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A MERN based Web Application for Analysing Student Dropout

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Abstract

The technological advancement has led to the rapid changes in education system, enhancing the student's engagement and improving personalized education. However, one major challenge that is faced by the school is students leaving before completing their courses. The proposed system aims to address this issue by identifying the various factors that lead to the student dropouts. The user-friendly website developed in the proposed work allows both students and educational institutions to provide the reasons for student dropouts. The system is designed to analyse the collected data, extract valuable information, and identify hidden patterns. These insights are then presented as visuals, such as charts and graphs, to help better understand the underlying causes of dropouts. The primary objective of the proposed system, developed using MERN, is to create a more inclusive and supportive learning environment that focuses on both student academic achievement and safety. Ultimately, this system aims to reduce dropout rates and improve access to quality education for all students, regardless of their background or circumstances.

Keywords: Student Dropout, MERN, Data Analysis, Dropout Prevention, Education System.

1. Introduction

Technological advancement has transformed the way the education is delivered and experienced. The process of imparting knowledge has taken a new direction due to the emergence of digital tools, online platforms, and data-driven methodologies [1]. Despite technological advancements, a major challenge faced by schools is students dropping out of the school before completing their education. This prevents schools from providing equal and

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high-quality education for all students, as it prevents the ability to fully take advantage of available education opportunities [2].

It is essential to understand and identify the reasons why the students leave school without completing their courses. This analysis will help in developing strategies and educational environments that can better accommodate and support all students [3]. Another study has shown that individuals from underrepresented communities, lower-income families, or marginalized groups have higher dropout rates than other groups [4]. The COVID-19 pandemic has further exacerbated these disparities, emphasizing the need for systematic approach based on data analysis to support these populations [5].

To overcome dropout issues, the proposed system aims to directly address this problem with a thorough, data-centric strategy. The solution revolves around a user-friendly website, which serves as a collaborative hub for students and institutions to exchange insights on dropout cases [6]. It reveals trends and patterns that may not be visible using traditional methods [7].

The valuable insights gained from the data analysis are represented in form of charts, graphs, and dashboards [8], which assist the decision-makers to identify the area needing attention [9]. Additionally, the approach enhances collaboration and engagement, allowing stakeholders to actively design solutions that address the specific needs of their communities [10].

Furthermore, the proposed approach aims to address the persistent issue of student's dropout [11] in schools and universities by analysing the reason and providing the possible solutions [12]. The primary objective of the proposed system is to reshape education, ensuring equal opportunities for all students, regardless of their background or situation [13].

1.1 Objective of the Proposed System

The objective is to develop a comprehensive system designed to address the challenge of student dropout rates in educational institutions. The primary goal is to identify and understand the underlying factors contributing to student dropouts. This involves creating a user-friendly website platform that facilitates collaboration among students, and the educational institutions.

2. Related Work

The related work emphasizes the need to analyse the student's withdrawal and the underlying issue to be considered in creating the review form in the website. This analysis is based on the existing researches and the national sample survey conducted by ministry of education in the year 2014. Moscoviz et al. [14], suggests that the Government and NGO collaboration is essential for ensuring education for all, requiring initiatives like free education, increased scholarships, awareness campaigns, and teacher training. Kristof De Witte et al [16], addresses the problems associated with school dropout, addressing underlying issues and methodological concerns. The survey [17] reveals that 4.3% of children in this age group of 6-13 were out of school, with significant variations across states underscoring the ongoing challenges in ensuring universal access to education. Mahrool and Farwis et al. [18]. discusses the long-term consequences of dropping out of school, which far outweigh any short-term benefits, emphasizing the critical importance of ensuring access to quality education for all individuals.

The study in [19, 15] and [20] emphasizes the importance of identifying dropout predictors and promoting school completion to address societal challenges and calls for increased attention to enhance student diligence

3. Proposed Methodology

The proposed methodology utilizes the MERN (MongoDB, Express.js, React.js, and Node.js) technology stack to create an integrated platform for data collection, analysis, and visualization. Data collection is facilitated through user-friendly survey forms accessible through the website platform. The collected data is stored using the MongoDB, while Node.js, and Express.js are used for data processing and server-side logic. In-depth data analysis are performed employing additional libraries or tools to perform specific analytical tasks. React.js is employed to visualize the analyzed data, presenting it in visually engaging charts and graphs. Additionally, the system incorporates role-based authentication using NextAuth.js to ensure secure access control.

The proposed system aims to address high student dropout rates in schools. It uses the MERN (MongoDB, Express.js, React.js, and Node.js) technology stack to create a website. The website serves as a central space where students and schools can work together to find out

why student dropouts [2]. The platform is easy to use and encourages open communication, allowing everyone involved to better understand the reasons behind dropout rates [4].

When the data is submitted through the website, it's analyzed using the MERN stack software tools. The data is stored in MongoDB. Express.js and Node.js find and process the data, while React.js helps make it easy to see the results with charts and graphs. This lets people in charge find trends, patterns, and relationships in the data. The Figure 1 illustrates the process of managing institution and government interactions with students through a survey system, with a database at the center for storing and managing data.

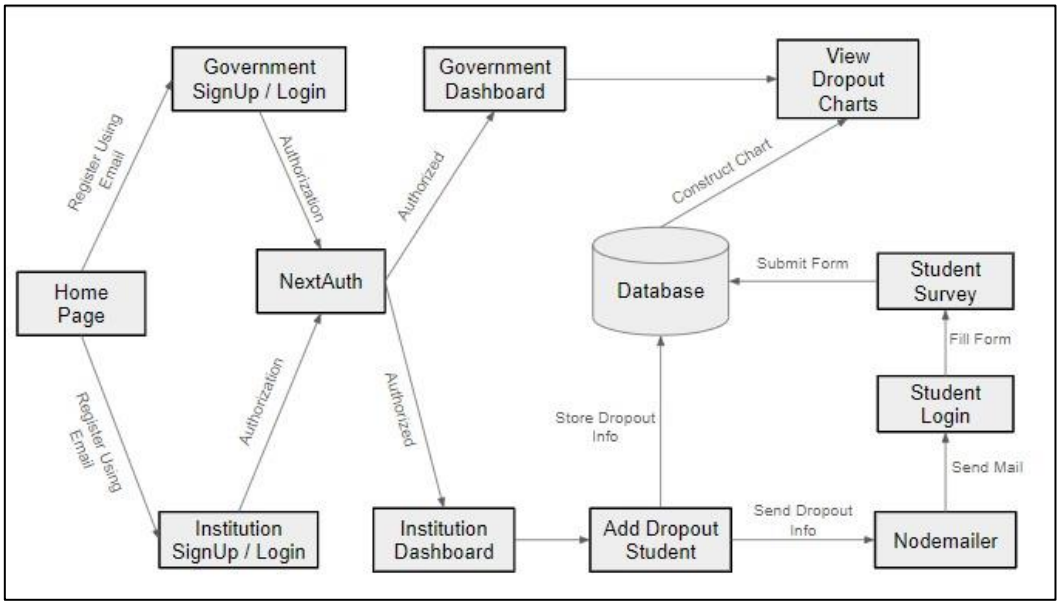

Figure 1. Flowchart

Under the proposed system, government bodies play a pivotal role in supporting schools and colleges. They use data analysis to identify key areas of improvement and develop targeted interventions to address them. This collaboration between government agencies and educational institutions creates a cohesive ecosystem focused on enhancing student success and well-being. The government's active involvement enables data-driven decision-making and policy implementation to reduce dropout rates and improve student retention.

Additionally, the system enables learners to actively participate by asking them to explain why they dropped out. By verifying credentials, the system guarantees the credibility and accuracy of student-provided information. This strategy encourages student engagement

and participation, ensuring that their perspectives and concerns are acknowledged and addressed.

The system not only tackles current student dropouts but also takes proactive steps to prevent future dropouts. By examining past data and spotting early warning signals, schools can give at-risk kids timely assistance and support systems, reducing dropout

3.1 Working

The system starts on the Home Page, from there, users can proceed to Register Page. The institutions can select an Institution Login / Signup. This takes institutions directly to the Institution Dashboard; this data is then used as the input to start the Institution Survey for information stored in the database. After completing the survey, institutions send emails to students, prompting them to complete the Student Survey, which is also stored in the Database. Government users, upon clicking on the Government Login/Signup button, navigate to the government dashboard, from where they can see drop-down charts according to city survey data. The database creates a seamless connection that stores data from institutions, students, and the government effectively.

The data collected includes information such as dropout date, religion, age, gender (selected through radio buttons for Male, Female, or Other), socioeconomic status, type of school attended (Public or Private), details of previous academic performance, reason for dropout (selected from a dropdown list of predefined options such as lack of interest, academic difficulties, family issues, etc.), future plans, employment goals or plans for further education or training, and plans for further education or training. This dataset is stored using MongoDB and processed using Node.js and Express.js to identify trends and patterns, facilitating informed decision-making. Additionally, the database connects the system's components, enabling smooth data exchange and integration [21]. The Table .1 below illustrates the use of MERN stack and NextAuth.js in developing a scalable and secular system for managing the student’s surveys, dropout analysis, and institutional and government dashboards.

Table 1. Software’s Used

Purpose	Tools used	Uses
Authentication	NextAuth.js	manages the flow of authentication, including

		secure sign-up and login options through email and password or OAuth providers (like Google and Facebook).
Frontend	React.js	Used in the development of dynamic, interactive user interfaces, such as surveys and dashboards.
Backend	Node.js and Express.js	Manages API routes, handles business logic, processes survey submissions, and manages user data.
Database	MongoDB	serves as the primary storage solution, managing user collections, survey administration, and analytic data.
Email	NodeMailer	Responsible for sending survey invitations to students with secure links.

4. Results and Discussion

The primary objective of the proposed system is to develop an efficient, scalable, and secure user-friendly interface that enables students, institutions and the government to comprehensively analyse student dropouts. The system, developed using MERN stack, is designed to collect a survey response from the student who has left the institution before the completion of the course. The data from the survey is analysed and processed by the system, and presented in form of graphs and charts that are easily understood. This helps the institution and the government to implement measure to reduce the dropout rates. The results in Figure 2-9 presents the homepage, student survey form, and the government login and the dashboard that visualizes the student's dropout through graphical representations.

Figure 2. Home Page

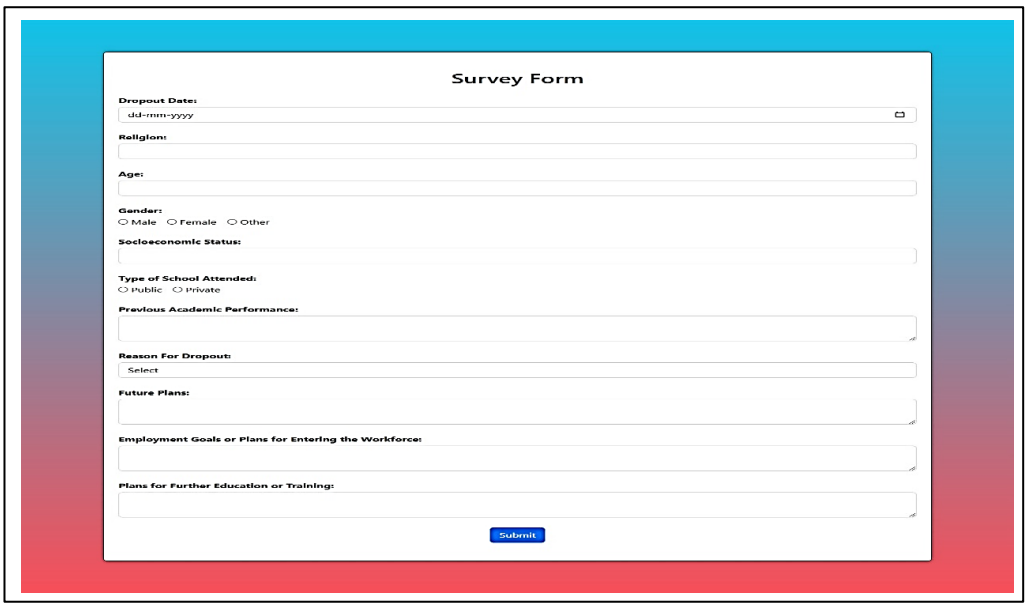

Figure 3. Students Survey Form

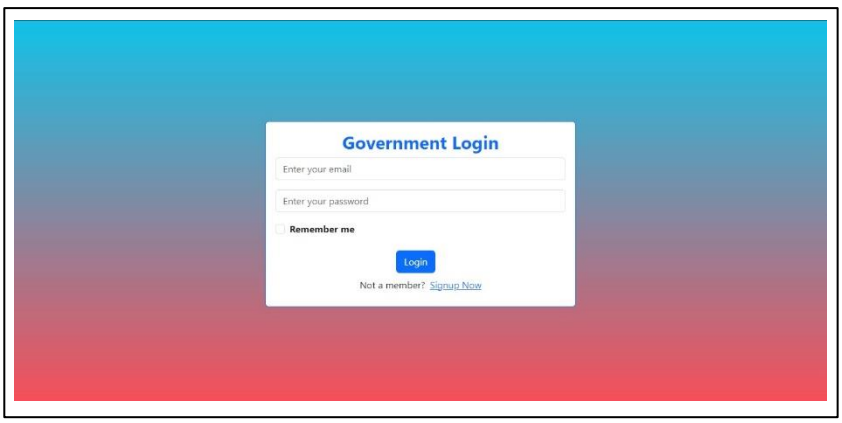

Figure 4. Government Login

Figure 5. Government Dashboard

Figure 2 illustrates the government's student dropout analysis dashboard, which is designed to help policymakers understand and address student dropout rates. This dashboard equips you with the knowledge to create effective strategies for keeping students in school and maximizing their educational opportunities. Charts allow users to delve into specific data and trends. The dashboard provides policymakers with up-to-date insights for informed decision-making. Data analysis aids in designing targeted interventions to reduce student dropouts. Collaboration with educational institutions and stakeholders is essential for implementing proactive student support measures. The dashboard tracks intervention effectiveness, allowing for continuous data analysis and refinement of strategies.

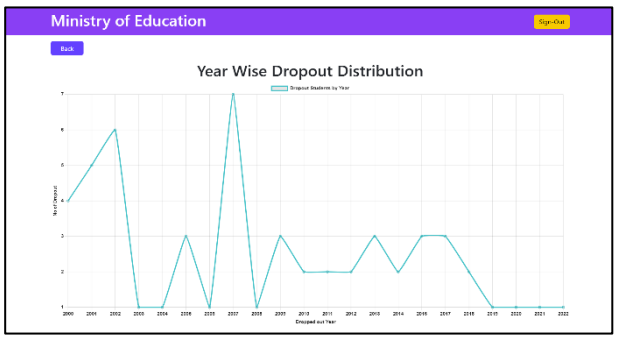

Figure 6. Year Wise Dropout Chart

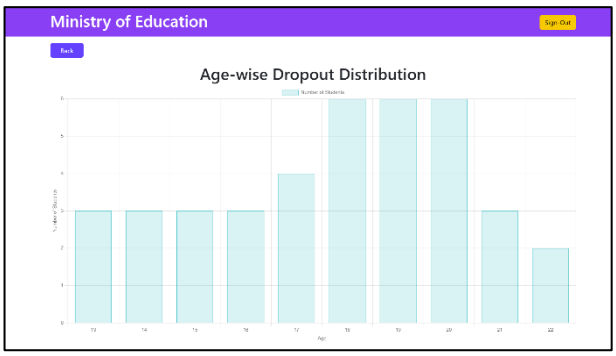

Figure 7. Age-Wise Dropout Chart

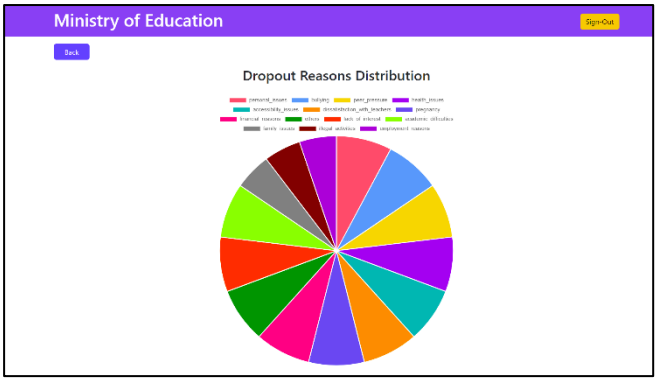

Figure 8. Dropout Reason Chart

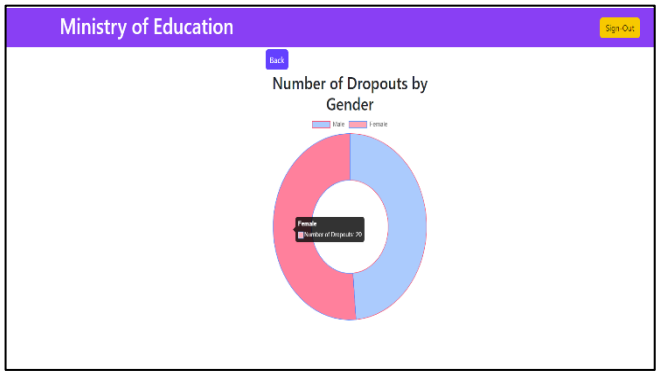

Figure 9. Gender-wise Chart

Figure 6 shows how school dropout rates change over time. This helps policymakers see changes and patterns in dropout rates, so they can take steps to fix the problems that cause dropouts. Figure 7 shows how many people of different ages drop out of school. By finding out which age groups have the most dropouts, policymakers can make plans to help those students, depending on where they are in their education. Figure. 8, This chart helps identify the reasons students give for leaving school. By understanding the main causes of student dropout, decision-makers can plan actions to address these issues, and the dropout details can be placed using multichain for cross-layer communication by all educational institutions in the future. Figure 9 This chart shows differences in dropout rates between boys and girls. It is important to create fair policies and interventions that give all students the same chance to get an education.

4.1 Benefits

The proposed method offers several significant benefits. By assisting educators and decision-makers in identifying students at risk of leaving the school, it facilitates early intervention and ensures timely and effective support to keep the students engaged in their studies. By analysing patterns across different student groups and an examining the reasons behind student dropouts, the system simplifies the creation of customized interventions to address specific problems. The information generated also helps education authorities allocate resources optimally, focusing assistance on areas with the highest dropout rates or most urgent requirements. Additionally, by providing thorough data on dropout rates and the factors that contribute to them, the system supports data-driven decision-making by enabling decision-makers to make informed decisions about the allocation of resources, the execution of programs, and the development of educational policies.

5. Conclusion and Future Work

The proposed system aims to address the serious problem of students dropping out by combining collaboration, data analysis, and visually appealing graphics. Students and schools can use the website to share their experiences, to uncover the reasons behind student disengagement. This helps us better understand why students are leaving school. The data analysis enables to find trends and patterns, which are presented in clear charts and graphs to assist students, parents, and teachers in making informed decisions to keep students in school. In the future, the integration of the blockchain technology is planned to strengthen the security

and accuracy of collected and distributed data. Furthermore, future research could focus on expanding the scope of the system to include predictive analytics capabilities, allowing for the early identification of students at risk of dropout. By utilizing the machine learning algorithms and predictive modeling techniques, the system can anticipate dropout incidents before they occur, enabling proactive interventions. The combination of blockchain and predictive analytics holds great potential for enhancing student dropout analysis. This continuous innovation and collaboration cab further enhance the educational environment that supports all students and promotes their well-being.

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