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The Influence of Environmental Factors on Honey Bee Activities: A Quantitative Analysis

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Abstract : Bees' incoming and outgoing behavior is a decisive index which can indicate the health condition of a colony. Traditional methods for monitoring the behavior of honey bees (Apis mellifera) take too much time and are highly labor-intensive, and the lack of automation and synchronization disables researchers and beekeepers from obtaining real-time information of beehives. To solve these problems, this study proposes to use an Internet of Things (IoT)-based system for counting honey bees' incoming and outgoing activities using an infrared interruption technique, while environmental factors are recorded simultaneously. The accuracy of the established system is verified by comparing the counting results with the outcomes of manual counting. Moreover, this highly -accurate device is appropriate for providing quantitative information regarding honey bees' incoming and outgoing behavior. Different statistical analysis methods, including one-way ANOVA and two-way ANOVA, are used to investigate the influence of environmental factors, such as temperature, humidity, illumination and ambient pressure, on bees' incoming and outgoing behavior. With the real-time data, a standard model is established using the outcomes from analyzing the relationship between environmental factors and bees' incoming and outgoing behavior. In the future, smart control systems, such as a temperature control system, can also be combined with the proposed system to create an appropriate colony environment. It is expected that the proposed system will make a considerable contribution to the apiculture and researchers.

Keywords : ANOVA, environmental factors, honey bee, incoming and outgoing behavior
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