170027429

CS39930 Web-based Major Project

Technical Design

Prifysgol Aberystwyth University

Adran Cyfrifiadureg/Department of Computer Science

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Introduction

The website is being requested by Bernie Tiddeman and the research team he is involved in. The research team is comprised of researchers from Aberystwyth University a d Bangor University. It is also sponsored by the Welsh Government, who have an input in the project.

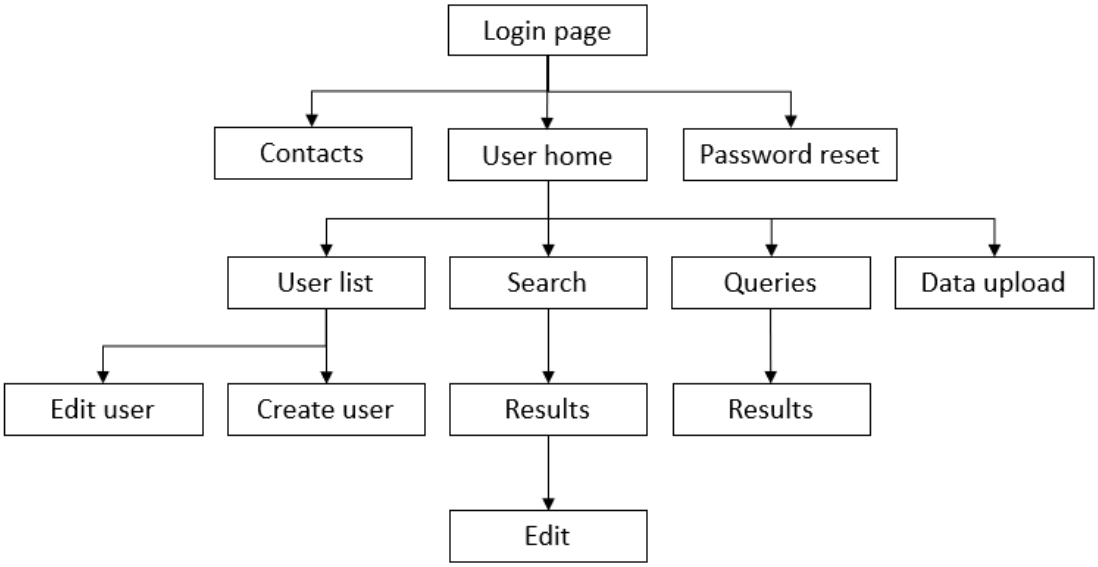
The website will allow the researchers to upload images and data associated with them, which will then be displayed on the website. The website will allow users to run various queries on the data. Data will also possibly be displayed on a map (dependent on further requirements/implementation).

Data presented will involve various information related to crustaceans such as crabs, their catch locations and others. The website will then allow the data to be collated and presented as graphs and potentially other types of information.

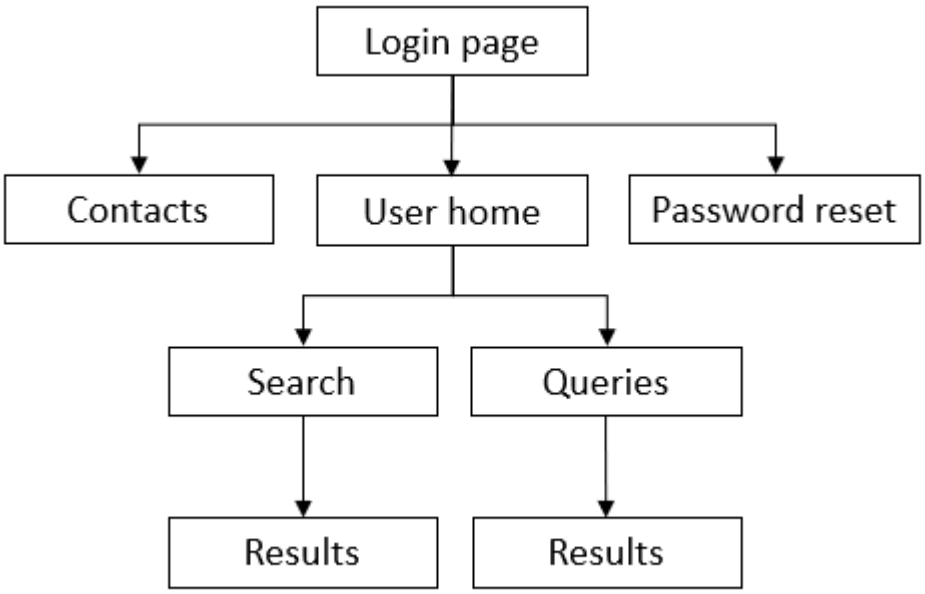
Web structure, hierarchy and navigation

The website structure is quite simple. The system is nothing more than a fancy picture gallery, with relatively few use cases.

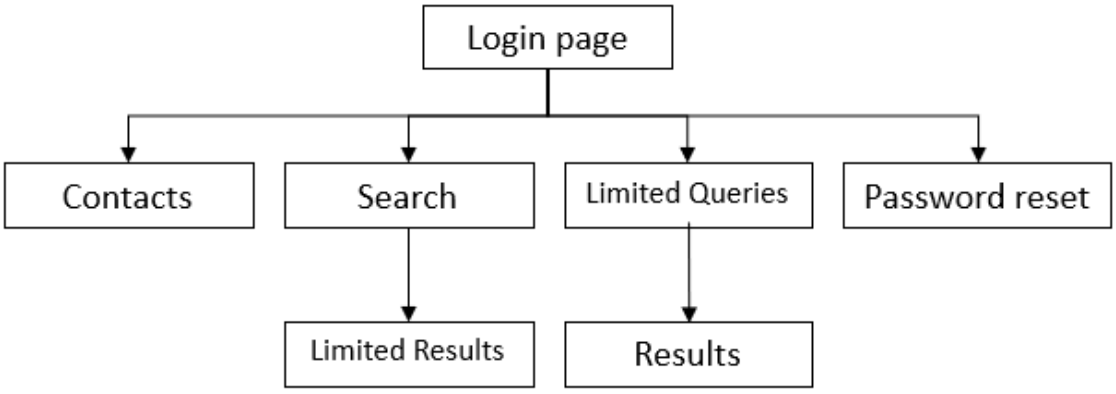
Below is the main page navigation diagram, as seen by an administrative user.



This is the full website hierarchy. Authorised users and general public will have less access to the system.



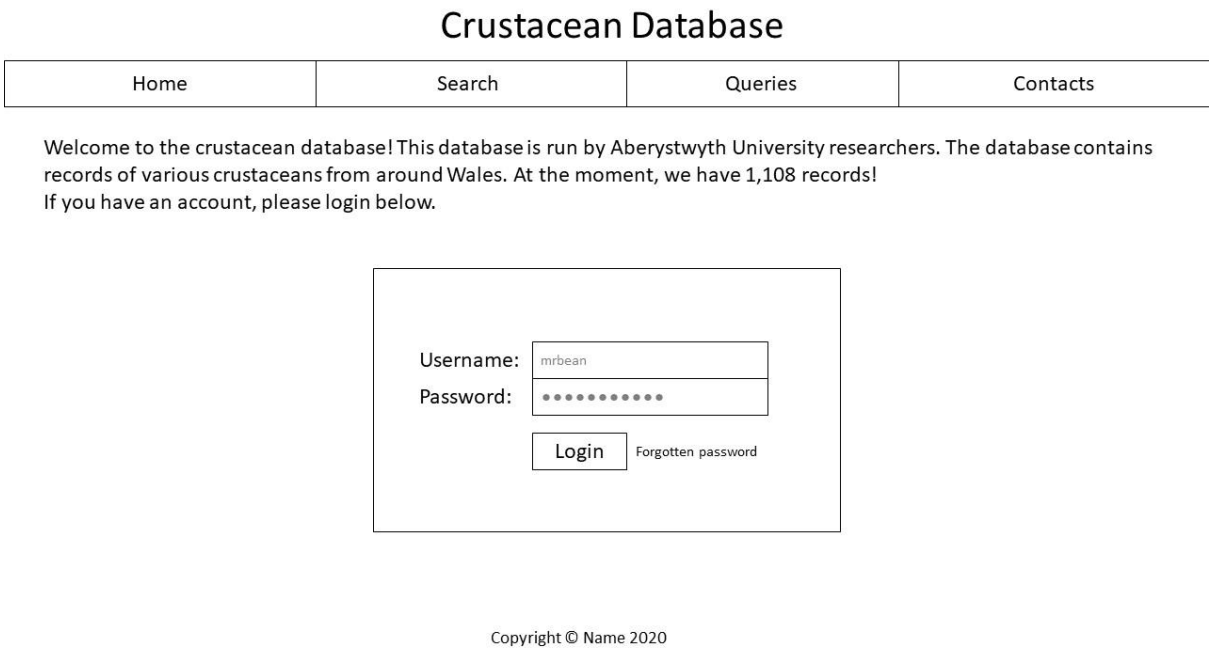
This is the diagram of the system as seen from an authorised user's perspective. The key differences are that authorised users do not have access to any of the administrative functions. Otherwise, they have full access to data and queries.



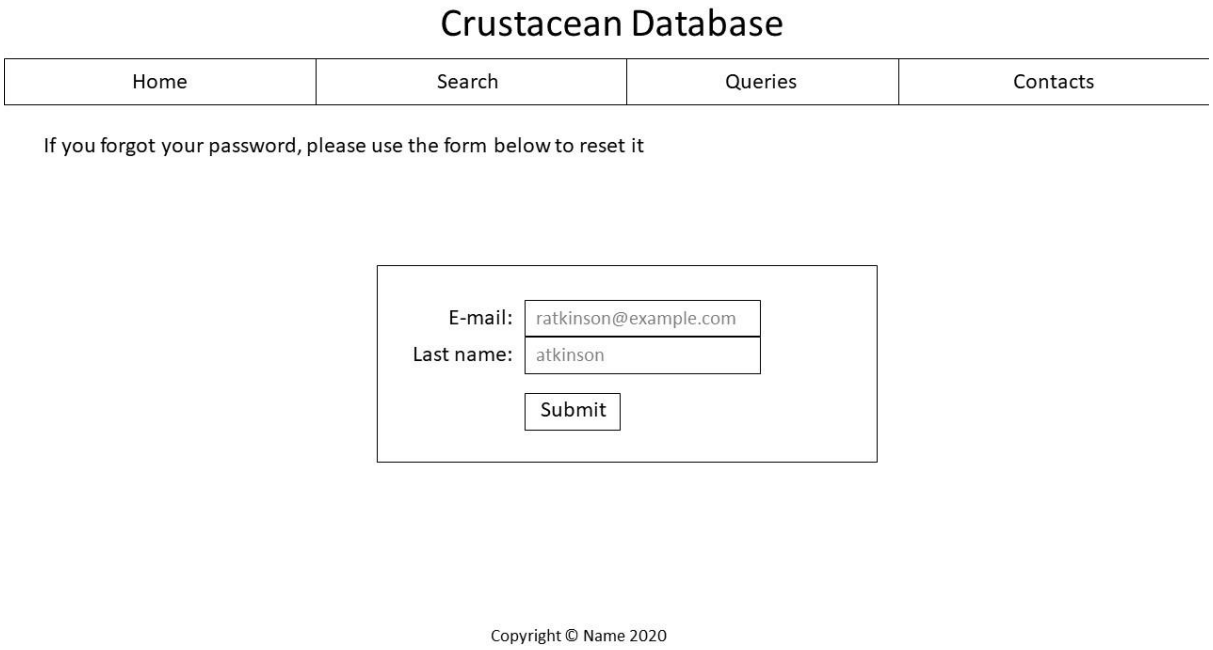
The most basic level of access is provided to people who are not logged in. They have access to some data processing queries and some publicly available data.

While the password reset page is accessible to everyone, logged in users will have an option to change their password via their user page, rather than having to go through the password reset procedure.

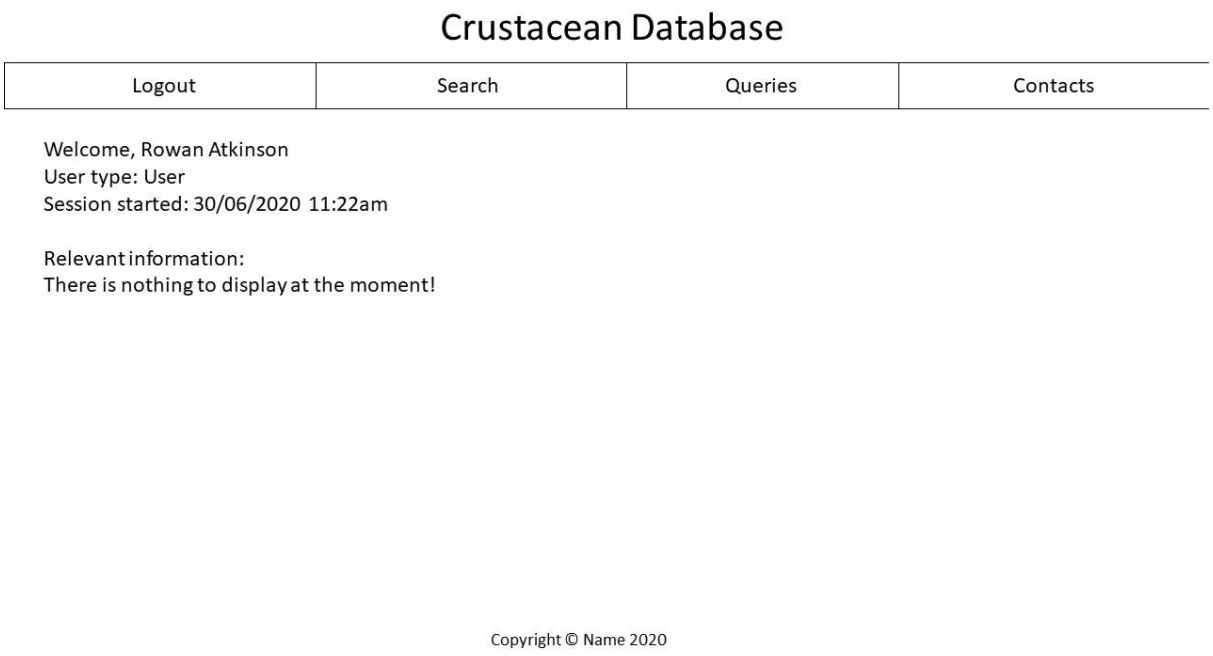
Descriptions of each page



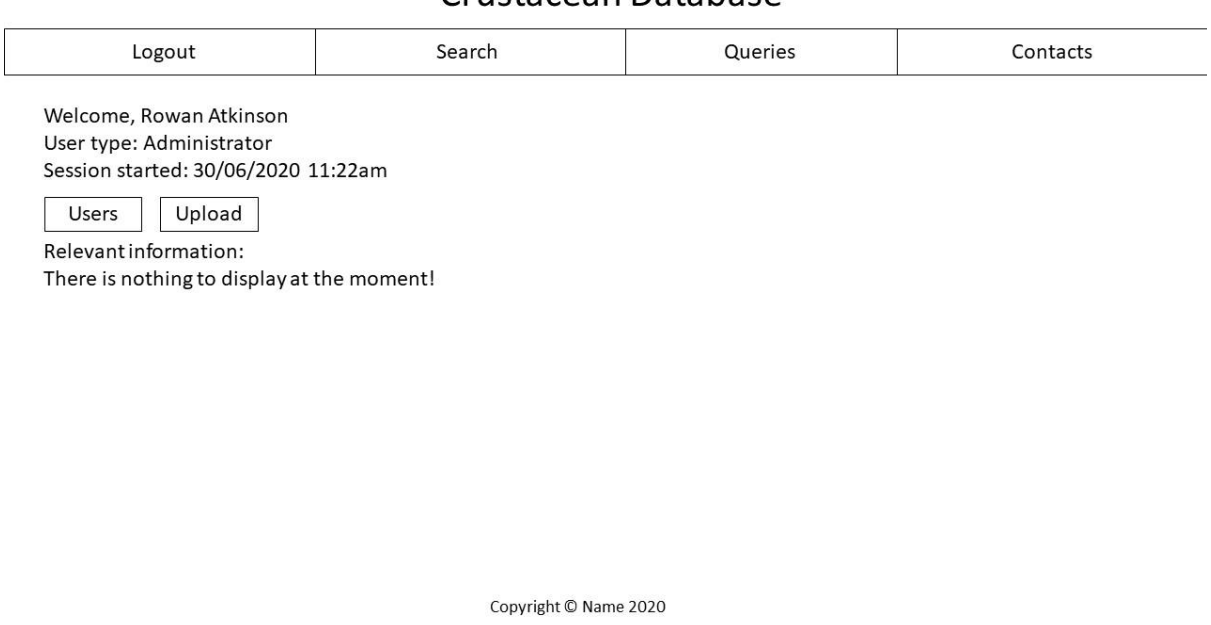
This is the main (home) page of the website, as majority of the users will have accounts, the default page will display the login form. It will display a short message at the top, alongside some statistics of how many records there are – it will be configurable and stored in the database.



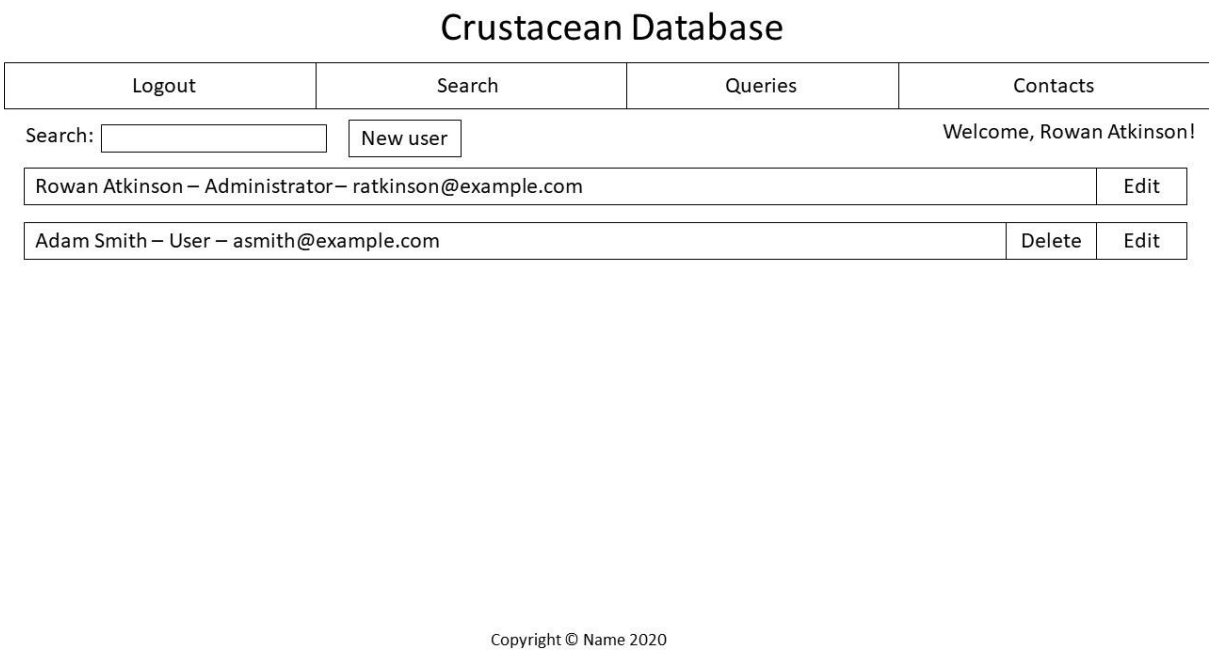
If the user clicks “Forgotten password”, they will be taken to this page, which will ask for their email and last name. This will be done so people cannot try random email addresses and spam account owners with password reset notifications. Once their details are entered, they will receive an email with a link which will allow them to create a new password.



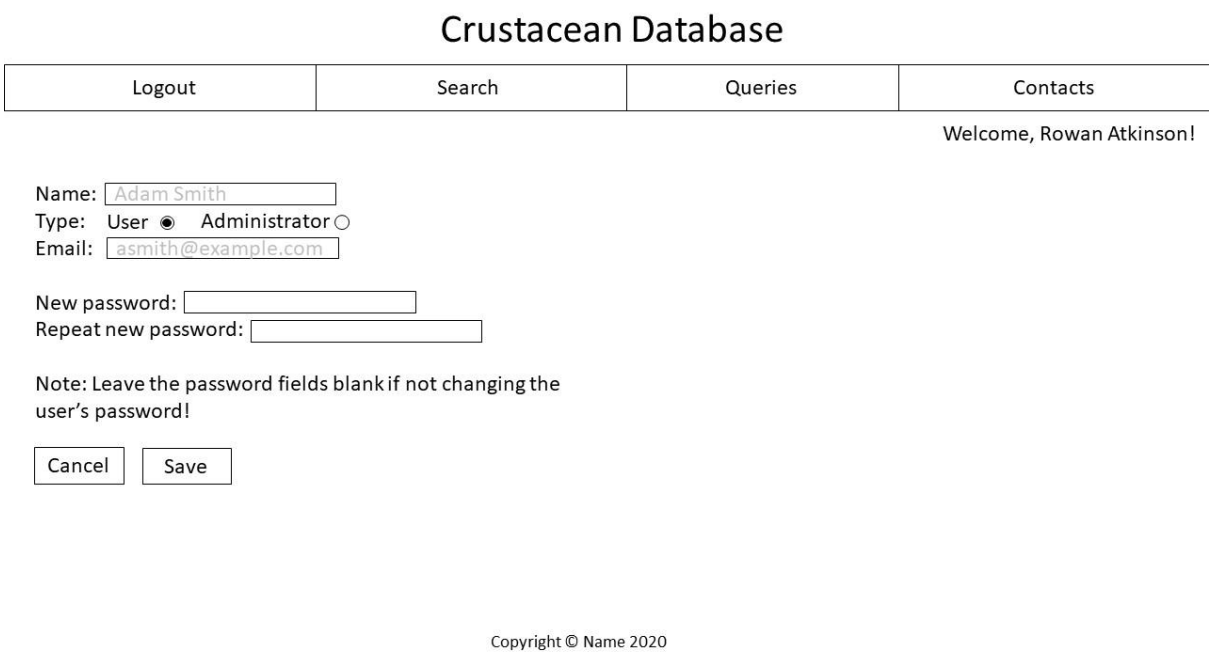
This is the page a regular user will see when logged in. It will display some information about the user, and any announcements that may have been posted by the administrators in the past.



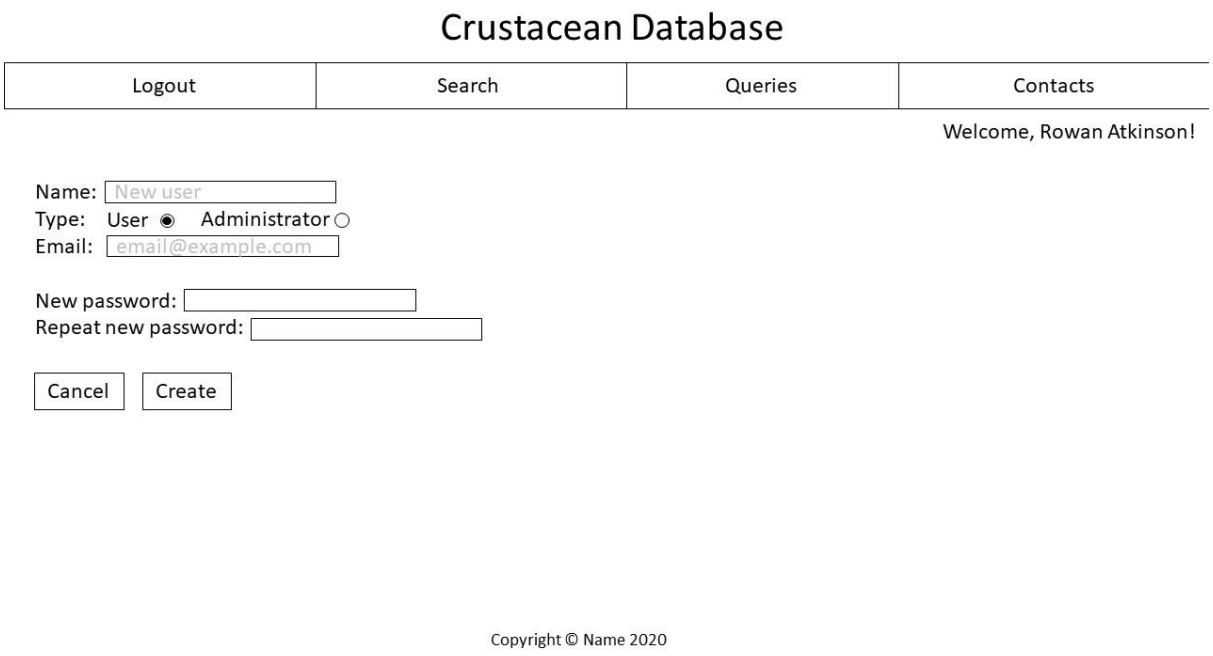
Administrators will have a slightly different interface, they will have additional two buttons called “users” and “upload”, which will allow them to access the list of users and to upload data.



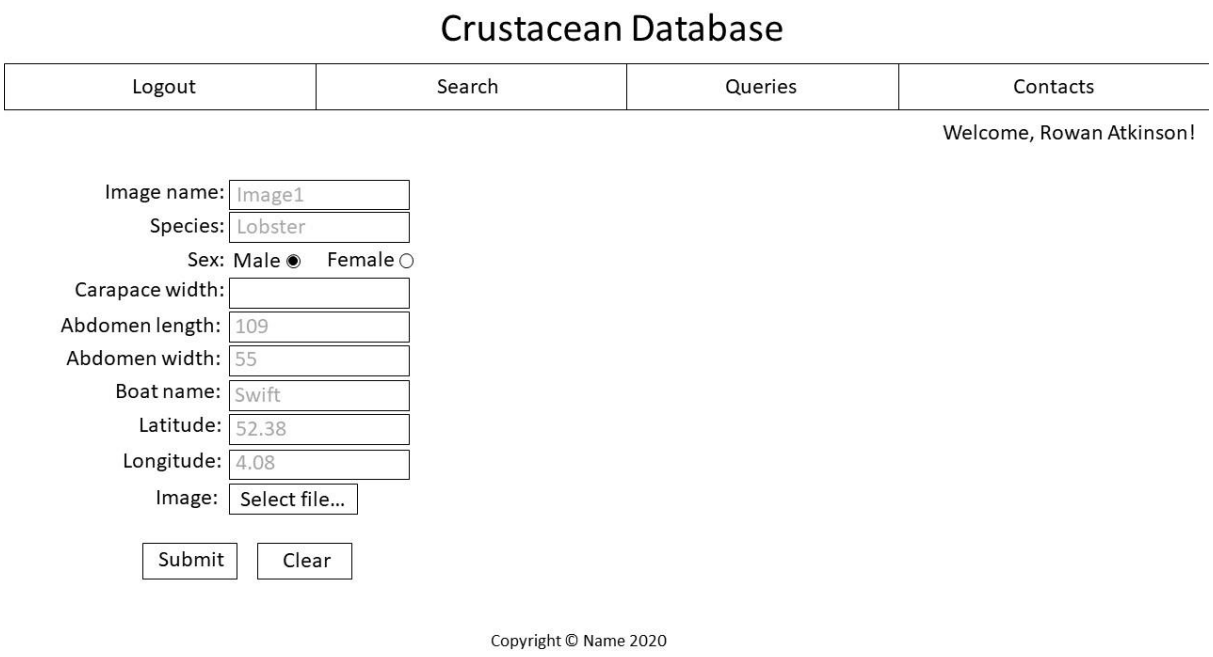
The user list will contain every user registered on the system, alongside a simple search bar. Administrators will be able to edit and delete everyone except themselves. They will also have an option to create new users. The feature preventing administrators from deleting themselves is meant as a precaution, therefore administrators will be able to only delete other accounts.



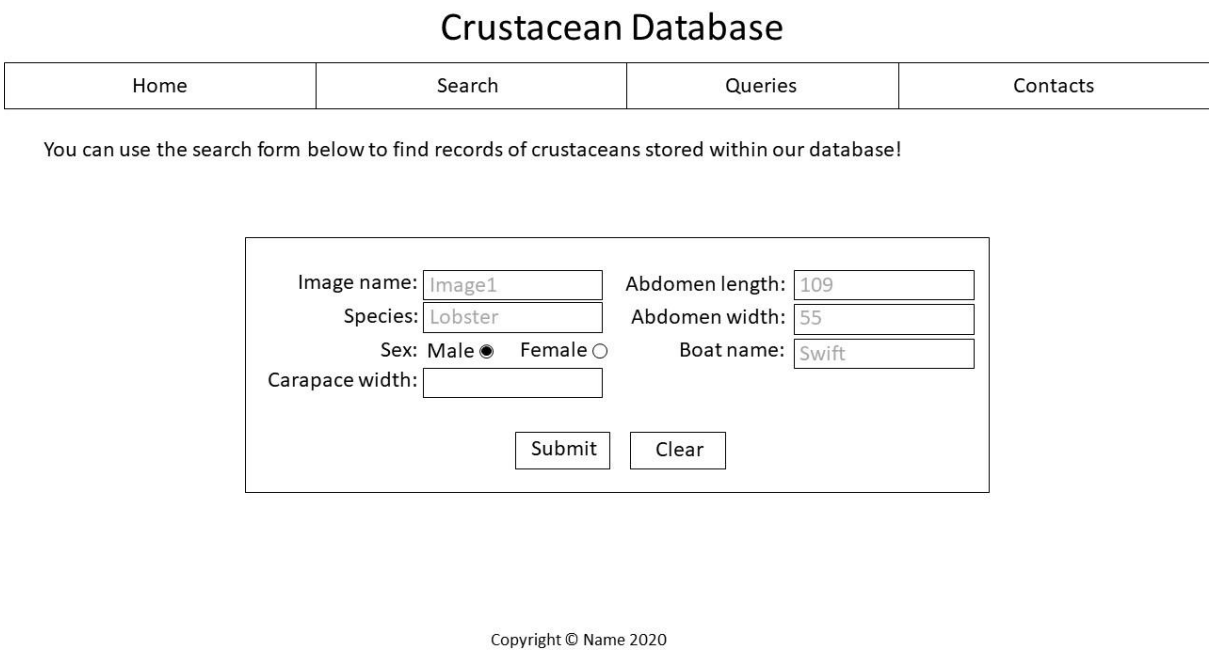
Above is the user editing screen, which allows the administrator to change all user details. The system will perform a simple check to make sure that both input fields contain the same password. If the passwords entered do not match, an error will be shown stating that they have made a mistake while entering the password.



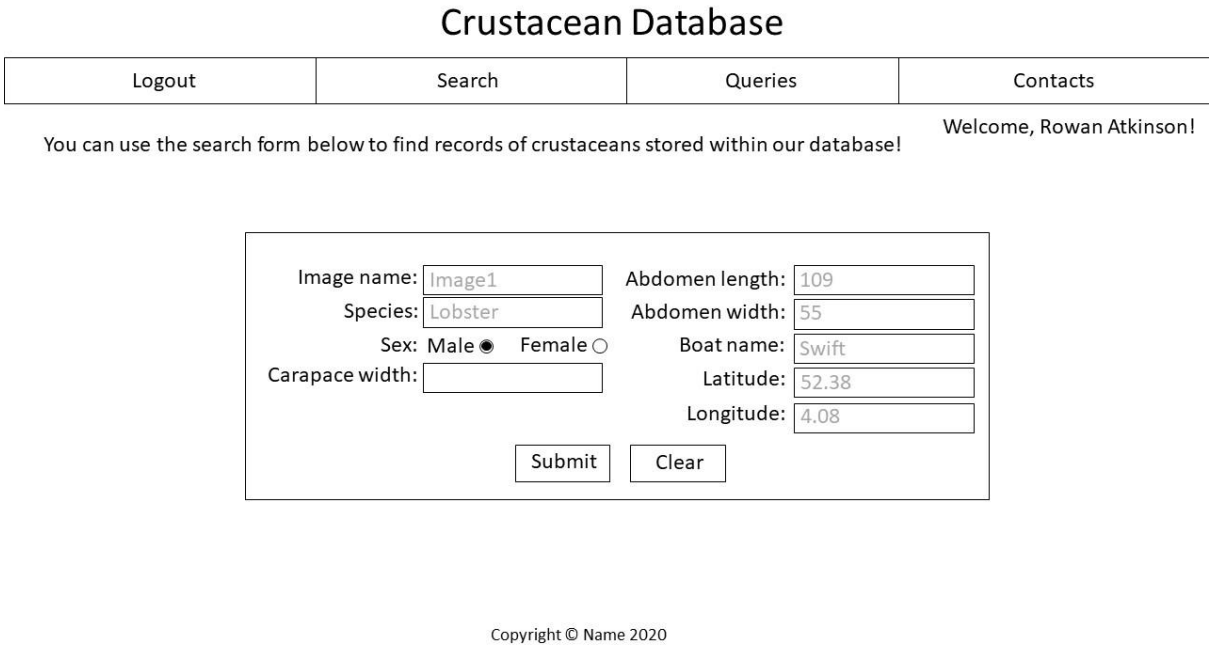
User creation page is almost identical to the edit page, with a few differences being the confirmation button is instead called “Create”, and entering a password is compulsory, otherwise an error will be shown.



Clicking “upload” from the administrator’s user page will bring them to the page above, which will allow the administrator to create a new record. Not applicable fields can be left blank. This page will be created in a modular manner, where new fields can be added with relative ease, without extensive programming.



Once the data has been uploaded, everyone will be able to search for it. Some data might be limited to authorised users only, although this has not yet been designed.



A logged in user will have slightly more search options, latitude and longitude format included above are used for illustration purposes only and might change during development.

Crustacean Database

Home	Search	Queries	Contacts

1 record found!

Image1	Lobster	Male	View

Searching for a record without being logged in will return a page showing a list of all matches. The users will then be able to view their chosen record. The search results page will show a few details about each result, to help the user identify the correct record.

Crustacean Database

Home	Search	Queries	Contacts

Image name: Image1
Species: Lobster
Sex: Male
Abdomen length: 109
Abdomen width: 55
Boat name: Swift
Latitude: 52’38 N
Longitude: 4’08 W

Back

This is what a record screen will look like to the user. It will contain information about the catch, and the image (if applicable).

Crustacean Database

Home	Search	Queries	Contacts

Welcome, Rowan Atkinson!

Image name: Image1
Species: Lobster
Sex: Male
Abdomen length: 109
Abdomen width: 55
Boat name: Swift
Latitude: 52’38 N
Longitude: 4’08 W

Back | Delete | Edit

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Administrative users will also have the option to edit or delete the record. Deleting will return the user back to the search page.

Crustacean Database

Home	Search	Queries	Contacts

Welcome, Rowan Atkinson!

Image name: Image1
Species: Lobster
Sex: Male ◉ Female ○
Abdomen length: 109
Abdomen width: 55
Boat name: Swift
Latitude: 52.38
Longitude: 4.08

Cancel | Save

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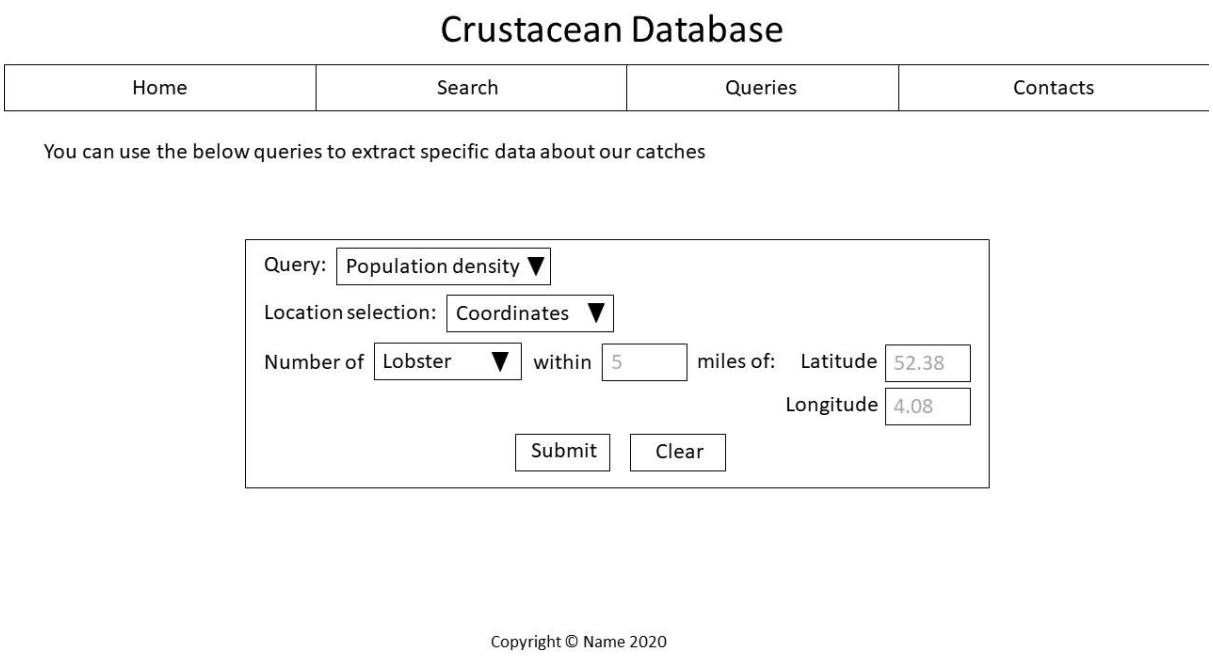
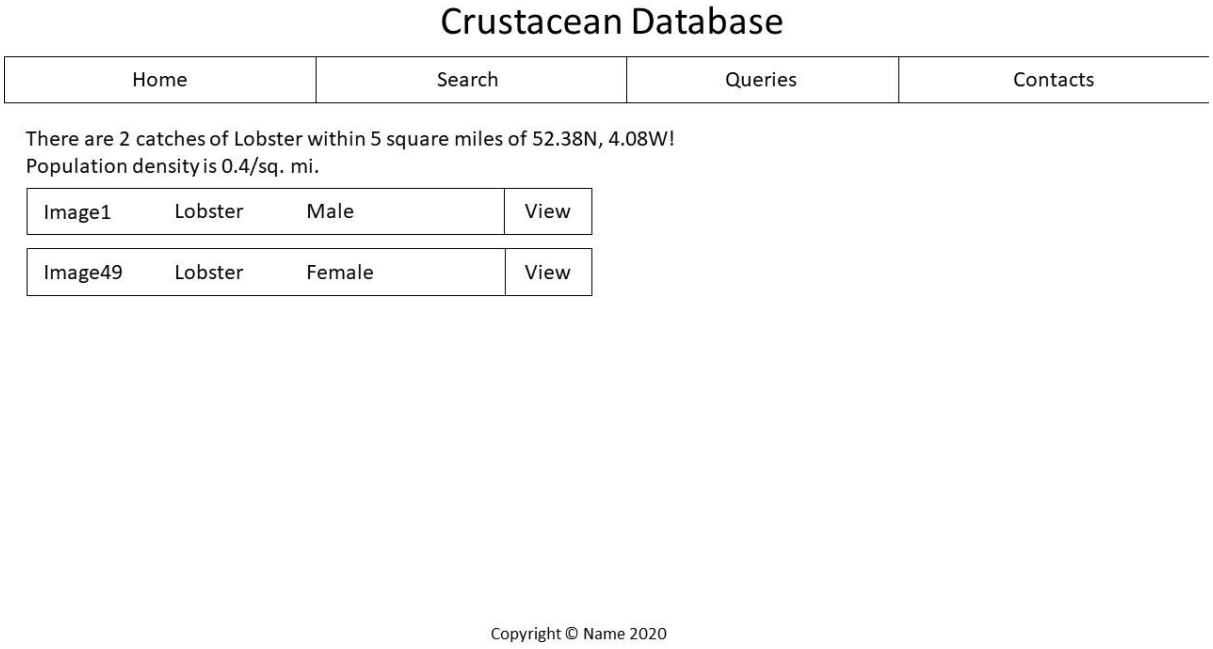
The edit screen will allow the administrators to change all the details about the record, except for the image. If they wanted to change the image, they should delete the record, and upload a new

one.

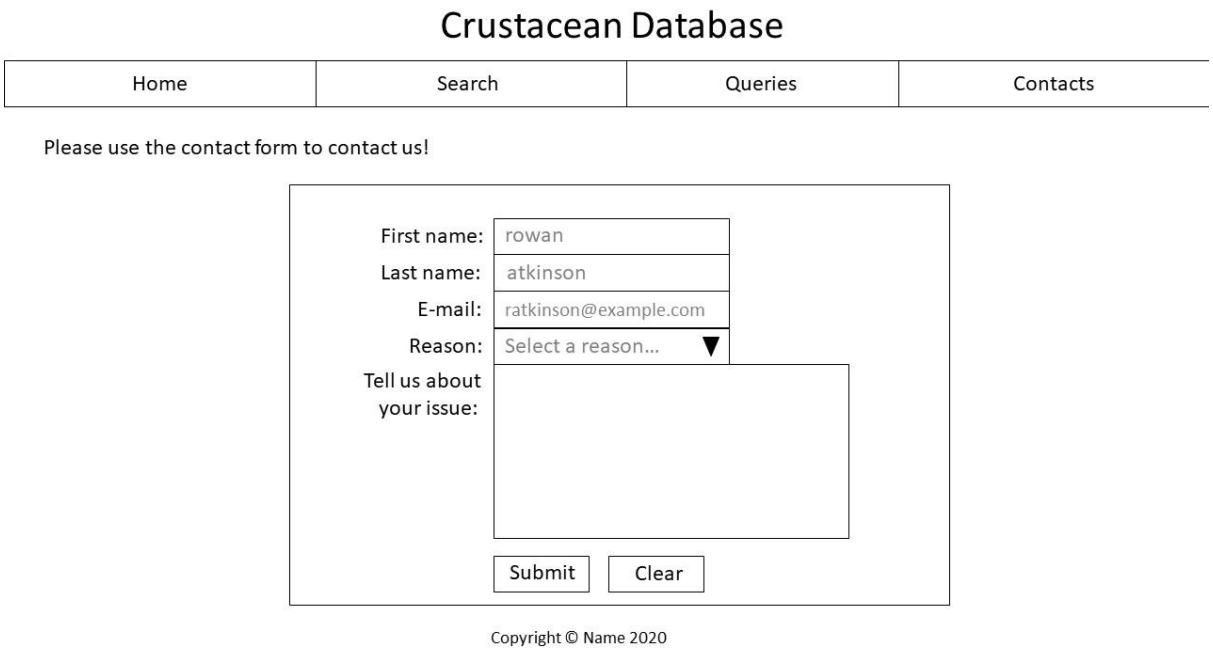


Users will also be able to run queries on the data. Logged in users will have more filters and tools than users who are not logged in.

Demonstrated above is the “population density” filter, which allows users to find the number of matches within a square area of a specific point, as well as the population density within that area.



This is what running the query would return.



Finally, there is a possibility that some problems might occur, therefore the contact form allows users to contact the maintainers of the website directly. The form could be used to report problems, or to request access to the system.

Database design

The database will contain 5 different tables.

system:

This table will only contain 3 columns: *id (PK)*, *motd* and *user_announcement*. It will be used for storing system configuration and information.

users:

This table will contain 5 columns: *email (PK), first_name, last_name, admin* and *password.* It will be used for storing user account details.

pass_resets:

This table will contain 5 columns: *email (PK), date, time, reset_key* and *valid.* It will be used to store user password reset request information.

records:

This table will be by far the largest and will contain 9 columns: *img_name (PK), species, sex, carapace_width, abdomen_length, abdomen_width, coords_lat, coords_long* and *boat*. It will be used to keep all the database entries on crustaceans.

images:

This table will only contain 3 columns: *img_name (PK), image* and *img_type*. It will be used to store image information.

Image information will be stored separately from its parent entry for 2 reasons:

1. So that queries will not take a long time to complete by having to run over large BLOBs during operations.

2. So that the database is easier to maintain, and that images can be created and deleted from the database manually, as per client's request.

There are some constraints implemented, which should prevent data from being changed in case the system encounters an error.

Columns *img_name* in tables "images" and "records" are related. This means that *img_name* in "images" must match a record in "records", and any changes to the image name will be reflected in both tables. Deleting the record will also delete the image from the "images" table. An equivalent constraint is also implemented between "users" and "pass_resets".

Sample data

Some sample data was provided by the researchers for use in productions and testing. Because the client does not have any strict requirements when it comes to data formats, it was converted data to an easier to implement format.

```
{
  "image1": {
    "species": "lobster",
    "sex": "1",
    "abdomen_length": "109",
    "abdomen_width": "55",
    "coords_lat": "52.38",
    "coords_long": "4.8",
    "boat": "swift"
  },
  "image5": {
    "species": "crab",
    "sex": "0",
    "carapace_width": "68",
    "coords_lat": "52.48",
    "coords_long": "4.11",
    "boat": "swift"
  }
}
```

Here are 2 records in JSON format, this is the format which will be used for performing data queries. A male lobster, and a female crab. Sex is represented as a Boolean, - male being 1 (i.e. true), and female being 0 (i.e. false). This is also how it will be represented in the database.

Below are the images associated with the above data, which will be stored in the "images" table as BLOBs (Binary Large Objects).

Fig. 1. Male lobster.

Fig. 2. Female crab.

email	first_name	last_name	admin	password
jsmith@example.com	John	Smith	0	*94BDCEBE19083CE2A1F959F…
ratkinson@example.com	Rowan	Atkinson	1	*2470C0C06DEE42FD1618BB9…

The table above shows two user accounts and their details. A user called Rowan Atkinson is an administrator with an email ratkinson@example.com. Whereas, John Smith is a regular user with an email jsmith@example.com.
The passwords will be stored in an encrypted form, using a secure and modern hashing algorithm with salting to reduce the likelihood of the user credentials being hacked.

email	date	time	reset_key	valid
ratkinson@example.com	2020-03-08	19:24:06	fjgutdlcjguthrckqz7g4d1cds597	1

Above is a sample password reset request, submitted for ratkinson@example.com on the 8 March 2020, at 19:24. The key was randomly generated by the system, and still has not been used, therefore the field *valid* is true. Once the password is reset, it will become invalid, and *valid* value will be set to false.

id	motd	user_annoucement
1	Hello and welcome to our system!	Thank you for using the user area!

The table above shows a sample entry in the “system” table. At the moment, the table only records “message of the day” type messages, and user area announcements. The system will only display the latest entry, this might later be improved to allow for multiple messages to be displayed.

img_name	image	img_type
image1	0xffd8fffe000e4c61766335342e34…	image/jpeg

Above table shows a sample image record. Value *image1* would have to match a record in the “records” table, field “image” keeps a BLOB which is usually upwards of 100 KiB in size. The last field records the MIME type of image, which will then be read from the database and sent by the server as a header in order for the browser to correctly recognise and display the image.

Appendices

Appendix A – Data Dictionary

cs39930

images

Column	Type	Null	Default	Links to	Comments	Media (MIME) type
img_name *(Primary)*	varchar(15)	No		records -> img_name		
image	mediumblob	No				
img_type	varchar(25)	No				

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
PRIMARY	BTREE	Yes	No	img_name	0	A	No	

pass_resets

Column	Type	Null	Default	Links to	Comments	Media (MIME) type
email *(Primary)*	varchar(50)	No		users -> email		
date	date	No				
time	time	No				
reset_key	varchar(30)	No				
valid	tinyint(1)	No				

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
PRIMARY	BTREE	Yes	No	email	0	A	No	
reset_key	BTREE	Yes	No	reset_key	0	A	No	

records

Column	Type	Null	Default	Links to	Comments	Media (MIME) type
img_name *(Primary)*	varchar(15)	No				
species	varchar(30)	No				
sex	tinyint(1)	No				
carapace_width	int(5)	Yes	*NULL*			
abdomen_length	int(5)	Yes	*NULL*			

abdomen_width	int(5)	Yes	*NULL*			
coords_lat	float	No				
coords_long	float	No				
boat	varchar(20)	No				

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
PRIMARY	BTREE	Yes	No	img_name	0	A	No	

system

Column	Type	Null	Default	Links to	Comments	Media (MIME) type
id *(Primary)*	int(4)	No				
motd	text	Yes	*NULL*			
user_annoucement	text	Yes	*NULL*			

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
PRIMARY	BTREE	Yes	No	id	1	A	No	

users

Column	Type	Null	Default	Links to	Comments	Media (MIME) type
email *(Primary)*	varchar(50)	No				
first_name	varchar(20)	No				
last_name	varchar(20)	No				
admin	tinyint(1)	No				
password	varchar(255)	No				

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
PRIMARY	BTREE	Yes	No	email	0	A	No	