

PROJECT PROPOSAL

A. INTRODUCTION TO PROJECT PROPOSAL

This project proposal is particularly focusing on “**AUTOMATIC AQUAPONIC BIOREMEDIATION**”. This proposal shall comprise in a brief about Core problems as facing, Solution foresees (Objectives), Implementation plan, Existing technologies, Project Outline, Expected Outcomes and Future Directions.

B. CORE PROBLEMS AS FACING

i. Problem related to water

Freshwater is indispensable for sustenance of life on earth, but it is rapidly becoming a scarce resource nowadays. Globally many countries and cities are facing so severe water crisis. A running out of water is a common threat to all living creatures more evidently. In contrast, the wastewater produced by the human being is surging incautiously either from domestic or industrial applications. The measure of wastewater produced by one person each day in an average home with Water Efficiency Labelling and Standards (WELS) scheme 3 star rated fixtures. The treating methods are usually varied based on the type of wastewater and could be used in many ways suitably to minimize the water demand. In example, Greywater (Shower, Hand basin, washing machine, Laundry tap, Kitchen tap, Dishwasher) is ideal for garden watering, with the appropriate precautions, such as using low or no sodium and phosphorus products and applying the water below the surface.

In India, a centre on wastewater aquaculture was established during the 1970's in Rahara, Kolkata which was originally initiated for its research on recycling of sewage water for production of fish through nutrient recovery. Huge volume of sewage water has been treating through different convenient modes and monitored for probable hazards of sewage water before its utilization in aquaculture. In this, both chemical and biological contaminants were reduced by 80% by different treatment methods.

ii. Problem related to food demand and Nature of productive

Further to water crisis, the global food production is having a hard time in keeping up with demand, and trends. Global demand for food is growing simultaneously as human and grazing animal populations increases, as more people are changing their diets to include more meat, and as more crops are used for biofuel production.

On the other hand, it is getting more difficult to continuously increase the annual agricultural yields as the downward pressure of soil erosion/degradation, aquifer depletion, and irrigation water supply complications due to melting glaciers begin to outpace technological advances in agricultural production.

Many new problems have arisen as producers try to meet these challenging trends by squeezing ever more production from remaining agricultural lands.

The majority of our food and animal feed now comes from large-scale industrial crop production using a mono-cropping approach. This involves growing a single crop over a large area of land. This method became widespread in most industrialized countries in the 1940's and 1950's, at the expense of the small family farm, as farming became more commodity- and less subsistence-based. This approach increases mechanization, and demands the use of fossil fuels, fertilizers, pesticides, herbicides, irrigation water, and genetic engineering. All of these factors decrease the need for human labour, and ultimately reduce crop prices. While proponents of industrial agriculture claim to have modernized and streamlined the production of food in the United States, such evolution has been at the expense of environmental, human, and community health.

More sustainable food production techniques offer many solutions to the problems of industrial farming outlined above, but have difficulty generating reliable, adequate production (amount and variety) for a given region over the course of an entire calendar year.

C. SOLUTION FORESEES (OBJECTIVE)

To solve the above problems, the aquaponic solution (“**AUTOMATIC AQUAPONIC BIOREMEDIATION**”) enters into the equation. Aquaponics offers the potential to generate large quantities reliably and varieties of food from very small urban spaces, in any season. If aquaponic food production methods can be made environmentally sustainable and economically viable, this approach could be used in combination with more typical sustainable farming methods to bring us to a more competitive local food system.

D. IMPLEMENTATION PLAN

The following are the implementation plan,

- ✓ To recycle the wastewater for development of low external input in aquaculture systems
- ✓ To undertake basic and applied research for evaluation of production performance and assessment of quality fish safe for human consumption
- ✓ To assess the nutrient harvest by application of unit wastewater effluent
- ✓ To develop the sewage-based agro-/aqua-horticulture integrated farming systems
- ✓ To produce the fish food organisms by utilizing wastewater
- ✓ To determine the characteristics of water quality from the cultured fish tank using sensors.
- ✓ To determine the effect of Plant distribution on the wastewater quality with AI system.
- ✓ To perform the Microbiological analysis of aquaponic system.

E. EXISTING TECHNOLOGIES

Many related technologies have been investigated which are involved in the fish, water and plant growth monitoring system.

An Arduino based Mini aquarium system called Fish talk which uses several sensors and actuators. The sensors are used to find the temperature, pH, Electrical Conductivity, Dissolved Oxygen, and total dissolved solvents. However, the Fish talk system did not have an ammonium sensing sensor and a turbidity sensor which is a measure of the extent to which the water loses transparency due to the presence of suspended particles. The sensors are also used to measure water temperature, water electrical

conductivity, water level, pH value, water body turbidity, and dissolved oxygen. However, this system did not have any sensor to measure Ammonia. For measuring the dimensions of the plant, the system is equipped with fully automatic. The system includes infrared sensors, temperature sensors, humidity sensor and GSM module. This allows the system to autonomously return to specified sites at set time intervals to identify changes in the growth rates with minimal human input (interference).

Modern methods of fish feeding include an intelligent feeding system based on fish behaviour and extend to speed respond fishes towards one kind of feed to minimise the impact of traditional feeding mechanisms. The proposed mechanism of nutrition interacts, recognises and reacts to the activity of fish. Such feeding system feeds fish at their request, regardless of the time of the day. The system also measures the Feeding Efficiency (FE), and Specific Growth Rate (SGR, % body weight per day) which reflects fish respond development of the given feed. The smart fish feeding is running independently from the beginning of the experiment in order to quantify the fish behaviour and its responses. The smart fish feeding architecture comprises of a few components, which includes the hardware design, and the software algorithm with the database of the fish.

F. PROEJCT OUTLINE

Our solution is to design and build a smart and sustainable aquaponics system which will be targeting to grow a substantial amount of food in a limited space. Our key objective in the project is to build an aquaponics system that will be resulting to a self-sustaining as much as possible as well as applicable to many environments.

The greywater will be reused for aquaculture. Direct application of raw sewage is avoided. Therefore, raw grey is treated before its utilization in home for reduction of microbial load and contaminants. Several natural, innovative, alternate approaches of wastewater treatment have been practised over the years in different parts of the world. Efficacy of varying treatments has been evaluated for their economic viability, operational ease and system sustainability. The raw sewage is undergone a distinctive treatment procedure as per requirements of biological and chemical treatments. The system that incorporates with AI the most important of these are the temperature control, pH, water flow, water quality, plant growth, soil moisture and fish feeding. In order to make this system viable in a wide variety of environments, this system would need to be capable of powering the rest of the components for days at a time in the event of external power source loss. The last key element was the aquaponics system needs to actually keep its inhabitants alive. This means that it can't get too hot or too cold, that the water must be clean enough for the fish to survive and the plants get sufficient nutrients for the water, and light

from the grow lamps to thrive. A 3D model for the fish feeder have also designed and successfully printed it using a 3D printer. This feeder uses a servo motor to drop the fish food in the water and I will determine the water quality characteristics from culture fish tank. Besides, I will determine the effect of vegetable distribution on the wastewater quality and effect of the vegetable growth. Fish species is an important material in my research besides vegetables. I will choose the fish used in my previews research work (Efficacy of fish effluent recycling system for improving growth performance of tilapia (*Oreochromis niloticus* L.) with probiotic supplemented feed. Radhathirumalaiarasu Selvaraj and Thirumalaiyammal Bogar) and medicinal plant to run my experiment the parameters that will be observed are Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Ammonia Nitrogen (NH) and pH . During the experiment, measure the plant growth parameters such as dimension height and width, stem size. Environmental conditions temperature and humidity shall also be measured by the system. The proposed system makes it possible to perform remote monitoring, which is nearly impossible with existing measurement methods. Aquaponics wastewater and the microalgae biomass production are more effective with microalgae inoculum than with just promoting natural blooms. In microalgae is able to remediate the aquaponics wastewater and the biomass obtained, at a higher scale production, might have different application such as fertilizers and fish feed.

G. EXPECTED OUTCOMES AND FUTURE DIRECTIONS

Aquaponics is a working model of sustainable food production wherein plant and animal agriculture are integrated and recycling of nutrients and water filtration are linked. As an automated model of sustainable food production, the science of aquaponics helps agricultural production through the implementation of certain principles. Grey water produced in an average home with WELS 3 star rated fixtures in 84 L/person/day. Appropriately treated greywater can also be reused in Aquaculture. The waste products of one biological system serve as nutrients for a second biological system.

Second, the integration of fish and plants results in a polyculture that increases diversity and yields multiple products.

Third, water is re-used through biological filtration and recirculation.

Lastly, the local food production provides access to healthy foods and enhances the local economy (Lennard, 2012). The expected outcome from our research based on implementation plan and project outline of **AUTOMATIC AQUAPONIC BIOREMEDIATION** shall have the ability to reduce the pollution potential of aquaculture wastewater, the plant distribution does not effect on the wastewater quality and the plant, and fish growing well.