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Editorial

"Eyes", "Brain", "Feet" and "Hands" of Efficient Harvesting Machinery

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The main function of harvesting is the cutting, picking, or digging of mature crop seeds, fruits, stalks, leaves, root parts, or the whole plant. They are also necessary to complete harvesting, threshing, cleaning, transfer, and other operations. The characteristics of harvesting machinery are as follows: first, the operating object is biological; second, the working process refers to either the separation of plant tissues or the separation of a plant from the soil; and third, the working environment is unstructured. Therefore, efficient harvesting machinery is a comprehensive research area that integrates the fields of mechanical and biological material, information, and computers. With the improvement of the intelligent level of agricultural equipment, the traditional harvesting machine has been gradually developing toward harvesting robots; the focus of harvester research efforts now includes mechanical components and intelligent systems, which include the development and optimization of harvesting components for specific crops as well as the design and optimization of travel components for different terrain and soil conditions. Intelligent system research includes operating environment sensing and crop target recognition, decision making, and the control of operation and traveling. This research area can be graphically summarized as these key technologies: precise identification and positioning systems ("eyes"), sensitive decision-making and control systems ("brain"), highly adaptable chassis and mobile platforms ("feet"), efficient end-effectors and harvesting components ("hands"), etc. In order to gather excellent papers in this field, showcase the latest ideas, and provide key technical references for efficient harvesting machinery research, we have organized the Special Issue entitled "'Eyes', 'Brain', 'Feet' and 'Hands' of Efficient Harvesting Machinery" in Agriculture.

In total, 21 papers are published in this Special Issue, including two papers related to the physical property parameter of materials or crops [1,2]. Thirteen papers describe efficient end-effectors and harvesting components ("hands"), with the crop objects harvested including Cabbage [3], Cotton Stalk [4], Potato [5], Dandelion Seed [6], Broccoli [7], Peanuts [8], Rice [9], Supernormal Jujube Branches [10], Silage Corn [11], Small Spherical Fruit [12], Chinese Little Greens [13], Hazelnut [14], and Chinese Milk Vetch (*Astragalus sin-icus* L.) Seeds [15]. Two papers describe highly adaptable chassis and mobile platforms ("feet"), which focuses on machine–soil relationship [16,17]. Two papers described precise identification and positioning systems ("eyes"); these studies applied the improved YOLO algorithm to the recognition of tea and apples [18,19]. Two papers described sensitive decision-making and control systems ("brain") [20,21]; these studies use intelligent control algorithms, such as BP neural network algorithms, to control actuating components or for fault diagnosis. These papers address harvesting components, traveling mechanisms, sensing systems and decision-making algorithms for a wide range of crop harvesters, including grains, vegetables and fruits.

From these studies, it is clear that the research focus with relation to harvesting machinery is on equipment intelligence, in addition to design improvements for crop-specific

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harvesting components. The advantages of agricultural equipment intelligence include improving the operating efficiency of agricultural machinery, reducing labor costs, reducing pesticides and fertilizer use, improving farmland ecosystem protection, and promoting the sustainable development of agriculture. At the same time, the intelligentization of agricultural machinery and equipment also faces some challenges, such as the high cost of technology research and development, low acceptance by farmers, etc., which requires joint efforts from the government, enterprises and farmers to promote the development of the intelligentization of agricultural machinery and equipment.

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