Dear Ilakkuvaselvi,
Here is the copy of the Project Pitch with reference number : **00068183** submitted to the **Advanced Manufacturing (M)** on **9/26/2023**.

1. Submitter Name

   Ilakkuvaselvi Manoharan

2. Submitter Email

   ilakk2023@gmail.com

3. Submitter Phone

   3093637732

4. Company Name

   Bubbles & Cafe Inc.

5. State

   IL

6. Zip Code

   60504

7. Corporate Website

   N/A

8. SBIR/STTR topic that best fits your projects technology area

   Advanced Manufacturing (M)

9. Is this Project Pitch for a technology or project concept that was previously submitted as a full proposal by your company to the NSF SBIR/STTR Phase I Program – and was not awarded ?

   No

10. Has your company received a prior NSF SBIR or STTR award?

    No

11. Does your company currently have a full Phase I SBIR or STTR proposal under review at NSF?

    No

12. Briefly Describe the Technology Innovation?

The technical innovation at the core of the Phase I project is the development and validation of a specialized reaction vessel optimized for nanomaterial growth in a microgravity environment. This innovation involves several key components:Precise Nanocrystal Growth: The project aims to achieve precise control over nanomaterial properties, including size, shape, composition, and crystallinity, under the unique conditions of microgravity. This involves the design and construction of a reaction vessel that can facilitate the growth of nanomaterials with tailored characteristics.Fluid Dynamics Optimization: Advanced fluid dynamics optimization techniques will be explored to ensure uniform mixing, temperature control, and turbulence management within the reaction vessel. Optimizing fluid dynamics is critical for achieving reproducible and high-quality nanomaterial properties.Integration of Spintronics and Quantum Sensors: The project seeks to integrate state-of-the-art spintronics and spin-based quantum sensors into the system to monitor and control the behavior of nanoparticles and molecules involved in nanomaterial synthesis. These sensors provide real-time data on spin properties, enabling precise manipulation of reactants.Closed-Loop Feedback Control System: The integration of spin-based sensors and fluid dynamics optimization will enable the development of a closed-loop feedback control system. This system will continuously adapt external parameters, such as magnetic field strength, temperature gradients, and reactant flow rates, to maintain desired fluid dynamics and optimize nanomaterial growth.Feasibility Study in Microgravity: The project aims to assess the feasibility of implementing these innovations in a true microgravity environment, either on the International Space Station (ISS) or in microgravity simulation facilities. This involves testing the specialized reaction vessel and conducting nanocrystal growth experiments under real microgravity conditions.Overall, the Phase I project's technical innovation revolves around the design, development, and validation of a comprehensive system that combines nanocrystal growth control, fluid dynamics optimization, and the integration of cutting-edge spintronics and quantum sensors. This innovation has the potential to transform nanomaterial synthesis, with applications spanning various industries, from advanced technologies to space exploration and biomedical research.Microgravity Effects on Nanocrystal and Nanoparticle Synthesis:Diffusion Dominance: In microgravity, the absence of buoyancy-driven convection allows for more precise control over the distribution of reactants. This can lead to better mixing and homogeneity in the reaction mixture.Reduced Sedimentation: Nanoparticles and nanocrystals often involve suspended particles in a solution. In microgravity, sedimentation is significantly reduced, which means that particles are more evenly distributed and do not settle at the bottom of the reaction vessel. This can lead to more uniform particle size and distribution.Quiescent Fluid Environment: Microgravity provides a quiescent fluid environment with minimal disturbances, resulting in fewer nucleation sites for crystal or particle formation. This can lead to the growth of larger, more well-defined nanocrystals or nanoparticles.Enhanced Self-Assembly: In the absence of gravity-induced settling, nanoparticles can exhibit enhanced self-assembly behavior, allowing for the formation of complex nanostructures and assemblies with improved precision.Gravitational Reduction: Microgravity reduces or eliminates gravitational forces, facilitating controlled experiments.Novel Growth Strategies: Researchers can explore innovative approaches for nanocrystal growth due to the unique fluid dynamics in microgravity.Bubble Formation Impact: Microgravity alters bubble behavior, influencing reaction kinetics and gaseous byproduct removal. Proper gas-liquid interaction is vital for reaction control.Precise Control: Microgravity environments offer precise control over reactant mixing, temperature, and other parameters, enabling tailored nanocrystal properties.Reduced Agglomeration: Nanocrystals are less likely to agglomerate or clump together in microgravity, resulting in uniform and well-dispersed particles.Improved Reaction Kinetics: Homogeneous mixing of reactants is crucial for many chemical reactions. When reactants are uniformly distributed, they have a higher probability of encountering each other, leading to increased collision rates and a greater chance of successful reactions. This can enhance reaction kinetics, including reaction rates and yields. The integration of state-of-the-art spintronics and spin-based quantum sensors into nanomaterial synthesis in microgravity has several significant impacts, enhancing control and precision in the synthesis process. Here are specific examples of how this integration affects nanomaterial synthesis:Real-Time Monitoring of Spin Properties:Example: Let's say the nanomaterial synthesis involves the alignment of magnetic nanoparticles for a specific application, such as magnetic data storage. Spin-based quantum sensors can provide real-time data on the alignment of the nanoparticle spins during synthesis.Impact: This real-time monitoring allows researchers to precisely control the orientation and alignment of nanoparticles, ensuring that the resulting nanomaterial exhibits the desired magnetic properties.Quantum Control of Chemical Reactions:Example: In a scenario where chemical reactions at the quantum level are involved in nanomaterial synthesis, spintronics and quantum sensors can monitor the spin states of reactant molecules. For instance, the control of radical spin states in a polymerization reaction.Impact: By monitoring and manipulating the spin properties of reactants, researchers can optimize reaction pathways, leading to the synthesis of nanomaterials with specific chemical structures and properties that are otherwise challenging to achieve.Enhanced Quantum Dot Synthesis:Example: Quantum dots are semiconductor nanoparticles with size-dependent electronic properties. Spin-based quantum sensors can monitor the quantum states of individual quantum dots during their formation.Impact: This integration enables the precise control of quantum dot size and properties, resulting in quantum dots with tailored electronic and optical characteristics for applications in quantum computing, photonics, and sensors.Closed-Loop Feedback Control:Example: Spintronics and quantum sensors can be integrated into a closed-loop feedback control system that continuously monitors and adjusts external parameters during synthesis, such as magnetic field strength or reactant concentrations.Impact: This real-time feedback control ensures the stability and reproducibility of nanomaterial growth, even in the microgravity environment where fluid dynamics behave differently. It leads to the production of high-quality nanomaterials with minimal variations.Spin-Based Quantum Sensors in Biomedical Nanoparticles:Example: In biomedical applications, nanoparticles are often used for drug delivery or imaging. Spin-based sensors can monitor the spin states of nanoparticles tagged with specific biomolecules, such as antibodies.Impact: This integration enables the development of advanced targeted drug delivery systems and highly sensitive magnetic resonance imaging (MRI) contrast agents, enhancing medical diagnostics and therapies.In summary, the integration of spintronics and spin-based quantum sensors into nanomaterial synthesis in microgravity provides a level of precision and control that is crucial for tailoring nanomaterial properties to specific applications. It enables real-time monitoring of quantum properties, precise manipulation of reactants, and the development of closed-loop feedback control systems, all of which contribute to the production of high-quality, customized nanomaterials with enhanced properties for various industries and scientific advancements.The design of a specialized reaction vessel for nanomaterial synthesis with optimized fluid dynamics is a critical aspect of the project. It plays a pivotal role in ensuring precise control over the nanomaterial properties, especially in a microgravity environment. The integration of Spintronics and Quantum Sensors further enhances this vessel's capabilities for optimizing fluid dynamics. Design of the Reaction Vessel:Geometry and Shape: The vessel's geometry and shape are carefully designed to promote even distribution of reactants and minimize the formation of gradients. Special baffles or flow channels may be integrated to facilitate controlled mixing.Temperature Control: The vessel includes provisions for precise temperature control. This control is crucial in nanomaterial synthesis as temperature variations can significantly affect the growth and crystallinity of nanoparticles.Material Selection: Materials for the vessel are chosen to minimize contamination and interference with the synthesis process.Fluid Inlet and Outlet: The vessel is equipped with strategically placed inlets and outlets to ensure a continuous flow of reactants and the removal of byproducts. This maintains a stable reaction environment.Integration of Spintronics and Quantum Sensors:How Spintronics and Quantum Sensors contribute to optimizing fluid dynamics within this reaction vessel:Real-Time Monitoring: Spintronics and Quantum Sensors provide real-time data on various parameters, such as temperature, pressure, and spin properties of reactants and nanoparticles. This information allows for instant adjustments in response to any deviations from the desired conditions.Feedback Control: The data from these sensors can be fed into a closed-loop feedback control system. This system can dynamically modify external parameters like magnetic field strength or reactant flow rates to maintain the desired fluid dynamics.Fluid Dynamics Algorithms: Advanced algorithms are developed based on sensor data to optimize fluid dynamics. For instance, if sensors detect uneven mixing, the system can adjust magnetic fields or fluid flow to ensure uniform distribution of reactants.Safety Protocols: Spintronics and Quantum Sensors also play a role in safety. They can detect anomalies or deviations from safe operating conditions and trigger automatic shutdowns or safety measures to prevent accidents.Data-Driven Optimization: Over time, data collected by the sensors can be used to refine and optimize the fluid dynamics of the vessel. This data-driven approach ensures continuous improvement in the synthesis process.In summary, the design of the reaction vessel for nanomaterial synthesis incorporates features for precise control of fluid dynamics. The integration of Spintronics and Quantum Sensors adds a layer of real-time monitoring, feedback control, and data-driven optimization. This combination of design and advanced technology ensures that the nanomaterial synthesis process can be finely tuned and reproducible, even in the challenging conditions of microgravity, leading to the production of high-quality, tailored nanomaterials for various applications. Origins of the Innovation:The innovation at the intersection of spintronics, quantum sensors, and fluid dynamics for nanocrystal growth in microgravity originated from:Microgravity Research: ISS experiments studying fluid behavior in microgravity laid the groundwork for adapting these findings to nanocrystal growth.Fluid Control Systems: Development of microgravity fluid control systems, incorporating passive mixing and microfluidics for precise control over fluid parameters.Cryogenic Fluid Management: Principles from cryogenic fluid management research were applied to control and manipulate fluids in nanocrystal growth experiments.Computational Fluid Dynamics (CFD): CFD simulations modeled fluid behavior in microgravity, enabling virtual testing and optimization of nanocrystal growth conditions.Spintronics and Quantum Sensors: Integration of spintronics and quantum sensors for precise fluid control and monitoring, leveraging their space-tested reliability.Nanocrystal Growth Research: Building on ISS experiments, research focused on achieving improved nanocrystal properties in microgravity.Biological and Material Science Insights: Knowledge from ISS experiments in these fields was applied to understand nanomaterial behavior in microgravity.Crystal Growth Simulations: Studies on fluid dynamics and crystal growth in simulated microgravity refined the nanocrystal growth process.Materials Science Advances in Space: Leveraging enhanced material properties observed in microgravity environments for superior nanomaterial synthesis.This innovation emerged from the synergy of these areas, facilitating the precision and optimization of nanocrystal growth in space. High-Impact

Potential: Nanocrystals and Nanoparticles in the Cancer Moonshot Initiative:Quantum Dots for Cancer Detection: Enable precise cancer cell identification, paving the way for early diagnosis and commercial diagnostic kits.Liposomes: Encapsulate and deliver drugs to cancer cells, reducing toxicity.Polymeric Nanoparticles: Biocompatible carriers for slow drug release to increase exposure.Gold Nanoparticles: Utilized in photothermal therapy to selectively kill cancer cells with laser light.Iron Oxide Nanoparticles: Enhance MRI contrast and serve as drug carriers for targeted therapy.Carbon Nanotubes: Deliver drugs, offer imaging, and support photothermal therapy.Silica Nanoparticles: Biocompatible carriers for drug delivery and cancer imaging.Dendrimers: Branched polymers carrying drugs or imaging agents for targeted delivery.Nanoparticle-Drug Conjugates (NDCs): Conjugated with drugs or antibodies for targeted delivery, minimizing off-target effects.Carbon Nanoparticles: Used in photodynamic therapy (PDT) to destroy cancer cells with light.Albumin Nanoparticles: Optimize drug delivery for improved solubility and efficacy, potentially leading to better cancer treatment formulations.Drug Delivery and Medical Imaging: Improve drug delivery systems and enhance MRI/CT scan accuracy, benefiting the pharmaceutical and medical technology sectors.Biomaterials and Tissue Engineering: Advance tissue engineering with nanoparticle-based biomaterials, providing innovative solutions for regenerative medicine. Nanocrystals and Nanoparticles in the Chips Initiative:Silicon Quantum Dots: Integrate into semiconductor chips for faster and more efficient quantum computing technologies with commercial applications.Semiconductor Nanowires: Enhance chip-based electronics for commercial electronic components with superior performance and energy efficiency.Topological Insulators: Enable specialized quantum processors for commercial quantum computers, impacting fields like materials science, drug discovery, and cryptography.Silicon Carbide (SiC) Defect Centers: Contribute to the commercialization of quantum computing systems for logistics, cryptography, and simulations.Nanomaterials for Cooling: Extend the lifespan and enhance efficiency of microprocessors in electronic devices, benefiting consumers and the electronics industry.The integration of nanocrystals and nanoparticles in these initiatives extends beyond their primary focuses, offering broader applications:Quantum Technologies: Quantum dots, silicon quantum dots, and topological insulators advance quantum computing and processors, benefiting industries like finance, cryptography, and simulations.Sensors: Nanoparticles enhance sensing capabilities, leading to more accurate and versatile sensor technologies for applications in environmental monitoring, healthcare, and security.Medical Devices: Nanoparticle-based advancements contribute to more precise and efficient medical devices, improving patient care and diagnostics in areas like imaging, drug delivery, and regenerative medicine.Advanced Electronics: Semiconductor nanowires and nanomaterials for cooling drive innovation in electronics, leading to more energy-efficient and reliable consumer and industrial devices.Interdisciplinary Innovation: Cross-sector collaboration and technology transfer foster innovation by addressing complex challenges and pushing the boundaries of various fields, leading to novel solutions for a wide range of industries. The project "Leveraging Spintronics, Spin-Based Quantum Sensors, and Optimization of Fluid Dynamics for Enhanced Nanomaterial Growth in Microgravity" aligns with the NSF's America's Seed Fund program goals by:Fostering Innovation: It introduces cutting-edge technologies for innovative nanomaterial synthesis.Creating Businesses and Jobs: It has the potential to spawn new businesses and job opportunities.Validating Deep Technologies: The project validates promising yet unproven deep technologies.Commercial and Societal Impact: It aims to create impactful products and services.Supporting Small Businesses: It provides vital support to small startups in uncharted tech areas.Congressional Mandate: The project echoes the program's commitment to advancing American innovation and technology.The project validates deep technologies with applications in:Biomedical:Enhancing drug delivery systems.Improving biosensors for disease detection.Advancing tissue engineering.Cancer Detection and Cure:Enhancing imaging techniques.Enabling targeted therapies.Supporting immunotherapies.Quantum Technologies:Improving quantum sensing.Developing advanced quantum materials.Expanding quantum sensor applications in medicine.

13. Briefly Describe the Technical Objectives and Challenges?

Task Descriptions, Schedules, Resource Allocations, Estimated Task Hours, and PlannedAccomplishments for multiphase R&D Plan: Phase 1 (Duration: 36 weeks)Objective 1: Design and Development of the Reaction VesselTask 1.1: Setup of Nanocrystal Growth Experiments (Weeks 1-12)Description: Prepare and set up nanocrystal growth experiments.Schedule: Weeks 1-12.Resource Allocation: Laboratory space, equipment, materials for nanocrystal synthesis, and PI.Estimated Task Hours (PI): 480 hours.Planned Accomplishments:Experiment setups ready.Preliminary experiments with nanocrystals and data collection.Identify and document preliminary optimized synthesis parameters for nanocrystal growth.Safety protocols and training. Task 1.2: Comprehensive Study of Fluid Dynamics (Weeks 13-24)Description: Conduct a literature review and preliminary simulations to understand fluiddynamics in microgravity.Schedule: Weeks 13-24.Resource Allocation: PI, access to research databases, and simulation software.Estimated Task Hours (PI): 480 hours.Planned Accomplishments:Literature review completed.Critical fluid dynamic parameters that are relevant to the nanocrystal growth experiments areidentified.Initial simulations set up and running.Data collection and analysis. Task 1.3: Design and Build the Reaction Vessel (Weeks 25-36)Description: Design and construct the specialized reaction vessel optimized for nanocrystalgrowth in microgravity.Schedule: Weeks 25-36.Resource Allocation: Laboratory space, materials for vessel construction, and PI.Estimated Task Hours (PI): 480 hours.Planned Accomplishments: Completed design of the reaction vessel; Completed construction ofthe initial version of the reaction vessel. Task 1.4: Document and Report Findings(Throughout)Create comprehensive documentation of research, methodologies, and results for Phase II andfuture development efforts. Include reports on fluid dynamics optimization and nanocrystalgrowth achievements.Task 1.5: Nanocrystal Growth Experiment with Fluid Dynamics Optimization in Microgravity(Tentative) Milestone: Phase I proposal package including papers and articles on the innovationsubmitted to the scientific journals, detailed documentation of the experiments and results andfindings, initial prototype of the reaction vessel will be submitted. Phase 2 (Duration: 36 weeks) Task 1.6: Iterative Design and Development (Weeks 38-49)Description: Use data from experiments to refine the design of the reaction vessel and developinnovative fluid control techniques.Schedule: Weeks 38-49.Resource Allocation: Laboratory space, materials for vessel modification, and PI;Estimated Task Hours (PI): 480 hours.Planned Accomplishments: Improved vessel design; Prototypes of fluid control techniques.Engineer grade set of variables. Objective 2: Integration of Spintronics and Spin-Based Quantum Sensors Task 2.1: Research and Adapt Existing Technologies (Weeks 50-61)Description: Investigate available Spintronics and Spin-Based Quantum Sensors technologies.Adapt or developprototypes for fluid control.Schedule: Weeks 50-61.Resource Allocation: PI, access to relevant technology databases, and materials for prototypedevelopment;Estimated Task Hours (PI): 480 hours.Planned Accomplishments: Identification of suitable technologies; Prototypes of adaptedsensors. Task 2.2: Experimentation with Sensors.(Weeks 62-73)Description: Conduct experiments to assess the precision and accuracy of sensors in controllingfluid behavior.Schedule: Weeks 62-73.Resource Allocation: Laboratory space, sensors, and PI.Estimated Task Hours (PI): 480 hours.Planned Accomplishments: Data on sensor performance in fluid control. Task 2.4: Nanocrystal Growth Experiment with Spintronics and Quantum Sensors Integration.(Tentative) Milestone: Phase II proposal package including papers and articles on the innovationsubmitted to the scientific journals, detailed documentation of the experiments and results andfindings, initial prototype of the reaction vessel will be submitted. Phase 3 (Duration: 36 weeks) Objective 3: Achievement of Desired Nanocrystal Properties Task 3.1: Implementation of Fluid Control and Monitoring (Weeks 75-86)Description: Apply the optimized fluid control techniques and Spintronics-based monitoringduring nanocrystal growth experiments.Schedule: Weeks 75-86.Resource Allocation: Laboratory equipment, sensors, and PI.Estimated Task Hours (PI): 480 hours.Planned Accomplishments: Controlled fluid dynamics during experiments; Developedalgorithms for the closed-loop feedback control system. Task 3.2: Analysis of Nanocrystals (Weeks 87-98)Description: Analyze resulting nanocrystals for structural quality, uniformity, and size.Schedule: Weeks 57-64.Resource Allocation: Laboratory equipment, materials for analysis, and PI.Estimated Task Hours (PI): 480 hours.Planned Accomplishments:Assessment of nanocrystal properties. Objective 4: Microgravity Experiment Validation Task 4.1: Feasibility Study and Reaction Vessel Testing on the ISS (Weeks 99-110) Description: Conduct a comprehensive feasibility study and validate the performance of thespecialized reaction vessel designed for nanocrystal growth in microgravity conditions on theInternational Space Station (ISS). Alternatively, microgravity simulation facilities could be used;Schedule: Weeks 99-110.Resource Allocation: Access to the ISS or any microgravity simulation facility, scientificequipment, materials for nanocrystal synthesis, implementation partners and PI.Estimated Task Hours (PI): 480 hours.Planned Accomplishments:Feasibility assessment of the reaction vessel's functionality in microgravity.Execution of nanocrystal growth experiments in the ISS environment.Data collection to validate the vessel's design and performance under real microgravityconditions. Milestone: Phase III proposal package including papers and articles on the innovationsubmitted to the scientific journals, detailed documentation of the experiments and results andfindings, initial prototype of the reaction vessel will be submitted. Commercial Viability and Impact: The successful execution of Phase I R&D activities will provide a strong foundation for subsequent phases and will contribute significantly to making the new product or service commercially viable and impactful: Commercial Viability: The research outcomes achieved in Phase I will attract further investment and partnerships, potentially leading to the development of commercial nanomaterial synthesis systems suitable for space and terrestrial applications. Impact: The project's outcomes have the potential to revolutionize nanomaterial synthesis, benefiting industries such as electronics, photonics, catalysis, and space exploration. High-quality, customized nanomaterials can drive innovation and economic growth, while fundamental insights into fluid dynamics in space environments contribute to broader scientific understanding. Ultimately, the project aligns with the definition of R&D by addressing technical challenges beyond incremental development, promising transformative impact on materials science and advanced technologies.

14. Briefly Describe the Market Opportunity?

Market Opportunity:The customer profile for this technical project encompasses a range of stakeholders from various industries, including electronics, photonics, catalysis, space exploration, and research institutions. These customers share a common pain point: the need for precise and reproducible nanomaterials with tailored properties for their specific applications.Biomedical Research and Cancer Detection/Treatment:Customer Profile: Biomedical researchers, pharmaceutical companies, and healthcare institutions are interested in leveraging nanomaterials for the early detection and treatment of cancer.Pain Points: Current cancer detection methods often lack the sensitivity and specificity required for early diagnosis. Additionally, effective cancer treatment often involves targeted drug delivery, which necessitates precise control over drug carriers' properties, such as size, surface chemistry, and drug release kinetics. Obtaining nanomaterials with these specific attributes is a major challenge in cancer research and treatment.Applications: Nanomaterials synthesized through this project can be functionalized with biomolecules and used for targeted cancer therapy and imaging. Their controlled properties enable enhanced drug delivery and imaging contrast, addressing the pain points of limited treatment efficacy and suboptimal diagnostic accuracy in cancer care.Spin Qubits and Quantum Sensors:Customer Profile: Quantum computing and sensing companies, as well as research institutions, are at the forefront of exploring spin-based technologies for quantum computing and sensing applications.Pain Points: Quantum technologies heavily rely on precise control over the quantum states of particles. Obtaining nanomaterials with the desired spin properties and qubit coherence times is challenging. In the case of quantum sensors, sensitivity and control over quantum states are vital for achieving high -performance sensors.Applications: The project's use of spintronics and spin-based quantum sensors has the potential to produce nanomaterials with tailored spin properties, addressing the pain points of limited qubit control and sensitivity in quantum computing and sensing. These nanomaterials can be integrated into quantum devices and sensors, unlocking new levels of performance in areas such as secure communications, materials characterization, and more.Electronics and Photonics Industry: Manufacturers of electronic components and photonic devices require nanomaterials with finely tuned properties to enhance device performance. For example, semiconductor companies need precisely engineered nanomaterials for faster and more efficient transistors and optoelectronic devices. The pain point here is the limited availability of nanomaterials that meet their exact specifications.Catalysis Sector: Catalysts play a pivotal role in various chemical processes, from fuel production to environmental remediation. Nanomaterials with controlled properties can significantly improve catalytic efficiency. Companies in the catalysis sector seek tailored nanomaterials to address the pain point of suboptimal catalyst performance.Space Exploration Agencies: Space agencies, private space companies, and research institutions involved in space exploration are keen to understand how nanomaterial synthesis behaves in microgravity. The project's findings will help them optimize material production for space applications, addressing the challenge of adapting industrial processes to space environments.Research Institutions: Academic and research institutions constantly seek advanced materials for fundamental studies and innovative applications. The project offers a solution to the pain point of limited control over nanomaterial properties, providing researchers with a valuable tool for their experiments.The near-term commercial focus will be to cater to these customer segments by offering tailored nanomaterials with precise properties. The project's success will alleviate the pain points of inconsistent material quality and limited control, driving commercial interest and partnerships in these industries. Additionally, the insights gained into microgravity's effects on fluid dynamics and nanomaterial growth may lead to opportunities in space materials science and technology development, further expanding the market potential.

15. Briefly Describe the Company and Team?

The team consists of only the solo founder - Ilakkuvaselvi Manoharan Ilakkuvaselvi (Ilak) Manoharan is a highly skilled and experienced professional based in Aurora, IL. With a diverse background in entrepreneurship, product management, research, and engineering, Ilak brings a unique set of skills and expertise to various industries. Ilak is currently the Founder, CEO, Scientist, Researcher, and Engineer at Curious & Connected NPO, an organization focused on research exploration, innovation, and product development. In this role, Ilak actively engages in scientific research, drives product development initiatives, and oversees the overall operations of the organization. Additionally, Ilak is involved in startup development and fundraising activities, demonstrating a strong entrepreneurial spirit. Furthermore, Ilak is the Founder, CEO, Scientist, Engineer, and Product Manager at Bubbles & Cafe, a venture that has applied for a utility patent for AIOS IoT Smart Restaurant. Ilak leads the innovation and product development efforts of Bubbles & Cafe, working towards revolutionizing the restaurant industry through the application of advanced technologies. As a strategic thinker and experienced product manager, Ilak combines scientific knowledge with business acumen to drive the success of the venture. Ilak's expertise extends to mobile app development, with a focus on iOS and Android platforms. With a portfolio of successful apps available on both the App Store and PlayStore, Ilak has demonstrated proficiency in Swift, Flutter, and other related technologies. Ilak's background also encompasses data engineering, data science, and backend development using technologies such as Java, Spring, Hibernate, RDBMS, NoSQL, and Python. Throughout Ilak's career, leadership, creativity, adaptability, and problem-solving skills have been key attributes that have contributed to success in various roles. Ilak has experience working in renowned companies such as JPMorgan Chase, Accenture, McDonald's, and Caterpillar, where they have held positions ranging from lead application developer to solution architect. Ilak holds a Master's degree in Electrical Engineering with a minor in Software Engineering from Texas A&M Kingsville, as well as a Bachelor's degree in Electronics and Instrumentation Engineering from the University of Madras. She have also acquired additional certifications in software development. Overall, Ilakkuvaselvi (Ilak) Manoharan is a multifaceted professional with a passion for entrepreneurship, innovation, and leveraging technology to drive positive change. Through her diverse skill set and experiences, Ilak is poised to make significant contributions in various domains, particularly in research, product development, and the advancement of the AIOS IoT Smart Restaurant concept.

16. How did you first hear about our program?

NSF email, webinar, or event

NSF SBIR/STTR Phase I Eligibility Information:

In addition to receiving an invitation to submit a full proposal from the NSF SBIR/STTR Phase I Program based upon the review of their submitted Project Pitch,potential proposers to the program must also qualify as a small business concern to participate in the program (see SBIR/STTR Eligibility Guidefor more information).

The firm must be in compliance with the SBIR/STTR Policy Directive(s) and the Code of Federal Regulations (13 CFR 121).

- Your company must be a small business (fewer than 500 employees) located in the United States. Please note that the size limit of 500 employees includes affiliates.
- At least 50% of your company's equity must be owned by U.S. citizens or permanent residents, and all funded work needs to take place in the United States (including work done by consultants and contractors).
- Primary employment is defined as at least 51 percent employed by the small business. NSF normally considers a full-time work week to be 40 hours and considers employment elsewhere of greater than 19.6 hours per week to be in conflict with this requirement.
- The Principal Investigator needs to commit to at least one month (173 hours) of effort to the funded project, per six months of project duration.

For more detailed information, please refer to the SBIR/STTR Eligibility Guide by using https://www.sbir.gov/sites/default/files/elig_size_compliance_guide.pdf. Please note that these requirements need to be satisfied at the time an SBIR/STTR award is made, and not necessarily when the proposal is submitted.