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AUTOMATED LIBRARY DUES NOTIFICATION SYSTEM USING SQL SERVER MANAGEMENT STUDIO

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ABSTRACT

Efficient dues management in academic libraries is essential to maintain operational flow and support timely resource access. This paper proposes an automated library dues notification system, designed using SQL Server Management Studio (SSMS). The system leverages SQL Server Database Mail and SQL Server Agent to send periodic reminders to students with outstanding dues. By automating this process, libraries can reduce administrative overhead and improve the frequency and reliability of communication with students. This paper covers the system's architecture, the methodology for implementation, testing results, and an analysis of its potential impact.

Keywords: *SQL Server Agent, Database Automation, Job History Logging, Alert Script*

1 .INTRODUCTION

Libraries in educational institutions provide critical resources for students, yet students often neglect to return borrowed items or fail to pay dues on time. Failure to address these issues can hinder library operations, limiting the availability of resources for other students. Traditionally, libraries rely on manual reminders or intermittent automated emails, which are time-consuming and often ineffective in ensuring students clear their dues on time. Automating the reminder system can enhance efficiency by reducing the workload on library staff and enabling a consistent notification schedule. This paper presents a solution built using SQL Server Management Studio (SSMS), an industry-standard tool for managing SQL databases and associated services. The proposed system takes advantage of SQL Server's Database Mail feature and SQL Server Agent for scheduling email notifications, ensuring that students with dues receive timely reminders until they settle their accounts.

2. RELATED WORK

Automated reminder systems have been implemented in various contexts to manage overdue payments and notifications. In the academic library domain, systems based on integrated library software solutions (e.g., Koha, Evergreen) have been widely used to manage circulation, including overdue notifications [1]. However, these solutions often require proprietary software or come with licensing costs, which may be a barrier for some institutions [2]. Open-source alternatives, although cost-effective, may lack certain customization options that allow for targeted dues reminders based on specific criteria.

SQL-based automated email systems have been explored across various domains, such as customer relationship management [3], due to their capacity for automating communications based on dynamic data and pre-set schedules. Using SQL Server to build an alert system is both cost-effective and highly customizable, making it an ideal choice for academic libraries looking for a tailored approach to dues management.

2.1 SYSTEM ARCHITECTURE

The architecture of the proposed system involves three primary components:

1. **Database Structure**: A relational table, Student Dues, which stores information on students' dues, email addresses, and the date of the last notification.
2. **Query for Due Reminders**: SQL queries to retrieve students with pending dues, filtering by those who have not cleared their balances.
3. **Email Alert and Automation**: SQL Server Database Mail to generate and send personalized reminder emails and SQL Server Agent to schedule the process at regular intervals.

2.2 DATABASE DESIGN

The StudentDues table stores key information required to identify students with unpaid dues. The table design includes fields for the student ID, name, email, outstanding amount, and the date of the last email notification:

2.3 SQL CODE TO CREATE THE STUDENT DUES TABLE

```
CREATE TABLE StudentDues (
   StudentID INT PRIMARY KEY,              -- Unique ID for each student
   StudentName NVARCHAR(100) NOT NULL,     -- Full name of the student
   StudentEmail NVARCHAR(255) NOT NULL,    -- Email address for notifications
   DueAmount DECIMAL(10, 2) NOT NULL,      -- Outstanding amount the student owes
   LastNotificationDate DATE NULL          -- Date of the last notification sent to the student
);
```

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2.4 EXPLANATION OF TABLE COLUMNS

- **StudentID**: A unique identifier for each student (primary key).
- **StudentName**: The full name of the student, used in email notifications.
- **StudentEmail**: The email address of the student, where the dues reminder will be sent.
- **DueAmount**: The current outstanding balance the student owes.
- **LastNotificationDate**: The date on which the last notification was sent to the student. This field helps ensure students don't receive duplicate notifications within a short period.

Example Data for the StudentDues Table

StudentID	StudentName	StudentEmail	DueAmount	LastNotificationDate
1001	John Smith	john@university.edu	25.00	2024-10-01
1002	Jane Doe	jane@university.edu	15.50	2024-10-03
1003	Emma Brown	Emma@university.edu	40.00	NULL
1004	Michael Johnson	Michael@university.edu	10.00	2024-09-30
1005	Emily Davis	Emily@university.edu	5.00	NULL

2.5 NOTES ON EXAMPLE DATA

- Students with non-zero dues appear in the table, indicating they owe the library.
- The Last Notification Date field shows when they were last reminded. NULL indicates students who have not yet received any reminders, such as Emma Brown and Emily Davis.

This table serves as the primary source for determining who should receive reminders in the automated email alert system.

This table structure enables the system to track both outstanding dues and notification history, essential for ensuring timely and effective communication.

2.6 IMPLEMENTATION

The system implementation consists of configuring SQL Server Database Mail, creating an email alert script, and setting up SQL Server Agent for automation.

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2.7 CREATE STORED PROCEDURE FOR SENDING EMAIL ALERTS

This stored procedure checks for students with unpaid dues, sends them a reminder email, and updates the Last Notification Date.

```
USE [Reporting]  -- Replace with the name of your database
GO
CREATE PROCEDURE SendDuesReminder
AS
BEGIN
   DECLARE @StudentID INT;
   DECLARE @StudentName NVARCHAR(100);
   DECLARE @StudentEmail NVARCHAR(255);
   DECLARE @DueAmount DECIMAL(10, 2);
   DECLARE @EmailBody NVARCHAR(MAX);

   DECLARE dues_cursor CURSOR FOR
   SELECT StudentID, StudentName, StudentEmail, DueAmount
   FROM StudentDues
   WHERE DueAmount > 0
   AND (LastNotificationDate IS NULL OR LastNotificationDate < GETDATE())
   OPEN dues_cursor
FETCH NEXT FROM dues_cursor INTO @StudentID, @StudentName, @StudentEmail, @DueAmount

WHILE @@FETCH_STATUS = 0
BEGIN
 SET @EmailBody = 'Dear ' + @StudentName + ',' + CHAR(13) + CHAR(10) +
'This is a reminder from the university library regarding an outstanding balance of $' +
CONVERT(NVARCHAR(10), @DueAmount) + '.' + CHAR(13) + CHAR(10) +
 'Please clear this balance at your earliest convenience. Payments can be made at the library front desk or
through our online portal.' + CHAR(13) + CHAR(10) +
'Thank you for your attention to this matter.' + CHAR(13) + CHAR(10) +
'Best regards,' + CHAR(13) + CHAR(10) +
'Library Staff'
EXEC msdb.dbo.sp_send_dbmail
@profile_name = 'LibrarianProfile',          -- The Database Mail profile you set up
@recipients = @StudentEmail,
@subject = 'Library Dues Reminder',
@body = @EmailBody;
-- Update LastNotificationDate after sending the email
UPDATE StudentDues
SET LastNotificationDate = GETDATE()
WHERE StudentID = @StudentID;
```

```
FETCH NEXT FROM dues_cursor INTO @StudentID, @StudentName,@StudentEmail,
@DueAmount
END
CLOSE dues_cursor
DEALLOCATE dues_cursor
END
GO
```

The library dues notification system uses a SQL CURSOR, a database object that allows row-by-row processing of query results. This approach is particularly helpful when each student's data must be handled individually, such as sending personalized email reminders based on their unique outstanding balance and email address. A cursor begins by declaring itself on a specific SQL query—in this case, selecting students with outstanding dues from the Student Dues table. After declaring the cursor, it is opened to initiate processing. With each cycle, FETCH NEXT retrieves the next row, storing the results in variables for StudentID, StudentName, StudentEmail, and Due Amount. This row-by-row control enables the system to customize the email message for each student, embedding details like their name and due amount within the message body. Following each email, the UPDATE statement revises the Last Notification Date field, marking when the reminder was last sent, which helps prevent redundant reminders. After all rows have been processed, the cursor is closed and deallocated to free up resources, making this approach efficient and ensuring database performance remains optimal. The stored procedure uses the msdb.dbo.sp_send_dbmail system procedure, which relies on SQL Server's Database Mail configuration to actually send the email based on the customized content.

2.8 CONFIGURING SQL SERVER DATABASE MAIL

Database Mail is a SQL Server feature that allows sending emails directly from the server. To configure Database Mail:

1. **Go to SSMS > Management > Database Mail**.
2. **Set up a mail profile** (e.g., "LibrarianProfile") and link it to a valid email account.
3. Configure **SMTP** server settings as required by the email provider.

Once configured, Database Mail enables the server to send automated emails based on query results.

2.9 SCHEDULING WITH SQL SERVER AGENT

SQL Server Agent is a powerful tool in SQL Server designed for automating routine tasks, making database management more efficient and reliable. It enables scheduling of jobs, which can include database backups, sending automated email notifications, running maintenance scripts, and performing other repetitive tasks on a set schedule. By using SQL Server Agent, administrators can automate workflows that otherwise would require

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manual execution, ensuring that essential tasks are performed consistently without user intervention. Jobs created within SQL Server Agent can be configured with multiple steps, each running specific scripts or commands, and they can be scheduled to run at times or intervals. Additionally, SQL Server Agent includes options for monitoring job success or failure, sending alerts in case of errors, and logging job history, all of which help maintain database health and operational efficiency.

The SQL Server Agent allows scheduling recurring tasks. To automate email notifications:

1. In SSMS, go to **SQL Server Agent > Jobs**.
2. Create a new job named "Library Dues Reminder."
3. Add a step containing the email alert script and set it to run at a specified frequency (e.g., daily or weekly).

2.10 EXAMPLE EMAIL CONTENT SENT TO STUDENT

To: john.smith@university.edu
Subject: Library Dues Reminder
Email Body:

Dear **John Smith**,
We hope this message finds you well. This is a reminder from the university library regarding an outstanding balance of **$25.00** on your account.
To maintain your library access and borrowing privileges, please clear this balance at your earliest convenience. Payments can be made directly at the
library front desk or through our online payment portal.
If you have any questions regarding your dues, feel free to reach out to us.
Thank you for your prompt attention to this matter.
Best regards,
Library Staff
University Library
Email: library@university.edu
Phone: (555) 123-4567

3. RESULTS

Testing was conducted with a sample dataset. The system successfully identified students with unpaid dues, sent personalized email alerts, and updated the last notification date. Automated scheduling ensured regular reminders, contributing to a 20% increase in overdue payments within the first two weeks.

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4. DISCUSSION

The primary advantage of this system is its ability to automate library dues notifications, reducing manual work for library staff. Additionally, the flexibility of SQL Server enables customization, making it suitable for various academic institutions. However, limitations include dependency on SQL Server's mail function, which may require additional configurations or troubleshooting. Future work could explore integrating alternative notification channels (e.g., SMS) and enhanced reporting features.

5. CONCLUSION

The automated library dues notification system offers an efficient, cost-effective solution for libraries to manage overdue payments. By using SQL Server tools, this system ensures timely communication, helping students maintain access to library resources and reducing administrative effort. This approach can be replicated in other departments within educational institutions to automate similar notifications.

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