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Farmer's Smart Assistant System

Prof.S.P.Gunjal, Shivraj Kakde, Rohan Kale, Atish Kharde, Rushikesh Mate
Department of Computer Science, SKN Sinhgad Institute of Technology & Science, Lonavala, Maharashtra

Abstract- Farmer Helper App is a mobile-based solution developed to simplify identification of agrochemical products. Application integrates Artificial Intelligence (AI) with Optical Character Recognition (OCR) to allow farmers to capture images of product labels using smartphones. Captured data is processed to extract essential information including usage instructions, recommended dosage, suitable crops, and safety precautions. System architecture consists of a Python FastAPI backend combined with a Flutter-based frontend, ensuring efficient performance and user-friendly interaction. Offline functionality is incorporated, enabling usability in rural regions with limited internet connectivity. This solution provides a cost-effective and reliable approach that supports farmers in making informed and safer agricultural decisions.

Keywords- Artificial Intelligence (AI), Optical Character Recognition (OCR), Machine Learning, Smart Agriculture, Agrochemical Identification, Farmer Application, Fast API.

I. INTRODUCTION

Agriculture plays a vital role in ensuring food security; however, many farmers face challenges in interpreting information printed on pesticide labels. Misinterpretation often results in improper application, crop damage, as well as potential health hazards. Advanced technologies such as Optical Character Recognition (OCR), widely applied in document scanning and text extraction, offer a practical solution to this issue. In this work, OCR is utilized to read and interpret pesticide labels, presenting information in a simplified manner, including support for regional languages. Proposed application integrates Google ML Kit-based OCR with a Flutter framework to develop a lightweight, cross-platform mobile solution capable of functioning without continuous internet connectivity. System delivers essential details such as product name, active ingredients, recommended dosage, along with critical safety instructions, thereby enabling safer and more effective pesticide usage among farmers.

Farmer Helper App operates entirely through software, eliminating any requirement for additional hardware devices or sensors. This design approach minimizes cost while improving accessibility for farmers. Application functions as a digital assistant, delivering accurate and timely information related to proper agrochemical usage. By providing clear and structured guidance, system promotes safer farming practices while also supporting adoption of sustainable agricultural methods.

II. PROBLEM STATEMENT

Agriculture provides livelihood to millions of farmers in India; however, accurate identification and proper usage of agrochemical products remain significant challenges. Factors such as limited literacy, language barriers, as well as visually similar product labels often lead to confusion. As a result, pesticides, fertilizers, along with fungicides are frequently misused, causing crop damage, soil degradation, and potential health risks. Conventional approaches, including printed manuals or hardware-based systems,

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tend to be costly and impractical for routine use. To address these limitations, Farmer Helper App introduces a software-driven solution utilizing Machine Learning (ML) and Optical Character Recognition (OCR). Farmers can capture images of product labels through smartphones, after which application extracts relevant information, matches it with a structured database, and presents simplified guidance covering dosage, suitable crops, as well as safety measures. Absence of additional hardware requirements ensures affordability and ease of use, thereby enabling informed decision-making and promoting safer, sustainable agricultural practices.

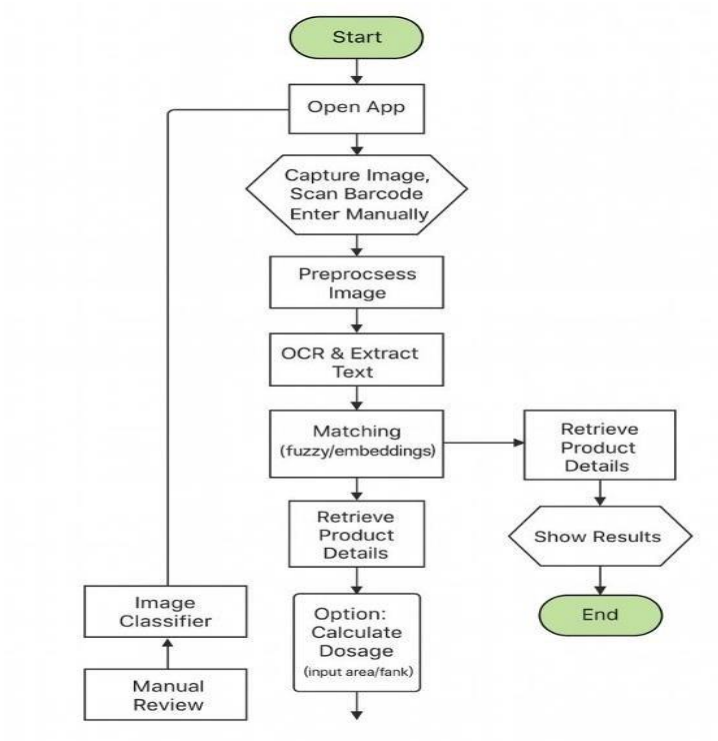

Figure 1: System Flow of the application

Flowchart illustrates stepwise operation of proposed system. Process starts when user launches application and selects an input method such as image capture, barcode scanning, or manual entry of product details. Captured image undergoes processing, after which Optical Character Recognition (OCR) extracts relevant text information. Extracted data is then compared with stored database using matching algorithms to identify corresponding product. Upon successful identification, application presents key details to user. In cases where no match is detected, system applies an image classification model or provides manual verification as an alternative approach. Additionally, application includes a dosage calculation feature based on user-provided inputs. Finally, all relevant information is displayed, completing overall workflow.

III. CONCLUSION

- Proposed system addresses common challenges faced by farmers, enabling improved decision-making while minimizing risks in agricultural activities.

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- Application promotes awareness by delivering relevant information, contributing to higher productivity along with sustainable farming practices.
- User interface, developed using Flutter, remains simple and intuitive, ensuring ease of use for first-time users.
- Integration of advanced technologies such as Machine Learning and Computer Vision enhances system capability, while FastAPI backend with database support ensures efficient data management.
- Overall design focuses on affordability, reliability, as well as scalability, making solution practical for improving agricultural efficiency.

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