Play Store Database Management System

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**Abstract**

Ever since Google released its Android App Distribution market, Google Play, aka Play Store, it has become one of the biggest App Markets in the world. With millions of apps available to be downloaded, a Database Management System can help managing and accessing of the wide range of apps. There are a total of 2.8 million applications on playstore as of 2022. With approximately 111.3 billion applications being downloaded annually.  In this paper, we have proposed an efficient and working Play Store Database Management System using SQL. The proposed approach covered every generic aspect of an application and categorized them on basis of features available on the Play Store. It can be considered as a useful tool for Developers and Users who can use the System to their avail. Developers can use it to expand their market and make their apps better; while users can use the System to search for the apps they want to download easily.

**Keywords-** Google Play Store, Database Management System, Apps, SQL, Play Store Database Management System (PDMS)

# Introduction

Google Play or Google Play Store originally announced by Google as Android Market back in 2008. It was retitled to Google Play or Google Play Store later on in 2012 with merging of Android Market, Google Music and Google eBook-store. [1] Play Store Stands today as one of the biggest App Distributing Markets. As of 2022, Play Store had an estimated total of 2.87 million applications available and as of 2021, 111.3 billion were downloaded annually.[2]

This illustrates what a giant market Google Play Store has become and as the Play Store expands even more, it becomes an enormous task to manage the application data daily. This calls for requirement of an efficient Database Management System to manage data on Play Store.

Google incorporates a complex search algorithm in their Play Store which provides the best applications under any Category to its users. [3] They also incorporate an AI-powered software catering to user specific needs. As of 2014, Google started providing transparency to its users, as now they had access to the size, reviews and ratings of what applications they were using [4], allowing them to rate their favorite applications on a scale of 1 to 5 stars (1 being the worst and 5 being the best) [5], and also letting them to leave a feedback through a comment section for each and every application [6]. Thousands of apps are made available by developers for users to download, daily on this platform. Play Store provides Database System for each and every application for efficiently storing data of every aspect, and not only this database management system, but Play Store’s features don’t stop here, it allows developers to advertise their apps on other platforms [7] and also add discount offers to them [8] using Play Console, it allows developers to bring new updates to their apps which satisfies users of that application [9], also has application ranking system [10] and provides users with features such as Beta Version [11] and Editor’s Choice to choose apps which suits them. The Play Store Database Management System (PDBMS) incorporates all of these features through relations and their attributes and also has interlinks between features that are interrelated. As of now, PDBMS has acquired data of over 6000 apps available to download from Play Store. The PDBMS is created such that it is user friendly, and also Developer friendly Database Management Systems. The Dataset used is one of the most detailed datasets available on Free Data Mine, Kaggle.com [12] and has been cleansed by following the instructions of [13]. Some data was missing in dataset and was generated using trustworthy Microsoft Excel RAND and RANDBETWEEN functions. The PDBMS can be represented using the Relational Database Model and the Entity-Relationship Model. Relational model is a model to represent data in the form of relations or tuples. The relational model is used to create the database using any RDBMS languages.[14] ER model is a way to represent the data in logical view which consists of these components Entity, Entity type, Entity Set.[15]

Applications:

PDBMS provides unique features of containing data about Apps Advertised, Apps With Discount Offers, Apps Deleted from PlayStore, Developer Information, A brief and detailed User information (which ranges from the user’s name and age to their subscriptions, downloaded apps and payment methods used), Beta Version, an efficient Ranking System (which ranks the paid and free apps along with a general Top Charts list and an outstanding feature showing the App that trended the most in Entire Week) and Editor’s Choice. The PDBMS is coded in SQL (Structured Query Language) and has had many working queries tested on it to make sure no discrepancies have crawled into the system. Looking at the working of the PDBMS, we decided to work on the following Research Questions:

**RQ1:** *How is the PDBMS unique from other Database Management Systems and the Play Store itself?*

**RQ2:** *Who would be the most benefited by the PDBMS?*

Here is how the Paper has been divided. Section 2 contains the Methodology involved in creating the PDBMS, Section 3 contains Review of Literature, Section 4 contains the Proposed System which involves the Framework of The System, along with the Relational and ER Models of the PDBMS, Section 5 contains Experimental Analysis of the PDBMS, Section 6 has the Results and Conclusions of the Research while the final Section 7 details the Limitations of The Study and its Scope of Future Research.

# Literature Review

Studying about Google Play Store Dataset has been one of the biggest attractions for Data Scientists and Machine Learning Experts because of various trends and features it provides. We have studied some of the literature written on the same and divided it into three different categories according to our research.

**A measurement study of google play**

[37]In paper, Viennot N, Garcia  E and Nieh, J created a Play store Crawler to collect data about applications available on the Play Store and asserted to find loopholes such as leaked secret authentication keys in Google Play Store, to overcome this problem they proposed an alternate efficient mechanism to collect and store data about application naming the same as Playdrone, which can be used to index and analyze over 1,100,000 applications on the Google Play Store. Four major challenges were resolved by PlayDrone: the characterization of Google Play application content at large scale and its evolution over time, duplicative application content, library usage in application and its impact on application portability and the ineffectiveness if OAuth and related service authentication mechanisms.

**Design and realization of rock salt gas storage database management system based on SQL Server**

Yingjie Wang, Jianjun Liu, XiangHe and BingWang, in their paper proposed a database for a rock salt gas storage using an SQL Server database for the efficient management of data storage, overcoming the problems like waste of storage space, lower efficiency of data calling, and negative effects on the efficiency of updating data. The proposed system included the management forms of the geological modeling, stability evaluation, covering the addition and checks of static and dynamic data. The degree of confidentiality of the information and security of the management system were improved with different levels of administrators and permissions.

Malavolta et al. [22] researched the Hybrid Apps on Play Store from the End User’s Point of View in a research unique in its own kind. Their research gave the result that the End Users usually just cared about applications working properly on their smartphones. They found out that Users usually preferred apps which worked on various platforms (Hybrid Apps) rather than Platform-native Applications. Choi and Chen et al. [8] researched one of the unique features of discount pricing on gaming applications. They formulated many hypotheses which all pointed to the positive effect of Discount offers on gaming applications. Their results concluded that under many cases, discount pricing had helped Gaming Applications grow, but under some circumstances, discounts have also led to users not trusting the applications. Ahsanuzzaman et al. [7] did research on the Evolution and Integration of Ad Libraries in Google Play Store and concluded that ads were really helpful for the advertising developer to spread their product.

* 1. *Study On Google Play Store:*

Many researchers have researched on Google Play Store Datasets over the years, specifically making crawlers to go through the Play Store. Vienott et al. [[3]](#_bookmark2) made a Play Store Crawler to collect data about the applications available on the Play Store and found various loopholes, such as leaked secret authentication keys in Google Play Store. They also generated an efficient mechanism to collect and store data about applications, which they named Playdrone. Callaham et al. [[4]](#_bookmark3) did a brief research on the changes that were incorporated by Google in its Play Store design through the years of its success. Google decided to merge all its different services it offered into one service, they collectively called Google Play. In 2012, they solved difficulties faced by the users due to not owning credit card or debit card, by introducing Google Play Gift cards to allow them to purchase items directly from Google Play. In 2014, Google decided to become more transparent with its users by providing data about the applications users were interested in like ratings, reviews and file size amongst others. Dey, Beheshti and Sido et al. [[17]](#_bookmark16) used a Play Store Crawler to have a check on Play Store Apps and rectify the malicious ones. Their reports identified around 2% of the total app

population to be a malware. Such applications which did not meet with Google’s Terms and

Conditions are deleted from the Play Store on daily basis [[3]](#_bookmark2).

* 1. *Study on Play Store Apps:*

This field of study has mainly attracted researchers who are trying to research app ratings on Play Store and its relation to other factors as ever since the instalment of ratings and reviews feature on the Play Store, developers have focused on bringing in more positive ratings and reviews, directly connecting them with app popularity [[18]](#_bookmark17). Olmstead and Atkinson et al. [[19]](#_bookmark18) did a research on all the applications on the Play Store and brought out statistical data related to the features of the apps.

The Play Store majorly contains apps belonging to about only eight categories, as identified by the Play Store and most of the applications available were free to use. She also threw light on Google’s preloaded apps in Android smartphones and their updating frequency. McIlroy et al [[20]](#_bookmark19) studied about the update frequency of the applications on Play Store and directly connected it with growth rate of the apps. His research showed that a significant percentage of applications have been updated bi-weekly while a very little percentage of applications have been updated weekly. Schmidt- Kraepelin et al. [[18]](#_bookmark17) did a research on the popularity of Mobile Health Applications and their direct relation to game Mechanics inserted in them. Their research showed that Gamification process in apps showed hugely promising results for the developers as their apps were used by the users for longer time than apps not having gaming mechanics. McIlroy et al [[6]](#_bookmark5) in their another Paper researched on the Ratings of applications whose developers provided feedback to the users.

Although they found that a very small amount of app developers responds to their critics on the Play Store, them ensuring the users of features or receiving praises from the users did increase their app ratings. Hecht, Mouvoy, Moha and Duchien et al. [[21]](#_bookmark20) developed a system called PAPRIKA which detected Anti-Patterns producing in the applications of the Play Store.

* 1. *Study on The Unique Features:*

To our best knowledge, there has been no research conducted which contains all the unique features being explored together. Our research paper is one of the firsts of the kind to do so in a

Database Management System related approach. Malavolta et al. [[22]](#_bookmark21) researched the Hybrid Apps on Play Store from the End User’s Point of View in a research unique in its own kind. Their research gave the result that the End Users usually just cared about applications working properly on their smartphones. They found out that Users usually preferred apps which worked on various platforms (Hybrid Apps) rather than Platform-native Applications. Choi and Chen et al. [[8]](#_bookmark7) researched one of the unique features that is effects of discount pricing on gaming applications. They formulated many hypotheses which all pointed to the positive effect of Discount offers on gaming applications. Their results concluded that under many cases, discount pricing had helped Gaming Applications grow, but under some circumstances, discounts have also led to users not trusting the applications.

Ahsanuzzaman et al. [[7]](#_bookmark6) did a research on the Evolution and Integration of Ad Libraries in Google Play Store and concluded that ads were really helpful for the advertising developer to spread their product.

# Proposed System

# 3.1 Framework

The proposed Play store Database Management System (DBMS) covers up various features provided by the Play Store, which would be briefed one by one in the subsequent paragraphs.

PDBMS contains information of over 6000 applications such as their Content Rating, their Genre and Category, their Current Version, Date of the Last Update, Size, Price, Release Date, Number of Downloads, Android Requirements, Permissions Needed, Reviews, Ratings and Feedback. Instead of browsing through all the application screens to read about these features, these are provided in a tabulated format in PDBMS. It also contains information related to various developers who have uploaded their applications on the Play Store.

PDBMS provides a technical overview of application details. All of these basic data help users choose an application they might want to download. For Eg. The Number of Downloads and Ratings features have helped many users make a decision regarding downloading an application as they rely heavily on the data provided to them on their screens [[18]](#_bookmark17). Similarly, the Feedback mechanism in the Play Store’s Comment Section has shown an increase in user Ratings for apps where developers have provided Feedback to their users [[6]](#_bookmark5). The Success of an Application is heavily based on the positive and negative reviews it gets, something that has been fairly distinguished in the PDBMS.

One of the features is that PDBMS helps the developers to advertise their applications and provide discount offers on them. [[8]](#_bookmark7) On the other hand, it also helps users to check details of the advertisements they are watching or discount offers they might want to avail. PDBMS provides data for the Advertised Apps such as their Ratings, Number of Downloads and the Country of their advertisement. On the other hand, it provides data such as Discount Percent and the Start and End Date for any discount offer on any application. Another unique feature of the PDBMS involves an efficient ranking system, also used by the Play Store [[10],](#_bookmark9) and provides data of the top applications under any category. The Google Play Store provides data of only the top 500 applications under any category [[3]](#_bookmark2). PDBMS has differentiated the best applications into Top Paid and Top Free lists. The Play Store uses a recommender system to recommend the best apps according to the requirements of users based on factors such as number of downloads and user reviews.[[3]](#_bookmark2) PDBMS also provides a Top Charts and Editor’s Choice list, which are some of the unique features of Google Play Store. But PDBMS stands out from the Play Store with a new feature of “App of The Week” where the PDBMS features the most popular app from every category on weekly basis. The Ranking System used by the PlayStore has been one of the most efficient ways to encourage developers to improve their apps and encourage users to download applications which have topped the charts. [[10]](#_bookmark9)

Users are the most important factor for any application on the Play Store. User feedback comprises on various factors affecting app functionality. Their reviews are evaluated in various ways by the developers to improve the apps as much as possible.[[3]](#_bookmark2) PDBMS provides us with every detail about the user, from their names and ages to their Payment details and subscription details and apps downloaded by them. This also helps users find applications which are liked by similar users and make their work easy to find and download the applications. [[22]](#_bookmark21)

*3.2 Relational Model and ER Model*

Timeline

Description automatically generated *3.2.1 Relational Model:*

**Figure 1.** Relational Model of The PDBMS

*3.2.2 Entity-Relationship Model:*

Diagram, engineering drawing

Description automatically generated

**Figure 2.** ER Model of The PDBMS

*3.3 Comparison of other proposed systems*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Reference Paper** | **F1** | **F2** | **F3** | **F4** | **F5** | **F6** | **F7** |
| [**[1]**](#_bookmark22) | Yes | No | No | Yes | Yes | Yes | No |
| [**[2]**](#_bookmark23) | Yes | Yes | No | No | Yes | Yes | No |
| [**[3]**](#_bookmark24) | Yes | No | No | No | Yes | Yes | No |
| [**[4]**](#_bookmark25) | Yes | No | No | No | Yes | Yes | Yes (Only inclusion of Feedback  System) |
| [**[5]**](#_bookmark26) | Yes | No | No | No | No | No | Yes (Only inclusion of App  Advertising) |
| [**[6]**](#_bookmark27) | Yes | No | No | No | No | No | Yes (Only inclusion of App  Discount) |
| [**[7]**](#_bookmark28) | Yes | Yes | No | No | No | Yes | No |
| [**[8]**](#_bookmark29) | Yes | No | No | No | Yes | No | No |
| [**[9]**](#_bookmark30) | Yes | Yes | Yes | Yes | No | No | No |
| [**[10]**](#_bookmark31) | Yes | No | No | Yes | No | Yes | No |
| [**[11]**](#_bookmark32) | Yes | No | No | Yes | No | No | No |
| [**[12]**](#_bookmark33) | Yes | Yes | No | No | No | Yes | No |
| [**[13]**](#_bookmark34) | Yes | No | No | No | Yes | Yes | No |
| [**[14]**](#_bookmark35) | Yes | Yes | No | Yes | No | No | No |
| **[15]1** | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

1 Refers to this Research Paper

**Table 1.** Comparison of our study with other studies in the same domain and proving its uniquenessi

|  |  |
| --- | --- |
| **Feature No.** | **Description** |
| F1 | General Information regarding any application . |
| F2 | Information regarding Updates of any application on the Play Store. |
| F3 | Information regarding the release version of the application. |
| F4 | User account information |
| F5 | Ranking status on Play-store. And featuring on Top charts |
| F6 | Application rating |
| F7 | App Advertising, Discount Offers on App Purchases and Providing Feedback to their Users. |

**Table 2.** Description of Features in Feature Table

# Results and Conclusions

With 24 brief relations and over 1,39,000 values filled in the attributes, the PDBMS stands as an efficient database management system . The striking features that differentiate the PDBMS from the Play Store include “App of The Week” feature, the feature to show “Deleted Apps” from a particular country and the feature which gives users a detail of all their “Downloaded App”. It also incorporates an efficient searching system where by entering the required details, a user can definitely find the most specific application, he is looking for. PDBMS contains data including the “Update Status” of the Apps, “Beta Version”, “Editor’s Choice” and the most important features i.e. The reason why PDBMS is better than other Database Management Systems is that it is the most detailed Database Management System. Out of the 24 relations, incorporated in the PDBMS, 15 of them correspond to the Unique Features provided by the Play Store and the rest 9 correspond to the General Features of the Play Store. The attributes involved in each of the relations are brief enough to explain the relation they represent in a detailed manner. Finally, PDBMS is detailed Database Management System which covers each and every possible aspect for the apps available on the Play Store. It is not only User-friendly, but also a Developer-friendly system which caters to the needs and requirements of both in a satisfying manner. The PDBMS also stands ahead of other Database Management Systems as more than 60% of its relations are unique and strikingly efficient. The PDBMS not only provides the unique data, but also caters to the general features of any application available on the Play Store. With more than 50 different assets of an application being explored by the PDBMS, through its attributes, we can easily conclude it as one of the best Database Management Systems of its kind.

# Limitations and Further Study:

While PDBMS might be a detailed and efficient system, it has its own drawbacks. The lack of incorporation of an Artificially Intelligent System to make it a self- sufficient system. PDBMS requires a Database Manager to operate efficiently and requires to be kept updated manual on a regular basis. The option of self-updating hasn’t been explored yet and can have a scope in the future. This brings us to our second limitation, PBDMS was built on data which was probably three years older than the system itself. It may not hurt the efficiency of the system statistically, but can be questioned on its authenticity in the present times. Hence, as a result, the PDBMS, if not updated regularly, may not remain as an authenticated system.

With 24 brief relations and over 1,39,000 values filled in the attributes, the PDBMS stands as an efficient database management system . The striking features that differentiate the PDBMS from the Play Store include “App of The Week” feature, the feature to show “Deleted Apps” from a particular country and the feature which gives users a detail of all their “Downloaded App”. It also incorporates an efficient searching system where by entering the required details, a user can definitely find the most specific application, he is looking for. PDBMS contains data including the “Update Status” of the Apps, “Beta Version”, “Editor’s Choice” and the most important features i.e.

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