



GAANN- GOSTARS Fellowship Project



Adviser: Yusuf Mehta, Ph.D., P.E.

Title: Development of Self-Powered, Durable Aggregate Particles for Condition Monitoring and Traffic Counting on Roadways

Description: The pavement industry relies heavily on pavement condition data when making decisions to allocate available resources. Having accurate data is substantial to cost-effectively allocate resources and prioritize construction, rehabilitation, and preservation pavement projects. Currently, agencies collect pavement condition data on yearly basis. This process is time consuming and very costly. The goal of this project is to develop economical, scalable, self-powered, and durable aggregate particles for condition monitoring and traffic counting operations. These particles will also help link roadway/bridge infrastructure with in-vehicle and personal devices for a safe, sustainable, and connected surface transportation.

Impact on GOSTAR: The student working on this project is expected to learn concepts related to pavement engineering, artificial intelligence, manufacturing processes, and data mining. Therefore, this project will allow the student to obtain a job in any of these fields. As discussed previously, the student working on this project has the opportunity to publish a total of three papers. Those papers will be sent to the Journal of the Transportation Research Record (TRR). Submission deadline will be August 1 of each target year. If accepted, the student will also be able to present at the Transportation Research Board's (TRB's) annual meeting which usually happen in January of each target year.

Impact on GAANN: The outcomes of this study will lead to various benefits of which is the improved maintenance and rehabilitation project prioritization at agency level. The developed aggregate sensors will allow agencies to obtain pavement performance data throughout a roadway's service life. This data can be used to accurately determine the service life of a pavement; thereby resulting in an improved resurfacing and replacement project prioritization. This ultimately leads to better allocation of resources by agencies.

Tentative Plan

Semester	1	2	3	4	5	6	7	8	9
Task	Literature review	Develop a prototype, wireless sensor for use in pavement applications		Developing technologies for generating and storing electrical power for self-powering the aggregate particles			Feasibility of the sensor modules to characterize mechanistic responses of pavements under full scale accelerated pavement testing		
Outcome	Develop a piezoelectric vibration sensor that can detect small vibrations			Develop technology for storing the energy generated from vibrations			Develop self-powered sensors that can measure mechanical responses.		
Deliverable	Publish in a refereed conference proceedings and journal			Publish in a refereed conference proceedings and journal			Publish in a refereed conference proceedings and journal. Potential patent Application.		
Graduation									Summer 2025