University of Moratuwa

Faculty of Engineering

Department of Electronic and Telecommunication Engineering

EN 1190:Engineering Design Project

Tronic Spirit

Automatic Fan Controlling System along with Typical Fan Controller

Group Members	
Index No	Name
220379N	Malshan K.K.R
220380J	Manawadu.D.N
220498D	Rajakaruna.R.W.M.D.S
220481U	Pitigala P.K.N.W.

ABSTRACT

Our automatic fan controller is designed to minimize electricity wastage by regulating fan usage, particularly in public settings. The fan is designed to power down automatically in the absence of human presence, effectively reducing energy wastage. Additionally, it has the capability to adapt its speed based on external temperatures automatically, thus providing added convenience to users, especially during busy moments. This product is suitable for countries like Sri Lanka, where energy conservation is crucial. Moreover, its automatic speed adjustment feature further enhances user convenience. We plan to collaborate with major fan manufacturers to integrate our product into their fan systems. In our upcoming projects, we aim to enhance the standard fan controller and extend our project concept to include ceiling fans and wall-hanging fans.

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1 Problem Description

1.1 Arriving at a Problem

We often see electronic equipment such as fans working in public places even when people aren't around, resulting in energy wastage. Additionally, adjusting the fan's speed during busy moments can be quite bothersome. Our product addresses these issues and provides an innovative solution.

1.2 Arriving at a Solution

Our automatic fan is designed to detect the presence of humans in a certain area and automatically power down when no one is detected in the vicinity. This helps reduce energy wastage by automatically turning off the fan when unnecessary. Our system also adjusts the fan speed according to the external temperature, eliminating the need for manual intervention.

1.3 Motivation

Seeing how fans and other electronic equipment were vainly switched on in public places such as lecture halls motivated us to create this product. The product aims to improve energy efficiency, reduce costs, and enhance user convenience.

1.4 Justification for Selection

We conducted a survey aimed at potential users, and the results validated our product. The survey revealed that the majority of respondents have noticed fans working unnecessarily in public places, admitted to forgetting to switch fans off when leaving, and found manually adjusting fan speed troublesome. Therefore, the survey justifies the importance of our product.

2 Feasibility

2.1 Technical Feasibility

2.1.1 Hardware Feasibility

Our product utilizes sensors to monitor temperature and human presence. We used two PIR sensors (Passive Infrared sensors) to detect human presence and selected the DHT11 temperature sensor to accurately track room temperature. The ATMEGA 328 microcontroller processes sensor data and controls the fan. Other hardware components include relays and push-button switches. The PCB interconnects all modules, and all hardware components are easily accessible and cost-effective, making our product feasible.

2.1.2 Software Feasibility

Our product was designed using Altium Designer and we used LTSPICE for simulations. We used Arduino IDE to program the microcontroller and SolidWorks for enclosure design. The software used is easy to use, making the product highly feasible in terms of software.

2.2 Economic Feasibility

Our product offers long-term benefits, such as lower electricity bills due to reduced energy consumption and a positive environmental impact with a lower carbon footprint, resulting in environmental sustainability. Although the initial cost might be higher than traditional fans, the long-term energy savings and environmental benefits make it economically feasible. The growing demand for smart home and office solutions further enhances its economic viability.

3 Architecture

The arrangement of the relays, configuration of the power supply unit, and microcontroller chip are as follows:

3.1 Subsystems Included in the Design

- **Power Supply Module:** Powers all components.
- **Sensing Module:** Includes sensors like the DHT11 temperature sensor and the PIR sensor used to monitor environmental parameters and detect human presence, respectively.
- **Actuation Module:** Connected to the microcontroller's output pins and power supply, includes relays that regulate the fan's speed and power based on sensor signals.
- **User Interface Module:** Includes the control panel with buttons for manual control, connected to the microcontroller to receive user inputs.
- **Main PCB:** Connects all components and subsystems with the microcontroller.

3.2 Wiring Diagram

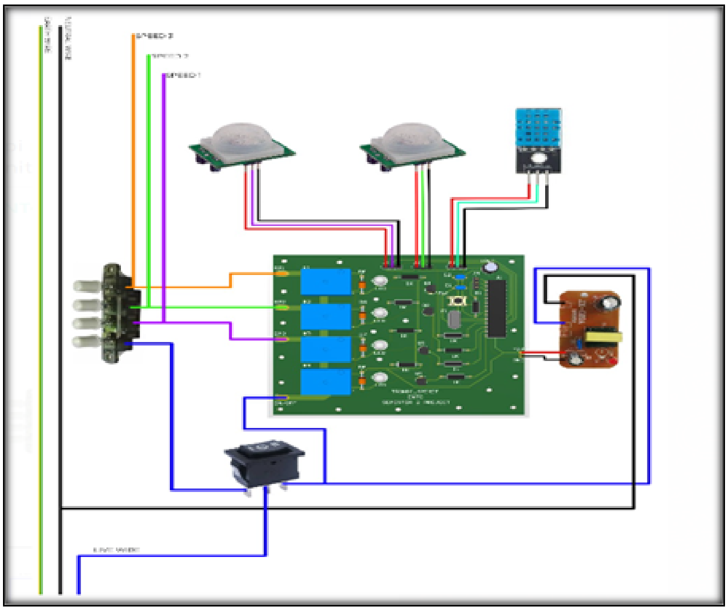

Figure 1: Overall Wiring Diagram

3.3 Block Diagram

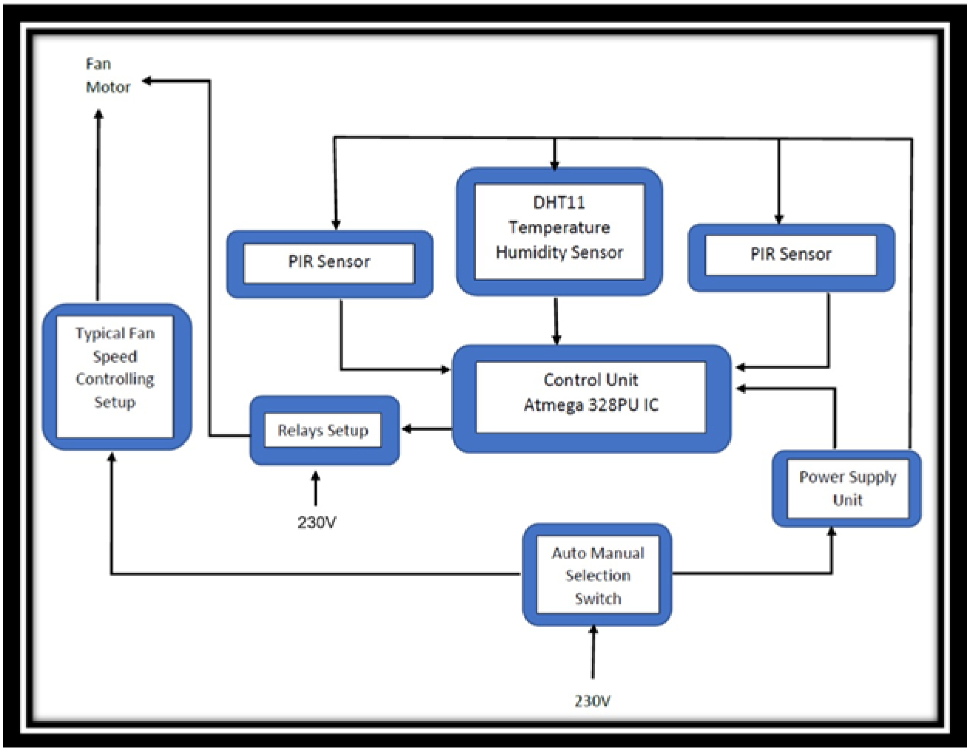

Figure 2: Block Diagram

4 Enclosure Sketches

4.1 The initial Sketch:

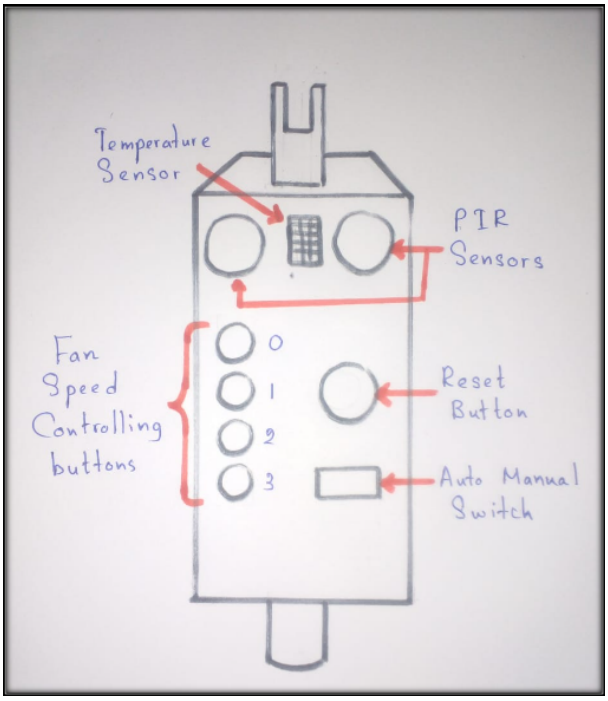

Figure 3: Initial Sketch of the Product Enclosure.

4.2 The final Sketch:

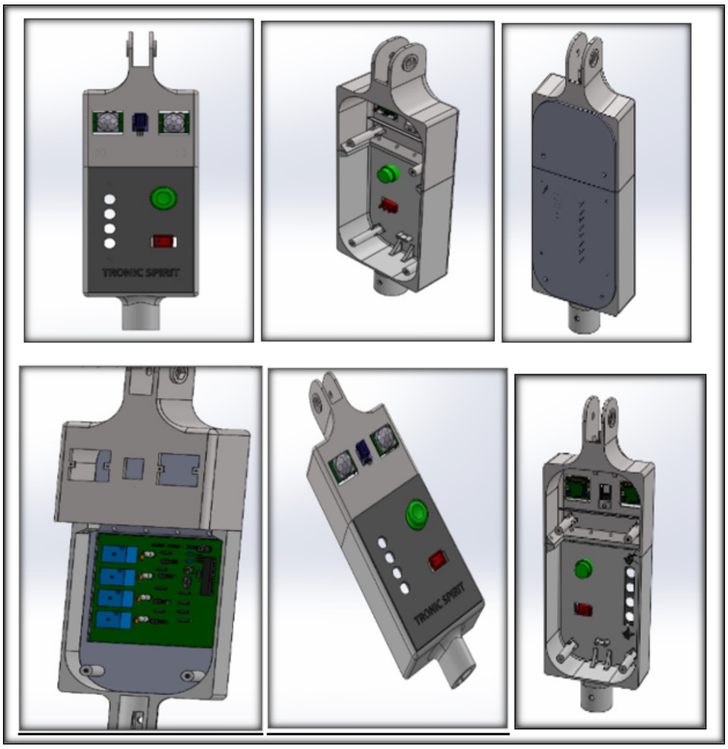

Figure 4: Final Sketch of the Product Enclosure using SolidWorks

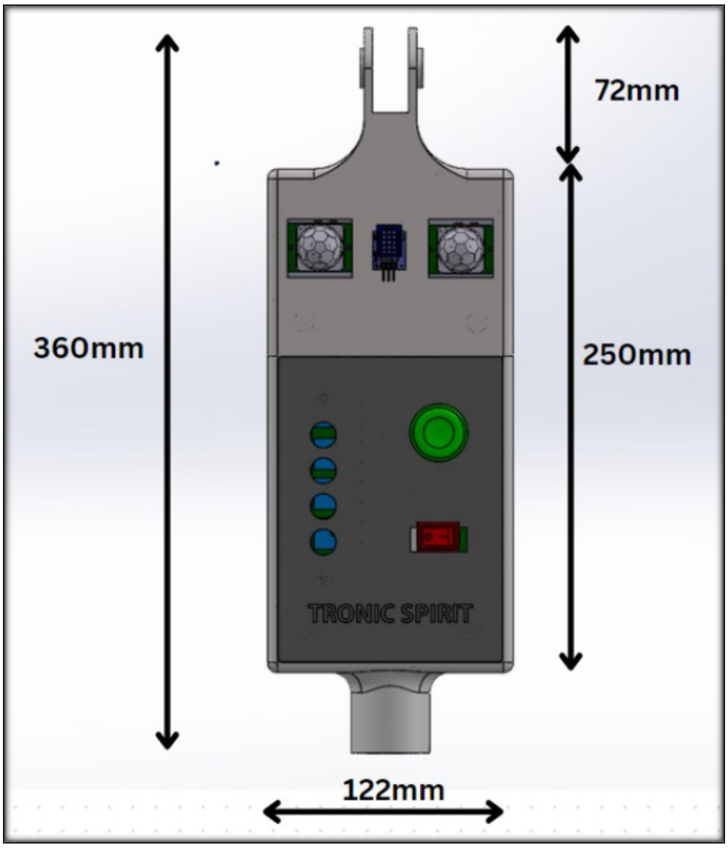

Figure 5: Enclosure Dimensions

5 PCB Design

5.1 PCB layout

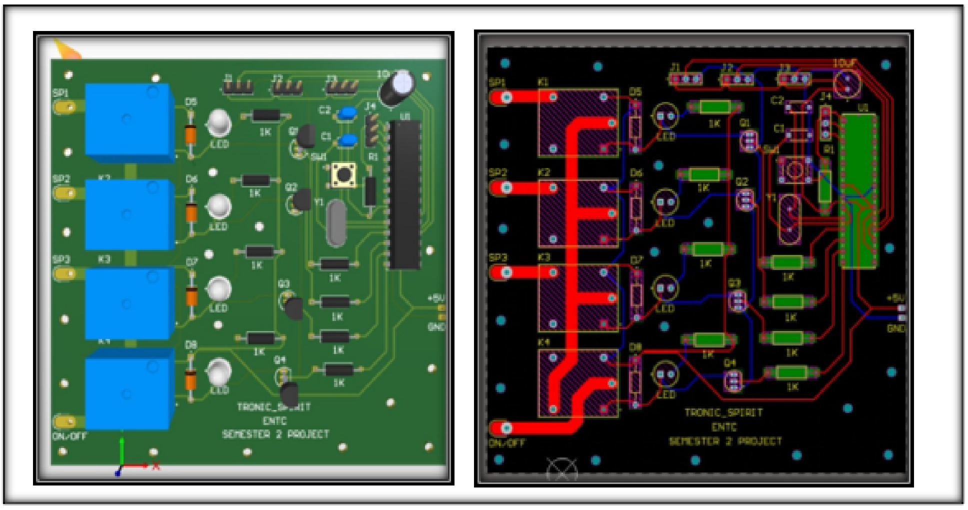

Figure 6: PCB Layout

5.2 PCB Schematic

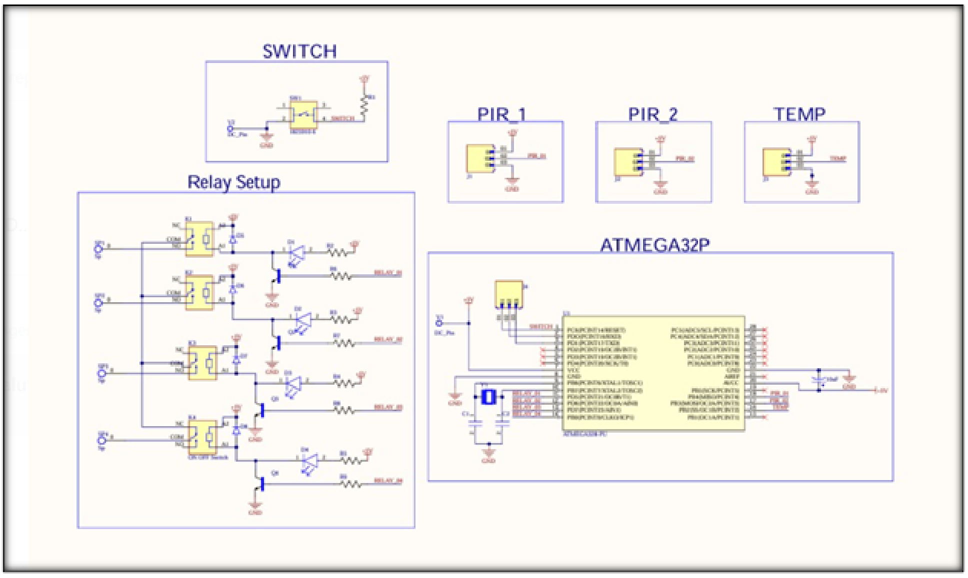

Figure 7: PCB Schematic

6 Final Product

The final product has a simple interface that makes it easy for customers to use. It includes an auto-manual switch that allows the user to select their preferred mode. In manual mode, the user can operate the fan using the panel of buttons, while auto mode allows for automatic operation.

Figure 8: Final Product

7 Marketing, Sales, and After-Sales Considerations

7.1 Marketing

The marketing strategy for the automatic fan control system targets residential consumers, commercial spaces, and smart home enthusiasts. It emphasizes the fan's energy efficiency and convenience. We plan to advertise our product through online advertising, content marketing and collaborating with industry-leading fan suppliers. The aim is to educate consumers, highlight the fan's ability to optimize comfort while reducing energy costs and position the product as a practical and sustainable solution for modern homes and businesses.

7.2 Sales

The sales strategy uses both online and offline channels to reach a wide audience. This includes e-commerce platforms, electronics retailers, direct sales through the company's website, social media promotional offers, and targeted sales campaigns.

7.3 After-Sales Considerations

We plan to offer responsive customer service and warranties while keeping in touch with customers, gathering feedback, and updating them on product improvements to ensure that our product meets long-term expectations.

8 Task Allocation

Task allocation	
Circuit design	Dhawala Malshan
PCB Design	Dhawala Malshan
Product enclosure Design	Nishitha Dulavinya
Microcontroller Programming	Dhawala Dulavinya
Testing and troubleshooting	Malshan Nishitha

Figure 9: Task Allocation

9 Project Budget

Approximate Budget

Item	Prices
PIR Sensors x 2	700
Temperature sensor	250
Atmega 328 PU IC	1400
Other passive components	1000
Enclosure	8900
PCB	1000
Total	13250

Figure 10: Product Budget

10 Power consumption

Power consumption	
Temperature sensors (DHT_{11})	0.2mA*5V= 1mW
PIR Sensors	0.125*5V*2= 1.25mW
ATMEGA328P(in active mode)	1.5mW
Relay	0.45mW*4= 1.8mW
220VAC to 5VDC Converter Module	3.5W
Total	3.5W

Figure 11: Power consumption