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Design of the Context Aware Sensor Tags

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Abstract. This paper discusses the design and implementation of context-aware sensor tags that can be attached to various containers. The tags are designed to be utilizable in non-standardized fruit boxes, and can identify whether fruit has been loaded in a box because they are attached inside the box.

Keywords: We would like to encourage you to list your keywords in this section.

1 Introduction

Because of the advancement of information technology, progress has been made in the technology of many other fields. In addition, the importance of fusion technology and industry in different fields is increasing gradually. This trend is also found in the agriculture, fisheries, and livestock (AFL) industries, and when applied to the AFL industries, many fusion technologies have greatly influenced the advancement of primary industries, and increased productivity. For many years, studies related to AFL industries have been performed in diverse fields and manners, and particularly, studies for original technologies, such as seed improvement related to AFL products, have been the majority of the studies performed. This research trend continues today, and various attempts are being made to apply fusion technologies and gain synergy effects through this.[1]-[3]

2 Proposed System

The importance of designing sensor tags that can be attached to various containers used as the means for loading, storing, and moving agriculture products is recognized in many areas, such as user management convenience and function.[4]-[6] In this study, a hard

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tag method is applied for attachment to non-standardized containers. The hard tag method has the following characteristics: arbitrary attaching/detaching is impossible because the tag is attached with a steel pin, and it can be used in containers of various materials, such as plastic fruit boxes, paper boxes, vinyl, and cloth. Furthermore, a sensor tag can be detached by a manager with a hard tag remover only, and it can be attached easily by inserting a hard tag pin.

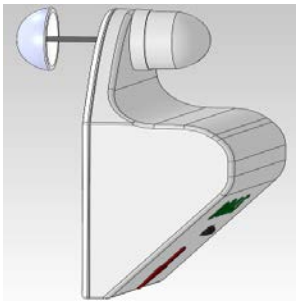

Fig.1. Tags

Furthermore, to avoid inconvenience when loading boxes from the management perspective, the sensor tag was designed to be attached inside a box in order to minimize damage or conflict between boxes when the boxes are loaded into storage; on the outside of the box, only a sensor tag attachment pin is present, thus minimizing conflict between boxes. The context-aware sensor tag was designed to have directivity to detect normal box load status. This refers to the case where a box is positioned in parallel; when a box is stacked or positioned in a different shape, it is determined to be an abnormal status. To detect such status, the sensor tag is positioned in such a way that the infrared projection is directed toward the bottom side in a standing state, as shown in Fig 2. To face the lower side, the sensor is attached as close as possible to the bottom of the box so that it does not rotate with the hard tag pin. To identify the existence of content inside the box (i.e., to determine whether the box is loaded), an infrared detection sensor is embedded in the sensor tag. The detection range for the detection sensor is 5 cm, and it determines whether there is content by analyzing an infrared ray that is reflected when there is fruit or other content within the detection range.

Fig. 2. Content detection range

Fig. 3. Normal content detection

3 Implementation and Experiment

With respect to content and box status detection, it is confirmed that there are many causes for malfunctions. The material for the tested fruit box was plastic, and when a sensor tag was installed, misdetection of the box load status occurred because lateral movement of the sensor tag occurred. When the sensor tag moved to the left and right, movement that surpassed the reference angle was detected, and consequently, the sensor tag erroneously perceived the fruit box to be loaded while lying on the side.

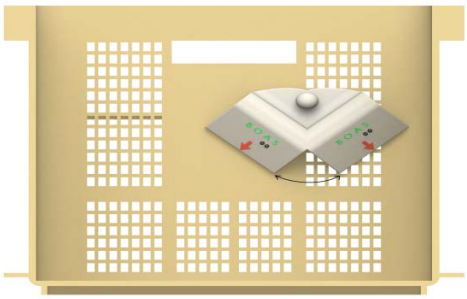

Fig. 4. Sensor tag lateral shaking

Furthermore, for the infrared detection part that identifies content, misdetection also occurred depending on the installed position of the sensor tag. When the attachment position of the sensor tag was at the bottom, there were cases where the sensor detected the bottom and determined there to be content. Such problem of content misdetection was determined to be caused by the protruding infrared sensor part of the sensor tag case that faces the downward direction.

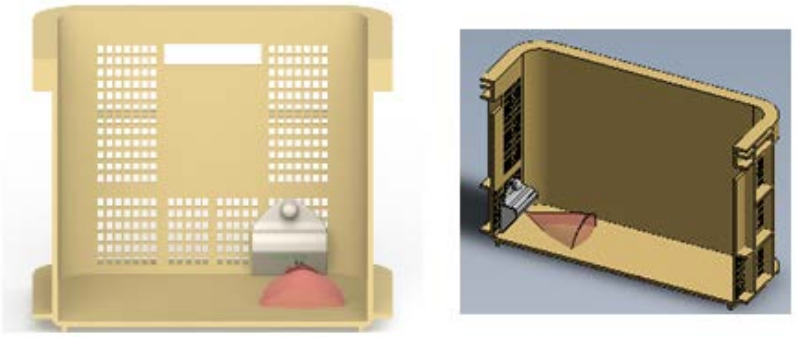

Fig. 5. Content misdetection

4 Conclusion

This paper discussed the design and implementation of a context-aware sensor tag for distribution calculation of agriculture products. By applying the proposed sensor tag to boxes loaded with agriculture products, the loaded/unloaded status of the agriculture products can be determined in producing areas, and the number of boxes loaded with agriculture products can be identified.

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