Project Presentation

on

SMART AGRO-SPRAYER

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Introduction

- India has the world's largest cropland area, yet it ranks fourth in agricultural production, trailing China, USA, and Brazil.
- One key reason is the absence of Precision Farming.
- The project involves creating a SMART AGRO-SPRAYER for precise herbicide application. Conventional methods waste resources due to uniform spraying despite uneven weed distribution, leading to cost hikes, crop damage, and pollution.
- The SMART AGRO-SPRAYER, using Computer Vision and Deep Neural Networks, targets weeds accurately, aiming to cut herbicide usage by 70%.
- This cost-effective solution is ideal for small Indian farmers, enhancing precision farming.

Problem Statement

- Weeds in agriculture take away essential resources like water, sunlight, and space from crops, reducing crop yields.
- The common herbicide method in India, a broad-spectrum broadcast, lacks precision, leading to herbicides mostly settling on crops. This poses a risk to human health through food contamination.
- Manual labor invested in weed control causes economic losses for farmers, adding to the challenges faced in agriculture.
- To address these issues, there is an urgent need to develop an intelligent precision spraying system. This system should distinguish between weeds and crops, ensuring targeted herbicide application and minimizing the waste of resources.

Literature Review

ZiZheng Yu, 'Weed detection based on improved Yolov5', 2023

- The objective is to achieve more accurate and efficient weed detection in the context of grain production.
- The paper proposes an improvement to the YOLOv5 model, by replacing the 3×3 convolution with multi-head self-attention (MHSA) in the network's backbone.
- Introduce Bottleneck Transformer as a powerful backbone for improved feature extraction.
- The paper concludes that the improved YOLOv5 achieves better detection accuracy (51.4%) with a slight reduction in calculation amount.

Literature Review

Mingkang Peng, 'Weed detection with Improved Yolov 7', 2023

- An enhanced version of Yolov7 is introduced with CBAM to better detect and identify weeds against complex backgrounds.
- Online data enhancement techniques were used to improve feature extraction and fusion, leading to more accurate weed detection.
- Achieved a mAP of 91.15%, surpassing original Yolov7 and other algorithms.
- The model effectively identifies different weed species, even when they are close together, aiding the development of intelligent weeding robots.

Literature Review

Paidi Sravanthi, 'Weed Detection using CNN and YOLO frame work', 2022

- This paper focus on developing a real-time weed detection system using CNN and YOLO to enhance accuracy, reduce manual labor and herbicide use, and enable early yield prediction in agriculture.
- The proposed system utilizes Convolutional Neural Networks (CNN) with 18 layers for weed detection. The YOLO framework is employed for real-time detection, and an Unmanned Aerial Vehicle (UAV) is used for image capture.
- The study concludes that the deep learning model with the YOLO framework surpasses traditional machine learning methods, offering a more accurate and efficient solution for agricultural weed detection.

Literature Review

Victor Partel, 'Smart Sprayer for Precision Weed Control Using Artificial Intelligence: Comparison of Deep Learning Frameworks', 2019

- The objective of this research is to compare deep learning-based target detection methods for a precision weed management system.
- Compare Faster R-CNN with Resnet 50, Faster R-CNN with Resnet101, and YOLOv3 with Darknet53
- The research results showcase that :
  - Resnet50 achieves 100% metrics, making it the best-performing network.
  - YOLOv3, with optimized processing time, is a viable solution for real-time smart sprayer detection.

Literature Review

Victor Partel, 'Development and evaluation of a low-cost and smart technology for precision weed management utilizing artificial intelligence', 2019

- The objective is to minimize wastage and costs associated with uniform spraying and develop a smart sprayer using machine vision and AI for targeted weed detection and precise spraying.
- Two scenarios were tested - one with artificial plants and weeds, and another with real plants, achieving different levels of precision and recall.
- Two GPUs were evaluated, with the NVIDIA GTX 1070 Ti performing better in the challenging scenario involving real plants.
- An RTK GPS system was used to create weed maps and visualize data, enhancing the precision of the spraying process.

Existing solution

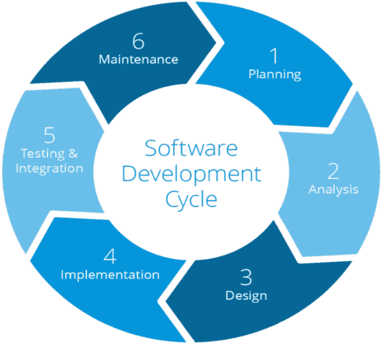
- Current farming practices in India heavily rely on widespread herbicide application without considering weed locations, leading to resource misallocation and risks of chemical residues in edible crops.
- The broadcast approach poses economic challenges due to the manual labor required for weed control, compounding the inefficiencies in agricultural processes.

Proposed solution

- The Smart Agro-Sprayer project offers an innovative solution to the longstanding problem of weed control in agriculture.
- Our solution entails the development of a cutting-edge model capable of real-time differentiation between weed and crop plants.
- Through advanced machine vision and deep learning algorithms, this model will precisely identify target weeds during their early growth stages, ensuring herbicide application is solely directed at the selected weed species.
- This approach not only minimizes the use of herbicides, mitigating environmental pollution and health risks, but also significantly reduces costs for farmers.

Software Develpoment Life Cycle

The software development life cycle (SDLC) is a structured process that is used to design, develop, and test good-quality software. SDLC, or software development life cycle is a methodology that defines the entire procedure of software development step-by-step.



Types of SDLC Models

SDLC Models:

- Waterfall Model :-
  - It is linear model
  - It is systematic and sequential model.
  - It is difficult to define all requirement at the beginning of project.
  - Model is not suitable for accomodating any change.

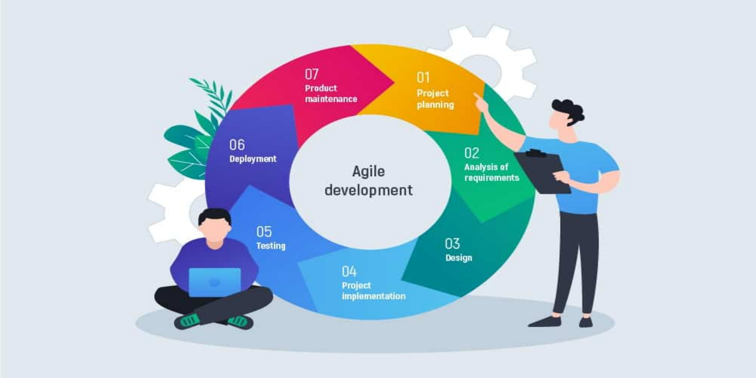
- Spiral Model:-
  - Try to resolve all possible risk involve in a project at starting.
  - It is very flexible model.
  - It requires expert for risk management.
  - It is a time and cost consuming model.

Types of SDLC Models

- Prototype Model:-
  - It is useful in the development of very large project.
  - It provide better understanding of customer requirements.
  - Developing the system may become never ending process.
  - Due to this model the cost of the project will increased.
- Evolutionary Development Model:-
  - Combination of Iterative and Incremental model.
  - It helps to elicit user requirements during the delivery of different versions of the software.
  - This model allows work broken down into maintainable work chunks

Selected SDLC Model

Agile SDLC model is a combination of iterative and incremental process models with focus on process adaptability and customer satisfaction by rapid delivery of working software product.



Selected SDLC Model

After thorough analysis and consideration, the Agile Model has been selected as the most suitable Software Development Life Cycle (SDLC) approach for the Smart Agro Sprayer project.

Reasons to use Agile Model:

- **Iterative Development:** Facilitates continuous improvement and adaptation based on feedback and evolving requirements.
- **Continuous Stakeholder Involvement:** Regular feedback ensures the Smart Agro Sprayer aligns with user needs.
- **Faster Time-to-Market:** Incremental development in Agile speeds up the deployment of essential features.
- **Risk Mitigation:** Iterative cycles and continuous testing identify and address issues early, reducing project risk.
- **Cost-Efficiency:** Agile prioritizes valuable features, managing costs effectively in the Smart Agro Sprayer Project.

Requirements Analysis

During the requirement analysis phase of our project, we focus on understanding and clearly defining how the model we are developing is going to help target farmers. It involves gathering all the necessary information and making sure we meet the needs effectively.

Developing Requirements

Hardware Requirement

- Raspberry pi V4 B+ (8GB RAM)
- External GPU (optional)
- L298 Motor Driver Module
- 2 DC Motor
- 12V Power Supply for Motor and Motor Driver

Software Requirement

- Respberry pi OS (Resbian)
- YOLO (CNN based Model)
- Dataset (Crop + Weed) :-
    -
    -
- A Custom Control Software (Python)

Running Requirements

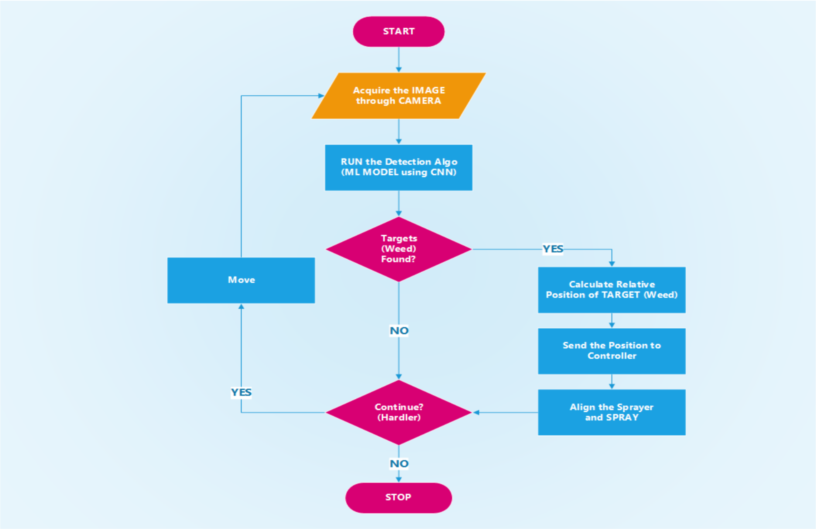
Hardware Requirement

- Arduino UNO
- Webcam
- L298 Motor Driver Module
- 2 DC Motor
- 12V Power Supply for Motor and Motor Driver

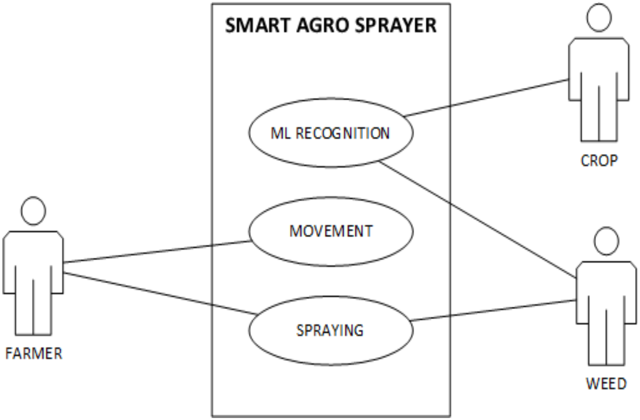
Software Requirement

- YOLO (CNN based Model)
- Dataset (Crop + Weed) :-
  -
  -
- A Custom Control Software (Python)

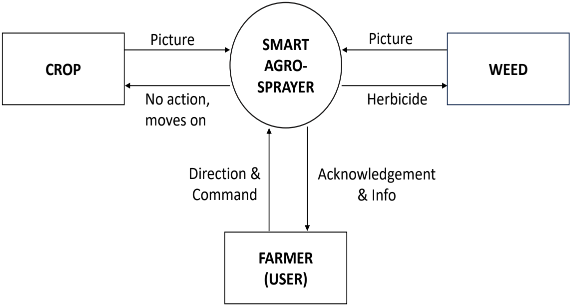
Work Flow Diagram



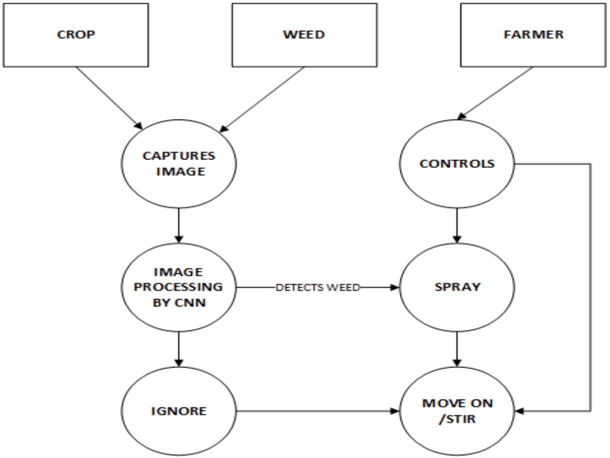
Use Case Diagram



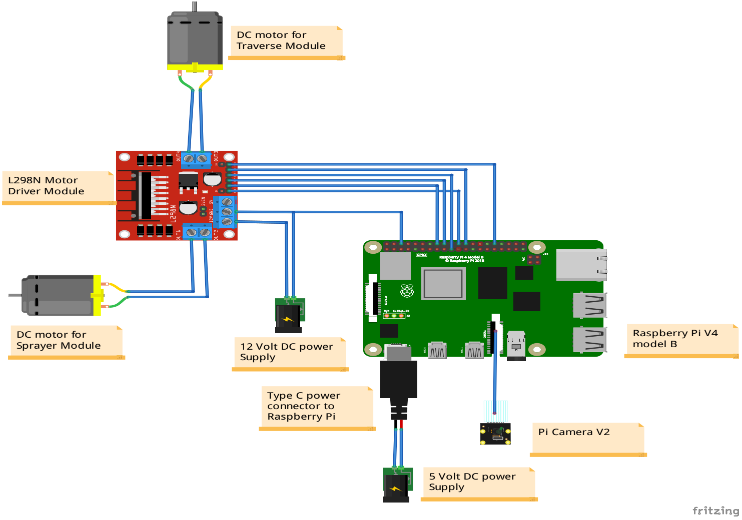
DFD 0-Level


CROP
Picture
No action,
moves on
SMART
AGRO-
SPRAYER
Picture
Herbicide
WEED
Direction &
Command
Acknowledgement
& Info
FARMER
(USER)

DFD 1-Level

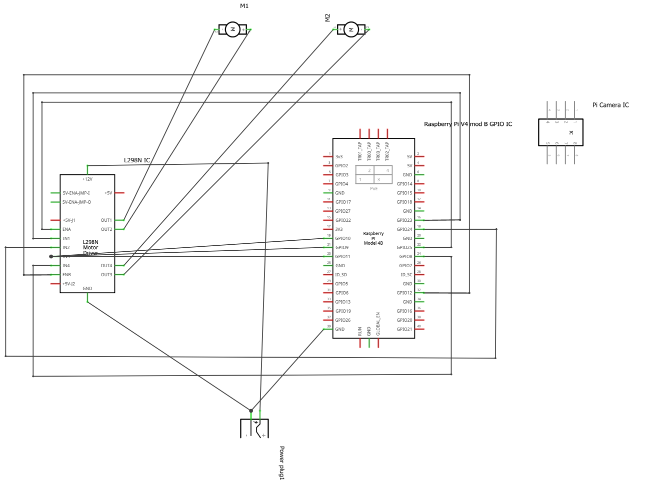

CROP
WEED
FARMER
CAPTURES IMAGE
CONTROLS
IMAGE PROCESSING BY CNN
DETECTS WEED
SPRAY
IGNORE
MOVE ON /STIR

Circuit Diagram

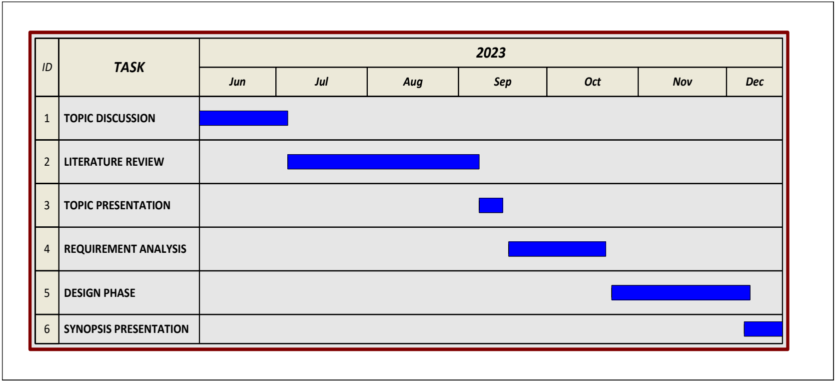


Circuit Pin Diagram

Circuit Pin Diagram



Gantt Chart


ID
TASK
2023
Jun
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1
TOPIC DISCUSSION
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LITERATURE REVIEW
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TOPIC PRESENTATION
4
REQUIREMENT ANALYSIS
5
DESIGN PHASE
6
SYNOPSIS PRESENTATION

Thank You

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