Botanical Air Filtration & The Purdue Biowall

Research Committee: Prof. William Hutzel (Chair),
Dr. Jose Garcia (SOET), Dist. Prof. Anthony Hyde (NMSU)
Presenter:
Jacob Torres (M.S. MET)

Abstract

It can be said that healthy living starts with the air we breathe. People spend the majority of their time indoors. It only makes sense that an air supply with contaminants in it can affect the health and productivity of people who breathe it. Filtering air supplied to a building is seemingly an afterthought. But it requires systems, components, and regular maintenance to deliver a consistent supply of quality air.

With intention of reducing the footprint, and tendency for inconsistency of current building air filtration systems, the Purdue Biowall has been developed to utilize plants to filter the indoor air supply of a buildings heating cooling and air conditioning (HVAC) system. Providing a constant, sustainable, and aesthetically pleasing way of ensuring that the air we breathe while within a residential building is contaminate free.

Purpose

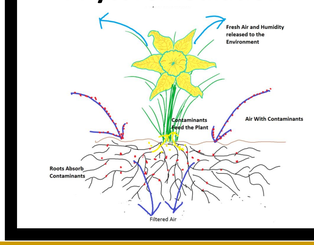
To field test the 2nd Generation Purdue Biowall prototype and drive innovation towards commercialization.

Botanical Air Filtration

Botanical air filtration utilizes a plants ability to capture contaminants from air through microbes around its roots. When air is drawn through a growth medium with plants growing in it, phytoremediation can occur and complete an air filtration process. Filtered air can be supplied to a buildings occupants if an arrangement of plant trays is introduced onto a Heating Ventilation and Air Conditioning (HVAC) systems indoor intake air supply.

This concept led to the development of the Purdue Biowall.

Phytoremediation



Purdue Biowall

The Drive Towards Commercialization

Sparked by the need for innovations towards net-zero energy residential buildings, the Purdue Biowall project was started by the Solar Decathlon Team in 2011. Proceeding research completed through the Applied Energy Lab quantified plant filtration capability. In 2016 a prototype was built to perform field testing within a full function research home.

With proof of concept complete, and a full functioning prototype in the field, researchers can set their sights towards commercialization. Things like user friendliness, system optimization, cost reduction, and aesthetics can be considered into the design to move this concept out of the realm of research and made available for use by all.

For more information on the ReNEWW house, visit the website: http://renewwhouse.com

Healthy living starts with the air we breathe...

Scope of Research

The work in this thesis evaluates a currently existing botanical air filter prototype. The scope of this work will include observational/experimental studies of the prototypes' nominal systems operation in an effort to drive innovation towards commercialization.

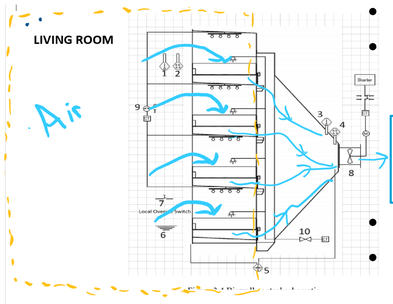
The Biowall has been installed in the Whirlpool sponsored ReNEWW home located near Purdue campus. A year long field test analysis will be conducted to monitor all systems. Data recorded will be reviewed for anomalies, irregularities, and identify areas with room for improvement. This thesis will report on the design and implementation of:

- Improved air flow management procedures
- Best plant selection guidelines
- Low flow irrigation
- Low energy lighting
- Control systems minimization

Plants

- Conditional plant growth study
- Plant selection based off NASA research
- Organic plant propagation
- Develop Biowall “healthy tray” system

Air Flow



- Define air flow characteristics
- Use statistical analysis to identify maximum filtration path
- Implement air management strategy
- Report on effectiveness

Under Development

Controls Miniaturization

Low Flow Irrigation

Low Heat Energy Efficient Lighting