

(54) Title of the invention : AN AI ML BASED SMART PEN FOR VISUALLY CHALLENGED PEOPLES FOR READING BOOKS AND TEXT CONTENTS USING NATURAL LANGUAGE PROCESSING

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(57) Abstract :
 For people with visual impairments, reading written materials continues to be a major obstacle, which restricts their access to independent life, education, and information. This project suggests creating an intelligent smart pen that uses machine learning, artificial intelligence, and natural language processing (NLP) to solve this problem. By instantly turning text into audio, this smart pen helps those with visual impairments read printed books and documents. The device's primary feature is a tiny camera module included into the smart pen that takes pictures of written text when the user points the pen at a book or document. To extract and digitize the text from these photos, optical character recognition (OCR) technology is used. NLP algorithms, which improve text accuracy, identify language, fix grammatical errors, and analyze the meaning of the content, are then used to refine and contextualize the digitized text. Using Text-to-voice (TTS) engines, the processed text is finally transformed into natural-sounding voice, which is then transmitted to the user via headphones or a speaker. By using machine learning (ML), the system may learn from user interactions and ambient elements like text orientations, font styles, and lighting to get better over time. Additionally, customization capabilities like language choices, speed control, and the capacity to bookmark or store items for later use can be incorporated. The smart pen is made to be portable, lightweight, and simple to use with little instruction. To change languages, repeat the previous sentence, or start or stop reading, the interface has straightforward tactile buttons or voice commands. High levels of usage and satisfaction, particularly among professionals and students, are indicated by test user feedback. From a technological standpoint, the system architecture includes camera interfacing, OCR libraries (like Tesseract), NLP tools (like spaCy or BERT-based models), embedded computing (like Raspberry Pi or Arduino with AI modules), and text-to-speech (TTS) systems (like Google Text-to-Speech or eSpeak). Low-latency audio output, power management, and data processing efficiency are important design factors to guarantee real-time usage. By giving them more access to written information, this smart pen might have a huge influence on the lives of millions of visually impaired individuals worldwide. It encourages self-reliance, promotes inclusive education, and closes the accessibility gap in both academic and real-world contexts. This AI/ML-enabled gadget is discrete, multipurpose, and scalable for a range of use scenarios, in contrast to traditional Braille systems or large screen readers. To sum up, the AI/ML-based smart pen provides a fresh and useful way for those with visual impairments to read and comprehend printed materials. This gadget can revolutionize how visually impaired people engage with the textual world by fusing OCR, NLP, and TTS into a small, clever device that makes knowledge genuinely accessible to everyone.

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