**Renewable Energy Monitoring**

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**BTech/III Year CSE/V Semester**

**15CSE302/Database Management Systems**

**Project Review -3**

**Team PS3**

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**Table of Contents**

**Title Page number**

**Chapter 1 Abstract 4 Chapter 2 Business rules 4 Tables**

**Output**

**Chapter 3 Preview for the project 5 Introduction**

**Need and motivation**

**Tools used**

**Chapter 4 Project analysis 6 List of modules in the project**

**Module-wise explanation**

**Chapter 5 Project design 8 ER-Diagram**

**Database scheme before normalization**

**Chapter 6 Normalisation 9 Normalization procedure**

**Database schema after normalization**

**Chapter 7 Backend design 34 Table creation comments**

**Sample instances of the tables**

**Chapter 8 Frontend design 36 Introduction to the tool(s)(used in the project)**

**Connectivity code**

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 2

**Chapter 9 Database connectivity 37 Introduction to the connectivity standard (used in the project)**

**Connectivity code**

**Chapter 10 Sample code 40 Sample code of selected UI screens**

**Chapter 11 Conclusions 41 Elucidating important features of the project**

**Chapter 12 References 42** Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 3

**Chapter 1 Abstract**

**Project Title : Renewable Energy Monitoring**

**Abstract:**

Remote renewable energy installations can be monitored and controlled in real-time, with features like: ➔ Has 3 Customisations on the type of Products that's to be monitored - Solar, Wind, and Geo-Thermal Based but can have no limit in the quantity.

➔ Cloud-based systems allow you to access your data on your desktop or on your mobile device. ➔ Real-time Voice, SMS, and/or Email alarm callouts to alert about the product ➔ Control your installation remotely, anytime, anywhere

➔ Remotely monitor temperature, power output, and more, in real-time

**Chapter 2 Business rules**

**Business Rules:**

➔ The user needs to have a license.

➔ One user multiple devices monitoring

➔ Can create 3 Types of Products - Solar, Geo-Thermal, Wind Energy-Based. ➔ Can access usage statistics of the Machine in Real-time

➔ Get to control the parameter of you Machine remotely in Real-Time

➔ Get Real-time Alerts for erroneous activities and abnormal functioning

**Tables:**

➔ wind\_power\_monitoring

➔ solar\_power\_monitoring

➔ geothermal\_monitoring

➔ product\_table

➔ user\_table

**Output:**

➔ Ability to control the functioning of the product

➔ A general overview of the products which are currently being active and their operational statistics

➔ An in-depth specification of a particular product like working hours, battery-levels, power consumption, and other things.

➔ Notifying the user if any unforeseen error rises due to over usage or due to any technical issue Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 4

**Chapter 3 Preview for the project**

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**Introduction:**

**Renewable energy monitoring** is a vital tool that's missing in the current landscape of Renewable energy plants. Renewable Energy Monitoring involves usage of Databases to facilitate the real time syncing of the vital parameters like the Energy Generated, Status, Running Temperature, etc. This helps the end consumers to easily monitor their smart energy devices. This project is applicable for the most used Renewable energy types - Solar, Wind and Geothermal Energy plants. This way, we can fix the missing puzzle in this Industry and make an impact in the environment with sustainable development.

**Need and motivation:**

The need for a connecting bridge between users and their renewable energy generating machines which need a time to time check so that the user doesn’t lose much in repair when the machine starts malfunctioning. Since the user knows his machine started malfunctioning he can reduce his loss before the machine needs a replacement. Also if the user wants a person to monitor it just brings him expenses which substitute the expenses of the replacement of the machine when the machine totally fails, hence even it isn’t viable so the app replaces the need and cuts down the expenses to some extent. So the app notifies the user before it is too late and proves the power of IOT.

**Tools used:**

● Dia

● Android studio

● Firebase

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 5

**Chapter 4 Project analysis**

**List of modules in the project:**

**Entity - Set Model:**

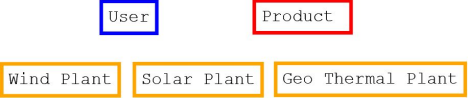
Table User( Product\_ID, User ID , Name , Email , Phone No , Address, Password) Table Product (Product\_ID , Efficiency, Energy generated, Uptime , Working Temperature, Status )

Table Wind Plant ( Wind\_ID, Wind Speed, No of Blades, Blade Radius, Air Density, Uptime , Energy consumed, Wind\_ID )

Table Solar Plant ( Solar\_ID, Uptime, Energy consumed , No of Blades, Cloud Cover, Sun Intensity, Heat Build Up, Soiling , )

Table Geo Thermal Plant ( GeoThermal\_ID, Energy consumed, Moisture numeric, Soil Type )

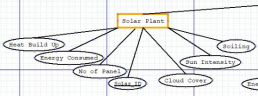
**Entities**

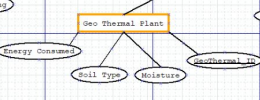
****Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 6

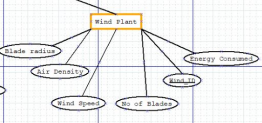
**Attributes**

****

****

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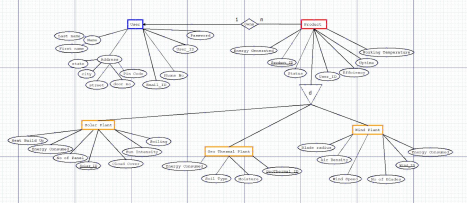
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Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 7

**Chapter 5 Project design**

**ER Diagram:**

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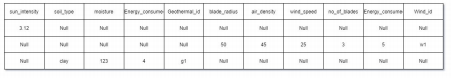
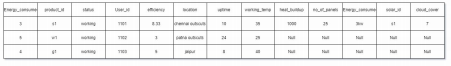
**Database Scheme before Normalization:**

**1. Write out the relation including all attribute names. Provide at least 3-5 records as sample data for the relation. Write down all Functional Dependencies. and draw dependency diagram**

**Initial Schema**

**Renewable\_Energy\_Monitoring(**First\_Name,Last\_Name,state,city,street,door\_no,pin\_code,email\_id ,phone\_no,User\_Id,password,Energy\_generated,Energy\_consumed,Product\_id,Status,User\_id,efficiency ,location,uptime,working\_temp,heat\_buildup,no\_of\_panel,Energy\_conumed,Solar\_id,cloud\_cover,sun\_in tensity,soiling,soil\_type,moisture,Energy\_consumed,Geothermal\_id,blade\_radius,air\_density,wind\_speed, no\_of\_blades,Energy\_consumed,Wind\_id)

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 8

**Chapter 6 Normalization**

**Normalization procedure:**

**Identifying all the Functional Dependencies :**

**1)User\_Id** → First\_name,Last\_name,state,city,street,door\_no,pin\_code,password **2)pin\_code** → state,city

**3)email\_id** → User\_Id

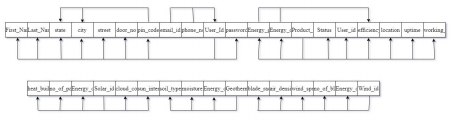
**4)phone\_no** → User\_Id

**5)Product\_id**→Solar\_id,Geothermal\_id,Wind\_id,Status,User\_id,efficiency,location,uptime,working\_ temp,Energy\_generated,Energy\_consumed

**6)Solar\_id** → cloud\_cover,sun\_intensity,heat\_buildup,no\_of\_panel,Energy\_consumed **7)Geothermal\_id** → Soil\_type,moisture,Energy\_consumed

**8)Wind\_id** → air\_density,wind\_speed,no\_of\_blades,blade\_radius,Energy\_consumed **9)Energy\_generated,Energy\_consumed** → efficiency

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 9



**2) Finding the FD closure and Attribute Closure**

**a)FD closure:**

**1)User\_Id** → First\_name,Last\_name,state,city,street,door\_no,pin\_code,password **2)pin\_code** → state,city

**3)email\_id** → User\_Id

**4)phone\_no** → User\_Id

From 1 and 3, 1 and 4 by the rule of Transitivity

We get 5 and 6

**5)email\_id** → First\_name,Last\_name,state,city,street,door\_no,pin\_code,password **6)phone\_no** → First\_name,Last\_name,state,city,street,door\_no,pin\_code,password

**7)Product\_id**→Solar\_id,Geothermal\_id,Wind\_id,Status,User\_id,efficiency,location,uptime,working\_ temp,Energy\_generated,Energy\_consumed

**8)Solar\_id** → cloud\_cover,sun\_intensity,heat\_buildup,no\_of\_panel,Energy\_consumed **9)Geothermal\_id** → Soil\_type,moisture,Energy\_consumed

**10)Wind\_id** → air\_density,wind\_speed,no\_of\_blades,blade\_radius,Energy\_consumed From 7 and 8,9,10,from 1 and 7 by the rule of transitivity

We get 11

**11)**

**Product\_id** → cloud\_cover,sun\_intensity,heat\_buildup,no\_of\_panel

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 10

**Product\_id** → Soil\_type,moisture

**Product\_id** → air\_density,wind\_speed,no\_of\_blades,blade\_radius

**Product\_id** → First\_name,Last\_name,state,city,street,door\_no,pin\_code,password **12)Energy\_generated,Energy\_consumed** → efficiency

**Attribute closure:**

**1)User\_Id+=**{User\_Id,First\_name,Last\_name,state,city,street,door\_no,pin\_code,password} **2)email\_id+={**email\_id,User\_id,First\_name,Last\_name,state,city,street,door\_no,pin\_code, password}

**3)phone\_no+={**phone\_no,User\_id,First\_name,Last\_name,state,city,street,door\_no,pin\_code, password}

**4)pincode+={**pin\_code,state,city}

**5)Product\_id+={**Product\_id,Status,User\_id,efficiency,location,uptime,working\_temp,Energy\_geberated, Energy\_consumed,heat\_buildup,no\_of\_panel,Solar\_id,cloud\_cover,sun\_intensity,soiling,soil\_type,moistu re,Geothermal\_id,blade\_radius,air\_density,wind\_speed,no\_of\_blades,Wind\_id,

User\_Id,First\_name,Last\_name,state,city,street,door\_no,pin\_code,password } **6)Solar\_id+={**Solar\_id,cloud\_cover,sun\_intensity,heat\_buildup,no\_of\_panel,Energy\_consumed } **7)Geothermal\_id+={**Geothermal\_id,Soil\_type,moisture,Energy\_consumed } **8)Wind\_id+={**Wind\_id,air\_density,wind\_speed,no\_of\_blades,blade\_radius,Energy\_consumed } **9){Energy\_generated,Energy\_consumed}+={**efficiency}

**10)First\_name+={**First\_name}

**11)Last\_name+={**Last\_name}

**12)state+**={state}

**13)city+**={city}

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 11

**14)street+={**street}

**15)door\_no+=**{door\_no}

**17)password+=**{password}

**18){Energy\_generated,Energy\_consumed,Staus,Owner\_id,efficiency,location,uptime,working\_tem p,heat\_buildup,no\_of\_panel,cloud\_cover,sun\_intensity,soiling,soil\_type,moisture,blade\_radius,air\_ density,wind\_speed,no\_of\_blades,Energy\_consumed,Energy\_generated}**=the respective attribute itself like in the cases of 10-17.

**b)Determine Canonical Cover**

**1)User\_Id** → First\_name,Last\_name,state,city,street,door\_no,pin\_code,password **2)pin\_code** → state,city

**3)email\_id** → User\_Id

**4)phone\_no** → User\_Id

**5)Product\_id**→Solar\_id,Geothermal\_id,Wind\_id,Status,User\_id,efficiency,location,uptime,working\_ temp,Energy\_generated,Energy\_consumed

**6)Solar\_id** → cloud\_cover,sun\_intensity,heat\_buildup,no\_of\_panel,Energy\_consumed **7)Geothermal\_id** → Soil\_type,moisture,Energy\_consumed

**8)Wind\_id** → air\_density,wind\_speed,no\_of\_blades,blade\_radius,Energy\_consumed **9)Energy\_generated,Energy\_consumed** → efficiency

● In the above functional dependency User\_Id state and city is not needed since both the attributes have been logically implied in the Functional Dependency pin\_code. So in canonical cover User\_id Fd will have

{First\_name,Last\_name,street,door\_no,pin\_code,password}

● In the above functional dependency Product\_id efficiency is not need since in the below functional dependency {Energy\_generated,Energy\_consumed} the attribute has been logically implied. So the Product\_id will have

**{**Status,Owner\_id,efficiency,location,uptime,working\_temp}

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 12

So the canonical cover will be

**1)User\_Id** → First\_name,Last\_name,street,door\_no,pin\_code,password

**2)pin\_code** → state,city

**3)email\_id** → User\_Id

**4)phone\_no** → User\_Id

**5)Product\_id**→Solar\_id,Geothermal\_id,Wind\_id,Status,Owner\_id,efficiency,location,uptime,workin g\_temp

**6)Solar\_id** → cloud\_cover,sun\_intensity,heat\_buildup,no\_of\_panel,Energy\_consumed **7)Geothermal\_id** → Soil\_type,moisture,Energy\_consumed

**8)Wind\_id** → air\_density,wind\_speed,no\_of\_blades,blade\_radius,Energy\_consumed **9)Energy\_generated,Energy\_consumed** → efficiency

**c)Super Key:**

**(User\_id,email\_id,Phone\_no,Product\_id)**

**d)Anomalies:**

**Insertion anomaly:**

The details or values for any devices can be entered only when the person is registered with that device.

**Updation anomaly:**

When the details about the user is updated or changed, the details should also be updated with all the devices the user is associated with or with all the devices the person owns. Also when the details about the device are updated the values or the details should also be updated with the user who owns or is associated with the device.

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 13

**Deletion anomaly:**

When the details about the user is deleted the details of the respective devices the user owns or is associated with also gets deleted.When the user owns only one device when the details about the user gets deleted, the details of the user also gets deleted.

**3)First normal form:**

**Check:**

**Primary key exists:**(Product\_id,User\_id)

**Non Atomic Attributes:**

In the given table the attributes phone\_no and email\_id are multivalued. So change the values to atomic ones meaning add rows having the all the attributes as same with different phone numbers and email ids when they are present more than one.

**Repeating columns or attributes:**

The attribute Energy\_consumed is repeated 4 times. So removing the 3 repeating attributes leaves only one Energy\_consumed column instead of 4 Energy\_consumed column.The attribute User\_id is also repeated twice so remove the repeating one.

**Schema after first normalization:**

**Renewable\_Energy\_Monitoring(**First\_Name,Last\_Name,state,city,street,door\_no,pin\_code,email\_id,ph one\_no,User\_Id,password,Energy\_generated,Energy\_consumed,Product\_id,Status,efficiency,location,up time,working\_temp,heat\_buildup,no\_of\_panel,Solar\_id,cloud\_cover,sun\_intensity,soiling,soil\_type,moist ure,Geothermal\_id,blade\_radius,air\_density,wind\_speed,no\_of\_blades,Wind\_id)

**4)Identifying the partial identities and checking for 2​nd normalization form.**

**1)** It is present in 1st normal form

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 14

**2)** Checking for Partial dependency:

**User\_id** → First\_name,Last\_name,state,city,street,door\_no,pin\_code,password **Product\_id**→Solar\_id,Geothermal\_id,Wind\_id,User\_id,Status,efficiency,location,uptime,wor king\_temp,Energy\_generated,Energy\_consumed

There are 2 partial dependencies where the non prime attributes are dependent on the subset of prime attributes. So as to remove them create 4 relation naming

User(user\_id),Product(Product\_id),Phone(phone\_no) and Email(email\_id).

The relation Phone and Email are created because both are multi-valued and both don't determine any non prime attributes.

**Schema after 2​nd normalization:**

**User**(User\_id,First\_name,Last\_name,state,city,street,door\_no,pin\_code,password) **Phone**(user\_id,phone\_no)

**Email**(user\_id,phone\_id)

**Product**(Solar\_id,Geothermal\_id,Wind\_id,Status,User\_id,efficiency,location,uptime,working\_temp, Energy\_generated,Energy\_consumed,cloud\_cover,sun\_intensity,heat\_buildup,no\_of\_panel, Soil\_type,moisture, air\_density,wind\_speed,no\_of\_blades,blade\_radius)

**5)Identifying the transitive dependency and checking for 3​rd normal form: 1)** The given schema is in 2nd normal form

**2)** Check for transitive dependency:

a)User\_id → pin\_code

pin\_code → state,city

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 15

b)Product\_id→Geothermal\_id,Wind\_id,Solar\_id

Solar\_id → cloud\_cover,sun\_intensity,heat\_buildup,no\_of\_panel,Energy\_consumed Geothermal\_id → Soil\_type,moisture,Energy\_consumed

Wind\_id → air\_density,wind\_speed,no\_of\_blades,blade\_radius,Energy\_consumed c)Product\_id →Energy\_generated,Energy\_consumed

{ Energy\_generated,Energy\_consumed}→efficiency

From above we can see that the relation is not independent of transitive dependency.So to make it into 3rd normal form free from transitive dependency, from User table create 2 tables namely User and Pincode, and from the Product table create 5 new tables namely

Product,Solar,Wind,Geothermal,Efficiency.

**Schema after 3​rd normalization:**

**User**(User\_id,First\_name,Last\_name,street,door\_no,pin\_code,password)

**Pincode**(pin\_code,state,city)

**Phone**(user\_id,phone\_no)

**Email**(user\_id,phone\_id)

**Product**(Product\_id,Status,User\_id,location,uptime,working\_temp,Energy\_generated,Energy\_consu med)

**Efficiency**(Energy\_generated,Energy\_consumed,efficiency)

**Solar**(Solar\_id,cloud\_cover,sun\_intensity,heat\_buildup,no\_of\_panel,Energy\_consumed) **Wind**(Wind\_id,air\_density,wind\_speed,no\_of\_blades,blade\_radius,Energy\_consumed) **Geothermal**(Geothermal\_id,Soil\_type,moisture,Energy\_consumed)

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 16

**6)Lossless decomposition and dependency preserving:**

**Lossless decomposition:**

**Step1:**

**Step2:**

**Step3:**

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After the 3rdstep the table Product is fully filled meaning that the decomposition done is a lossless decomposition.

**Dependency Preserving:**

**1)User\_Id** → First\_name,Last\_name,state,city,street,door\_no,pin\_code,password Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 17

This functional dependency is preserved by ‘User’ Relation

**2)pin\_code** → state,city

This functional dependency is preserved by ‘Pincode’ relation

**3)email\_id** → User\_Id

This functional dependency is preserved by ‘Email’ relation

**4)phone\_no** → User\_Id

This functional dependency is preserved by ‘Phone’ relation.

**5)Product\_id**→Solar\_id,Geothermal\_id,Wind\_id,Status,User\_id,efficiency,location,uptime,working\_ temp,Energy\_generated,Energy\_consumed

This functional dependency is preserved by ‘Product’ relation.

**6)Solar\_id** → cloud\_cover,sun\_intensity,heat\_buildup,no\_of\_panel,Energy\_consumed This functional dependency is preserved by ‘Solar’ relation.

**7)Geothermal\_id** → Soil\_type,moisture,Energy\_consumed

This functional dependency is preserved by ‘Geothermal’ relation.

**8)Wind\_id** → air\_density,wind\_speed,no\_of\_blades,blade\_radius,Energy\_consumed This functional dependency is preserved by ‘Wind’ relation.

**9)Energy\_generated,Energy\_consumed** → efficiency

This functional dependency is preserved by ‘Efficiency’ relation.

**We can see that all the FDs are preserved meaning,it is dependency preserving. 7)Normalise to bcnf if possible:**

**1)User\_Id** → First\_name,Last\_name,state,city,street,door\_no,pin\_code,password **2)pin\_code** → state,city

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 18

**3)email\_id** → User\_Id

**4)phone\_no** → User\_Id

**5)Product\_id**→Solar\_id,Geothermal\_id,Wind\_id,Status,User\_id,efficiency,location,uptime,working\_ temp,Energy\_generated,Energy\_consumed

**6)Solar\_id** → cloud\_cover,sun\_intensity,heat\_buildup,no\_of\_panel,Energy\_consumed **7)Geothermal\_id** → Soil\_type,moisture,Energy\_consumed

**8)Wind\_id** → air\_density,wind\_speed,no\_of\_blades,blade\_radius,Energy\_consumed **9)Energy\_generated,Energy\_consumed** → efficiency

All the left hand side attributes or all the determinants are super key ,so the relation is already in BCNF normalization.

**Database Scheme after Normalization:**

**Final Schema with Primary keys, Dependency diagram:**

**Final Schema:**

**User**(User\_id,First\_name,Last\_name,street,door\_no,pin\_code,password)

**Pincode**(pin\_code,state,city)

**Phone**(user\_id,phone\_no)

**Email**(user\_id,email\_id)

**Product**(Product\_id,Status,User\_id,location,uptime,working\_temp,Energy\_cosumed,Energy\_genera ted)

**Efficiency**({Energy\_generated,Energy\_consumed},efficiency)

**Solar**(Solar\_id,cloud\_cover,sun\_intensity,heat\_buildup,no\_of\_panel,

Energy\_consumed)

**Wind**(Wind\_id,air\_density,wind\_speed,no\_of\_blades,blade\_radius,

Energy\_consumed)

**Geothermal**(Geothermal\_id,Soil\_type,moisture,Energy\_consumed)

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 19

**Data dependency table:**

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Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 20

**Creation of Tables**

**a. Include the create command for ALL THE TABLES, sample insert commands. b. Minimum 10 meaningful records to be inserted.**

**c. Data from all the tables.**

create Table User\_table

(

User\_ID varchar(20) not null ,

firstname varchar(10) not null,

lastname varchar(10) not null,

Password varchar(12) not null,

street varchar(20)not null,

doorno varchar(20) not null,

pincode numeric(7,0) not null,

primary key(User\_ID)

)

create Table Product(

Product\_ID varchar2(6) not null,

User\_ID varchar(20) not null,

location varchar(40) not null,

Energy\_generated numeric(10,3),

Energy\_consumed numeric(10,3),

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 21

Uptime varchar2(20),

Working\_Temperature varchar2(10),

Status varchar2(10) not null,

primary key(Product\_ID),

foreign key(User\_ID) references User\_table)

create Table Wind\_Plant(

Wind\_ID varchar2(5) not null,

Wind\_Speed number(4) not null,

No\_of\_Blades number(2) not null,

Blade\_Radius number(5) not null,

Air\_Density number(3) not null,

Energy\_consumed numeric(10,3),

Primary key (Wind\_ID))

create Table Solar\_Plant(

Solar\_ID varchar2(5) not null,

Energy\_consumed numeric(10,3),

No\_of\_Panels number (2) not null,

Cloud\_Cover varchar2(5) not null,

Sun\_Intensity number(3) not null,

Heat\_Build\_Up varchar2(5) not null,

Primary key(Solar\_ID))

create Table Geo\_Thermal\_Plant(

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 22

GeoThermal\_ID varchar2(5) not null,

Energy\_consumed numeric(10,3),

Moisture number(5) not null,

Soil\_Type varchar2(10),

primary key(GeoThermal\_ID))

create table Phone(

Phone\_no number(15) not null,

User\_ID varchar(20) not null,

primary key(Phone\_no),

foreign key(User\_ID) references User\_table)

create table Email(

Email\_id varchar(30) not null,

User\_ID varchar(20) not null,

primary key(Email\_id),

foreign key(User\_ID) references User\_table)

create table Pincode(

pincode numeric(7,0) not null,

state varchar(10) not null,

city varchar(10) not null)

create table Energy(

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 23

efficiency numeric(2,3),

Energy\_generated numeric(10,3),

Energy\_consumed numeric(10,3))

insert into User\_table values('rooney10','wayne','rooney','goat','baker street','12',062345); insert into User\_table values('messi10','lionel','messi','goat1','baker street','13',062345); insert into User\_table values('ronaldo7','cristiano','ronaldo','goat3','la masia','14',345627); insert into User\_table values('neymar10','neymar','junior','goat4','rennes','18',123456); insert into User\_table values('mbappe10','kylian','mbappe','goat5','rennes','67',123456); insert into User\_table values('chhetri9','sunil','chhetri','goat7','taj road','46',638051); insert into User\_table values('lewa9','robert','lewa','goat8','liverpool','12',012334); insert into User\_table values('bhutia23','biachang','bhutia','goat10','cross valley','123',634581); insert into User\_table values('zlatan9','zlatan','ibraham','goat6','alphine','56',234588); insert into User\_table values('morgan112','alex','morgan','goat9','seattle','28',993546); **Table:**

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Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 24

insert into Email values('rooney@gmail.com','rooney10');

insert into Email values('rooneymanchester@gmail.com','rooney10'); insert into Email values('messi@gmail.com','messi10');

insert into Email values('ronadlo@gmail.com','ronaldo7');

insert into Email values('neymar@gmail.com','neymar10');

insert into Email values('mbappe@gmail.com','mbappe10');

insert into Email values('chhetri@gmail.com','chhetri9');

insert into Email values('lewa@gmail.com','lewa9');

insert into Email values('bhutia@yahoo.com','bhutia23');

insert into Email values('zlatan@outlook.com','zlatan9');

insert into Email values('zlatan@gmail.com','zlatan9');

insert into Email values('alex@outlook.com','morgan112');

**Table:**

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 25



insert into Phone values(123456789,'rooney10');

insert into Phone values(123456798,'messi10');

insert into Phone values(123456879,'messi10');

insert into Phone values(087654321,'ronaldo7');

insert into Phone values(986754321,'neymar10');

insert into Phone values(932156789,'mbappe10');

insert into Phone values(7367886151,'chhetri9');

insert into Phone values(7502933457,'lewa9');

insert into Phone values(7373544799,'bhutia23');

insert into Phone values(52345634,'zlatan9');

insert into Phone values(345672,'morgan112');

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 26

insert into Phone values(345789,'morgan112');

**Table:**

****

insert into Pincode values(062345,'england','london');

insert into Pincode values(345627,'spain','madrid');

insert into Pincode values(123456,'france','paris');

insert into Pincode values(638051,'india','delhi');

insert into Pincode values(012334,'sweden','zurich');

insert into Pincode values(634581,'india','mumbai');

insert into Pincode values(234588,'poland','wroclaw');

insert into Pincode values(993546,'usa','texas');

**Table:**

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 27



CREATE SEQUENCE sequence\_1

start with 1

increment by 1

minvalue 0

maxvalue 100

cycle;

insert into Geo\_Thermal\_Plant values(concat('g',sequence\_1.nextval),12356.23,123,'sandy'); insert into Geo\_Thermal\_Plant values(concat('g',sequence\_1.nextval),24368.17,128,'clay'); Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 28

insert into Geo\_Thermal\_Plant values(concat('g',sequence\_1.nextval),389698.91,134,'silt'); insert into Geo\_Thermal\_Plant values(concat('g',sequence\_1.nextval),48026.73,140,'peat'); insert into Geo\_Thermal\_Plant values(concat('g',sequence\_1.nextval),39946.03,150,'chalk'); **Table:**

****CREATE SEQUENCE sequence\_2

start with 1

increment by 1

minvalue 0

maxvalue 100

cycle;

insert into Solar\_Plant values(concat('s',sequence\_2.nextval),12356.23,123234,2,3.525,1934); insert into Solar\_Plant values(concat('s',sequence\_2.nextval),24368.17,12832,4,5.216,4710); insert into Solar\_Plant values(concat('s',sequence\_2.nextval),389698.91,13426,9,1.157,19501); insert into Solar\_Plant values(concat('s',sequence\_2.nextval),48026.73,140267,1,9.525,848); Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 29

insert into Solar\_Plant values(concat('s',sequence\_2.nextval),39946.03,150168,0,1.259,9347); **Table:**

****CREATE SEQUENCE sequence\_3

start with 1

increment by 1

minvalue 0

maxvalue 100

cycle;

insert into Wind\_Plant values(concat('w',sequence\_3.nextval),12356.23,3,3,123,3.525); insert into Wind\_Plant values(concat('w',sequence\_3.nextval),24368.17,4,4,128,5.216); insert into Wind\_Plant values(concat('w',sequence\_3.nextval),389698.91,7,3,134,1.157); insert into Wind\_Plant values(concat('w',sequence\_3.nextval),48026.73,9,3,140,9.525); insert into Wind\_Plant values(concat('w',sequence\_3.nextval),39946.03,1,3,150,1.259); **Table:**

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 30



insert into Product values('s1','rooney10','15-stretford end,manchester',34567.23,12356.23,'2 hour','100','on');

insert into Product values('s2','messi10','15-kop end,liverpool',45678.34,24368.17,'0 hour','0','off');

insert into Product values('s3','ronaldo7','34-camp nou,catalona',456723.12,389698.91,'3 hours','170','on');

insert into Product values('s4','neymar10','26-meeryside view,rennes',56789.34,48026.73,'1.5 hours','120','on');

insert into Product values('s5','mbappe10','38-iduana signal,dijon',43567.89,39946.03,'0 hours','0','off');

insert into Product values('g1','zlatan9','26-sanmia,glascow',23345.56,12366.23,'0 hours','0','off'); insert into Product values('g2','chhetri9','48-ncp road,delhi',30657.88,24368.17,'1 hours','130','on'); insert into Product values('g3','lewa9','34-trafford,geneva',456123.78,389698.91,'3 hours','200','on');

insert into Product values('g4','morgan112','56-disneyland,nebraska',54123.56,48026.73,'1.5 hours','117','on');

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 31

insert into Product values('g5','bhutia23','13-amrita,ettimadai','45987.00','39946.03','2 hours','108','on');

insert into Product values('w1','rooney10','15-vikkaragecottage,liecester',34567.23,12356.23,'1.75 hours','123','on');

insert into Product values('w2','neymar10','26-meeryside view,rennes',32456.89,24368.17,'1 hours','123','on');

insert into Product values('w3','lewa9','34-wandametropolitana,stockholm',456723.12,389698.91,'4 hours','223','on');

insert into Product values('w4','bhutia23','13-brookfield,kovai',49444.12,48026.56,'0 hours','0','off'); insert into Product values('w5','zlatan9','26-sanmia,glascow',56893.90,39946,'0 hours','0','off');

**Table:**

****Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 32

insert into Energy values(34.65,34567.23,12356.23);

insert into Energy values(67.89,45678.34,24368.17);

insert into Energy values(29.12,456723.12,389698.91);

insert into Energy values(38.67,56789.34,48026.73);

insert into Energy values(23.78,43567.89,39946.03);

insert into Energy values(59.34,23345.56,12366.23);

insert into Energy values(23.22,30657.88,24368.17);

insert into Energy values(34.97,456123.78,389698.91);

insert into Energy values(71.67,54123.56,48026.73);

insert into Energy values(34.89,45987.90,39946.03);

insert into Energy values(45.67,32456.89,24368.17);

insert into Energy values(19.22,49444.12,48026.56);

insert into Energy values(45.89,56893.90,39946.45);

**Table:**

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 33



**Chapter 7 Backend design**

**Table creation comments:**

We used a NoSQL design and we structured the DB in a way that we categorised which entities and attributes are important and then, created the DB design with the inputs from the normalised schema of the SQL DB. Reasons for using a NoSQL DB over an SQL based ones is that, while developing an app latency and response times are important factors and using a NoSQL based structure helps achieving these factors easily.

**Sample instances of the tables:**

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 34

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 35



**Chapter 8 Frontend design**

**Introduction to the tool:**

We used Android Studio to create the UI/UX parts of our app and the language used were XML and Kotlin/ Java. XML structures the UI elements and components while Kotlin/ Java helped us form the logic for all those UI elements.

**Connectivity code**

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 36

**Chapter 9 Database connectivity**

**Introduction to the connectivity standard:**

The standard used here is the Firebase Realtime Database, which is a cloud-hosted NoSQL database. Data is stored as JSON and synchronized in realtime to every connected client. For connecting this to the app, we used the Firebase SDK for Android which helped us connect the Android app to the Online DB and sync data in real-time. Again we used Kotlin for the Logic part of Database connectivity.

**Connectivity code:**

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 37

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 38



**Chapter 10 Sample code**

**Sample code of selected UI screens**

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 39

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 40



**Chapter 11 Conclusions**

**Elucidating important features of the project**

➔ Connects the user with his product in single touch

➔ Deep analysis of the product status in live

➔ Control the device in single touch

➔ Authorized login

➔ Security of the data of the product from other users

➔ Precise analysis of the data

➔ As app is connected to firebase which provides faster data to the app, the data refreshes faster **Chapter 12 References**

**Books references:**

Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 41

Database Management Systems by Ramakrishnan and Gehrke, McGraw Hill **Websites references:**

https://www.scadacore.com/applications/renewable-energy-monitoring/ Department of CSE, Amrita School of Engineering , Coimbatore 2020Page 42