Real-Time Identification of Erroneous 3D Print Designs (#7636)

A system for the identification of erroneous 3D prints that identifies internal print errors

Georgia Tech inventors have designed a system for the identification of erroneous 3D prints through a multi-layer scheme that leverages acoustics, spatial sensing, and imaging techniques to identify internal print errors. This is completed during and after the printing process. The identification scheme bypasses both the controller computer and the printer firmware, and does not require any changes. The acoustic monitoring, done with an inexpensive microphone and filtering software, can detect changes in the printer's sound that may indicate installation of malicious software. To create the desired object, the printer's extruder and other components should follow a consistent mechanical path that are observed by inexpensive sensors. Variations from the expected path could indicate an attack, sending a signal to the manufacturer. By using the Raman Spectroscopy and computed tomography, researchers were able to detect the location of gold nano-rods that are mixed in with the filament material used in the 3D-printer. Variations from the expected location of those particles indicate a quality problem with the component, which may originate from malicious activity.

Benefits/Advantages

- Real-time automated monitoring of 3D printing process
- Addresses potential threats of malicious manipulations

Potential Commercial Applications

- Industrial-scale additive manufacturing
- Medical 3D printing

Background/Context for This Invention

Additive manufacturing (AM), also known as 3D printing, is an emerging field that shows promise in reducing waste, time, and infrastructure needed in a manufacturing process. The highly computer-integrated nature of AM leaves the control scheme susceptible to malicious manipulation. A printing software may compromise the integrity of the design by using an erroneous set of printing patterns. The manipulation may result in changes to a product's internal structure, causing the exterior to appear correct but the internal structures severely compromised. This can be both expensive for the user and dangerous for safety-critical applications if the errors go unnoticed.

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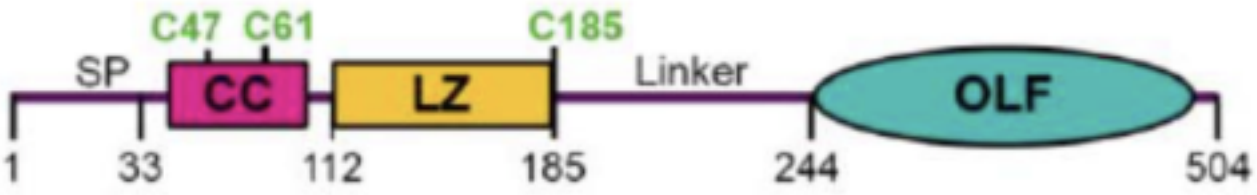
More Information

U.S. Number:

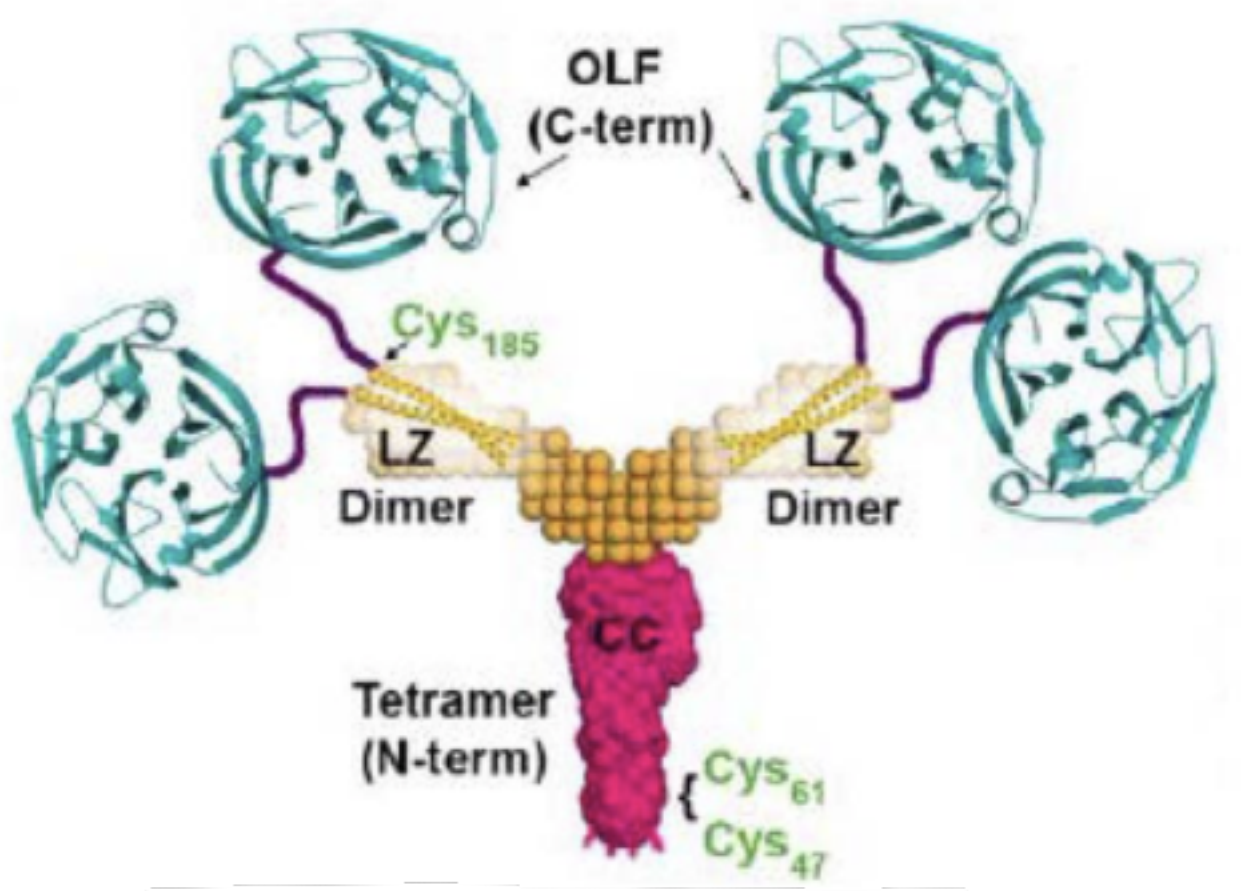
Publications

For more information about this technology, please visit:
https://licensing.research.gatech.edu/technology/real-time-identification-erroneous-3d-print-designs

Images:



The gene structure depicting the domains of myocilin, including signal peptide, location of key cysteine residues, and its coiled-coil, leucine zipper, and olfactomedin domains.



The myocilin quaternary structure based on solution X-ray scattering, X-ray crystallography, and chemical cross-linking experiments.