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Automatic Rain Sensing Car Wipers

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Abstract:

Traditional car wiper systems often operate at preset intervals or manual controls, leading to inefficiencies during varying weather conditions. The development of automatic rain-sensing car wipers addresses this challenge by leveraging sensor technologies and automation to enhance safety and convenience for drivers. The problem lies in inefficient and inconvenient manual control of windshield wipers during varying weather conditions, particularly wiper systems that rely on preset intermittent settings or manual adjustments, which may not always match the intensity of the rainfall in real time. This can lead to suboptimal visibility, compromising driver safety, and overall driving experience. This project aims to mitigate these issues by implementing an automatic rain-sensing mechanism. Research objectives include designing a robust sensor system capable of accurately detecting rainfall intensity and adjusting wiper speed accordingly. The research methodology used for this project is gathering information, sensor selection and integration, coding development, prototype development, evaluation, and testing. Findings reveal that automatic rain-sensing car wipers significantly improve visibility and driver safety while optimizing wiper blade lifespan and energy consumption. However, certain limitations such as sensor accuracy in extreme weather conditions may require further refinement. Improvement suggestions include fine-coding rain sensor sensitivity for more precise rain detection. Overall, the project contributes to the evolution of automotive safety and driving efficiency through intelligent wiper systems.

Key words: Distraction, Safety, driving experience, accurate, lifespan

Introduction

Nowadays car wipers are manual systems that work on the principle of manual switching. Therefore, the idea of proposing an automatic wiper system that automatically switches ON when detecting rain and stops when rain stops. Our project brings forward this system to automate the wiper system not needing manual intervention. For this purpose, we use a rain sensor along with Arduino Uno and a servo motor to rotate the wiper motor. Our system uses a rain sensor to detect rain, this signal is then processed by Arduino uno and to take the desired action. The rain sensor works on the principle of using water to complete its circuit, so when rain falls on it its circuit gets completed and sends out a signal to the Arduino Uno. Then its now processes this data sends signals to the servo motor and performs the required action as a car wiper. We use Arduino IDE as a coding platform for this project.

Literature review

Rain-sensing wipers operate through sensors typically mounted on the windshield, near the rearview mirror. These sensors detect moisture on the glass using infrared light or capacitive sensing. When raindrops are detected, the system sends a signal to the wiper control module to activate the wipers. The speed and frequency of the wiper movements adjust automatically based on the amount of moisture detected, ensuring optimal visibility for the driver without manual intervention (Schmitt, 2015). Despite their advantages, rain-sensing wipers are not without challenges. Issues such as sensor calibration, false activations, and performance under certain environmental conditions (e.g., dust or debris on the windshield) can affect the system's reliability. Additionally, the integration of rain-sensing technology adds to the vehicle's cost and complexity, which can be a consideration for manufacturers and consumers alike (Smith & White, 2012).

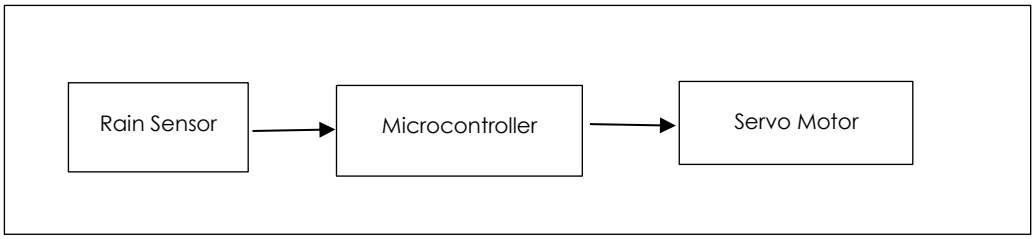

Figure 1: Block Diagram

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Research Methodology

The research methodology for the development of automatic rain-sensing car wipers involves several key steps:

1. Gather information: Gathering problems of using manual wipers or other types of wipers from users, automotive engineers, and safety experts to define the desired functionalities, performance criteria, and user. experience goals for the automatic rain-sensing car wipers.

2. Sensor selection and integration: Evaluating various types of sensors such as optical, acoustic, or capacitive sensors to detect rainfall accurately. Selecting the most suitable sensor based on factors like sensitivity, reliability, cost-effectiveness, and compatibility with the vehicle's electronics. Integrating the chosen sensor with the car's wiper control system.

3. Coding Development: Create or research suitable coding applications for my project such as Arduino, phyton, C++, and so on. Research rain sensors and their rain intensity values in detailly and determine the appropriate wiper speed based on rainfall intensity.

4. Prototype Development: Building a prototype system comprising the selected rain sensor, servo motors, Arduino uno and other electrical components. Testing the prototype in real-world conditions to validate its performance.

5. Evaluation and Testing: Conducting rigorous testing and validation procedures to assess the accuracy, responsiveness, and robustness of the automatic rain sensing car wipers. Collecting feedback from project supervisor to identify any issues or areas for improvement.

6. Optimization and Refinement: Iteratively refining the design, algorithms, and implementation based on test results.

Analysis and Discussion

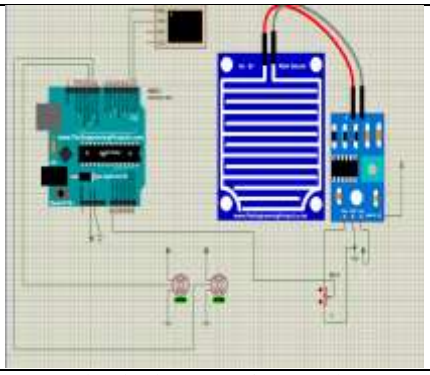

Figure 2: Circuit diagram of our project by using PROTEUS

Figure 3: Hardware circuit

This diagram shows the actual arrangement and connections of our circuit for the prototype. It contains 2 servo motors, Arduino uno, rain sensor. Additionally, the virtual terminal and potentiometer are just for showing the output in simulation proteus, and in the actual prototype we do not use it because it is just a source of input in stimulation but in real life, it isn't needed. The two diagrams have the same function but in the circuit diagram, there are two extra components to show the rain sensor detects rain in app stimulation since there are no other way to proof our system works by using software. Thus, in figure 3 which is hardware circuit the two components that we used in software is not there because in real life, the rain is the input. There are some discussion and analysis about component and the process of our project given below:

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Table 1: The List of Components

1. Arduino 	Arduino Uno function as a Mult controller in this circuit and it reads inputs from the rain sensor, processes data and controls the servo motor to actuate the wipers accordingly.
2. Rain Sensor 	The rain sensor detects the presence and intensity of raindrops it will send output to Arduino uno to run the servo motor. In my project, I have set up 4 situations of rain which are "no rain", "moderate rain", "slow rain ", and "fast rain". All these situations are set up by different values of rain intensity.
3. Servo motor 	The servo motor acts as a car wiper. It's responsible for moving the wiper blades. In my project, there are two servo motors for right and left. It receives commands from Arduino uno based on the input given by my rain sensor. The rotation angle is set to 120 degrees by coding.
4. Breadboard 	Breadboard has a primary function where it is allowed for testing of electronic circuits without the need of soldering. So it made our life easier by saving time and cost. By using this I have protected my components from damage.
5. Jumper wires 	Jumper wires are electrical wires that have pins at each end. It helps to connect all the components above into Arduino uno without shouldering it. It makes my life easier.

ARDUINO	We used Arduino ide as our programming application. We mainly focus on programming for servo motor responds and speed. Below are my programming data:

Figure 2: Programming data flow chart

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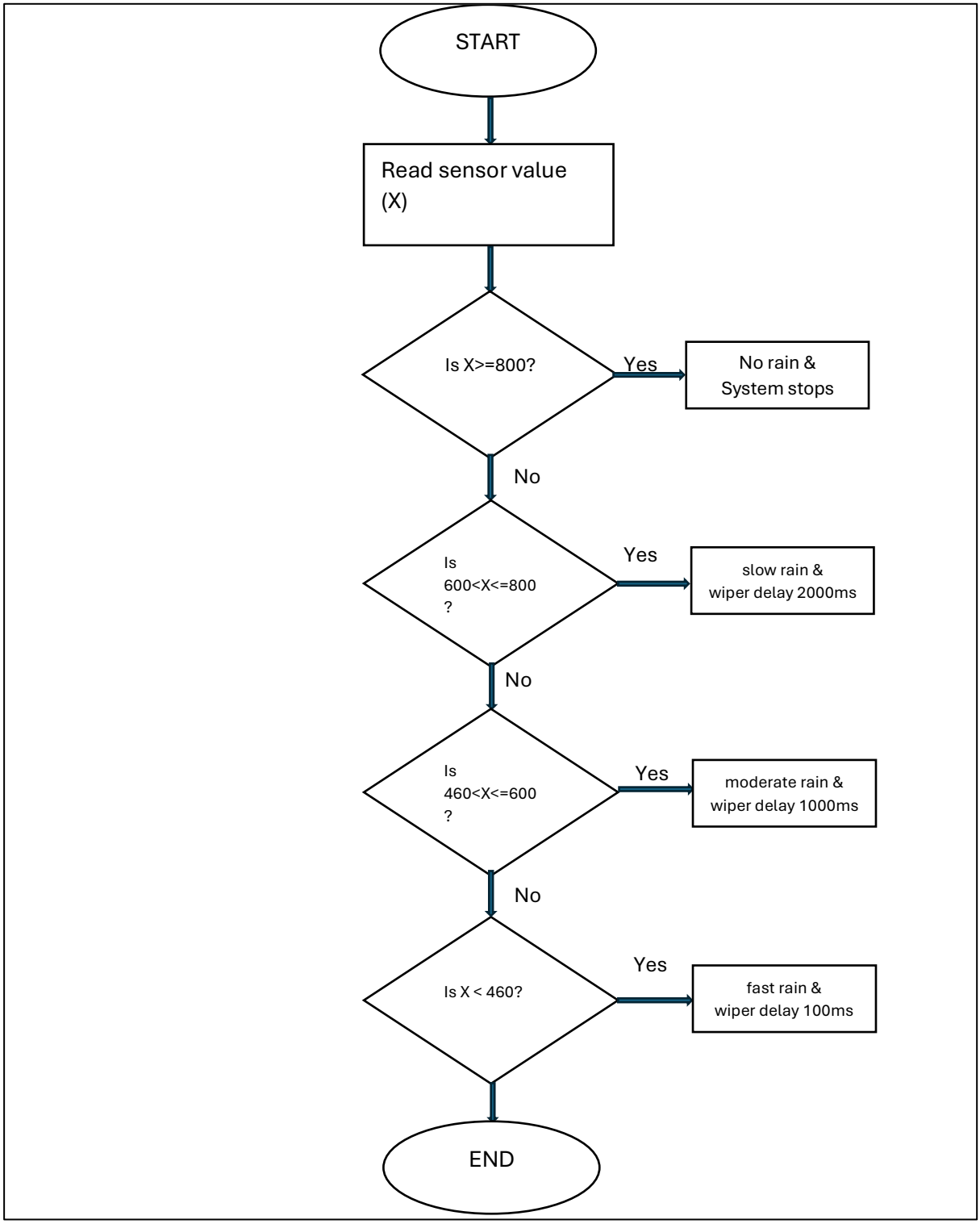

Angle of rotation of servo motor: 120 degree

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Conclusion and Recommendation

Figure 3: Result

In conclusion, our project has been success as it achieved all the objectives that we stated before. This automatic rain-sensing wiper project demonstrates a promising advancement in automotive safety and convenience by effectively integrating sensor technology with wiper controls. Its ability to adjust wiper speed/delay based on real-time rain intensity value that I have been setting in Arduino. It enhances the driver's visibility and reduces distraction when driving especially in heavy raining conditions. I hope this low-cost project will be introduced by the automotive industry for economy cars. To further enhance this project, maybe I recommend designing an intuitive user interface, and exploring the reliability and durability of components by referring to user's feedback in the future for continuous improvement. In my opinion, headlight control according to the rain conditions can be added with this automatic rain-sensing wiper system to enhance safety. These recommendations aim to optimize the performance, usability, and overall effectiveness of the automatic rain-sensing car wiper system, highly drivers' safety and satisfaction.

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