

Smart way of Augumenting Ecological Environment – Smart Organic Farming

J. J. Nandhini, K. Premalatha

Abstract: *Agricultural Runoff is a serious concern of fertilizers used in agriculture: Chemical fertilizer usually contains chemicals which are not easily biodegradable and those chemicals leech in to the soil and run in to the ponds, canals, rivers and sea with rain water which pollutes our environment and leads to serious consequences. The nitrogen and other chemical present in chemical fertilizers can contaminate the ground water. To avoid the negative effect of the chemical fertilizer these days people prefer using organic fertilizer in their farms. Chemical fertilizers have many negative effects for our health and environment. It makes the plant to grow well but not actually healthy; almost all essential natural resources from air, soil, and water has been polluted in the big city. Among the types of pollution, the worst pollution is water pollution through chemical fertilizers or inorganic fertilizer.*

From the above details, it is noted that Chemical fertilizers and pesticides acts as a slow poison for the future generation. To make the living environment healthier, Organic fertilizer (Ancient organic farming method - Panchagavya) is the best choice. This paper introduces the smart way of organic fertilizer production and utilization thereby makes the process simpler and cost effective accessibility of benefits by each and every farmers.

Keywords- *Chemical Fertilizer-effects; Organic and inorganic fertilizer; Panchagavya; Production; Utilization Healthy environment; Smart way*

I. INTRODUCTION

After 20 years of neglect by international donors, agriculture is now again in the headlines because high food prices are increasing food insecurity and poverty. In the upcoming years, it will be essential to increase food productivity and production in India. The agricultural sector continues to play a crucial role for development, especially in low-income countries where the sector is large both in terms of aggregate income and total labour force.

There are two challenges related to agriculture:

The first thing is to increase food productivity and production in developing countries.

2) The second problem is the volatility of food prices, often because of events outside the control of poor countries.

India, whose GDP depends on the agriculture is lagging behind other nations in terms of modernization in agriculture.

Question asked in Rajya Sabha:

Will the Minister of chemicals and fertilizers be pleased to state: (a) the total quantum of chemical fertilizers used annually in the country; (b) the indigenous fertilizers used for agricultural purposes and (c) by when Government will

come out of these chemicals fertilizers pressure, which are harmful to health?

Answer by Minister of state in the ministry of chemicals and fertilizers (Shri Hansraj Gangaram Ahir)

“There is no scientific evidence of declining soil/ crop productivity from judicious use of chemical fertilizers. However, indiscriminate and imbalanced use of fertilizers coupled with low addition of organic matter over the years may result in nutrient deficiencies. There is also the possibility of contamination of ground water due to excessive use of nitrogenous fertilizers, particularly in light textured soils, that has consequence on human health if used for drinking purpose. Government is recommending soil test based balanced and integrated nutrient management through conjunctive use of both inorganic and organic sources of plant nutrients to reduce the negative impact of chemical fertilizers”

Let's switchover to Organic fertilizer globally to save the soil nature and enhance our environment's healthiness as chemical fertilizer acts as an agricultural pollutant [1].

Medicinal Usage of Panchagavya:

In Ayurveda, Panchagavya including cow urine (Gomutra) are used for purification of many herbal drugs (such as 'Kupilu and Gunja etc), metals and minerals in the process of medicine preparation. There are some Ayurvedic medicines being fortified with Gomutra too. Number of institutes/ pharmaceutical units manufacturing Ayurvedic Medicines including Panchagavya is maintained by the State Governments. [2]

The quality standards of Panchagavya Ghrita has been published in Ayurvedic Pharmacopoeia of India, Part II, Vol.I by Department of AYUSH.

This proposed methodology mainly focused to decrease the labor cost and the time spent in manual operation for organic fertilizer production. It will help in increasing the productivity of high quality crops available at affordable price. It will also help to check the fertility of the soil for growth of high quality crops.

Therefore, this paper emphasizes the smart and effective use of resources such as water and organic fertilizer. The Panchagavya acts as the Heritage of Indian agriculture [3].

The main objectives of this paper are to improve the environment's healthiness which includes agricultural soil fertility, nature of crop growth, human health, to increase productivity of high quality crops available at affordable price, and to make the organic fertilizer production process as smart and effective one.

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II. PROPOSED METHODOLOGY

The proposed methodology is divided into two categories.

CATEGORY 1 - Organic fertilizer Production:

The ancient organic farming method of organic fertilizer production (panchagavya mixture) is introduced in a smart and effective way. There are some readily available panchagavya mixture products [4]. But the process of spraying is not efficient if it is done manually. This proposed methodology of organic fertilizer production is done in a smart/automated way thereby reducing the manual effort of farmers. The overall process is done by making the container with front panel, stirrer motor, inlet pipe for input ingredient pouring, and outlet pipe with solenoid valve, gate valve and adjustable sprayer tray. The area of field (in square feet) considered will be entered in the panel by the farmer. Then it displays the quantity of ingredient to be mixed with respect to already available mixture, size of field and required quantity of organic fertilizer according to its nature. Since the system efficiently uses the available natural ingredients, this product can be implemented at every farmer’s field at affordable price. The proportion for 1 acre [5] is listed in Table 1 as shown below.

Natural ingredients	Quantity	Usage
Cow dung	7 kg	Improves Soil fertility, immunity, plant growth and microorganism production
Cow ghee	1 kg	
Mix the above two ingredients thoroughly both in morning and evening hours and keep it for 3 days		
Cow Urine	10 liters	Organic pest repellent and Increase crop immunity
Water	10 liters	
After 3 days mix cow urine and water and keep it for 15 days with regular mixing both in morning and evening hours.		
Cow milk	3 liters	Promotes plant growth and boosts its immunity
Cow curd	2 liters	
Tender coconut	3 liters	
Jaggery	3 kg	
Well ripened poovan banana	12 nos	
After 15 days mix the above ingredients and then panchagavya will be ready after 30 days.		

Table -1panchagavya Mixture- Ingredient And Usage (1 Acre)

In the existing methodology, the production of Panchagavya mixture takes place manually. The Panchagavya usage is proved to be a beneficial one for our earth’s environment [6].

CATEGORY 2 - Smart and effective Utilization of Organic fertilizers:

After the successful production of Organic fertilizer (which is stored in a container), the sprayer tray holds the organic fertilizer mixture which is sprayed over the agricultural field by actuating the sprayer according to its requirement. This overall process takes place automatically.

This leads to effective and smart utilization of organic fertilizer. The overall process takes place under category 1 and 2 is shown below Figure 1.

That is after the successful production of organic fertilizer, it can be utilized efficiently in the agricultural field using automated sprayer and gate valve design. The timer and control circuit actuates the gate valve once the fertilizer in the container is ready to use. The flow control of fertilizer is monitored and it reaches the sprayer tray. The sprayer tray sprays the fertilizer every 1 week (set time) until the container gets emptied. Once the container is emptied, it notifies the farmer through alarm. Thus the whole process of automated spraying neglects the usage of manpower and the field utilizes its required amount of fertilizer through automated gate valve and sprayer design.

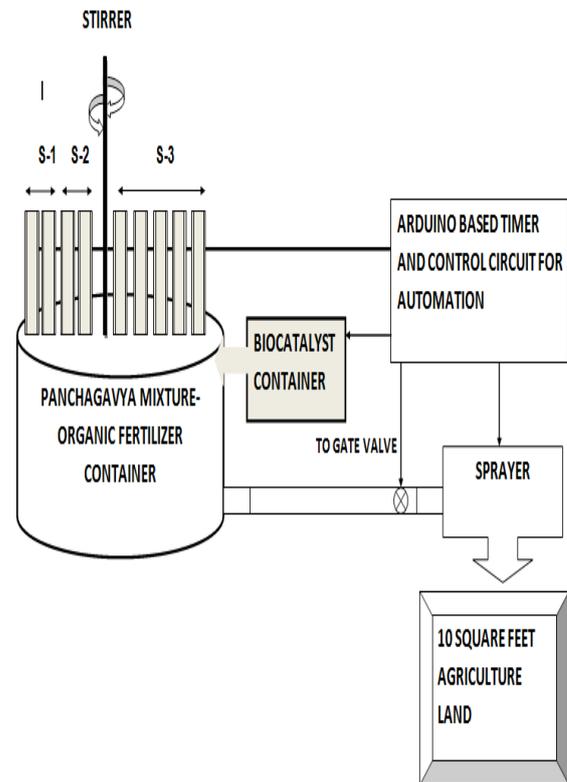


Figure 1. Organic fertilizer production

III. PROPOSED METHODOLOGY – DESCRIPTION

A. Category 1:

The organic fertilizer is manufactured by using the Panchagavya main ingredients. The block diagram and connection diagram of the category 1 of proposed methodology is shown in Figure 1. and Figure 2.



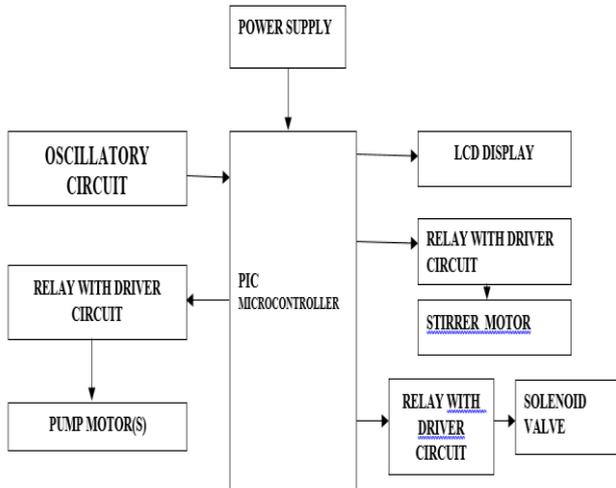


Figure 2. Organic fertilizer production

In the first cycle, the motor 1 is started and made to work for ten seconds. Then the stirrer is in on position for three times in ten second and this process is repeated for motor 2,3,4,5.

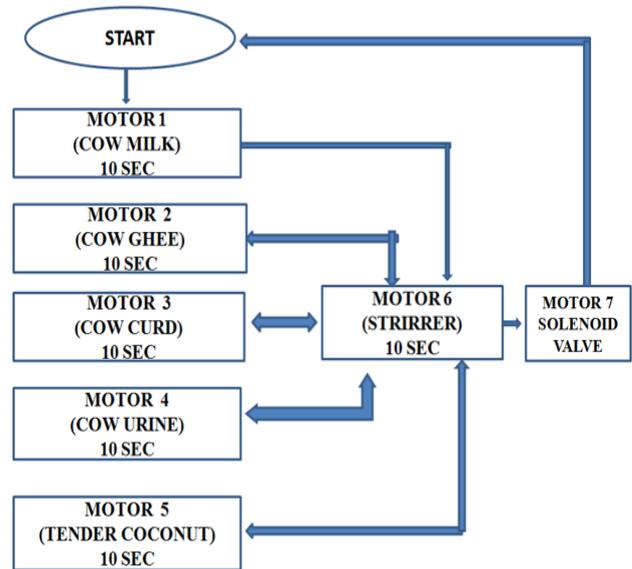


Figure 4. Process flow – Organic Fertilizer Production

They are being taken from five different tanks and then it is being mixed continuously. In order to get all the five products into the single container for mixing, five DC motors are used. They are being activated by relay circuit interfaced with controller. Initially, when motor 1 is ON, the first product reaches the container but the stirrer would not come into operation. After the delay of 10 second as mentioned in program, remaining products are extracted into the container and mixed simultaneously. After the extraction of each product, the stirrer mixes the contents for about 3 times within 10 seconds. After the complete extraction and mixing of all products, solenoid valve is opened. Then, the same process is repeated for consecutive cycles. This cow therapy [8] enhances the healthy environment by safeguarding the health of animals and humans.

B. Category 2:

The organic fertilizer produced in category 1 is effectively utilized in a smart/automated way in category 2. The requirement for automating the process is explained below

- Automation- It helps in saving time and producing accurate results and good quality of crops.
- Reducing labor cost- Since the machine would take care of the field, the requirement of laborers would reduce.
- Reducing wastage of resources- The excess use of resources due to human error can be avoided by implements automation of the process.
- Maximizing Crop yield- Since time and effort is saved, the quantity of crop production increases.
- Environmental Friendly- It does not create any kind of pollution or harm to the soil, earthworm or the nature.
- Efficiency- High quality crops can be produced within a minimum amount of time.

The block diagram for the category 2 process is shown in Figure 5 and Figure 6.

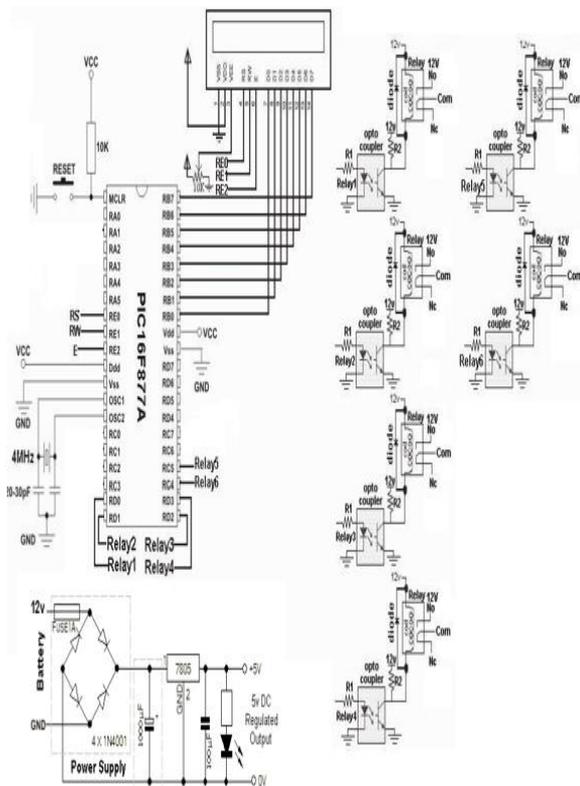


Figure 3. Connection Diagram

After completing the operation of 5 motors the solenoid valve is in on condition and then the first process is continued for second cycle

The working model is based on the operation of components that are interfaced with PIC16F877a. The panchagavya products namely cow dung, cow urine, cow milk, curd and ghee. The container selection is very important as the stirring mechanism takes place continuously for selected time period. The holding capacity, material used, breaking capability should be checked and used [7]



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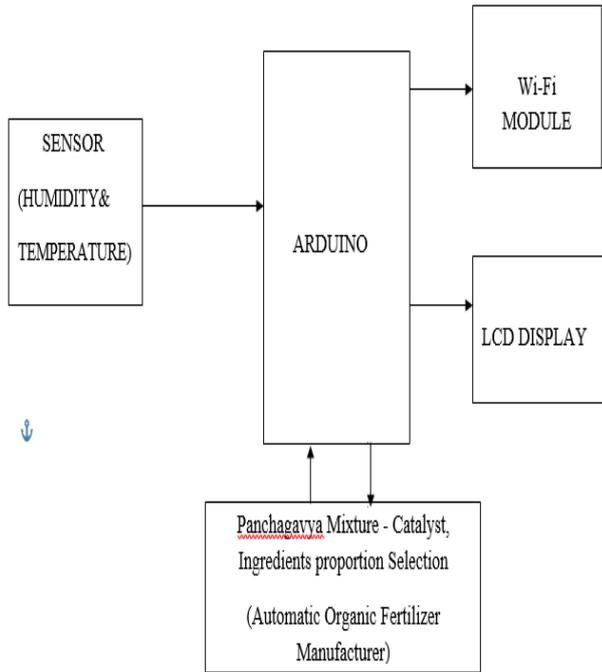


Figure 5. Layout process of Category 2

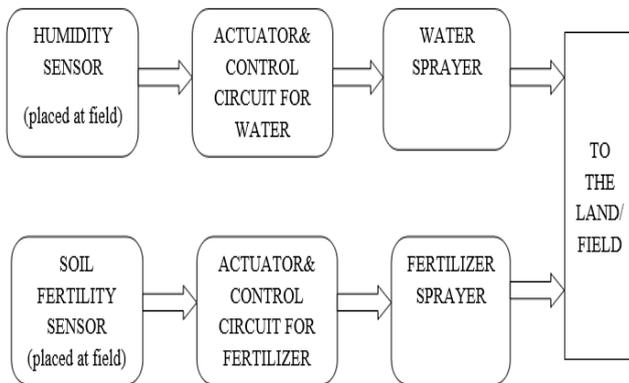


Figure 6. Category 2 –Block diagram

The process under category 2 is easily made by using devices used for precision agriculture [9] and by using smart agriculture system [10]. The soil moisture sensor and the pH sensor continuously monitor the health of the soil and displays the values on the LCD screen using the Arduino Code. A threshold value is pre-set in the code for the soil. If either of the sensor values drop below the pre-set value, then the Arduino will send signal to the relay and it will actuate the sprayer. It uses Arduino based sensors [11]. This sprayer will spray the content inside it to the field according to the requirement. When the value reaches above the pre-set value this action will stop automatically hence saving the resources from wastage

IV. SOFTWARE – RESULT VALIDATION

By using Proteus Simulation software, the category 1 and category 2 process were analyzed as shown in Figure 7. and Figure 8.

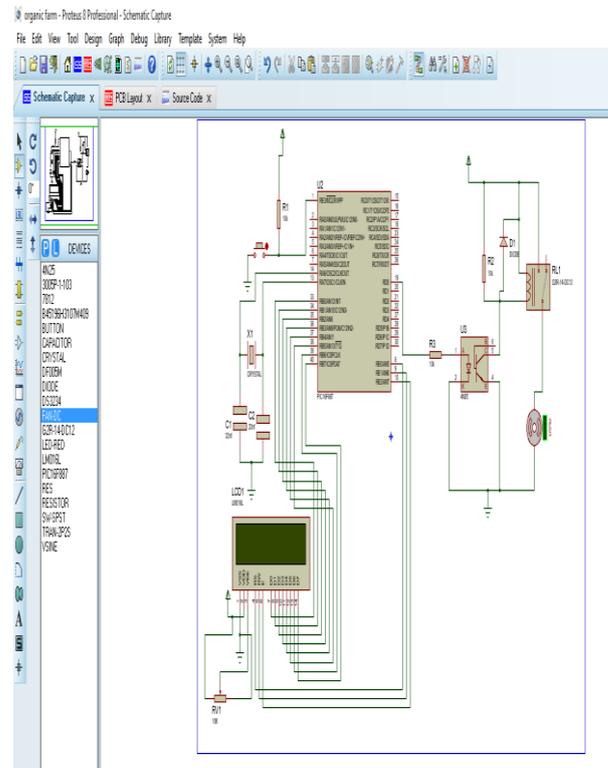


Figure 7. Simulation-Category

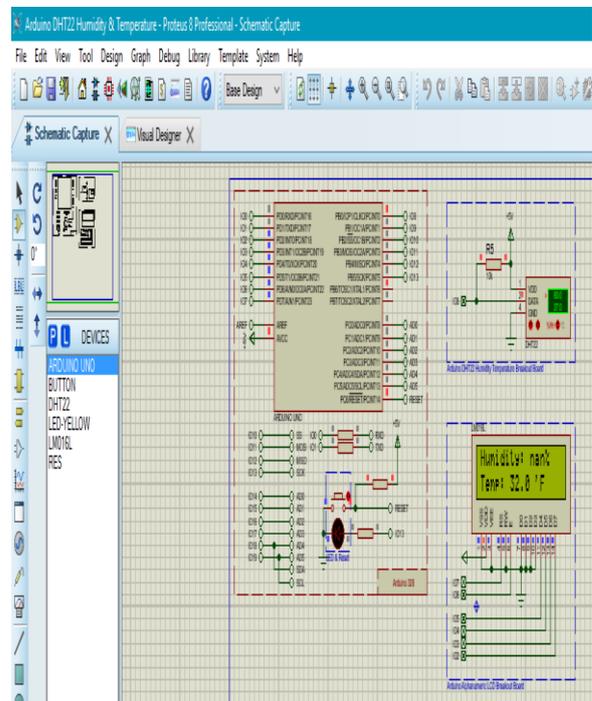


Figure 8. – Simulation-Category 2

V. HARDWARE – DESCRIPTION

The hardware is validated for production of organic fertilizer with stirring mechanism and automatic actuation of motors and solenoid valves as shown in Figure 9.



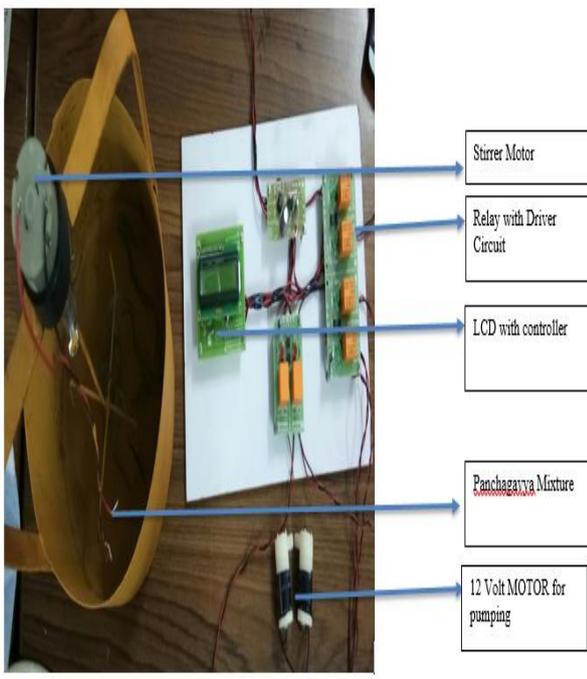


Figure 9. Category 1 – prototype/model

The category 2 process is validated for 10 square feet land by actuating the sprayer and monitoring the healthiness of soil through sensors as shown in Figure 10.



Figure 10. Category 2- Prototype model

COMPONENTS:

- pH Sensor
- Arduino Board
- DHT11 Humidity Sensor
- LCD Screen
- Battery
- Sprayer
- Relay

VI. CONCLUSION

With the constant increase in population growth rates, especially in the developing world, the implementation of improved bio-engineering technologies are essential in increasing the world's food production and supporting the

ever-increasing world population growth. Panchagavya is considered as one of the best natural anti-oxidant and results in removal of physical and mental disorders and acts as an enhancer for healthier environment. This methodology is simple, healthier, robust, flexible and cost effective when compared to existing methodology. Relocation of sensors can be easily done, so by manufacturing this type of system can be portable and fixed in any type of field which completely requires organic farming technique. Wastage of water is minimized, and water resources are optimized to obtain better crop yield by using this proposed methodology.

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