

Bubbles & Cafe Inc.

Project Title: Leveraging Spintronics, Spin-Based Quantum Sensors, and Optimization of Fluid Dynamics for Enhanced Nanomaterial Growth in Microgravity.

PI: ILAKKUVASELVI MANOHARAN

Task Descriptions, Schedules, Resource Allocations, Estimated Task Hours, and Planned Accomplishments for multiphase R&D Plan:

Task 0: Document and Report Findings(Throughout)

Create comprehensive documentation of research, methodologies, and results for every phase and future development efforts.

Phase 1 (Duration: 36 weeks)

Objective 1: Synthesis and Characterization of Nanocrystals for the selected applications.

Task 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 the preliminary knowledge gained.

Plan and document specifications for experiments in the next task.

Safety protocols and training.

Task 1.2: Synthesis and Characterization of Nanocrystals for Spin Qubits and/or Sensors (Weeks 13-24)

Description: Characterization of nanocrystals for spin qubits.

Schedule: Weeks 13-24.

Resource Allocation: Laboratory space, equipment, materials and PI.

Estimated Task Hours (PI): 480 hours.

Planned Accomplishments:

Synthesis and characterization of nanocrystals for spin qubits and/or sensors

Document the results.

Task 1.3: Synthesis and Characterization of Nanocrystals for Biomedical use (Weeks 25-36)

Description: Characterization of nanocrystals for drug delivery.

Bubbles & Cafe Inc.

Project Title: Leveraging Spintronics, Spin-Based Quantum Sensors, and Optimization of Fluid Dynamics for Enhanced Nanomaterial Growth in Microgravity.

PI: ILAKKUVASELVI MANOHARAN

Schedule: Weeks 25-36.

Resource Allocation: Laboratory space, equipment, materials and PI.

Estimated Task Hours (PI): 480 hours.

Planned Accomplishments:

Synthesis and characterization of nanocrystals for drug delivery.

Document the results.

★ Milestone: Phase I results package including papers and articles on the innovation submitted to the scientific journals, detailed documentation of the experiments and results and findings will be submitted.

Phase 2 (Duration: 36 weeks)

Objective 2: Design and Development of the Reaction Vessel

Task 2.1: Comprehensive Study of Fluid Dynamics (Weeks 38-49)

Description: Conduct a literature review and preliminary simulations to understand fluid dynamics in microgravity.

Schedule: Weeks 38-49.

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 are identified.

Initial simulations set up and running.

Data collection and analysis.

Task 2.2: Design and Build the Reaction Vessel (Weeks 50-61)

Description: Design and construct the specialized reaction vessel optimized for nanocrystal growth in microgravity.

Schedule: Weeks 50-61.

Resource Allocation: Laboratory space, materials for vessel construction, and PI.

Estimated Task Hours (PI): 480 hours.

Bubbles & Cafe Inc.

Project Title: Leveraging Spintronics, Spin-Based Quantum Sensors, and Optimization of Fluid Dynamics for Enhanced Nanomaterial Growth in Microgravity.

PI: ILAKKUVASELVI MANOHARAN

Planned Accomplishments: Completed design of the reaction vessel; Completed construction of the initial version of the reaction vessel.

Task 2.3: Iterative Design and Development (Weeks 62-73)

Description: Use data from experiments to refine the design of the reaction vessel and develop innovative fluid control techniques.

Schedule: Weeks 62-73.

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.

Improved prototype of the reaction vessel.

Task 2.4: Nanocrystal Growth Experiment with Fluid Dynamics Optimization in Microgravity, Testing of the Prototypes in Microgravity. (Tentative)

★ Milestone: Phase II results package including papers and articles on the innovation submitted to the scientific journals, detailed documentation of the experiments and results and findings, details and progress about the improved prototype of the reaction vessel will be submitted.

Phase 3 (Duration: 36 weeks)

Objective 3: Integration of Spintronics and Spin-Based Quantum Sensors

Task 3.1: Research and Adapt Existing Technologies (Weeks 76-87)

Description: Investigate available Spintronics and Spin-Based Quantum Sensors technologies.

Adapt or develop prototypes for fluid control.

Schedule: Weeks 76-87.

Resource Allocation: PI, access to relevant technology databases, and materials for prototype development;

Estimated Task Hours (PI): 480 hours.

Planned Accomplishments: Identification of suitable technologies; Prototypes of adapted sensors.

Task 3.2: Experimentation with Sensors.(Weeks 88-99)

Bubbles & Cafe Inc.

Project Title: Leveraging Spintronics, Spin-Based Quantum Sensors, and Optimization of Fluid Dynamics for Enhanced Nanomaterial Growth in Microgravity.

PI: ILAKKUVASELVI MANOHARAN

Description: Conduct experiments to assess the precision and accuracy of sensors in controlling fluid behavior.

Schedule: Weeks 88-99.

Resource Allocation: Laboratory space, sensors, and PI.

Estimated Task Hours (PI): 480 hours.

Planned Accomplishments: Data on sensor performance in fluid control.

Task 3.3: Iterative Design and Development (Weeks 100-111)

Description: Use data from experiments to refine the design of the reaction vessel.

Schedule: Weeks 100-111.

Resource Allocation: Laboratory space, equipment and materials and PI;

Estimated Task Hours (PI): 480 hours.

Planned Accomplishments: Improved vessel design; Prototypes of sensors, Improved prototype of the reaction vessel.

Task 3.4: Nanocrystal Growth Experiment with Spintronics and Quantum Sensors Integration in Microgravity, Testing of the Prototypes in Microgravity. (Tentative)

★ Milestone: Phase III results package including papers and articles on the innovation submitted to the scientific journals, detailed documentation of the experiments and results and findings, details and progress about the improved prototype of the reaction vessel will be submitted.

Phase 4 (Duration: 36 weeks)

Objective 4: Achievement of Desired Nanocrystal Properties

Task 4.1: Implementation of Fluid Control and Monitoring (Weeks 114-125)

Description: Apply the optimized fluid control techniques and Spintronics-based monitoring during nanocrystal growth experiments.

Schedule: Weeks 114-125.

Resource Allocation: Laboratory equipment, equipment and materials, sensors, and PI.

Estimated Task Hours (PI): 480 hours.

Planned Accomplishments: Controlled fluid dynamics during experiments; Developed algorithms for the closed-loop feedback control system.

Bubbles & Cafe Inc.

Project Title: Leveraging Spintronics, Spin-Based Quantum Sensors, and Optimization of Fluid Dynamics for Enhanced Nanomaterial Growth in Microgravity.

PI: ILAKKUVASELVI MANOHARAN

Task 4.2: Synthesis and Characterization of Nanocrystals for Spin Qubits (Weeks 126-137)

Description: Analysis and characterization of resulting nanocrystals for spin qubits.

Schedule: Weeks 126-137.

Resource Allocation: Laboratory equipment, materials for analysis, and PI.

Estimated Task Hours (PI): 480 hours.

Planned Accomplishments:

Assessment of nanocrystal properties for spin qubits

Task 4.3: Synthesis and Characterization of Nanocrystals for Biomedical use (Weeks 138-149)

Description: Analysis and characterization of resulting nanocrystals for biomedical use.

Schedule: Weeks 138-149.

Resource Allocation: Laboratory equipment, materials for analysis, and PI.

Estimated Task Hours (PI): 480 hours.

Planned Accomplishments:

Assessment of nanocrystal properties for biomedical use.

★ Milestone: Phase IV results package including papers and articles on the innovation submitted to the scientific journals, detailed documentation of the experiments and results and findings will be submitted.

Phase 5

Objective 5: Microgravity Experiment Validation

Task 5.1: Feasibility Study and Reaction Vessel Testing on the ISS (Weeks 150-169)

Description: Conduct a comprehensive feasibility study and validate the performance of the specialized reaction vessel designed for nanocrystal growth in microgravity conditions on the International Space Station (ISS). Alternatively, microgravity simulation facilities could be used;

Schedule: Weeks 150-169.

Resource Allocation: Access to the ISS or any microgravity simulation facility, scientific equipment, reaction vessel, materials for nanocrystal synthesis, implementation partners and PI.

Estimated Task Hours (PI): 480 hours.

Bubbles & Cafe Inc.

Project Title: Leveraging Spintronics, Spin-Based Quantum Sensors, and Optimization of Fluid Dynamics for Enhanced Nanomaterial Growth in Microgravity.

PI: ILAKKUVASELVI MANOHARAN

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 microgravity conditions.

★ Milestone: Phase V results package including papers and articles on the innovation submitted to the scientific journals, detailed documentation of the experiments and results and findings will be submitted.