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Design of an Electric Fan with Intelligent Air Blowing System

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Abstract

Most fans on the market currently can only oscillate within a fixed angle range. This paper presents the design of an intelligent oscillating fan that can track and oscillate based on the number of people present. When only one person is present, the fan automatically tracks their position and oscillates within a 15°range. When multiple people are present, the fan oscillates between the two individuals furthest away. Testing has demonstrated that this oscillation strategy provides an excellent user experience and has significant practical value.

Keywords

Fan; Oscillation Strategy; Angle Ranger; Automatically Tracks.

1. Introduction

Currently, intelligent fan products account for over 35% of the market, with smart control, variable frequency and infrared remote control being the main drivers of demand [1]. However, fans are rarely fitted with automatic tracking functions. This paper presents a facial recognition smart fan. It actively tracks faces within its effective range, directing the airflow while recognising distance. This ensures a gentle and comfortable breeze when it comes into contact with your skin. It can also humidify and cool the air based on user preferences and indoor conditions.

2. Fan Sweeping Strategy

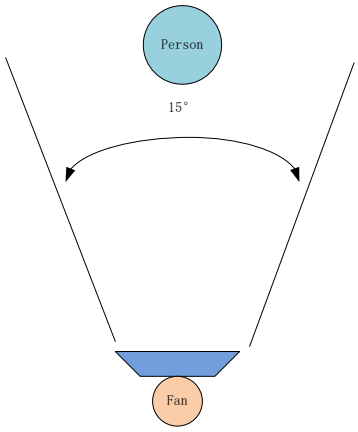

Fig 1. Single-user Mode Blowing Strategy

The Breeze algorithm is much more than just a combination of 'tracking' and 'oscillation'; it is an integrated system that uses real-time sensing, intelligent decision-making and precise execution[2]. It ensures that the airflow consistently 'envelops' the user rather than 'blowing directly at' them. The goal is to forget the fan's presence entirely while enjoying perfectly tailored comfort at all times[3]. Designed to deliver an exceptionally comfortable, imperceptible intelligent airflow experience for solitary users, this algorithm is one of the smart fan's core functions[4]. Its core philosophy shifts from 'people seeking airflow' to 'airflow

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seeking people', employing dynamic strategies to avoid the discomfort caused by continuous direct blowing[5].

Single-Person Mode Blowing Strategy: Automatic tracking function, delivering either direct blowing or oscillation within a 15 degree range.

The multi-user airflow strategy is much more complex than simple mechanical oscillation. It precisely locates the two outermost users in order to define the swing boundaries. To enhance the experience further, the algorithm can be upgraded to pause briefly (for example, for one to two seconds) when swinging to the farthest left and right points. This ensures that users at both ends enjoy sufficient, sustained airflow and avoids the issue of inadequate wind volume. The system continuously monitors visual data. If anyone leaves or joins mid-session, the algorithm instantly recalculates the two outermost users and dynamically adjusts the swing range seamlessly, without requiring any manual intervention.

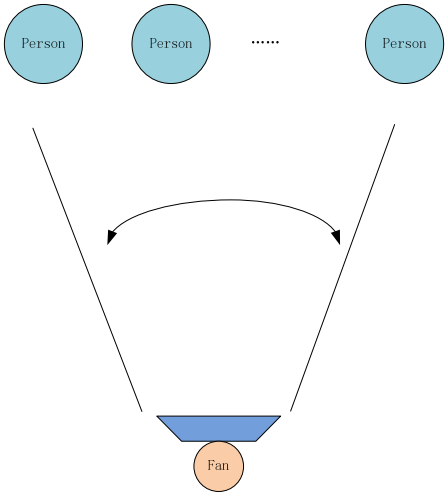

Fig 2. Multi-user Mode Blowing Strategy

3. Testing

The camera uses an 180-degree wide-angle lens, with the optical centre precisely aligned with the centre of the fan. Upon detecting a human presence using machine vision technology, the system calculates the subject's centre line. It then identifies the angular deviation by measuring the difference in pixels between this centre line and the centre line of the image captured by the camera. Using a PID algorithm, the fan's mechanical positioning is adjusted until the subject's centreline aligns with the centre of the camera's frame, confirming successful tracking.

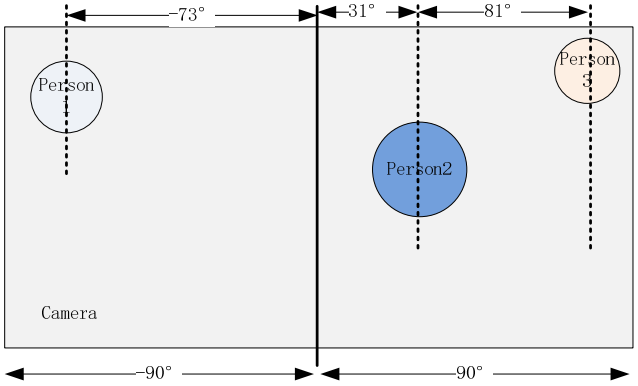

Fig 3. Schematic Diagram of Tracking Algorithm

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After initialisation upon powering on, the smart humidifying fan with facial tracking activates its camera. When the camera detects a person within its recognition area, the fan starts to operate. The servo motor then starts to track the face and direct the airflow from the fan towards the person. At the same time, the ultrasonic module and the temperature/humidity sensor activate to regulate the optimal speed and angle of the fan. If no person is detected within the camera's recognition area, the fan automatically powers off. It only resumes functioning when a person is detected again within the recognition zone.

4. Summary

This paper presents a smart fan based on the STM32 microcontroller that uses machine vision technology to detect human faces and adjust the airflow intelligently. Compared to conventional household fans, this design is more intelligent as it can autonomously track faces to provide the most comfortable living environment, significantly improving the user experience of home appliances. In addition to fulfilling basic fan functionality and user needs, integrating internet connectivity features provides valuable insights for future smart fan technology developments.

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