International Journal of Innovative Research in Engineering & Management (IJIREM)
ISSN: 2350-0557, Volume-9, Issue-2, April 2022
https://doi.org/10.55524/ijirem.2022.9.2.48
Article ID IJIR-2251, Pages 324-330
www.ijirem.org

An Experimental Study of Smart Sub Surface Precision Irrigation System

KunjThakor[1], and Ankit Chauhan[2]

[1,2] Computer Science And Engineering and Technology Parul University Vadodara, Gujrat, India.

Correspondence should be addressed to KunjThakor; kunjthakore@gmail.com

ABSTRACT: In farming, a smart subsurface accuracy water system framework is a mix of relocated equipment hardware and programming applications, as well as numerous innovations. Among them, artificial intelligence (AI) has a vital role to play. Drought is the greatest serious threat to agricultural productivity, and its severity is growing in most farmed regions across the globe. As a result, the major goal of sustainable agriculture is to increase water production. In this trial study a savvy subsurface exactness based on water system framework is created to accomplish higher precision. In the flow away and flow research the water system is done dependent on the information which can ascertain the outcome utilizing the measurable information. The authors are utilizing AI calculation to figure the water utilization for the harvest. It will plan and execute deductively demonstrated, carried out and tried on field, sharp subsurface water system framework which is reasonable to utilize less water/battle dry spell (even not as much as dribble/flood/sprinkler water system), utilize less power, decrease amount manures utilized, diminish amount of water utilized for explicit yield and gather and break down information for expectation of necessities and spending the executives.

KEYWORDS: Artificial Intelligence, Irrigation System. Linear Regression, Productivity, Machine Learning.

I. INTRODUCTION

A smart subsurface accuracy water system framework in farming is the blend of shifted equipment hardware and programming applications with various innovation. Among those, AI innovation assumes a significant part[1]. It's an information insightful procedure which has contrasting sorts of calculations and models to be told data straightforwardly from information. AI application assists with keeping up an appropriate water system framework. For example, streamlines water utilization and gives a fundamental measure of water and ripeness to field improves yield creation, decreases manual mediation, and reduce crop sicknesses.[2] The overview estimates the effect of applied strategies and the best approach to support efficiency utilizing those procedures and it assists the users with adjusting appropriate framework per their prerequisites. The central issues that should be thought of while water system planning are: Suitability for Farm, powerful weather, decide when (this relies upon the dirt, harvest, and climate) to irrigate, how much water the yield needs is, use the most effective strategy to irrigate, Value of the water which is inundated [3]–[5].

Accuracy Gardening has additionally integrated deep learning neural organizations and IoT for practical water systems framework. It is considered a criticality framework that works successfully in any atmospheric condition. The shade of a plant's leaves and the development of its branches can help livestock owners to isolate the water requirement in this structure. It should be eliminated by using machine vision to stay away from mistakes caused by human perceptions. Subsurface water system design is the best method to save water from the water system. Subsurface water system water does not percolate through the silt surface, unlike conventional surface water system structure water. In the underground water system framework, water is supplied directly to the utilitarian core area of the date palm at low force. The independent water system framework, which integrates remote soil moisture sensors, enhances water usability while expanding yields while using less water system water. Compelling water system structures can significantly support horticultural water yields, especially where there are water requirements and there is no computerized water system foundation. The bulk of the ebb and flow water system framework relies on intermittent water that is independent of the water needs of the plant's actual water system, which presents an important test. The crop yield is supported by a systematic water system program all around. When using a surface water system framework, it is not possible to change the water depth and recirculation of the water system due to the multi-functional design of the execution. At a time when the depth of the water system is reduced, manufacturers find it challenging to change the water system plan. Figuring out how much water to use is complicated; it depends on various variables including air temperature, relative viscosity, wind speed, hours of the sun and sunlight-based radiation. As a consequence, the depth and stretch of the water system are related to remain constant during the developing season. Accurately tracing a water system plan is a difficult and complicated conversation. Due to the use of PC framework, it is possible to accurately design the water level of the water system at present depending on how much water is required from the crop. Sensor-based water system planning is a convenient tool that can be adapted to individual field conditions and improves water system booking options. As a result of the vast transformation of IoT and the improvement of sensors for practical gardening, IoT applications strongly influence water conservation of plants and water systems. Subsurface dribble water system is a low-pressure, high-productivity water system framework that meets crop water needs with covered trickle cylinders or dribble tape as shown in Figure 1. Flooded agribusiness has utilized these advances since the 1960s, with the innovation progressively progressing over the most recent thirty years. A subsurface framework is versatile and can give light water system consistently. This is especially appropriate to bone-dry, semi-bone-dry, muggy, and breezy environments with restricted water supplies, especially on sandy soils. Water generally streams out every which way in the wake of being wetted around the channel[2], [6].

Through eliminating surface water vanishing and diminishing the event of weeds and sickness, subsurface water system saves water and expands yields. Water is added to the harvest's root zone as opposed to the dirt surface, where most of weed seeds sprout after development. Subsequently, yearly weed seed germination is fundamentally decreased, bringing down weed tension on money crops. Moreover, if water is accessible in the root area, certain harvests may profit by the extra warmth offered by dry surface conditions, bringing about expanded yield biomass[7]–[9]. Water and manure application efficiencies are improved by the utilization of a compost injector, and work necessities are diminished. Furthermore, where water system is utilized, field exercises are yet essential. A smart sub-surface water system framework has tracked down the best result by utilizing the distinctive methodology they found that the plastic container sub-surface water system (SIPB) shows better soil dampness maintenance on the whole three seasons comparative with other sub-surface water system frameworks, so we utilize a similar innovation with AI and IoT based on this strategy and attempt to improve result[10].

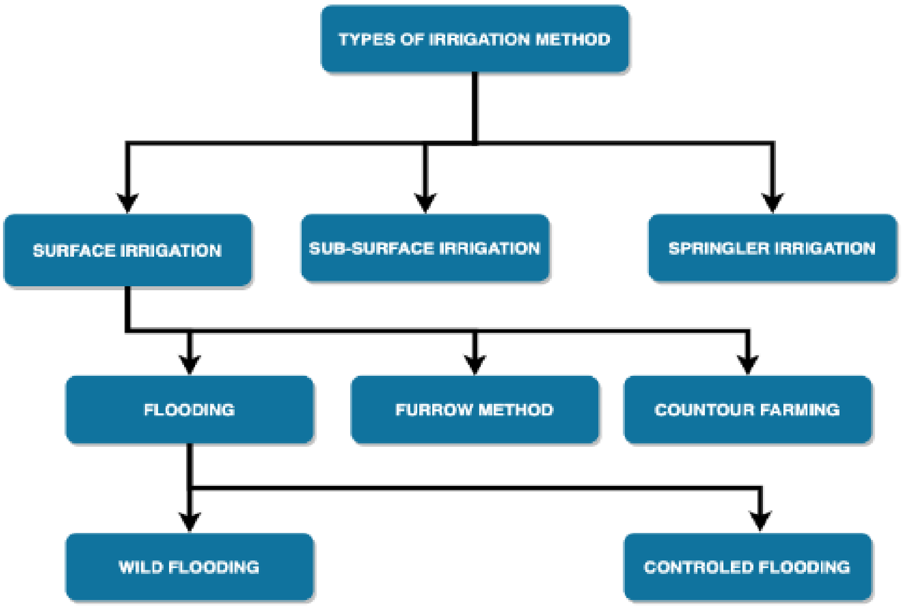

Figure 1: Illustrates the Various sorts of Water System Strategies.

II. LITERATURE REVIEW

The authors of this paper have purposed six types of water system techniques. Six different water structure processes were used during the exploratory work: dribble water system, trickle water system (DIPM) with plastic mulching, trickle water system with natural mulching, subsurface water system with stone segments, soil sludge system, etc. Subsurface Water System with Pots, and Subsurface Water System with Plastic Container (SIPB). They've likewise accumulated information for three seasons, for instance. Utilizing an IoT PC in the mid-year, winter, or blustery. They found that subsurface water system with plastic jugs (SIPB) is the most grounded of every one of them, and that it utilizes less water than different procedures they utilized in the execution, and that the dampness level is held at 25–30%higher than the standard dribble water system technique[10].

Constraints of this work are they didn't utilize a keen water system strategy with AI procedures author have utilized the factual technique and furthermore they utilized a dataset and applied it to the Software (which is an instrument that produces results relying upon the measurable information) and accumulated the outcomes. Along these lines, rather than utilizing the numerical methodology or the old style strategy, we may utilize the AI calculation, which consequently forms the principles from the outcomes[11].

It empowers the making of advancements for improved common asset the executives. As per the IoT standard, savvy objects installed with sensors permit contact with the physical and intelligent universes. The proposed system in this paper depends on IoT and uses ongoing info information. The android telephone is utilized in the keen homestead water system framework to follow and oversee dribbles distantly through a remote sensor organization. For contact between sensor hubs and the base station [2]. In future we can utilize that sensor to gather the information and by applying the diverse calculation we can foresee the outcome. In this paper, authors have proposed a coordinated water system framework that utilizes the Internet of Things (IoT), distributed computing, and enhancement strategies to limit water use in horticulture. Minimal effort sensors are utilized in the programmed water system framework to recognize factors of interest. The information from the ground is shipped off the mist by means of Wi-Fi modem as well as GSM cell organizations. The ideal water system rate is then determined utilizing an improvement model, which is mechanized utilizing a solenoid valve worked by an ARM regulator.The factors of concern are prepared in the cloud and made accessible to users as a product. The proposed arrangement is tried on a pilot scale rural plant, and the discoveries show abatement in water use, an improvement in information access, and improved perception. In future, the author can likewise add this kind of sensor to our examination to save the force utilization and lessen the water wastage to check the degree of water tank and anticipate the outcome all the more precisely[2].

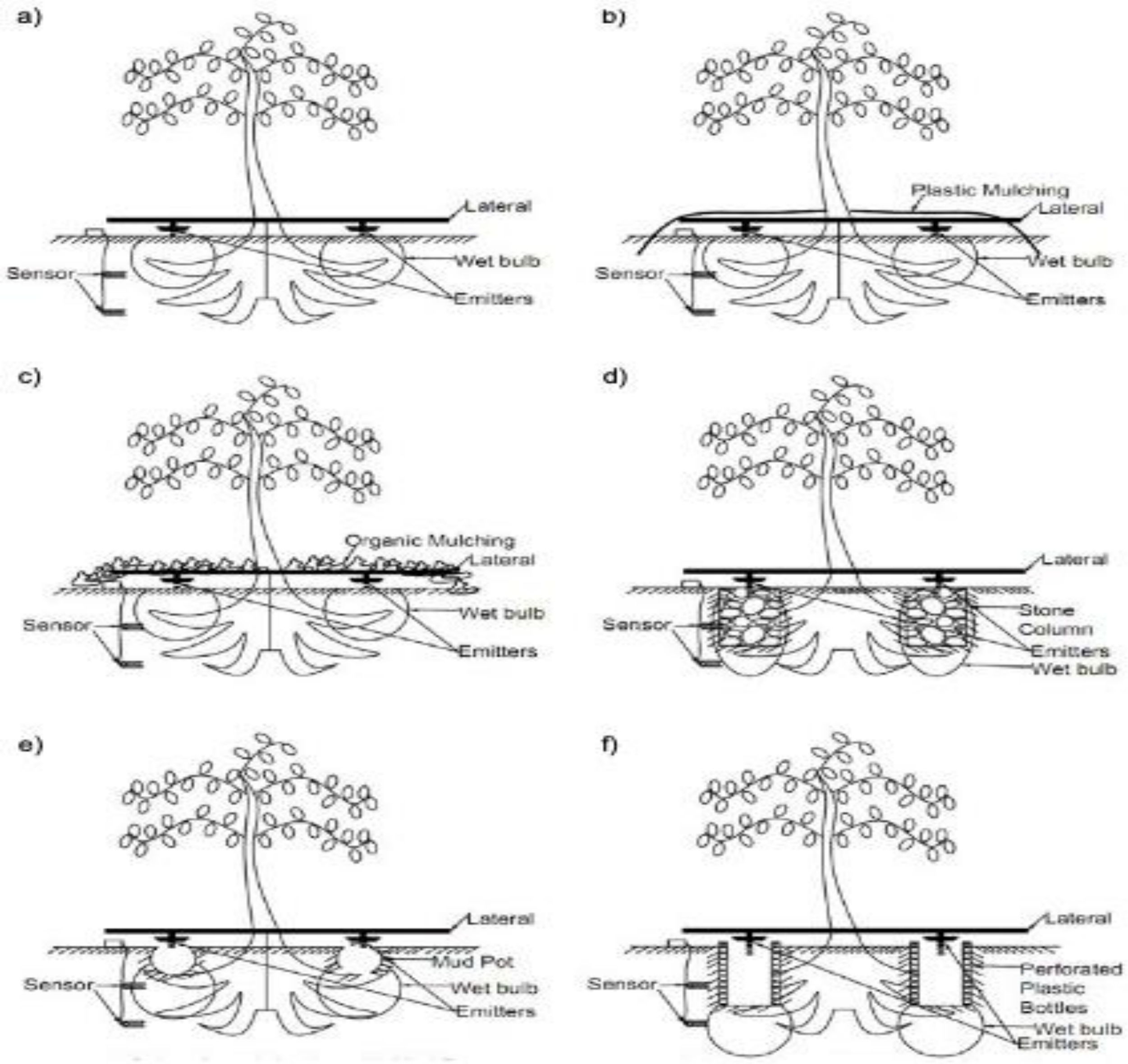

Figure 2: Illustrates the Six Different Irrigation Method [a. DI, b. DIPM, c. DIOM, d. SISC, e. SIMP, f. SIPB]

The paper clarifies the strategy and goes over the data handling execution of three weeks of information utilizing the proposed calculation in incredible detail. The machine is totally working, and the results of the forecasts are exceptionally encouraging. Future Work is done by utilizing the distinctive AI calculation with the IoT we can anticipate the more exact outcome. In this paper, they present an Intelligent IoT founded Automated Irrigation framework in which detectors information on the soil dampness as well as temperature is gathered, and a KNN (K-Nearest Neighbour) order AI calculation is utilized to investigate the sensor information and anticipate when water ought to be applied to the dirt. This is a totally advanced framework where PCs cooperate with each other and use data to water. This was made utilizing minimal effort implanted gadgets, for example, the Arduino Uno and Raspberry Pi 3. By utilizing distinctive calculation we can anticipate the outcome so in future we can likewise take the information from various sensor and apply the AI calculation to foresee the outcome[12].

For locales all throughout the planet that face water shortage and force deficiencies, the plan of an IoT-based sunlight based energy framework for keen water system is basic. Subsequently, this paper proposes such a plan. The proposed framework depends on a solitary board framework on-a-chip regulator (hereinafter alluded to as the regulator) with worked in Wi-Fi systems administration as well as associations with a sun founded cell to stretch the necessary running forces. The controller looks at the precipitation, tenacity, and temperature sensors in the field and sends the water framework siphons suitable incitation demand signals. The controller additionally watches out for the subsurface water level, which is important to keep the siphon motors cool. For the force utilization we can utilize sun based energy to save force and we likewise we can investigate that for the specific framework how much force is required and furthermore examine the general expense of force utilization. As indicated by this report, utilizing AI in agribusiness improves water system framework effectiveness. It aids the compelling utilization of water and the end of water contamination. This profound learning execution of programmed information preparing, information recording, and dynamic is a really information based system[12]. It improves the amount and proficiency of yield creation. This study can be helpful in giving earlier data to users so they can carry out AI procedures for water system frameworks that address their issues and increment profitability. The methodology utilized by the author in this paper was created with the point of defeating three snags. The first is to decide the compelling measure of precipitation, the second is to utilize the powerful precipitation to decide the measure of water system water required, and the third is to prescribe fitting yields for users to acquaint all together with improve crop efficiency. The framework is successful altogether three regards, and it is wanted to be extended later on to incorporate more zones under survey just as more harvests. They need to think about the results of profound learning approaches like DNN and CNN later on[2]. Various other review are h=discussed below in Table 1

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Table 1: The below Table Illustrates the Various Literature Review.

Sr. No	Paper name	Method	Future Work
1	An exploratory investigation of the surface and subsurface water system strategies concerning soil dampness on grape yard. Diary of Water and Land Development [1]	SISC,DIPM,DIOM,SIPM	Statistical Method is Used to predict the water Requirement
2	IoT Based Smart Irrigation Monitoring and Controlling System[2]	IOT, Irrigation, Sensor	Not used in any irrigation method
3	An Automated Irrigation System for Smart Agriculture Using the Internet of Things [12]	ARM, Data Transmission	Less convolutional layers
4	Machine learning and open source technologies are used in an IoT-based smart irrigation management system [13].	Machine-learning based Soil moisture prediction algorithm, Smart irrigation scheduling algorithm	Hardware dependency Less amount of data
5	Insightful IoT Based Automated Irrigation System [14]	M2M, K-Means, Arduino, Raspberry Pi3	Less amount of data and no specific irrigation method is used
6	Smart agricultural irrigation system driven by IoT and solar energy [15]	Fuzzy Logic, Local Control Mode	Hardware dependency
7	A Machine Learning Study on Smart Irrigation [11]	Back Propagation (BP),ANN	The computational time in indirect approach is highly excessive
8	Statistical machine learning techniques for agricultural machine vision systems: current and prospective applications [16]	Statistical Method, SVM, kNN	This Technique is not used with irrigation data.
9	Data mining methods are being used to predict effective rainfall and agricultural	DNN, CNN	Hardware dependency

	water demands. [10]		
10	IoT and Machine Learning Approaches for Automation of Farm Irrigation System	SVM, SVR	This Technique is not used with irrigation data.

The suggested solution is based on the Internet of Things, which would be a more realistic and precise solution to the homestead's requirements. To make it simpler and more compelling to deal with water system issues, an observing framework would be worked with the essential objective of settling over water system, soil corruption, and yield explicit water system issues. Since water is a limited asset, unnecessary misuse of a particularly significant asset ought to be kept away from. The proposed arrangement would be set up by building up a dispersed remote sensor organization (WSN), in which distinctive sensor modules will cover every territory of the cultivate and send information to a focal server. Predictions for water system designs dependent on yields and climate situations would be upheld by AI (ML) algorithms. The author of this paper has water system, which are quite possibly the main farming undertakings. Because the amount of water needed for a water system is sensitive to a variety of factors, we offer a help vector machine (SVM) based water system forecast control technique for beginners in home planting. Our framework's point is to consequently permit proper water system utilizing SVM-based sensor information mining.

III. DISCUSSION

A. Comparative Study

a. Support Vector Machine (SVM)

It is an arrangement framework that utilizations regulated AI. SVM is equipped for arrangement just as relapse. I'll be focusing on non-straight SVM, or SVM with a non-direct piece. Non-direct SVM signifies that the calculations determined limit doesn't need to be a straight line. The benefit is that you can get substantially more powerful connections between your information focuses without executing complex changes yourself. The disservice is that it takes significantly more to learn in light of the fact that it is all the more computationally requesting. The implementation of the software is show in Figure 3.

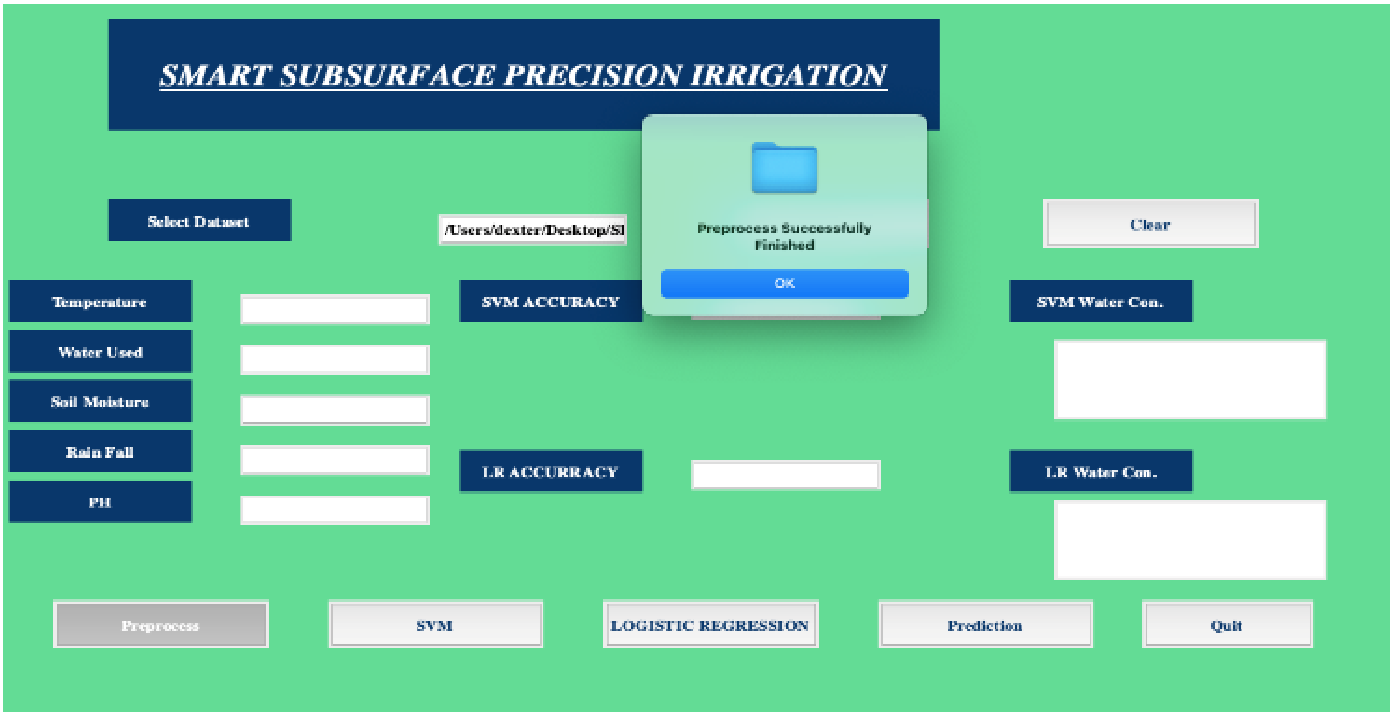

Figure 3: Illustrates the Applying the Data set for Pre Processing.

b. Linear Regression

LR is the next step up after connection. This recipe is used if we want to compare the estimate of one variable to the estimation of another variable. The reliant variable is the one we need to figure out (or in some cases, the result variable).

The free factor is the one we utilize to evaluate the other variable's estimate (or in some cases, the indicator variable). You may use direct relapse to see whether test yield can be predicted based on modification time, tobacco admission can be predicted based on smoking duration, and so on. If you have many autonomous variables rather than just one, you may use multiple relapses. Table 2 shows the results of the comparison investigation.

Table 2: The below Table shows the Comparative Study along with its Advantages Disadvantages.

Method	Advantages	Disadvantages
SVM	-SVM is a simpler algorithm. -Create highly accurate classifiers. -Low overfitting, -noise resistance.	SVM is a binary classifier that may be used to classify multiple classes and pairs of classes. It's computationally costly, yet it takes a long time to complete.
LR	- Linear regression is easy to use and the performance coefficients are simpler to analyze.	- SVM is a parallel classifier that can characterize anything. Exceptions might affect the relapse in the straight relapse approach, then again, and the procedure's limits are direct.
ANN	-Knowledge is stored throughout the whole network. -Ability to deal on a limited amount of information -Tolerance for flaws -The ability to store data in parallel	-Difficulty in bringing the issue to the attention of the network -The network's length is uncertain. -Choosing the right network

c. Artificial Neural Network

An artificial neural network (ANN) is a part of a computer system that simulates how the human brain analyzes and processes data. On this foundation, artificial intelligence is developed, and it solves issues that would be impossible or difficult to solve using human or statistical criteria. Self-Learning capabilities enable ANNs to increase their performance as new data becomes available.

Result Analysis:

Based on the tests did we accomplish the SVM Accuracy 75% and LR Accuracy-82%? It is shown in Figure 4.

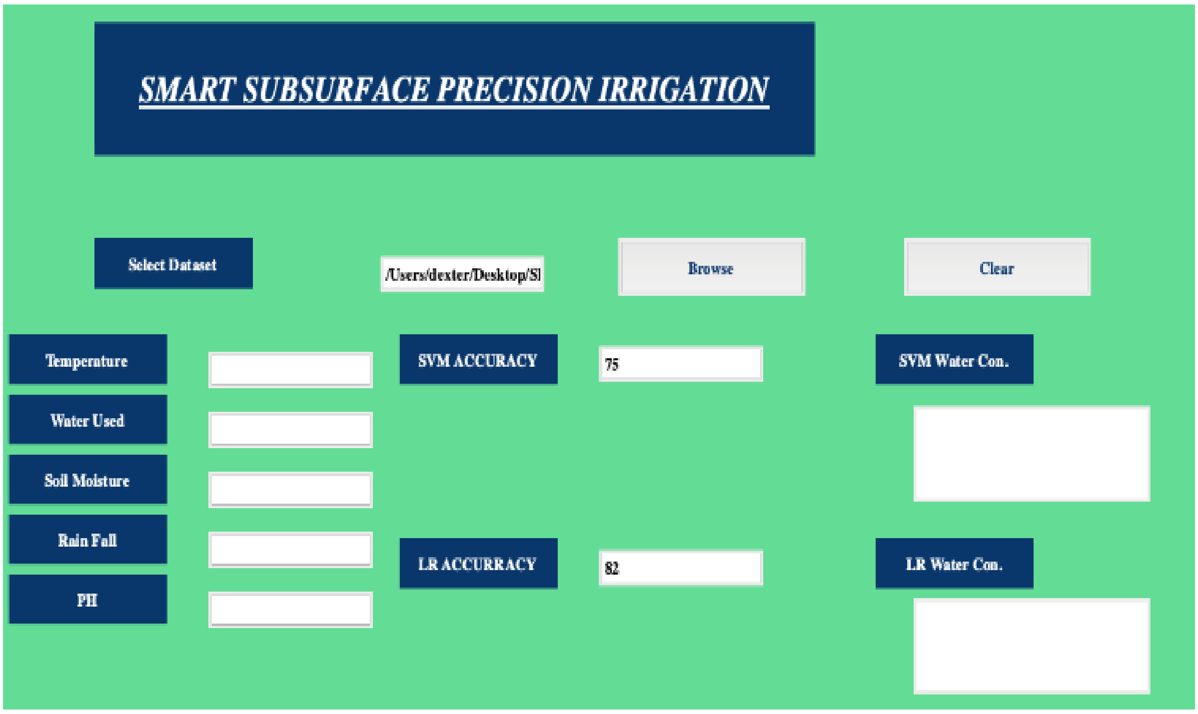

Figure 4: Illustrates the Calculation of Accuracy and SVM.

IV. CONCLUSION

The bulk of current irrigation systems are based on a periodic water delivery that is independent of the plant's actual irrigation water need, which presents a considerable challenge. A well-planned irrigation scheme improves crop productivity. Due to the complexity of the execution, it is not possible to modify the irrigation water depth and frequency too much when using surface irrigation systems. Producers find it difficult to change the irrigation schedule when the irrigation depth varies. It's difficult to figure out how much water to use since it relies on a lot of variables including air temperature, relative humidity, wind speed, sun hours, and solar radiation. As a consequence, the irrigation depth as well as interval are expected to remain constant throughout the growing season. IoT devices and various machine learning techniques are used to solve farmer problems in smart subsurface precision irrigation systems. We can forecast weather conditions, moisture, and soil conditions with the aid of IoT devices, which can assist farmers in improved crop production and water use with greater precision. Using this plastic mulching system with IoT, we can collect data from various crops and conduct research on the dataset to obtain more accurate results.

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