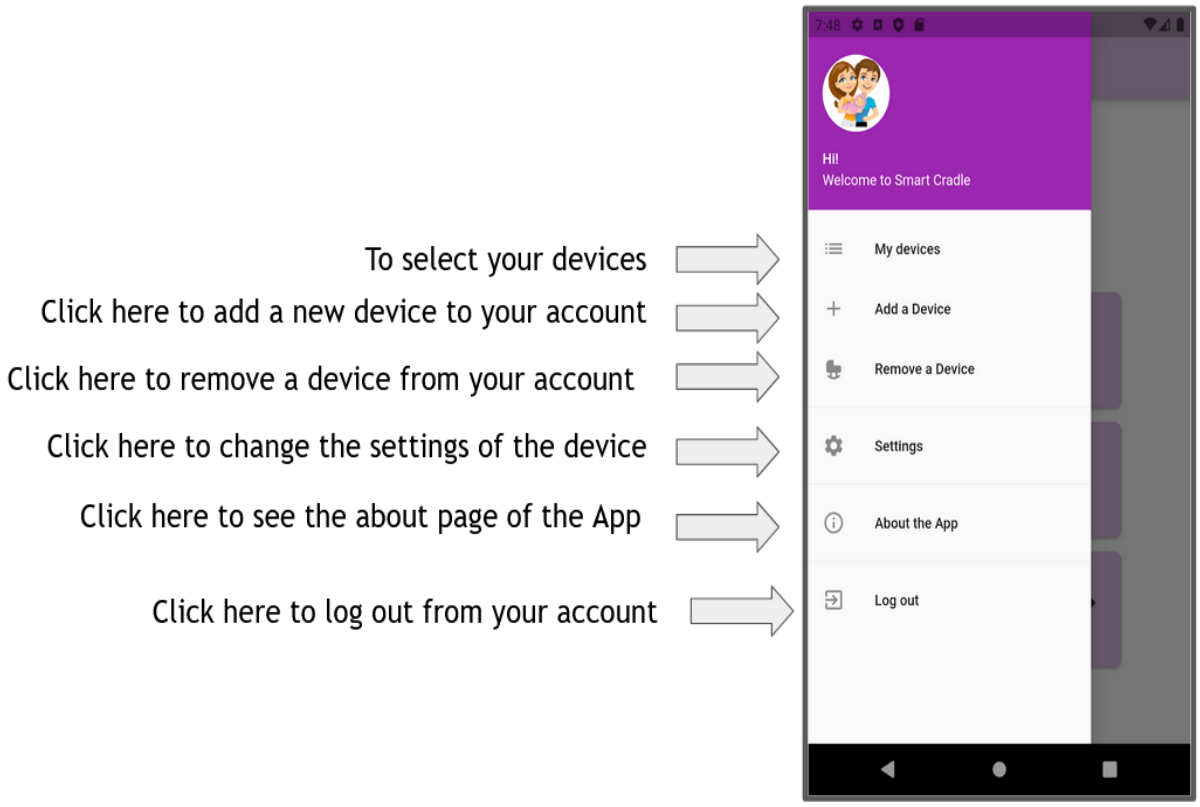
Send alert box notifications to the users according to the status responses received from the server.



When the user hasn't selected the speed before turning on the power.

Invalid Inputs	Status code - 400
Successful fan option	Status code - 200

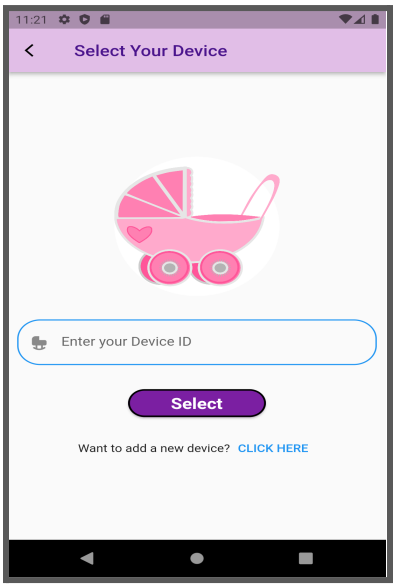
2.5 Side Menu Bar



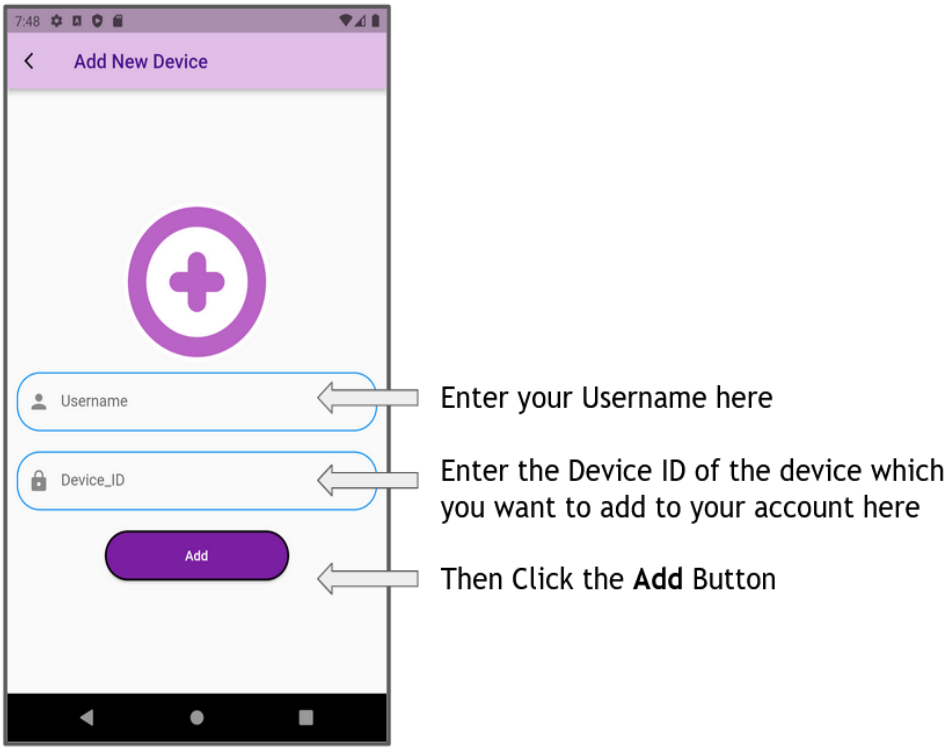
You can manage your account from the features available here.

2.5.1 My Devices

To select the device



2.5.2 Add a Device

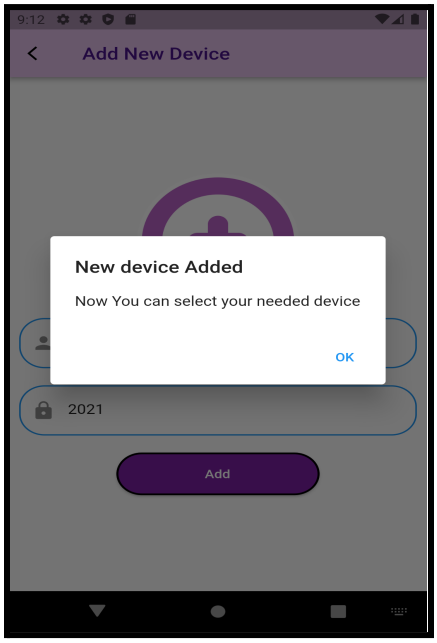


To add several devices to the same account,so that users can manage more than one device easily.

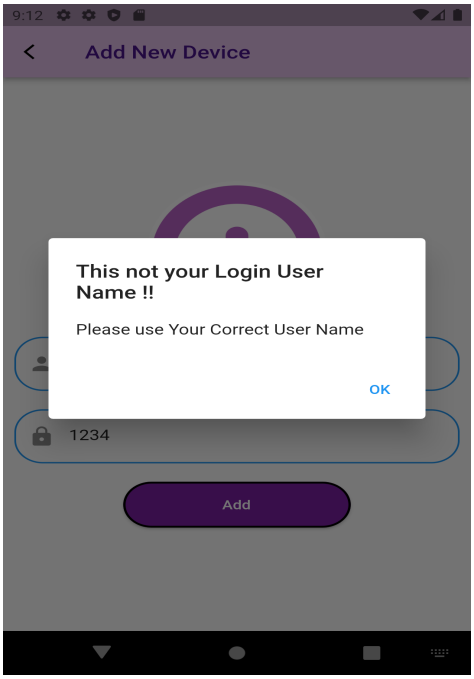
2.5.2.1 Backend Validation

Displaying alert boxes according to the responses received from the server.

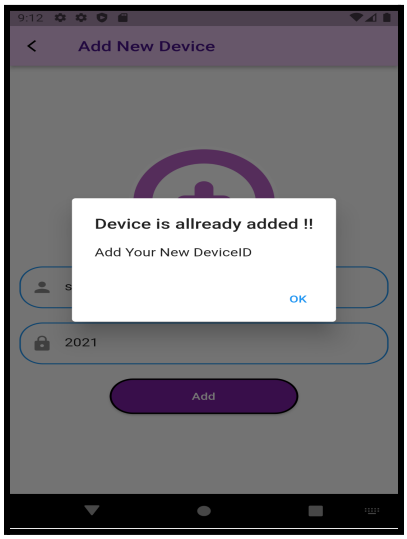
- ❖ After a successful addition



- When username is incorrect

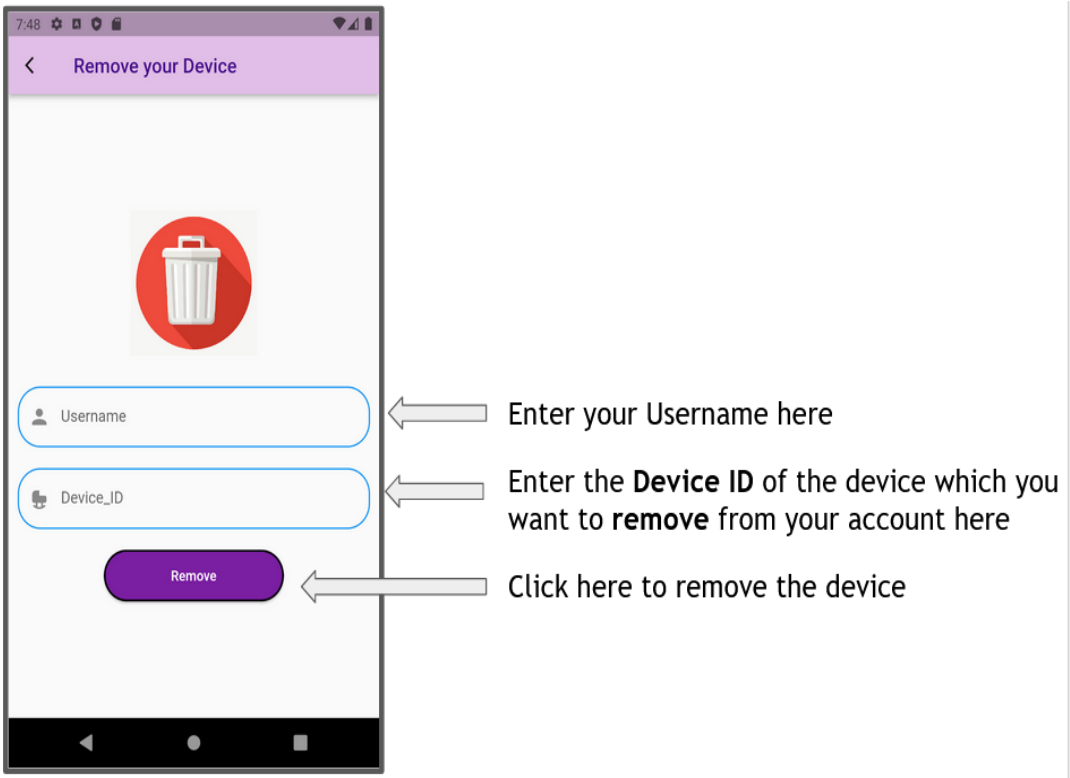


- When the device ID is already added to the account



Incorrect username	Status code - 400
Device ID already added	Status code - 401
Successful Added the device	Status code - 200

2.5.3 Remove a Device

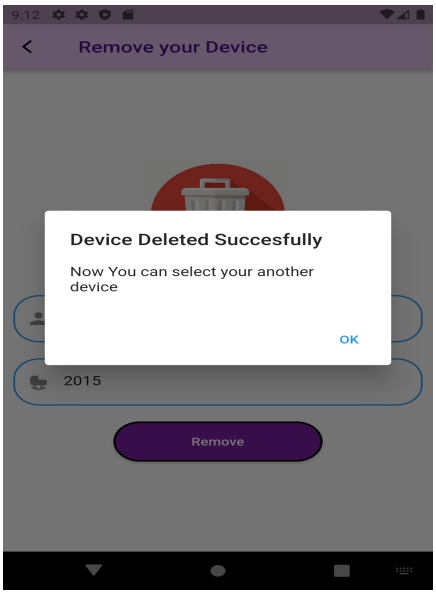


To remove any device,if the users don't want to keep that device in their account any more.

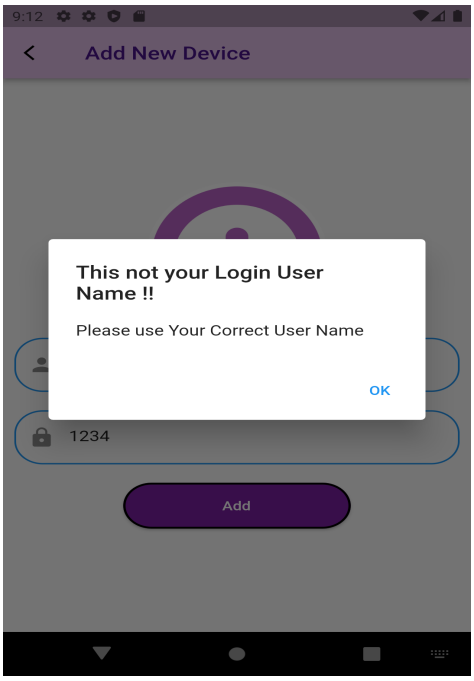
2.5.3.1 Backend Validation

Display alert notifications according to the responses received from the server.

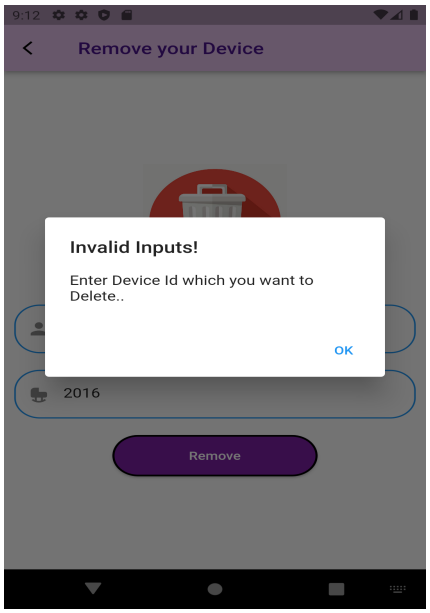
❖ After a successful removal



- When the entered username is incorrect



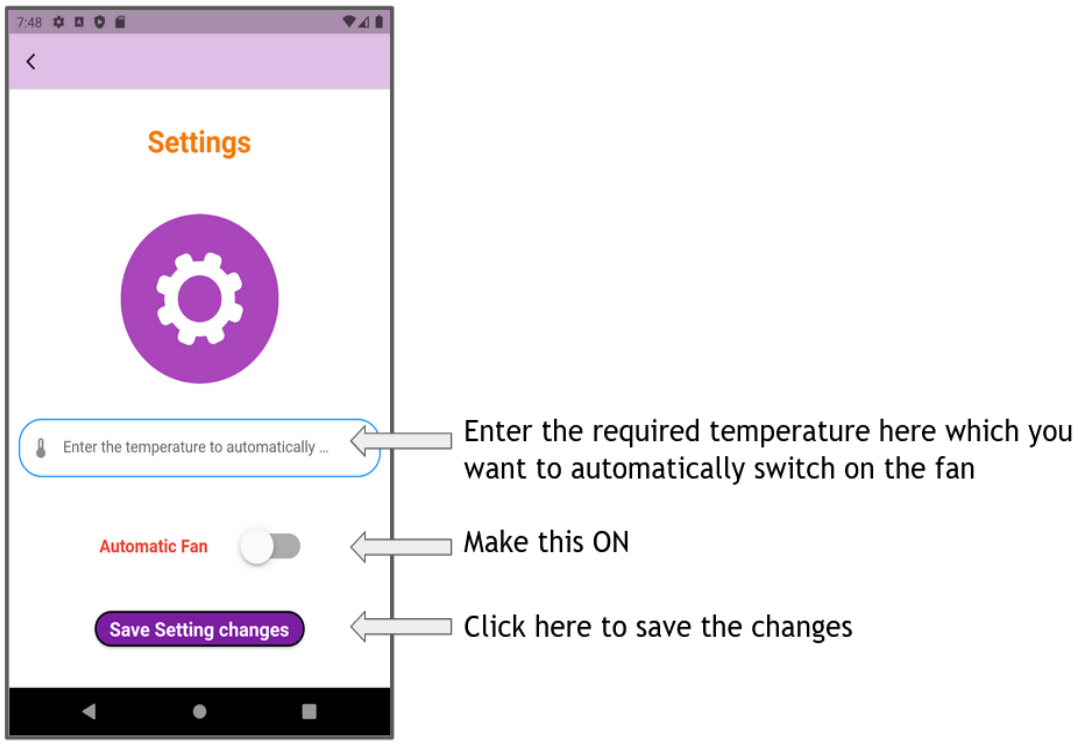
- When trying to delete a device which is not in the users' account



Invalid Inputs - Incorrect username	Status code - 400
Invalid Inputs - Incorrect Device ID	Status code - 401
Successful fan option	Status code - 200

2.5.4 Settings

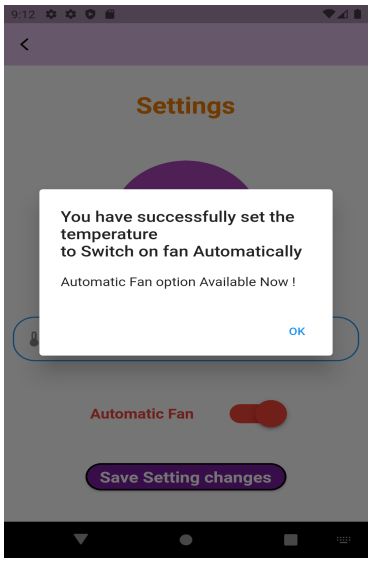
Using the settings option users can enable the Automatic fan option where they can set a threshold temperature value and if the room temperature exceeds that value it will automatically switch on the fan.



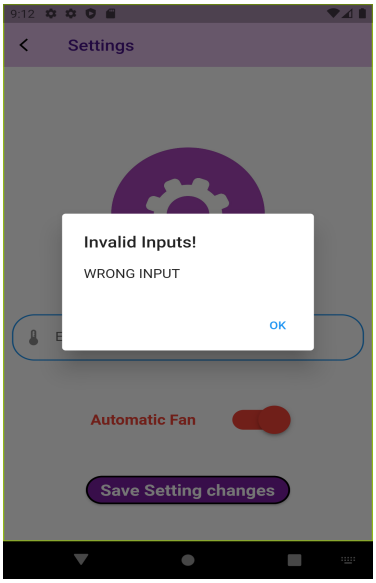
2.5.4.1 Backend Validation

Display alert notifications according to the status response received from the server

❖ Successfully setting the setting options



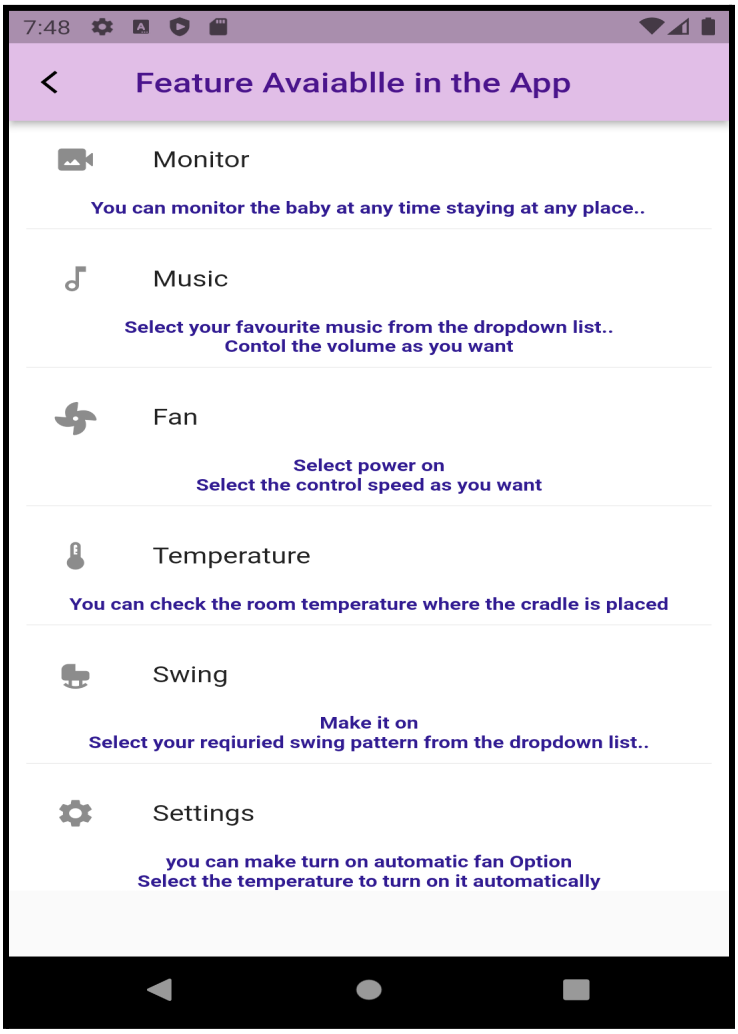
- If the threshold temperature value is not entered before the user switch ON the automatic fan option.



Invalid Inputs - Wrong input	Status code - 400
Successful fan option	Status code - 200

2.5.5 About

Using the about page you can get a basic idea about the functions available in the mobile application.It can be considered as a quick guide.



3 TECHNOLOGY FOR FRONTEND DEVELOPMENT

3.1 Flutter

3.1.1 Reason for selecting Flutter

- One codebase for all platforms
- “It’s all Widgets” principle offers countless possibilities
- Rich libraries

3.1.2 Used Libraries and Packages

font_awesome	To get icons
form_field_validator	To provide common validation options in the form. Front End validations
http	A composable, Future-based library for making HTTP requests. This package contains a set of high-level functions and classes that make it easy to consume HTTP resources.
flutter_secure_storage	Flutter plugin used to store data in secure storage storing them securely and encrypted.
url_launcher	A Flutter plugin for launching a URL

4. BACKEND DEVELOPMENT

Node js is used for the backend development.To connect the mobile application with the server.

- MySQL connection is established giving the server name,username,password and the name of the database
- Authentication is done using jsonwebtokens (jwt)
- Routes are created that associates an HTTP verb (GET, POST, PUT, DELETE, etc.), an URL path/pattern, and a function that is called to handle that pattern.

4.1 Reasons for the selection of Node js are as follows,

- better efficiency and overall developer productivity
- code sharing and reuse
- speed and performance
- easy knowledge sharing within a team
- a huge number of free tools

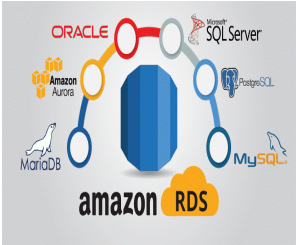
4.2 Mainly used libraries and Frameworks

Express	To manage servers and routes.
Joi	Used for backend data validation
Mqtt	For publishing messages and subscribing to topics on an MQTT broker
Bcrypt	To hash passwords securely

5. DATABASE MANAGEMENT SYSTEM

- MySQL is used as the relational database.
- Provides high performance,scalability and security.

- ***Amazon RDS*** is the storage service that is used.We since it supports MySQL and it is secure.It uses data encryption to secure data.The data stored in the disk is encrypted.The data which is transmitted via the network is also encrypted.



3 tables in the database as USER,DEVICE and the OWNERSHIP

Attributes,data types ,primary keys and foreign keys of the tables as follows.

USER table

- To keep the basic information about the users

Attribute	***Data type***	
User_name	Varchar(10)	Not Null
Password	Varchar(15)	Not Null
Email	Varchar(50)	Not Null
Mobile_number	Varchar(10)	Not Null
Device_ID	Int	Not Null

Primary key: User_name
Foreign key: Device_ID

- Hashed passwords are stored in the database

DEVICE table

- To keep the information about the devices

Attribute	***Data type***
Device_ID	Int
Temperature	Float
Cry_analysis	Bool
Fan	Bool

Primary key: User_name

OWNERSHIP table

- ❖ To keep a track of users with their device IDs

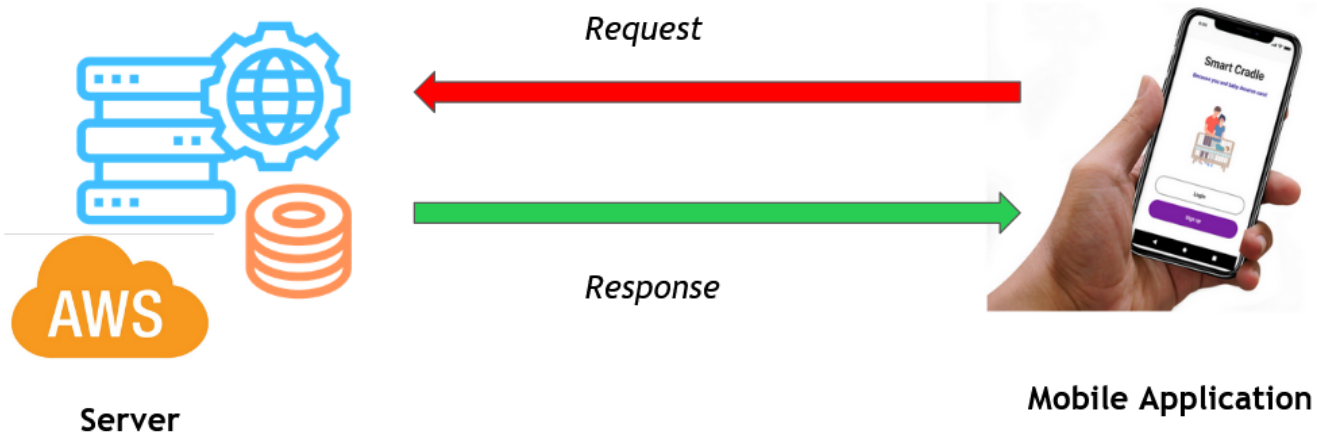
Attribute	***Data type***	
User_name	Varchar(10)	Not Null
Device_ID	Int	Not Null

Primary key: Device_ID
Foreign key: User_name

6. COMMUNICATION PROTOCOLS

6.1 HTTP

- To connect the mobile application with the server.
- Http post and get methods are used



6.2 MQTT

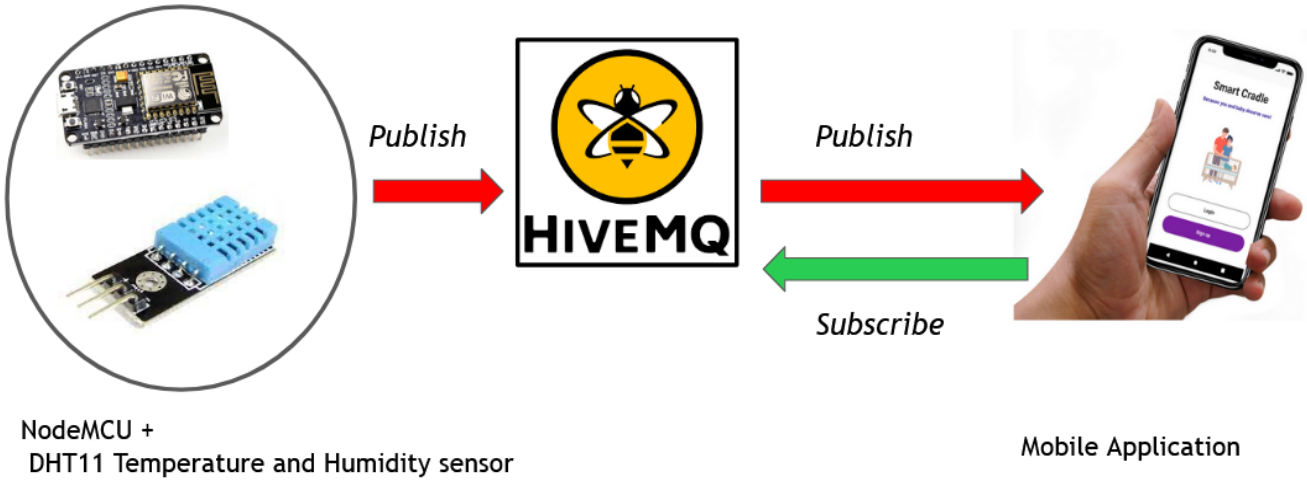
MQTT is a lightweight IoT communication protocol based on the publish/subscribe model.

Used to establish a connection between sensors and actuators with the mobile application.

HiveMQ MQTT Broker is used.

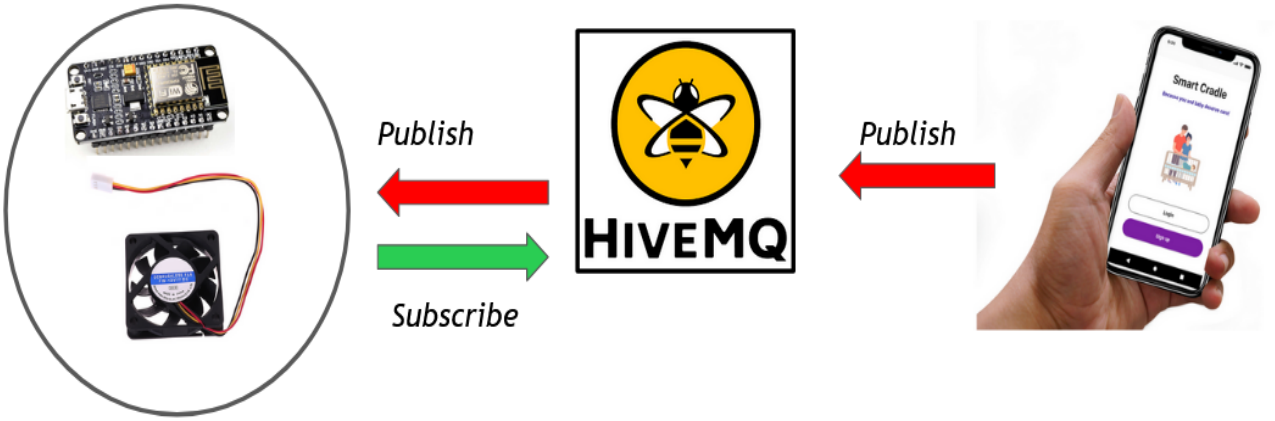
Created MQTT Topics

Topic	*Mobile Application*	*Sensors/Actuators*
cradle/fan/speed/state/device_id	publish	subscribe (fan)
cradle/songs/song_name/state/device_id	publish	Subscribe (speaker)
cradle/swing/pattern/state/device_id	publish	Subscribe (motor)
cradle/temperature/device_id	subscribe	Publish (temperature sensor)
cradle/sound/device_id		publish (sound sensor)
cradle/sound/device_id		subscribe (Speaker)



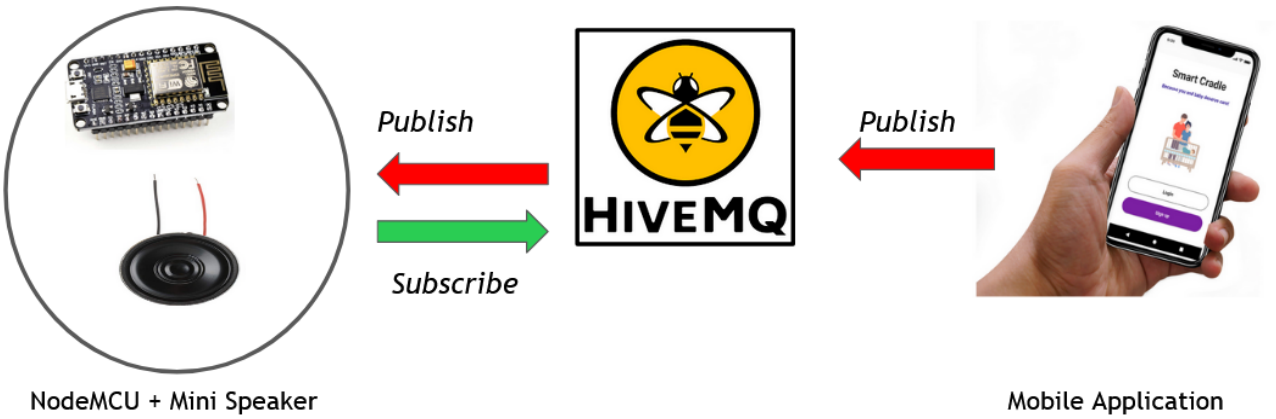
NodeMCU +
DHT11 Temperature and Humidity sensor

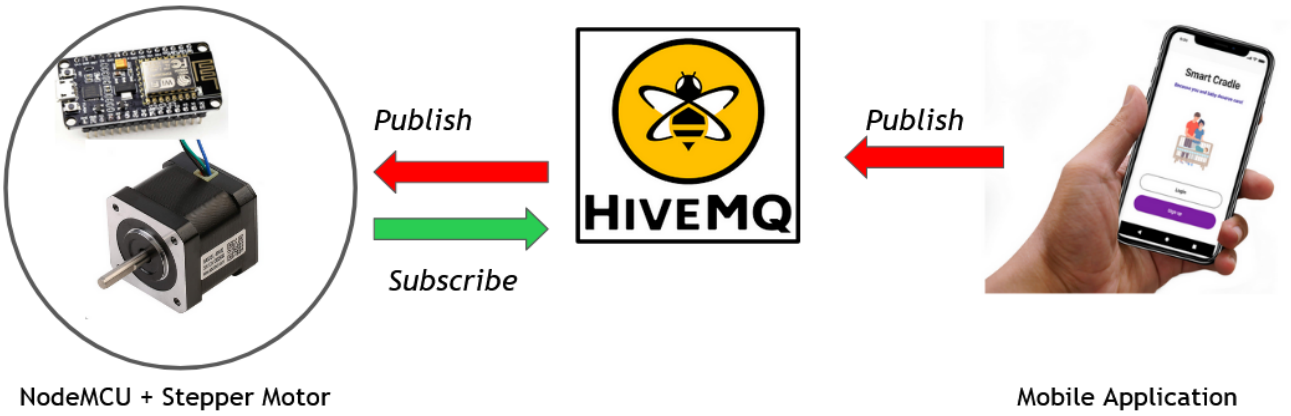
Mobile Application

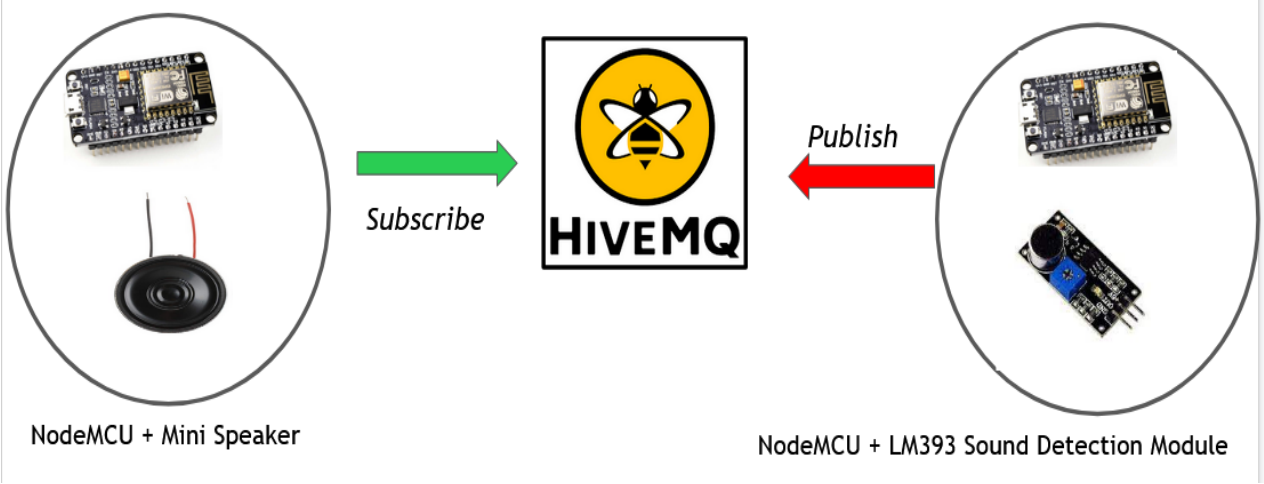


NodeMCU + Mini Fan

Mobile Application


Publish
Subscribe
HIVEMQ
Publish
Smart Cradle
NodeMCU + Mini Speaker
Mobile Application


Publish
Subscribe
HIVEMQ
Publish
Smart Cradle
NodeMCU + Stepper Motor
Mobile Application


Subscribe
HIVEMQ
Publish
NodeMCU + Mini Speaker
NodeMCU + LM393 Sound Detection Module

7. SOFTWARE AND BACKEND TESTING

WHY Testing ?

Signup and Login : To make sure that the system is only accessible by authorized users with accurate user details.

Add device and Remove device : To make sure that the 'device' and the 'ownership' tables in the database are correctly updated.

Select device : To make sure that the devices are only accessible by their owners.

Swing , Play Music ,Fan ,Temperature ,Monitor and Settings : To make sure that the basic functionalities of the mobile application are working properly

Backend : To make sure that all API endpoints are working correctly.

7.1 TEST CASES

TEST SUMMARY : SIGNUP

TEST CASE	RESULT
User should enter all data fields , otherwise cannot proceed	passed
User should enter a valid email	passed
Duplicate user names are not allowed	passed
Duplicate device ids are not allowed	passed
Should enter a valid phone number	passed
Password and confirm password should be same	passed
Number of characters in the username should be in between 5-10	passed
Password should contain more than 6 characters	passed

TEST SUMMARY : LOGIN

TEST CASE	RESULT
Login with a valid username and password is allowed	passed
Login with a valid username and invalid password is not allowed	passed
Login with an invalid username and valid password is not allowed	passed
User should enter bothl data fields (username and password) , otherwise cannot proceed	passed

TEST SUMMARY : SELECT DEVICE

TEST CASE	RESULT
User should enter a device id(data field should not be empty) ,otherwise cannot proceed	passed
Should enter a valid device id (device id must contain only numbers)	passed
User should enter a device id that belongs to him,otherwise cannot proceed	passed
JSON web token should be valid ,otherwise cannot proceed	passed

TEST SUMMARY : ADD DEVICE

TEST CASE	RESULT
User should enter all data fields,otherwise cannot proceed	passed
Should enter a valid device id (device id must contain only numbers)	passed
User should not enter an already exist device id,otherwise cannot proceed	passed
JSON web token should be valid ,otherwise cannot proceed	passed

TEST SUMMARY : REMOVE DEVICE

TEST CASE	RESULT
User should enter device id and username(data field should not be empty) ,otherwise cannot proceed	passed
Should enter a valid device id (device id must contain only numbers)	passed
User should enter a device id that belongs to him,otherwise cannot proceed	passed
JSON web token should be valid ,otherwise cannot proceed	passed

TEST SUMMARY : SWING

TEST CASE	RESULT
User should select a swing pattern and give a state (start or stop),otherwise cannot proceed	passed
JSON web token should be valid ,otherwise cannot proceed	passed

TEST SUMMARY : PLAY MUSIC

TEST CASE	RESULT
User should select a song and give a state (start or stop),otherwise cannot proceed	passed
JSON web token should be valid ,otherwise cannot proceed	passed

TEST SUMMARY : FAN

TEST CASE	RESULT
User should select a speed and give a state (on or off),otherwise cannot proceed	passed
JSON web token should be valid ,otherwise cannot proceed	passed

TEST SUMMARY : TEMPERATURE

TEST CASE	RESULT
JSON web token should be valid ,otherwise cannot proceed	passed

TEST SUMMARY : MONITOR

TEST CASE	RESULT
JSON web token should be valid ,otherwise cannot proceed	passed

TEST SUMMARY : SETTINGS

TEST CASE	RESULT
User should enter a temperature (must contain only numbers) and set the status of the fan (on or off) ,otherwise cannot proceed	passed
JSON web token should be valid ,otherwise cannot proceed	passed

7.2 Testing tools

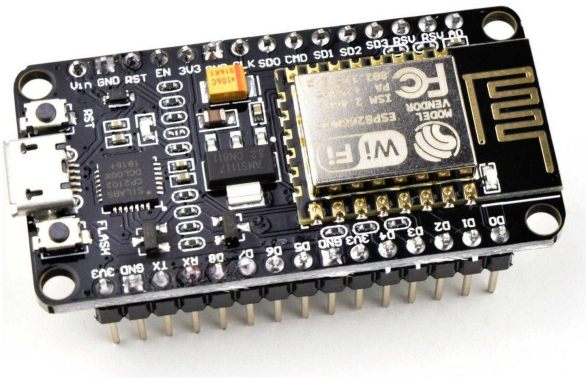
Unit Testing	• Flutter test package - for unit testing • Frontend validation
POSTMAN	• API testing tool. • HTTP requests that are sent to the server in each api call, are tested using these tools.
appium	• For mobile application testing • This enables testers to write test scripts against multiple platforms such as iOS and Android using the same API.

8. HARDWARE DEVELOPMENT

8.1 COMPONENTS

- ➔ NodeMCU Controller ESP8266
- ➔ Arduino UNO
- ➔ LM393 Sound detection module
- ➔ DHT11 Temperature and Humidity sensor
- ➔ ESP32 Cam module
- ➔ Stepper Motor
- ➔ TB6600 Stepper Motor Driver
- ➔ L298N Motor driver
- ➔ 12V Mini Fan
- ➔ Mini Speaker
- ➔ 12V Battery
- ➔ 5V Power pack
- ➔ 2N3904 Transistor
- ➔ 1K resistors

NodeMCU Controller ESP8266



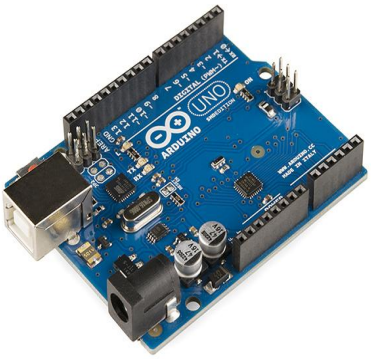
- GPIO pins + WIFI module inbuilt
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 MHz

This is used to control the sensor and actuators.

Sensors and Actuators connected to the NodeMCU controller:

- LM393 Sound detection module
- DHT11 Temperature and Humidity sensor
- 2N3904 Transistor
- 12V Mini Fan
- Mini Speaker
- L298N Motor driver

Arduino UNO ATmega328P Controller



- Operating Voltage: 5V.
- Input Voltage (recommended): 7-12V.
- Input Voltage (limit): 6-20V.
- Digital I/O Pins: 14 (6 provide PWM output)
- PWM Digital I/O Pins: 6.
- Analog Input Pins: 6.
- DC Current per I/O Pin: 20 mA.

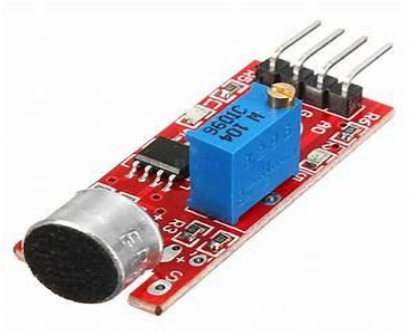
Connected components to this ATmega328P controller,

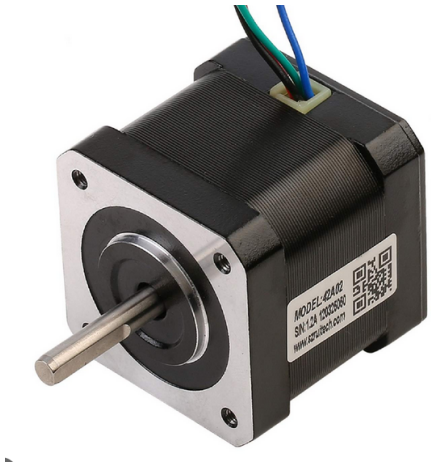
Stepper Motor

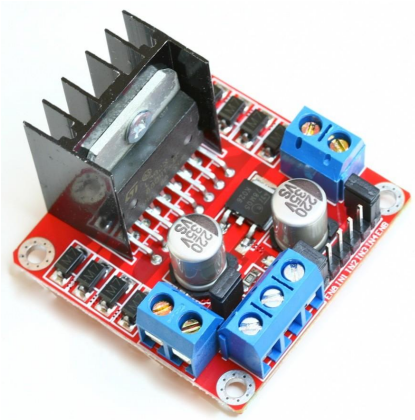
ESP32-CAM module

- Onboard ESP32-S module, supports WiFi + Bluetooth
- OV2640 camera with flash
- Onboard TF card slot, supports up to 4G TF card for data storage
- Supports WiFi video monitoring and WiFi image upload
- Supports multi sleep modes, deep sleep current as low as 6mA
- Control interface is accessible via pinheader, easy to be integrated and embedded into user products

Use for the live monitoring of the baby

LM393 Sound Detection Module *For the cry detection purpose* 	• Operating Voltage: 3.3V to 5V DC • LM393 comparator with threshold preset • PCB Size: 3.4cm * 1.6cm • Induction distance: 0.5 Meter • Operating current: 4~5 mA • Microphone Sensitivity (1kHz): 52 to 48 dB • Easy to use with Microcontrollers or even with normal Digital/Analog IC • Small, cheap and easily available
DHT11 Temperature and Humidity sensor *To detect the room temperature* 	• Operating Voltage: 3.5V to 5.5V • Operating current: 0.3mA (measuring) 60uA (standby) • Output: Serial data • Temperature Range: 0°C to 50°C • Resolution: 16-bit • Accuracy: ±1°C

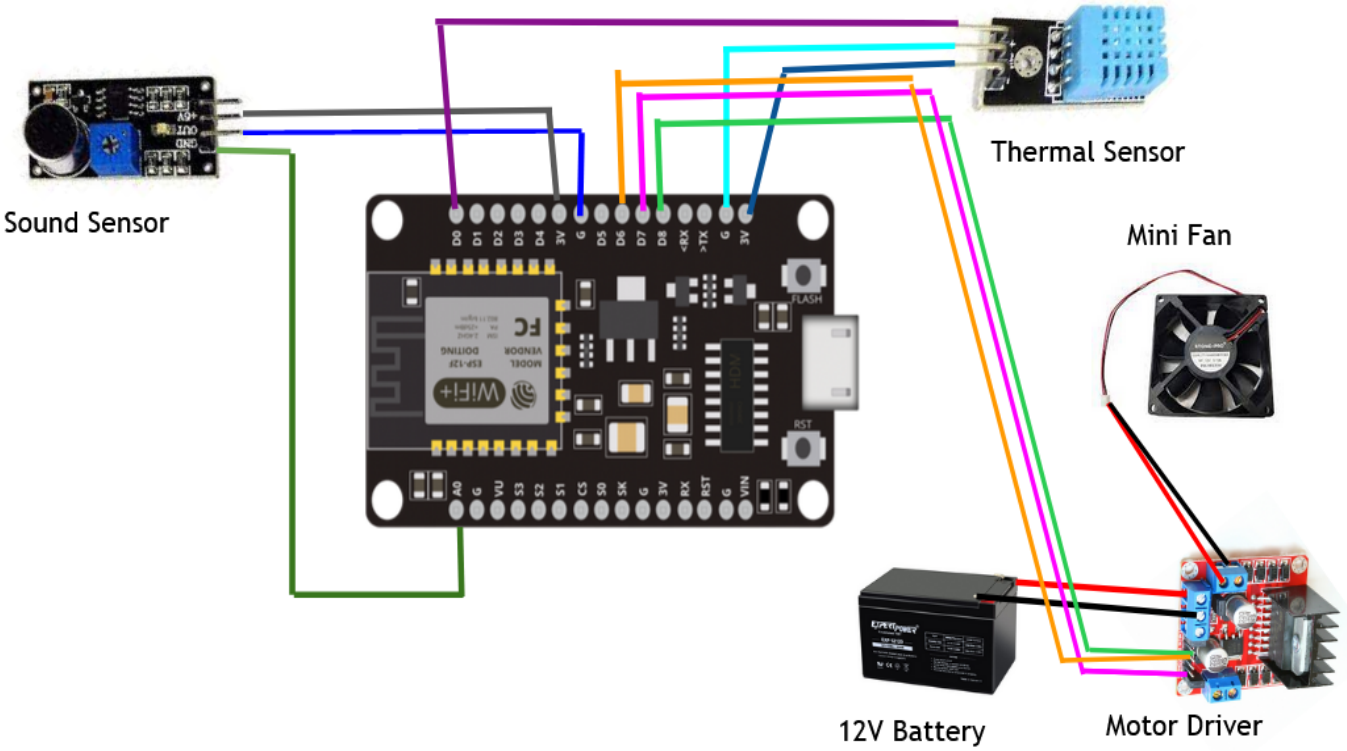
Stepper Motor *To swing the cradle* 	• Shaft diameter: 5 mm “D” • Steps per revolution: 200 • Current rating: 1.2 A per coil • Voltage rating: 4 V • Resistance: 3.3 Ω per coil • Holding torque: 3.2 kg-cm (44 oz-in) • Inductance: 2.8 mH per coil • Lead length: 30 cm (12”) • Output shaft supported by two ball bearings • *small step angle* • *high positioning accuracy* • *high torque to inertia ratio* • *stepping rate and accuracy*
TB6600 Stepper Motor Driver *To provide microstepping ability to a stepper motor* 	• Operating voltage: 9-40V DC • Output Current: 0.7-4.0A • Pulse input frequency up to 20kHz • 5V levels input signal • 200-6400 pulse per revolution • Logic signal current: 8-15mA • Output current selectable in 8-steps via DIP switches • Suitable for 2 and 4 phase motors • Over current and over heat protection • Inputs are optically isolated

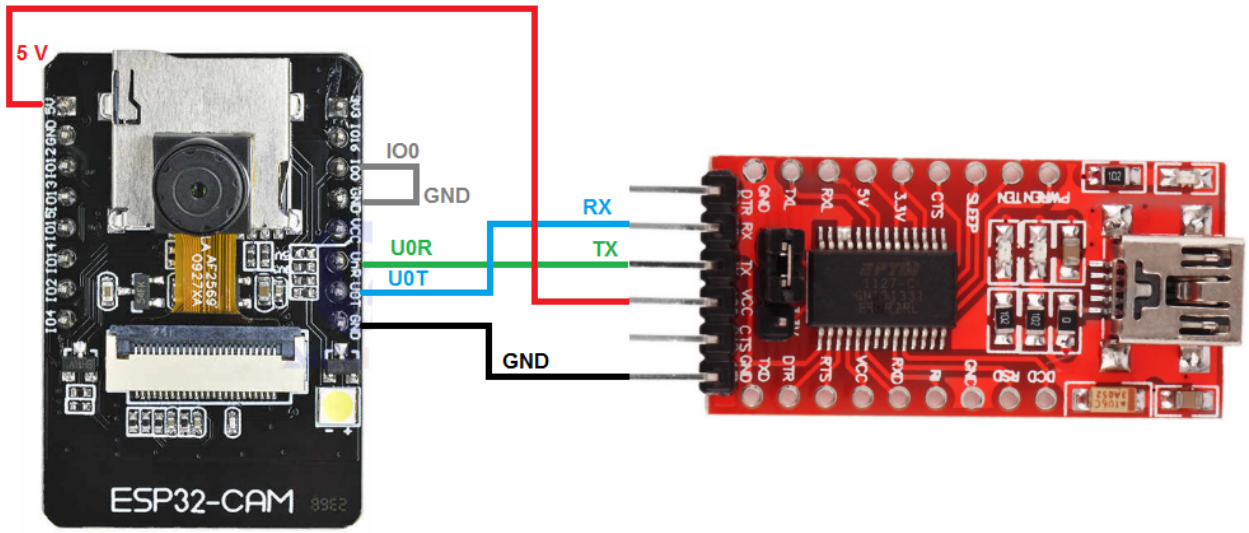
12V Mini Fan 	• Connector: 4pin. • Rated Voltage: DC 12V. • Rated Current: 0.11±0.02 Amp. • Rated Speed: 6500 ±10%rpm. • Air Flow:9.8CFM. • Noise: 15±10%dB. • Bearing Type: Sleeve. • Dimension(Fan): 30mm x 30mm x 20mm.
L298N Motor driver *To control the fan* 	• Driver Model: L298N 2A • Driver Chip: Double H Bridge L298N • Motor Supply Voltage (Maximum): 46V • Motor Supply Current (Maximum): 2A • Logic Voltage: 5V • Driver Voltage: 5-35V • Driver Current:2A • Logical Current:0-36mA • Maximum Power (W): 25W • Current Sense for each motor • Heatsink for better performance • Power-On LED indicator

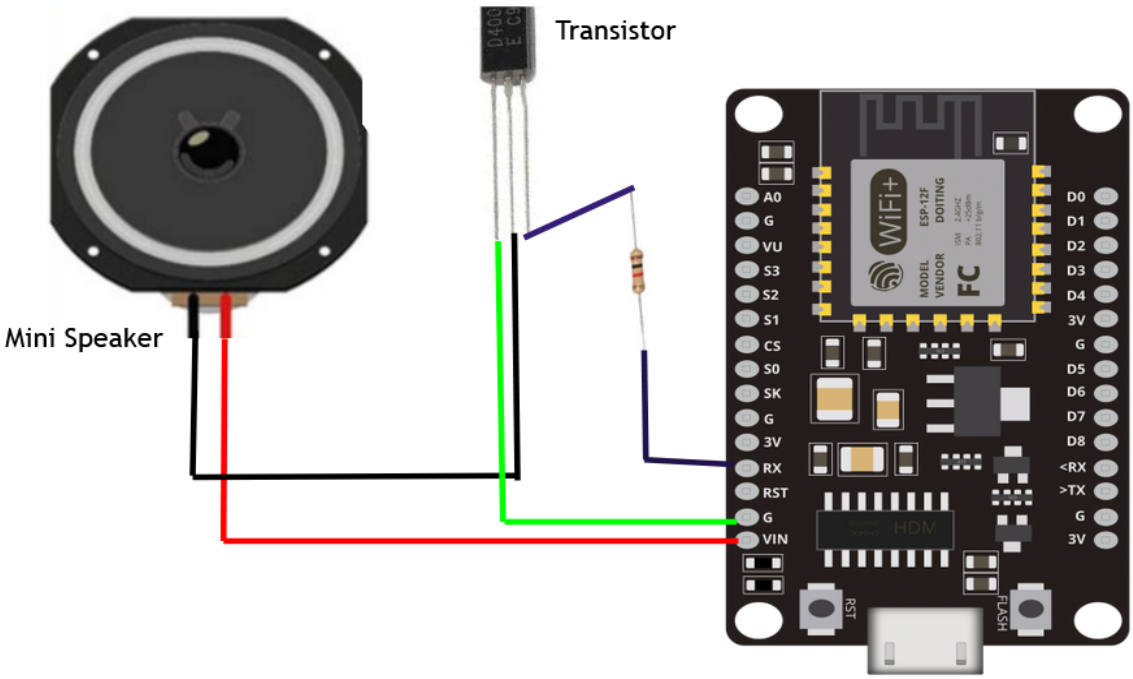
Mini Speaker *To play music* 	• Power : 0.5W • Resistance : 8 Ohm • Type : Internal Magnet Speaker • Magnet Diameter : 14mm/ 0.55" • Size : 30 x 4.5mm/1.2" x 1.4"(D*T)
12V Battery *To give power to fan and the stepper motor* 	• Charge Current:0.2C • Charge Cut-off Voltage:14.6v • Discharge Cut-off Voltage:10.0v • Discharge Current:0.5C

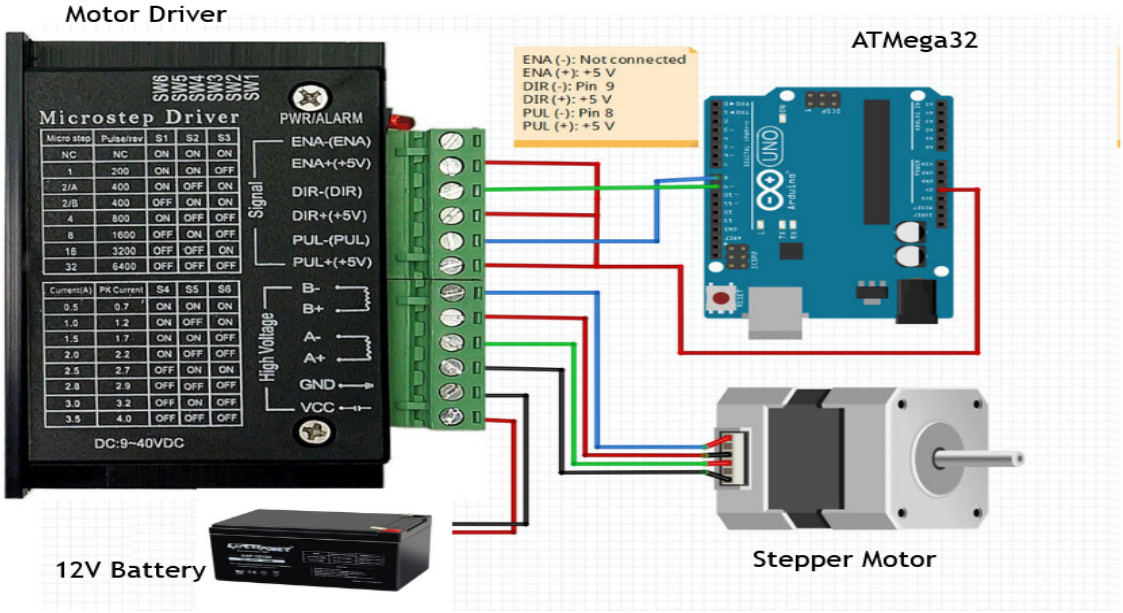
5V Power pack *To give power to ESP8266 NodeMCU and ESP32 CAM Module* 	• AC input voltage: 110 - 240 VAC • AC input frequency: 47Hz - 63Hz • AC input current: 0.3A max. • Max. inrush current: 30A max. • Leakage current: max. 0.75 mA • Efficiency: 70% typical at full load • No load power consumption 0.5W • DC output voltage: +5VDC • Load min: 0.0A • Load max: 1.0A
2N3904 Transistor *To amplify the signal giving to the speaker* 	• Bi-Polar NPN Transistor • DC Current Gain (hFE) is 300 maximum • Continuous Collector current (IC) is 200mA • Base- Emitter Voltage (VBE) is 6V • Collector-Emitter Voltage (VCE) is 40V • Collector-Base Voltage (VCB) is 60V

8.2 CIRCUIT DIAGRAMS

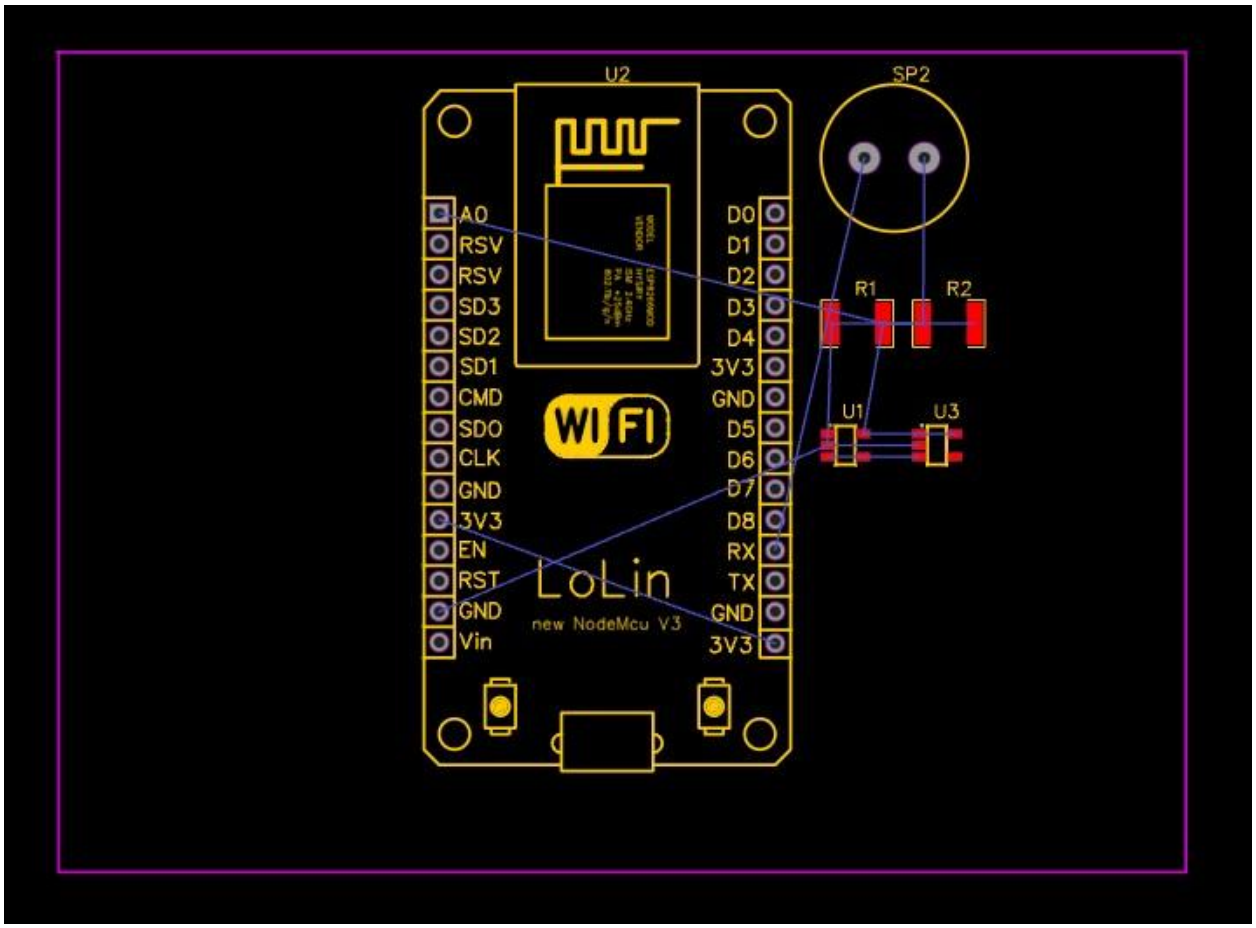




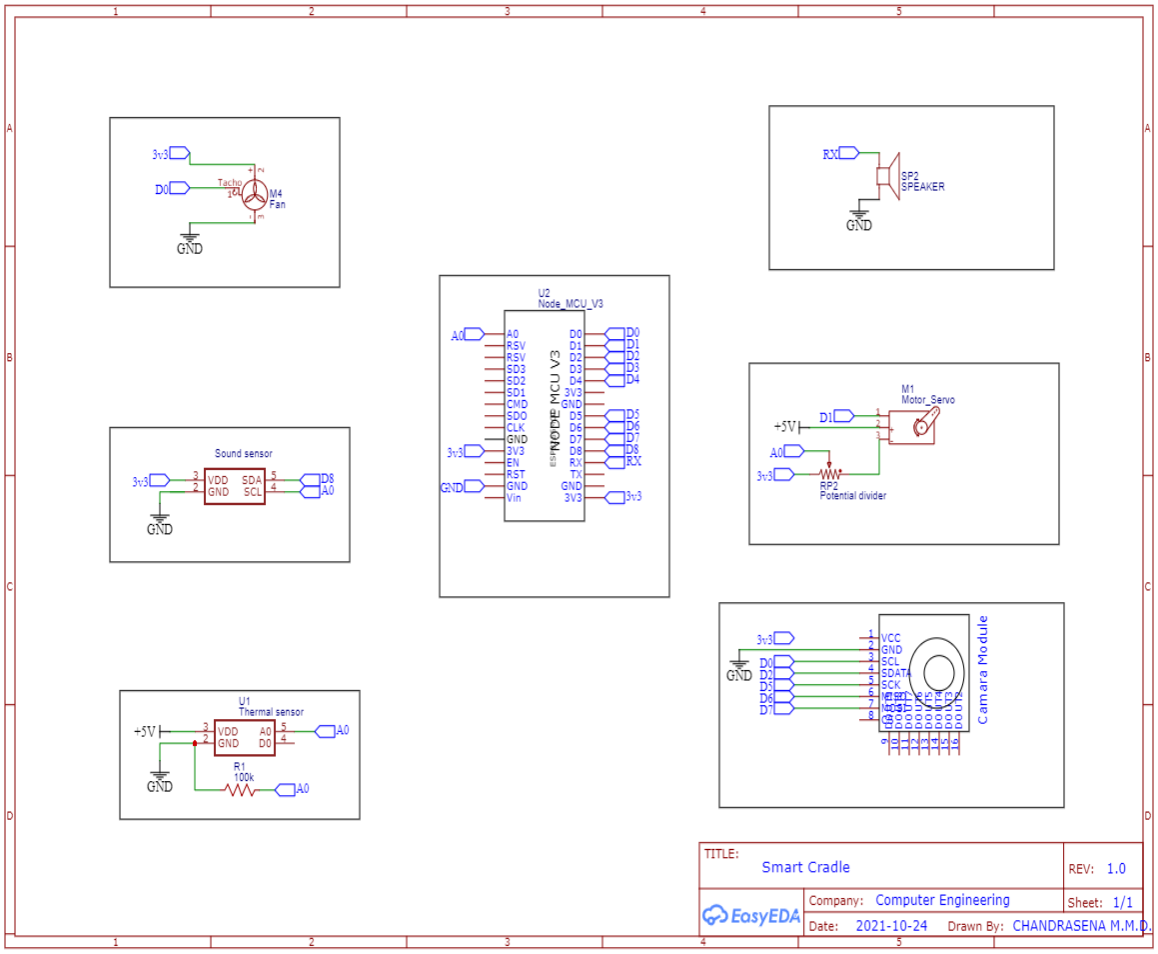

Transistor
Mini Speaker
A0
G
VU
S3
S2
S1
CS
S0
SK
G
3V
RX
RST
G
VIN
D0
D1
D2
D3
D4
3V
G
D5
D6
D7
D8
<RX
>TX
G
3V
RST
FLASH


Motor Driver
ATMega32
Microstep Driver
PWR/ALARM
ENA-(ENA)
ENA+(+5V)
DIR-(DIR)
DIR+(+5V)
PUL-(PUL)
PUL+(+5V)
Signal
B-
B+
A-
A+
GND
VCC
High Voltage
DC:9~40VDC
ENA (-): Not connected
ENA (+): +5 V
DIR (-): Pin 9
DIR (+): +5 V
PUL (-): Pin 8
PUL (+): +5 V
12V Battery
Stepper Motor

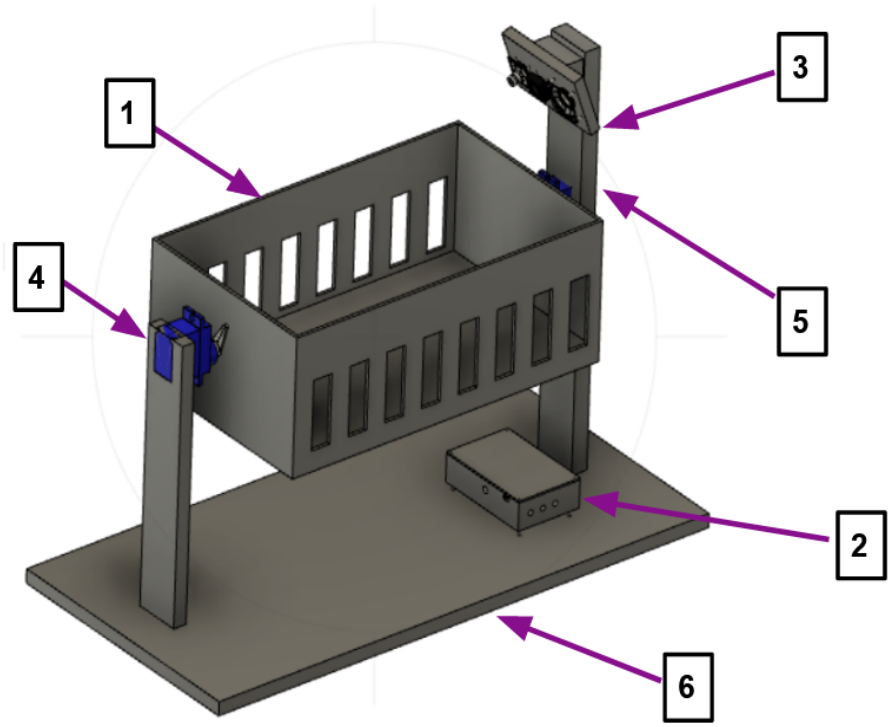
8.3 PCB Design



8.4 Schematic Design



8.5 3D Model



1 - Cradle

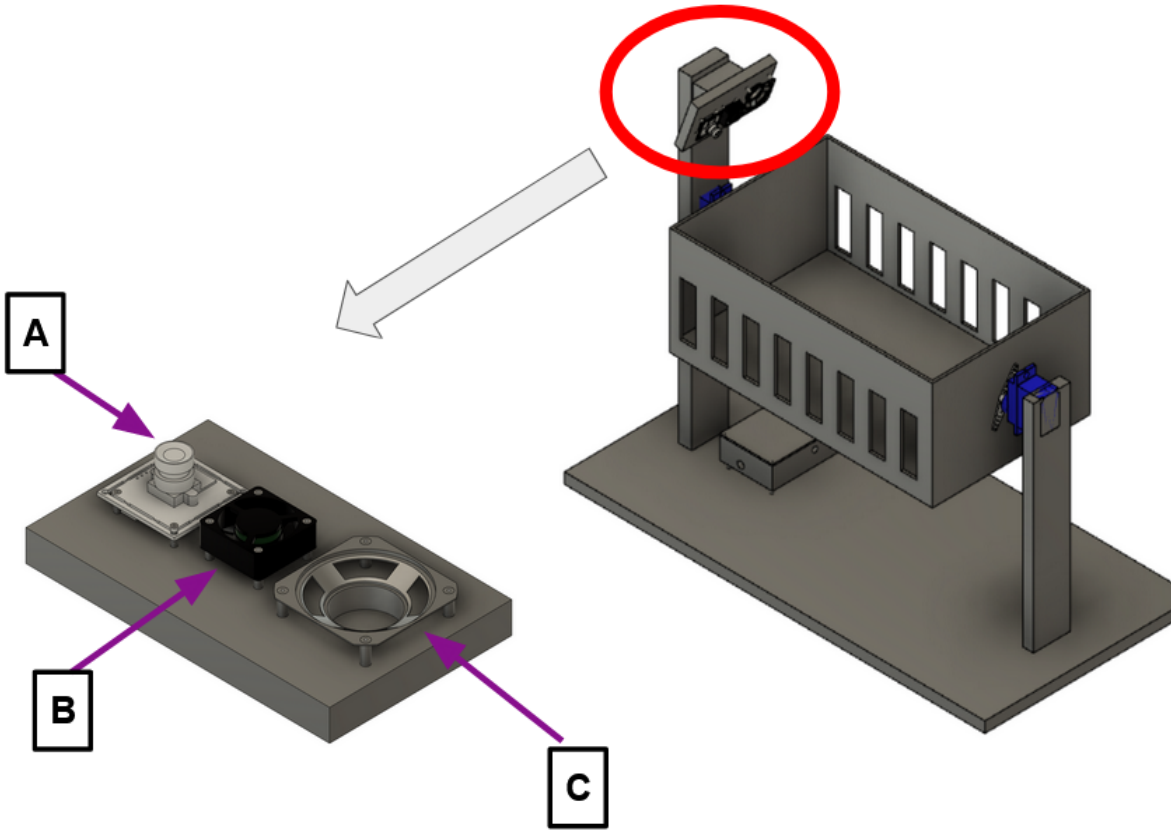
2 - Electronic Component Box

3 - Mini fan , Speaker and Camera circuit

4 - Motor

5 - Adjustable height fixer

6 - Base



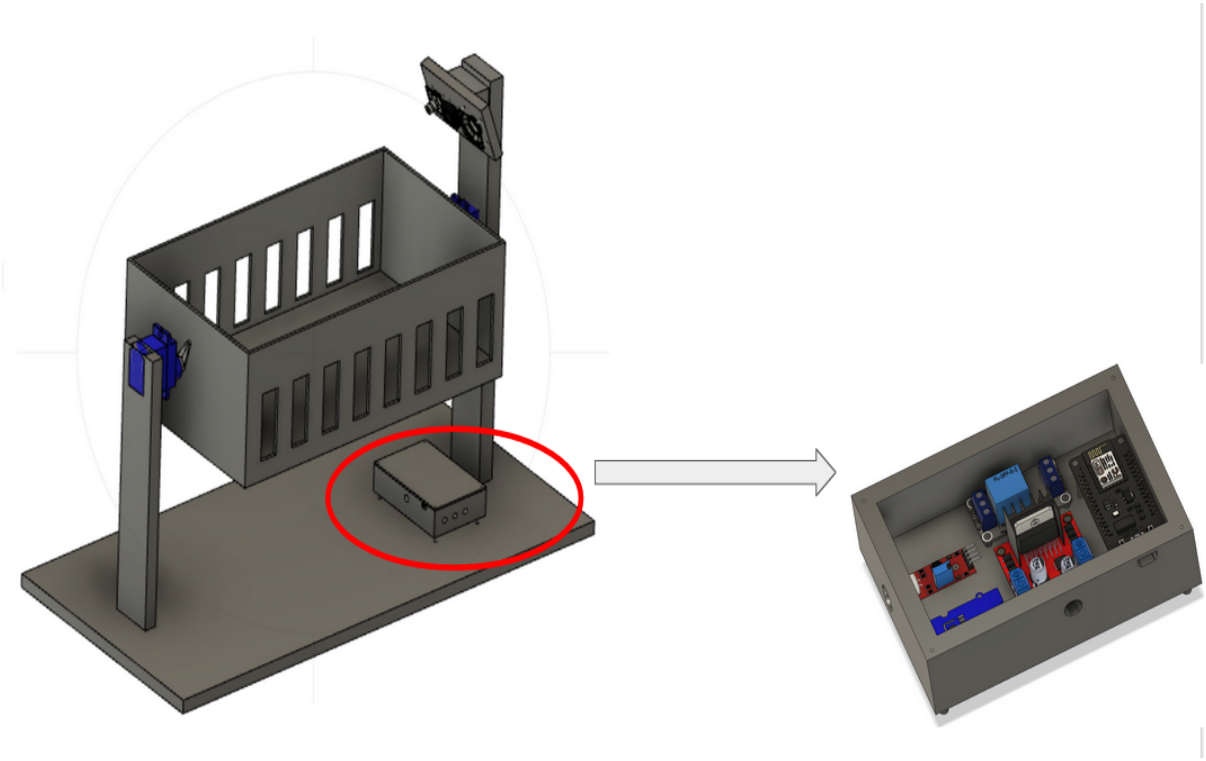
A - Camera module

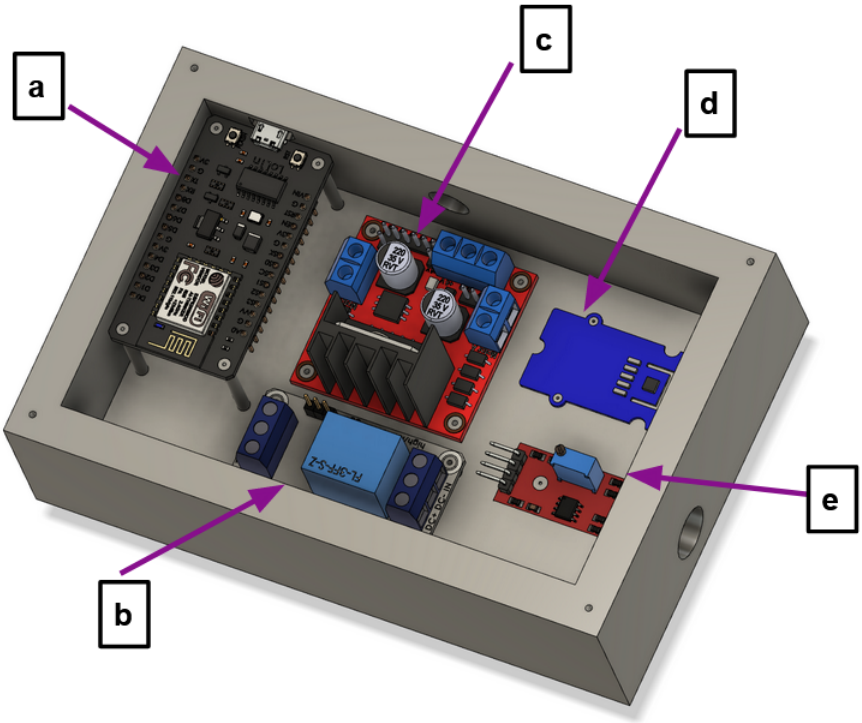
B - Mini Fan

C - Speaker

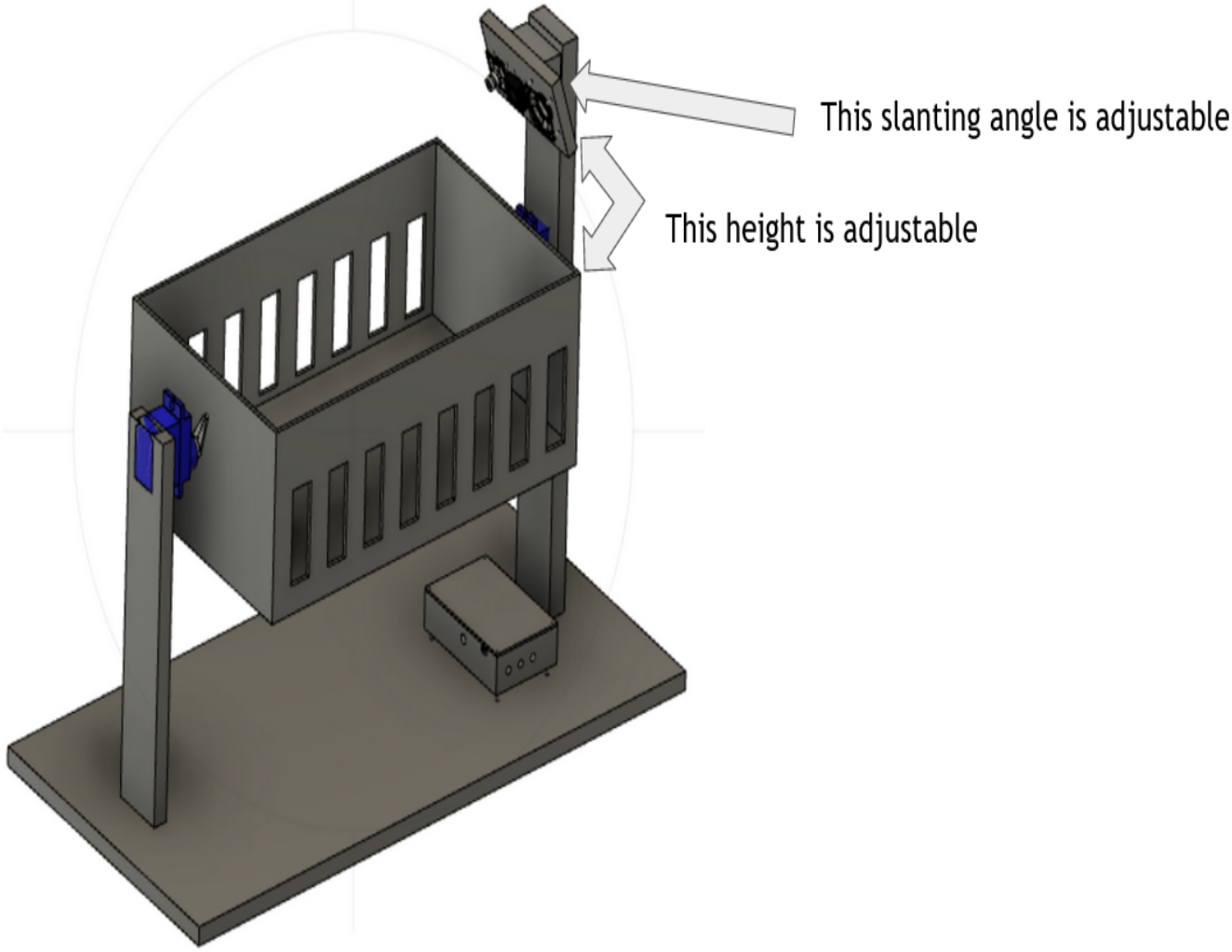
Component Box:

All the circuit components are embedded inside a wooden box.





a - ESP8266 Controller
b - Relay
c - Motor Driver
d - Temperature sensor
e - Sound Sensor

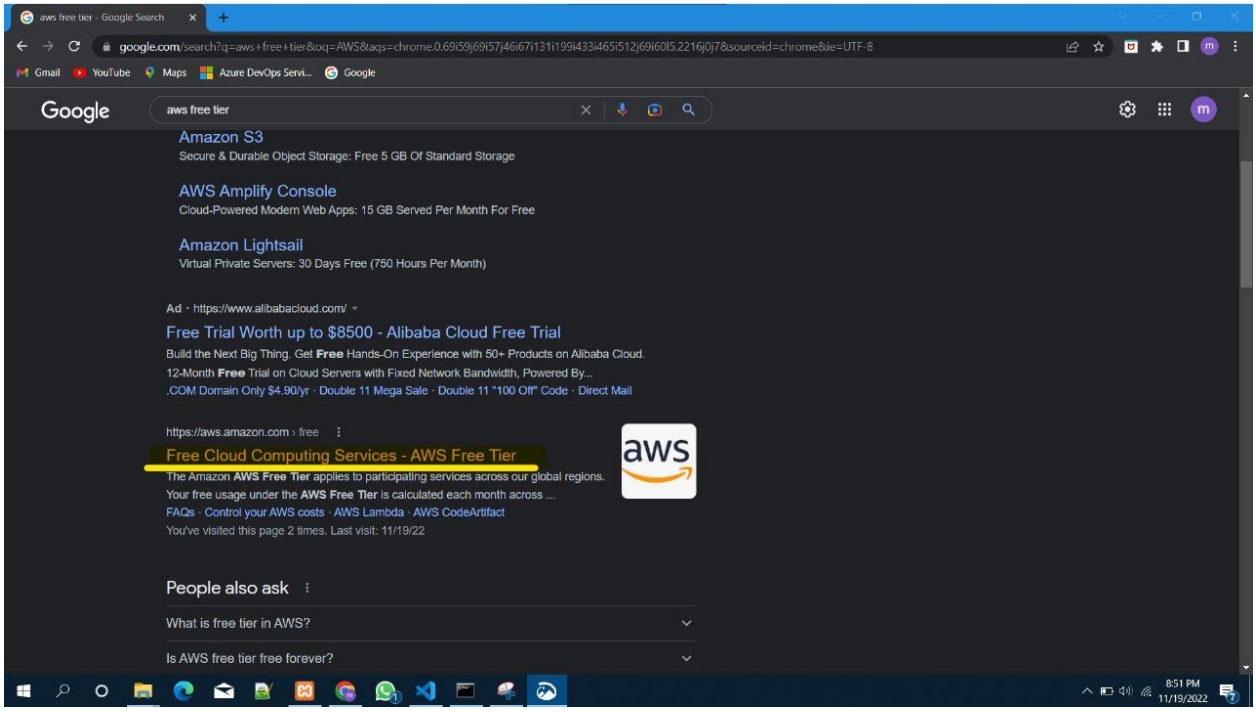

This slanting angle is adjustable
This height is adjustable

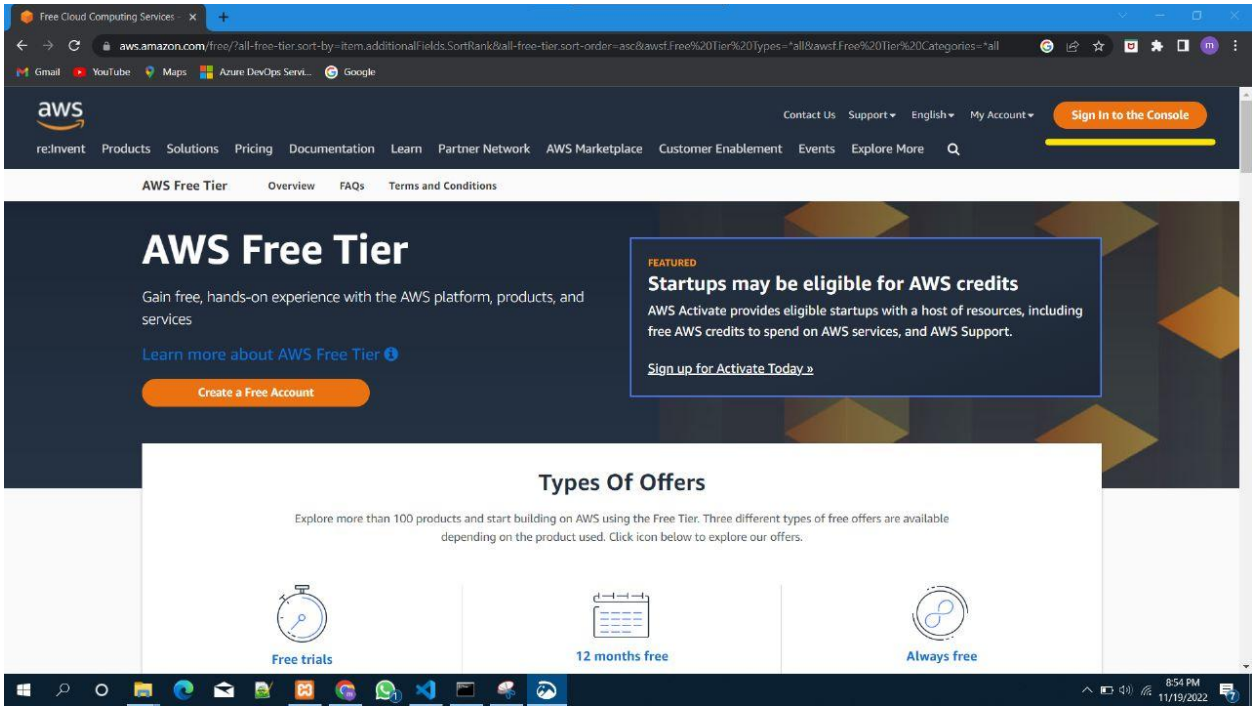
9. CLOUD DEPLOYMENT

For hosting AWS is used
Other amazon web services like EC2 and Amazon RDS are used.
It provides secure,reliable and scalable services.

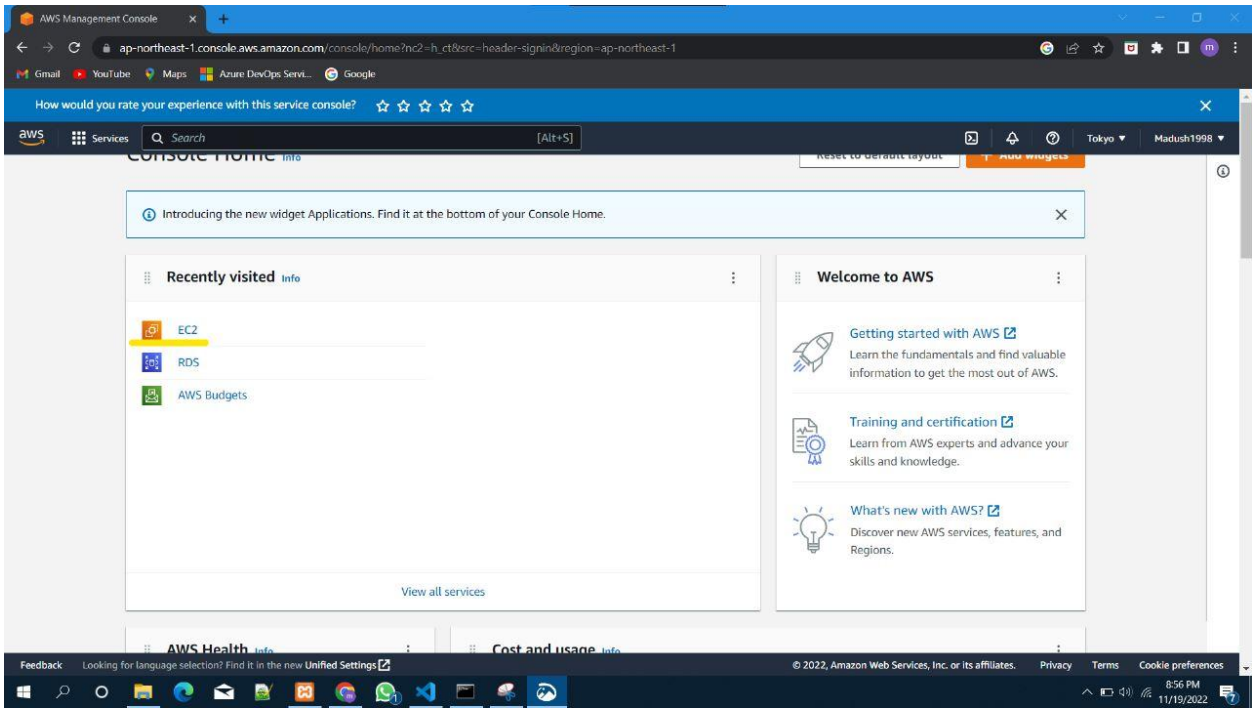
Steps followed for the cloud deployment

- Creating AWS account

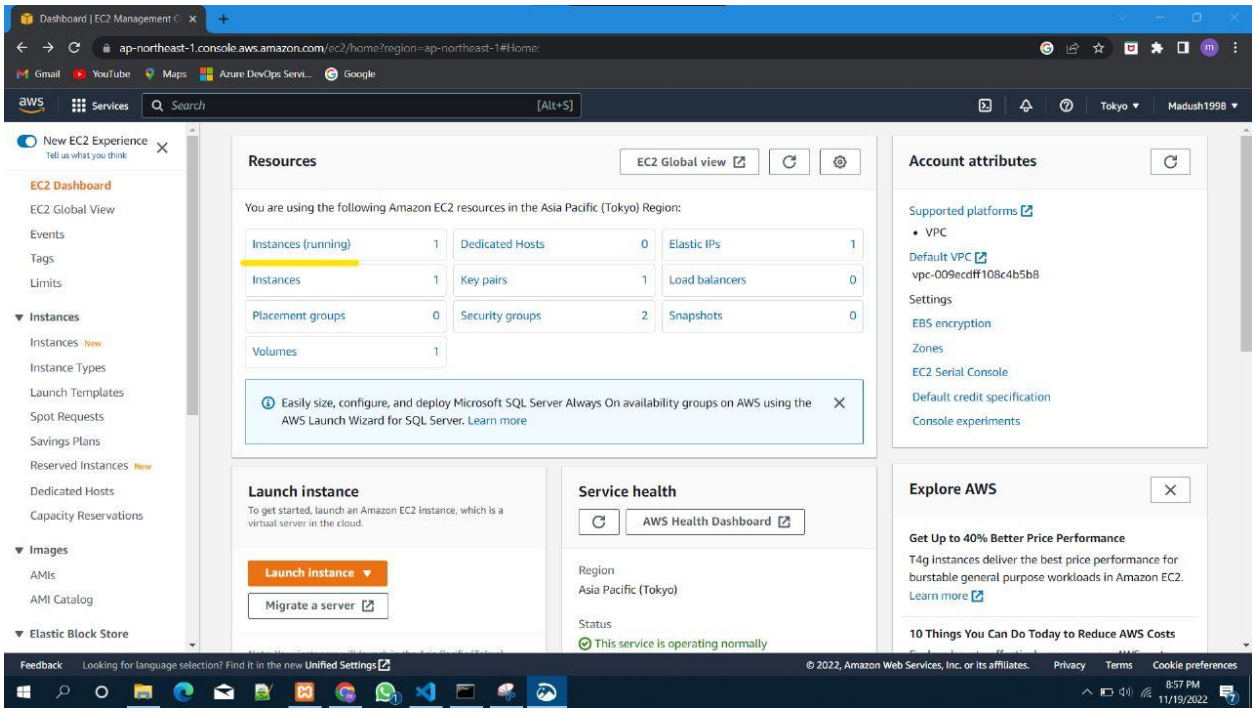


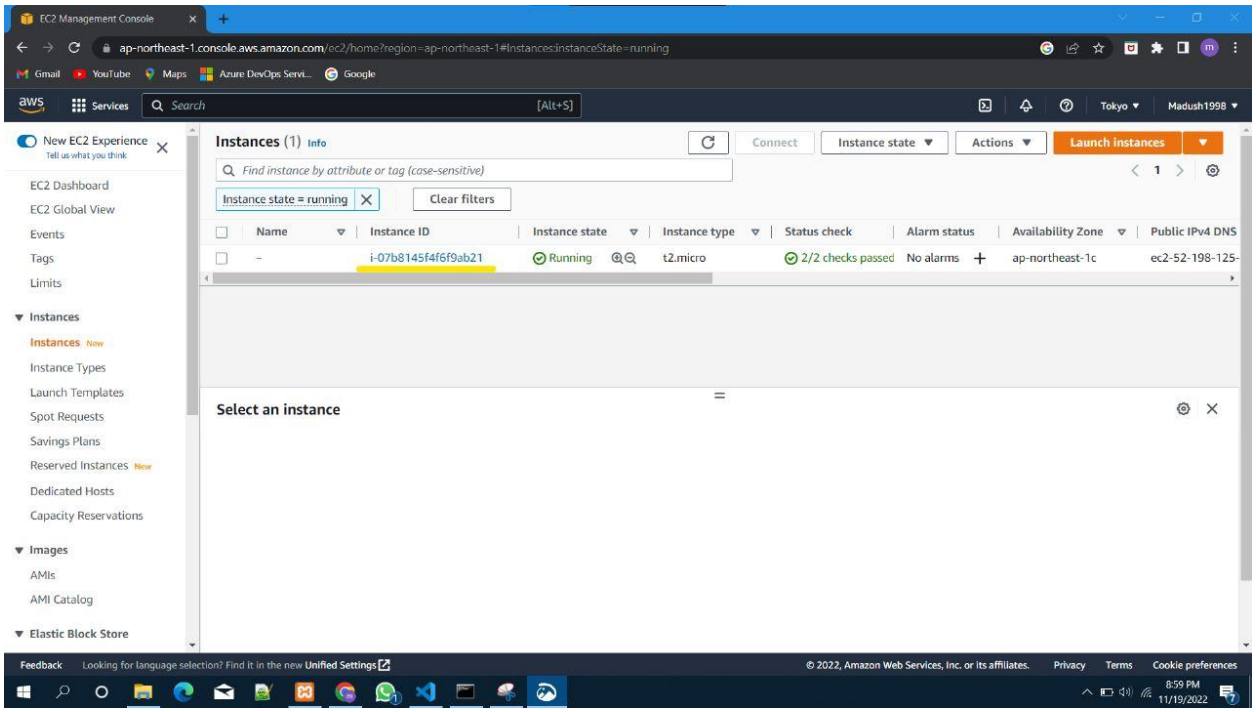


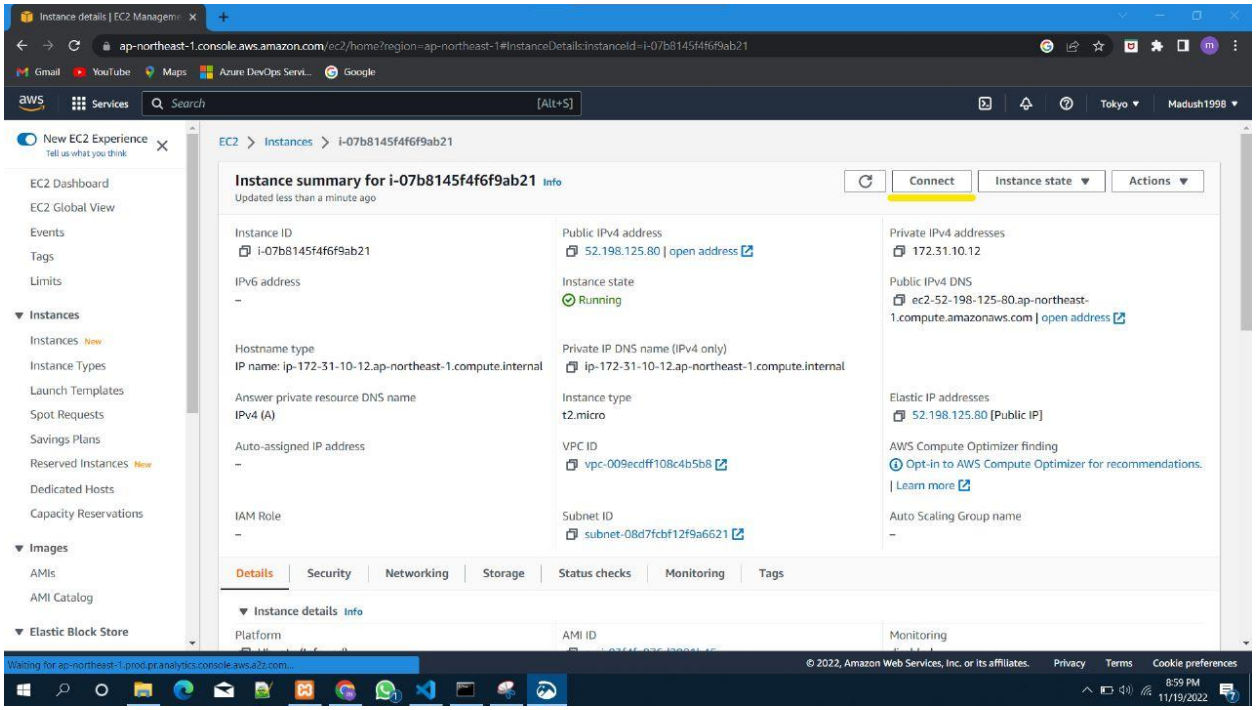
- Using EC2 Services



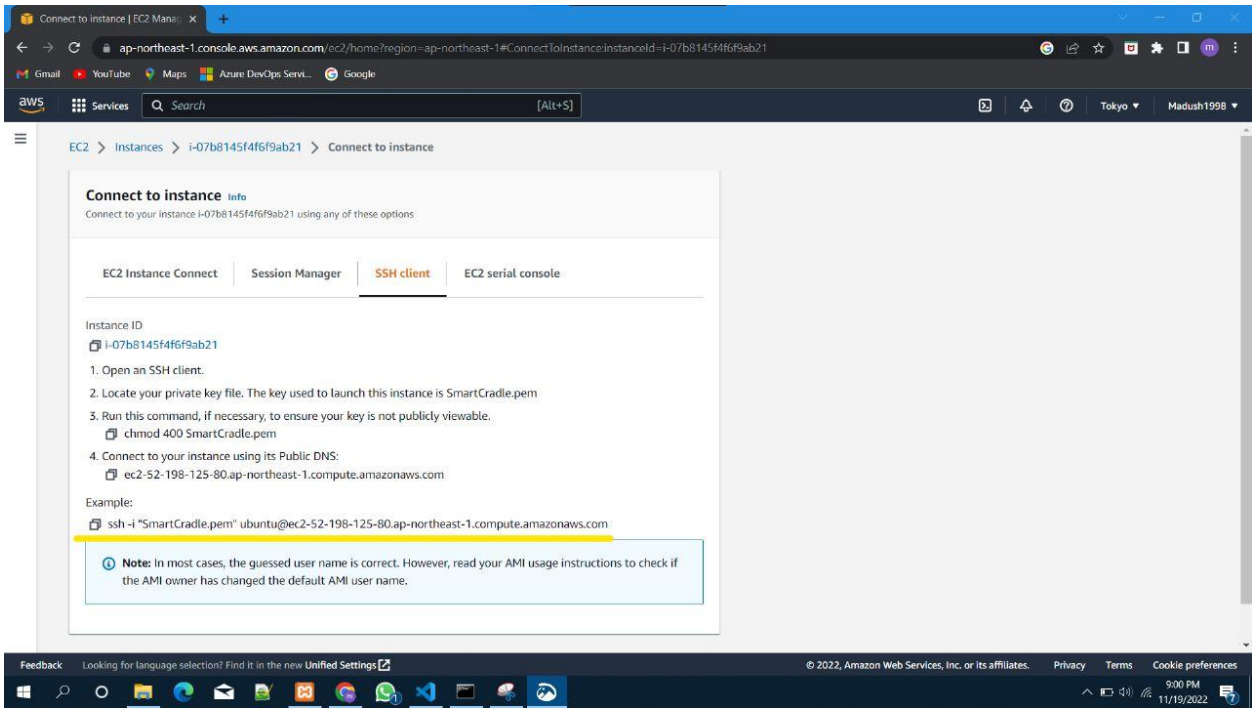
- Launch Instance

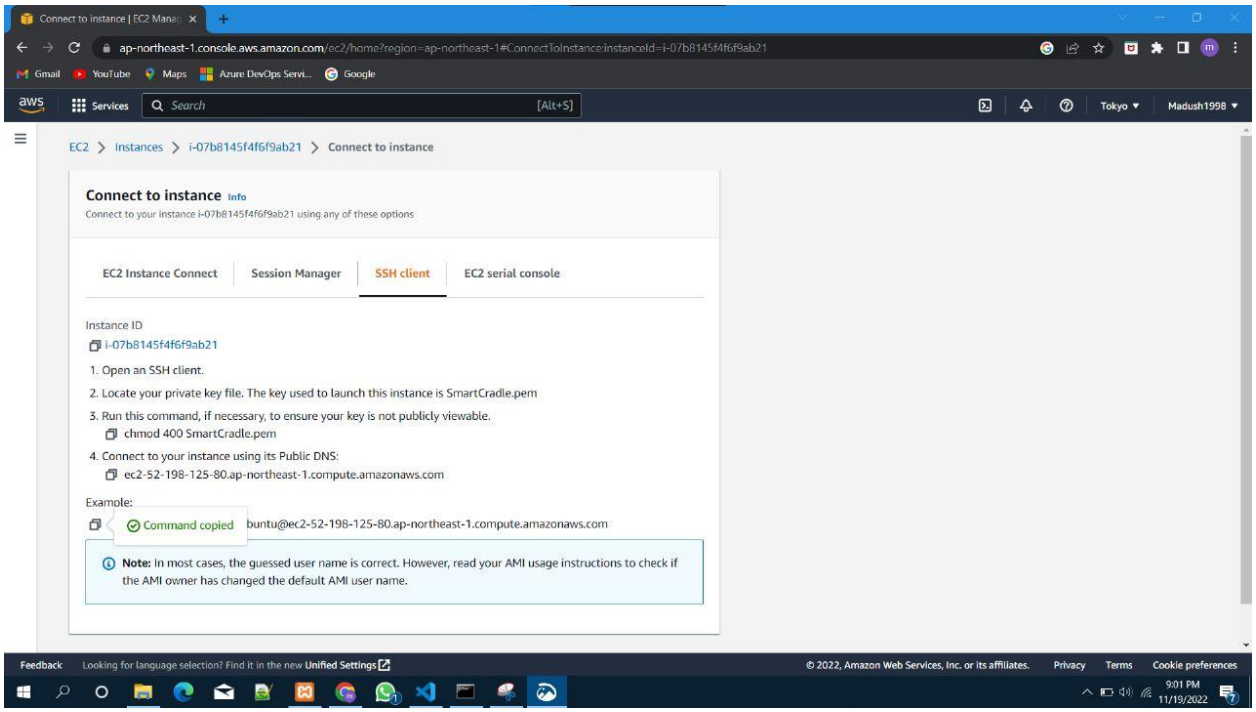




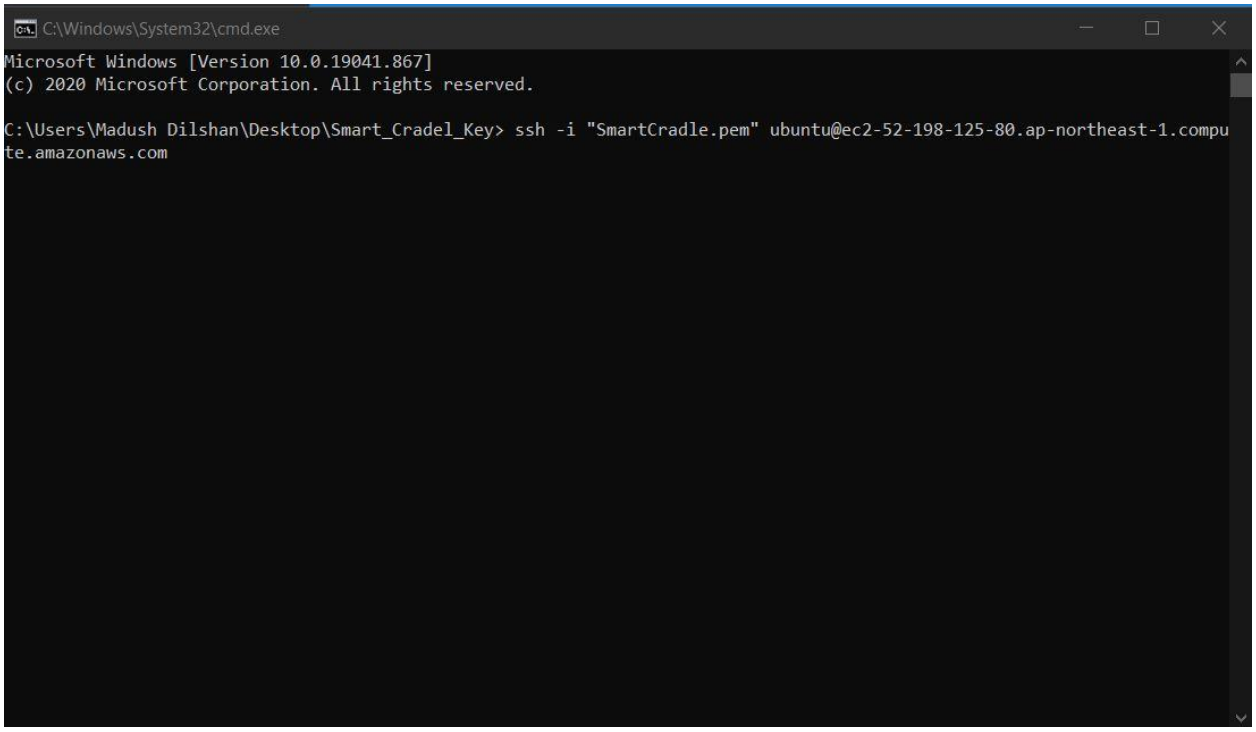


- Connect to instance





- Connect to DNS using public DNS



```
ubuntu@ip-172-31-10-12: ~
C:\Users\Madush Dilshan\Desktop\Smart_Cradel_Key> ssh -i "SmartCradle.pem" ubuntu@ec2-52-198-125-80.ap-northeast-1.compu
te.amazonaws.com
Welcome to Ubuntu 22.04.1 LTS (GNU/Linux 5.15.0-1019-aws x86_64)

 * Documentation:  https://help.ubuntu.com
Welcome to Ubuntu 22.04.1 LTS (GNU/Linux 5.15.0-1019-aws x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Sat Nov 19 15:33:03 UTC 2022

  System load:  0.0               Processes:             112
  Usage of /:   41.1% of 7.57GB   Users logged in:       1
  Memory usage: 33%               IPv4 address for eth0: 172.31.10.12
  Swap usage:   0%

 * Ubuntu Pro delivers the most comprehensive open source security and
   compliance features.

   https://ubuntu.com/aws/pro

34 updates can be applied immediately.
To see these additional updates run: apt list --upgradable


*** System restart required ***
Last login: Sat Nov 19 15:17:40 2022 from 223.224.1.157
ubuntu@ip-172-31-10-12:~$
```

- Create database and Connected to it successfully

```
ubuntu@ip-172-31-10-12: ~/Smart-Cradle/e17-3yp-Smart-Cradle/Backend/server
ubuntu@ip-172-31-10-12:~/Smart-Cradle/e17-3yp-Smart-Cradle/Backend/server$ npx kill-port 9000
Process on port 9000 killed
ubuntu@ip-172-31-10-12:~/Smart-Cradle/e17-3yp-Smart-Cradle/Backend/server$ node index.js
serevr on port 9000
Connected to the databse : cradle
Subscribed Successfully
```

10. SECURITY ,SAFETY AND SCALABILITY

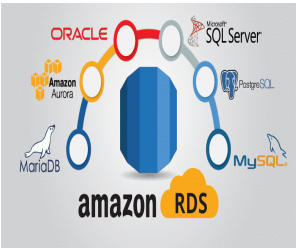
10.1 Security and safety

10.1.1 Hardware Aspect

- Good depth of the cradle prevents the baby from escaping.
- Automatic and manual swing.Automatic swing with good motor quality.
- Cradle doesn't have any sharp edges
- All electronic components are embedded inside a wooden box and connected at a place which is not reachable to the baby.
- Adjustable height to the top fan,camera and speaker components .

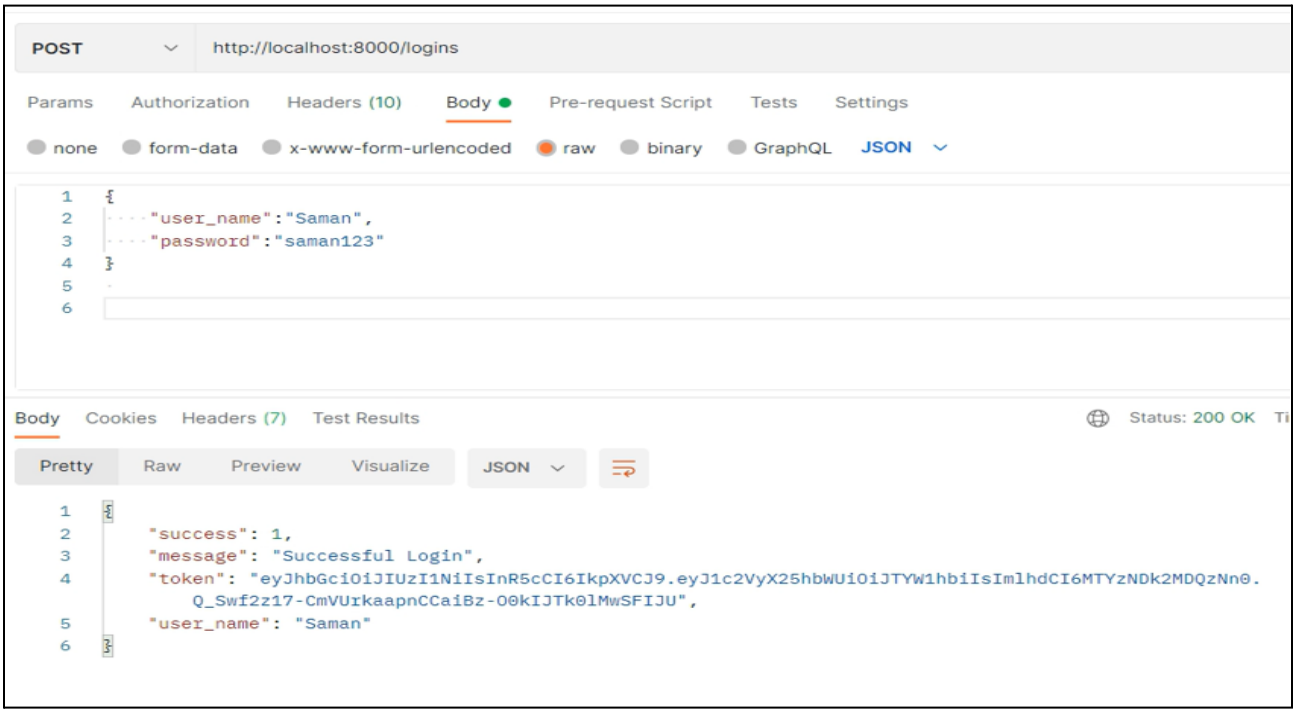
10.1.2 Software Aspect

- ***AWS cloud based server*** is used since it provides secure services.It uses certificates to authenticate machine to machine communication and provides policies to control the actions of the devices.



- ***Amazon RDS*** is the storage service that is used.We since it supports MySQL and it is secure.It uses data encryption to secure data.The data stored in the disk is encrypted.The data which is transmitted via the network is also encrypted.

- ***JSON Web Token (JWT)*** is used for the authentication.Once the user login to the system the server sends this token to the user.



Sending JSON Web Token at the login.

Password Hashing ,the original password is not stored in the database.Hashing performs a one-way transformation on a password, turning the password into another string.

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content

user_name	password	email	mobile_number
hasara	$2b$10$EtkegTfzr7/BPDDT16ujp.Qu0YOrmQsg...	Hasara@gmail.com	0715569874
Madush	$2b$10$CUL.CEvJgyGMEK/Zg6cwVeuzgAefj8K...	Madushchandrasenac@gmail.com	0775523577
Saman	$2b$10$MnRhHFPR.MGJ0IWRv6e9.uoGlw4oG5...	Saman@gmail.com	0775642371
shashini	$2b$10$WeXRnbhChkNnyEt/HoiRKOEN8Gp.NZz...	shashini@gmail.com	0771478523
NULL	NULL	NULL	NULL

10.2 Scalability

- Single App can control several devices
- Can easily add/remove devices

11. RESOURCES

All the designs and codes can be found on our github repository.

https://github.com/cepdnaclk/e17-3yp-Smart-Cradle