ENVIRONMENT MONITORING SYSTEM USING SENSORS

V.Vijayalakshmi [1], Dr.A.Senthilkumar[2]

1. Assistant Professor , Dept of Computer Science, M.G.R.College ,Hosur – 635109.

2. Assistant Professor , Dept of Computer Science,Arignar Anna Govt Arts College,Namakkal – 637002.

Abstract: **In last decades there have been tremendous advancements in technology for agriculture and growth of final yield. Due to uneven natural distribution of rain water it is very crucial for farmers to monitor and control the equal distribution of water to all crops in the whole farm or as per the requirement of the crop. There is no ideal irrigation method available which may be suitable for all weather conditions, soil structure and variety of crops cultures. Green house technology may be the best solution for this solution. All the parameters of greenhouse require a detailed analysis in order to choose the correct method. It is observed that farmers have to bear huge financial loss because of wrong prediction of weather and incorrect irrigation method to crops. In this contest with the evolution in wireless sensor technologies and miniaturized sensor devices, it is possible to uses them for automatic environment monitoring and controlling the parameters of greenhouse, for Precision Agriculture (PA) application. WSNs are originally motivated for the use in military applications, such as border monitoring. Now a day it is mainly focused on civilian applications such as environment monitoring, object tracking and bio -medical applications. They carry out collaborative activities due to limited resources, such as battery, processor and scarce memory. Nowadays, the applications of WSNs are several and diverse, and the applications in agriculture are still budding. One appealing WSN application is in environmental monitoring and greenhouses, where the plant condition such as climate and soil does not depend on natural agents. To manage and monitor the environmental factors, sensors and actuators are critical. Under these circumstances, WSN should be used to make a distributed assessment, spreading sensors all over the greenhouse by means of distributed clustering. This paper reveals some grave issues when a wireless sensor network is exposed to real world environment to monitor and manage parameters like temperature, humidity, smoke, CO_2, light and greenhouse gases and how distributed clustering mechanisms can be integrated within this monitoring process. The enduring challenge in environmental monitoring application of wireless sensors has been elaborated in this paper.**

Keywords—**Wireless sensor network (WSN), greenhouse, environment control, CO_2 monitoring, distributed clustering.**

I. INTRODUCTION

In the Precision Agriculture (PA) various techniques are available to monitor and control the required environmental parameters for the particular crop. It is particularly crucial to analyze the methods which can effectively manage the proper environment. The use of wireless sensor network for the large area is now becoming popular in green house technology of precision agriculture. The parameters of greenhouse to be control are increasing day by day so that it may cause the data traffic and congestion in the future. So that, the wireless sensors derived from PSoC technology with high-bandwidth spectrum or cognitive radio technology may be the proper solution for smooth data traffic and remote control of greenhouse from long distance.

With the use of greenhouse concept, the farmer can produce different crops in different climates and various seasons. In proposed design of the green house, the farmer can easily keep the desired Crop's environment conditions. WSNs consist of hundreds of even thousands of sensor nodes which may be sparsely distributed in remote locations. Thus, it becomes infeasible to recharge or replace the dead batteries of the nodes. As soon as, some of the sensor nodes in a WSN run out of energy, they stop functioning causing progressive deconstruction of the network. Therefore, one of the most stringent limitations that the development of a WSN faces is that of power consumption [1]. Due to current technological advances, the development of materials for tiny and low cost sensors became technically and economically reasonable. In order to put into practice a WSN, few parameters are to be well thought-out: deployment of wireless sensor nodes, uncovering of percentage of pollution (De Boer, M. 1998) and other environmental conditions, converting them into an equivalent electrical signals for processing. An enormous number of these sensors nodes can be networked in countless applications (Van Egmond, N.D. 1998) that entail unattended operations fashion a wireless sensor network. Wireless sensors are devices that vary in size from a portion of glitter to a floor of cards. Integration of a variety of components with an internal distributed clustering mechanism for these sensor nodes craft an

exceptional monitoring system. A sensor node is functionally composed of: sensing unit that is intended and

programmed to sense pollutants in air, light, temperature, humidity, pressure, etc., a converter that converts the sensed signal from analog to digital signal, a processing unit process the signals sensed form sensor with aid of embedded memory, operating system and few related transceiver circuits. A radio unit facilitates communication from the node level to the sink level. Powering these components is classically one or two tiny sized batteries.

There are also wireless sensors exploited in applications that use a fixed assessment, wired power source and do not use batteries as power source. In an exterior environment where the power source is batteries, wireless sensors are positioned in an area of interest that is to be monitored, any in a random or known fashion. The sensors self-organize themselves into a network using any clustering mechanisms, thereby proficiently grouping the sensor nodes to supervise the area for gas measurement, moisture levels in air and transmit the data to a central node called as cluster head (CH), which in turn periodically onward the aggregated data to the tenuously located base station (BS). The nodes may be the identical as the other detection nodes or because of its augmented requirements or may be a more sophisticated sensor node with bigger power can be used. The most pro of wireless sensors is that they may be implemented in an environment for extended time period, incessantly detecting the environment without the need for human interaction or action. If a centralized clustering method is used, the operation becomes immobile with unchanging design, leading to reduced scalability [2-11]. When a distributed clustering technique is employed, the CH can be rotated periodically, thereby the life span of the wireless sensor nodes can be prolonged with added scalability (Boselin S.R., et al.,). This investigation discusses a quantity of chief issues when a distributed clustering mechanism is used for real world environmental monitoring application.

II. RELATED WORKS

Many researchers observed that, the greenhouse technology is well accepted in agriculture engineering. The integration of wireless sensor network in green house is the recent concept which leads to precision agriculture. Blackmore et al. in 1994 [2], explained that, the system can be designed to increase the quality agricultural yield by, properly monitoring soil and environment. They also observed that, in early stage of WSN, farmers were reluctant to deploy it, because of high cost. Technological development has reduced the cost. In addition to MEMS technology for hardware,

some other technologies like, satellite sensing, Remote Sensing, Global Positioning System and Geographical Information System are also contributing in overall progress [3]. Beckwith et al. had worked on WSN in large scale vineyard on very large scale design and deployment [4]. They work on 65 motes, which have only eight hops, to collect the data of pH values. Predesigned crop management in precision agriculture is studied in the Lofar Agro project, in Europe. In this project, Proper application of pesticides and fertilizer as per real time environmental changes is explored. For effective control of crop diseases like phytophthora, the information collected from a weather station and the wireless network is very much useful [5].

There are complementary types of technologies such as a GPS system, which can be added to perk up their performance. There is an imperative system for forest fire detection based on satellite imagery, which studies the images taken from satellites. But, weather conditions are greater important problem in these systems. Clouds and rain soak up parts of the frequency spectrum and lessens spectral resolution of satellite imagery. So, the performance of this arrangement changes very much. Satellites can keep an eye on a large area, but the resolution of satellite images are near to the ground [12-21]. A fire is detected when it has grown-up quite a lot, so real time detection cannot be provided. Moreover, these systems are very costly. The system presents numerous advantages: automatic action, consistent data superiority, cost-effective use and rapid response but not in real-time. A novel system called Fire sensor sock, to defend every sensor node of a wireless sensor network in order to keep away from these devices being damaged or destroyed when they are sending the data, detecting or controlling a fire has been anticipated. Fire sensor sock is an extraordinary protection dedicated to the thermal insulation of sensors that leave undamaged their ability to sense thermal data. Thus, the purpose of this work is to have a wireless sensor network that is intelligent to resist being burnt. The sensors will keep on transmitting data flow to the final user.

Besides, a WSN protected with Fire sensor sock is capable of sensing thermal information in the open air. They are able to spot a fire and track the fire spread during its spatial and temporal evolution. Nowadays, wireless sensor networks are widely used to watch, detect a fire and there is a fair quantity of literature on it. An example is the Fire Bug system. A system based on a wireless sensor network for forest fire monitoring has been planned with MICA motes using GPS attached to it. Its purpose is to assemble environment parameters like temperature, relative humidity and the barometric pressure whilst there is an active fire. Motes correspond with base station and information is amassed in a

database server. Thus to have admittance to this server, a net browser based on a web significance which is able to communicate with the database server is required. This design uses the Crossbow sensor mote and the Tiny OS programmed in the nesC language. This software is solely built up for embedded devices. The provisions that have to be well thought-out for such sort of network, together with liability of firefighters, smart scheduling and resource allotment, web services and incorporation. To fulfill these requirements,

Fire Net has been projected. It is a wireless sensor network structural design where sensors are sprinkled in vehicles, figuring a self-organized heterogeneous network with the fire fighters. Fire Net design is considered to be tremendously supportive for fire rescue process. The Forest Fires Surveillance System (FFSS) was developed after that. If a fire is noticed, FFSS automatically turns on an alarm to assist a hasty extinguishing of the spreading fire. In this piece of work, the nodes employ TinyOS as the operating system. In adding up, the WSN exercise a minimum cost path forwarding (MCF) to hurl their information to the sink node. One more characteristics analyzed is the quantity of measurements taken from varied sensors to reduce error estimation.

A distributed algorithm is in use to resolve this sort of problem. The purpose of FireWxNet is to decide the behavior of fire rather than its detection. It contains a WSN that functions as a gauge to monitor weather conditions around an active fire. Webcams are employed to acquire visual data of burned area and the base station which is capable of providing lengthy distance communication. For each predetermined time period, the arrangement measures environmental temperature, relative humidity, wind speed and its direction. In contrast, cameras present images constantly regarding the current state of the vigorous fire. The arrangement uses lengthy distance wireless communication links, sensor networks and few web-cameras. The outcome of the arrangement is found to be exceptionally first-class and they reveal that it is exceedingly supportive to investigate the fire behavior. Military applications are incredibly and intimately related to the perception of the sensor networks (Rajaravivarma,V., et al.,). In reality, it is exceptionally rigid to speak for definite whether motes were developed because of military and defense needs or whether they were invented autonomously and were subsequently useful to armed forces.
Concerning armed applications, the province of concentration extents from information collection, normally to opponent tracking (Hao,J., et al.,) or battleground surveillance. For instance, mines might be regarded as dangerous and obsolete in the future and

may be replaced by thousands of separated motes that will sense an intrusion of defensive units. Outdoor monitoring is another celestial area for applications of wireless sensors networks. one of the fabulous examples is the exploitation of wireless sensor nodes on an Island. This wireless sensor network was used for habitat observation (Dardari,D., et al.,). The sensor nodes that were employed were talented to sense and monitor the temperature, barometric pressure and humidity. Additionally, passive infrared sensors and photo resistors were engaged at a moderate level. The traditional arrangement was employed to effectively monitor the natural background of a bird and its behavior according to the changes in relative climatic conditions. For such reason, a quantity of wireless sensor motes were installed inside birds burrows to speck out the bird's presence while the rest were set out in the close by location areas.

The data sensed by various motes are aggregated by the utilization of sensor nodes and are conceded to the monitoring station through the gateway. Management of precious assets like utensils, equipments and diverse types of products can be a quandary (Boselin S.R., et al.,). Owing to this reason, the dilemma is highly distributed, as these corporations expand to the edge of the globe. One emerging gifted way to realize the tracking of asset and deal with this problem is believed to be with the use of wireless sensor networks. The appliance of sensor nodes in petroleum bunks and chemical warehouses refers to warehouses and storage management of containers or barrels.

The design is that sensor motes attached to large barrels will be intelligent to locate nearby located objects, detecting their content inside and alerting when inaptness happens with their own and aging effects. Health care system can also yield from the use of wireless sensor nodes with the patients. Emerging applications in this category include tele monitoring human physiological statistics, monitoring of the patients within a hospital, monitoring drug administrator in hospitals, etc. (Lee, D.S., et al.,). In case of smart sensors, retina prosthesis chip constituting of hundreds of sensors are set within the human eye. This allows the patients with inadequate vision to see at a relative ample level. Cognitive disorders which might probably lead to Alzheimer's can be monitored and very well controlled at their premature stages with the aid of wireless sensors. Robotic applications previously implemented are the unearthing of level sets of scalar fields using mobile sensor networks and imitation of the task of bacteria for seeking and discovering dissipative gradient sources.

The tracking of a light source is complete with some of

the basic algorithms. In addition, a reply to the coverage problem by robots and motes is accomplished for thick measurements over a broad area. The association of both static and mobile networks is accomplished with the aid of mobile robots, which travel around the environment and arrange motes that act as beacons. The beacons help the robots to portray the directions. The mobile robots can act upon as gateways into wireless sensor networks. Examples of such tasks are: supporting the energy resources of the wireless sensor network indefinitely, configuring the hardware, detecting sensor collapse and apt deployment for connectivity in the midst of nodes. Landslide discovery employs distributed sensor scheme for predicting the occurrence of the landslides in hilly areas. The idea of predicting the hilly-area landslides by means of wireless sensor networks arose out of a must to alleviate the destruction caused by landslides to individual lives and to the railway networks.

A fusion of practices from terrain sciences, signal processing, distributed systems and fault tolerance is employed. A solitary peculiarity of these type of systems is that it joins a quantity of distributed systems techniques and technologies to pact with the complexities of a distributed wireless sensor network environment where connectivity is underprivileged and power budgets are extremely unnatural, while rewarding real world necessities of safety and fortification. Normally these methods make use of a collection of single-axis strain gauges united to contemptible nodes each one with unique processor, battery and exclusive wireless transceiver block. Forest fires, also recognized as wild fires are wild fires happening in wild areas and cause chief damage to human resources (Cerpa, A., et al.,).

These forest fires washes out forests and might consequence in soaring human demise toll nearer to urban regions. Some regular causes of forest fires comprise of lightning, human carelessness and seepage of fuel to great heat. It is acknowledged that in a miniature number of cases fires are components of the forest ecosystem and they are remarkable to the life cycle of local habitats (Edoardo Biagioni., et al.). ensor-Clouds can be used for fitness monitoring by using a quantity of simply obtainable and most frequently wearable sensors like accelerometer and temperature sensors, so forth to fetch together patient's health-related information for tracking sleep action pattern, human body temperature and other respiratory situations.

III. GREENHOUSE ISSUES

The Greenhouse Environment: A recent greenhouse can consist of several parts which include their own local climate settings (Zhang Qian., et al.). Hence, quite a group of measurement points are also enviable. This smart environment is necessarily demanding both for the wireless sensor node electronics and for the short-range wireless network in which communication range is to a vast extent longer in wide areas [22-27].

Sensors: Speedy response time, relative humidity and temperature, the sensor forms an ideal solution for greenhouse environment. Smart communication between the sensors is analogous to IIC interface. Patchy output signal is properly handled by a filter to obtain accurate luminosity values. CO_2 measurement and processing takes quite longer time than other measurements and these sensor voltage supply must be within a fewer voltage levels. The CO_2 estimation can be examined from the corresponding output voltage levels. The operational amplifier raises the voltage level or generally increases the amplitude of the frail signal from the wireless sensor.

Greenhouses: A greenhouse is an array covering the ground frequently used for expansion and development of plants that will revisit the owner's assets (Jong-Won Kwon., et al.,). This arrangement is basically mounted with the belief of defending the crop and allowing an improved environment for its progress. This guard is much adequate to guarantee a superior quality in the production in some cases. But, when the foremost intention is to achieve an improved control on the horticulture expansion, it is indispensable to manage the variables that sway the growth of a culture. The function of a greenhouse is generally to supply a more auspicious environment than the outside environment. Contrasting to what happens in the traditional agriculture, where crop yield depends on natural world resources such as climate and soil, whereas a greenhouse should promise better production independently of climatic factors. It is very important to examine that even a greenhouse protects crop from exterior factors, it may reasons to several problems such as fungus and extreme humidity conditions. As a result, the mechanisms to detect and control a greenhouse atmosphere are awfully significant for attaining improved productivity. To achieve first-rate productivity, a superior control method is important and thus the production costs also gets abridged. The central elements involved in a greenhouse control system are temperature, humidity, concentration of carbon dioxide, light radiation, water availability and minerals.

Temperature: Temperature is one of the most significant factors to be monitored because it is unswervingly related to the plant growth. Intended for all plants, there is a minimum temperature assortment considered to be perfect and to most plants this range is comparatively varying around 30ºC. Amongst these

temperature parameters of to be controlled are essential the extreme, maximum, minimum temperature and tolerably the difference between these temperatures.

Water and humidity: An additional imperative aspect in greenhouses is water. The assimilation of water by plants is associated with radiation. The nonappearance or low level of water influences growth and photosynthesis. Besides this, air and ground humidity also adjust the development of plants. The air humidity is correlated with transpiration, while the ground humidity is interrelated to water absorption and photosynthesis. An environment with extreme humidity decreases plants transpiration thereby reducing the growth and may endorse the proliferation of fungus. On the other hand, low humidity level environments might cause dehydration of the plants.

Radiation: Radiation is an influential element in greenhouse production and sunlight is the most important source of radiation. It is an indispensable constituent to photosynthesis and for carbon fixing. The important radiation features are concentration and duration. The radiation intensity is allied to plant growth and the duration is unswervingly connected to its metabolism.

CO_2 concentration: CO_2 is important because it is an indispensable nutrient for plant development, allowing the assimilation of carbon. The carbon retaining process occurs throughout the photosynthesis, when plants take away CO_2 from the environment. Throughout the photosynthesis, the plant uses carbon and radiation to create carbohydrate, whose role is to permit the plant growth. Therefore, an enriched air environment should add to the plant growth, but it is important to note that an unwarranted carbon level may turn the environment poisonous.

Sensor node functionality: Design of sensor node consist of four fundamental functionalities a) Signal conditioning: The time gap between quantity of gas concentration deposited on the sensing plates and the time required to clear the gas concentration on the sensing plates. b) Sense the changes in air: Sensors are used to sense the changes in gas concentration of different pollutants such as carbon monoxide, carbon dioxide and sulphur concentration in air. As the output of the sensors are analog, the signal strength and correctness need to assured. c) Signal amplification: The signal detected by the sensors are in need to be amplified and regenerated to boost the accuracy of the systems. d) Signal calibration: ADC provides the mapping between analog input signals to digital signals for processing. The integrated ADC in the microcontroller unit is used to renovate the analog signal to the corresponding digital values.

Radio design and number of devices needed: In order to plan the wireless sensor network, the signal loss during its path in a rural or forest environment has to be considered to the highest degree. The major parameter to be considered here is the coverage. How far the Wireless IP camera and the wireless sensor could be from the access point to accept enough signal power has to be cautiously analyzed before real world implementation.

Hardware deployment: A router can be used as the core controller. It is an embedded system that has a wireless IEEE 802.11 b interface, a Fast Ethernet interface in its board and so it meets the requisites. In addition, a router offers internally general purpose input/output (GPIO), UART (JP2) and ETAJ (JP1) ports. A few extensions can be made to the router by using these ports.

Wireless IP camera: The wireless cameras chosen transmit MPEG-4 standard video compression, which has superior compression and excellence compared to other standards. It also consumes little bandwidth. MPEG-4 is frequently used in video streaming over IP environments. The video is streamed by means of the HTTP protocol with very good quality results. Chosen cameras must be talented to transmit in both directions.

Photovoltaic system: The photovoltaic system is fashioned by a photovoltaic panel, battery, load regulator and an inverter. There are several basic types of photovoltaic panels, all of them employ silicon: mono crystalline cells, polycrystalline cells and amorphous cells. Polycrystalline cells are preferably used because they have superior performance than the amorphous cells and they are cheaper than the mono crystalline cells. There are various types of batteries that can be used in a photovoltaic system like VRLA battery and AGM battery.

System design and operation mode: The wireless sensors is usually placed in various critical points with supplementary risk. Both the sensors and cameras are beneath the coverage area of the access points. The mode of operation is as follows. All cameras are recorded with the corresponding coordinates where they have to budge and focus for each sensor placed in their visual coverage. The server has a database with the location of the sensors and the name of the cameras placed in the rural area close to every sensor. When a sensor detects a fire, it sends an alarm unswervingly to the server. This alarm message generally has the name of the wireless sensor. Whenever the server gets this message, it searches in its database the neighboring wireless cameras to that sensor and sends them a message with the name of the sensor that has sent the

alarm and the location they must move to in order to look at the image of that zone. Finally, the cameras shift their objective to the coordinates of the sensor and the fire fighter can corroborate if there is a fire occurrence or not.

User interface: A web page that shows the video streams received from numerous wireless cameras in real time has to be developed. Images are revealed without jumps and there is no any quality reduction in these images. The iris lens should be kept erratic to attain an enhanced visualization. All the cameras can be accessed separately and their control is independent, so users or the fire fighter gets access to the camera and administer it without any trouble.

IV. CONCLUSION

This technology can also be useful in breeding of confined animals in precision zoo, where the sensor nodes should propel information about the fauna. To manage and check the environmental factors the wireless sensors and actuators are indispensable. For a WSN to make distributed measure, dispersal of sensors all over the greenhouse using distributed clustering has been done. This paper reveals some solemn issues when a wireless sensor network is uncovered to real world environment to check and control parameters like temperature, humidity, smoke, CO_2, light and greenhouse gases and how distributed clustering mechanisms can be integrated within this monitoring procedure.

References

[1] Boer De, M. 1998. Facing the air pollution agenda for the 21st century. Air pollution in the 21st century- Priority Issues & Policy. Elsevier Science B.V. 3-8

[2] Cerpa, A., Elson, J., Estrin, D., Girod, L., Hamilton, M., Zhao, J. 2001. Habitat monitoring: application driver for wireless communications technology. Proceedings of the ACM SIGCOMM Workshop on Data Communications in Latin America and the Caribbean

[3] Dardari,D., Conti,A., Buratti,C, Verdone,R. 2007. Mathematical evaluation of environmental monitoring estimation error through energy-efficient wireless sensor networks. IEEE Transactions on Mobile Computing. 6: 790-803

[4] Guo, L, Xie, Y, Yang, C & Jing, Z 2010, 'Improvement on LEACH by combining adaptive cluster head election and two-hop transmission', Proceedings of the 9th International Conference on Machine Learning and Cybernetics, pp. 11-14.

[5] Hamid Ali Abed Al-Asadi, "Energy Efficient Hierarchical Clustering Mechanism for Wireless Sensor Network Fields", International Journal of Computer Applications, Vol. 153, Issue 8, PP 42-46, 2016.

[6] Boselin Prabhu S.R. and Sophia S., 'A review of energy efficient clustering algorithm for connecting wireless sensor network fields', International Journal of Engineering Research and Technology, 2(4), 2013.

[7] Boselin Prabhu S.R. and Sophia S., 'Real-world applications of distributed clustering mechanism in dense wireless sensor networks', International Journal of Computing Communications and Networking, 2(4), 2013.

[8] Hamid Ali Abed Al-Asadi, "Analytical analysis of second-order Stokes wave in Brillouin ring fiber laser,", Optics.
Express, Vol. 19, No. 25, pp. 25741- 25748.

[9] Hamid Ali Abed Al-Asadi, "Simplifying Handwritten Characters Recognition Using a Particle Swarm Optimization
Approach," EUROPEAN ACADEMIC RESEARCH, Vol
1,pp. 535- 552, Issue(5), 5 Aug.2013.

[10] Boselin Prabhu S. R. and Balakumar N., "Evaluation of Quality in Network and Interoperable Connectivity between IP
Networks", International Journal of Current Engineering and
Scientific Research, Volume 3, Issue 9, pp. 81-85.

[11] Boselin Prabhu S.R. and Sophia S., "Bio-Medical Application of Wireless Power Transmission System",
International Journal of Research and Engineering, Volume 3, Number 7, July 2016.

[12] Hamid Ali Abed Al-Asadi, "Effects of pump recycling technique on stimulated Brillouin scattering threshold: A theoretical model," Optics. Express, Vol. 18, No. 21, pp.
22339-22347.

[13] Hamid Ali Abed Al-Asadi, "Fuzzy model for evaluation of selected Diabetes Medical Sites", IJRDO-Journal of Computer Science Engineering, Vol. 2 Issue 1, January 2016.

[14] Boselin Prabhu S.R. and Sophia S., 'Evaluation of clustering parameters in WSN fields using distributed zone-based approach', ASTM Journal of Testing and Evaluation,
43(6), 2015.

[15] Boselin Prabhu S. R. and Gajendran E., "An

Investigation on Enlightening Performance in an Overburdened Highway
System by Integrating Roadside Technologies", International
Journal of Advances in Engineering Research (IJAER), Vol. No. 12, Issue No. V, November 2016, pp. 06-15.

[16] Hamid Ali Abed Al-Asadi, "Particle swarm optimization on threshold exponential gain of stimulated Brillouin scattering in single mode fibers," Optics. Express, Vol. 19,
No. 3, pp. 1842-1853.

[17] Hamid Ali Abed Al-Asadi, "Brillouin Linewidth Characterization in Single Mode Large Effective Area Fiber through the Co-Pumped Technique," International Journal of
Electronics, Computer and Communications Technologies (IJECCT), Vol. 1(1), pp. 16-20.

[18] Boselin Prabhu S. R. and Balakumar N., "Methodology for Improving Security Issues and Reducing Vulnerability in Microprocessors", International Journal of Advances in
Agricultural Science and Technology, Vol.3, Issue.6, November- 2016, pp. 60-65.

[19] 1. Boselin Prabhu S. R. and Balakumar N., "Smart
Antenna and RFID Technology Enabled Wireless Charger for Mobile Phone Batteries", International Journal of Current
Engineering and Scientific Research, Vol. 3, Issue. 12, December 2016, pp. 66-70.

[20] Hamid Ali Abed Al-Asadi, "Object Recognition Using Artificial Fish Swarm Algorithm on Fourier Descriptors", American Journal of Engineering, Technology and Society; Volume 2, Issue 5: pp. 105-110, 2015.

[21] Boselin Prabhu S. R., "Reliable Security Approach for Wireless Embedded Systems", International Journal of
Emerging Technology and Innovative Engineering, Vol. 2, Issue 11, November 2016, pp. 402-406.

[22] Boselin Prabhu S. R., and Pradeep M., "Implementation of Voice Recognition Wireless Home Automation System with Zigbee", International Journal of Research in Electrical
Engineering, Vol. 3, Issue 4, December 2016, pp. 54-58.
[23] Hamid Ali Abed Al-Asadi, "A Hybrid Model of MFCC/MSFLA for Speaker Recognition, American Journal of Computer Science and Engineering, Vol. 2, No. 5. Pp: 32-37, 2015.

[24] Hamid Ali Abed Al-Asadi , "Analytical study of nonlinear phase shift through stimulated Brillouin scattering in single mode fibre with pump power recycling technique,",
 Volume 13 Number 10, Journal of Optics..

[25] Boselin Prabhu S. R. and Balakumar N., "Enhanced
Clustering Methodology for Lifetime Maximization in Dense
WSN Fields", International Journal for Technological
Research in Engineering, Volume 4, Issue 2, pp.343-348, October-2016.

[26] Boselin Prabhu S.R. and Sophia S., 'Real-world applications of distributed clustering mechanism in dense wireless sensor networks', International Journal of Computing
Communications and Networking, 2(4), 2013.

[27] Haitao, Z, Shiwei, Z &Wenshao, B 2014, 'A clustering routing protocol for energy balance of wireless sensor network based on simulated annealing and genetic algorithm',
International Journal of Hybrid Information Technology, vol. 7, no. 2, pp. 71-82.