SMART DONATION AND RESOURCE MANAGEMENT SYSTEM

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Abstract—Charities need systems to manage their donations and distribute their charitable donations. Manual systems tend to create inconsistencies in the data, hampering the tracking of donations and causing inefficient allocation of resources. Therefore, this research proposes a Smart Donation & Resource Management System based on Database Management System (DBMS) principles designed to automate the process of tracking donations, storing charitable resources, as well as managing both charities and donors who will receive charity resources. These components will be integrated into a structured relational database that captures all entity information (i.e. donors, administrators, resources and charities). Furthermore, entity-relationship and normalisation techniques will be used to ensure the integrity of the data and to reduce redundancy. The proposed system will achieve normalisation to Third Normal Form (3NF) to maintain efficiency, provide improved transparency and assist with the overall management of the non-profit organisations.

I. INTRODUCTION

Large improvements in organizational management through digital transformation. Many charity organizations still use the traditional way of managing donations and resources by hand. This causes inefficiencies, such as duplication of records, lack of transparency, and delays in the distribution of resources.

For this reason, the Smart Donation and Resource Management System will provide a central database solution for managing the activities of donations and therefore allow administrators to manage all of their donors, resources, and recipients, in order to keep accurate records.

II. LITERATURE REVIEW

Development of database management systems has greatly enhanced organizational efficiency in various areas, such as charity and resource management. Various research works and existing systems have provided concepts that are the basis of this proposed Smart Donation and Resource Management System.

A. Database Management Systems in Organizational Applications

According to Silberschatz, Korth, and Sudarshan, a Database Management System provides techniques to store and manage large amounts of data efficiently while maintaining data integrity and reducing redundancy **[1]** and provides data integrity through normalization and relational database concepts. DBMS technology provides mechanisms for efficient data storage, retrieval, and management in large information systems **[2][3]E**. These concepts are important in applications that require multiple users and interconnected data entities.

B. Relational Model and Data Normalization

E.F.Codd proposed a relational model that provides a collection of tables that are interconnected with relationships **[7]**. Research works emphasize normalization techniques to reduce anomalies and increase database management efficiency. Research works proved that normalization up to Third Normal Form (3NF) is enough to increase database management efficiency in most management systems.

Normalization techniques are applied in this proposed Smart Donation and Resource Management System to provide a reliable database management of donations and resources.

C. Donation Management Systems

Previous donation management systems were primarily focused on monetary donations and did not provide any facility to track resources.

Computer application journals have emphasized the significance of an integrated system that is capable of handling donor data as well as physical resources like food, clothing, and medicines.
Some of the problems associated with existing systems:
Errors during data entry
Lack of transparency
Poor monitoring of resources
The proposed system would overcome all these problems with centralized database control.

III. SYSTEM ARCHITECTURE

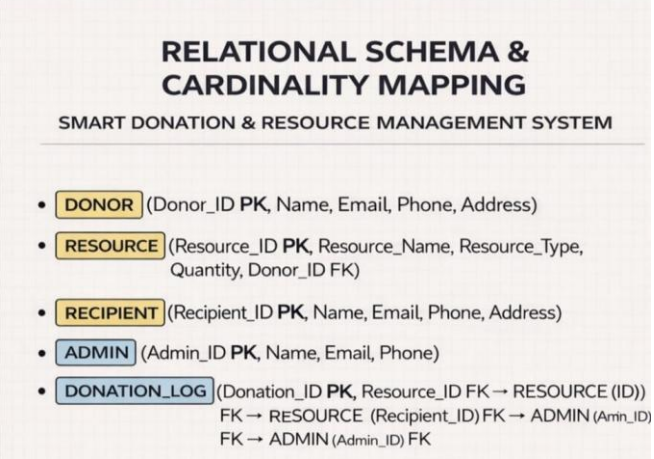
The system architecture defines the overall structure of the system and the way different components interact with each other. The Smart Donation and Resource Management System follows a layered architecture that consists of three main components: the user interface, the application logic, and the database.

The user interface acts as the front-end of the system, allowing users to interact with the application. It provides forms and interfaces for entering data, viewing information, and performing various operations. The design of the interface is kept simple and intuitive to ensure ease of use.

The application logic forms the core of the system, where all processing takes place. It handles tasks such as data validation, processing user requests, and managing business logic. This layer ensures that all operations are performed correctly and efficiently.

The database serves as the backend of the system, where all data is stored and managed. It maintains information about donors, recipients, resources, and donations. The use of a relational database ensures that data is organized systematically and can be accessed efficiently.

The interaction between these components ensures smooth operation of the system and enables efficient data processing.



IV. PROPOSED SYSTEM

The Smart Donation System is an automated method for tracking and managing donations, storing and distributing donated items, and effectively managing donated resources. Structured Query Language (SQL) is used to implement relational database structures and perform operations such as data insertion, retrieval, and updates **[5][6]**.This database-driven approach improves accuracy, transparency and efficiency by moving the storage and management of records from a manual to a centralised digital platform.
The system integrates the donors, administrators, recipients and donated resources into a structured relational database using the concepts of a Database Management System (DBMS) including ER modelling, normalisation and relational schema design.

A. SYSTEM OVERVIEW

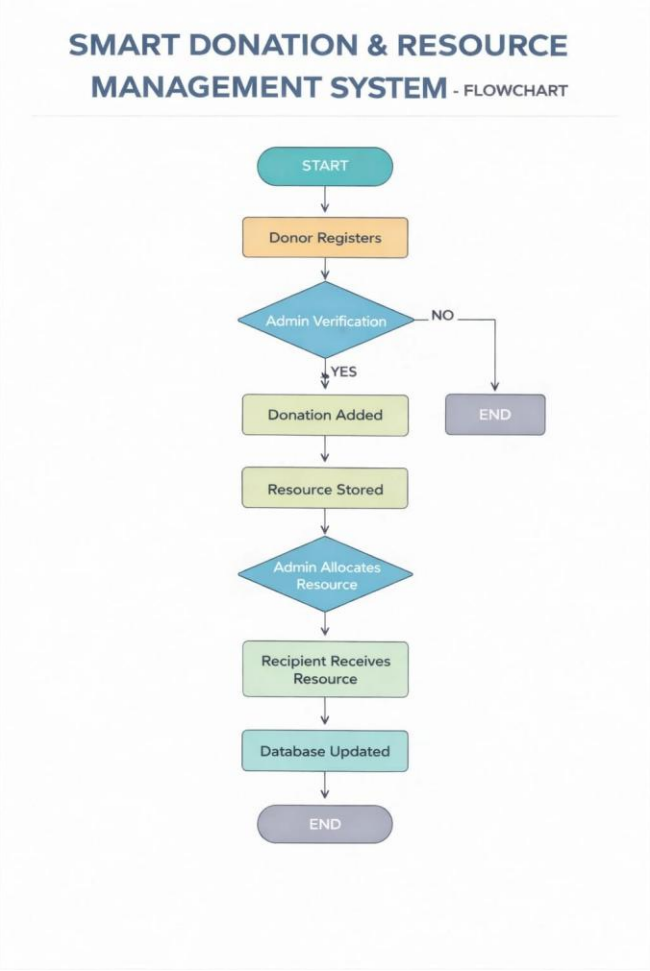
Donation management systems have evolved significantly over time, moving from simple manual record-keeping methods to more sophisticated digital platforms. These systems are designed to assist organizations in managing donor information, tracking contributions, and ensuring proper utilization of resources. The primary goal of such systems is to simplify administrative tasks and improve the overall efficiency of donation processes.

In earlier times, donation management was handled using paper-based records, which were difficult to maintain and prone to errors. As technology advanced, organizations began using spreadsheets and basic software tools to store data. While these tools provided some level of improvement, they still lacked advanced features such as data validation, relationship management, and real-time tracking.

Modern donation management systems

incorporate various functionalities, including donor relationship management, automated communication, and reporting tools. However, many of these systems are primarily focused on financial donations and do not adequately address the management of physical resources. This limitation reduces their effectiveness in real-world scenarios where both monetary and non-monetary donations are equally important.

Another important aspect of donation management systems is their ability to handle large-scale operations. As organizations grow, the volume of data increases, making it essential to have systems that can scale efficiently. The lack of scalability in traditional systems often leads to performance issues and data management challenges.



Database Management System is a crucial component in modern information systems, providing a structured approach to data storage and management. It allows users to create, modify, and manage databases while ensuring data consistency and security[1]. DBMS eliminates many of the problems associated with file-based systems, such as data redundancy and inconsistency.

One of the key advantages of using a DBMS is its ability to enforce data integrity through constraints and rules. For example, primary key constraints ensure that each record is unique, while foreign key constraints maintain relationships between tables. This is particularly important in a donation management system, where accurate and consistent data is essential for effective decision-making.

DBMS also provides powerful query capabilities, allowing users to retrieve specific information from large datasets quickly. This enables administrators to generate reports, analyze trends, and monitor system performance. Additionally, DBMS supports concurrent access, allowing multiple users to interact with the system simultaneously without compromising data integrity.

Security is another important feature of DBMS. It provides mechanisms for controlling access to data, ensuring that only authorized users can view or modify information. This is especially important in systems that handle sensitive data, such as donor details and financial transactions.

Furthermore, DBMS enhances data independence, allowing changes to be made in the database structure without affecting the overall system. This flexibility makes it easier to update and maintain the system as requirements evolve.them to recipients. Furthermore, the system must have one database where all records related to resources are stored (providing transparency and efficient resource management), organized, and managed in order to facilitate effective placement and distribution of those resources. Database design techniques such as ER modeling and relational schema mapping are commonly used for designing structured database systems **[4]**.

Once the requirements were analyzed, the next step was to create a design for the new system in relation to the ER (Entity Relationship) model. This model consists of four separate entities, which include Donor, Admin, Recipient, and Resources. These entities represent the major components of the new system, as well as data associated with those components that will need to be maintained.

Each of these entities also has multiple relationships to one another that illustrate possible interactions in the real world; Donors donate Resources, thereby creating a relationship between the two entities, and the Admin allocates

Resources to Recipients by managing Recipients to ensure the proper allocation of donated Resources. The Admin is also responsible for managing the allocation and placement of the available Resources within the system. Each entity will need a Primary Key in order to uniquely identify each record.

During the database modeling stage, the ER diagram is mapped into relational tables using standard mapping rules. Each entity represented in the ER diagram is transformed into its corresponding relational table. Each entity's unique record is represented by its primary key and the related tables are connected by foreign keys to represent the relationships between different entities and maintain referential integrity between tables.

Most relationships in this system are one-to-many, allowing for one entity instance to be related to multiple records in another table. This relational structure works together with structured query to provide efficient data retrieval. Overall, the design of this database will allow this system to successfully store, manage and retrieve all relevant data regarding donors, resources, recipients and administrative activities.

NORMALISATION

Smart Donation and Resource Management System's Database Design is Normalized to Third Normal Form (3NF). The Database Achieves First Normal Form (1NF) by Keeping Attributes Atomic, Second Normal Form (2NF) by Removing Partial Dependencies, and Third Normal Form (3NF) by Eliminating Transitive Dependencies. Fourth Normal Form and Fifth Normal Form (4NF and 5NF) Are Not Necessary because there are no Multivalued or Join Dependencies in the Database Schema.

VI. RESULTS AND DISCUSSION

The Smart Donation and Resource Management System utilized database management principles to assess the effectiveness of automated donation tracking and resource allocation processes. Modern database management techniques support efficient data retrieval and improved organizational data handling **[8]**. The different functionalities of the system were evaluated by using a sample dataset that included the following categories: donors, administrators, recipients, and available resources.

A. Implementation Results

The database system completed all of the following operations:

Stored donor records with no duplicate records

Recorded details of donations (e.g., amount of donation, date of donation)

Managed ^resources through an inventory of available resources.

Created clearly defined ways to allocate resources to recipients

Used SQL queries retrieved from the database to retrieve data

All of the entity tables were created with primary keys to ensure consistency, and foreign keys were used to keep relationships between those tables intact (i.e., preserve referential integrity).

Observed Outputs

Donor records were correctly added to the database and retrieved.

The administrator management of resources and recipients was successfully managed.

After allocating a resource, the quantity of the resource was automatically updated.

For recipients, the resource assigned to the recipient was accurately reflected in the recipient record.

SQL JOIN operations were used effectively to join related tables together.

The overall performance of the system with respect to the accuracy of data stored against each table and the efficiency of executing SQL queries demonstrated the overall performance of the system.

B. Analysis

Implementation of Database Management Systems (DBMS) has enhanced donation management processes significantly when compared to those using traditional manual systems.

Fundamental outcomes include:

The use of centralized data storage has improved access.

Admin-staff controlled workflow for managing resources appropriately.

Utilizing a structured schema results in fewer records when inconsistencies occur.

Utilizing Third Normal Form (3NF) normalization reduces the potential of an anomaly happening during insertion, deletion, or updating of records.

Utilizing Entity-Relationship Model design ensures there are logical relationships established between donor(s), resources and recipient(s), thus allowing resources and donors to be able to work together with recipient(s).

C. Reliability of the System

To maintain a reliable system, the following will be utilized:

Primary Key Constraints - prevents duplicate entries.

Foreign Key Constraints - enforces valid relationships between tables.

NOT NULL Constraints - enforce that mandatory

fields must contain data.
Testing has verified that when invalid data is entered, the database rejects the data, thus preventing any integrity loss from occurring to the database.
D. Limitations
While the system is effective, there are various limitations:
Requires the supervision of administrators
Currently, donations can't be integrated with an online donation systemLimited options for analyticsThese limitations can be addressed by future enhancements.
E. Overall Results
The implementation of the Smart Donation/Resource Management System is confirmed to provide:
Efficient Management of DatabaseTransparency of resource Reliable Distributionof ResourcesOperational Complexity Reduction
Each of the project objectives have been met, as well as validating that DBMS-based systems can be successful in social service usage.

VII. CONCLUSION

The Smart Donation and Resource Management System (SDRMS): offers an efficient database-driven solution for managing donation activities and resource distribution in charity-based organizations by integrating donors, administrators, recipients, and resources into one central relational database structure, allowing for an organized means of storing, entering, maintaining, retrieving, and utilizing data.
The Entity Relationship model (ERM) along with database normalization methods was applied to eliminate data redundancy as much as possible and produce a consistent database that conforms to the Third Normal Form (3NF). The design of the database produces a consistent and reliable structure, and the implementation produces enhanced transparency, accuracy, and operational efficiency when compared to using traditional manual processes. The use of the automated tracking feature of both donations and resources assists administrators in making the best allocation decisions for their available resources while providing accurate records.
The project validates the importance of using database management concepts to help real-world businesses. In the case of the charity and social service, types of organizations, SDCRM provides a stable, scalable foundation on which to build additional advanced technologies, including web and mobile applications with intelligent analytical capabilities.
In conclusion, the Smart Decision Resource Management System provides reliable, organized, and efficient methods managing donation and resource allocations which contribute to improving resource utilization and improving service delivery to members of any charity-based organization

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