Team 58 Sponsored by Purdue University Northwest

Ink Age Determinations and Testing Randomly Acquired Characteristics (RACs) for Tire Mark Comparison

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PURDUE UNIVERSITY
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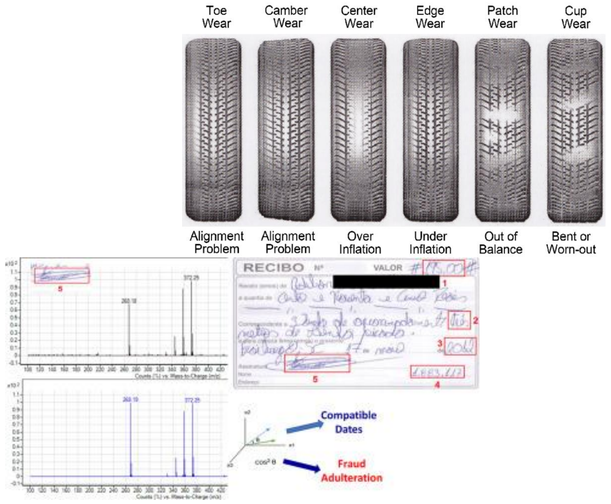
Virtual Teams Demo

OBJECTIVE

Printer inks degrade and discolor over time. The goal of the Ink Age Determination project is to accurately estimate the timeline of an altered document by examining the fading ink while considering environmental conditions. The Tire Mark Comparison project is to develop a means of holding car tires so that their damage can be cataloged and used to compare to tire impressions in a forensic application.



CUSTOMER PROBLEM AND BACKGROUND

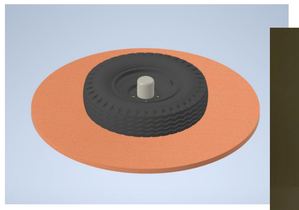
Ink age analysis has been used since 1969 when the Bureau of Alcohol, Tobacco, and Firearms established a program for forensics. However, this program was ineffective, costly, and required collaboration with ink manufacturers which caused it to discontinue in 1991. 11 years later, the Secret Service restarted the program but found difficulties as the database is limited and has many variables such as ink type, environmental factors, and writing pressure differences.

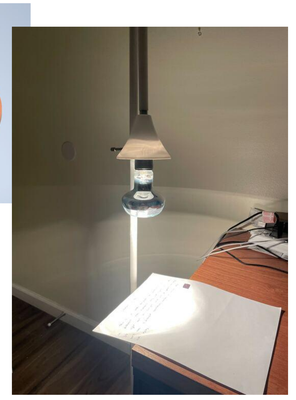
Different vehicles have patterns and unique wear patterns which can lead investigators to conclude the vehicle type, service history, and speed. There are both individual characteristics which are not manufactured into the tire but result from wear such as a notch of the rubber being ripped off or a nail stuck in the tire. Wear characteristics can determine the age of the tires and if the tires are aligned. These specific markings can help identify a suspect's vehicle in a court case.

The client is Professor Charles Steele from Purdue Northwest campus. Future clients may include forensic analysts using these techniques in a court of law.

CONCEPTS AND EXPERIMENTATION

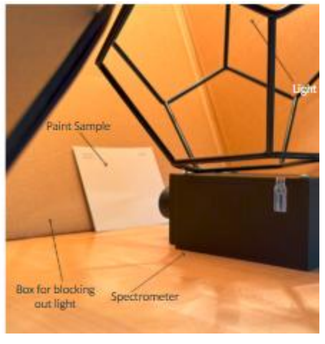
To develop a system for holding tires for cataloging, we decided on a turntable design that can accommodate variable tire sizes. A small camera stand was used separate from the turntable for cataloging because the goal was to develop a means for holding the tire that would aid in tire imaging.



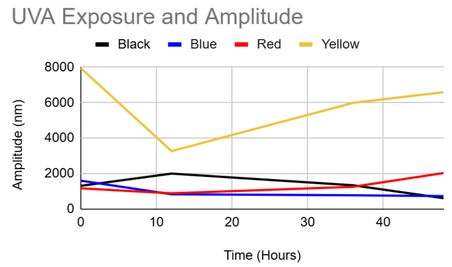


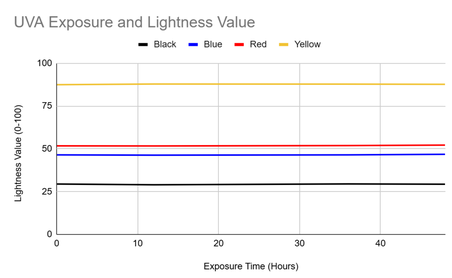
To test the effectiveness of ink aging using spectrometers, a 100-watt UVA lightbulb was used to age ink samples. UVA is the same type of light that the sun emits which we believed would be most effective for artificial aging for our purpose. Using time intervals of 12, 24, 36, and 48 hours with ink colors of blue, yellow, red, and black, measurements were taken on each sample using a spectrometer. The spectrometer measured the dominant wavelength of the sample along with the magnitude of the wavelength.

REQUIREMENTS AND FINAL DESIGN



TESTING RESULTS





CONCLUSION AND RECOMMENDATIONS

Our goal for the project was to create a method of documenting tire patterns consistently so it could be catalogued and stored for forensic examination. To do this we designed a turntable and camera stand to record an image of the tire's circumference. Going forward, our team would standardize the recording distance which is dependent on the radius of the tire.

For the ink aging analysis, our team reached the conclusion that with our spectrometers, we can't observe noticeable changes in our data. We believe this is due to the low-cost spectrometers we used to record amplitude and wavelength. Our recommendation is to use more sensitive spectrometers or spectrophotometers to observe the change in wavelength, amplitude, and lightness values after being subjected to artificial UVA light aging.