THE USE OF AI AND ADVANCED COMPUTER SYSTEMS TO DEVELOP DRUGS AGAINST NEW EMERGING THREATS

Using AI-driven Chemical Biology Tools For Ultra-fast, Ultra-high-throughput Small Molecule Development To Counter Biological Threats

Shailesh Date Laboratory for Research in Complex Systems **Jose Jaramillo** Laboratory for Research in Complex Systems

The explosion in wearable monitoring devices, miniaturized sensors, and artificial intelligence (AI) is providing new opportunities that are person centric and provide localized information about the threats in the area. Current chemical and biological sensors have a high cost, bulky, limited in supply and disconnected, restricting their use. These sensors were built for specific threats, requiring complicated calibrations to ensure effectiveness, and provide minimal data. Hence, there is a need for multi-functional sensor technologies that significantly reduce size, weight, and power plus cost (SWaP+C) so they could be deployed widely and could be distributed widely and/or could be person-worn, robotics mounted, and human focused.

In a Department of Homeland Security funded SBIR effort TDA Research has developed a person-worn colorimetric sensor platform that could detect seven or more Toxic Industrial Chemicals (TICs):H2S, NH3, PH3, HCN, NOx, Cl, CO; with capability to be expanded to detect up to 15 with a T90 detection time of 10-60 seconds at concentrations down to the Permissible Exposure Limit (PEL). This platform is at TRL 8 and will provide alarms (audible, visual, haptic alarms to the user). We designed the device to be affordable so it could find wide-spread use in first responder departments as well as national security and sports events. The device is also compatible with Android, IOS and ATAK enabled devices, allowing the sensor data to be sent remotely to centralized monitoring locations. More recently we demonstrated that the platform can be used to detect chemical agents (such as VX, A232 and GA) and can distinguish which chemical agent is present in the air.

This person-worn device will provide an early warning of any TICs and Chemical Agents (CAs) present in the surrounding air and alert the user of the danger so they can take appropriate action. The wearable chemical detection sensor utilizes cheap replaceable colorimetric cartridges for gas detection, eliminating monthly gas calibrations typically required for standard electrochemical cells. The device has a small clip at the back to attach the device to a jacket, vest, etc. A small screen on the front provides the status of the device and audible, visual and vibration alarms are included as well. It has a durable case and some water resistance. The size of the device is 1.9” x 2.7” x 0.9’ (<5 cu inches) and weighs ~70g and consumes uses rechargeable/ replaceable battery and is expected to cost <$250 at large volumes. The indicator cartridges have a shelf-life of 1 year (estimated) and an active life of 1 week at ambient conditions or up to when a TIC or CA is detected, and a color change has happened. We are also working to expand the technology/platform to have the capability to detect the presence of aerosolized CAs, Riot Control Agents (RCAs), Non-Traditional Agents (NTAs), and Pharmaceutical Based Agents (PBAs). The results from this sensor development, demonstrating its detection capabilities for Cas and TICs and its use case for DTRA CBRN detection will be presented at the meeting.