IJARCCE
ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁑ Peer-reviewed & Refereed journal ⁑ Vol. 15, Issue 4, April 2026

DOI: 10.17148/IJARCCE.2026.154112

Design And Development of Solar Powered Intelligent Weed Removal system for Sustainable Farming using ESP32

Mrs.Affrose[1], Padigelawar Hemanth[2], Vatrapu Sathya Sai Reddy[3], Routu Girish[4]

Computer Science & Engineering-Internet of Things, Malla Reddy University, Hyderabad, India[1-4]

Abstract: Farming is the source of income for more than half of the Indian population. One of the serious issues in agriculture is the control of weeds growing among the plantation crops. At present weeds are being removed manually by farmers wherever possible, or weed killers/herbicides are being sprayed all over the field to keep them under control. This technique is very inefficient because chemicals are being sprayed on plantation crops also, which leads to, polluting the environment and health problems in humans. To avoid these consequences, a smart weed control system should be deployed. This project presents a solar-powered autonomous robotic system capable of detecting and mechanically removing weeds using edge-based TinyML inference on an ESP32-CAM module. The system captures field images, classifies them using a machine learning model trained via Edge Impulse, and activates a mechanical cutter upon weed detection. The integration of renewable solar energy enhances sustainability and field usability.

Keywords: Weed Detection, TinyML, Edge AI, Real-Time Image Classification, Autonomous Agricultural Robot.

I. INTRODUCTION

Agriculture is the backbone of the Indian economy and is the main source of livelihood for more than half of the Indian population. However, one of the biggest problems in agriculture is the uncontrolled growth of weeds among plantation crops. A weed is generally described as "a plant in the wrong place." Although some plants labeled as weeds have some useful applications, among crops, they grow aggressively and compete fiercely with crops for basic requirements such as nutrients, water, sunlight, and space in the soil. If not controlled, weeds cause a substantial decrease in crop production and quality. Moreover, they provide a breeding ground for plant pathogens, are a source of pest attacks, and can even cause damage to irrigation systems and soil composition.

Weeds are currently removed either manually or by using chemical herbicides on a large scale. Manual removal is a time-consuming and labor-intensive process. On the other hand, indiscriminate use of herbicides causes environmental pollution, soil degradation, and severe health problems for human beings. Moreover, herbicides affect both crops and weeds, making agricultural practices less sustainable. Thus, there is an urgent need for a smart, automated, and eco-friendly weed removal system.In recent years, advancements in Artificial Intelligence (AI), Internet of Things (IoT), and embedded systems have enabled the development of smart agricultural solutions. Computer vision techniques combined with deep learning models such as Convolutional Neural Networks (CNN) have shown promising results in crop–weed classification. Image processing techniques, including segmentation algorithms such as the Watershed Segmentation Algorithm, further enhance detection accuracy by isolating relevant plant regions from background noise.

This paper presents a smart automated weed detection and removal system using an ESP32-CAM module mounted on a robotic vehicle that moves in the field and has a mechanical cutter attached to it. The ESP32-CAM module takes real-time images of the field, which are then processed using image segmentation and a CNN model to classify plants as either crops or weeds. Unlike the traditional Raspberry Pi-based systems, the proposed system uses mobility and mechanical functionality to remove weeds in real-time without the use of chemical herbicides. The robotic vehicle moves in the field using DC motors and motor driver modules, and the mechanical cutter is turned on when weeds are detected. This method not only reduces human labor but also reduces the use of pesticides, which is beneficial for sustainable agriculture. The system is designed to precisely remove weeds without affecting crops.

In addition, the inclusion of a mechanical cutter for the physical removal of weeds makes the system even more feasible. Instead of just identifying the locations of the weeds or spraying chemicals, the proposed system actually removes the weeds mechanically, thereby avoiding environmental pollution and the use of herbicides. The system can also be extended by incorporating other sensors such as ultrasonic sensors for obstacle avoidance and solar panels for environmentally friendly power supply. Therefore, the proposed automated weed detection and removal system is a promising solution for precision agriculture.

Furthermore, the inclusion of TinyML capabilities makes it possible to perform real-time plant classification on the edge without the need for cloud connectivity.

II. LITERATURE SURVEY

[1] Lustiness Nandurkar et al. (2014) proposed a weed detection system using Support Vector Machine (SVM). The system captured field images using a camera mounted on a mobile platform and extracted features such as color and texture for classification. Their approach demonstrated that SVM can effectively differentiate crops and weeds. However, the system required manual feature extraction and was sensitive to environmental conditions like lighting variations.[2] Ghazali et al. developed a machine vision-based automatic weeding strategy by comparing multiple image processing techniques. They evaluated segmentation methods and feature extraction techniques to determine the most effective approach for weed detection. Their study emphasized that proper image preprocessing significantly improves classification accuracy. However, their work mainly focused on detection rather than integrating a complete removal mechanism.

[3] Mary et al. proposed a robotic weeding system using Convolutional Neural Networks (CNN) for crop–weed discrimination. The CNN model was trained on a large dataset of crop and weed images, enabling automatic feature extraction. The results showed improved detection accuracy compared to traditional machine learning approaches. However, the system required higher computational resources for real-time processing.[4] Ya et al. designed a weeding robot integrated with an optimized path planning algorithm to improve navigation efficiency in agricultural fields. Their research focused on mobility and coverage optimization. While the navigation performance improved significantly, the weed detection method was not deeply explored in terms of embedded processing constraints.

[5] Yasuda et al. introduced a sweeping weeding mechanism using brush rollers for mechanical weed removal. This method was effective for crops planted in regular rows. However, it posed a risk of crop damage in irregular plantation patterns. The study highlighted the need for intelligent weed discrimination before mechanical removal.[6] Narayana et al. (2024) implemented a YOLOv7-based object detection system for high-speed weed detection and classification. The system allowed targeted herbicide spraying, reducing chemical usage compared to conventional spraying methods. Although the detection speed was high, visual similarity between crops and weeds sometimes led to misclassification.

[7] K. L. Joshitha et al. (2022) developed a Raspberry Pi-based crop and weed classification system using machine learning algorithms. The system used image segmentation and binary classification techniques based on physical parameters such as color and size. The reported accuracy ranged from 75% to 100% under controlled conditions. However, performance was affected by environmental factors and Raspberry Pi increased power consumption.[8] Hema Swathi S., Swetha B., and Subalakshmi V. (2024) proposed an autonomous weed remover using CNN implemented on a Raspberry Pi-based robotic platform. The system combined real-time detection with a mechanical weed-cutting mechanism. It successfully reduced pesticide dependency and labor requirements. However, the computational load and hardware complexity remained relatively high.

[9] Johnson et al. (2020) developed an automated weed detection and removal system using Raspberry Pi and image processing techniques such as erosion and dilation. The system enhanced plant regions before classification and activated a cutting mechanism upon weed detection. While effective, the approach relied heavily on traditional segmentation techniques, limiting adaptability in complex field environments.

[10] Parth Mahajan et al. (2024) introduced an ESP32-based autonomous weed cutter using TinyML for embedded weed detection. The ESP32-CAM module was used for image acquisition and lightweight machine learning inference. The system demonstrated low power consumption and cost-effectiveness compared to Raspberry Pi-based systems. However, further improvements in detection robustness were suggested.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.471 ⁘ Peer-reviewed & Refereed journal ⁘ Vol. 15, Issue 4, April 2026
DOI: 10.17148/IJARCCE.2026.154112

III. PROPOSED SYSTEM DESIGN

A. System Architecture

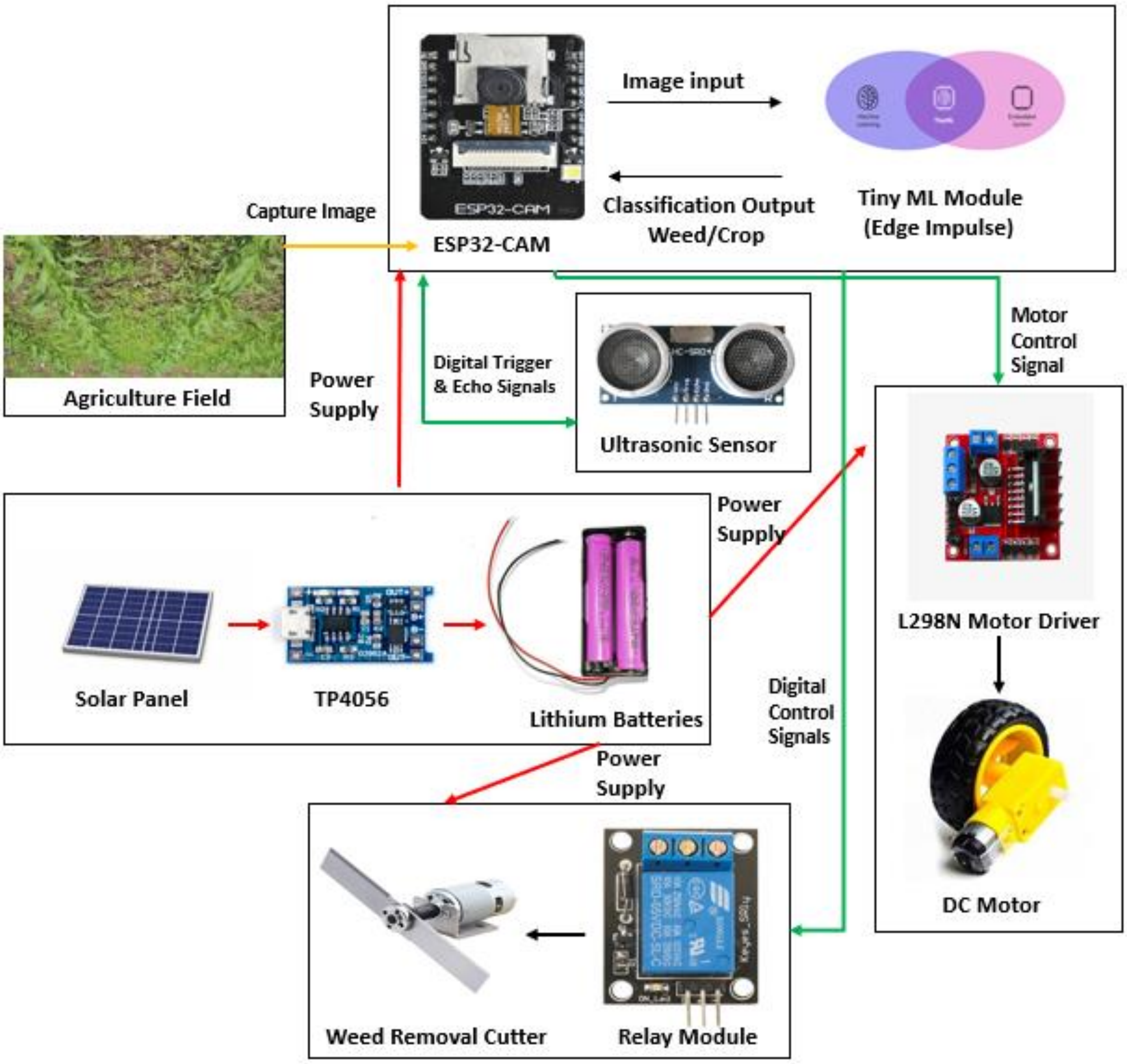

Fig. 1. Block Diagram of Solar Powered Intelligent Weed Removal System

The proposed system has six main units: the Solar Energy Unit, Power Management Unit, Edge AI Processing Unit, Obstacle Detection Unit, Motor Control Unit, and Actuation Unit, as shown in Fig. 1.

The Solar Energy Unit consists of a solar panel and a TP4056 charging module for charging lithium batteries. The stored energy sources the ESP32-CAM, ultrasonic sensor, motor driver, and cutter mechanism. The Edge AI Processing Unit revolves around the ESP32-CAM module. It uses real-time images from the agricultural field and processes them using a TinyML model developed using Edge Impulse. The model classifies the detected object as either a crop or a weed. The Obstacle Detection Unit consists of an ultrasonic sensor that calculates the distance between the robot and the obstacles. The distance value is sent to the ESP32 for processing. If an obstacle is detected within a predetermined range, the system halts or turns to avoid the obstacle. The Motor Control Unit uses an L298N motor driver to control the DC motors using PWM and direction commands from the ESP32. The Actuation Unit consists of a relay module and a cutter motor. When the TinyML model detects a weed, a digital control signal activates the relay to switch on the cutter mechanism to eliminate the weed.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 4, April 2026

DOI: 10.17148/IJARCCE.2026.154112

IV. METHODOLOGY

A. Flowchart

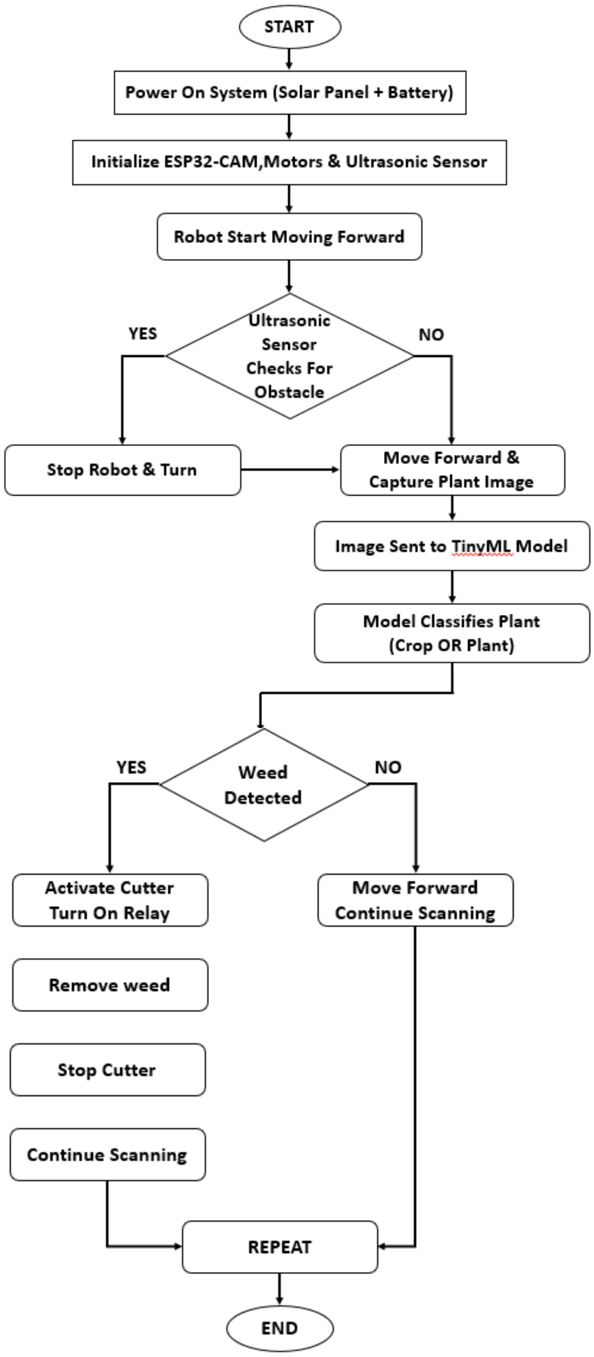

Fig. 2. Workflow of the Intelligent Weed Removal System

Fig. 2. Illustrates the operational workflow of the proposed solar-powered intelligent weed detection and removal system. The system starts with the powering of the system using a solar panel and a rechargeable battery to ensure sustainable and uninterrupted operation in the agricultural field. After the system is powered on, the ESP32-CAM, DC motors, ultrasonic sensor, and cutter mechanism are initialized. After the initialization process, the robot begins to move forward automatically. The ultrasonic sensor continuously scans the path for any obstacles; if there is an obstacle, the robot stops and turns to avoid the obstacle. If there is no obstacle, the ESP32-CAM takes a picture of the plant in front of the robot. The picture is analyzed using a TinyML model deployed on the ESP32 for real-time plant classification. Depending on the output of the model, the system determines whether the plant detected is a crop or a weed. If the plant is determined to be a weed, the relay module turns on the cutter mechanism to remove the weed, and the cutter is turned off immediately after

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁝⁝ Peer-reviewed & Refereed journal ⁝⁝ Vol. 15, Issue 4, April 2026

DOI: 10.17148/IJARCCE.2026.154112

the removal process to save energy. If the plant is determined to be a crop, no cutting mechanism is performed, and the robot continues scanning.

V. IMPLEMENTATION

A. Hardware Requirements

Fig. 3. ESP32-CAM Module

Fig. 3. shows the ESP32-CAM Module it is a small and low-cost microcontroller module that has an OV2640 camera and Wi-Fi/Bluetooth connectivity. The ESP32-CAM has the ability to perform image acquisition and processing tasks. The module has enough processing power to run simple TinyML models. The ESP32-CAM is suitable for use in edge agricultural automation systems because it consumes low power and has wireless connectivity.

Fig. 4. Ultrasonic Sensor

The Picture of the ultrasonic sensor (HC-SR04) is shown in Fig. 4. Is applied for obstacle detection and distance calculation in the proposed system. The ultrasonic sensor works by sending ultrasonic waves and determining the distance based on the time-of-flight principle of the reflected wave. The ultrasonic sensor is capable of accurate distance measurement without physical contact with the object, with a range of 2 cm to 400 cm. The application of the ultrasonic sensor improves the safety of the system by avoiding collisions when the system is self-driven in agricultural fields.

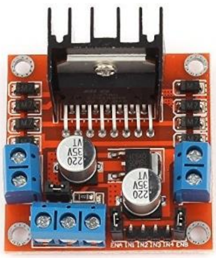

Fig. 5. L298N Motor Driver

The Fig. 5. Shows L298N motor driver module it is a dual H-bridge motor driver that is used to control DC motors in the proposed system. This motor driver module allows for the bidirectional control of the DC motor by controlling the rotation direction and speed of the motor using PWM signals from the microcontroller. The motor driver module has the capacity to drive motors with a maximum voltage of 35V and is capable of handling the current required for small robotic applications. In this project, the L298N motor driver module is used to control the DC motor that is responsible for the weed cutting mechanism and robot movement.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.471 ∺ Peer-reviewed & Refereed journal ∺ Vol. 15, Issue 4, April 2026
DOI: 10.17148/IJARCCE.2026.154112

Fig. 6. DC Motor

The Fig. 6. Shows DC motor it is applied as the main actuation device for the operation of the weed cutting mechanism and the movement of the robot. The DC motor is responsible for the conversion of electrical energy into mechanical rotational energy based on electromagnetic theory. The speed of the DC motor can be varied using Pulse Width Modulation signals via the motor driver module. The DC motor is applicable in agricultural weed removal due to its high torque and ability to rotate continuously.

Fig. 7. Relay Module

The Picture of the Relay module is shown in Fig. 7. is an electromechanical switch that is employed to control high-power loads with low-voltage control signals from the microcontroller. The relay module ensures safety in the system by providing electrical isolation between the control circuit and the power circuit. The relay module works by energizing a coil inside the relay to open or close the switching contacts. In the proposed system, the relay module is employed to control high-current components such as the DC motor or cutting mechanism.

Fig. 8. TP4056

The Fig. 8. Shows TP4056 it is a linear lithium-ion battery charging module intended for safe and efficient charging of single-cell 3.7V lithium-ion batteries. It supports constant current and constant voltage charging with overcharge and over-discharge protection . The module guarantees stable battery management and prolongs battery life. In the proposed system, the TP4056 module is employed for safe charging of the rechargeable battery that supports the solar operation.

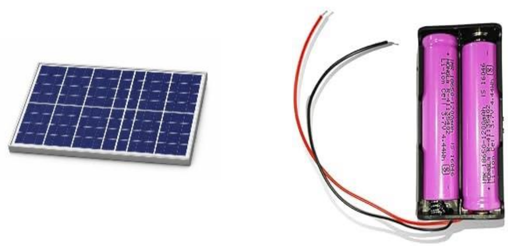

Fig. 9. Solar Panel & Rechargeable Batteries

The Above Fig. 9. Shows solar panel which is applied as a source of renewable energy to facilitate the functioning of the proposed weed removal system. The solar panel is capable of converting solar energy into electrical energy, which is stored in a rechargeable battery to facilitate continuous functioning. The rechargeable battery is applied to ensure a stable power supply in cases where there is low sunlight and to facilitate uninterrupted system functioning.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.471 ⁘ Peer-reviewed & Refereed journal ⁘ Vol. 15, Issue 4, April 2026
DOI: 10.17148/IJARCCE.2026.154112

Fig. 10. Cutter

The Fig. 10. Shows cutter mechanism it is a mechanical system that will be used to remove the weeds identified by the machine learning algorithm. The cutter mechanism will be powered by a DC motor to ensure continuous rotation for effective cutting close to the ground. The cutter mechanism will be positioned by a servo motor to ensure that weeds are selectively removed without affecting other crops.

B. Software Requirements

The Arduino Integrated Development Environment (IDE): It is employed for the development of embedded C/C++ code for the ESP32-CAM module. The IDE is a friendly platform for the integration of the TinyML model developed using Edge Impulse into the microcontroller firmware. The IDE supports the required libraries for camera, motor, and sensor communication. Moreover, the IDE's serial monitor makes it easy to debug and analyze the performance of the system

Edge Impulse: It is a cloud-based machine learning development platform that can be used for developing and optimizing embedded AI models. It provides an integrated workflow for data collection, labeling, feature extraction, and model training. In the proposed system, Edge Impulse is utilized for developing a lightweight image classification model to classify crops and weeds. The trained model is optimized for microcontroller deployment and can be executed using TinyML on the ESP32-CAM.

TinyML: It is the implementation of machine learning models on low-power microcontrollers for real-time inference. TinyML allows for the efficient execution of small neural networks with low memory and computational complexity. In the proposed system, TinyML is utilized to implement the trained weed classification model on the ESP32-CAM without the need for cloud services. The system ensures low latency, low power consumption, and is suitable for solar-powered agricultural systems.

VI. RESULTS AND DISCUSSION

The Fig. 11. illustrates the performance evaluation of the trained model for the purpose of weed detection. It is evident that the model has an overall accuracy of 97.7%, with a very low loss value of 0.06, which implies that the model is well-trained and has the capability of providing highly accurate results with a very low margin of error.

ACCURACY 97.7% LOSS 0.06

Confusion matrix (validation set)

	CROP	WEED
CROP	93.8%	6.3%
WEED	0%	100%
F1 SCORE	0.97	0.98

Fig. 11. Confusion Matrix

From the confusion matrix, a detailed performance evaluation of the model for two classes, namely Crop and Weed, has been provided. It is evident that the model is highly accurate for the Crop class, with an accuracy of 93.8%, whereas 6.3% of the crop is classified as a weed. However, for the Weed class, the model is 100% accurate, which implies that all the weed is being detected correctly without any confusion.

Moreover, the F-score for the two classes is also very high, i.e., 0.97 for crops and 0.98 for weeds, which implies that the model is providing a balanced result for the two classes. The low accuracy of the model for the crop class could be due to the visual similarity between crops and weeds, which could be present in certain environmental conditions. The results show that the system is very reliable and efficient for real-time weed detection with good classification and very few false detections. This makes the system suitable for precision agriculture.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⫶ Peer-reviewed & Refereed journal ⫶ Vol. 15, Issue 4, April 2026

DOI: 10.17148/IJARCCE.2026.154112

The below Fig. 12. illustrates a scatter plot type of visualization for the classification results obtained from the model for the given crop and weed samples. Each point in the plot represents a sample from the dataset, with different colors representing the results of the classification process. The green points represent correctly classified weed samples, while the yellow points represent correctly classified crops. The red points represent misclassified samples, where the model incorrectly classified the samples.

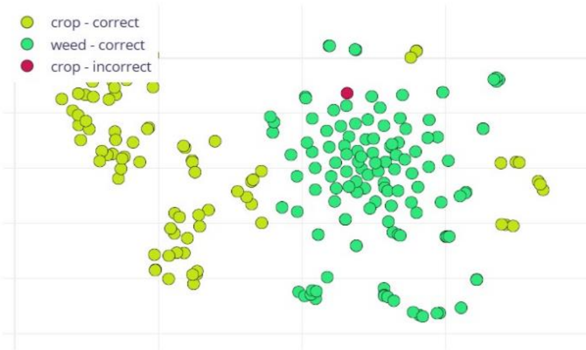

Fig. 12. Cluster representation of crop and weed samples in feature space.

From the figure, it can be observed that the majority of the weed samples are well clustered, which indicates that the model is highly efficient in correctly identifying the weeds. Similarly, the crops are also well clustered in different regions, with a small overlap with the regions of the weeds, which results in a small number of misclassifications, as indicated in the above figure by the red points. The distinction between the majority of the crop and weed data points is a clear indication of the effectiveness of the feature extraction and the TinyML model in learning discriminative features between the two classes.

The low occurrence of misclassified points further reinforces the accuracy of the system. However, the presence of a few areas of overlap indicates the influence of environmental factors such as lighting conditions or similarity of features of the plants on the performance of the model.The visualization of the model has confirmed its robustness by showing its high clustering and classification capability.

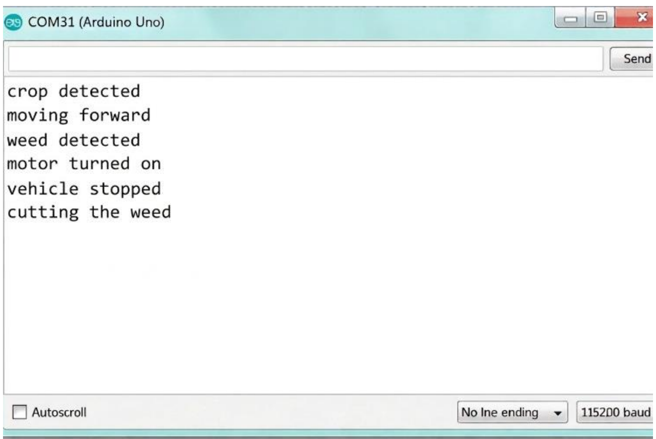

Fig. 13. Serial monitor output showing real-time weed detection and removal process.

The above Fig. 13. illustrates the output of the proposed system through a real-time serial monitor, which shows the sequential execution of the proposed algorithm. As shown in the output, the system is initially identifying the plant as a crop, as indicated by the message “crop detected.” It is also moving forward, as indicated by the message “moving forward.” However, once the plant is detected as a weed, as shown by the message “weed detected,” the system immediately starts the actuation process. As shown in the output, the cutter motor is turned on, as indicated by the message “motor turned on.” The vehicle is also stopped, as indicated by the message “vehicle stopped.” Then, the cutting process is performed, as shown by the message “cutting the weed.”

The Fig. 14. shows the detection of a crop plant by the proposed method for detecting weeds and crop plants. The image captured by the camera is passed to the machine learning model for processing and classifying whether the detected

 ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁑ Peer-reviewed & Refereed journal ⁑ Vol. 15, Issue 4, April 2026

DOI: 10.17148/IJARCCE.2026.154112

object is a crop or a weed. In the above result, it is clear that the proposed method for detecting weeds and crop plants has detected the object as a crop and has highlighted it as a bounding box containing the words “Crop.” The bounding box shows the region where the crop plant is detected by the machine learning model. The classification is done based on various features of plants such as size, shape, and color. The machine learning model has detected the crop plant precisely even though the background is soil, which is a complex condition.

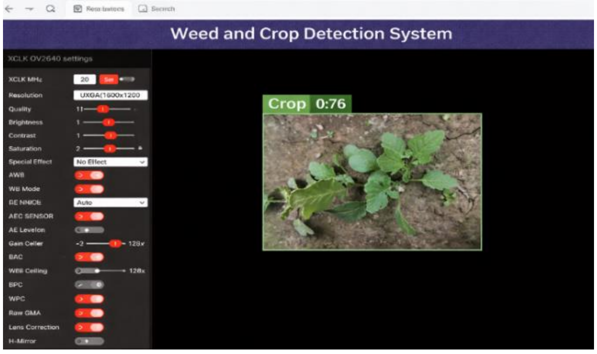

Fig . 14. ESP 32 Cam Detecting Crop

The Fig. 15. depicts the detection of the weed plant using the developed weed and crop detection system. The camera is able to capture the image of the plants present in the soil.The image is analyzed by the machine learning model. Using the features of the plant, like the shape, structure, and texture of the leaves, the model is able to detect the type of plant. The detected weed plant is marked using a box, showing the type of plant, i.e., “Weed.” This helps in the clear identification of the unwanted plants present in the agricultural field. The accurate identification of the weeds enables the system to remove the weeds without damaging the other plants. This helps in the effective management of the weeds present in the agricultural field.

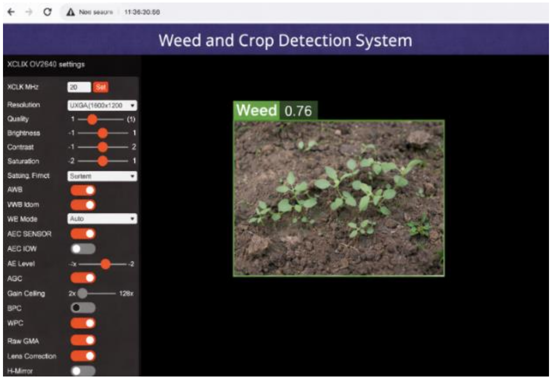

Fig . 15. ESP 32 Cam Detecting Weed

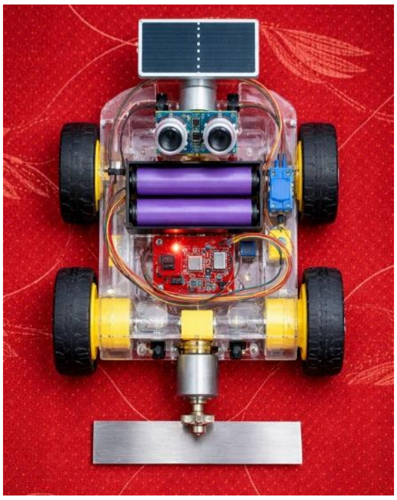

Fig. 16. Complete Prototype Setup

DOI: 10.17148/IJARCCE.2026.154112

The above figure indicates the developed weed detection and removal robot, showing the placement of all major hardware components of the system. At the rear of the system, a solar panel is fixed for providing power to the system, which is stored in rechargeable batteries placed at the center of the system for better balancing. Just below the solar panel, the ultrasonic sensor module is fixed for detecting obstacles in front of the system. The ESP32-based control unit and driver circuitry are fixed at the center of the system, ensuring better processing and control of all hardware components of the system. The system is provided with four wheels, each driven by a DC motor for smooth motion of the system on agricultural land. At the front of the system, a cutter mechanism is fixed using a DC motor, having a straight metal blade fixed at the center of the system for better cutting of weeds. The motor is fixed at a hanging position for better contact of the blade with the ground surface.

VII. CONCLUSION AND FUTURE SCOPE

This paper introduced a solar-powered weed detection and removal system using ESP32-CAM and TinyML for precision agriculture. The proposed system uses Edge Impulse to build a lightweight image classification model that can identify crops and weeds. The developed model is then deployed on the ESP32-CAM to perform real-time image classification without relying on cloud services. An ultrasonic sensor is used for obstacle detection and safe passage, and a DC motor-driven cutter system, controlled by a motor driver and a servo motor, allows for selective weed removal. The addition of solar power increases the sustainability of the system and makes it ideal for use in remote agricultural settings. The experimental results show that the proposed system offers an efficient, low-cost, and eco-friendly solution for automated weed control.

The proposed system can be further improved by incorporating state-of-the-art deep learning architectures for enhancing the classification accuracy even in varying environmental conditions. Future research work can be done by incorporating GPS and autonomous navigation algorithms for the large-scale implementation of the system in a farm setting. The inclusion of IoT-based monitoring and cloud-based data analytics can facilitate real-time performance analysis and predictive farm management. Additionally, multi-class classification can be incorporated for the classification of various types of weeds and crops. Improving mechanical design and optimizing energy management strategies can also be done.

REFERENCES

[1] Lustiness. r. nandurkar, slant. r. thool, r. tumor. thool, "plan together with situation coming from rigor horticulture technique executing trans-missions sensor network", ieee world consultation toward telemechanics, regulate, intensity also wiring (aces), 2014. Development (TIAR 2015).

[2] Kamarul Hawari Ghazali, Mohd Marzuki Mustafa, and Aini Hussain. “Machine vision system for automatic weeding strategy using image processing technique,” American-Eurasian Journal of Agricultural & Environmental Science 3, pp. 451–458, 2008.

[3] M. Florance Mary, D. Yogaraman. “Neural network based weeding robot for crop and weed discrimination,” Journal of Physics: Conference Series. vol. 1979. no. 1. IOP Publishing, 2021.

[4] Xiong Ya, Ge Yuanyue, “Development of a prototype robot and fast path-planning algorithm for static laser weeding,” Computers and Electronics in Agriculture, vol. 142, pp. 494–503, 2017.

[5] Kentaro Yasuda, Fumiaki Takashina, Yoshihiro Kaneda, and Atsuo Imai, “Weeding ability of brush roller-type paddy field weeding robot and its effect on paddy rice growth” Weed Research, vol. 62, no. 3, pp. 139148, 2017 [in Japanese]I. S. Jacobs and C. P. Bean, “Fine particles, thin films and exchange anisotropy,” in Magnetism, vol. III, G. T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.

[6] Lakshmi Narayana, “An Efficient Real-Time Weed Detection Technique using YOLOv7,” International Journal of Advanced Computer Science and Applications, vol. 14, no. 2, 2023.

[7] K L Joshitha et al “Raspberry Pi based crop and weed classification using Machine Learning Algorithm ”2022 IOP Conf. Ser.: Earth Environ. Sci. 980 012029 . 2.

[8] Hema Swathi S, Swetha B and Subalakshmi V ` Weed Remover Using Machine Learning‟ International .

[9] Rincy Johnson, Thomas Mohan and Sara Paul „Weed Detection and Removal based on Image Processing‟ International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277- 3878 (Online), Volume-8 Issue-6, March 2020.

[10] Parth Mahajan, Samarth Otari, Pratik Meshram and Krishna Mhaske “Autonomous Weed Cutter Leveraging ESP32 and Tiny ML” Grenze International Journal of Engineering and Technology, Jan Issue.

