MECHATRONICS BOOK SERIES SYSTEM DESIGN AND SIGNAL PROCESSING

VOLUME 1

Editors
Asan G. A. Muthalif
Amir Akramin Shafie
Siti Fauziah Toha
Iskandar Al-Thani Mahmood

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CHAPTER 4

Applications of Mechatronics Engineering in Modern Agriculture

Nahrul Khair Alang Md Rashid, Dayang Nurulain binti Abang Mohamad Moasili, Intan Zaharah Johari, and Azizullah Saleem

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4.1 Introduction

Generally, agriculture is labor intensive and requires a large tract of land for planting, grazing of farm animals, or for rearing of fishes. The traditional approach of relying on farm animals, farm hands, human labor has given way to modern methods whereby technology is extensively used. The introduction of technology has increased farm yield by several folds to ensure that enough food is produced to feed the world population. Reduction of wastage, enhancement of yield quantity and quality, preservation of harvested produce, reduction of maturity period, and generation of new breed of plant with superior quality such as pest resistance all contribute to betterment of food production. Minimization of the use of scarce resources such as agriculture land, proper use of water for irrigation and fertilizer, reduced labour requirements are characteristics of modern agriculture.

Increasingly, agriculture is moving away from the concept of large land-based plantation to resemble a production or manufacturing factory. Plants are grown and harvested within buildings, in elevated platforms, fed and irrigated by computerized system in a controlled environment. The use of automated milking machine in cows for milk production has increased the efficiency of production and the cleanliness of the production operation [1]. Mechatronics Engineering plays important roles spanning the complete life cycle of the plant, from seed to seed.

The use of hydroponics [2], aerophonics [3] and fertigation [4] systems enabled plants to be grown and harvested not in the field but in a controlled space and in multistory platform arrangement. Plants are grown indoors, livestock are housed in climate-controlled environment, and fishes are reared in captivity in the water. Hitherto agriculture to some extent has moved away from large to plantations to buildings much like in a production or manufacturing factory such as that shown in Fig. 4.1. The trend is expected to continue as the need for food increases.

The use of Mechatronics systems has not only reduced human intervention, hence reduction in the use of labor, but also extends the capability of certain tasks to be done in a more consistent and efficient manner. Farm mechanization through the use of combined harvester, seed planting machines, soil leveler, are some examples.

4.2 Mechatronics in Seed-to-Seed Plant Life Cycle

Various aspects of Mechatronics engineering are used throughout the life cycle of a plant to carry out specific tasks. The complete life-cycle of a plant can be seen to start from seed and end with seed as well. The phases cover planting, growing in a farm or otherwise laboratories and specialized buildings, harvesting, processing, packaging, distribution, storage, and some seeds are kept for future use.