

Integration of Database and Mobile APP to Manage the Activities of Unmanned Aerial Vehicle (UAV) In a Named Locality

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Abstract – With the development of database management systems and the advent of android application to ease the burden of data storage and retrieval (management), collection and processing of data on devices and artifacts that seemed extremely difficult is presently made quite easy. In this paper, the concept of database management is introduced and a mobile application is designed and hosted online. Management software of database server is established to realize instruction-level management and scheduling of databases. A Web-based management application interface (android APP) is set up to meet user needs, thus to retrieve a variety of repositories. Thereby, meets the needs of stakeholders, researchers and all sectors of society for statistical query of UAV data.

Keywords-Android APP, Database Management System, Java classes, MySQL database

1. Introduction

An unmanned aerial vehicle is an aircraft with no pilot (Flown by a pilot at a ground station) or can fly autonomously base on pre-programmed flight plans or more complex dynamic automation systems.

We are on the verge of a paradigm shift in the way geospatial data is collected for commercial, scientific, and recreational purposes. Unmanned aerial systems (hereafter called drones) have the ability to collect data with higher speed, accuracy, and resolution than conventional methods, and their uses as well as applications will only continue to accelerate.

It has clearly been ascertained that Unmanned Aerial Vehicles have been effective way delivering cargo, providing battle field intelligence to the military, combating crime, disaster relief and rescue mission, hurricane hunting, pest and diseases control, explosion missions and many others [2]. However, it is a known fact that many others adversely use the UAVs to engage in activities that are detrimental to life and properties (criminal use) such as selling of narcotic drugs, dropping of explosives (bombs) as well as stealing and robbery according to FAA [3]. Viewing it from this perspective, it is appropriate to take note off all UAVs in a particular locality to ascertain which specific one has been deployed for what mission.

The Database Management System (DBMS) provides users and programmers with a systematic way to create, retrieve, update and manage data.

The DBMS essentially serves as an interface between the database and end users or application programs, ensuring that data is consistently organized and remains easily accessible. [4]

In recent years, with the graphic development of network technology and wireless communication technology, people's target is hope to achieve unconstrained communication and sharing resources, this is a flexible and complicated distributed computing environment and usually called mobile computing environment. The main characteristics of mobile computing environment is the mobility, diversification network condition, and these characteristics make mobile computing environment cannot be supported by the traditional distributed database technology effectively, and formed a kind of new database technology, i.e. the mobile database [5].

With respect to this study, the paper is aimed at

- ❖ Developing a working app that can be used to keep the records of all UAVs in a locality
- ❖ Helping owners of UAVs to be able to manage their devices on their mobile phones. The mobile APP will help owners to basically update the information of their devices on their phones remotely.
- ❖ Guiding authorities to keep track of UAVs in the area as well as the purpose to avoid criminal usage of the devices.

This paper is organized as follows;

- I. The creation of databases,
- II. The development of android APP,
- III. The creation and hosting of websites with underlying databases that can be accessed ubiquitously.

IV. Results, conclusion and discussion from the practical framework and experiment are presented.

This piece of research work is very useful to people with the interest in databases, mobile app development as well as those who have interest in website designs.

The outcome of the work equally is important to individuals who use UAVs for their private activities, firms that manufacture and/retail UAVs. Moreover, in order to realize the real-time monitoring the operation state and predict the possible state of UAVs at any point in time, the police and district/provincial assemblies may use the app to ease the burden of manually addressing this issue.

Scholars and technocrats in the field have written diversely on the topic. Many works have direct bearing while others have some resemblance to my theme. [6] Writes on android platform's pedometer application design which uses database to provide the historical data query function and bases on the acceleration sensor and the orientation sensor. It introduces the background of the application and the principle of Android platform pedometer. In addition, it also analyzes and compares the different designs between the single acceleration sensor pedometer and the multi-sensor pedometer, which proves the advantage of this design. It takes into consideration databases and android application including sensors. [7] Uses database and android app to introduce the implementation of a dating application especially designed for students. The application based on Android platform adopts C/S architecture and is developed in Java. It responds to users' operations via the instant interaction between the client and server. Some functions such as free time update, private affairs management, information query and instant-communication can be achieved by mobile devices.

2. Methodology

1. MySQL database was created using SQL query language. Tables were also created inside the database to handle data flow, in and out of the database.
2. Android app was designed with about 9 Java classes designated for fetching data, displaying data and also housing using experience. The interface of the app is built using xml layouts. Each layout was connected to its respective java class by making use of the function "R.layout.LayoutName"
3. PHP files with specific commands were written to make data transfer from the database to the user efficient.
4. The database and PHP documents are then transferred to a live server to ensure global access of data.
5. Permission such as "INTERNET permission was allowed in android studio. This makes it possible for data to be transferred to the user and from the user via internet connection.

6. The built application is then run to an android device for use.

3. Creation of Database (Schema)

The database that serves as the underlying store for the whole project is structured as seen below. It comprises of a schema (database) with tables which are linked to each other (cardinality) with a foreign key constraint. [8] [9][10]. The tables were created and populated using the SQL syntax below:

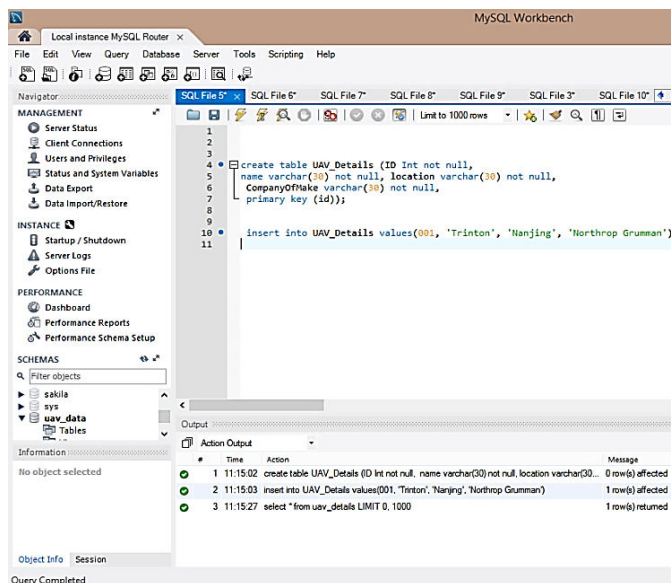


Fig.1 Syntax to create a database table

The above syntax is used to create and populate the tables with the respective information. All tables are created with their respective keys to obey the referential integrity law. The tables were made to have same number of attributes without repeating values. The primary key is unique and identifies a record and determines other attributes. All the non-key attributes depend on the primary key and no other attributes.

Any record should not contain more than one related attribute. The conditions were followed to certify first normal form (1NF), second normal form (2NF), third normal form (3NF) and fourth normal form (4NF) respectively. [11]

This database is either created with MySQL workbench and linked to the project or can be created in the server provider in the case of this paper the 'bluehost'.

4. Development of Android APP

Android app was designed with about 9 Java classes designated for fetching data, displaying data and also housing

using experience. The interface of the app is built using xml layouts. Each layout was connected to its respective java class by making use of the function “R.layout.LayoutName” [12] [13]. The server class is responsible for sending the files (login, and all the commands to be executed in the database such as delete, add, edit) in the database into the web so all users across the world can have access to the database respective of their privileges. The database and PHP documents are then transferred to a live server to ensure global access of data through an (FTP). The register class permits user to register in the application. The proposed user provides his credentials and it is stored in the database for identification. The login class is responsible for allowing the duly registered user to log onto the app through his mobile app. The server, the login and the register classes are linked together.

Android WebView is a technique deployed to display content from the web directly inside an app. It permits the user to use his android device to act as browser internally and it enhances fast flow of data.

All said and done, the project is then connected to the server platform so it can be accessed by all users across the globe base on the PHP file;

```
<?php
$conn =
mysqli_connect("grandstudy.org","grantl1tc_caleb","obengdrone1","g
rantl1tc_obengdrone");

// Check connection
if (mysqli_connect_errno())
{
    echo "Failed to connect to MySQL: " . mysqli_connect_error();
}
?>
```

Fig.2 PHP file to link project to server

Fig. 2 comprises of the server name “grandstudy.org”, the user name “grantl1tc_caleb”, user password “obendrone1” and finally the database which has been uploaded on the server which is being requested “grantl1tc_obengdrone”. Once the information provided is correct and the access is granted, it means data can go in and out. User can update, add, delete and perform all the functions of the database management.

4.1 How it operates

Fig.3 shows the Login page that leads to the main interface (into a new intent according to the privilege level of the use). It permits a new user (User without account) to sign up by registering with a username and a password. The user name and password (the user’s data) is secured in a database which is being hosted on a live server, it is then invoked when the user tries to login again. When user logs in, his/her unique ID and registered name in database displays on the homepage of the app. Users can also logout. And the ‘LOADDATA’ button leads to the display of the data table. There is a

constraint in the registration section that checks if user already exists in database or not.

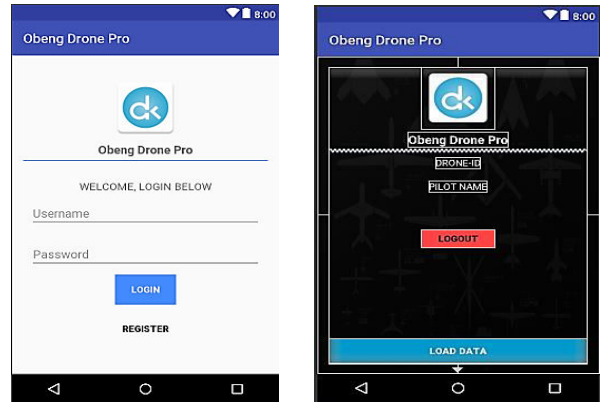


Fig.3 Login page

Fig.4 Presents how data is fetched from the database and displayed on the APP. The data is fetched using PHP query. This data is displayed using android web view. Data can be modified or deleted. Data can be added by filling the forms and submitting it to the UAV online database which is being hosted on a live server. Sample of codes enable the execution and display of data is found in the project file. Data seen are just for illustration purpose.

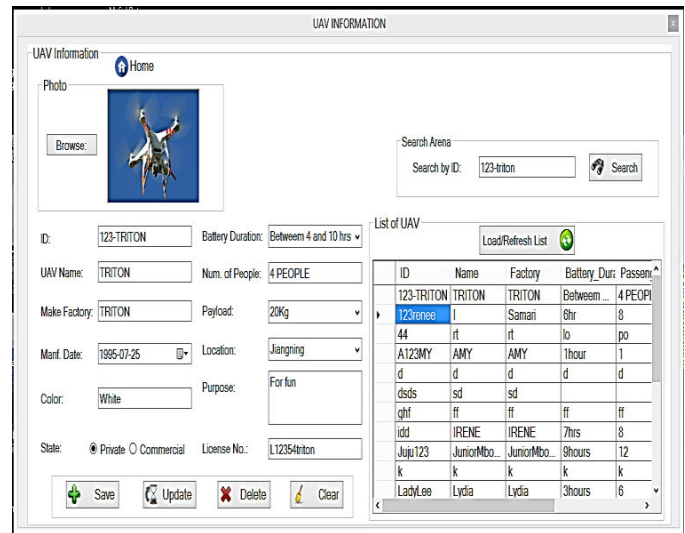


Fig.4. Database tables

Fig.5 is a php query that sends data into the database. This demands the creation of a php form. In the php query, a connection path is created to enable connection to the database server. After the connection is successful, an “insert” statement is used to populate the selected table in the database.

```

<?php
include('conn.php');

$uavname=$_POST['uavname'];
$location=$_POST['location'];
$uaid=$_POST['uavid'];
$ownername=$_POST['ownername'];
$ownertel=$_POST['ownertel'];
$manufcomp=$_POST['manufcomp'];

mysqli_query($conn,"insert into `user` (uavname,location,uavid,ownername,ownertel,manufcomp) values
('$uavname','$location','$uaid','$ownername','$ownertel','$manufcomp')");
header('location:index.php');

?>
    
```

Fig.5. PHP query to populate the database

```

2
3
4
import ...
22
23 public class flight extends AppCompatActivity {
24
25     private String postUrl = "http://grandstudy.org/obengdrone/";
26     private WebView webView;
27     private ProgressBar progressBar;
28     private float m_downX;
29     private ImageView imgHeader;
30
31     @Override
32     protected void onCreate(Bundle savedInstanceState) {
33         super.onCreate(savedInstanceState);
34         setContentView(R.layout.flight);
35         // Toolbar toolbar =findViewById(R.id.toolbar);
36         //setSupportActionBar(toolbar);
37         getSupportActionBar().setDisplayHomeAsUpEnabled(true);
38
39         webView = findViewById(R.id.webView);
40         progressBar =findViewById(R.id.progressBar);
41         imgHeader =findViewById(R.id.backdrop);
42
43         if (!TextUtils.isEmpty(getIntent().getStringExtra("name: postUrl"))) {
44             postUrl = getIntent().getStringExtra("name: postUrl");
45         }
46
47         initWebView();
48         initCollapsingToolbar();
49         renderPost();
    
```

Fig.6. Displaying data from the server

Fig. 6 is a Java program that displays data from the server into android. On line 25 of the code is the server address that hosts the data being display, the entire project makes use of java classes in android studio with layouts written in XML. Firstly, a Layout was created using XML code. We gave Internet Permission in Android Manifest (Controller of Android Project) file because we are connecting with server to get data.

A PHP file (Server side scripting – To get the data from database and send to the Android project) was created. And finally, we created an Activity using Java.

The tables in the database can be populated with data; the content can be retrieved with web view and displayed in the mobile app. This makes it easy for users to use the app on their android devices everywhere they find themselves. It

actually depends on the privilege level of the user and the extent to which he/she can go. Some users can only add data into the database while others can add, delete and update existing data.

5. Discussion

All said and done, this APP, it is assumed that the research's outcome provides a well-regulated database which contains the information on UAVs in a named area and hence the activities of the UAVs can be controlled and coordinated with a mobile APP remotely. An android app is developed and linked to a web host which can then be installed and used on any android device.

The app comes with a user interface which gives the user the right to install the app, register through the user interface and use the app. Once registered, the user has the right to log in at any time with his credentials provided he is connected to a source of internet. Depending on the privilege level of the user, he/she may have the right to perform some specific task in the database. The android APP can be used anywhere the user finds himself, this means that anytime a new UAV is brought into the community, its information is registered in the database. Important details such as the UAV's details, the owner's details, parameters, purposes and specific location are registered so it can be monitored.

Different set of information were entered in the app and saved, then all the functions such as delete update, add were performed on it to check the validity of the APP. The APP was compared to other drone apps like DJI GO, B4UFLY, UAV FORECAST and others. [5] These APPS look quite different in the sense that their primary function is to pilot the drone, check weather conditions, and gather data, record flight routines and many others while this APP is meant to keep the data of UAVS.

Center for study of drones equally has a database of drones. The database contains the information of drones and their make companies, countries and some basic information about the drone. It looks similar to this APP just unlike this app, the database of 'the center for study of drones' does not include a mobile app which can be populated frequently and by anyone using a drone.

The result from this piece can be generalized in different fields. I can be used by employers to keep the data of their employees. I can be used by communities to store and validate the population of the citizenry, as well it can be used in the field of agriculture to keep daily inventory. It can be used by the military, schools and many other places to keep records.

Comparing to other apps meant to control and coordinate the activities of UAVs, the app is appropriate, it works well. Notwithstanding, a few things can be included to make it highly efficient. If the app is able to connect to the UAV sensor so that it can identify and record the present state of all the UAVs (present location, altitude) recorded in the database automatically, would have been best.

6. Conclusion

The problem of indiscriminate use of UAVs which has been a cancer in many countries as perpetrators use them dubiously has been investigated and a possible antidote of such a menace suggested. By the use of a management system that take into cognizance collection and storage of information on all UAVs in the area taking into consideration, the purpose, location and the specific details of each device. Adopting a mobile application system, an APP is developed with an underlying database to host the information. The app is hosted online to be accessed ubiquitously by all stakeholders. After building the app and hosting online, it is tested using different test values to prove if the app can really be used to manage the information as required. In larger perspective, the piece of work could be adopted in different fields. It has the ability to be accessed universally and hence useful for top managers and decision makers since they can still work remotely. The challenge associated with this software is that it cannot track the activities of the UAV when it takes off because it is not connected to the UAV's sensor. It is therefore the foresight of the researcher to include into the project a sensor detection component that will be able to read and record the state (GPS and other flight information) of the UAV when it is in the flight mode, thus, in the future works.

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