

A STUDY AND APPARATUS OF ECO FRIENDLY FARMER ASSISTANCE ROBOT BASED ON ARTIFICIAL INTELLIGENCE

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Abstract: As per Food and Agriculture Organization, more than 60% of the world's population depends on agriculture as their livelihood. India is the largest producer globally with 25% of production. Apart, 45 farmers commit suicide every day for various reasons like daily wages to the labor, machinery, natural disasters, etc. Considering all the factors inventors designed a robot that performs various tasks like Planting, Cutting, Weed Removal, and Fertilizer Spraying. It also works as a friend with the farmer. Besides, it reduces a lot of conceptions like stress, manpower, cost, time, etc. It is capable of working in any environment and under any circumstances. It also operates in two modes Manual (Remote Control) and Automatic (Voice of Command). The major innovation is robot doesn't require internet for communication this will intent a big advantage for rural and other backward areas.

Keywords: Artificial intelligence, Robotics, Precision farming, Agriculture robot.

1. INTRODUCTION

Agriculture is one of the most essential and important fields of the economy. According to Worldbank.org, agricultural development is one of the most critical components for eradicating global poverty, and development in this sector would increase collective wealth and feed the future Population. Agriculture accounted for 4 % of the world's gross domestic product (GDP) in 2018, and can account for about 18% of the nation's GDP for countries like India [1]. Agriculture faces many threats right from sowing till to harvesting. Significant factors such as climate change, global warming, water scarcity, insect and disease infestation, overuse of pesticides, weeds, under-irrigation, and drainage, along with these labor shortage is another critical problem [2]. One of the reasons for labor shortages is that the current generation of farmer's age is rising, and when they go out of farming activities, the new generation is less likely to replace them, and this gives rise to considerable concern.

The agriculture industry and its participants are the critical drivers for environmental change, accountable for shifts toward land usage, degradation of freshwater supplies, and contamination of marine and terrestrial environments by excess use of nitrogen and phosphorus inputs. This threat is mainly due to farming activities such as forest clearing, heavy use of synthetic fertilizers, and livestock emissions [3]. For much of our history, if we wanted to grow more crops, we merely deforested to obtain more land for farming.

Agricultural activities have contributed to the destruction of entire ecosystems across the world. The forests, such as tropical forests continue to be cleared at unprecedented rates. Today, almost 500 billion hectares of land are used for agriculture, accounting for almost 40% of the world's available land [4]. Agriculture sector, a massive consumer of freshwater, accounting for 70% of all water use in the world [5]. Artificial intelligence and robotics in agriculture are bringing about a revolution. These technology are enhancing crop production and improving real-time management, harvesting, processing, and marketing. Various high-tech computer-based systems are being designed for identifying the plant's diseases, weed detection and removal, analyzing quality of produced yield [6]. Agriculture is a diverse sector, which means a common approach cannot suggest for every circumstances. The AI and robotics techniques help one to collect the details of each scenario and provide an optimal solution to a given problem. AI and robotics-based technologies have the potential to solve these problems efficiently. AI and robotics-based technologies can enable the farmer to produce more and better yield with reduced production cost and increase their profit.

The traditional farming methods are incapable of producing the food required by the future population of the world and it also risks people's health, and the planet. Some of the limitations in agriculture produces unacceptable amounts of pollution and waste. These issues have driven the agriculture sector into finding more innovative ideas and techniques for improving crop yield and protecting the ecology. Over the past century, agriculture has moved from labor-intensive to mechanization and power-intensive production systems. Although, agriculture has begun to digitize over the last 15 years. However, the development in the sector when compared to the available modern technology is very minimal. This motivated us to use the trending technology artificial intelligence as AI and robotics are a robust combination for automating any tasks. In recent years, AI has become an increasingly common presence in robotic options, introducing learning and adaptability capabilities in formerly rigid applications [10].

1.1 Problem Statement:

- There is an increasing rate of expenses for machinery and daily labor
- Shortage of agriculture labor
- During the work lot of stress and strain are faced by farmers
- Multiple equipment's used and huge loss during natural disasters
- More time consuming Labor in agricultural activities.
- Shortage of network in many rural and backward areas for automation.

1.2 Objectives:

To design and implement eco-friendly farmer assistance robot based on AI. In which robot performs various tasks like Planting, Cutting, Weed Removal, and Fertilizer Spraying. It also works as a friend with the farmer. Besides, it reduces a lot of conceptions like stress, manpower, cost, time, etc. This robot consist of a visualization machine with containing cameras is an approach for automated object detection, measurement and management of agricultural resources.

The cameras can be used to identify objects. One embodiment of the present disclosure provides the autonomous platform system to selectively manage the agricultural sector by creating an in-season task. The Raspberry-pi is programmed to operate the autonomous vehicle platform autonomously while performing a management task in the course of a season. In addition, the raspberry pi is configured to alert an operator to a navigational obstacle. It is capable of working in any environment and under any circumstances. It also operates in two modes Manual (Remote Control) and Automatic (Voice of Command). The major innovation, is robot doesn't require internet for communication this will intent a big advantage for rural and other backward areas.

2. METHODOLOGY

A robot designed to work as a personal assistant with the farmer in the field of agriculture. It consists of four modules faced to the four sides of the robot named planting, weed removal, fertilizer/water sprinkler, crop cutter. It can operate in manual mode using remote, automatic mode using voice command as input from the user. A docking assembly coupled to the frame, the docking assembly including Battery unit, the control unit for transmission of instruction in electrical communication with the raspberry-pi, docking station, configured for storing one or more fertilizer spray, Water. A multiplicity of sensors on the machine, with each of its multiple sensors electrically linked with the controller, receiving instructions from the control unit and controlling the machine, in which the PIC16f877a controller controls according to the instructions from the user.

The present disclosure describes one or more embodiments for an independent robotic machine that is capable of conducting different farming operations, such as planting, seeding, spray (application of nutrient and pest control), tillage (primary, secondary, weed control), plowing etc.[8]. A robot-autonomous or robotic operating machine is capable of performing desired tasks with minimal human guidance in unstructured or structured Run environments. In some modes of operation, the autonomous robotic work machine can be of little or no human participation.

That moment when soil sensor shows dryness in the land, the sprayer starts spraying water, and at particular intervals sprays fertilizers accordingly using relay, after the crop fully grown, robot cuts the crop using sharp blades and returns to farmer. Using computer vision (Open CV) we identify specific obstacles, the camera is used to check any small animals or human movements during the process and stops the whole functionality to avoid accidents and also stays active in the nights which helps for surveillance. All the above process can also work with voice commands, by using an application in the mobile. As in villages and rural places, the network may not be proper so we used remote functionality for farmer communication with robot.

2.1 Hardware and Software tools used

Hardware used,

- Raspberry pi3 A+
- External body chassis
- Dc Motors
- Wheels
- Pi Camera
- Blades
- Sprinkler

- Planter
- L293 drivers
- Relay board
- 6V batteries
- Pic16f877a Board
- Soil moisture sensor (Hygrometer)

Software used,

- CCS compiler(PIC)
- Thonny IDE(R-pi)

2.2 IMPLEMENTATION

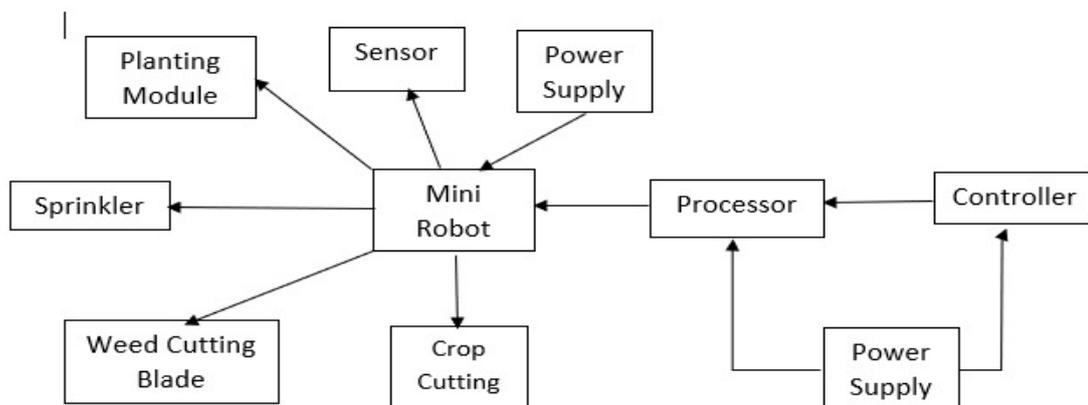


Fig 1: Block Diagram

Block diagram illustrating the entire functionality and operation includes the all modules of the proposed system, in one embodiment of the present invention. The mini robot comprising of motors, sensors, having a processor with a controller and supply power provides supply to all the modules of the mini robot. Mini robot provides the control to the following modules planting, fertilizer/water sprinkler, weeding, Crop cutting.

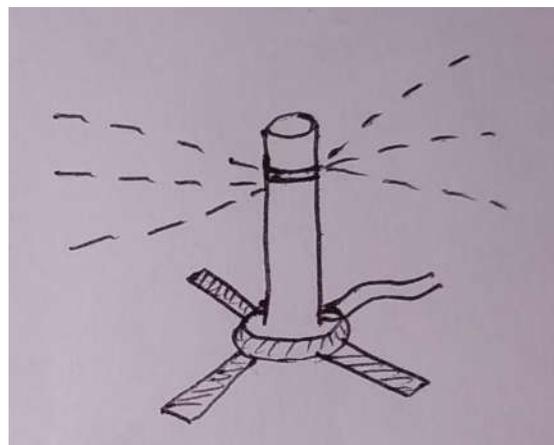


Fig 2: Sprinkler

Illustrating the following modules of the proposed system i.e. Sprinkler and visualize the module design mounted on the robot, in one embodiment of the present invention. This module used to water supply for the crop with sprinkling mechanism

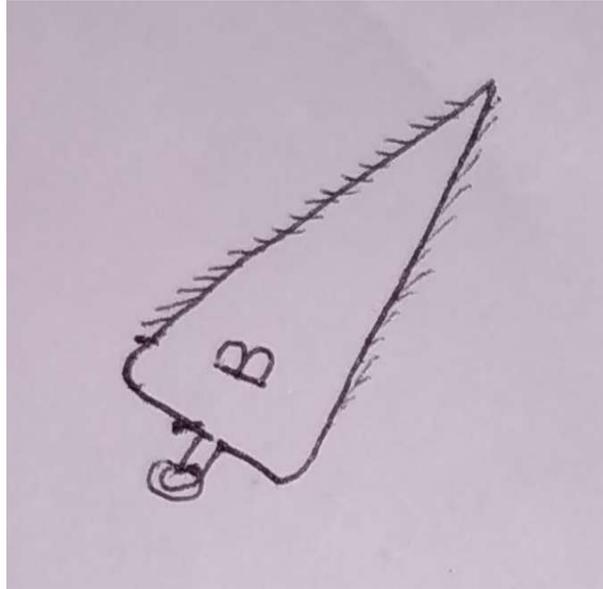


Fig. 3: Crop cutter

Illustrating the one the module of all the modules of the proposed system i.e., cutting blade. According to the user input either from manual remote or voice control specific module will perform its functionality, this module helps in crop cutting which reduces the huge man power.

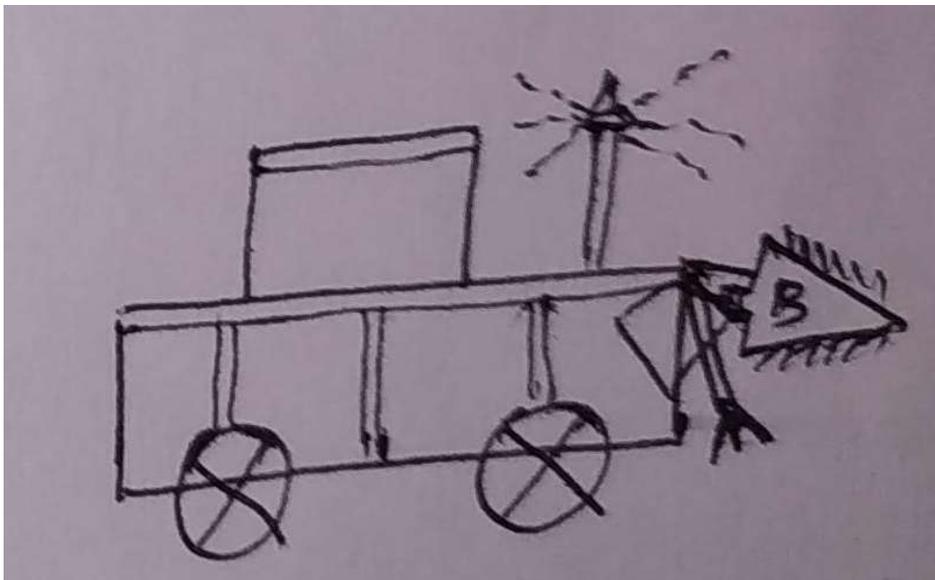


Fig. 4: Prototype

Illustrating the output design of the Mini robot with all the modules implanted in it. The four wheeled robot has all the modules surrounded to it, Sprinkler is faced on side of the robot used for fertilizer/water spray in the field, Cutter is implanted on the front side of the robot used for crop cutting in the field, weed removal is placed to the one face the robot used to remove the unwanted weed grown in the field. All the modules can be controlled using two modes either voice control or remote control.

3. CONCLUSION

This idea covers some of the vital research articles and developed solutions in the field of Ai and Robotics for the agriculture sector till today. It is created to provide a glimpse of innovations that are taking place in Ai and robotics for agriculture. Ai, Embedded systems and Sensors have played a dominant role in the development of various application in the agriculture sector. The transition from labor-intensive to advanced technology in agriculture tend to accelerate in the upcoming years and will give rise to new growth possibilities and creative business models, with a range of creative offerings in the sector. Some of the contributions include:

- As all modules are connected together multiple machinery equipment cost and maintenance is saved.
- As this prototype does most of the farming work the cost for labor and time is saved.
- Lot of stress and strain is reduced as it does the work with minimal contribution of farmer.
- With the use of camera, obstacles are detected and used also for surveillance
- As our prototype can work with remote control it will be helpful for rural and backward areas where there is shortage of network.

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