Chapter 9
Design of Wheels of Agri-Rover for Both Dry and Wet Surfaces (Run-Way)

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ABSTRACT

The agricultural sector is susceptible to changes in output, methods, and modernization, much like other industry sectors. Farmers' methods of labouring in the fields may be altered by agricultural robots. An agri-rover is most beneficial to farmers since it reduces the time required to plant seeds in the field. It is also possible to automate other farming procedures. The goal of the rover created for this project is to provide farmers with automated planting and ploughing. The wheel and tire system is necessary for easy mobility on uneven, dry, and wet surfaces. Thus, the right wheels are chosen. A problem for this project was the apparatus's weight. The rover's weight was raised by having too many joints and links, which also made manufacturing it more difficult. For the rover to be able to withstand drastic temperature changes throughout its year-round operation, certain materials must be chosen. This is because the rover would function throughout all four seasons, from seed sowing to harvest. Ansys modelling was used to simulate stress, load, and deformation analyses.

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INTRODUCTION

India has a largely agrarian economy. Farmers are the nation's debtors. According to the Indian Economic Survey of 2020–21, 20.2% of India's GDP came from the agricultural sector, which employed more than 50% of the labour force. Indian farmers are professionals who cultivate crops. In 2020, over 41.49% of the workforce will be employed in agriculture and related industries such as forestry, fishery, and animal husbandry, which together accounted for 17.5% of the GDP in 2016. India has the largest net cropped area in the world, ahead of the US and China (Wikipedia, n.d.). Variable weather and geographic factors pose a big obstacle to enhancing crop productivity in India, making agricultural techniques difficult. Changing weather patterns, various settings, customary methods, and financial losses as a result of insufficient knowledge about crop output are some of these difficulties. One way to get around these obstacles is to use cutting-edge technology. These challenges are overcome by implementing advanced technology in agriculture (Upendra et al., 2020).

In India, the agricultural and farming sectors are rapidly digitizing, much like any other industry. A machine, perhaps a robot, could be programmed to carry out the farmers' duties. The robot can manoeuvre in challenging conditions and bear harsh weather. The expense of inputs, the shortage of skilled personnel, the lack of water resources, and crop inspections are some of the major problems facing Indian agriculture. Advanced mechanization in agriculture sector using robots can be used to tackle this challenge (Bangar et al., 2019).

Agri-rovers are one sort of robot that this project aims to produce a prototype of. The task of sowing will be successfully completed by the rover. To virtually shape the rover, CAD/CAM programs like SolidWorks and Ansys were utilized. The Agri-rover's job of “seedling” is to plant the seeds. A seeder or seed drill is another term for a seedling equipment. A straight furrow in the soil is filled with seeds at precise rates and depths by means of seeders or seeding machines, which are used in agriculture to plant seeds for crops. In order to plant and water plants autonomously, Reddy et al. (2022) created a rover that mimics human behavior. An Arduino Nano, a DHT11 sensor, a WiFi module, and ESP8266 Node MCU controlled DC motors were employed. Their rover runs its entire setup using both solar and DC battery power, depending on availability. The dimensions and mass, material selection, and the rover's multipurpose nature comprised our challenge definition. Heavy weight and numerous joints and linkages made up the original chassis design. The production of a rover like that would be challenging. For the purpose of dispersing the seeds evenly along the field's length, a screw conveyor would be utilized [Figure 1].