Automatic Phase Conversion and Drip Irrigation System

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Abstract

The modern challenge in improving plant growth and reducing cost for its growth justifies the development of an automated irrigation system that will minimize the waste of water and develop the single phase to three phase conversion and trip the motor depends upon the water level. A design is proposed for a residential environment. It is made up of reliable parts and is a relatively low cost. Its different sections have been simulated and tested and their effectiveness in reducing water consumption and human intervention has been demonstrated. Decoupled control strategies are developed to make sure that the current drawn from the single-phase supply is sinusoidal and in phase with the supply voltage, the generated phase voltages contain low voltage harmonics even when the load is non-linear and the neutral point is maintained stable. Simulation of this model will be carried out by using MATLAB/ Simulink.

Keywords- *irrigation system; water consumption; single phase supply; decoupled control strategy; simulink*

I. INTRODUCTION

Water is a natural resource that all living species need. It is therefore very precious and has to be preserved for the generations to come. For agriculture, we need a lot of water. Most of the time, water resource is not used efficiently and substantial amount of water is wasted. In near future, these wastes will represent a large sum of money. Those who manage this resource efficiently are winning time and money. In the past, single-phase to three-phase conversion systems were done by the connection of passive elements capacitors and reactors with auto transformer converters. Such kind of system presents well known disadvantages and limitations. To overcome these disadvantages, the newly adopted thyristors like SCRs, MOSFETs, and GTOs etc and power electronics devices are used. This paper is about single phase to three phase conversion system using IGBTs.

In this project report, an automated irrigation system is suggested to minimize the water consumption and human intervention, while satisfying the plants needs. In a phase conversion method, there are three phases that is RYB. Anyone phase are cut, it's automatically converts three phase by using capacitors and the motor will run. First, the details of the problem are summarized. The objective and the scope of the project were described. Some general approaches to the design are reviewed. The results and conclusions to determine the required amount of water are discussed. Then, the suggested design is explained in detail with the purpose, requirements and constraints, simulation and test results for each of its parts. A brief cost analysis is done to estimate the viability of such a project on the market. Finally, the some suggestions are given for future improvements.

The single-phase induction motor drives and the three-phase induction motor drives are used in low-power industrial applications. In some rural areas where only a single-phase supply is available, we should convert a single-phase to a three-phase supply. This paper suggests an alternative solution for phase conversion with very low overall cost, moderate motor performance during start up and high steady-state performance at line frequency. This system fits

the requirements of rural areas where only a single-phase supply is available

II. REASEARCH SURVEY

A. Smart Irrigation Controllers

Most soil moisture sensors(SMS) are designed to estimate soil water content based on the dielectric constant of the soil. The dielectric constant is the soil's ability to transmit electricity. The dielectric constant of soil increases when the water content of the soil increases. Because the dielectric constant of water is much larger than the other soil components, including air. Thus, the measurement of the dielectric constant gives a predictable estimation of water content.

The SMS controller has an adjustable threshold setting. If the water content in the soil exceeds that setting, the event is bypassed. The threshold of soil water content is set by the user. An another type of control technique with SMS devices is "on-demand". Here the controller initiates irrigation at a low threshold and terminates irrigation at a high threshold.

B. Soil Moisture Sensor

The Soil Moisture Sensor uses capacitors to measure dielectric permittivity of the surrounding medium. In soil, the dielectric permittivity is a function of the water content. The sensor creates a voltage which is proportional to the dielectric permittivity, and therefore the water content of the soil.

The sensor asenses the water content over the entire length of the sensor. There is a 2 cm zone of influence which has little or no sensitivity at the extreme edges. The figure above shows that the electromagnetic field lines along a cross-section of the sensor, illustrating the 2 cm zone of influence.

C. Water Level Sensor

A liquid level sensor with Aqua Plumb series measure liquid level in tanks, reservoirs and in the environment without any moving parts. The sensing element in the sensor consists of a special cable which is capable of accurately sensing the level of nearly any fluid, including water, salt water and oils. The Aqua Plumb waterlevelsensorcan be easily calibrated forany range and any fluid in the field with the use of two buttons. One button records the minimum fluid level (0V level) and the other button records the maximum fluid level (3Vlevel). The sensor element is electrically insulated and isolated from the liquid into which it is inserted, and will not be corroded over time. Unlike other sensors, the measuring range is adjustable from a few centimeters to over several meters. The reading is reported as an analog voltage, ranging from 0V to 3V, where 0V represents the sensor not being submersed, and 3V represents the maximum water level.

III. IMPLEMENTATION

A. MATLAB

MATLAB is most widely used in all areas like applied mathematics, education system and research works in universities and in the industry. MATLAB stands for MATrix LABoratory and the software is built up of vectors and matrices. This makes the software useful particularly for linear algebra. But MATLAB has a great tool for solving algebraic, differential equations and numerical integration. MATLAB has powerful plotting tools which can produce nice pictures in both 2D and 3D. It is also the one of the easiest programming languages for writing mathematical programs. MATLAB has also some tool boxes useful for signal processing, image processing, optimization, etc.

B. Phase Converter

A 3-Winding induction motor with three electrical terminals, a single phase power supply with two lines, and a transformer with at least three electrical terminals, a first motor terminal connected to a first supply line, a second motor terminal connected to a second supply line, a first terminal of said transformer also connected to said second supply line, means to connect a capacitor between a second terminal of said transformer which is intermediate said first and third terminals, and said first supply line, and means to connect a third terminal of said transformer to a third terminal of said motor.

C. Drip Irrigation

Drip and subsurface drip irrigation are used almost exclusively when using recycled municipal waste water. Regulations typically do not allowt spraying water through the air that has not been fully treated to potable water standards.

D. Design Consideraion

The following factors are considered in the choice of a design solution; Installation costs, Water savings, Human intervention, Reliability, Power consumption, Maintenance.

Among these, a critical consideration is the installation costs, since costs generally determine the feasibility and viability of a project. The installation cost must be low enough for a domestic user. The

water savings is also an important aspect, since there is a demand to minimize water loss and to maximize the efficiency of water used. Since the objective is to minimize the cost of labor and minimal supervision, the calibration must be needed. The system must operate with optimized consistency.

IV. RESULT AND DISCUSSION

Design and Simulation Results

Drip irrigation is the best method of irrigation. The sprinkler systems are around 75-85% efficient whereas drip systems are typically 90% or higher. i.e. drip systems waste much less water. Drip irrigation is also known as trickle irrigation which works by applying water slowly, directly to the soil, bloop, bleep. The high efficiency of drip irrigation depends on two primary factors.

The first factor is that the water soaks into the soil before it is evaporated or run off. The second factor is that the water is applied only where it is needed, rather than sprayed everywhere. The drip systems are simple and pretty, forgiving of errors in design and installation. Some guidelines, if followed, will make a much better drip system. The block diagram consists of field , phase converter, PIC, tank and indication (Figure 1 Block diagram of Phase conversion and drip irrigation)

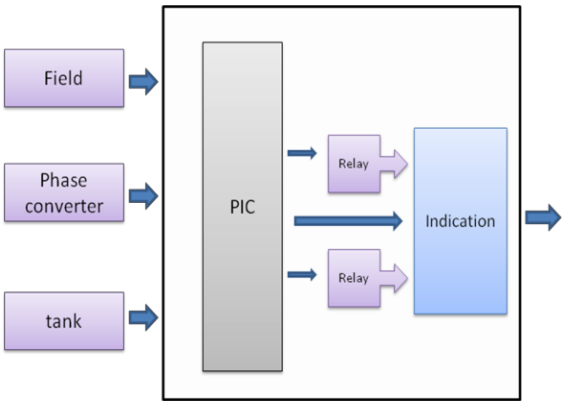

Figure 1 : Block Diagram of Phase Conversion Drip Irrigation

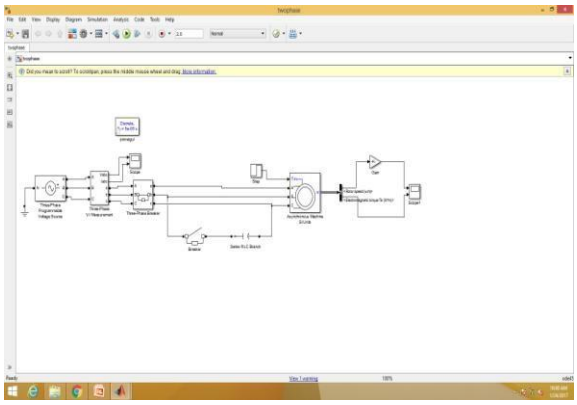

Figure 2. Simulation model of phase conversion using MATLAB

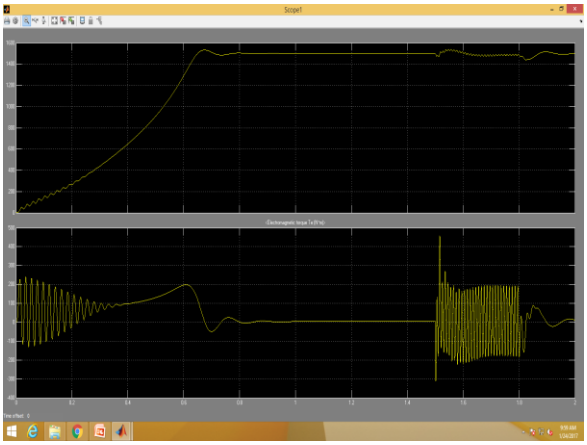

Figure 3. Speed torque characteristic of induction motor

The installation costs is the critical consideration, since costs generally determine the feasibility and viability of a project. The installation cost must be low enough for a domestic user. The water savings was also an important aspect, since there is a demand to minimize water loss and to maximize the efficiency of water used.. The system must operate with optimized consistency.

The power consumption must also be monitored. For maintenance, the replacement parts must be readily available and easy to install in the case of failure. Finally, the possibility for implementing the system (Figure2. Simulation model of phase conversion using MATLAB) at a larger scale (e.g. in greenhouses) should be investigated

Torque speed characteristics is the curve plotted between the torque and the speed of the induction motor. Figure.3 shows the speed torque characteristics of induction motor.

V. CONCLUSION

In this paper based on the Microcontroller based Drip Irrigation System proves to be a real feedback control system which monitors and controls all the activities of drip irrigation system efficiently. The present proposal is a model to modernize the agriculture industries at a mass scale with optimum expenditure. Using this system one can save manpower, water to improve production and ultimately profit. The use of soil moisture sensors helps growers with irrigation scheduling by providing information about when and how much to water. This provides for efficient use of water, enough to meet crop needs without applying excess or too little water.

Excessive irrigation increases the cost of production from additional pumping costs and fertilizer lost to runoff and leaching. It can also decrease yields from water logging and leaching of soil nutrients. Excessive runoff can sometimes be harmful to the environment if fertilizers and pesticides move to sensitive environments. Under-watering results in plant stress which can reduce yield and crop quality. This fact sheet introduces several soil water monitoring options that, when used correctly, can help growers avoid over and under watering. The use of soil moisture sensors requires an understanding of soil moisture depletion, available soil water, and irrigation application.

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