IRRIGATION SYSTEM ON SENSING USING ARDUINO

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ABSTRACT

This project on "Automatic Irrigation System on Sensing Soil Moisture Content" is intended to create an automated irrigation mechanism which turns the pumping motor ON and OFF on detecting the moisture content of the earth. In the domain of farming, utilization of appropriate means of irrigation is significant. The benefit of employing these techniques is to decrease human interference and still make certain appropriate irrigation. This automated irrigation project brings into play an Arduino board ATmega328 micro-controller ,is programmed to collect the input signal of changeable moisture circumstances of the earth via moisture detecting system.

Key Words: *Arduino, Irrigation, Soil Moisture Sensor, Automated Irrigation Mechanism*.

1.INTRODUCTION

Continuous increasing demand of food requires the control in highly specialized greenhouse vegetable rapid improvement in food production technology. In a production and it is a simple, precise method for country like India, where the economy is mainly based on irrigation. It also helps in time saving, removal of human agriculture and the climatic conditions are isotropic, still error in adjusting available soil moisture levels and to we are not able to make full use of agricultural resources. Maximize their net profits. The main reason is the lack of rains & scarcity of land Irrigation is the artificial application of water to the soil reservoir water. The continuous extraction of water from usually for assisting in growing crops. In crop production earth is reducing the water level due to which lot of land is it is mainly used in dry areas and in periods of rainfall coming slowly in the zones of un-irrigated land. Another shortfalls, but also to protect plants against frost. Very important reason of this is due to unplanned use of Types of Irrigation water due to which a significant amount of water goes to surface irrigation waste. Localized irrigation in modern drip irrigation systems, the most significant Drip Irrigation advantage is that water is supplied near the root zone of sprinkler irrigation. The plants drip by drip due to which a large quantity of water is saved. At the present era, the farmers have been the conventional irrigation methods like overhead using irrigation techniques in India through manual control sprinklers, flood type feeding systems usually wet the in which farmers irrigate the land at the regular intervals. Lower leaves and stem of the plants. The entire soil this process sometimes consumes more water or surface is saturated and often stays wet long after irrigation sometimes the water reaches late due to which crops is completed. Such condition promotes infections by leaf get dried. Water deficiency can be detrimental to plants mold fungi. On the contrary the drip or trickle irrigation is before visible wilting occurs. Slowed growth rate, lighter a type of modern irrigation technique that slowly applies weight fruit follows slight water deficiency. This problem small amounts of water to part of plant root zone. Water is can be perfectly rectified if we use automatic micro supplied frequently, often daily to maintain favorable soil controller based drip irrigation system in which the moisture condition and prevent moisture stress in the plant irrigation will take place only when there will be acute with proper use of water resources. Drip irrigation saves requirement of water because only the plant.

2. IRRIGATION

Little water is lost to deep percolation if the proper amount is applied. Drip irrigation is popular because it can Irrigation system uses valves to turn irrigation ON and increase yields and decrease both water requirements and OFF. These valves may be easily automated by using labor. Controllers and solenoids. Automating farm or nursery Drip irrigation requires about half of the water needed by irrigation allows farmers to apply the right amount of sprinkler or surface irrigation. Lower operating pressures water at the right time, regardless of the availability of and flow rates result in reduced energy costs.

2.1MATERIALS AND METHODS

A conceptual system layout of distributed in-field WSN is illustrated in Fig. 1. The system consists of five in-field sensing stations distributed across the field, an irrigation control station, and a base station. The in-field sensing stations monitor the field conditions of soil moisture, soil temperature, and air tempera- ture, whereas a nearby weather station monitors micrometeo-rological information on the field, i.e., air temperature, relative humidity, precipitation, wind speed, wind direction, and solar radiation. All in-field sensory data are wirelessly transmitted to the base station. The base station processes the in-field sensory data through a user-friendly decision making program and sends control commands to the irrigation control station. The irrigation control station updates and sends georeferenced locations of the machine from a differential GPS mounted at the cart to the base station for real-time monitoring and control of the irrigation system. Based on sprinkler head GPS locations, the base station feeds control signals back to the irrigation control station to site-specifically operate individual sprinkler to apply a specified depth of water.

2.2. Site-Specific Field Configuration

The spatial variability of agricultural fields has been widely addressed in precision agriculture [10], [11]; however, optimiz-ing field configurations for site-specific management in each field remains a difficult task. The spatial variation of the study site was examined in this paper so that a minimum number of in-field sensor systems could be placed with optimal impact for characterizing the scope of the field information. In this case, the optimal distribution of the in-field sensing stations was determined on the basis of the spatial soil variability [12].

2.3. In-Field Sensing Stations

The system components of the in-field sensing stations and weather station contained three main parts: data logging, wireless data communication, and power management. A data logger measured field sensors and was self-powered by a solar panel (SX5, Solarex, Sacramento, CA) that recharged a sealed lead acid 12-V battery (NP7-12, Yuasa Battery Inc., Laureldale, PA) through a voltage regulator (SunSaver-6, Morningstar Corporation, Washington Crossing, PA). The sensory data were transmitted via a Bluetooth radio transmitter that is later de-scribed in detail.

2.3.1Data Logging: Field data were logged by a data logger (CR10, Campbell Scientific Inc., Logan, UT) for five in-field sensing stations and one weather station. A peripheral inter-face was implemented with a nine-pin D-type connector that was converted to a serial communication through an optically isolated RS-232 interface adapter (SC32B, Campbell Scientific Inc.). All six data loggers used in this paper were programmed to read data at the same time and configured at 10 s for scanning and 15 min for the data storage and download.

Two water content reflectometers (CS616, Campbell Scientific Inc.) were horizontally installed at 30- and 60-cm soil depth to measure the volumetric water content of soil. Soil tem-perature is a useful information to determine how temperature affects the soil water-holding capacity. A temperature probe (107, Campbell Scientific Inc.) measured soil temperature at the 30-cm depth and was also used for air-temperature measure-ment at the 60-cm height with a solar radiation shield. A humid-ity probe (HMP35C, Vaisala, Helsinki, Finland) was mounted with a solar radiation shield to measure relative humidity. A pyranometer (LI200X, Licor, Lincoln, NE) was horizontally leveled and provided measures of solar radiation as total flux and flux density.

3.Irrigation Control Station

3.1 Plot Design: The wireless variable rate irrigation control and monitoring was implemented on 3.6-ha experimental plots that were laid out in 14 strips in the direction of travel. Each strip was planted with either sugar beet or malting barley, which alternated from year to year. There are a total of 56 plots with the individual plot being 15 m wide and 24 m long, including buffers. Each strip was divided into four plots with two plots being irrigated with midelevation spray application (MESA) and two with low energy precision application (LEPA) that are blocked by replication [9]

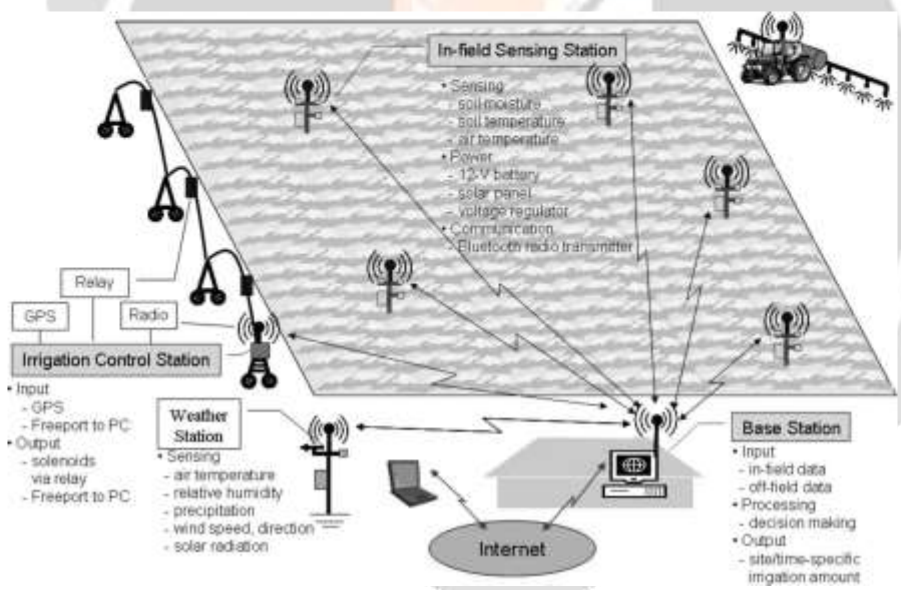
3.2. Linear-Move Irrigation System*:* A 295-m-long self-propelled linear-move irrigation system (Valley, Valmont Irriga-tion, Valley, NE) was used for in-field sensor-based variable rate irrigation. It had six towers including the "cart" on one end, on which an industrial diesel engine was mounted and coupled to a water supply pump and an electrical generator (480 V, three-phase) to provide power for the tower motors and cart motors. A buried wire alignment system was used with the antennas located in the middle of the machine. The water supply for the linear-move machine was a screened floating pump intake in a level ditch. Nominal operating pressure was about 250 kPa. Two double direction boom backs were installed at each of the towers. Spans were 49 m in length except for the center span with the guidance system that was a 47-m span. The machine moved at about 2 m/min at the 100% (fastest) setting. A control panel (Valley CAMS Pro, Valmont Irrigation) was used to turn the machine on or off, and to control machine ground speed.

This self-propelled linear-move irrigation system has the capability to apply water using two different irrigation tech-niques [9]. MESA heads were spaced every 3 m with a spinner sprinkler (S3000, Nelson Irrigation Corporation, Walla Walla, WA) with 103-kPa regulators (#31 nozzles). These heads were about 1 m above the ground on flexible drops with 0.5-kg weights below each regulator. A different head (Quad-Spray, Senninger Irrigation, Inc., Clermont, FL) was used for a LEPA system with 69-kPa regulators (#10 nozzles) and sliding 1-kg weights above each regulator. The drops were spaced every 1.2 m along submanifolds suspended from the truss rods and positioned at about 15 cm above the furrow surface. Water was applied on an alternate-row basis so that each pair of plant rows has a single LEPA nozzle between them. The LEPA heads were lifted above the crop when the MESA heads were operating so as to reduce water distribution interference.

3.3 Positioning System: The georeferenced location of the sprinklers was obtained for real-time nozzle control and irriga-tion monitoring. A wide area augmentation system (WAAS)-enabled differential GPS (17HVS, Garmin, Olathe, KS) was used to determine and track machine position as it moved across the plots. It was a compact GPS sensor that included an embedded 12-channel receiver and antenna and utilized WAAS corrections that yielded 3–5-m position accuracy [20]. How-ever, the relatively slow travel speed of the machine allowed frequent averaging of GPS readings that increased accuracy to within 1 m. The GPS was mounted on top of the main cart and continuously updated georeferential information for the sprinklers as the irrigation cart moved across the field. The GPS readings were used to switch water application between the LEPA and MESA heads and to differentially apply water to the different crops or plots depending on treatments.

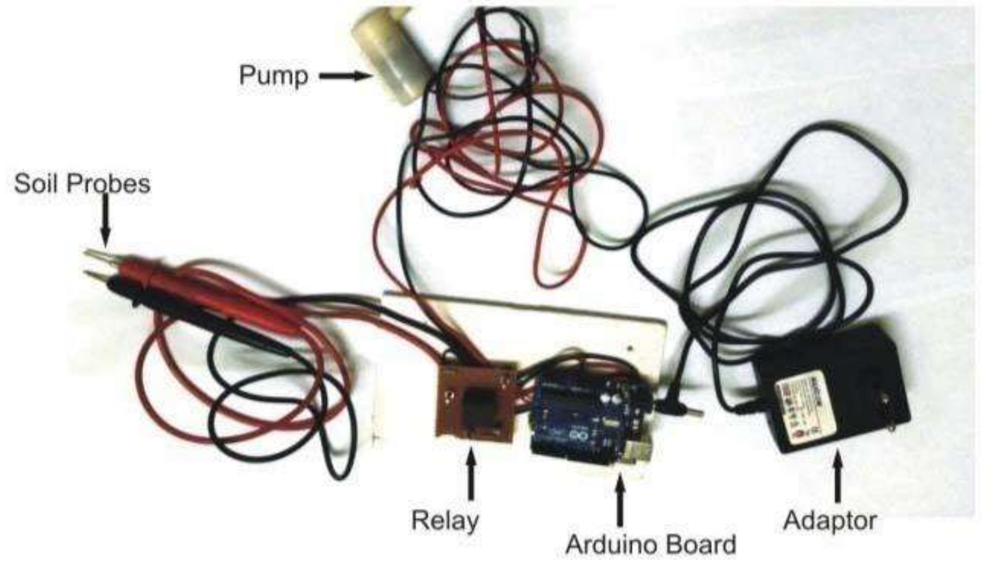
3.4 Variable Rate Sprinkler Control*:*

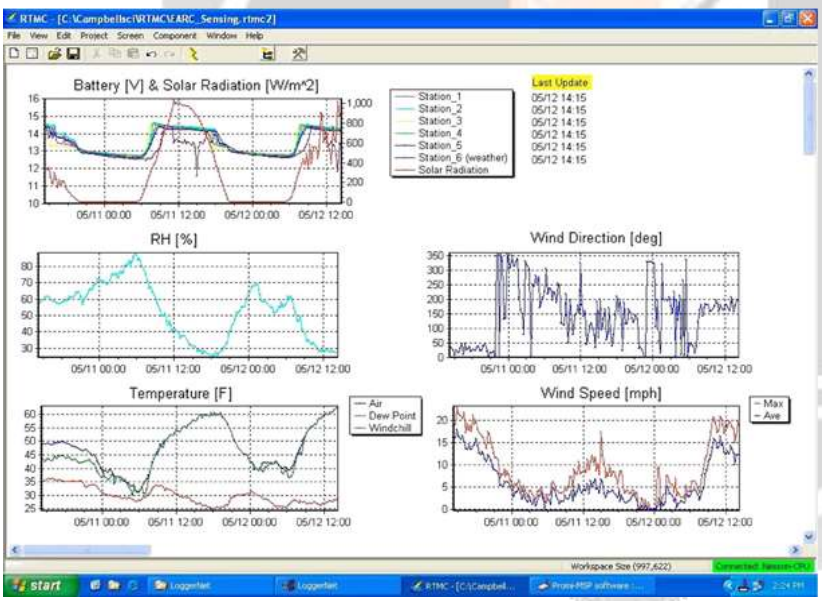
The linear irrigation system used in this paper utilized a basic control and valve system composed of off-the-shelf components. A program-mable logic controller (PLC) (S7-226 with three relay expan-sion modules, Siemens, Johnson City, TN) activated electric over air solenoids (U8325B1V, ASCO, Florham Park, NJ) to control 30 banks of sprinklers. There were 15 banks of side-by-side MESA and LEPA treatments that cover the same areas. The electric solenoid, in turn, activated a pneumatic system to close normally open 1.9-cm plastic globe valves (Model 205, Bermad Inc., Anaheim, CA). In the case of the MESA heads, the valves were located on the gooseneck above each drop to each head in groups of five (15-m width). The air-activated valves were located on three goosenecks that supplied water to submanifolds for the LEPA heads in each 15-m section. The controlling electric solenoid valves were grouped into two clusters of six valves (three MESA and three LEPA) and placed



4. HARDWARE CONSTRUCTION

We did our project with less components since it is a demonstration figure (2). As the area of irrigation increases we can use more number of moisture sensors and temperature sensors so that it will work according to the climatic conditions.


Pump
Soil Probes
Relay
Arduino Board
Adaptor


Battery [V] & Solar Radiation [W/m^2]
Station_1
Station_2
Station_3
Station_4
Station_5
Station_6 (weather)
Solar Radiation
Last Update
RH [%]
Wind Direction [deg]
Temperature [F]
Air
Dew Point
Windchill
Wind Speed [mph]
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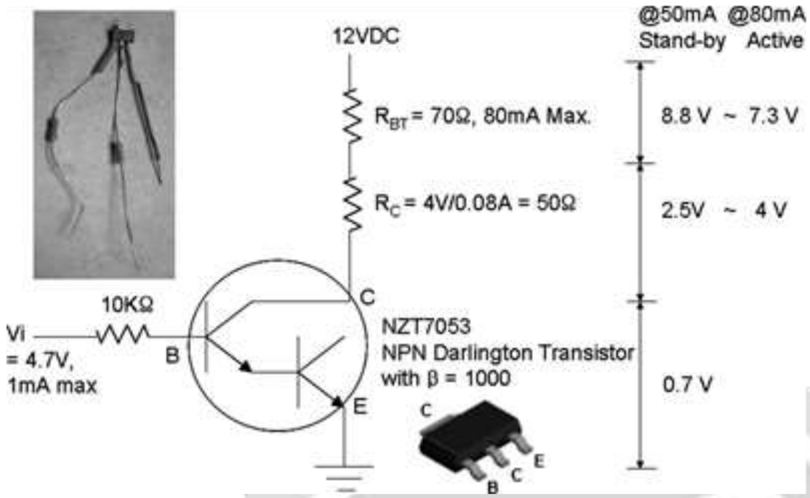
Ave



5. RESULT

Irrigation becomes easy, accurate and practical with the same soil sample impossible. Because of the idea above shared and can be implemented in agricultural difficulties of accurately measuring dry soil and water fields in future to promote agriculture to next level. The Volumes, volumetric water contents are not usually output from moisture sensor and level system plays major determined directly. Role in producing the output.

6.CONCLUSION

An automated closed-loop irrigation system requires three major components: machine conversion, navigation, and mis-sion planning to support the solid communication proto-col. This paper developed the machine conversion from a conventional irrigation system to an electronically control-lable system for individual control of irrigation sprinklers and formulated the navigation of the irrigation system that was continuously monitored by a differential GPS and wirelessly transferred data to a base station for site-specific irrigation control. This paper also provided extensive details for the wire-less communication interface of sensors from in-field sensor stations and for a programmable logic controller from a control station to the computer at a base station. Bluetooth wireless technology used in this paper offered a plug-and-play com-munication module and saved significant time and expense by using commercially available sensors and controllers equipped with serial communication ports. Stable wireless signal connec-tivity was achieved by power management circuit design and antennas at 1-m above the plant canopies. The development of WISC software provided real-time remote monitoring and con-trol of variable rate irrigation, and continued decision making of mission planning for the automated closed-loop irrigation system. This paper proved a concept of a promising low-cost wireless solution for an in-field WSN and remote control of precision irrigation. Potential applications of Bluetooth wire-less technology in agricultural systems can be extended to real-time field monitoring, automated irrigation control, and remote operation of field machinery.

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