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DETECTION OF RAIN FALL AND WIND DIRECTION USING WIRELESS MOBILE SENSOR NETWORK

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ABSTRACT:

In the present days it becomes very difficult to estimate monsoons and their arriving at different states. Because of the global warming the expected monsoons are making delay in giving artefact of rain to humankind. The global warming also cause un-expecting flood in many villages and cities. The climate always habituated in changing its behaviour in terms of its direction and intensity suddenly, which cause a large damage to humankind directly and indirectly. Sometimes farmers fail to protect their products safely from calamities. Although the satellite systems are working in this direction to make people alert, but it is highly essential to monitor the nearest area weather, to take immediate action. In this paper the detection techniques of rainfall and wind direction within small regions are presented. And in this paper few sensor model operations are discussed to meet the requirements.

Keywords: Rainfall, diaphragm, wind velocity, direction, sensor nodes

INTRODUCTION

The satellite systems are playing vital role in monitoring weather system on earth and giving their valuable measurements to scientist to take correct decisions. But this is some time difficult to monitor these satellite results through televisions and other media at different locations. Sometimes farmers, industrialists, and other mankind eagerly wait for weather effect of their next village, town, city or an area in the city. If we can estimate the weather condition such as rainfall, wind direction, and pressure in the next village, people can alert to finish their priority jobs immediately, before it enters in to our village. If small sensor systems are arranged in the nearest place or next village from which we want to measure the weather readings, those sensor readings can be transmitted to individual mobile phones through sensor network. Basically satellite readings are also use full in estimating weather report, but these reports are calculated on wide range of area. And the estimations sometimes go deviated from the expected values due to global warming, local industries, or due to local environmental disasters.

So along with these satellite readings it is also highly essential to monitor the nearest area weather readings automatically. The weather readings of the nearest area are automatically transmitted to mobile phones through sensor network. The sensor network play vital role in measuring the environment conditions in the previous village and sending to next village as shown in figure 1. Based on these results the base station readers will be more vigilant in doing their current jobs. Accurate measurements and accurate predictions can be made in this system.

The sensor nodes can store data, make decisions about what data to transmit on and even make decisions about when and what to sense. Sensor networks can be used to monitor the environment, objects in that environment, and the interactions between objects and their effect on surrounding environment. The sensor networks include environmental sensing, and their effects, equipment maintenance and their interfacing with respective sensor element.

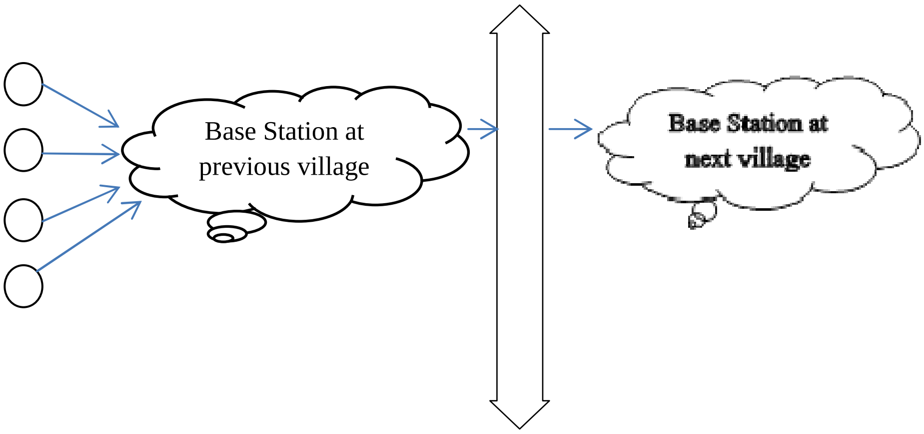

Figure 1: Physical analysis of the present measurement system

Wireless network technology and miniaturization now make it possible to realistically and accurately monitor the environment. These systems can provide new data for environmental science, such as climate models, as well as vital hazard warnings such as flood alerts. This capability particularly benefits research in remote or dangerous locations, where many fundamental processes have rarely been studied due to inaccessibility.

1. HARDWARE

In the present work sensor network is designed in view that in future the size of the sensor network may increase to large extent. In that case the system nodes may not be sufficient to support future system requirements. Keeping this in mind the system is designed in such a way the ports can and nodes can be expandable to meet future requirements [12]. Before designing and installing any system, it is necessary to understand its physical environment and deployment in detail. The system must be able to withstand specific conditions such as temperature, pressure, or vibration [1].In addition, the collection and interpretation of data can dramatically affect the design of communications and security mechanisms. Sensor networks are designed to interface array of sensors with signalling conditioning. Every sensor node in figure 2 is equipped with a transducer, small processing unit, transceiver, and power source. The readings from various sensing nodes are collected and send to signal conditioner for attenuation and then send to signal processing as shown in figure 2. The signal processor will convert the attenuated signal into processor understandable signal and transmittable signal.

Sometimes the final digital system may not be fully justified in receiving full strength signal from ADC (Analog to Digital Converter). In some cases the system is fully busy with complex algorithms due to its complexity. While the complexity is high the system cannot grant port to receiving channel. In such type of situations there is chance of losing information due to improper synchronization. So here a pipeline is used to overcome from data losing and to match the synchronization between system and external peripheral. For achieving accurate information a new clock scheme [6] is implemented in the present design. Accurate readings can be obtained by checking the data pulses at each stage and triggering next stages by checking previous data pulse stages. More over less relative error can be obtained by checking data waves at each stage of the new clock scheme pipeline. Power consumption can be minimized with the new clock scheme. In achieving new clock scheme clock constraints and limitations are considered to minimize the clock skew in pipeline [10].

Self-configured techniques are followed to enable power down configuration [2]. In self-configured mode the sensor node will be dependent on one another. In power down configuration the sensor network system will be in idle mode, when the weather is in normal condition. This will save the power consumption in the system. Some of the main factors need to consider in self configuring network design are, moving intelligence closer to the point of measurement/control. Convergence of transducers, computation and communication towards common goal such that make cost effective to maintain distributed systems.

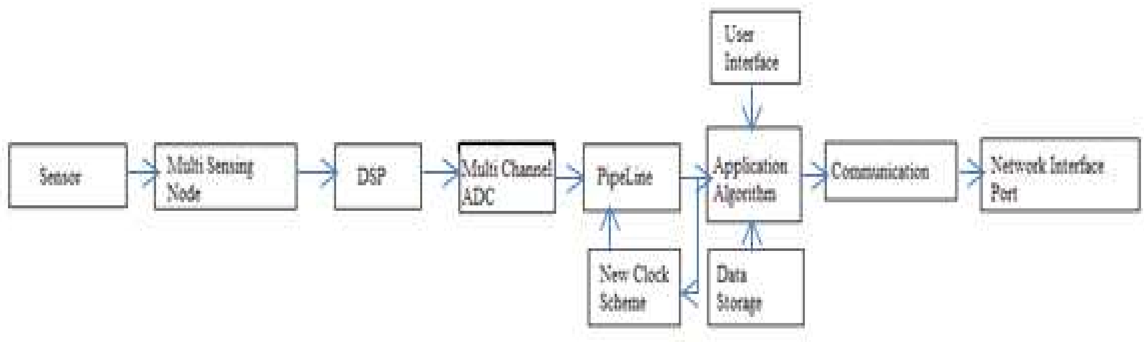

Figure 2: Signal Conditioning

The problem of estimating spatial coordinates is known as localization. Localization is an important building block for sensor networks and is itself a sensor network. It is developed for automatic self-configuration through adaptive localized algorithms. A localized algorithm is a distributed computation in which sensor nodes achieve a desired global objective, [5] while constraining their communication to sensors within some neighbourhood. Assume that neighbouring reference points are synchronizing, so that their signal transmissions do not overlap in time. Furthermore,

in any time interval T, each of the reference points would have transmitted exactly one signal. Each mobile node

listens for a fixed time period t and collects all the beacon signals that it receives from various reference points. The characterization of the information per reference point Ri by a connectivity metric (CM_i), defined as [11],

$$CM_i = \frac{N_{recv}(i,t)}{N_{sent}(i,t)} X100 \quad \text{------------------- (1)}$$

$N_{sent}(i,t)$ = Number of beacons that have been sent by Ri in time t

$N_{recv}(i,t)$ = Number of beacons sent by Ri that have been received in time t

R = Transmission range of the reference point

t = t Receiver sampling or data collection times

Unlike the Internet, wireless sensor networks are organized around the naming of data, not nodes [5]. Nodes are neither unique nor reliable; applications express a need for a particular data element or type of data by naming it directly. By eliminating indirection, e.g. the mapping from a name to a node address to a route, a sensor network can eliminate the maintenance overhead associated with constructing and maintaining these mappings and directory services[7]. Because sensor data are intrinsically associated with the physical context of the phenomena being sensed, spatial coordinates are often a natural way to name data. Spatial coordinates are also employed by collaborative signal processing algorithms (e.g. beam forming) that combine data from multiple sensor nodes for such tasks as target tracking. Furthermore, geographic assistance in ad hoc routing promises significant reductions in energy consumption [8][9].

2. DATA ASSIMILATION

A sensor networking system contains various computing systems which contains large number of sensor nodes that are tightly held or communicate to measure a specific physical environment. Sensor nodes communicate with one another over wireless low-bandwidth links and have limited processing capacity. Sensor nodes work together and integrated to collect information about their surrounding environment, this may include things like temperature, light intensity, humidity, rainfall, wind speed or GPS location.

Attenuation due to the rainfall intensity along the path is calculated by, [3]

$$A_r\left(dBkm^{-1}\right) = aR^b \text{ ---------------- (2)}$$

Where A_r is the rain induced attenuation, R is rain rate in mm/hr and the coefficients a and b are generally functions of frequency, polarization and drop size distribution (DSD). It has long been known that the relationship in (2) could serve as a basis for measurements of path-integrated and area-integrated rainfall. The major problem identified in context of rainfall monitoring, Evaluate the confidence intervals of the obtained estimates by making use of available information [4] (such as the link density, frequency band, instrument noise, and environmental uncertainties).

It is quite difficult to measure the rain intensity and wind direction in the same region. But finding the wind direction is more important in predicting the rainfall in a particular area. The diaphragms are placed to find the wind pressure. The Diaphragms are placed in different directions to find the wind movement in different angles. Identifying pressure ranges in different angles realises the low pressure directions. The displacements of the diaphragms are proportional to wind velocity. When the velocity of the air increases the diaphragms senses the direction of the air in that particular direction. The displacements are converted into electrical signal using LVDT. LVDTs are best transducers in perceive minute displacements. The wind directions decide indirectly the rain stream direction. So the LVDT directions are very important in deciding wind directions and predicting rain fall. At the same time the rain gauge readings confirm the rain fall in the particular location. So in the next village based on the wind directions and velocity, villagers can predict rain fall.

3. CONCLUSION

Accurate measurements and accurate predictions can be made in this system. The percentage of relative error comparatively very small over wide range of frequency ranges. The architecture bridges an intelligent connection between environment and present sensor network. In future we are concentrating on further accurate process with lesser hardware with less power consumption. This can be achieved by reducing spatial complexity of the program and hardware design. Intelligent self-configured networking is maintained and controlled by localization algorithms. The system is designed to compatible with few mobile adapters only. With fewer modifications in interfacing port stand the system can made prepare to exchange data with any type of mobile adapter.

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Biography

P.J.Rao (P.Jagannadha Rao) has passed out B.Tech (Chemical Engineering) and M.Sc. (Mineral Process Engineering) during the years 1982 and 1984 respectively. He is pocessing 22 years of Industrial , consultancy and 6 years of Academic experience in various Industries of repute and Department of Chemical Engineering, Andhra University. He has the hands on exrerience in the fields of Production, Process, Environmental Management and Industrial Safety. He had been associated with industies include Petrochemical, metallurgical, Pharma, Chemical, Agro processing, Tanneries, cement, sugar,beach sand processing, fertiliser, sugar, steel tec. Presently he is working as Associate Professor in the dept. of Chemical Engineering. He had been awarded Ph.D in Chemical Engineering during the year 2011.

P.Bhavya Manjeera has passed out B.Tech(Chemical Engineering) during the year 2009 from A.U.College of Engineering, Andhra University with first class. She is persuing M.Tech in Chemical Engineering under the scheme of locally employed while working as Assistant Engineer (Chemical) in Trimex Sands Pvt. Limited, Vastavalasa, Srikakulam Dist since August 2009 to till date. She is reporting The Director and Unit head in the matter pertaing to Project Management, Process calculationd, Production R & D Activities on Pigmentation of TiO_2, Recoveries of Heavy Minerals, Environmental and Safety aspects. Presently she is engaged in M.Tech project work

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V. Sridevi has received her Diploma in Electronics and Communication engineering in 2003. She has completed her B. Tech Degree from Andhra University in 2010. Presently she doing her M. Tech. and she has two years of academic experience.Her research of interest are Image processing, Radar engineering, Sensor networking