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LOW COST ELECTRICAL CONDUCTIVITY SENSOR FOR AUTOMATED HYDROPONICS SYSTEM

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ABSTACT

Hydroponics is a technology of growing plants in a soil less medium with nutrients and water. Nutrient solution is a main part of the Hydroponics system. Because good nutrient management directly affect to the growth of the plants. Electrical conductivity is an effective way to estimate the nutrient content. Normally electrical conductivity meters are more expensive. The aim of this project is to design low cost Electrical Conductivity sensor conductivity level of the solution. Key pad is used to enter the change of values of the optimum range of Electrical conductivity for an Automated Hydroponics System. This system is consists of Electrical conductivity sensor, Microcontroller, Liquid Crystal Display (LCD), keypad and Relay Drive Circuit. This system monitors the Electrical Conductivity level a throughout 24 hours in a solution tank. When the recommended range of Electrical conductivity of the solution changed, the system allows adjust automatically by adding water or nutrients in to the solution tank. If the Electrical Conductivity is higher than the optimum range, the system automatically add fresh water to reduce it. If it is lower, add nutrients. The microcontroller is used to control the whole system. LCD is used to display Electrical.

Keywords: Automated Hydroponics System, Electrical conductivity, Relay drive circuit

1. INTRODUCTION

Soil is the natural growth media for cultivation of many crops. But it has created many problems such as soil borne diseases, undesirable microbial activities, changing acidity level, salinity, poor drainage, poor nutrient level and undesirable soil characters[1]. Also in some places, soil is not available for crop growing. Especially in urban society, people have not

enough space to growing their plants. Therefore to overcome these problems, new method is needed.

Hydroponic is a good solution to reduce these problems. Hydroponic is a method of growing plants in soil less culture. Hydroponics has several advantages such as possibility of using areas unsuitable for conventional farming, independence of the crop to weather conditions such as frost, wind, and flooding, allowing cultivation throughout the year, off season production is possible, high yield, water wastage minimum. Also in hydroponic, weeds are easier to control. A well-kept soil less garden requires less work than its traditional counterpart. Therefore hydroponic system is very useful growing method for everyone. The success of Hydroponic garden depends on the strict nutrient management program. In nutrient management, the two most important factors are pH and electrical conductivity. Carefully manipulating the nutrient solution pH level, electrical conductivity will lead to a successful hydroponic garden[2].

Therefore, using pH and Electrical conductivity sensors, can calculate these values. These two sensors are available in market. But Electrical conductivity sensors are more expensive. Therefore, design low cost electrical conductivity sensor is needed.

The aim of this project is to design a low cost Electrical Conductivity sensor for automated hydroponics system.

2. EXPERIMENTAL

The system is consists of Electrical conductivity sensor, Microcontroller, LCD, keypad and Relay Drive Circuit.

Using Electrical conductivity sensor sense Electrical conductivity in a solution tank. Sensing values are displayed on LCD. Optimum Electrical conductivity level pointed in a programme. Also we can change that levels in a programme using keypad. First, sensors are sensed present value of the solution and that values displayed on LCD. Then present values and optimum value range compare using microcontroller. If the present values are not in optimum range, active relay for add water or nutrients into solution tank. When present values are in optimum range, relay is deactivated. The programme was written in mikroC PRO for PIC. A 16F877 microcontroller basically controls the functionalities of the system. Relay driver circuit consist of two relays. One relay is used to active water pump. Next one is used to active nutrient pump.

Designed Electrical conductivity sensor tested several samples. That samples are consists with same volume of purified water and several salt weights.

3. RESULTS AND DISCUSSION

This system is designed to monitor Electrical conductivity. Reading unit of the sensor is dS/m. This designed electrical conductivity sensor is low cost. But in a market, electrical conductivity meters are high priced.

Figure 1 shows the design of the system.

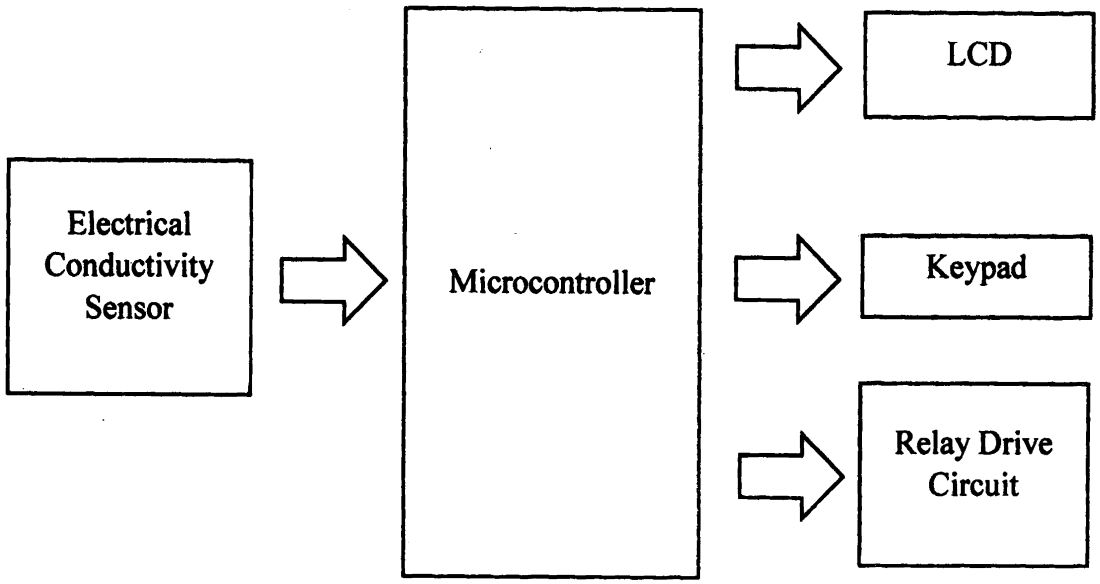

Figure 1: Design of the system

Figure 2 shows the schematic design of the Electrical conductivity sensor. It consists of three parts. There are the sine wave oscillator, the gain loop and the AC to DC converter.

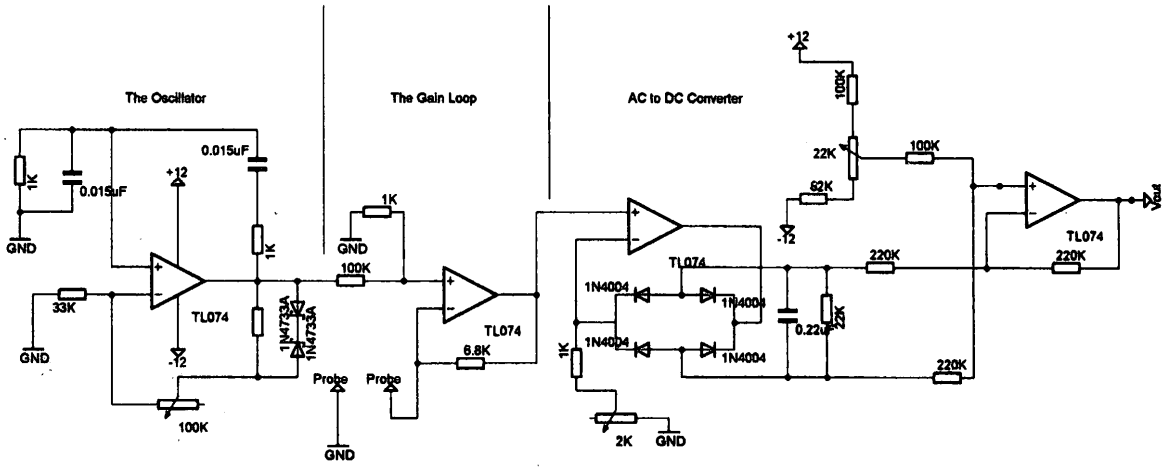

Figure 2: Schematic Design of Electrical Conductivity sensor

Two gold plated probes are used as a probe of this sensor. Gold is a good conductor and it does not tarnish or corrode easily. Graph of the tested values were shown in figure 3.

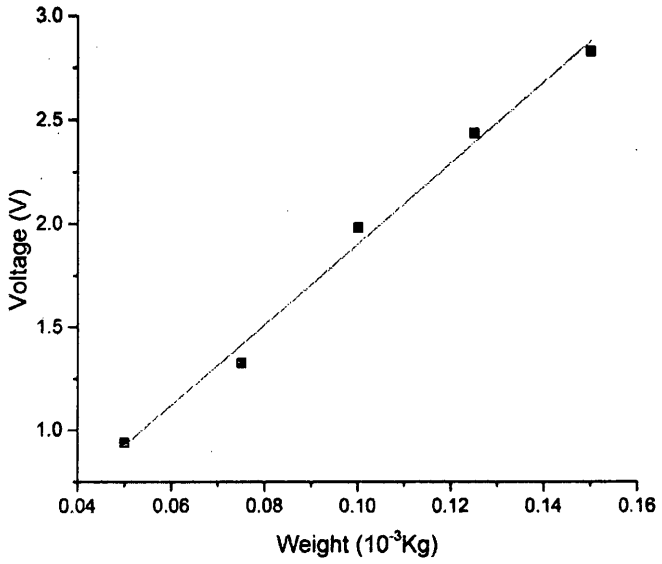

Figure 3: Graph of test values

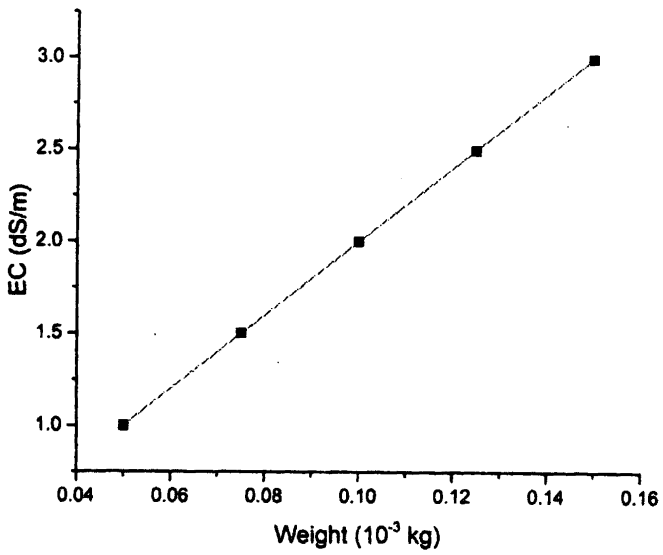

Figure 4: Exact values of the salt weight vs. Electrical conductivity

Figure 4 shows the exact Electrical conductivity values with salt weight [3]. By comparing figure 3 and 4, it was experimentally found that the output voltage of the designed sensor is linearly equal to the values of electrical conductivity (dS/m).

4. CONCLUSION

To get good harvest from hydroponics, good nutrient management system is needed. Therefore measuring electrical conductivity will help to maintain good nutrient solution. Normally electrical conductivity sensors are more expensive. Low cost electrical conductivity sensor is a good solution for hydroponics growers.

Designed sensor is low cost and it can used to measure Electrical conductivity with unit of dS/m.

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