UNC CHARLOTTE
The WILLIAM STATES LEE COLLEGE *of* ENGINEERING

Senior Design Project Description

Company Name	*City Startup Labs, Inc.*	**Date Submitted**	*07/27/2020*
Project Title	*AquaSol Project* **(CSL_AQUASOL)**	**Planned Starting Semester**	Fall 2020

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

Discipline	Number	Discipline	Number
Mechanical	4	Electrical	1
Computer		Systems	
Other ( )			

Company and Project Overview:

Since 2014 City Startup Labs (CSL), a Charlotte, NC-based nonprofit, has been the preeminent accelerator program for aspiring African American millennials (initially black males) and most recently returning citizens, through the *ReEntry Entrepreneurship Program (REEP).* It has been closing the entrepreneurial divide, where these under-represented populations haven't been adequately participating in startup activity and business building. CSL creates this new class of entrepreneurs by providing a robust, accelerated, progressive and disciplined approach to developing entrepreneurial talent, new venture creation and deployment.

The goal has been to not only provide business-ready skills for launching new ventures, but to also to help improve the participant's ability to become better innovators, problem-solvers and leaders within the community more broadly. In fact, over 90% of the former participants see the value that CSL has had on them as employees.

The CSL model includes 4 modules over the course of six months, through which these aspiring entrepreneurs learn how to research, plan, launch, and operate their own ventures. The first 3 modules are in the form of a 16-week accelerator, with the final module being a 3-month incubator, where those ideas worked on during the accelerator are prototyped and positioned for the marketplace.

City Startup Labs is a UNC at Charlotte University Business Partner

This project, while not directly associated with the aforementioned accelerator programming, would be a consideration for incubating the manufacturing of proven units. This project is partially supported by a grant from the NC Manufacturing Extension Partnership which provides support to efforts to expand manufacturing jobs in North Carolina.

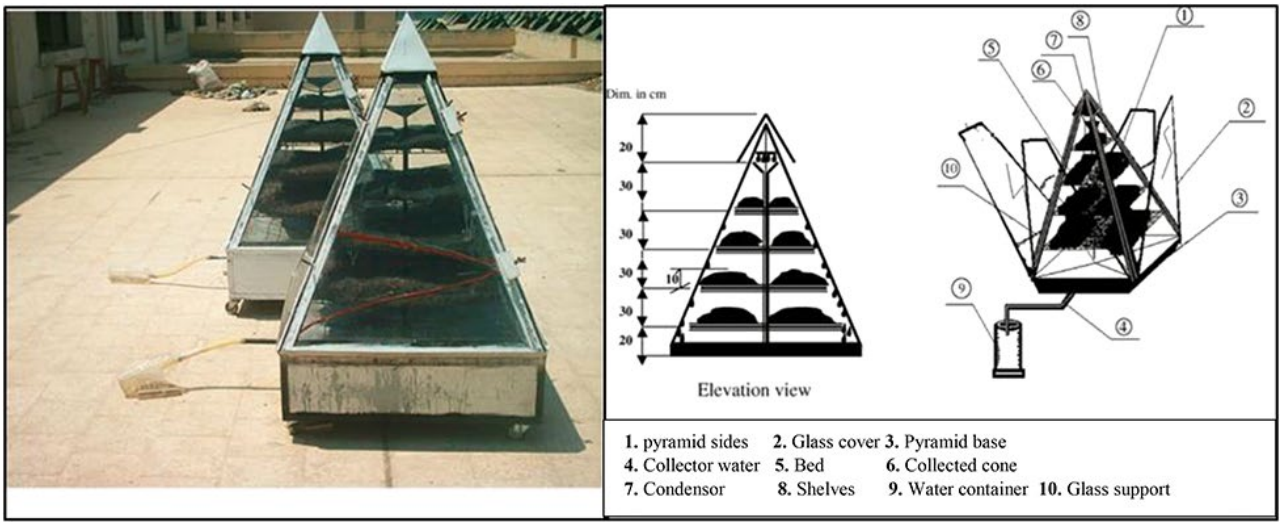
Project Requirements:

This project is focused on the R&D and prototyping of an innovative water generation & irrigation process using atmospheric humidity. Most efforts in this space are focused on answering potable water needs. These systems tend to be expensive, power-hungry and require ongoing operational maintenance (https://www.treehugger.com/suntowater-water-generator-4858458). Other water-sourcing methods, particularly internationally, focus on well-digging, purification and desalination.

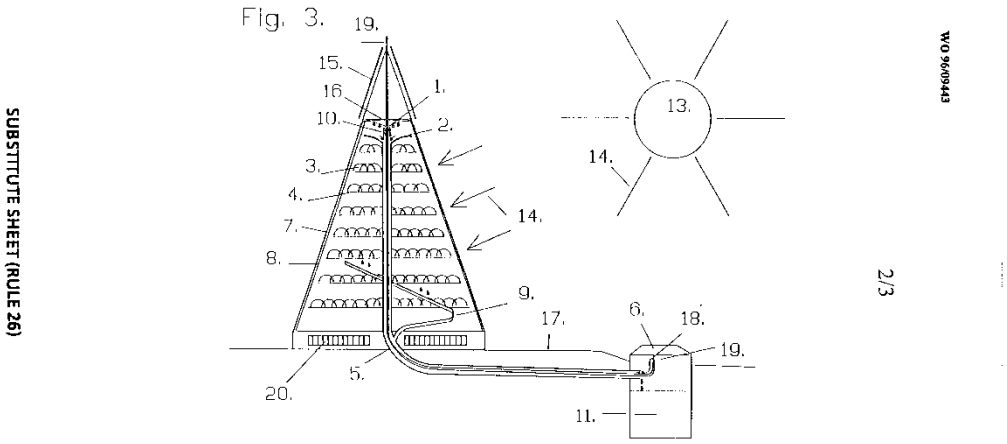
With this project, the opportunities for direct impact without concerns about sizable yields or outputs can potentially be realized in a drip-irrigation application. Access to regular, convenient and low-cost water for agricultural purposes will help to stabilize drought-stricken and water-challenged areas internationally and domestically. Internationally, this system can improve water productivity by increasing irrigation efficiency and decreasing proportion of total water resources redirected for agriculture, thereby increasing water resources available for water supply and sanitation.

There are several different applications that make use of condensation and collection or harvesting of water from the atmosphere – *the world's largest fresh water source*.

- "Review of sustainable methods for atmospheric water harvesting" — Hasila Jarimi, Richard Powell, Saffa Riffat *International Journal of Low-Carbon Technologies*, Volume 15, Issue 2, May 2020, Pages 253–276, https://doi.org/10.1093/ijlct/ctz072, outlines several methods [https://academic.oup.com/ijlct/article/15/2/253/5718410].
- The associated technology (see image below) for this project as R&D by the Egyptian inventor A.E.Kabeel can be found within the following source material: https://www.sciencedirect.com/science/article/pii/S0960148106000462.



- An additional resource for the design of a comparable model (see below) is available through the expired international patent by the Norwegian inventor Per Kåre Krumsvik [https://patentscope.wipo.int/search/WO1996009443].



The objective of this project is to review the current designs that have been published and seek to design an improved version that is optimized to be low cost and designed for irrigation (that is non-potable) water generation.

Expected Deliverables/Results:

- A determination is needed as to whether this method is effective for water generation from atmospheric humidity primarily for drip irrigation purposes.
- Design refinements to the current designs that can improve yields. What circumstances effect outputs and how can these be mitigated or enhanced?
- Design modular structure that allows units to be connected in a series to function as a unit, rather deploying sizable units which cover large areas.
- Design and materials to allow of easily assembly and disassembly and improved packing and portability for shipping and transportation (i.e., folding flat, weight reduction, etc.)
- Design to allow repairs be done easily and inexpensively, using replacement materials which can be found readily (locally sourced) and inexpensive.

Disposition of Deliverables at the End of the Project:

Deliver to CSL after the conclusion of the second Expo.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

- Associated patent with drawings and documents can be found at https://patentscope.wipo.int/search/en/detail.jsf?docId=WO1996009443&tab=PCTDESCRIPTION

- Here's another elegant system for review: https://offgridworld.com/waterseer-provides-endless-supply-pure-water-thin-air/

- This is another examination of several of the current technologies: "Progress and Expectation of Atmospheric Water Harvesting" — YaodongTu, RuzhuWang, YannanZhang, JiayunWang, Joule Volume 2, Issue 8, 15 August 2018, Pages 1452-1475 https://doi.org/10.1016/j.joule.2018.07.015 https://www.sciencedirect.com/science/article/pii/S254243511830326X