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Future of Diploma Education: A Comprehensive Solution for Practicing Programming, MCQ, Note Creation, and Institutional Mapping.

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Abstract: *Modern educational software often prioritizes automated solutions and high performance hardware, inadvertently encouraging passive learning and creating accessibility barriers for students on budget end devices. This paper presents Lucid Deck, an all in one, browser based academic toolkit specifically engineered for the Maharashtra State Board of Technical Education (MSBTE) ecosystem.*
The core challenge addressed is the "copy paste" culture in programming; unlike traditional IDEs, Lucid Deck implements a specialized coding environment that disables clipboard operations, forcing manual syntax entry to optimize cognitive retention and muscle memory. Beyond this learning approach, the system integrates a data driven admission explorer that utilizes real world DSE CAP1 and CAP2 round cutoff data to map student percentiles and categories to eligible college branches. To further support exam readiness, the platform provides a localized MCQ module covering core diploma subjects such as BEE, BSC, EES, ETI, and MAN for Computer (CM) and Information Technology(IF) branches.
By incorporating a digital whiteboard for visual derivations and circuit sketching, the platform eliminates the need for heavy, storage intensive software like VS Code or Eclipse. This paper demonstrates that a zero installation, lightweight architecture can effectively bridge the digital divide while transitioning students from passive content consumption to active, deliberate practice

Keywords: MSBTE, DSE Cutoff, Active Learning, Browser based Code IDE, Maharashtra Diploma, Learning Approach

I. INTRODUCTION

The modern educational landscape for technical students is often divided between high performance professional software and automated learning tools that prioritize convenience over deep understanding [1]. Lucid Deck is developed as a student focused, all in one academic toolkit specifically engineered to meet the unique requirements of engineering and diploma students under the Maharashtra State Board of Technical Education (MSBTE). While traditional study platforms often provide generalized content, Lucid Deck consolidates localized academic resources into a single, browser based environment [1]. This approach is designed to bridge the gap between technical accessibility and active learning, ensuring that students in the Maharashtra technical circuit have a dedicated platform for their specific curriculum and admission needs.

A primary challenge addressed by Lucid Deck is the growing "copy paste" culture in programming education. Most modern Integrated Development Environments (IDEs) like VS Code or Eclipse are designed for professional efficiency, offering features that allow students to complete assignments without truly grasping the underlying logic. Lucid Deck disrupts this cycle by implementing a specialized coding environment that intentionally disables clipboard operations. By forcing students to manually type every line of code, the platform fosters better cognitive retention, forces engagement with syntax, and builds the muscle memory necessary for effective problem solving [2][3]. This

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shift from passive consumption to deliberate practice is central to the platform's goal of making students truly understand what they write rather than blindly dumping solutions.

Beyond programming, the platform integrates critical data driven tools and visual workspaces tailored to the local academic ecosystem. It features a college admission explorer that utilizes real Maharashtra DSE CAP1 and CAP2 round cutoff data, allowing students to map their percentiles and categories to eligible college branches with precision [5]. For exam readiness, the system provides a localized MCQ module covering core diploma subjects such as BEE, BSC, EES, ETI, and MAN specifically for Computer (CM) and Information Technology (IF) branches [4]. To complement these features, a built in digital whiteboard allows for the sketching of circuit diagrams and mathematical derivations, providing a comprehensive workspace for problems traditionally solved on paper [1].

The technical architecture of Lucid Deck is specifically optimized for inclusivity and performance. Many students rely on budget friendly or low end devices where heavy software installations lead to significant lag or storage issues. By running entirely within the browser with no installation required, Lucid Deck remains lightweight and accessible from any device with internet access [1]. This ensures that academic success is determined by a student's effort and logic rather than the hardware specifications of their computer. Ultimately, Lucid Deck serves as a free, high performance bridge that transitions students from being passive consumers of content to active, engaged participants in their own technical education [2][3][4].

II. MOTIVATION

The motivation behind Lucid Deck is driven by the need to combat the growing "copy paste" culture in technical education, which often results in students completing tasks without actually understanding the logic. By creating an environment that discourages passive shortcuts and requires manual input, the project aims to shift the focus back to active learning and cognitive retention. The goal is to ensure that students develop the fundamental muscle memory and problem solving skills necessary for a successful career in engineering, rather than just finishing assignments.

Additionally, this project is motivated by the desire to provide high quality, localized academic resources to students who may be limited by budget end hardware. Many professional development tools are too heavy for low specification devices, and global platforms often lack the specific data required for the MSBTE curriculum and DSE admissions. Lucid Deck fills this gap by offering a lightweight, zero installation toolkit that is tailored specifically to the Maharashtra (MSBTE) education system, ensuring that every student has access to the right tools regardless of their financial or technical constraints.

III. LITERATURE SURVEY

Manvi Godbole et al. proposed Sketch Sync, a real time collaborative whiteboard web application developed using Next.js [1]. Their research introduced a browser based whiteboard that utilizes WebSocket communication to achieve low latency collaboration. The system effectively demonstrates that lightweight web applications can support complex academic interactions without the necessity of heavy software installations. This architectural approach provides a technical foundation for the browser based, zero installation framework adopted in Lucid Deck.

Seymour Papert detailed the Constructionism Theory in his seminal work, Mindstorms: Children, Computers, and Powerful Ideas [2]. Papert emphasized that the learning process is most effective when students are actively involved in constructing knowledge rather than passively consuming information. This educational philosophy directly supports the design of the Lucid Deck Code IDE, which intentionally restricts copy paste functionality to encourage active typing and promote a deeper cognitive understanding of programming logic.

John Sweller proposed Cognitive Load Theory [3], which posits that meaningful learning is significantly enhanced when unnecessary cognitive shortcuts are minimized. By preventing the blind copying of solutions, Lucid Deck increases active student engagement and improves conceptual clarity during programming practice. This ensures that the learner's cognitive resources are focused on understanding syntax and logic rather than superficial task completion.

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Henry L. Roediger III and Jeffrey D. Karpicke introduced the concept of Test Enhanced Learning [4], demonstrating that active retrieval practice improves long term retention more effectively than repeated study sessions. This pedagogical principle forms the core of the Lucid Deck subject wise MCQ practice module, providing MSBTE diploma students with a structured method for reinforcing their knowledge through active testing.

Furthermore, research in Educational Data Mining highlights the critical role of data driven decision systems in academic planning [5]. By transforming complex historical admission cutoff data into interactive, user friendly tools, educational platforms can significantly improve clarity and decision making for students. Lucid Deck applies this data driven approach through its Maharashtra DSE CAP cutoff explorer, enabling students to make informed choices regarding their academic future.

IV. PROPOSED SYSTEM

The proposed system, Lucid Deck, is a web based platform that brings together several important study tools into one simple website. It is designed to run entirely in a browser, which means students do not need to install heavy software that takes up storage or slows down budget laptops. A core part of the system is the Code IDE, which is specifically built to block copy and paste actions. This forces students to type every line of code manually, helping them learn syntax and understand logic rather than just moving text. Alongside the editor, the Digital Whiteboard feature allows students to draw circuits, work out derivations, and solve visual problems digitally, providing a complete workspace for both coding and theoretical subjects.

Additionally, the system includes specialized tools for Maharashtra diploma and engineering students. The MCQ Practice module provides subject wise questions for MSBTE subjects like BEE, BSC, and ETI, helping students prepare for exams through active testing. To help with the admission process, the Admission Cutoff Explorer uses real DSE CAP1 and CAP2 data to show students which colleges they are eligible for based on their percentile and category. By combining these features, Lucid Deck provides a helpful, lightweight, and localized academic toolkit that helps students manage their studies and career planning in one place.

V. PROPOSED FRAMEWORK

1. Active Learning and Development Framework : The first framework provides a web based Integrated Development Environment (IDE) where the user inputs their code directly into the editor. This framework includes a specialized restriction layer that blocks copy paste actions, ensuring the user manually types the source code. The output is a live preview of the code, which helps in improving technical understanding and memory retention.

2. Academic Assessment and MCQ Framework : The second framework encompasses the subject wise practice module for MSBTE diploma students. Users select specific subjects such as BEE, BSC, or ETI to obtain a relevant set of practice questions. The framework evaluates the user's input and provides instant feedback, allowing students to prepare for their board examinations through active retrieval practice.

3. DSE Admission Strategy Framework: This third framework provides a specialized tool for admission preparation and college selection. The user provides their diploma percentile and category as input. The framework then searches through a processed dataset of DSE CAP1 and CAP2 cutoff data to generate a filtered list of colleges and branches. This allows students to create a data backed preference list for their admission process.

4. Visual Problem Solving and Efficiency Framework : The fourth framework provides a digital whiteboard for visual tasks. It allows users to input hand drawn sketches, circuit diagrams, or mathematical derivations. Because this framework is entirely browser based and lightweight, it ensures high efficiency and accessibility on low end devices, providing an output that is clear, digital, and storage free.

VI. ADMISSION DATA ANALYTICS

The data processing architecture for Lucid Deck follows a structured pipeline to convert unstructured academic PDFs into a normalized, queryable JSON format. The process is broken down into the following stages:

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Step 1: Automated Text Extraction : The pipeline begins by utilizing the pdfplumber engine to programmatically access the CAP Round 1 and Round 2 PDF documents. The system iterates through the document's page objects, extracting raw string data and consolidating it into local text repositories. This step is foundational, as it converts complex document layouts into a linear text stream compatible with pattern-matching algorithms.

Step 2: Heuristic Pattern Recognition (Regex): To translate raw text into meaningful data, the system employs Regular Expressions (Regex) to identify institutional markers. Specific patterns are defined to isolate four key entities:

• Institutional Identity: Captures the unique College ID, Name, and Management Type.

• Academic Branches: Identifies Choice Codes and specific Course Names (e.g., Computer Engineering).

• Reservation Categories: Detects uppercase strings corresponding to Maharashtra state categories (GOPEN, GOBC, EWS, etc.).

• Cutoff Percentiles: Isolates numerical values within brackets to ensure precise extraction of threshold scores.

Step 3: Stateful Parsing and Mapping : During this stage, the parse_file() function executes a stateful scan of the text. It uses a buffer-and-map logic: category headers are temporarily stored in a list, then "zipped" with the subsequent line of percentage values. This ensures a 1:1 mapping between a category and its respective cutoff score, preventing data misalignment between Round 1 and Round 2.

Step 4: Hierarchical Data Structuring : The extracted data is organized into a nested dictionary architecture. The system utilizes the setdefault() method to manage data entry efficiently; if a college or branch already exists in the memory, the system appends the new round-wise data to the existing object. This avoids redundancy and builds a comprehensive multi-round profile for every institution.

Step 5: Normalization and JSON Serialization : In the final stage, the data undergoes a structural normalization. The dictionary-based "lookup" objects are converted into indexed lists to comply with standard JSON schema requirements. This ensures the final college_data.json file is optimized for frontend performance, providing the Lucid Deck interface with a lightweight, high-speed dataset for student queries.

VII. CONCLUSION

Lucid Deck is an all in one website built specifically to help engineering and diploma students in Maharashtra (MSBTE). The platform brings together four important tools in one place: a coding editor that helps students learn better, a college admission finder using real DSE CAP cutoff data, a practice section (MCQ) for MSBTE exam questions, and a digital whiteboard for drawing diagrams. By putting all these tools on one website, students no longer need to jump between different apps or websites to find what they need for their studies.

One of the most important parts of this project is that it stops students from just copying and pasting their code. By making students type every line, the platform helps them actually understand and remember what they are learning. Because the whole system runs in a web browser, it is very lightweight and works on any device, even old or budget laptops. Overall, Lucid Deck makes it easier for students to get the right study materials and encourages them to learn by doing rather than just reading.

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