ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

IJARCCE

International Journal of Advanced Research in Computer and Communication Engineering

NCRICT-2017

Ahalia School of Engineering and Technology

Vol. 6, Special Issue 4, March 2017

Coconut Plucking Robot

Anagha Mohan[1], Anjana Prabhakaran[2], Lakshmi.K[3]

Students, Department Of Electronics & Communication Engineering, SIMAT, Pattambi, India [1,2,3]

Abstract: Kerala has around 18 crore coconut trees which have to be harvested in every 45 days. So, there is demand of 40,000 climbers to ensure that the products are harvested. But the number of climbers available in the state is less than 10,000. This paper is to find a design of a device that can harvest coconut- a mechanism for tree climbing and plucking. We have taken into account the safety, reliability, the ease of use. Additional functions like cleaning the tree tops and spraying pesticides can be incorporated in the future. This system is so designed that it can be controlled by a common man as it does not involve complex procedure. Though there are a number of tree climbing machines available, an efficient coconut harvesting machine which can be feasibly made and employed in the agricultural sector is lacking. This is what motivated us to take up this as our project. Our aim is to design a robot that can make coconut harvesting quick, safe, and efficient. The coconut harvesting robot can be considered to be made of two parts: a coconut climbing mechanism and a coconut harvesting mechanism using robotic arm.

Keywords: Coconut Harvesting, Reliability, Robotic arm.

I. INTRODUCTION

Kerala has been known for its coconut cultivation for centuries. Coconut provides coconut milk, coconut oil which are essentials in Kerala households and the ingredients of most Kerala as well as all parts of the country. Coconut husk is used in the coir industry to manufacture carpets, ropes and similar items.

Thus arising a need for harvesting by skilled workers. Coconut harvesting is a major problem in today's world as it involves factor of risk. Coconut plucking robot is a new invention against these harvesting problems. An automatic robot control by the user climbs and plucks the coconuts with respect to user input.

II. METHODOLOGY

In this work, methodology is separated to three different sections, which are mechanical design, embedded system and testing.

A. Mechanical Design
The mechanical design include conceptual design of robot, fabrication and assembly process.

I) Climbing Module
Fig 1 shows design of robot climbing over tree. The robot consist of wheels which are driven by DC motors of 12V,10 RPM. The entire body of robot is made up of PMMA(Poly Methyl Methacrylate).

The wheels support climbing up and down and the rotation in clockwise and anticlockwise direction. The wheels are made up of highly toughened rubber with gripping structure which enhances climbing.

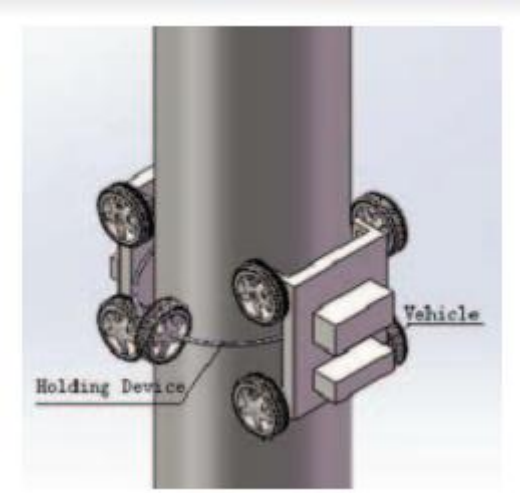

Fig 1: Climbing Mechanism

II) Cutting Module

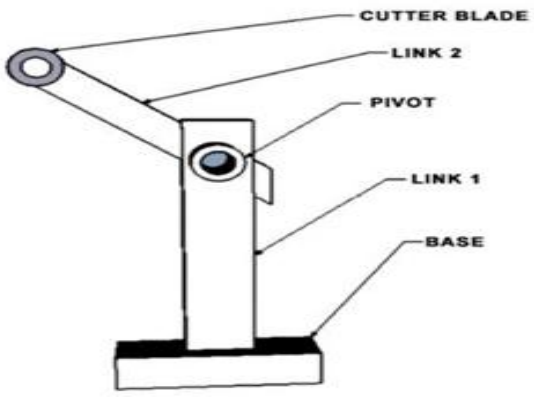

Fig 2:Robotic Arm Model

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This is simplest model for the robotic arm as shown in Fig 2. It has two links and two motors,one for cutting purpose and the other to give the arm a rotating motion along a single axis. This model has comparatively less weight(about 2.8Kg) and does not disturb the stability of the system. Being a simple design basic joints this system actually quite stable. Also this model is the most cost efficient of the lot. But having just limited degrees of freedom, the model would not be able to reach the coconut bunches grown in a very complex manner on top of the coconut trees.

II) Microcontroller Module

ATmega328 is the microcontroller used for the robot. It has 32 bit RISC architecture which consists of 28 pins. As it is simple and low powered it is well suited for this application. External RF remote is also being attached to the robot, which enables the human to control the robot manually. RF is choosen over many other alternatives including InfraRed because of its ability to work beyond the LOS. This property is explioted over here when it reaches the treetop.

III) Camera Module

Wireless camera is mounted over the robot, which is connected over to an LCD screen. This helps in visualising the Coconuts. The person standing on the ground could easily identify the matured coconuts. Camera is tilted to the desired position an thereby the controlling of cutiing arm accordingly.

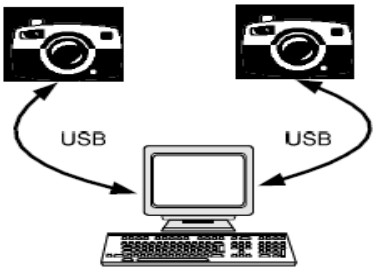

Fig: Camera Module

III. BLOCK DIAGRAM AND FLOW CHART

I) Layout of Working

The microcontroller is the coordination unit of the device. According to the user input microcontroller gives commands to the other unit which have to work and when. The RF transmitter receiver circuits create a path between user and microcontroller. When input for climbing is received then microcontroller drives the motor driver and motor for climbing. When 1011 is received up climbing occurs and 0000 for down climbing,0111 for clockwise rotation and 1100 for anticlockwise rotation.

After climbing it reaches the top and using the camera module the matured coconut is identified with its colour.

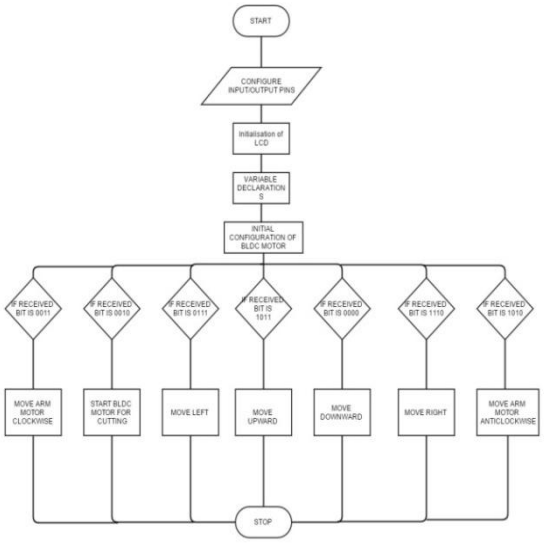

Fig: Flow Chart

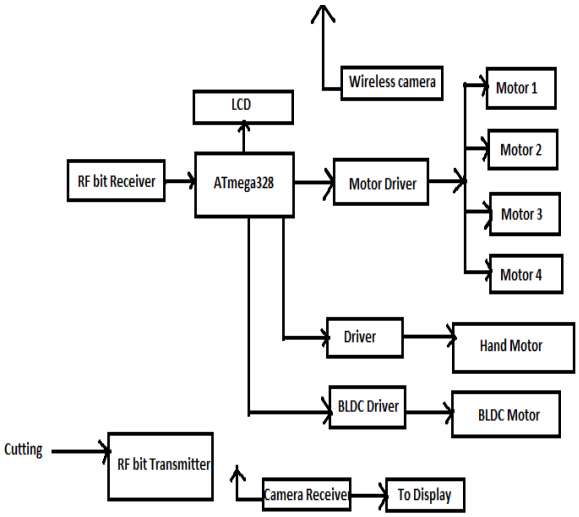

Fig: Block Diagram

Then for cutting the input is given through the remote. First arm motor is enabled for correcting the position. If 0011 is received ,then arm rotates in clockwise direction and if it is 1010 then rotates in anticlockwise direction. After positioning the arm , cutting is started by giving the input as 0010.

IV. CONCLUSION

The present difficulties in coconut harvesting can be avoided using this simple coconut plucking robot. It has a simple structure which can easily manufacture. Since simple ICs and microcontroller is used designing is simple. The DC motors and the BLDC motor are highly efficient and reduces the power. The wheels provide better gripping with tree. So the proposed coconut plucking robot introduces new technology for coconut harvesting.

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