Design & Development of Automatic Soil Salinity Control System

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Abstract - The main objective of this project is to control soil salinity and improve soil fertility. The word salinity defines amount of salt present in water or soil which tends to decrease soil fertility through natural or human induced processes that results in the accumulation of dissolved salt in the soil water to an extent that inhibits plant growth and salinity is a severe environmental hazards that degrades the growth of many crops Spatial characterization of soil salinity is required for establishing salt control measurements in irrigated agriculture. For that, cost-effective, specific, rapid, and reliable methodologies for determining soil salinity in-situ and processing those data are required.

Keywords: Microcontroller AT89S52, Soil Salinity, Salinity Sensor, salinity control

I. INTRODUCTION

Salinity means amount of salt in water and soil . soil salinity means unwanted amount of salt present in soil .As population is increasing so demands of food increasing ,soil salinity degrads quality of food availability in market. The accumulated salts include sodium , potassium, magnesium, calcium, chloride, sulphate, carbonate and bicarbonate. primary salinization involves salt accumulation through natural process due to high salt containment in ground water , whereas in secondary salinization is due to human interventions such as inappropriate irrigation procedure e.g with salt rich irrigation water. In agriculture and land management application proper irrigation procedures are essential to prevent salinization.Poor drainage of irrigated soils or poorly aerated soil (such as those with high amount of clay) will causes pudding which leads to salt accumulation at the surface of the soil as shown in figure 1.

Figure 1:Salt Accumulation due to Salinity

1.1 WHAT IS SOIL SALINITY SENSOR?

Soil salinity sensors are ideal for efficient in situ field monitoring of soil salinity with minimal Disturbance to the soil profile. Salinity at selected depths can be monitored over a long period with Sufficient accuracy for intermediate-term monitoring. The sensors are also suitable for use with soil columns in the laboratory. The soil salinity sensor consists of a pair of electrodes embedded in a fine-textured ceramic element. Moisture saturating the ceramic element comes to equilibrium with the soil water to give constant salinity measurements. The sensor is spring loaded with a stainless-steel spring to ensure good hydraulic contact between the sensor and the soil.After the sensor is placed in position a stainless-steel release pin is removed to activate the spring. The sensors are designed to fit crosswise into a 3.2 cm diameter cored hole.Detect dynamic changes in soil salinityUsed in conjunction with an ICT Smart Logger, the soil salinity sensor can measure salinity values over time without continuous disruption to the soil. Dynamic changes in soil salinity can be detected and recorded. ICT5000M Salinity Meter and SEC 5000 Salinity Sensor as shown in figure 2.

Figure 2: Salinity Sensor

1.2 WHY IT IS REQUIRED?

One can control soil moisture and soil salinity anywhere. It helps in detection and increases of soil fertility by sensing while working in agricultural fields outside. to. It is very much reliable and possesses, high order of security and reliability hence used for specialized purpose only.Effect of salinity on crop production

Plant growth and yield are limited mainly by the soil environment factors. Soil, water, nutrients, salinity, sodicity, structure, temperature, pH, and mineral toxicities can all interact to limit plant growth. In Saline soils although pH (<8.5) and ESP (<15%) are not high, CEC is >4 mmhos/cm and an excess of soluble salt in the subsoil restricts water uptake by crops; in the case of alkalinity there are Nutrient deficiencies (either because of a lack of nutrients, or because roots are unable to access them). The best way of understanding these limitations is to consider them in terms of the interacting factors that directly influence crop growth as shown in figure 3:

Figure 3: Showing All Salty Fields with Less Productivity

1.3 BASIC HARDWARE AND SOFTWARE REQUIREMENTS

Power supply, LED, Transformer , Relay , PCB , Microcontroller ,Pump , at89c51 micro controller, 7805 three terminal voltage regulator, 230/12V step down transformer ,relay driver circuit, 3 loads +pump motor,one 100 micro farad and one 1000 micro farad electrolytic capacitor ,two 22 pico farad ceramic capacitors, six p-n junction diode, quick switch , one 3.57 megha hertz crystal oscillator , orcad for pcb designing, tiny boot loader program burn.

II. NEED OF SOIL SALINTY CONTROLLING

Now a days there is a Rapid development of soil , to get better productivity. Soil salinity sensors are incorporated in fields to help farmers to get better output with less input by employing various designed sensors formulating high degree of stability and reliability.

2.1 SALINITY CONTROL BY LEACHING

When the build-up of soluble salts in the soil becomes or is expected to become excessive, the salts can be leached by applying more water than that needed by the crop during the growing season. This extra water moves at least a portion of the salts below the root zone by deep percolation (leaching). Leaching is the key factor in controlling soluble salts brought in by the irrigation water. Over time, salt removal by leaching must equal or exceed the salt additions from the applied water or salts will build up and eventually reach damaging concentrations.

All plants do not respond to salinity in a similar manner; some crops can produce acceptable yields at much greater soil salinity than others. This is because some are better able to make the needed osmotic adjustments enabling them to extract more water from a saline soil. The ability of the crop to adjust to salinity is extremely useful. In areas where a build-up of soil salinity cannot be controlled at an acceptable concentration for the crop being grown, an alternative crop can be selected that is both more tolerant of the expected soil salinity and can produce economical yields.

There is an 8 to 10-fold range in salt tolerance of agricultural crops. This wide range in tolerance allows for a much greater use of moderately saline water much of which was previously thought to be unusable. It also greatly expands the acceptable range of water salinity (ECw) considered suitable for irrigation.

2.2 REMOVING SALT FROM SOIL THROUGH MAGNETIZED WATER FLUSHING

Salt in soil can only be removed by flushing with water. Magnetized Water applied to salty soil breaks down the salt crystals twice as fast as un-magnatized water allowing the salt to be leached from the soil. The process is lengthy and there is a cost but the cost of not beating this problem is infinitely greater,

Saline or sodic soil is caused by four separate conditions:

1. High salt in the parent material and low rainfall (low leaching),
2. High rainfall with poor internal drainage,
3. High water table that carries salt to the soil surface, and
4. High amount of salt being applied through chemicals, manure and poor quality irrigation water

Figure 4 shows the different salinity control methods:

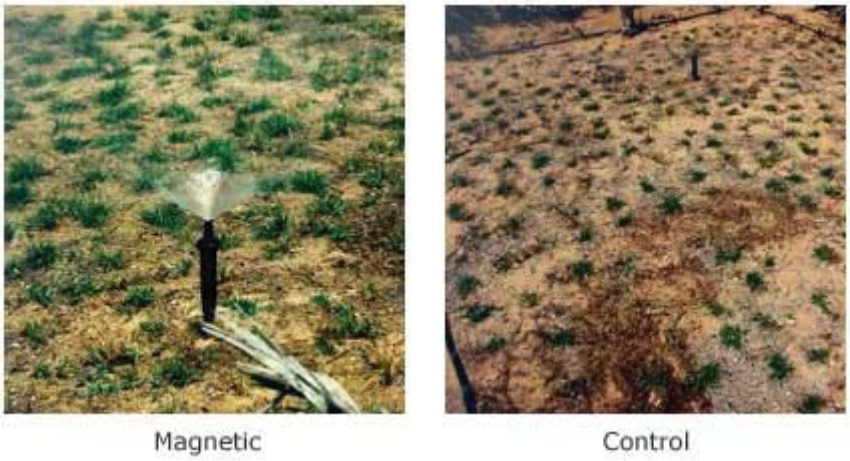

Figure 4: Salinity control methods

III. CIRCUIT DIAGRAM AND LAYOUT

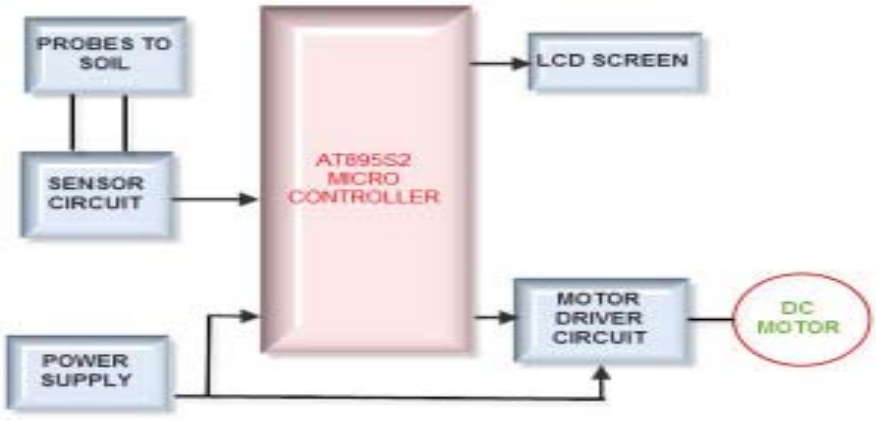

Figure 5: Block Diagram of Proposed Technique

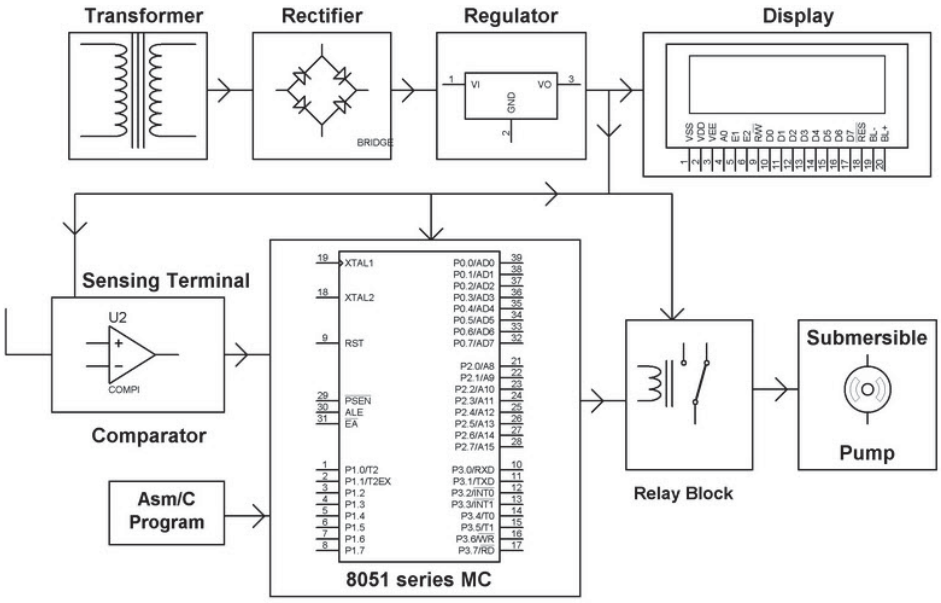

Figure 6: Circuit Diagram of Proposed Technique

Figure 5 & Figure 6 showing Circuitry and layout of soil salinity controlled system and figure 7 shows the actual circuit diagram

Figure 7: Actual Circuit Set up

IV. ADVANTAGES OF SOIL SALINITY SENSORS

User friendly: It is easy to operate. Even a villager who is less educated or a farmer can operate this device. Its operation is not much complicate.

Time Effective: It is time saving device Also a famer at night can save his time by operating sensors from agriculture land. The network is available for 24 hours. Due to this even at midnight we can control devices.

V. RESULT AND CONCLUSION

The device controls soil salinity in an unique way so as to reduce soil infertility by the soil sensors i.e. this system will be very much useful in rural areas which will result in the increase productivity and hence the development of the country.

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