ChromaVer: Computer Vision Assisted Multimodal Colorimetric Sensing System Based on Anthocyanins and Curcumin pH-Responsive Indicators for Real-Time, Non-Invasive Assessment of Packaged Meat Freshness

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Traditional “best-before” dates on packaged meat are often rough estimates that do not take real storage conditions into account which can increase the risk of consuming spoiled food, posing a potential public health risk. To address this problem, we developed ChromaVer, a system designed to monitor meat freshness in real time. As meat decomposes, bacteria produce volatile compounds, primarily ammonia. Ammonia is highly water-soluble and reacts with moisture to form a basic solution, resulting in a pH increase. Our system leveraged this pH change through ‘sensors’ infused with natural bio-indicators: anthocyanins (from red cabbage) and curcumin (from turmeric). As decomposition progressed, the sensor film changed color, offering an immediate and discernible visible warning that could be accurately analyzed using a computer vision algorithm. The software is written in Python, using the OpenCV library and it analyses images captured in real-time through a webcam. The results revealed a clear and consistent relationship between the color shift of the film and the actual level of spoilage. ChromaVer offers to enhance food safety through real-time freshness monitoring. Additionally, ChromaVer aims to develop lab-made bioplastics with built-in sensors as packaging materials. Thus it also supports environmental sustainability by relying on biodegradable materials instead of petroleum-based plastics. By providing clear, reliable information about meat freshness, ChromaVer offers a scalable solution to move the food supply chain toward a healthier and smarter future.

Awards Won:
Fourth Award of $600