ARECANUT CLASSIFIER AND SEGREGATOR USING IMAGE PROCESSING

Theertha Bharathan (4NM15EC175) Yashwanth C Vishwa (4NM15EC191)
Thrishala (4NM15EC176) Naveenkumar G (4NM16EC420)

Guide: Mrs Roopa B Hegde., Assistant Professor Grade II, Dept. of Electronics and Communication Engineering

ABSTRACT

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Introduction: Arecanut or betel-nut is an important cash crop in the Western Ghats, Eastern Ghats and the north-eastern regions of India. Arecanut is an important component of the religious, social, and cultural celebrations and economic life of people in India. It is also used in Ayurvedic and veterinary medicines. Although production of arecanut is localized in few states, the commercial product is widely distributed all over the country. The world productivity of arecanut stood at 1.21 tonnes/ha. The Indian productivity is also on par with the world productivity (of about 1.27 tonnes/ha.). India is also the major producer and consumer of arecanut in the world and contributes to 51% of the world arecanut production. Karnataka has a significant contribution to the production of arecanuts in India. In the arecanut producing districts of South Karnataka like Tumkur, Shimoga and Hassan, the arecanuts are peeled using a peel shredding machine which takes in raw, green arecanuts. The arecanuts which are of good quality come out with their peel completely removed and turn brown in a few hours. These are highly priced in the market and cost about Rupees 35,000/- per quintal. The arecanuts which are of poor quality will come out of the peel shredder with their skin on and they appear white in colour. These cost about Rupees 20,000/- to Rupees 25,000/- per quintal in the market. There is a third class of arecanuts which come out of the shredder broken. These have a market value of about Rupees 10,000 to Rupees 15,000/- per quintal. These arecanuts have to be further sorted and graded into their respective classes. So far they have only been sorted by traditional man-power in India. The manual cost and sorting time always impacts the income of farmers. The classification of arecanuts takes about two days using only manpower. Hence any improvement in this situation by any agricultural technology to classify the arecanuts which is also cost effective, will be welcome by farmers.

Objectives:

- Correct identification and recognition of good, bad and broken arecanuts with minimal false positives.
- Efficient and reliable classification and segregation of the three classes of arecanuts.
- Implementing a system to enable reduction in labour cost and duration of time required for the process of segregating arecanuts.
- Providing a non-expensive, employable and convenient method for arecanut cultivators to sort and grade their produce, thereby resulting in a significant reduction in segregation cost.

Methodology: In this project, image processing is done by extracting the colour feature of the arecanuts to process and further grade them. The processor used is Raspberry Pi 3B which features a Quad Core 64 bit ARM Cortex clocked at 1.2 GHz. It includes on board 802.11 wi-fi and Bluetooth 4.0. Open CV and Python programming language is used to perform the processing. The images of the arecanuts are captured using an 8MP Pi camera which is able to deliver an 8MP resolution image and can be attached to the pi board with a 15 pin ribbon cable. It is very tiny and compact and weighs just over 3g. The hardware set up consists of a conveyor belt which is connected to two gear motors and is controlled by the processor. The Pi-camera set up is placed on the conveyor belt and two pair of infrared sensors are placed on the conveyor belt, one near the camera set up and the other near the end of the belt. When the arecanut arrives on the belt, the first set of the infrared sensors will detect it and signal the Pi camera through the processor. The image of the arecanut is captured by the camera and is then processed by the Raspberry Pi. Based on the colour of the arecanut it is classified into its respective class. When the arecanut arrives at the end of the belt set-up, the second set of infrared sensor will detect it and will send a signal to the servo motor which is placed at the end of the belt through the processor. Based on the class of arecanut to which it is graded, the servo motor rotates a particular angle and the arecanut will fall into its respective bin.
Results and Conclusions:
- The classification and segregation of arecanuts using the Raspberry Pi processor is an inexpensive and cost-effective process when compared to the traditional method of sorting arecanuts manually.
- The proposed method is novel as previous systems for the same application made use of Matlab and incorporated expensive processors to perform image processing.
- The project provides an economical means to perform an otherwise laborious task and can be utilize in real time.
- The system, inclusive of the hardware implementation consisting of conveyor belt assembly, motors, sensors, camera set-up and the processor can be employed to perform grading and sorting of arecanuts with good results.