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Article

Smart Arm-Autonomous Low-Cost Device for Smart Agriculture

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I N F O

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A B S T R A C T

Agriculture is quickly changing technology to ensure reliability, reduce natural resources usage of the cost and keep up with the increasing demand for food. This is a born for large scale industries and personal agriculture like as it reduces the cost of manual labor for industries. Agriculture autonomous using Smart arm is used to condense the maintenance load with automaton of seed sowing, crop harvesting, pesticide spryer and areca nut or coconut plucking in trees. It is use in more reliable, cost effective and efficient agriculture systems. This paper presents a simplified approach to future smart arm Autonomous Agriculture. The implementation of modular farming automation system has been discussed. There is a plucking arm which provides interface of attaching new modules to the existing implementation. Low cost Zigbee technology allows an electronic device to exchange data wirelessly, including monitoring and controlling.

Keywords: Smart Arm, Modular Farming, Plucking Arm, Zigbee

Introduction

Now a days, farming is to be updated with the speedily changing technology to ensure reliability, reduce natural resources usage and the cost and keep up with the increasing demand for food. Deploying such automated wireless systems offer attractive benefits such as remote operation, security and reduces manual labor significantly. This is a boon for large scale industries and personal farmers alike as it reduces the cost of manual labor for industries which is extremely high and the most error prone section of farming due to the unavailability of skilled laborer's and even for personal farmers, it means reduced work.[1,2]

India is a major exporter of agricultural products to several nations. This is mostly due to a reliance on conventional methods, with an even greater reliance on manual labor and the monsoons, which are insufficient and unreliable sources of water, resulting in inadequate water supplies. Automation-related papers reveal new ways to save water and other resources while lowering costs.[3-5] Such technologies can encourage industries to start their own large-scale farming operations, which are still underdeveloped due to factors such as the high cost and inefficiency of manual labor.[7-9] The system's main purpose is to develop and execute a system a scale model of a cheap and open-source agriculture automation system that confirms to principles of Autonomous Robot Architecture mainly concentrating on the modular structure, centralized control of the system respectively.[10-12] This system will also provide a base and interface to design much more complicated modules and implement in the existing systems.

Proposed Work

The uses of robots in agriculture especially in seeding, pesticide apply, cutting of nuts in coconut and areca nut

tress as well as its use for the society. Because of the low cost, the technology can be used in a wide variety of wireless control and monitoring applications. In addition, the low power consumption allows for longer battery life with smaller batteries. As a result, mesh networking provides high reliability and a wider range. Low cost Zigbee technology allows an electronic device to exchange data wirelessly, including monitoring and controlling. A device that can use Zigbee can be used to move the device from a distance and to set the directions of a robotic arm which is used to spray and pluck the nuts from trees with a range of around 300 to 400 meters. The paper mainly consists of two modules transmitter part another one is the receiver part as shown in Figure 1. The transmitter part is the controlling part, which is consisting of a centralized microcontroller, the keys for giving the directions to move the receiver in different directions, a ZigBee for establishing communication between transmitter and receiver. The receiver is a device which can be used to move the device near the trees and do the different functions like spraying of pesticides and plucking of areca nuts using a robotic arm which is elevated above the ground to a height of tree tip as shown in Figure 2.

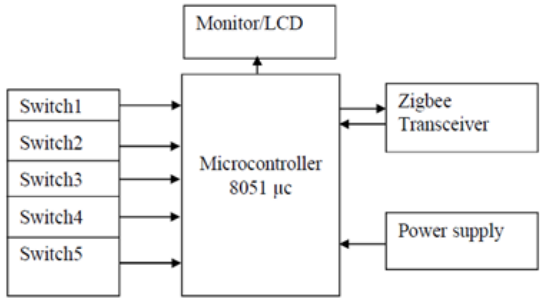

Figure 1.Block diagram of smart arm transmitter

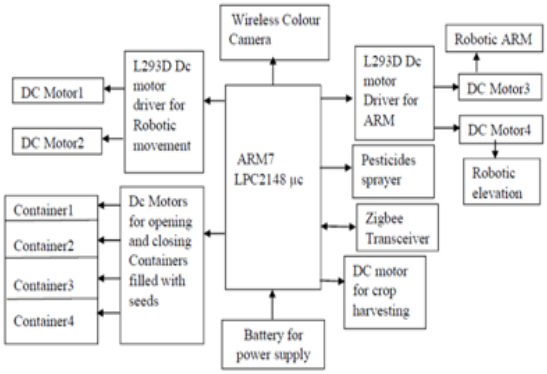

Figure 2.Block diagram of smart arm receiver

Implementation

Agricultural automation with smart arm is an effort to reduce the stress of managing a farm on a small and large scale by automating the most frequently performed tasks such as seed sowing, pesticide spraying, and harvesting and crop harvesting. In addition to all the above the architecture of smart arm is modular i.e., there is a plucking arm which provides interface of attaching new modules to the existing implementation. This arm can move in a circular and vertical direction and mounting it on a moving platform allows the device to move along three axes.

Automation is a technique, procedure, or framework for controlling or running a process using highly automated means, such as electronics devices, with minimal human interaction. Any structure composed of separate components that can be connected is referred to as modular architecture. The advantage of modular architecture is that any part can be replaced or added without impacting the rest of the system.

Automation using robots has become one of the world's fastest growing application-based innovations in the field of digital electronics and intelligent systems. The incorporation of the mobile communication technologies into the automation systems, now allows the users to use mobile application on their phone to control their farms from different geographical areas. This removes the need for the farmer to be present in the farm all the time thus provide flexibility.

Accessibility aspects of agricultural automation using robots is becoming more acceptable, considering the current demographical shift in the world which is increasingly looking forward to bringing down the laborious tasks. The various sensors can also be integrated into such systems leading to precise processing and analysis of data. The recent use of smart sensors in areas such as automotive applications, medical applications have shown progressive results in helping the analysis of data using advance software techniques such as Big Data, Machine Learning also hold a bright future for agricultural automation robots.

Result and Discussion

Implementation of the wireless control is done with the help of Zigbee transceiver CC2500RF Module. Controlling of various modules (motors) are done by receiving the commands over the ZigBee transceiver from 8051 microcontroller remote. Once the commands are received, the ARM & processor sends a digital signal to the respective port pins in the ARM processor, these are turn connected to enable pins of L293D motor driver boards, which drive the respective motors. The working model of SMARTARM is shown in Figure 3.

The robot designed in the paper is connected to the user microcontroller remote over Zigbee transceiver therefore it is limited to the ZigBee range, this can be extended with the help of GSM module in place of ZigBee receiver. The figure 4 shows the smart arm with all different component labelled.

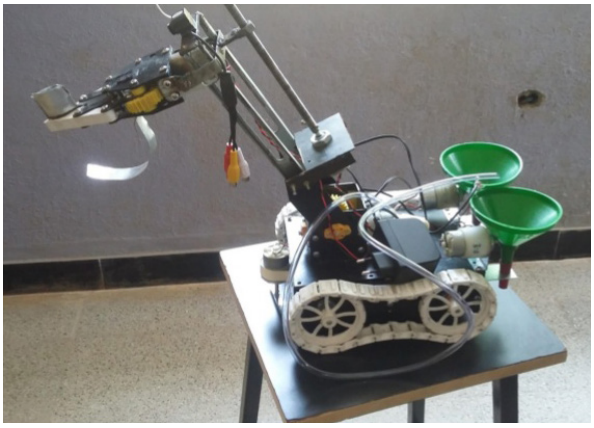

Figure 3.Working model of SMARTARM

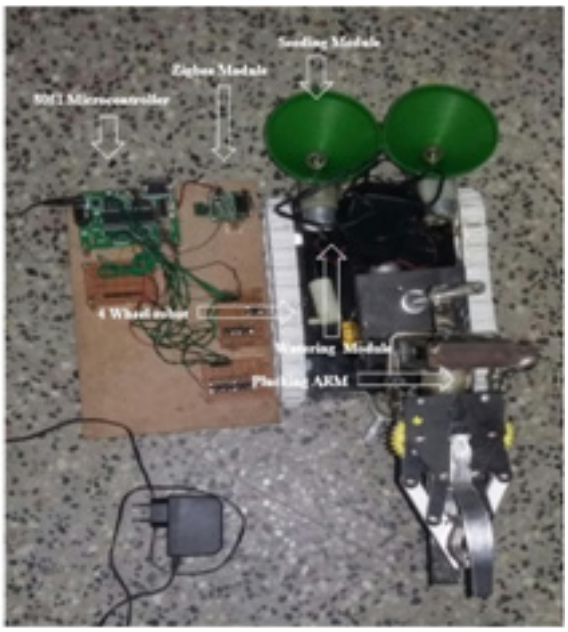

Figure 4.Labelled diagram of the smart arm

Conclusion

The Smart arm does not get sick or tired, so no time off is needed. This can be applied to a variety of agricultural fields; robots can easily work around trees, rocks, ponds, and other obstacles. This robot can eliminate up to 80% of farm work, such as pesticide spraying, water pumping, and harvesting. In the future, it will perform additional or different tasks. The agriculture automation system has been designed and realized using simple model controlled over the Zigbee transceivers from switches. The designed system is a low-cost demonstration model, which can convey the application and future scope modular automated agriculture systems.

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