International Journal of Modern Agriculture, Volume 10, No.2, 2021
ISSN: 2305-7246

An Intelligent Design of Wireless Powering in Agricultural Sensor Networks

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Abstract - In the field of decision agriculture, energy efficiency is essential for the long operation of wireless communication nodes. Energy harvesting and wireless power transfer strategies are discussed in this project, and including these applications in Wireless Sensor Networks (WSN).WSN has gained a lot of popularity and application as a base support for the Internet of Things (IoT). In intelligent agriculture, for example, we would use a sensor network to collect data on crop growth and other factors. The difficulty in supplying power to wireless nodes, on the other hand, has severely hampered IoT application and growth. sOn the nodes, people use low-power sleep scheduling and other energy-saving methods to solve this problem. Despite the fact that these techniques can extend the working time of nodes, they will ultimately become ineffective due to energy exhaustion. This project proposes a three-layer Wireless Energy Powering (WEP) framework for data collection in rechargeable WSN to keep the node running forever, called WEP, which includes the input sensor layer, renewable energy PV panel layer, and mobile station layer. A distant base station (BS) is also included in the WEP rechargeable layer to monitor the status of the project through IoT. In addition, the framework will reduce the system's total energy consumption. Such energy harvesting techniques led to the development of an efficient wireless network communication system to energy Sensor networks in decision agriculture for extended field operation.

Keywords-Wireless Power Transfer, IoT, WEP

I. Introduction

In deep underground sensor network structures, rechargeable batteries are more effective than replacing batteries of the sensors. To achieve this, wirelessly charging of sensors using electromagnetic (EM) waves is studied. Wireless Underground Sensor Networks (WUSN) have uncovered cluster heads that transmit scientific information in real using communication systems [1].

It's thought to be a popular development for tracking a variety of underground activities, such as sports, farming, the weather, immigration enforcement, and safety. WUSN adoption, on the other hand, faces numerous operational problems [2]. WUSN achieves wireless communication by propagating electromagnetic (EM) waves into soil. When electromagnetic waves travel into soil, those are attenuated more than when they travel into air [3]. Many scientists are working to experimentally explore WUSNs and develop the underground wireless communication channel as a result of these challenges [1]. The sensor nodes are prone to failure, which is a common issue when implementing WSNs. Unscheduled installation of nodes in such situations may result in network segmentation, affecting the network's actual quality. Sensor nodes, on the other hand, can ‘self-organize' by rapidly modifying the network architecture as a protective measure. In general, WSN protocols are intended to work for any network, regardless of its size or number of nodes [4].These function certainly increases the utility of WSNs in a variety of applications. The primary aim of this research is to develop an integrated platform for simultaneous wireless information and power transfer (SWIPT) using MI-based power transfer that can support one data file and numerous different power sources [6].To minimize the transit time in a period, we introduce a layered proposed system containing the perception layer, network lifetime layer, and base station layer in this project. In a sub era, the WSN travels all network lifetime at the network lifetime layer and chooses the cluster in which the WSN travels all sensor nodes at the perception layer [5].

II. System

We represent a set of N cluster heads that are spread out over a two-dimensional space. Each cluster head has a charger with an Emax capacity, and the charger initial energy is a numerical number. Emin refers to the minimum amount of energy required for a charger to function [7]. Detecting data is generated at a rate of N by each cluster head. A mobile CBW is used in the network system to charge access points and collect network data [11].

To transport power over a long period of time, farming networks are used as PV panels and batteries. The spreading Mutual Induction is then transformed to Electrical energy to recharge the battery of sensor nodes using high-efficiency regulator systems [5].

III. Related Work

A. SOIL EFFECTS ON THE UNDERGROUNDTO-ABOVEGROUND COMMUNICATION LINK IN ULTRAWIDEBAND WIRELESS UNDERGROUND SENSOR NETWORKS

WUSN (Wireless Underground Sensor Networks) is a recent field of study. From those studies they're used for a range of uses, from smart irrigation to protection and navigation assistance. WUSN predominantly hires narrowband devices running at frequencies below 1 GHz, which have limited localization capabilities and require large antennas. These limitations can be solved by using the Impulse Radio Ultra-Wideband (IR-UWB) technique. The effect of sand on the UWB basement to top ground contact loop is explored in an experiment in this letter. In results of the uncovered antenna's position, grave details, and moisture content are analyzed in greater detail.

B. EFFICIENT CHARGING OF ACCESS LIMITED WIRELESS UNDERGROUND SENSOR NETWORKS

WUSNs (wireless underground sensor networks) pose a new collection of research challenges. Over the years, magnetic induction (MI)- related communication has already been suggested as a way to solve the exceedingly difficult propagation conditions in underground communications[4]. In this procedure, induction wires can be used as receivers in the cluster heads. As opposed to the conventional electromagnetic (EM) waves-based method, this solution achieves longer propagation ranges. Any attempts have been made in the past to describe the signal propagation in MI-WUSNs. Such inquiries, on the other hand, are mainly focused on knowledge sharing. The powering of individual sensor nodes is one of the open problems that may restrict the device architecture in certain applications. This paper suggests a new wireless power transfer (WPT) system for MI-WUSNs due to the poor connectivity of the nodes. This system is based on multiple sensor nodes transmitting signals at the same time with tailored signal locations. In addition, a optimum schedule for transmitting and receiving power is given, optimizing a network charging procedure's energy efficiency. As opposed to naive methods, the suggested method indicates a substantial increase in device output in terms of energy efficiency.

IV. Proposed System

To minimize the travelling period in a cycle, we implement a layered device architecture including the perception layer, network lifetime layer, and base station layer in this project. For a sub cycle, the WSN travels all network lifetime at the network lifetime layer and chooses the cluster in which the WSN travels all sensor nodes at the perception layer [8].

Using the Wireless Power Transfer module, a new method for wirelessly powering farming sensors deeply buried basement is developed and applied in an experiment [8]. To transmit energy over a long period of time, agricultural nodes are used as PV panels and batteries. The propagating Collective Induction is then transferred to electrical energy to recharge the batteries of sensor nodes using high-efficiency controller circuits [9]. The Level sensor is used in the automated water level detection and refilling of water storage systems. It is a substitute for ultrasonic sensors because of its precision and limited scale. The water level is detected by the sensor, which is mounted within the tank and constantly tracks the water level in real time [10].

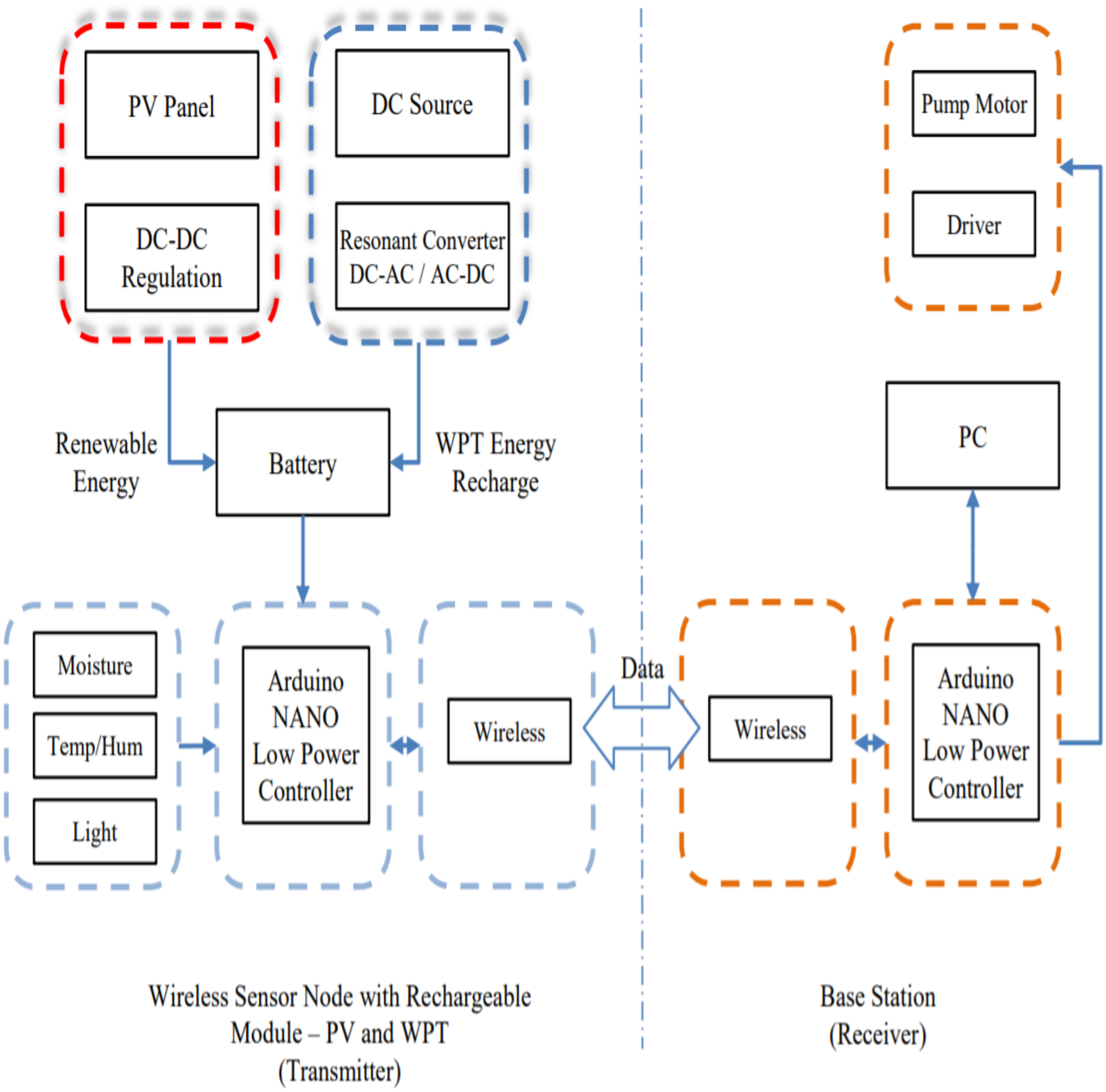

Fig 1: Proposed System

This project suggests tiered device architecture for rechargeable mobile data collection wireless sensor network in order to make the nodes operate indefinitely [13]. Perception layer, network lifetime layer, and base station layer are three layers that make up the structure. The use of this system will minimize the amount of time spent travelling in a given timeframe [12]. The Rechargeable WSN goes all sensor nodes at the network lifetime layer and chooses the network through whereby WSN goes all perception nodes at the perception layer in record time in this three-layer system [14] [16].

- ❖ The water level in the soil of the plants is detected using a soil moisture sensor.
- ❖ Humidity and temperature measurements are used to keep plants protected from the elements. They are important for weather analysis and forecasting, especially in agriculture.
- ❖ The pump is used for drainage, and if it is turned on, the water will run through the water hose and then through the tubing[17].
- ❖ The pump will continue to operate or stop depending on the humidity of the farm.
- ❖ The automatic shading is powered by a motor. Depending on the measured needs of the farm, the motor drives the shutter to reduce or increase the amount of water within the agriculture field.

V. Results and Discussion

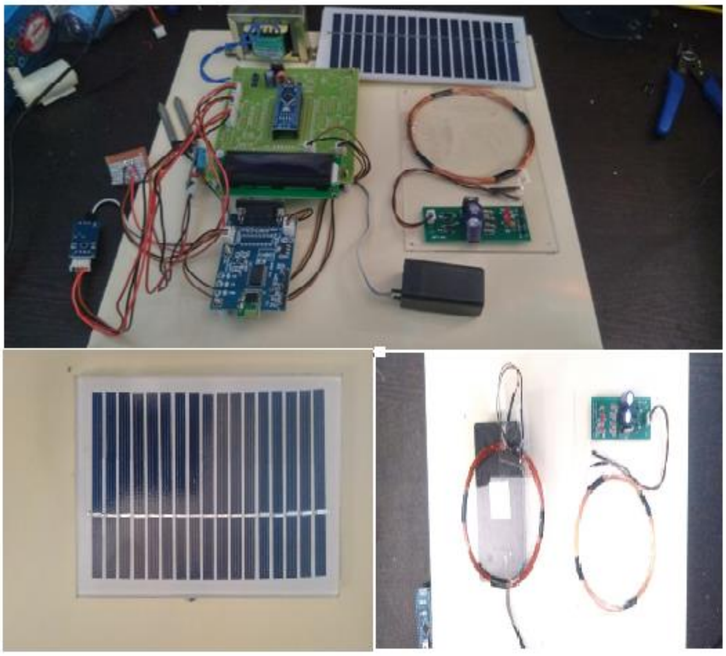

Fig 2: Wireless Power Transfer Overview, Input Source, Wireless Power Transfer Module

A current wireless power transmission framework for a basement network of nodes has been suggested and outlined for use in an agricultural WSN network [1]. Farmlands' sensor systems are interconnected in this technique to transmit WPT electromagnetic power to a network of rechargeable farming sensors [3].

Input is given in two ways one is PV panel renewable resources and another one is DC power source [14]. In output it will monitor the working of sensor and display it in LCD.

Initiating with rectifier and gradually progressing only the larger device, for more complex adjustments like water level, the WPT was related to stringent incoming power and frequency approaches to recognize its unique output level [13]. In future, a prototype model will implant this technique, which will sense all environmental parameters and send the data to the user via cloud [15]. The user will take control action in accordance with that, which may be accomplished by the use of an actuator. This asset enables the farmer to increase cultivation in the way that the plant requires.

VI .Refrences

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