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Enhancing Monitoring And Automation in Agriculture Using IoT

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Abstract: Recently, the Algerian economy starts to decline due to the drop in oil prices. The decline in oil prices shows the dependence and vulnerability of a system built on the only resource of the hydrocarbon sector. In this case, it is urgent to develop other sectors of the economy to reduce the dependence on hydrocarbons. Agriculture is a strategic and important sector for economic development, especially in southern Algeria. In general, poor irrigation management affects agricultural production, for this purpose it is necessary to develop strategies to optimize irrigation. An automated irrigation system is designed to monitor and control the various factors derived from an agricultural field such as humidity, water level, temperature, and human interaction. The integration of modern technology in irrigation management system is one of the ways to improve the irrigation processes to optimize the use of water, electricity consumption and labour costs. This new mechanism allows the farmer to monitor and manage agricultural area using smart phones via Internet.

I. INTRODUCTION

Embedded systems are self-contained programs that are embedded within a piece of hardware. Whereas a regular computer has many different applications and software that can be applied to various tasks, embedded systems are usually set to a specific task that cannot be altered without physically manipulating the circuitry. Another way to think of an embedded system is as a computer system that is created with optimal efficiency, thereby allowing it to complete specific functions as quickly as possible.

The contemporary world is in a transition stage where problems concerning global issues, such as global warming and alternative energy sources, are combined with new challenges demanding immediate solutions. Society's focus has shifted from economic growth to sustainable development, where environmental, social, and economic aspects are considered together, rather than separately. Policies that promote sustainability in all sectors of the economy (manufacturing, agriculture, and services) are now considered as a part of good governance. Problems such as climate change, population growth, and poverty (especially hunger), occur in a context of a gradual depletion of natural resources and the fear of diminishing coal energy reserves. These are some of the global issues that are thought to require multidisciplinary approaches in order to be addressed successfully. In this Master's project we focus on agricultural production and cultivation. This overall process has a significant role in fulfilling the basic human need for food. The production, preparation, packaging, distribution, etc. of food also generates a lot of income. The aim of this Master's thesis project is to exploit modern technologies and tools to improve monitoring and management of crops, in order to improve the efficiency and sustainability of farming and food production. To this end, we have designed a system for precision agriculture, which relies on a wireless sensor network combined with a service to provide individual farmers with access to data that they find useful. The system utilizes wireless sensor nodes that collect and transmit data about the quality of the water supply, the soil, and other parameters in an agricultural field. While such sensor-based systems have been investigated earlier, one of the key innovations to be explored in this Master's thesis project is the combination of these sensors systems with a service-driven business model to increase their ease of use and to amplify the gains that can be realized via an integrated system. The goal is to give a farmer a more complete picture of the current and historic crop status in order to foster better informed decision making. It is expected that such decisions will benefit both farming and irrigation by saving time and resources. Factors such as the diversity of conditions which vary depending on location (for example weather, presence of insects, and disease) combined with the inability to predict the future characteristics of the environment during the different seasons over time complicate the decision making process and require specialized knowledge.

II. RELATED WORKS

The design and instrumentation of variable rate irrigation, a wireless sensor network, and software for real-

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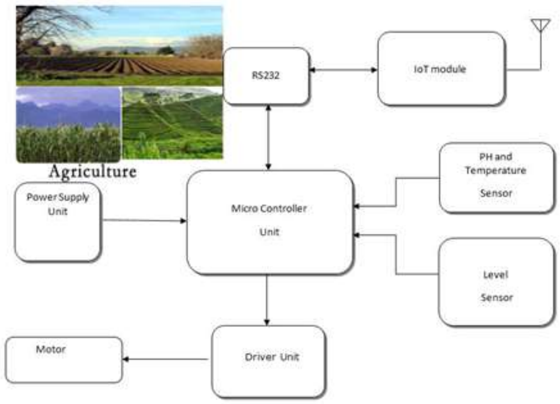
time in-field sensing and control of a site-specific precision linear-move irrigation system. Field conditions were site-specifically monitored by six in-field sensor stations distributed across the field based on a soil property map, and periodically sampled and wirelessly transmitted to a base station. An irrigation machine was converted to be electronically controlled by a programming logic controller that updates geo referenced location of sprinklers from a differential Global Positioning System (GPS) and wirelessly communicates with a computer at the base station. Communication signals from the sensor network and irrigation controller to the base station were successfully interfaced using low-cost Bluetooth wireless radio communication. Graphic user interface-based software developed in this paper offered stable remote access to field conditions and real-time control and monitoring of the variable-rate irrigation controller.

III. IoT

The Internet of things (stylized Internet of Things or IoT) is the internetworking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things defined the IoT as "the infrastructure of the information society. "The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine (M2M) communications and covers a variety of protocols, domains, and applications, the vision of the Internet of things has evolved due to a convergence of multiple technologies, including ubiquitous wireless communication, real-time analytics, machine learning, commodity sensors, and embedded systems.



IRRIGATION

Irrigation system uses valves to turn irrigation ON and OFF. These valves may be easily automated by using controllers and solenoids. Automating farm or nursery irrigation allows farmers to apply the right amount of water at the right time, regardless of the availability of labor to turn valves on and off. In addition, farmers using automation equipment are able to reduce runoff from over watering saturated soils, avoid irrigating at the wrong time of day, which will improve crop performance by ensuring adequate water and nutrients when needed. Automatic Drip Irrigation is a valuable tool for accurate soil moisture control in highly specialized greenhouse vegetable production and it is a simple, precise method for irrigation. It also helps in time saving, removal of human error in adjusting available soil moisture levels and to maximize their net profits. Irrigation is the artificial application of water to the soil usually for assisting in growing crops. In crop production it is mainly used in dry areas and in periods of rainfall shortfalls, but also to protect plants against frost. Types of Irrigation

- Surface irrigation
- Localized irrigation
- Drip Irrigation
- Sprinkler irrigation

SOIL MOISTURE

Soil moisture is an important component in the atmospheric water cycle, both on a small agricultural scale and in large-scale modelling of land/atmosphere interaction. Vegetation and crops always depend more on the moisture available at root level than on precipitation occurrence. Water budgeting for irrigation planning, as well as the actual scheduling of irrigation action, requires local soil moisture information. Knowledge of the degree of soil wetness helps to forecast the risk of flash floods, or the occurrence of fog. Soil water content is an expression of the mass or volume of

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water in the soil, while the soil water potential is an expression of the soil water energy status. The relation between content and potential is not universal and depends on the characteristics of the local soil, such as soil density and soil texture. The basic technique for measuring soil water content is the gravimetric method. Because this method is based on direct measurements, it is the standard with which all other methods are compared. Unfortunately, gravimetric sampling is destructive, rendering repeat measurements on the same soil sample impossible. Because of the difficulties of accurately measuring dry soil and water volumes, volumetric water contents are not usually determined directly. The capacity of soil to retain water is a function of soil texture and structure. When removing a soil sample, the soil being evaluated is disturbed, so its water-holding capacity is altered. Indirect methods of measuring soil water are helpful as they allow information to be collected at the same location for many observations without disturbing the soil water system. Moreover, most indirect methods determine the volumetric soil water content without any need for soil density determination. The new soil moisture sensor uses Immersion Gold which protects the nickel from oxidation. Electrodes nickel immersion gold (ENIG) has several advantages over more conventional (and cheaper) surface plating such as HASL (solder), including excellent surface planarity (particularly helpful for PCB's with large BGA packages), good oxidation resistance, and usability for untreated contact surfaces such as membrane switches and contact points. A soil moisture sensor can read the amount of moisture present in the soil surrounding it. It's a low tech sensor, but ideal for monitoring an urban garden, or your pet plant's water level. This is a must have tool for a connected garden. This sensor uses the two probes to pass current through the soil, and then it reads that resistance to get the moisture level. More water makes the soil conduct electricity more easily (less resistance), while dry soil conducts electricity poorly (more resistance).

IV. CONCLUSION

In this project, detailed study and literature survey of various automated irrigation system have been presented. We have successfully designed a remote control and monitoring system for farmers that will graphically represent the soil condition of the crop distantly using ZigBee The designed system is Power-efficient, cost-effective and user friendly that is efficient enough to monitor the crop condition and remotely control the peripherals of the irrigation system which will make the job of the farmers easier. This system is scalable, as it allows any number of devices to be added with no major changes in its core architecture.

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