Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 4, April : 2023

DESIGN AND IMPLEMENTING OF IRRIGATION SYSTEM IN A TOWN

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ABSTRACT

Irrigation is the artifical application of water to the land or soil. It is used to assist in the growing of agriculture crops, maintaince of landscapes, and revegitation of disturbed soils in dry areas and during period of in adequate rain fall the modern challenge of improving the growth of plants and reducing costs justifies that the development of an irrigation system that will minimize the waste of water and reduce workers and monitor over head is crucial. This project is taken up as malayasia is an agricluture oriented country and the rate at which water resources are depleting years by years due to increasing of population. This system is to help and provide an irrigation system that will ease the burden of the users to take care of plants. Soil moistures are difficult to measure and their target levels cannot be maintained effeciently. That is the reason an automated irrigation system would be the best solution for this problem. The soil moisture sensor will refer to the level of soil moisture and the system will start automatically when the level of moisture is below the suffecient level for the plants to grow healthily. This system will automatically stop when it reached the moisture soil level for such particular time such as we set the time during morning and evening. The brain for this system is microcontroller. Besides that, it made up of reliable parts and relatively low cost.

1. INTRODUCTION

Freshwater is needed for crop and energy production, industrial fabrication as well as human and ecosystem needs. According to AQUASTAT database (AQUASTAT, 2016), 69% of the total extracted freshwater is used by agriculture sector, whereas 19% is used by industrial sector and the rest in used by domestic segment. therefore, water can be considered as a critical need in agriculture sector for future global food security however, continued increase in demand for water by domestic and industrial sector and greater concerns for environmental quality have create a challenge to every one country to reduce the farm water consumption and sustain the fresh food requirement. Consequently, there is an urgent need to create strategies based on science and technology for sustainable use of water. Industrialist and researchers are working to build efficient and economic automatic system to control water usage in order to reduces much of the wastage.

Irrigation is an artifical application of watering the land for agriculture production. The requirment of water you the soil depends on the soil properties such as soil moisture and soil temperature. Effective irrigation can influence the entire growth process and automation in irrigation system using modern technology can be used to provide better irrigation management. In general, most of the irrigation system are manually operated.

It is used to assist in the growing of agricultural crops, maintance of landscaps, and revegetation of disturbed soils in dry areas and during periods of inadequate rainfall.

WHAT IS IRRIGATION

Irrigation is defined as a process of supplying of water to crops artificially.

The science of planning and designing a water supply system to the plants, crops, for the normal growth during the period of no rainfall with the help of dam, weir, barrage, reservoir and canal system with head works, cross drainage works, and miscellaneous works of canal like canal fall is called irrigation engineering.

Irrigation is the artifical application of water to the land or soil.

Freshwater resources are becoming scarce due to population increase and associated increases in water, food, and energy demands. The state of Florida alone is projected to add 6 million people by 2030 (Rayer and Wang 2017). Moreover, extreme weather events (e.g., floods and droughts) are becoming common phenomena. Therefore, as freshwater resources become increasingly scarce and droughts become more frequent, there is a need for efficient use of water resources. There have been significant advancements in irrigation technologies (e.g., electric valves, smart controllers, soil moisture sensors, etc.) that can allow water savings (Dukes 2012). However, the effectiveness of these technologies depends on several factors such as the design of the irrigation system. Designing efficient irrigation systems and equipment will not only save money but also conserve water.

OBJECTIVES OF IRRIGATION

- To ensure the proper growth and development of plant.
- To control soil temperature.
- The decomposition of organic matter
- To soften tillage pans and clods.
- To control some distractive pests and diseases.

FACTORS TO CONSIDER WHEN DESIGNING IRRIGATION SYSTEMS

This document provides a basic overview of the major factors to consider when designing irrigation systems and choosing irrigation equipment. Figure 1 presents a few of the major factors that affect design of irrigation systems.

WATER SOURCE

Total freshwater withdrawal in Florida across all uses is 6.4 billion gallons per day. Almost two-thirds of this is from groundwater, while the rest is from surface water (Marella 2015). Almost 40 percent of freshwater withdrawal is accounted for by agricultural use, while 36 percent is for public supply. The remaining 24 percent of freshwater withdrawals goes to other uses such as power generation, recreational-landscape irrigation, commercial-industrial mining, and domestic self-supplied uses. Freshwater withdrawal in Florida follows the population density and the intensity of irrigated croplands. Freshwater withdrawal is the highest in Palm Beach county (more than 1 billion gallons per day). Knowing the quality and available quantity of the irrigation water source is critical. Water sources could be from reclaimed water, surface water, or groundwater. Depending on the water source used, the amount of water available and the equipment needed to deliver the water will differ. Water allocations for irrigation could be subject to local ordinance, depending on several factors.

FIELD CHARACTERISTICS

Field characteristics (i.e., field size, land slope, soil type) could affect the choice of the irrigation system, necessary irrigation equipment (e.g., pump), and plant types.

FIELD SIZE

Field size (acreage) affects the maximum number of plants that can be planted and, as a result, total irrigation requirement. The maximum area that can be irrigated at any given time should be determined based on the availability of water, the pump's allowable flow rate, and the pressure at the source. Pressure loss should be considered when designing an irrigation system to minimize pressure drops and variations across the irrigated area.

LAND SLOPE

Terrain slope affects the flow of water and irrigation distribution uniformity. Water flows from high potential (high elevation) to low potential (low elevation). Depending on the irrigation system layout, fields at lower elevation could receive too much water while higher-elevation locations could receive too little water. Pumps might be needed to deliver enough water against a slope gradient. In addition, terrain slope could promote runoff and erosion. In some cases, leveling of uneven fields could be considered.

SOIL PROPERTIES

Soil properties (e.g., texture, structure, soil depth, organic matter content) affect soil and water relationships such as soil water-holding capacity. Soil water-holding capacity affects the frequency and rate of water application. For example, sandy soils have low water-holding capacity and need to be irrigated more frequently at lower irrigation rates. Alternatively, clayey soils have a relatively higher water-holding capacity and could be irrigated less frequently at a higher irrigation rate. Soil depth also affects effective plant rooting depth and leaching of water and nutrients below the root zone.

PLANT TYPE

Plant type affects irrigation system selection. Irrigation requirements differ depending on plant growth stage. In addition, reports show that annual crops have smaller water requirements compared to perennial plants (Vico and Brunsell 2018). In addition, different plants have different planting densities (spacing). If the same irrigation system is used to irrigate different plants, plants should be placed in different zones so they will be irrigated independently. Crop coefficients (Kc) vary at distinct growth stages for different plants. Thus, plant-specific Kc values should be used when calculating actual evapotranspiration (ETc) and irrigation requirements. Crop market values affect the feasibility of more expensive irrigation systems. Higher-value crops may allow for greater investment in an irrigation system; this may not be a viable option for lower-value crops.

2. LITERATURE REVIEW

Muhammad et al (2010): A simple approach to Irrigation control problem using Artificial Neural Network Controller. The proposed system is compared with ON/OFF controller and it is shown that ON/OFF Controller based System fails miserably because of its limitations. On the other hand ANN based approach has resulted in possible implementation of better and more efficient control. These controllers do not require a prior knowledge of system and have inherent ability to adapt to the changing conditions unlike conventional methods. It is noteworthy that ANN based systems can save lot of resources(energy and water)and can provide optimized results to all type of agriculture areas.

Kalyan et al (2011): The need for systems that make agriculture easier and more sustainable has increased within the past few years. The ability to conserve two of the most important resources of a farmer, water and time, has been the latest challenge. A system that provides this ability - through the use of efficient and reliable methods such as wireless sensor networking, sprinkler irrigation, GSM, SMS technologies and readily available mobile phone devices – is certain to help the farmers get a better yield and on a larger scale, help the agricultural and economic growth of the country.

Prisilla et al (2012) : Water is one of nature's most important gifts to mankind, because of the increase in population food requirement for human being is also increasing. Over the past few decade usage of water for irrigation has increased hysterically. Water is polluted due to wastage and contaminants in the industries. Saving water is more important. This ultimate aim can be achieved by using the exiting ANN control system. It will provide a way to save flood water in the fields for future irrigation purpose

3. EXISTING AND PROPOSED SYSTEM

Irrigation the artifical application of water to crops. has been used by humans for thousands of years. Ancient civilizations build complex irrigation system without the aid of modern technology or construction equipment.

MATERIALS

- Paper or plastic cups
- Drinking straws
- Modelling clay
- Scissors
- Xacto-Knife
- Tapwater
- out door area or bathtub

DESIGN A SYSTEM THAT EQUALLY DISTRIBUTES WATER AMONG DIFFERENT FEILDS

Irrigation systems can be vital for growing crops in areas that do not otherwise receive enough rainfall to sustain them. They are even used in areas that are near natural water sources like lakes and rivers, to help evenly distribute water amongst the crops.

In this project you will build a simple model irrigation system using plastic cups and straws, powered by nothing but gravity. Can you design a system that evenly distributes water among different cups.

Preparation

Adult supervision is required when using an Xacto knife.

If you are doing the project indoors, make sure you have towels handy to clean up any spilled water.

Procedure

Use the Xacto knife to make two small X-shaped slits about one-third of the way down from the top of a cup, on opposite sides of the cup.

Get two more cups and make one X-shaped slit in each up, about one-third-of the way up from the bottom. The slits in the first cup should be higher than the slits in the second two cups.

Poke one drinking straw through each slit in the first cup, then poke the other ends of the straws through the slits in the other cups.

Use small pieces of modeling clay to form a seal around the straws inside each cup, to prevent water from leaking out.

If you have trouble getting the cups to sit flat, put a few coins in the bottom of each one to help weigh them down.

Slowly pour water into the central cup. You can pretend this cup represents a natural water source like a river or lake, or an area that receives rainfall, and the other cups represent locations without water.

OBSERVATION AND RESULT

When you pour water into the central cup, it should start flowing into the other cups once it reaches the straws. This occurs because gravity pulls the water through the straws, which are angled downward since you made the holes in the first cup higher than the holes in the other cups. To get equal amounts of water in each cup, it is important to have the straws in the central cup all at the same height. If one straw is higher than another, the cup it leads to will not receive as much water (or any water at all, depending on how slowly you pour the water – if you pour slowly enough, all of the water might go through the lower straw.

4. METHODS OF IRRIGATION

There are four methods in irrigation system :

- ❖ Surface irrigation
- ❖ Sub-surface irrigation
- ❖ Sprinkler irrigation
- ❖ Drip irrigation

Surface Irrigation:

- In all the surface methods of irrigation, water is either ponded on the soil or allowed to flow continuously over the soil surface for the duration of irrigation.
- It does not result in high level of performance.
- This is mainly because of uncertain infiltration rate which are affected by year to year changes in the cropping pattern, cultivation practices, climatic factors, and many other factors.

Uncontrolled method :

- When water is applied to the cropland without any preparation of land and without any levees to guide or restrict the flow of water on the field, the method is called uncontrolled, wild or free flooding.
- Uncontrolled flooding generally results in excess irrigation at the inlet region of the field and insufficient irrigation at the outlet end.
- Efficiency is reduced because of either deep percolation or flowing away of water from the field.
- The advantage of this method is the low intial cost of land preparation.

Border strip method :

- Border strip irrigation (or simply border irrigation) is a controlled surface flooding method of applying irrigation water. In this method, the farm is divided into a number of strips. This strips are seperated by low levees.
- The border strip method is suited to soils of moderately low to moderately high intake rates and low erodibility.

- This method, however, requires preparation of land involving high intial cost.

'Crop per Drop' or 'Cash per Splash': The True Imperative

The goal of increasing agricultural production per unit of water applied is expressed in the catchphrase "more crop per drop." This phrase, however, can be misleading for nonspecialists as well as for governments as it suggests the intent to produce more at all costs and dilutes the emphasis on farmers, their decision making and profitability, and the economic justification for projects.

The performance of the sector revolves around the farmer, and this fact should be an integral factor in project preparation. For farmers, climatic and financial risk, labor demand, and, critically, the prospect of good profits are of overriding importance. If the profits promise to be good and the risks are acceptable, farmers will respond with further production, provided they have the skills and resources. To bring this imperative and understanding to the attention of project officers and governments, an additional catchphrase that captures the farmers' perspective—'cash per splash'—is needed.

Problems Related to Irrigation in India

Despite large-scale investment and expansion of irrigation facilities it is a matter of serious concern that about 60 per cent of the total cropped area is still dependent on rain. There are number of problems related to irrigation and they have to be solved.

(1) Delays in completion of projects:

The biggest problem in our major and medium irrigation sectors right from the First Five year plan has been the tendency to start more and more new projects resulting in want on prolification of projects. There is also delay in utilisation of potentials already present. In most of the projects, there have been delay in construction of field channels and water courses, land levelling and land shaping.

(2) Inter-state Water disputes:

Irrigation is a state subject in India. Development of water resource is, therefore, being planned by states individually taking into account their own needs and requirement. However, all major rivers are inter-state in character. As a result, difference with regard to storage, priorities and use of water arise between different states. Narrow regional out look brings inter-state rivalries over distribution of water supply.

(3) Regional disparities in irrigation development:

The Ninth Five Year Plan Document estimated that the water resource development in North Eastern region through major, medium and minor schemes is only at the level of 28.6 per cent whereas in the Northern region it has reached about 95.3 per cent. This indicates a wide regional variation in the development of irrigation facilities.

(4) Water-logging and salinity:

Introduction of irrigation has led to the problem of water logging and salinity in some of the states. The working group constituted by the Ministry of Water Resources in 1991 estimated that about 2.46 million hectares in irrigated commands suffered from water logging. The working group also estimated that 3.30 million hectares had been affected by salinity/alkalinity in the irrigated commands.

(5) Increasing cost of irrigation:

The cost of providing irrigation have been increasing over the years from the first five year plant to tenth five year plan.

(6) Losses in operating irrigation projects:

While just prior to Independence (1945-46) public irrigation schemes showed a surplus after meeting working expenses and other charges, the position deteriorated considerably in the post independence period.

(7) Decline in water table:

There has been a steady decline in water table in the recent period in several parts of the country, especially in the western dry region, on account over exploitation of ground water and insufficient recharge from rain-water.

Factors contributing to irrigation-induced salinity

At the technical level, irrigation-induced salinity has developed in some areas due to: (i) poor on farm water use efficiency; (ii) poor construction, operation and maintenance of irrigation canals leading to excessive seepage; (iii) the inadequacy or lack of drainage infrastructure; and (iv) even when drainage structures are provided, their poor quality of construction, operation and maintenance. These technical problems, however, maybe the product of several other factors. Distortive government policies lead to inefficient use of water resources. In the case of irrigation water, it is frequently priced below its true economic value, thus leading to overapplication. Water use efficiency is further aggravated by a lack of awareness of farmers of more efficient production and water application methods and poor water management by irrigation authorities. Off-farm, excessive irrigation and drainage canal seepage can be traced to ineffective project planning, poor quality of construction and inadequate monitoring and maintenance, which lead to rapid infrastructural deterioration. In some cases, no provision for drainage is made at all. These weaknesses in the planning and implementation of irrigation and drainage projects, however, frequently stem from the shortsighted perspectives assumed by many policy makers. Often, there is a lack of or weak understanding of the consequences of inaction or at the extreme, weak or lack of commitment to environmental protection. At the same time, donor agencies have inadvertently contributed to the problem. Weaknesses in donor project planning and supervision and, not until recently, the inadequate priority to environmental consequences of projects, have similarly contributed to the problem.

Farm Level

There are two main avenues by which on-farm water-use efficiency can be promoted. First, greater effort should be directed towards promoting farmer adoption of more efficient production and water management practices (e.g., the use of furrow instead of flood irrigation and preventing diversion of excessive amounts of water at the headreaches). Externalities associated with on-farm salinity control measures and the nature of the land structures in most developing countries (predominance of smalllandholdings) may result in less than socially optimal levels of adoption. But mechanisms for internalizing these externalities, such as water user's associations, can be pursued. Second, where it is technically and economically feasible, for example in the production of high value crops, more water-use efficient technologies such as pipe, sprinkler and drip systems, should be promoted. Effectively promoting both strategies will require the provision of some agricultural support services, such as agricultural extension to introduce and train farmers in the use of new technologies or practices. It may also necessitate assistance to facilitate access to agricultural credit to finance the purchase of these technologies.

In areas where salinity problems exist, farm output has declined drastically, and technical measures (e.g. drainage) to correct for it are shown to be presently economically or technically infeasible, alternative crop mixes should be introduced to farmers. The cultivation of more salt-tolerant crops (see Table 2.1) will alleviate or remedy the decline in farm incomes resulting from the reduced output of the traditional crops. Similarly, the provision of support services, such agricultural extension and the marketing support services, will play a significant role in this endeavor. It should be noted, however, that the cultivation of salt-tolerant crops should not be undertaken as a substitute for good cultivation practices; neither should it be used as a corrective mechanism for improper irrigation practices. A program to shift to the cultivation of salt-tolerant crops should only be promoted when the traditional crops can no longer be grown profitably.

Irrigation in India

Irrigation in India includes a network of major and minor canals from Indian rivers, groundwater well based systems, tanks, and other rainwater harvesting projects for agricultural activities. Of these groundwater system is the largest. In 2013–14, only about 36.7% of total agricultural land in India was reliably irrigated, and remaining 2/3 cultivated land in India is dependent on monsoons. 65% of the irrigation in India is from groundwater. Currently when? about 51% of the agricultural area cultivating food grains is covered by irrigation. The rest of the area is dependent on rainfall which is most of the times unreliable and unpredictable.

Indian government launched a demand side water management plan costing ₹6000 crore or USD854 million across 8,350 water stressed villages of 78 districts in seven states – Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh – over five years from 2021–2022 to 2026–27, with the view to harvest rainwater, enhance water table, water recharge rate with village panchayat level water management plans. Most of the canal irrigation is in the canal network of Ganges-Yamuna basin mainly in the states of Punjab, Haryana, and Uttar Pradesh and somewhat in Rajasthan and Bihar, while small local canal networks also exist in the south in Tamil Nadu, Karnataka, and Kerala. The largest canal in India is Indira

Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 4, April : 2023

Gandhi Canal, which is about 650 km long. India has an ambitious river linking national project to enhance the coverage of canal-irrigated area, reduce floods and water shortage.

Irrigation in India helps improve food security, reduce dependence on monsoons, improve agricultural productivity and create rural job opportunities. Dams used for irrigation projects help produce electricity and transport facilities, as well as provide drinking water supplies to a growing population, control floods and prevent droughts.

FUTURE ENHANCMENT

A six-year research programme on irrigation has concluded with a big win for the agricultural industry - the development of promising new sensor technology systems that give arable, vegetable, and pastoral farmers the tools to use precision irrigation at sub-paddock scales.

The new technology systems work alongside existing irrigation scheduling technology, mapping and monitoring a field at sub-paddock scales and calculating exactly how much water is needed at the right time and place. It is a leading development for irrigation and field trials have proven to dramatically reduce water wastage, save users money, and minimise farm runoff.

Irrigation is the important theme for crop production. So we have to select effective method for it and also should not select any costly methods.

5. CONCLUSION

Irrigation is the important theme for crop production. So we have to select effective method for it and also should not select any costly method.Today the conditions are once again excellent for irrigation expansion. Markets for increased production from the farm and processing off the farm are available. Water supplies and water management and conservation systems are evolving to allow for the sustainable use of available water storage in the province, including Lake Diefenbaker waters and other water storage infrastructure. The returns to farmers and society from a fully diversified irrigation economy have been measured and would make significant contributions to provincial output (GDP), household incomes and employment. The value of water when used in a comprehensive irrigated value chain is clearly as high, if not higher, than most competing uses for the water.

The shortages of food production projected for the 1990s have been averted to some extent by the explosive exploitation of groundwater and the increase in water saving technologies over the last three decades. However, overexploitation of the groundwater resource and an associated decline in water quality have been occurring in many parts of the world, particularly in the semi-arid regions. Exploitation of groundwater was originally spurred by the need of farmers for additional water. In many regions, the farmers reacted to the inadequate service they received from the large surface irrigation systems.

There are various examples that support the viewpoint that it is the association of technical changes with institutional and policy reforms that contributes to the success of reform programmes in irrigation. Deficiencies in management as well as in design of irrigation projects are the causes of the poor performance of irrigation. This observation does not suggest that design of irrigation projects should be refocused to the conventional engineering aspects of the past. Modern approach to design means taking into account the quality of service, the ease of operation, the social and institutional aspects, in brief the needs of the farmers and the working conditions of field operators.

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