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Automatic Drip Irrigation System using Wind energy

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Abstract: ***This paper proposes a combined automatic wind-electric system for efficient use of water in agriculture which is supported by self generated power by windmill. India seems to be significantly behind in terms of automation and sophistication in agriculture. We are not able to cultivate faster and maximize our yields through automation. We therefore thought of applying the field of electronics to our main occupation i.e. agriculture. Efficient irrigation is the process of developing a technique which supplies precise amount of water directly to the root zone of the plant, offering adequate irrigation and sufficient quantity of water. It discourages the growth of weeds and helps to prevent from fungal diseases which often grow in moist environment. Since today, world water resources are diminishing at a higher rate, therefore we have involved "Drip Irrigation System" .This saves water and delivers water using mainlines and sub-mains with emission points along their lengths. Each dripper/emitter, orifice supplies a precisely controlled uniform application of water by the plants in proper amount. Thus, this system ensures that plants never suffer from water stress, enhancing quality, its ability to achieve optimum growth and high yields. The main components of the model developed here are soil moistures sensor, microcontroller, water pumping system and windmill. The combination of automatic drip irrigation system which is operated with windmill energy is making this work unique. World energy demands are increasing continuously due to increasing of the world population, economic growth and energy usage .The combination of a wind –electric system with suitable irrigation equipment for watering crop fields could also make the supply of electricity for common applications in regions without a public electric grid.***

Keywords: Wind Mill**,** Drip Irrigation, Wind Energy, Microcontroller, Moisture Sensor**s.**

1. Introduction

Fan Sheng-Chih Shu, written in China during the first century BCE, describes the use of buried, unglazed clay pots filled with water as a means of irrigation [8]. Modern drip irrigation began its development in Germany in 1860. The usage of plastic to hold and distribute water in drip irrigation was later developed in Australia by Hannis Thill. Usage of a plastic emitter in drip irrigation was developed in Israel by Simcha Blass.

Water is the primary source of life for mankind. The rural demand for water for crop irrigation and domestic water supplies is increasing. The groundwater level is decreasing, which makes traditional hand Pumping and bucketing difficult. Diesel, gasoline, and kerosene pumps (including windmills) have traditionally been used to pump water [1].

In the irrigation systems, the most significant advantage is that when proper amount of water gets by roots of the plant that time the water supply section automatically OFF due to which a large quantity of water is saved [7]. At the present era, the farmers have been using irrigation technique in India through the manual control in which the farmers irrigate the land at the regular intervals. This process sometimes consumes more water or sometimes the water reaches late due to which the crops get dried. Water deficiency can be detrimental to plants before visible wilting occurs.

Slowed growth rate, lighter weight fruit follows slight water deficiency. This problem can be easily rectified if we use automated irrigation in which the continuous increasing demand of food requires the rapid improvement in food production technology [5]. Due to lacking availability of electricity it is necessary to choose an irrigation system which is reliable and can be operated with the energy source available. This paper describes the water and energy saving irrigation.

1.1 Drip Irrigation

With drip irrigation, the water is conveyed under pressure through a pipe system with small diameter and then slowly emitted into the soil. The emitters are placed nearby the plants so water can reach the crop roots directly, which lowers the evaporation. Because of this, a smaller amount of water is needed than when using surface or sprinkle irrigation [2]. The water is emitted at a low rate, only about 2-20 liters per hour and emitter, and the emitters can be placed on the surface or underground.

Figure 1.1: Main pipe and sub-pipes

1.2 Wind Mill

It is the main part of this system as shown in figure 1.2, which converts the wind energy into an electrical energy. Basically the windmill converts the wind energy into a mechanical energy and then mechanical energy is converted into an electrical energy [4]. After that this electricity is used in the farm to run water pump, controller, and other part of this system [6].

Figure1.2: Wind Turbine Assembly

1.3 Sensors

The Soil moisture sensor as shown in figure 1.3, plays a crucial factor here. There are several ways to measure the moisture of the soil. We are going to measure the moisture level by the conductivity property of the moist soil. We all know that the moist soil conducts electricity better than the dry one. And the impedance level of the dry soil is higher than the moist one.

Another one is water level sensor for checking whether the water is sufficient or not. This sensor automatically generates a signal and give to the microcontroller for proper water to the plants.

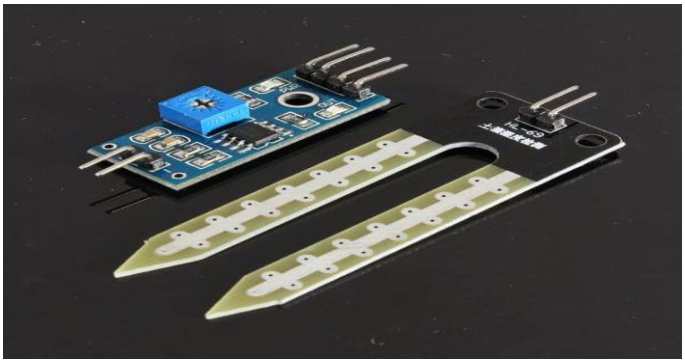

Figure 1.3: Moisture Sensors

2. Objective

The objective of this work is to obtain electricity using windmill and utilization of this energy for the irrigation purpose being run automatically with the help of moisture sensors and microcontroller.
Utilization of wind energy by setting up of a wind mill followed by the storage of the acquired power is our work part. The stored power is to be utilized for driving control unit thus running automatic pump controlled irrigation system [3].

The objectives of this project is,

- To design, implement and provide a simple and economic solution for water lifting and irrigation.
- The Electromechanical system should be developed for rural area as it suffers from power supply failure by using non-conventional energy sources.
- This system should operate on 12 volt DC, which is less hazardous than present high voltage system.
- The system should monitor water content in soil and should regulate water release.
- The system should generate sufficient power for operation of additional components.
- The system should be easily configurable by minor changes in hardware and software.
- To make the system more user friendly and greater reliability.

3. Methodology and block Diagram

Wind energy has been selected the prime source for the generation of electricity, which is shown in figure 1.2. Now in order to fetch this energy source a wind mill cum vertical turbine has been setup which would rotate due to the kinetic energy of the wind i.e. intensity of wind blow. This turbine will be rotating and shall be connected to the power generator via a gear box. Such an arrangement would resemble to the functioning of a dynamo which will convert the mechanical energy of the turbine fan to the electrical energy. As the wind energy source is discontinuous so to make the power supply independent of the continuous wind we have preferred using a battery so as to store the power being generated instantly. This stored power can be further used any time even if there could be the absence of wind. Since the project is based on dc power we have used a Li-ion battery.
However on the commercial scale we would be having the generation of ac power so the battery used here would be replaced by an inverter. Now further controlling includes automatic switching system controlled by microcontroller control unit. The incoming power supply shall be made dc using regulated power supply. Next the input ports of the controller have been connected to the soil moisture sensors TNST-45 which would sense the moisture level of the field soil. Right after sensing it will send an electrical signal to the microcontroller and the controller would start the pump connected at its output port accordingly with respect to the sensor. Water flows out of the pump through drip pipe line system, which is as shown in figure 1.4.
In this way the required field can be irrigated and leaving non-required area unwatered automatically without man supervision.

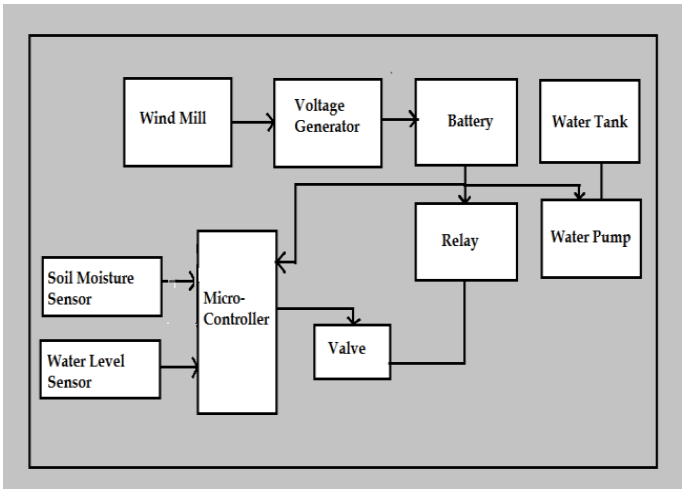

Figure 1.4: Block Diagram

Implementation

The below mentioned code is used to drive the motors. This code is implemented using AVR studio 4 software.

```
1.  #include<avr/io.h>
2.  int adc(void);
3.  void pump(void);
4.  int adc_value;
5.  int main(void)
6.   {
7.    DDRC=0x01;                    //Defining PC0 as
    output
8.    ADCSRA=0x87;                  //Setting the mode of
    operation
9.    ADMUX=0x00;                   //Selection of channel
    and bit alignment
10.   while(1)
11.    {
12.     adc_value=adc();            //reading moisture level
13.     pump();                     //Pump activator
    routine
14.    }
15.    return 0;
16.  }
17.
18. int adc(void)
19.  {
20.   int lower_bits,higher_bits,result;
21.   ADCSRA|=(1<<6);              //Turning on conversion
22.   while(ADIF==0);
23.   lower_bits=ADCL;
24.   higher_bits=ADCH;
25.   result=lower_bits|higher_bits<<8;        //Accessing
    converted value by shifting
26.   return result;
27.  }
28.
29. void pump(void)
30.  {
31.   if(adc_value>=700)                      //Pump ON
    trigger point
32.    {
33.     PORTC|=(1<<0);
34.    }
35.   else if(adc_value<=600)                 //Pump Off
    trigger point
36.    {
37.     PORTC&=~(1<<0);
38.    }
39.  }
```

4. Result and Discussion

The idea behind this project is to develop an inexpensive and user friendly system which will provide an additional sense to the Agriculture field so that the expenses toward the Electricity, Manpower, and water requirement can be minimized and more efficient water delivery can be made possible.

The controlling of the automatic watering system is used in a farm. On the basis of the analysis carried out in the present work, the following conclusions are drawn:

- Wind energy is used for providing the proper voltage to the microcontroller and water lifting for efficient working.
- Cost of this project is less as compare to other system because sensors for water level and soil conductivity are used.
- In this work problem of over irrigation which is because of poor distribution or mismanagement wastes water, and may lead to water pollution is solved.

- Deep drainage (from over-irrigation) may result in rising water labels which in some instances will lead to problems of irrigation salinity and the said problem is addressed in this work.

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