Minimal Energy Consumption by WSN Nodes during Communication using LEACH and NetLogo in Intelligent Greenhouse

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Abstract: WSN in recent years has been one of the most potential and reliable technologies for agricultural farms. WSN technologies must be low in energy consumption to increase their working lifetime. During communication maximum energy is consumed. To minimize energy consumption, LEACH protocol has been used with a different concept. Here nodes and cluster head (CH) along with core nodes (CN) are sent to sleep or ready mode as per requirement. Multi hop concept is used. This concept of communication can be used in greenhouse agriculture as data transmission occurs every time, thus aiming at minimum energy consumption. NetLogo has been used for showing nodes behavior when it acquires or looses energy.

Keywords: WSN, LEACH, NetLogo, Precision Agriculture, ZigBee and GSM.

I.   INTRODUCTION

India is a country where the livelihood of the farmers depend solely on agriculture. It is a well known fact that around two-third [4] of Indian population depend on agriculture for employment. Unfavorable weather conditions deteriorate conditions to worst. So in order to improve farmers conditions we need to improve the standards of farming in agricultural fields. WSN has been proved to be a great potential for farming. This technology is flourishing with great intense for improving the growing conditions of all varieties of crops [5]. WSN sensors are installed inside greenhouse to monitor different parameters for the growing crops. Parameters such as temperature, humidity, light, water level and soil moisture are measured and monitored in real time [5]. Farmers can easily monitor the parameters on the LCD display or via SMS through GSM technology if residing far from farm field.

The techniques of WSN applied in agriculture assists to gather distributed data, monitoring of crops in harsh environment, production with minimum cost. Two or more greenhouse models can communicate with each other and share their relevant data with the help of GSM technique. ZigBee helps to connect two or more greenhouse models with each other [6]. This process happens with the help of SMS via GSM. WSN has become very popular as it is scalable and easy to handle in automation and control applications. Also as communication will take place for transferring data, minimum energy consumption should be done. For this, a concept has been applied to LEACH protocol [1, 2]. NetLogo, an agent based modeling tool is available free. It is an open source program. It has been used for modeling and stimulating complex systems [7, 8].

II.   INTELLIGENT GREENHOUSE

Under this concept less problems of the changing weather conditions is faced by farmers. A system for increasing the quality of agricultural yield by monitoring soil and environment conditions could be designed was explained by Blackmore et al. in 1994 [3]. Using these concept farmers can grow different crops easily and efficiently all over the year. Farmers will be able to grow seasonal as well as unseasonal crops irrespective of outside environmental conditions. Main objective of this concept is monitoring and controlling the environments as per the crop requirements. A crop may undergo different stages of growth under greenhouse conditions. Greenhouse concept is an upcoming technology in Precision Agriculture for growing crops with high quality. PA model is designed using WSN nodes. These sensor nodes help in collecting spatial data, controlling irrigation parameters, sending information to farmers, etc.

III.   PROPOSED WORK

To monitor various parameters in greenhouse the system needs to be very efficient and energy consumption by the sensors should be minimum. In this paper, I have divided my work in two sections: 1) Proposed model & 2) Proposed concept.

A) *Proposed model*

Four different parameters were taken for measurement purpose in greenhouse environment. The hardware shown below comprises of various parameters such as light, humidity, temperature and water level. Readings of all these parameters are shown on the LCD screen one by one.
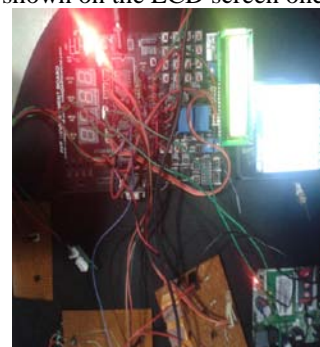

Figure 1. Project hardware showing various parameters

Initially, the circuit was connected as per the circuit diagram and all the connections were checked and then the