Distribution of Wireless Sensor Network for Efficient Environmental Monitoring and Greenhouse Control

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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 reveals an initiative of environmental monitoring and greenhouse control using a sensor network.

Keywords: Wireless sensor network, Greenhouse control, Environmental monitoring.

1. Introduction

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 [1].The best possible green house 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, green houses it was enough to have one cabled dimension point in the middle to offer the information to the 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 [2]. Thearchetypal 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 [3]. It should also

beprobable to easily alter the location of the measurement points according to the particular needs, which depend onthe 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 [4]. 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 communicationrange of the coordinator gadget. If the greenhouse vegetation is high and dense, the small and light weight nodes can be hanged upto the branches.

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 a 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. Figure1 shows the assorted components of a wireless sensor node.

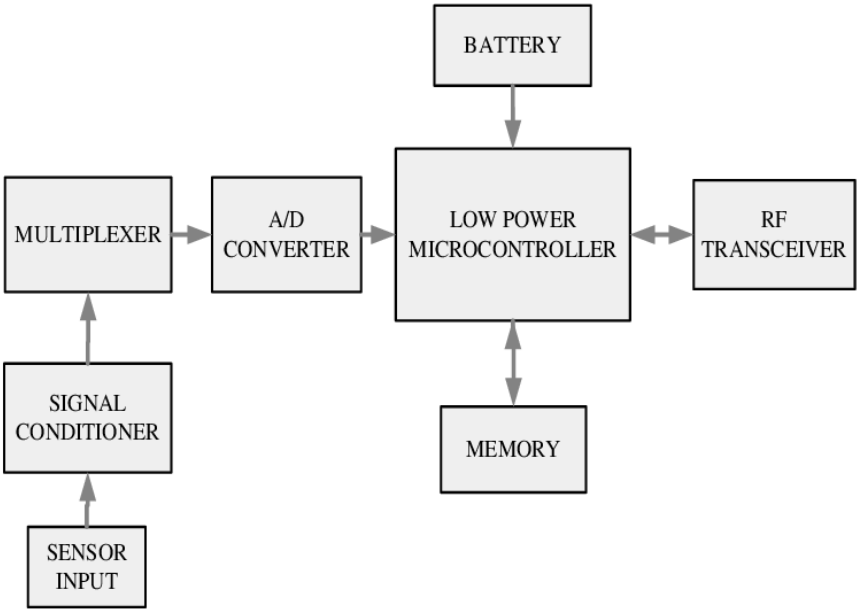

Figure1. Elementary components of a wireless sensor node

2. Review of Literature

Regarding military applications, the province of concentration extents from information collection, normally, to enemy tracking or battlefield surveillance. For example, mines may perhaps be regarded as unsafe and outdated in the future and may be replaced by thousands of remote sensor nodes that will detect an imposition of unreceptive units [5].

Open-air monitoring is an added celestial area for applications of sensors networks. One of

the mainly delegate examples is the action of sensor nodes on Great Duck Island. This sensor network has been used for atmosphere monitoring. The sensor nodes used were gifted to sense temperature, barometric pressure and humidity. Inadding together, passive infrared sensors and photo resistors were affianced. The arrangement was to watch thenatural environment of a bird and its activities according to climatic changes. For that reason, a number of moteswere installed within birds‘ burrows, to mark out the bird‘s presence, while the rest were deployed in the close by areas. Data are aggregated by the employment of nodes and are conceded through to a gateway.

Management 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 assettracking and deal with this trouble is believed to be with the exercise of sensor networks. The application of wireless sensors in petrol eumbunks 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.

Health science and the health care arrangement can also yield from the employment of wireless sensors. Applications in this group included a tele monitoring human physiological information remotely, tracking and monitoring of doctors and patients within a hospital, medicine super intendent in hospitals, etc. In Smart Sensors, retina prosthesis flake consisting of 100 micro sensors are built within the human eye. This allows patients withscarce vision to see at an adequate level. Cognitive disorders, which roughly direct to Alzheimer‘s, can bemonitoredand controlledattheirhastystageswith thesewireless sensors.

Mechanical 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 answer to 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 around the 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.

Mud slide discovery employs scattered sensorsy stem for predicting the happening of the land slides. 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, signal processing, scattered systems and fault-tolerance is used. One solitary peculiarity of these systems is that itcombines 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.

Woodland fires, also recognized as feral fires are wild fires occurring in wild areas and cause chief damage to naturaland human resources. Forest fires wipes out forests, burn the

infrastructure and might effect in high human deathtoll closer to urban areas. Universal causes of forest fires squeeze lightning, individual carelessness and revelationof 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 lifecycle of native habitats

Clouds can be used for fitness monitoring by using a measure of simply obtain able and most often wearable sensors like accelerometer sensors, propinquity and temperature sensors and so forth to collect patient‘s health-related statistics for tracking sleep action pattern, body temperature and other respiratory conditions. Thesewearable sensor devices should have sustain of Bluetooth‘s wireless interface, Ultra wideband and so forth interface for streaming of information, linked wirelessly to some smart phone through the interface. Figure 2 shows the Schematic diagram of possible environmental applications.

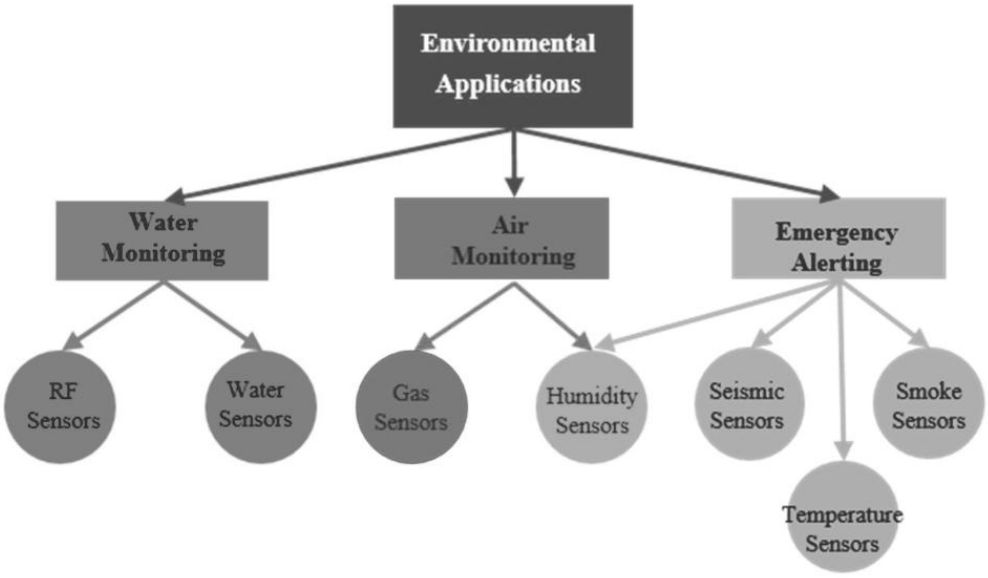

Figure 2. Schematic environmental applications

3. Proposed Modules

3.1.TheGreenhouseAtmosphere

Modern greenhouse can consist of copious parts which contain their own confined climate variablesettings. As a result, a quantity of measurement points is also needed. This group of environment is demanding both for the sensor node electronics and for the short-range IEEE802.15.4 wireless network, in which communication choice is greatly longer in open environments.

3.2. Sensor Nodes

Speedy response time, squat power consumption and tolerance beside moisture climate, relative humidity andtemperature sensor forms an idyllic preference and explanation for the greenhouse environment. Communicationamong sensor nodes can be carried out by IIC interface. Luminosity can be measured by light sensor, whichconverts light intensity to equivalent voltage. Unstable output signal is handled by low-pass filter to acquire exact luminosity values.CO_2 measuring [7] takes longer time than other measurements and CO_2 sensor voltage supplyhave 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.

3.3. Greenhouse Monitoring

When the chief idea is to achieve a superior control on the horti culture 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 cropconditions 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 green house 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 get reduced. The chief elements concerned in a greenhouse control system are:temperature,humidity, CO_2concentration, radiation,water andnutrients.

3.4. Climate change

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 mostplants 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.

3.5. Environmental Humidity

An additional significant factor in greenhouses is water. The absorption of water by plants is associated with theradiation. The deficient in or low level of water affects growth and photosynthesis of these plants. Besides air, the ground humidity also regulates the development of plants. The air humidity is interconnected with the transpiration, while the ground humidity is linked to water absorption and the photosynthesis.

3.6. Solar Radiation

Radiation is an elementary element in green house production and sun light is the key starting place of radiation. It is an imperative component for photosynthesis and carbon fixing. Momentous radiation features are intensity andduration. The radiation intensity is linked to plant development and the duration is explicitly associated with its metabolism. During photosynthesis, the plant use carbon and radiation to produce carbohydrate, whose purpose is to permit the plant development. Therefore, an enriched air environment should add to plant growth, but it is also vital to note that an intense carbon level may turn the environment poisonous.

3.7. Security

The avoidance of intrusion will be the answer of the defence system. One example project is— A line in the Sand ‖ and refers to the deployment of several nodes which are gifted for

detecting metallic objects. 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, there by 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 will be taking on.

4. Conclusion

The best possible green house 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 to the greenhouse automation system.To control and observe the environmental factors, sensors and actuators are necessary. Under the second itions, these devices must be used to make a distributed measure, scattering sensors all over the greenhouse using distributed clustering mechanism. This paper reveals an initiative of environmental monitoring and greenhouse control using WSNs.

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