SMART IRRIGATION CONTROL SYSTEM

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Synopsis

Agriculture has played a key role in the development of human civilization. One of the major requirements of agriculture is irrigation, agriculture accounts for 70 per cent of withdrawals of freshwater resources. However, increasing pressure being placed on water resources by industry, cities and the involving biofuels industry means that water scarcity is increasing and agriculture is facing the challenge of producing more food for the world's growing population with fewer water resources.

Successful agriculture is dependent upon farmers having sufficient access to water. However, water scarcity is already a critical constraint to farming in many parts of the world. The only other way for successful agriculture is the proper use of the available fresh water for irrigation.

For the proper use of the available fresh water we may go for a solution i.e., ***SMART IRRIGATION CONTROL SYSTEM.*** This system operates at definite intervals of time; it senses the quantity of water present in the soil and the quantity of water available for irrigation and irrigates the crops only if it is necessary.

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Introduction

Overview

Agriculture is the cultivation of animals, plants, fungi and other life forms for food, fiber, and other products used to sustain life. Agriculture was the key implement in the rise of sedentary human civilization, farmers use irrigation to supplement rainfall. Irrigation may be defined as the science of artificial application of water to the land or soil. It is used to assist in the growing of agricultural crops, maintenance of landscapes, and revegetation of disturbed soils in dry areas and during periods of inadequate rainfall.

Motivation

Fifty years ago, the common perception was that water was an infinite resource. Today, the competition for water resources is much more intense. This is because there are now nearly seven billion people on the planet, their consumption of meat and vegetables is rising, and there is increasing competition for water from industry, urbanization and biofuel crops, activities resulting in global climate change are expected to trigger droughts with a substantial impact on agriculture. To avoid a global water crisis, farmers have to utilize the available water efficiently, to assist farmers to utilize the water efficiently i decided to develop an Electronic system which can irrigate the crops with greater efficiency.

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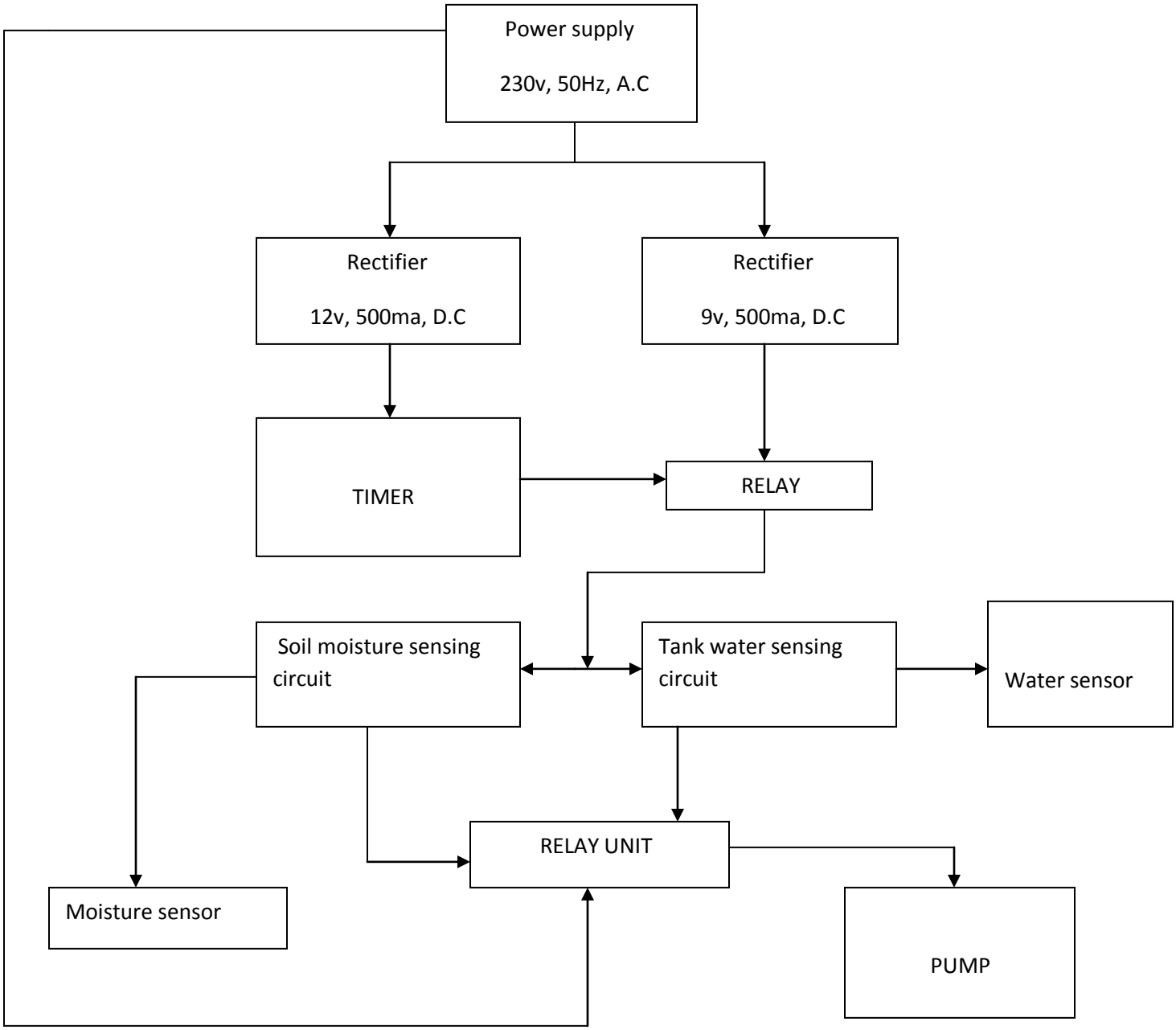
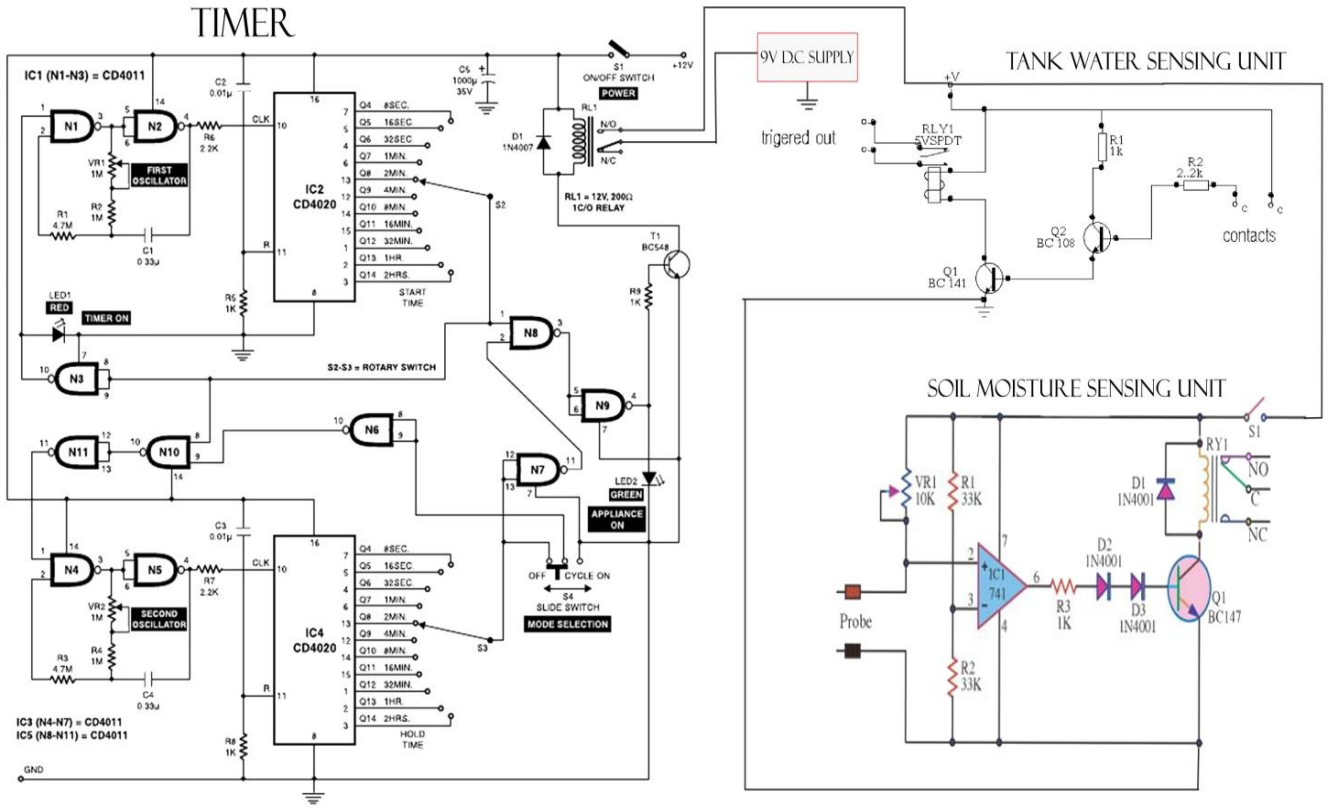
Description

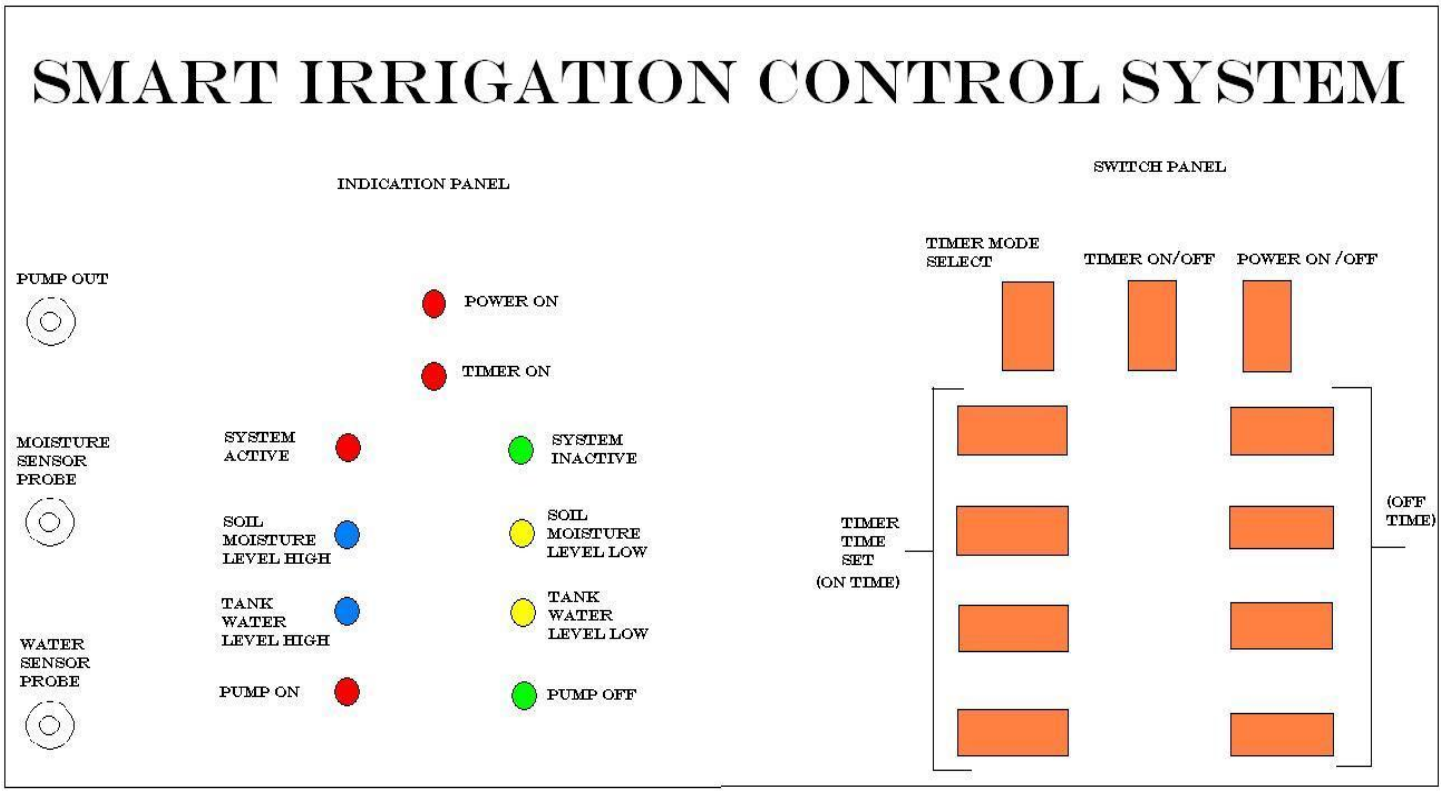
Block diagram



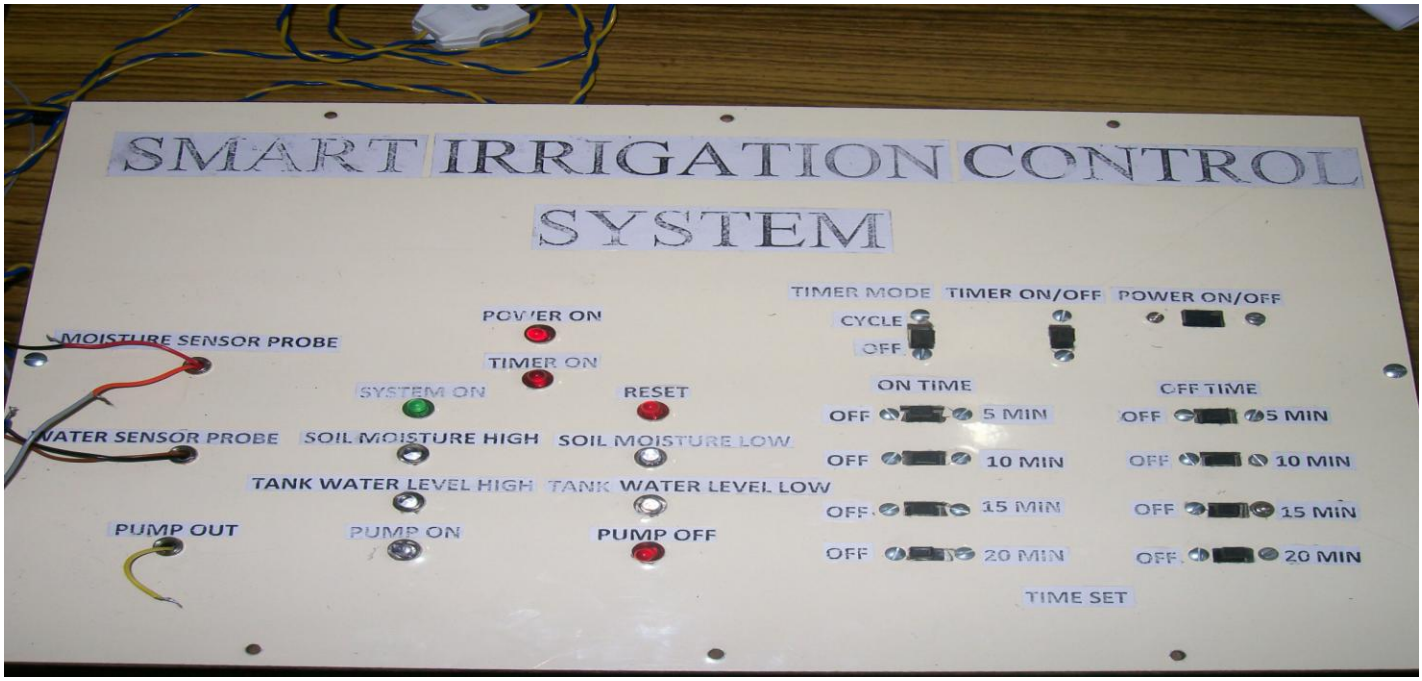
Circuit Diagram

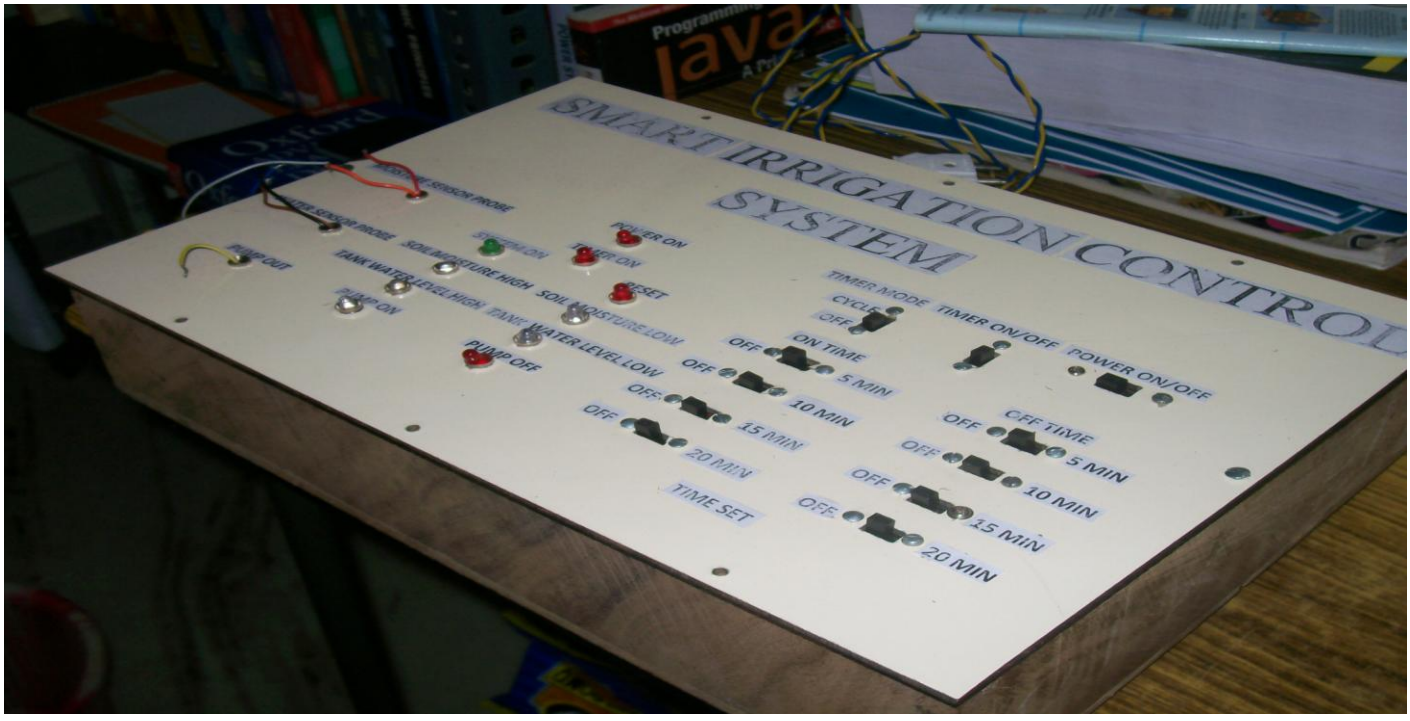


Panel diagram

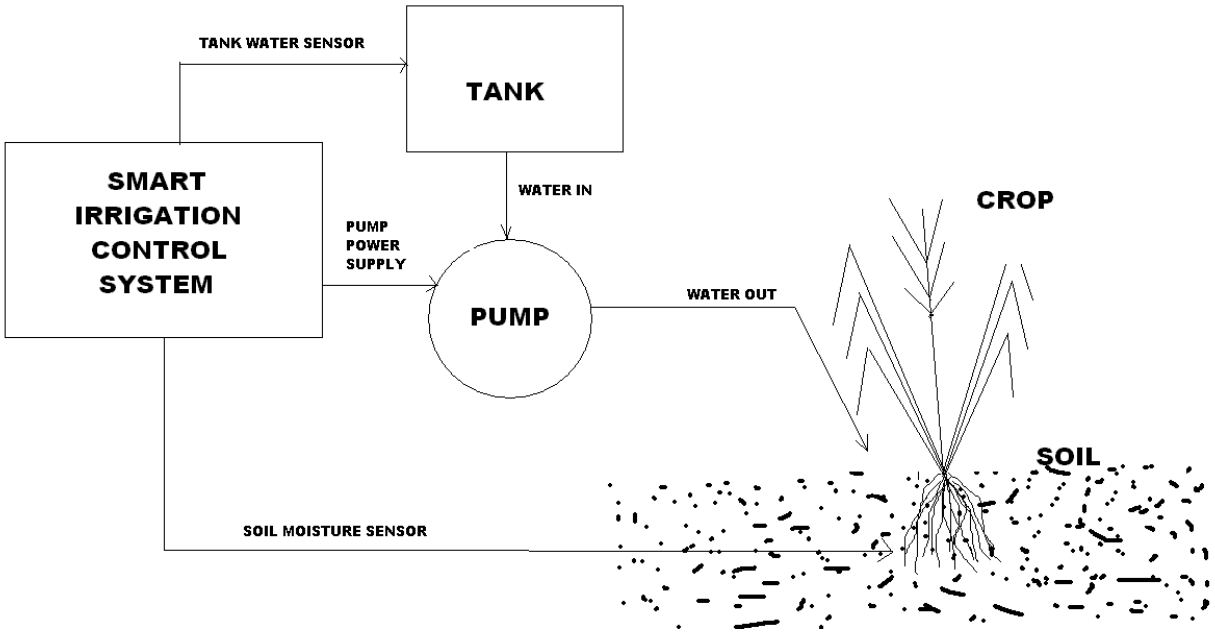


Prototype Developed





Operation



The Smart Irrigation Control System (SIC) contains four main units they are:

i. Timer unit
ii. Soil moisture sensing unit
iii. Tank water sensing unit
iv. Relay unit

i. Timer unit:

The timer is used to automatically turn ON and turn OFF the system at definite time intervals. The circuit works in two modes: off mode and cyclic mode. A Slide switch is used for mode selection. In the off mode, the appliance turns on after a preset time (set by rotary switch S2), remains on for another preset time (set by rotary switch S3) and then turns off. In the cyclic mode, this process repeats again and again.The circuit is built around three quad two-input NAND gate ICs CD4011 (IC1, IC3 and IC5), two 14-bit binary ripple counters CD4020 (IC2 and IC4) and a relay driver transistor (T1). It works off a12V DC, 500mA power supply. Let's assume that the timer is set for 2mins, when power switch S1 is closed, a small charging current pulse through capacitors C2 and C3 resets both the counters(IC2 and IC4) to make all their outputs (Q4 through Q14) low. The high output at pin10 of NAND gate N3 starts the first oscillator comprising NAND gates N1

and N2, which provides clock pulses to IC2 at the rate of one pulse per second. The glowing of red LED (LED1) indicates that this oscillator is Working well and timer is ‘on.’ During the first 2 minutes, relay RL1 remains de-energized by the control circuit formed by NAND gates N7, N8 and N9 and LED2 is off, which indicates that the appliance is in ‘off’ condition. The second oscillator built around NAND gates N4 and N5 (which provides clock pulses to IC4 at the rate of one pulse per second) is inhibited by the timing control circuit formed by NAND gates N6, N10 and N11.

After 128 pulses (approximately two minutes), the Q8 output of IC4 goes high. This de-energizes the relay via NAND gates N7 and N9 and relay driver transistor T1, provided the mode-selection slide switch S4 is towards off position. The high Q8 output will inhibit the second oscillator via NAND gates N6, N10 and N11 to stop clock pulses to pin 10 of IC4. Thus the relay is energized only once (for 2 minutes) since clock pulses to both IC2 and IC4 are stopped altogether and their outputs get latched.

ii. Soil moisture sensing unit

The soil moisture sensing circuit senses the moisture content present in the soil and triggers the relay in the relay unit. The circuit is built using IC 741 OP-AMP, one of the output of the water sensor probe is connected to the second pin of the IC, the other output of the probe is connected to the third pin of the IC. The sensing side of the probe is fixed with the soil, thus when moisture is sensed in the soil the output of the op-amp goes high and it triggers the base of the relay driving transistor, the transistor gets ON and it triggers the relay.

iii. Tank water sensing unit

The tank water sensing unit senses the presence of freshwater in the tank; it is used to prevent the pump running dry. This unit stops the pump when the water level in the tank is low. The water sensing probe is fixed in the tank, one of the output of the probe is connected to the VCC of the circuit, the other output is connected to the base of the transistor BC108, when water is

sensed BC108 gets on and triggers the transistor BC141 thus the relay that is connected with the collector of BC141 is triggered.

iv. Relay unit

The relay unit contains the relays of each unit and they are inter connected to each other, when the relay of the timer unit is triggered it gets on and VCC is applied to the water and moisture sensing units. When the relays of water and moisture sensing units are triggered, A.C supply is given to the pump and the pump starts working.

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Applications

- Can be used in farms and plantations to irrigate the crops efficiently when the availability of water and Electric power are the limiting factors.
- Can be used to irrigate the plants grown in houses,offices,parks e.t.c.
- Can be used to irrigate the crops automatically in the farms that are found far away from human habitation.

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Advantages

- Consumes less power, irrigates smartly and ensures maximum crop quality.
- Can be used to control all types of irrigations such as sprinkler, drip e.t.c.
- Easy to operate.
- Eliminates the need for human labour that is required for manual irrigation.
- Higher reliability, efficiency and life.
- Affordable.

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Future Works

- The water and the moisture sensors has to be made wireless using IR or RF remote modules, so that the system remains isolated from water and moisture and also the sensitivity of the system increases.

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Conclusion

The SMART IRRIGATION CONTROL SYSTEM is successfully developed, the controller developed is highly affordable and it can be used by the farmers in rural areas to solve the problems they face in irrigation.

I hope that the irrigation controller I made will serve to make the work of farmers more easy and bring happiness in their life.

THANK YOU.