EE2044 - ELECTRICAL MEASUREMENTS & INSTRUMENTATION

SMART TABLE FAN

PROJECT PROPOSAL

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Introduction

Introducing our Smart Table Fan with Intelligent Environmental Sensing, this project transforms the traditional table fan experience through cutting-edge technology. The fan adapts to its surroundings with advanced sensors for angle detection, environmental sensing, and adaptive speed control.

Its ground-breaking feature dynamically adjusts rotation based on individual presence, directing airflow precisely where needed. Real-time measurements of temperature, humidity, and distance enable autonomous speed level selection. Manual control options provide flexibility for users who prefer hands-on adjustments.

Importance and Relevance of the Project

In an era of smart technologies, our Smart Table Fan enhances user comfort and energy efficiency. Adapting to environmental conditions ensures optimal airflow, contributing to reduced energy consumption.

Relevant for revolutionising table fan interactions, it addresses inefficiencies in traditional models. Adaptive speed control and environmental sensing make it a sustainable choice, setting a new standard for air circulation devices. Anticipating future needs, this fan aligns with the demand for seamless technology, efficiency, and user-friendly control.

Background and Context

Explanation of the Problem/Opportunity

Traditional table fans indiscriminately rotate their full angle, irrespective of the presence or absence of individuals, leading to significant energy wastage. This inefficiency is a pressing concern as it contributes to unnecessary consumption of energy resources, creating an environmental and economic burden.

Literature Review/Prior Research

Object detection is an important area in computer vision for identifying humans. It involves detecting instances of semantic objects of a certain class (such as humans, buildings, or cars) in digital images and videos [1]. This field has seen significant advancements with the development of deep learning and convolutional neural networks.

LabVIEW has become a popular platform for motor speed control, enabling the design of control algorithms [2]. Integration with hardware platforms like Arduino allows for real-time speed adjustments based on external factors such as temperature variations, enhancing motor performance [3]. The user-friendly interface of LabVIEW supports the implementation of advanced control strategies like fuzzy logic systems and genetic algorithms, offering flexibility and ease of use for researchers and engineers in automation and control engineering [4]. This combination of LabVIEW and Arduino provides scalability and efficient implementation for motor speed control systems.

Why This Project is Necessary

In the current economic crisis in Sri Lanka, where energy production demands substantial financial investment, the need to conserve energy is more critical than ever. Wasteful practices, such as the indiscriminate rotation of traditional table fans, contribute to increased energy expenses. The Smart Table Fan with Intelligent Environmental Sensing addresses this urgent need by efficiently targeting airflow based on user presence, thereby reducing energy wastage.

By introducing this innovative fan amidst an economic crisis, the project aligns with the timely necessity of optimising energy usage. As the nation grapples with the financial strain of energy production, the Smart Table Fan emerges as a practical solution to mitigate energy wastage associated with conventional fans. This not only aligns with the immediate need to save resources but also contributes to a more sustainable and economically viable future.

Objectives

- Smart Rotation - Fan adapts rotation angle based on individual presence, minimizing power wastage.
- Environmental Sensors - Automatic speed control using real-time data (distance, temperature, humidity).
- User-Friendly Interface - Intuitive manual operation for customizable fan settings.
- Economic Benefits - Reduced energy usage for cost-effectiveness and sustainability.

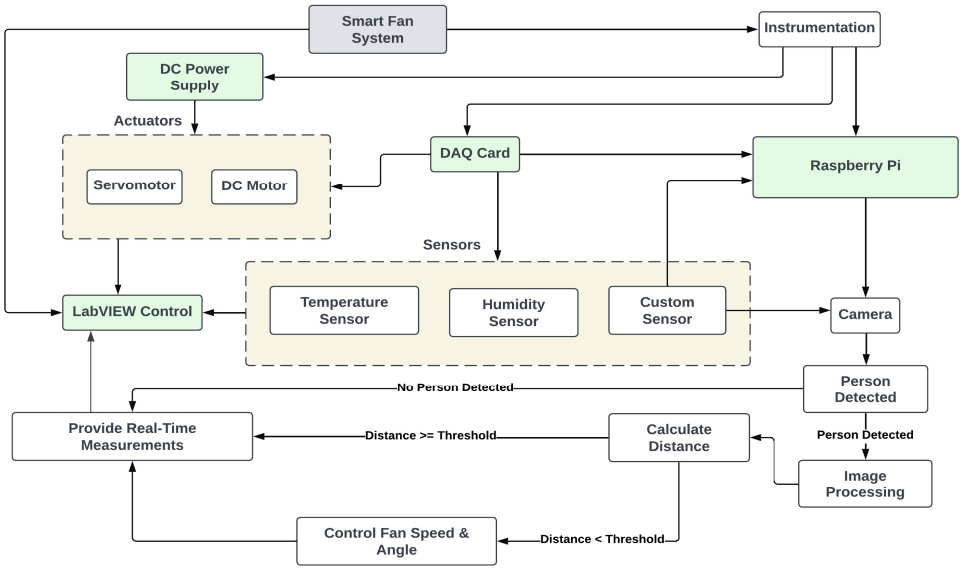
Project Scope

This project outlines the development of a LabVIEW-controlled smart fan that dynamically adjusts its speed and direction based on the perceived distance and location of individuals within its field of view, along with real-time measurements of temperature and humidity. Image processing capabilities are limited to situations where the fan is positioned upright, and distance estimation based on identified box height will vary in accuracy. Additionally, the practical range is contingent upon sensor capabilities, budget constraints, and the project's primary focus as a proof-of-concept. While further development may be required for real-world deployment, this smart fan concept holds potential applications in personalised comfort control for homes and offices, energy-efficient air circulation in public spaces, and improved comfort and focus on work environments.

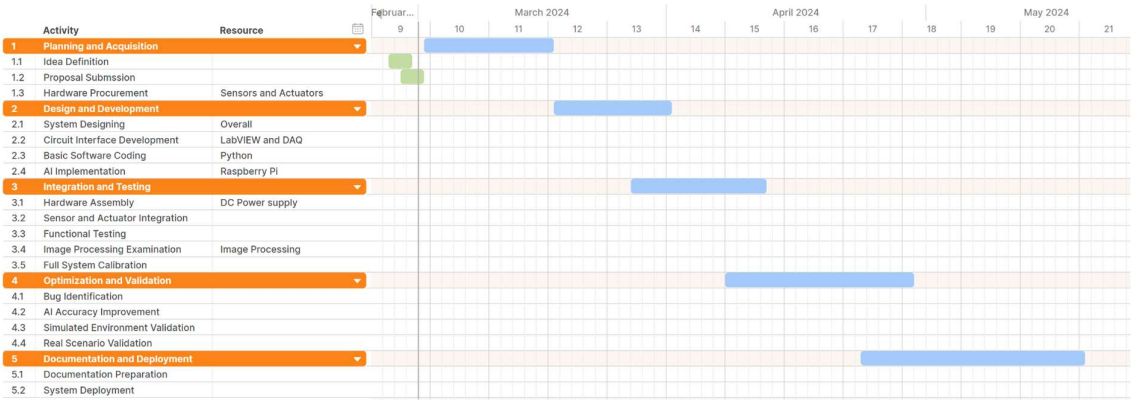
Methodology

This smart fan utilises LabVIEW for system control and DAQ card communication. The National Instruments DAQ card facilitates sensor data acquisition and actuator control. Image processing with OpenCV on the Raspberry Pi identifies human presence through a camera that will act as the custom sensor while temperature and humidity sensors provide environmental data. LabVIEW controls the fan's speed (DC motor) and direction (servomotor)based on the detected distance and pre-defined calibration factors. A programmable DC power supply can be used for fine-tuning sensor calibration or fan speed control.

System block diagram is as follows.



Timeline - Week-based view



Conclusion

This project proposes the development of a LabVIEW-controlled smart fan that adjusts its speed and angle based on the detected distance and direction of a person along with real-time measurements of the environment. This innovative project holds great promise for personalised comfort control in various settings, promoting energy efficiency and user satisfaction. We strongly believe in the project's potential and request your valuable approval and support to bring this concept to fruition.

References

[1] “Learning to Predict What Humans Look at: Computational Visual Attention,” IEEE Xplore, 20225 4 “Computer Vision System for Determining the Reference Point,” IEEE Xplore, 20223 5 H. Wang, O. Salunkhe, W. Quadrini, B. Johansson, D. Lämkull, F. Ore, M. Despeisse, L. Fumagalli, and J. Stahre, “A Systematic Literature Review of Computer Vision,” arXiv, 20236

[2] Lab VIEW Basics I Course Manual, National Instruments.

[3] Asha K R et al. "Real Time Speed Control of a DC motor by Temperature Variation using LabVIEW and Arduino" in Proceedings of the 2017 International Conference on Recent Advances in Electronics and Communication Technology.

[4] A.Thorat, S.Yadav, S.S.Patil. "Implementation of Fuzzy Logic System for DC Motor Speed Control using Microcontroller" in IJERA.