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Review on Input-to-State Stability Analysis using Particle Swarm Optimization in Communication

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ABSTRACT*:* In Wireless Sensor Network, many localization algorithms have been proposed which focuses only on localization for static sensor network i.e. they are not for mobile node. With all the advancement and development of sensors and distinct network technologies, WSN with mobile sensor nodes becomes pertinent. A mobile wireless sensor network subsists of nodes which can move. This paper examines the particle swarm optimization (PSO). PSO is used as a feedback cascade system and then apply the input-to-state stability analysis. By using feedback cascade system, it involves the effects of the personal-best value and global-best value directly in the model. Therefore contrary to earlier studies related to PSO dynamics, the property of input-to-state stability is used which allows the analysis of PSO in both the cases i.e. before stagnation and at stagnation. In this paper different techniques for localization and determining position are deliberated.

KEYWORDS: mobile wireless sensor networks; PSO; Optimization; ACO; RSSI; Input-to-State Stability; FCS.

I. INTRODUCTION

A wireless sensor network consists of sensor nodes that may move often. Traditional localization algorithms for static sensor networks are not suitable to WSN. WSN applications demand new localization algorithms. This paper survey various approaches and techniques used in wireless sensor networks and correlate the results of individual algorithms. WSNs are tremendously being used in different habitat to perform diversified auditioning responsibility such as search, rescue, disaster relief, target tracking and a number of tasks in crafty environments. Countless applications in wireless sensor networks desire sensor nodes to obtain their outright geographical positions. There are distinct localization algorithms have been latterly recommended. Localization – finding the position of specific sensor nodes- remains one of the most difficult research challenges.

Optimization plays a very important role in wireless sensor network as it is an act or process of making something as entirely perfect, functional, competent or efficient as possible, especially the mathematical procedures implicated in this.

In [1] authors proposed a PSO algorithm used along with the feedback cascade system.

FEEDBACK CASCADE SYSTEM (FCS)

In communication, feedback is a necessary part because it allows the transmitter (who sends the message) to judge how efficient it has been. It is important because it indicates successful transmission of the message and enables us to evaluate the effectiveness of the message.

Cascade control systems control the system to allow more impartiality to the commotions. Feedback cascade system gives response instantly if there is any problem in communication or if there is point of stagnation.

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RECEIVED SIGNAL STRENGTH INDICATOR (RSSI)

In the field of telecommunication, received signal strength indicator is a measurement of power which is exist in a signal received. RSSI is persistently concealed from the user at receiver. However, when the strength of signal alters excessively and the impact range of abilities to perform in wireless network systems mainly build the wireless standards which are attainable to users.

In the zero-IF structure RSSI is accomplished in the IF phase ahead the IF amplifier and former the baseband amplifier, in the baseband signal chain. The output of RSSI is mainly a DC analog level. In an IEEE 802.11 system, received signal strength is the provisional strength of signal received in wireless environment in erratic units. RSSI is a connotation of the level of power that is being received by receiver antenna. Thence, for this reason higher the value of RSSI, stronger is the strength of signal. Now days, it may also be utilised within in a wireless networking card to make decision though in channel the amount of radio energy below certain steady threshold level that illustrate the network card is CTS (clear to send).Once the card is clear to send than the packet consisting of information can be transmitted. The value of received signal strength will be examined by the receiver end.

II. WORK SO FAR

A literature survey goes further the search for information and involves the identification and articulation of relationships among the literature and our research field. While the form of the literature review may vary with different types of studies, the basic purposes remain constant: In 2015, Daqing Yi, Kevin D. Seppi, Michael A. Goodrich gives paper on Input to State Stability Analysis on particle swarm optimization [1]. This paper examines the dynamics of particle swarm optimization (PSO) by modeling PSO as a feedback cascade system and then applying input-to-state stability analysis. Dian Palupi Rini, Siti Sophiyati Yuhaniz, and Siti Mariyam Shamsuddin works on Particle Swarm Optimization: Techniques, System and Challenges [2]. They have made review of the different methods of PSO algorithm along with the advantages, disadvantages and how to overcome the lack of basic particle swarm optimization. There are several basic variant of PSO.

Baoli Zhang, and Fengqi Yu “An Event- triggered Localization Algorithm for Mobile Wireless Sensor Networks” [3] With the development of sensor and network technology, a wireless sensor network with mobile sensor nodes becomes applicable. A mobile wireless sensor network (MWSN) consists of sensor nodes that may move often. Mamta Kanwal and Kanika Sharma “An Improved Range-free Localization Algorithm for Wireless Sensor Networks” [4] Localization of sensor nodes is required to know the location of origin of events. In this improved localization algorithm in terms of localization error. MATLAB simulations are done for comparison with previous Range-free algorithms.

Mohammad Reza Gholami *et al.* “RSS-Based Sensor Localization in the Presence of Unknown Channel Parameters”[5]. The author studies the received signal strength based on the problem of localization when the power transmitted or path-loss exponent is not known. To avoid the difficulty in resolving the MLE (Maximum Likelihood Estimator), they use suitable approximations and formulate the problem of localization as a general trust region, which may be resolved precisely under mild conditions. Imitation results exhibit a promising performance of the prospected approach that also has prudent complexities as compared with existing methods.

Ssu and Guo [6] proposed an algorithm for localization by utilizing a mobile anchor node. In their algorithm, a mobile anchor node moves around in a sensor area and repeatedly broadcasts beacon messages that involves information of its current location. A sensor node which is stationary receives and records the initial and final locations of mobile anchor node when it is in motion within the communication range.

The paper in [7] presents an energy efficient localization algorithm for WSNs using a mobile anchor node. The proposed algorithm is based on the distance measurement. The node that is mobile is rigged with a RF and ultrasonic transmitter and GPS receiver and every node that is stationary is equipped with RF and ultrasonic receiver. Mobile node repeatedly broadcasts information regarding its location, and stationary nodes take the present position of

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the mobile node as a virtual anchor point. The location of a node is executed by calculating the distance to virtual anchor point by utilizing method TDOA (Time Difference of Arrival).

In [8] authors consider directional antenna that offers distant benefits for WSNs, as increase in spatial reuse ratio and reduction in consumption of energy. After investigating the effect of directional antenna on WSNs, location of a sensor may be calculated by utilizing geometric characteristics. The mobile anchor node moves around communication area for broadcasting beacons. The sensor nodes which are stationary use the information for determining the locations.

In [9], authors discussed the location fingerprinting technique that connects information of location with the characteristics of RSS (received signal strength) and such characteristics are utilized to infer sensor node location. Locations within the whole area of interest are mainly expressed as a set of rectangular grid points. Positioning based on fingerprinting is categorised in to two phases namely; training phase and online phase. In the training phase, fingerprint database is constructed and in online phase, a node calculates the fingerprint vector of RSSIs from distinct anchor nodes. This vector is then compared with stored fingerprints in the database for determining the sensor node's location.

Even though till now many algorithms and protocols have been proposed for WSNs in recent years, they may be not applicable to Mobile WSNs. All in all application scenarios of Mobile Wireless Sensor Networks and restriction of power of a node, mobile nodes don't required localizing themselves continually and constantly. They only require localizing themselves when they are asked to report the data collected.

III. TECHNIQUES USED

ACO (ANT COLONY OPTIMIZATION)

Ant Colony Optimization is a class of calculations, whose first part is known as 'Ant System'. At first ACO was proposed by Marco Dorigo in 1992. The first algorithm aims to search for an optimum path in a graph, on the basis of the behavior of ants seeking a path between their colony and a source of food.

This algorithm is a probabilistic technique for resolving the problems related to computation which may be decreased to find good, favorable and optimal paths through graphs. The essential hidden thought, imprecisely propelled by the conduct of authentic real ants, is that of a parallel search over certain invaluable computational strings of within issue information and on an element memory structure consisting of data on the nature of already attained result. In the legitimate world, initially ants amble randomly and at the time of find food and return to the colony while leaving down pheromone trails. If other ants find such a path which they are probable not to retrain travelling randomly, but instead pursue the trail, returning and strengthen and emphasize it if they finally find food.

Nevertheless, over time, the trail of pheromone starts to evaporate, hence abbreviating its alluring strength. More the time taken by an ant for traveling down the path and reach back to colony, there is more time for the pheromones has for evaporation. Therefore, in comparison with a short path, the pheromone density becomes higher than longer paths. The evaporation of Pheromone also has the advantage to avoid the convergence for optimum solution. If there were no pheromone evaporation at all, the paths opted by first ants would be apt to be extremely alluring to the succeeding ones. Accordingly, when one ant finds an optimum and short path from the colony to a source of food, rest of the ants follow that path, and positive feedback finally accelerates all the ants subsequent a single path.

PSO (PARTICLE SWARM OPTIMIZATION)

Particle Swarm Optimization is a computing method that optimizes a problem repetitively trying for improving a solution with commendations to a given measure of quality. PSO optimizes a problem by having a populace of solutions, where designated particles and moving such dubbed particles around the search-space in accordance with simple mathematical formulas over the position and velocity of particle. The movement of each particle is affected and altered by its most excellent known position. Although, it is also directed approaching the most excellent positions known in the search-space, that are amended as excelling positions found by other particles. This is anticipated for moving the swarm toward the best solutions.

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Particle Swarm Optimization is formerly ascribed to Kennedy, Eberhart and Shi. It was the first predetermined for imitating the social behaviour, say representation of activity of organisms in a flock of bird or fish school. PSO was made simple and was attended to perform optimization and also applied on optimization dilemmas which are partly irregular, change over time, noisy, and so forth.

IV. CONCLUSION

In this paper different techniques are delineated for optimization and localization and for determining the exact position of the nodes in the wireless communication. Optimization and input-to-state stability is very crucial part of wireless communication system. Generally, in wireless communication ant colony optimization and particle swarm optimization is used for determining the location of the nodes.

Different algorithms can be used for enhancing the signal strength of the received signal at the receiver end and for reducing the complexity of the system and minimizing the execution time.

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