Investigations on the Hardware Components and Internetworking Architectures of Wireless Sensor Network for Environmental Monitoring

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Abstract: Nowadays, the applications of these networks are copious, varied and the applications in agriculture are still budding. One interesting purpose is in environmental monitoring and greenhouse control, where the crop conditions such as weather and soil do not depend on natural agents. To control and observe the environmental factors, sensors and actuators are necessary. Under these conditions, these devices must be used to make a distributed measure, scattering sensors all over the greenhouse using distributed clustering mechanism. This paper evaluates the investigations on the hardware components and internetworking architectures of wireless sensor network.

Keywords: Sensor, Sensor nodes, Wireless sensor network (WSN), Distributed clustering.

1. Introduction

The most imperative factors for the quality and yield of plant growth are temperature, humidity, light and the level of the carbon dioxide. Constant monitoring of these ecological variables gives information to the cultivator to better understand, how each aspect affects growth and how to administer maximal crop productiveness. The best possible greenhouse climate modification can facilitate us to advance productivity and to get remarkable energy saving, predominantly during the winter in northern countries. In the past age band, greenhouses it was enough to have one cabled dimension point in the middle to offer the information tothe greenhouse automation system. The arrangement itself was typically simple without opportunities to supervise locally heating, light, ventilation or some other actions which were affecting the greenhouse interior climate. The archetypal size of the greenhouse itself is much larger than it was before, and the greenhouse facilities afford several options to make local adjustments to light, ventilation and other greenhouse support systems. However, added measurement data is also needed to put up this kind of automation system to labor properly. Increased number of measurement points should not dramatically augment the

automation system cost. It should also be probable to easily alter the location of the measurement points according to the particular needs, which depend on the definite plant, on the possible changes in the external weather or greenhouse arrangement and on the plant placement in the greenhouse. Wireless sensor network can form a helpful part of the automation system architecture in contemporary greenhouses constructively. Wireless communication can be used to accumulate the measurements and to communicate between the centralized control and the actuators located to the different parts of the greenhouse. In highly developed WSN solutions, some parts of the control system itself can also be implemented in a distributed manner to the network such that local control loops can be created. The representation of distributed clustering can be seen from Figure 1.

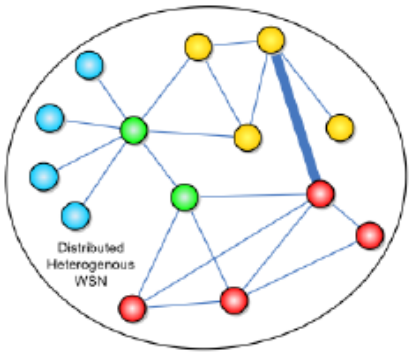

Figure 1. Clustering in Wireless Sensor Network [1]

Compared to the cabled systems, the setting up of WSN is fast, cheap and easy. Moreover, it is easy to relocate the measurement points when needed by immediately moving sensor nodes from one location to another within a communication range of the coordinator gadget. If the greenhouse vegetation is high and dense, the small and light weight nodes can be hanged up to the branches.

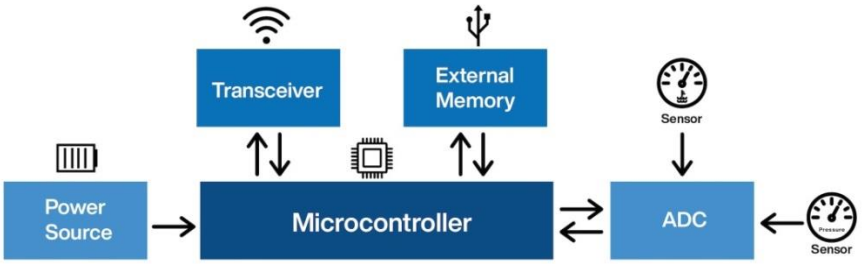

Figure 2. Components in a Wireless Sensor Network [2]

WSN maintenance is also relatively inexpensive and trouble-free. The only other costs occur when the sensor nodes run out of batteries and the batteries need to be charged or replaced, but the lifespan of the battery can be several years if an proficient power saving algorithm is applied. In this work, the very first steps towards the wireless greenhouse automation system by building a wireless measuring arrangement for that purpose is taken and by testing its feasibility and reliability with a straightforward experimental setup. The components in a wireless sensor network is shown in Figure 2.

Clustering may be centralized or distributed, based on the array of CH. In centralized clustering, the CH is preset but in distributed clustering CH has no permanent architecture. Distributed clustering mechanism is used for some classified reasons like sensor nodes prone

to failure, better collection of data and minimizing redundant information. Hence these distributed clustering mechanisms cover enormously self-organizing capability.

2. Related Works

Supervision of costly possessions like equipment, machinery, diverse types of stock or products can be a quandary. The problem is highly distributed, as these companies expand all over the globe. A gifted technique to attain asset tracking and deal with this trouble is believed to be with the exercise of sensor networks. The application of wireless sensors in petroleum bunks and chemical warehouses refers to warehouses and freight space administration of barrels. The consideration is that motes attached to barrels will be gifted to position nearby objects (other barrels), detecting their content and alerting in case of unsuitability with their own, aging effects of the field, etc.

Fitness science and the health care arrangement can also yield from the employment of wireless sensors. Applications in this group include telemonitoring human physiological information remotely, tracking and monitoring of doctors and patients within a hospital, medicine superintendent in hospitals, etc. In Smart Sensors, retina prosthesis flake consisting of 100 micro sensors are built within the human eye. This allows patients with scarce vision to see at an adequate level. Cognitive disorders, which roughly direct to Alzheimer‘s, can be monitored and controlled at their hasty stages with these wireless sensors.

Robotic applications previously implemented are the unearthing of level sets of scalar fields using portable sensor networks and replication of the function of bacteria for looking for and discovering dissipative gradient sources. The tracking of a beam source is completed with a few of the effortless algorithms. In addition, an answerto the coverage crisis by robots and motes is accomplished for chunky measurements over a broad area. The association of both static and mobile networks is accomplished with the aid of mobile robots, which journey aroundthe environment and set up motes that act as beacons. The beacons bear the robots to portray the directions. The mobile robots can act upon as gateways into wireless sensor networks.

Landslide discovery employs scattered sensor system for predicting the happening of the landslides. The deliberation of predicting landslides by means of sensor networks arose out of a necessity to mitigate the stain caused by landslides to human lives and to the railway networks. A blend of techniques from earth sciences, signalprocessing, scattered systems and fault-tolerance is used. One solitary peculiarity of these systems is that it combines several distributed systems techniques to contract with the complexities of a distributed sensor network environment where connectivity is disadvantaged and power budgets are very constrained, while fulfilling real-world requirements of protection. Generally these methods use a set of low-priced single-axis strain gauges attached to cheap nodes, all with a CPU, battery and best wireless transmitter block.

Forest fires, also recognized as feral fires are wild fires occurring in wild areas and cause chief damage to natural and human resources. Forest fires wipes out forests, burn the infrastructure and might effect in high human death toll closer to urban areas. Universal causes of forest fires squeeze lightning, individual carelessness and revelation of fuel to tremendous heat and aridity. It is well identified that in few cases fires are ingredient of the

forest ecosystem and they are vital to the life cycle of native habitats.

3. Experimental Analysis

A contemporary greenhouse can consist of copious parts which contain their own confined climate variable settings. As a result, a quantity of measurement points are also needed. This group of environment is demanding both for the sensor node electronics and for the short-range IEEE 802.15.4 wireless network, in which communication choice is greatly longer in open environments.

Speedy response time, squat power consumption and tolerance beside moisture climate, relative humidity and temperature sensor forms an idyllic preference and explanation for the greenhouse environment. Communication among sensor nodes can be carried out by IIC interface. Luminosity can be measured by light sensor, which converts light intensity to equivalent voltage. Unstable output signal is handled by low-pass filter to acquire exact luminosity values. CO_2 measuring takes longer time than other measurements and CO_2 sensor voltage supply have to be within little volts. The carbon dioxide assessment can be read from the ensuing output voltage. Operational amplifier raises the voltage level of weak signal from the sensor.

A greenhouse is a pattern covering the ground frequently used for growth and progress of plants that will revisit the owner‘s risk, time and capital. This exhibit is mounted with the purpose of caring crop and allowing a better environment to its advancement. This defend is enough to guarantee a higher quality in production in some cases. However, when the chief idea is to achieve a superior control on the horticulture development, it is necessary to examine and control the variables that influence the progress of a culture. The chief role of a greenhouse is to offer a more compassionate environment than outside. Unlike what happens in customary agriculture, where crop conditions and yield depend on natural resources such as climate, soil and others, a greenhouse ought to promise production independent of climatic factors. It is noteworthy to view that even though a greenhouse protects crop from peripheral factors such as winds, water excess and warmth it may root plentiful problems such as fungus and extreme humidity. Therefore, mechanisms to inspect and manage a greenhouse environment are unbelievably vital to get better productivity. To obtain higher productivity and quality, enhanced control system is necessary and as a result the fabrication costs also gets reduced. The chief elements concerned in a greenhouse control system are: temperature, humidity, CO_2 concentration, radiation, water and nutrients. The principle of CO_2 sensor is shown in Figure 3.

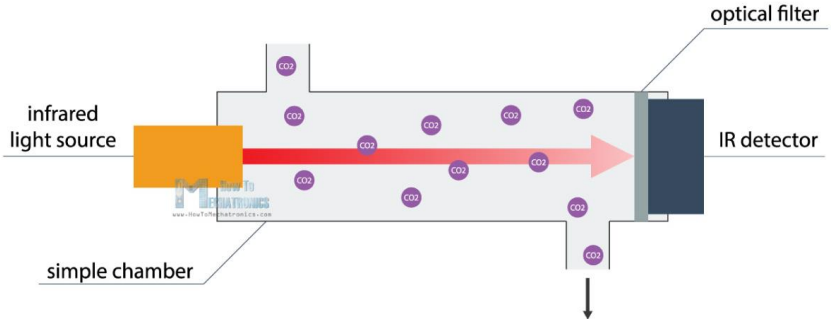

Figure 3. Schematic Representation of CO_2 Sensor [3]

Temperature is one of the main key factors to be monitored since it is unswervingly related to the development and progress of the plants. For all plant varieties, there is a temperature variety considered as a best range and to most plants this range is comparatively varying between 10ºC and 30ºC. Among these parameters of temperature: intense temperatures, maximum temperature, minimum temperature, day and night temperatures, difference between day and night temperatures are to be cautiously considered.

An additional significant factor in greenhouses is water. The absorption of water by plants is associated with the radiation. The deficient in or low level of water affects growth and photosynthesis of these plants. Besides air, the ground humidity also regulate the development of plants. The air humidity is interconnected with the transpiration, while the ground humidity is linked to water absorption and the photosynthesis. An atmosphere with tremendous humidity decreases plants transpiration, thereby reducing growth and may endorse the proliferation of fungus. On the other hand, crouch humidity level environments might cause dehydration [4]-[6].

CO_2 is an indispensable nutrient for the plant development, allowing the adaptation of carbon. The carbon retaining process occurs through the photosynthesis when plants take away CO_2 from the atmosphere. During photosynthesis, the plant use carbon and radiation to produce carbohydrate, whose purpose is to permit the plant development. The ultimate goal was the tracking and categorization of moving items with metallic content, and specially the tracking of vehicles and weapon-carrying soldiers. Other civilians were uncared by the system. The principle here is to coordinate with a number of this category of sensors in order to keep sensing the moving object, thereby diminishing any information gaps about the track that could arise. Peacetime applications of wireless sensor networks like homeland security, possession-protection, surveillance, border patrol, etc., are the actions that possibly the future sensor network willbe taking on.

4. Conclusion

This paper evaluates the investigations on the hardware components and internetworking architectures of wireless sensor network. The hardware implementation shows periodic monitoring and control of greenhouse gases in an improved manner. Future research is concentrated in application of the same mechanism using wireless sensor network. This knowledge can also be applied in breeding of cramped animals in precision zoo, where the sensor nodes should propel information about animal temperature, pressure and additional vital signals to guarantee a strong environment to animals.

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