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Department of Electronics – Wayamba University of Sri Lanka

LOW COST ELECTRONICALLY CONTROLLED DRIP IRRIGATION SYSTEM

M. S. R. Bandara*, K.P. Vidanapathirana

Department of Electronics, Wayamba University of Sri Lanka, Kuliyapitiya, SriLanka
*srashmi.bandara@gmail.com**

ABSTRACT

Drip irrigation is one of the plant watering methods. And it is also considered as one of most efficient method of irrigating. Drip systems typically are 90% or higher efficient than the other systems and saves water and fertilizer by allowing water to drip slowly to the roots of plants, either onto the soil surface or directly onto the root zone, through a network of emitters. This paper describe about an electronically controlled drip irrigation system. There are lots of drip irrigation systems in use but the proposed system s low cost and very convenient to use. In this system, the sensing mechanism does not have any external threads. It is designed on the principle that water conducts electricity. System is designed to switch ON the valves when the soil moisture is low and switch OFF when the soil moisture is high. The switching levels can be adjusted according to the soil type and the plant type because, different plants required different water levels. This system is capable of maintaining the soil moisture level between temporary wilting point (TMP) and field capacity (FC).

Keywords:*Soil moisture, drip irrigation, temporary wilting point , field capacity*

1.0 INTRODUCTION

In real world almost all the people used automated systems to get their day to day work done efficiently and effectively. The primary objective of irrigation system is to provide plants with sufficient water to obtain optimum yields and a high quality product. The required timing and amount of water that should be applied is determined by the prevailing climatic conditions, the type of crop and its stage of growth, soil properties, and the extent of root development[1].

Automation in irrigation is required when it is inconvenient, if not impossible to correctly irrigate without automation. Most of the time skilled labor may not be available to operate manual drip systems frequently for short durations of time, which in many cases is the ideal to maximize yields and avoid wasting water and fertilizer. As a solution for those this electronically controlled drip irrigation system was designed. This automated drip irrigation system uses a soil moisture sensor. The soil moisture sensor can sense the soil moisture level using its probes, which measure changes in the soil resistance. When the probes detect that plant needs water, the LED in the circuit flashes and valve get opened automatically. After the water requirement of the plant is fulfilled, the LED OFF and valve get closed. Other automatically control drip irrigation systems are very expensive. Some commercially available automated drip irrigation systems are Labyrinth belt drip irrigation system, flat dripper irrigation pipe extrusion line drip irrigation system, etc[2]. The proposed system can be used in small gardens to big plantations within a low budget. The main function of the system is to control the soil moisture. Therefore most of the time operation of this systemdepends on the evaporation, raining and other surrounding effects.

2.0 EXPERIMENTAL

2.1 Circuit Implementation

Soil moisture sensors usedin this system, are made from electroless nickel immersion gold (ENIG) are manufactured by DFRobot company[3]. Their working temperature is in between 10°C ~ 30°C. The controlling unit was designed using PIC 16F877A microcontroller and it was programmed using mikro C language. The TWP and FC values can be calculated by according to the soil texture. Soil texture was calculated using the soil texture triangle. The output of the circuit is indicating by the LEDs and wiper water motors. ANHUI JIANGHUAI AUTOMOBILE CO.LTDwas manufactured this wiper motor. When the plant needs water, the LED will flashes and water motorget switchedON. After the water requirement of the plant is fulfilled, the LED get switched OFF and water motor is also get switched OFF.

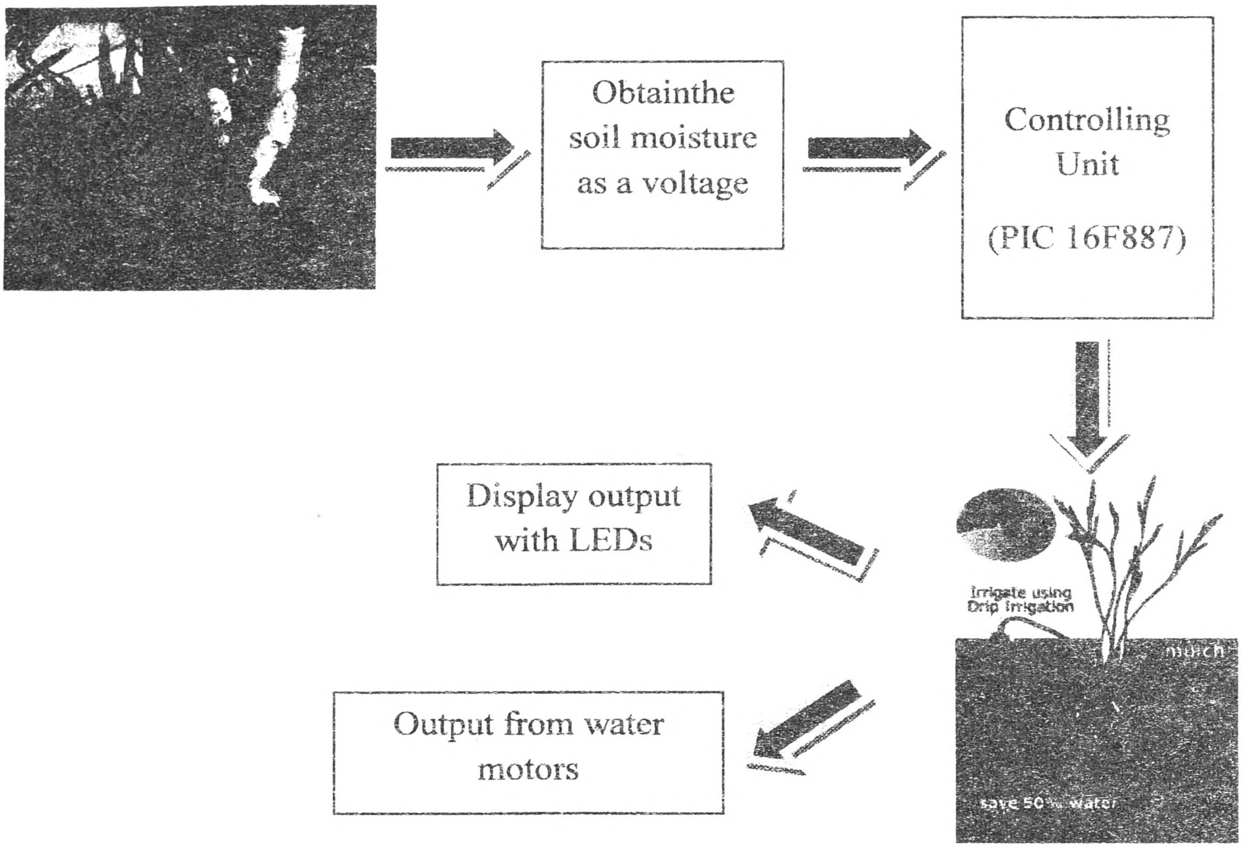


Figure 1: Block diagram of the system

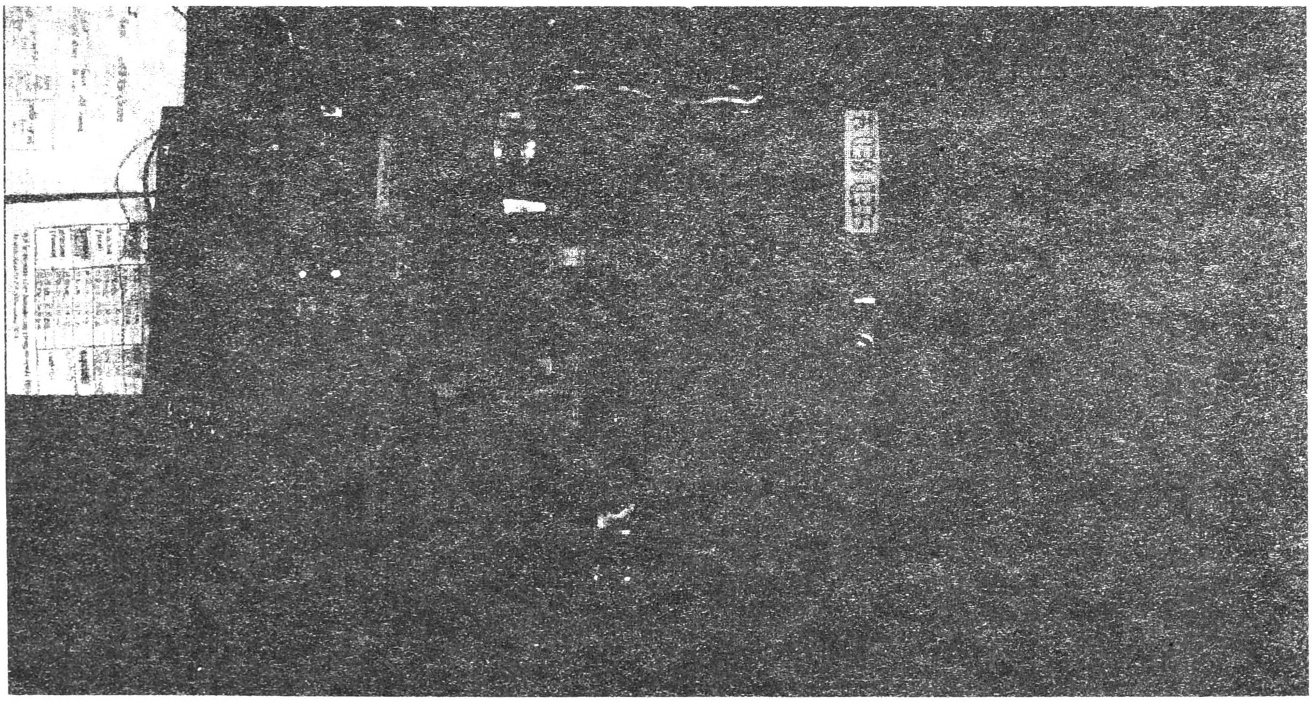
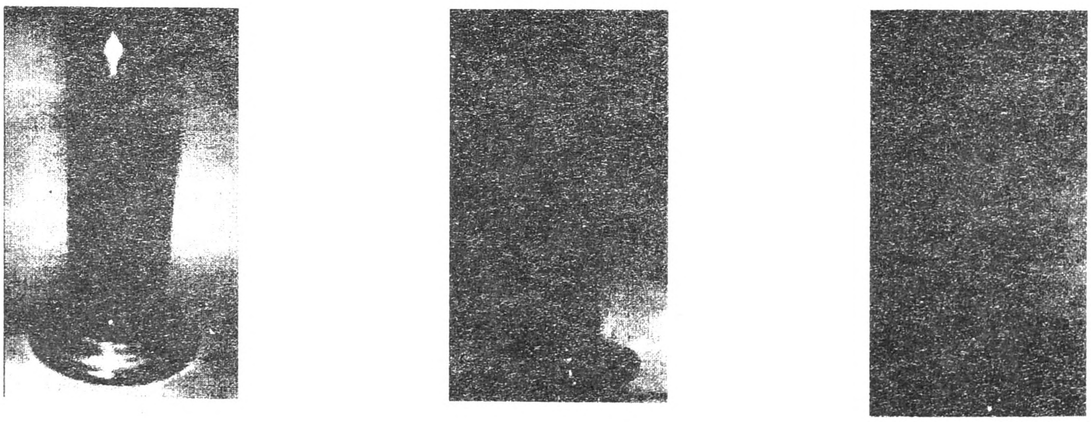


Figure 2: Schematic of the prototype of the electronically controlled drip irrigation system

2.2 Soil texture measurements

Procedure:

First the soil separation tube was filled up to the 10 ml line with soil. The tube was gently taped after each partition is added. The sample was diluted by adding water up to the 40ml line. Then 10 drops of texture dispersing reagent was added. The bottle was hold vertically when adding the drops. Cap the tube and it was being shaking for 2 minutes. The tube was allowed to stand for exactly 30 seconds. The height of the soil particles that have settled at this time was measured. That was the sand portion. That value was recorded. The tube was allowed to stand undistributed for 30 minutes. The ruler was used to measure the height of the particles that have been settled and the value was recorded. The first (30 second) reading was subtracted. That difference is the portion of soil that is silt.The tube of soil was allowed to stand for at least 24 hours. At the 24- hour point, another reading was taken. The height at the 30 minute reading was subtracted. That difference is the clay portion of the soil. If the water is still very cloudy, another reading was taken after it has completely cleared. It was compared to the 24-hour reading. If the level has been raised, the 30-minute reading was subtracted from this value and that was used for the clay reading. In some cases, had been found that the soil continues to settle, and the level actually goes down. If that happened, simply the 24-hour reading was used or a zero value was assumed for clay[4]. Finally, the percentage of each fraction was calculated and lines were drawn on the soil texture triangle according to the values. With that the soil type can be identified.



After 30 seconds | After 30 minutes | After 24 hours

Figure 3: Measurement of soil texture

Table 1: Measurements of soil texture

Height in millimeters after:	Corresponds to fraction of:	Difference in height, or portion: (ml)	Portions expressed as percentage:
30 seconds	sand	4	4/5.25 = 76%
30 minutes	silt	1	1/5.25 = 19%
24 hours	clay	0.25	0.25/5.25 = 4%

3.0 RESULTS AND DISCUSSION

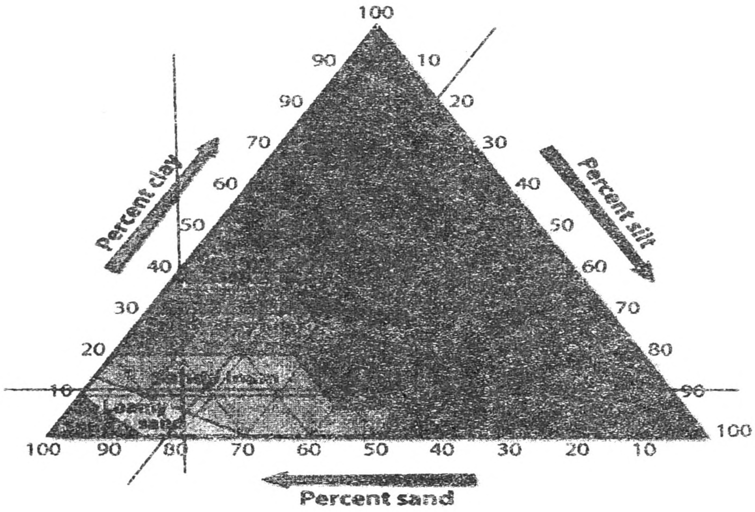


Figure 4: Soil moisture texture triangle

According to the soil texture measurements, the soil which was used for the system is identified as Loamy Sand.

Theproposed electronically controlled drip irrigation works based on the sensing of soil moisture. Soil moisture is sensed using the two probes that are plated with Immersion gold. Therefore it is resist to corrosions. And also its sensitivity is high. The sensors are placed in the field near to the plants. It should be inserted into the soil about 3-4 cm. After that, a small current is passes through probes. Sensors are contacting with the soil and generatea voltage difference between the probes according to the resistance of the soil according to the Ohm's low. When the soil is dry, the voltage difference between two probes is high andwhen the soil is wetit is low. The voltages levels according to temporary wilting point and field capacity belong to the soil textureare measured. The controlling circuit is designed with relevant to the two voltage levels that are calculated.

4.0 CONCLUSION

This paper discusses a preliminary study of an electronically controlled drip irrigation system. It showed acceptable high accuracy because switching levels of the system can be controlled according to the soil texture. Surrounding temperature can be affect to the accuracy of the system. As mentioned the system improved by adding a temperature sensor.

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