PROJECT TITLE

DESIGN AND DEVELOP OF EXAM KIT FOR CHILDREN WITH DYSGRAPHIA DISORDER

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Keywords:

Dysgraphia, Raspberry Pi, Optical Character Recognition (OCR), Machine Learning, Education Technology.

Introduction:

Dysgraphia is a neurological learning disability that significantly affects a child's ability to write clearly and efficiently. Children with dysgraphia often face challenges with fine motor coordination, making it difficult to form letters, maintain consistent spacing, and organize written content. These difficulties can result in frustration, low academic performance, and reduced self-confidence, especially when compared to their peers.

In many cases, dysgraphia coexists with other learning disorders such as dyslexia or attention-deficit hyperactivity disorder (ADHD), further complicating the child's educational experience. Traditional teaching methods—such as repeated handwriting drills or one-on-one support—can sometimes lead to stress, dependency, and a lack of engagement.

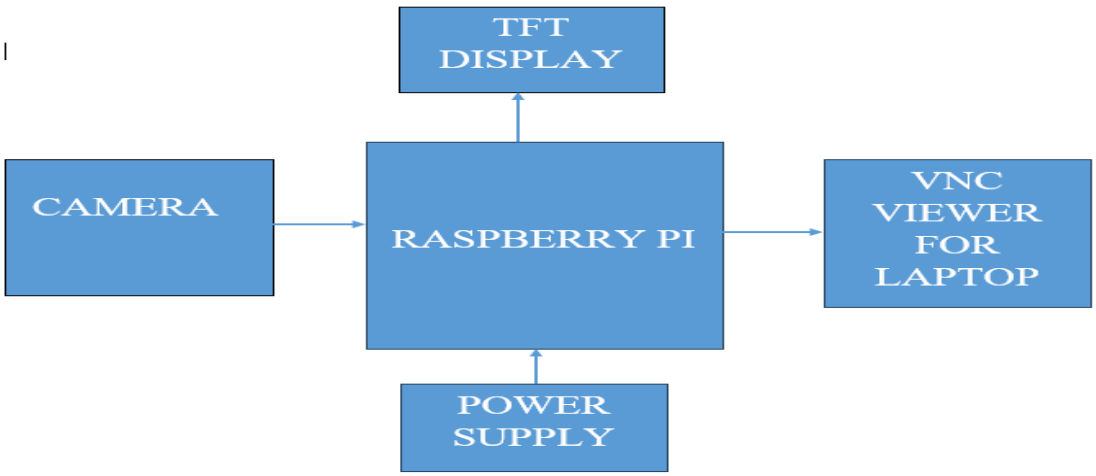
There is a growing need for more effective, engaging, and independent tools to support children with dysgraphia in their learning journey. This project proposes an innovative examination kit that uses technology, such as Raspberry Pi and artificial intelligence, to provide real-time handwriting feedback. With the integration of gamification, voice-

based assistance, and caregiver monitoring, this solution aims to create a supportive and inclusive environment for children with dysgraphia to improve their writing skills.

Objectives:

- To develop an Exam Kit that helps children with dysgraphia improve their handwriting skills using Raspberry Pi and machine learning techniques.
- To utilize Optical Character Recognition (OCR) and deep learning models to analyze handwritten text and provide feedback on issues such as letter mis formation, inconsistent spacing, and stroke direction.
- To provide real-time feedback on handwriting accuracy and offer tailored suggestions for improvement based on the analysis.
- To enhance motor control, writing skills, and overall academic confidence in children by providing a hands-on approach to improving handwriting.

Methodology:



The project of development of the Exam Kit for Children with Dysgraphia follows a structured and user-centered approach, combining hardware, software, and machine learning to provide real-time visual feedback during writing tasks. The system begins with a high-resolution camera mounted above the writing surface to capture the child's handwriting in real time. A Raspberry Pi acts as the core processing unit, handling the input from the camera, analyzing it, and displaying the results on a connected TFT or LED screen. This setup enables the system to function independently, without the need for external computing resources.

As the child writes, the camera continuously captures images of the handwritten text. These images undergo preprocessing steps such as grayscale conversion, noise removal, and edge detection to enhance clarity and prepare them for further analysis. The pre-processed images are then fed into an Optical Character Recognition (OCR) engine that extracts the handwritten text. Each character is individually segmented and processed to identify patterns, irregularities, or mistakes in the writing.

A deep learning model, trained on a diverse dataset of handwritten characters, evaluates the extracted text for issues such as incorrect letter formation, inconsistent spacing between characters or words, and improper stroke direction. By comparing the user's handwriting to ideal writing samples, the system identifies deviations and generates corrective feedback. Instead of using distracting audio cues, the system displays visual guidance on the screen—such as corrected letter shapes, alignment lines, or directional arrows—to help the child make real-time adjustments while writing.

To enhance the learning experience and avoid overwhelming the user, the feedback is presented in a clean, minimal interface. The system also stores handwriting data and tracks progress over time, enabling teachers and caregivers to monitor improvements. Settings like feedback intensity, correction frequency, and visual aid styles can be customized based on the child's developmental level and needs. The entire system is tested with actual users—children with dysgraphia—and refined through feedback from educators and therapists to ensure that it is both effective and user-friendly. This adaptive and practical methodology ensures that the exam kit supports independent learning and fosters long-term improvement in handwriting skills.

Result and Conclusion:

In conclusion, the system is designed around a Raspberry Pi, which serves as the central processing unit, responsible for handling image capture, processing, and feedback generation. A high-resolution camera is integrated with the Raspberry Pi to continuously capture clear images of the child's handwritten text in real-time. These images are analyzed using Optical Character Recognition (OCR) to extract the handwritten text.

Once the text is extracted, a deep learning model—trained to identify handwriting issues such as letter mis formation, inconsistent spacing, and incorrect stroke direction—processes the data. The system then provides real-time feedback to the child. This feedback includes suggestions for correcting the handwriting, such as improving letter formation, adjusting spacing, and refining stroke direction.

Figure 1. Hardware Implementation

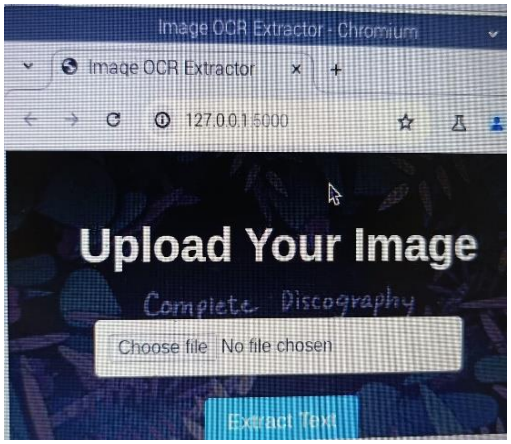


Figure 2. Software Implementation

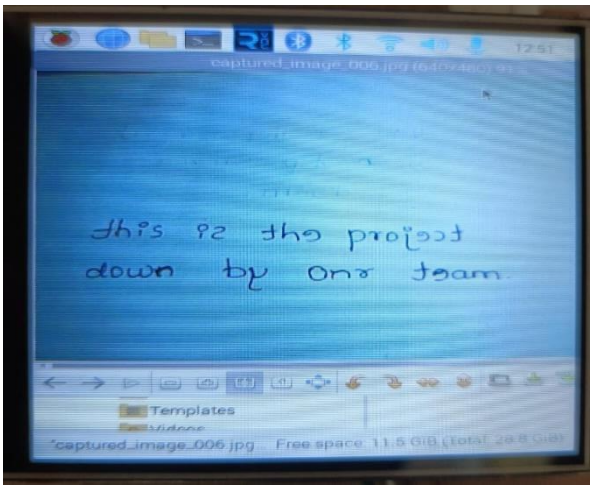


Figure 3. Image Captured

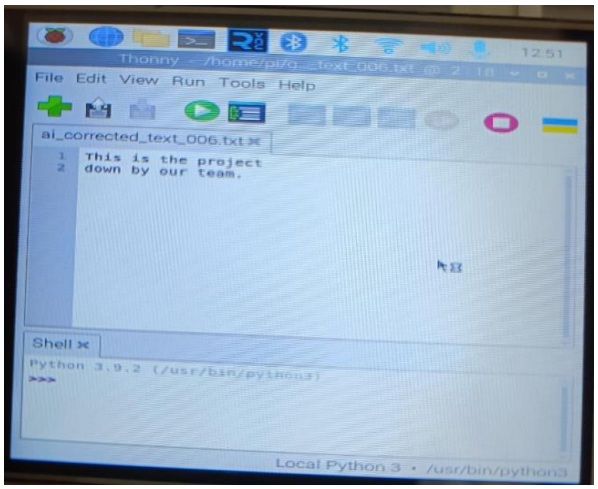


Figure 4. Image corrected

As shown in Figures 1 and 2, a fixed camera scans the handwritten page, which is briefly displayed on a TFT screen. If the push button is pressed within 2 seconds, the next page is scanned; otherwise, the session ends. The images are saved and processed using OCR and a trained model to detect and correct handwriting errors. Figures 3 and 4 compare the handwriting of a typical child and a child with dysgraphia, highlighting issues like reversed letters and uneven

sizing. Figures, and also show the original and corrected handwriting, demonstrating real-time feedback and improvement.

Future Scope:

The future scope of this project includes:

1. The Exam Kit for Children with Dysgraphia successfully offers a real-time, AI-powered solution to assist children in improving their handwriting independently. It enhances letter formation, spacing, and stroke accuracy through visual feedback and gamified interaction, making learning more engaging and less stressful. The system's ability to generate detailed progress reports allows educators and therapists to provide targeted support and track long-term improvement.
2. In terms of industry relevance, this project has potential applications in **edtech**, **special education**, and **assistive technology** sectors. It aligns with the growing demand for **inclusive learning tools** that address diverse learning needs. Schools, therapy centres, and examination boards can adopt this system to create a more equitable assessment environment for students with learning disabilities. With further development, it can be commercialized as a cost-effective, scalable product for widespread educational use.