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Research paper

Detection of Genetic Replica Robots Using Wireless Sensor Networks.

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Abstract

The collaboration between wireless sensor networks and the distributed robotics has prompted the making of mobile sensor networks. It is also a key enabler for a range of advanced hybrid applications, such as environmental monitoring and Ambient Assisted Living (AAL). We also refer this work to be a robotic wireless sensor networks. The reduction in costs of mobile sensor networks and their expanding capacities makes mobile sensor networks conceivable and useful. Today, many types of research are focused on the making of mobile wireless sensor networks due to their favorable advantage and applications. By using this strategy we focus on detecting the genetic (clone) robots in a cluster of robots which passes the intercepted and fabricated messages to the other robots. A novel algorithm called Snow Ball Endurance Algorithm (SBEA) has been proposed here to detect the cloned robots in a cluster of robots. Also, this paper focuses on Mobile Wireless Sensor Networks (MWSN) and robotics which plays a crucial role if it integrated with static nodes to become a Mobile Robot, which can enhance the capabilities, and enables their new applications. Finally the algorithm has been implemented with a cluster of robots and the simulated results have been given out.

Keywords: *AAL, Genetic replica robots, mobile robots, Snow Ball Endurance Algorithm.*

1. Introduction

Wireless Sensor Networks (WSN), has a relay node (R) to establish the connection between Gateway 'G' and sensors 'S'. This connection can often be called as mesh network in Wireless Sensor Networks (WSN). This connection exposes the system based application to the real world through 'Relay' node. On the other hand wireless Multi-Hop Network (WMHN) are the combination of WSN & Mobile Sensor Networks (MSN), with smaller sensing devices which have communication among themselves by monitoring environmental and physical conditions. MSN is another concept which is used to sense the environmental and physical conditions in movable manner. By doing so, this can cover a vast area than the WSN in low installation and computational cost. This technology can be considered in manufacturing process, marketing, pointing natural hazards, dangerous environment etc., This MWSN can also behave like human beings in all the above specified field, with low efficiency.

To improve the efficiency of this technology, it can be combined with robotic technology. So that, both physical and logical slog can be resembles like humans. Navigation and localization are the issues in current system, which can be monitored using this MWSN.

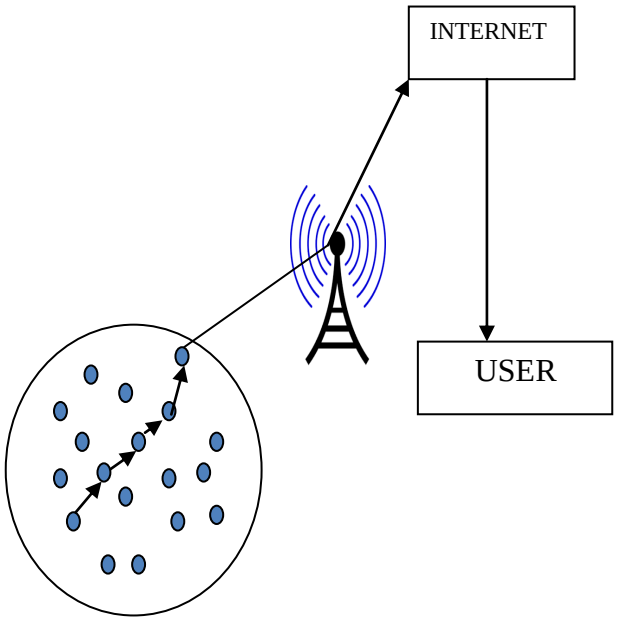

Fig 1: MHWSN architecture

When MWSN combined with robotics it can be called as Mobile Robots (MR). It carries the sensor found in him around the geographical area to collect the details around the atmosphere by sensing. MR or MWSN can otherwise be called as rescue sensor, search sensor (or) environmental monitoring sensor networks. Fig 1. refers the architecture of MHWSN

A sensor node, also known as a mote is a node in a sensor network that is capable of performing some processing, gathering sensory information and communicating with other connected nodes in the network. A mote is a node but a node is not always a mote.

Although wireless sensor nodes have existed for decades and used for applications as diverse as earthquake measurements to warfare, the modern development of small sensor nodes dates back to the 1998 Smart dust project[1] and the NASA Sensor Webs Project[2]. Fig 2. refers the architecture of sensor nodes. One of the objectives of the Smart dust project was to create autonomous sensing and communication within a cubic millimeter of space. Though this project ended early on, it led to many more research projects. They include major research centres in Berkeley NEST[3] and CENS.[4] The researchers involved in these projects coined the term *mote* to refer to a sensor node. The equivalent term in the NASA Sensor Webs Project for a physical sensor node is *pod*, although the sensor node in a Sensor Web can be another Sensor Web itself. Physical sensor nodes have been able to increase their capability in conjunction with Moore's Law. The chip footprint contains more complex and lower powered microcontrollers. Thus, for the same node footprint, more silicon capability can be packed into it. Nowadays, motes focus on providing the longest wireless range (dozens of km), the lowest energy consumption (a few uA) and the easiest development process for the user.

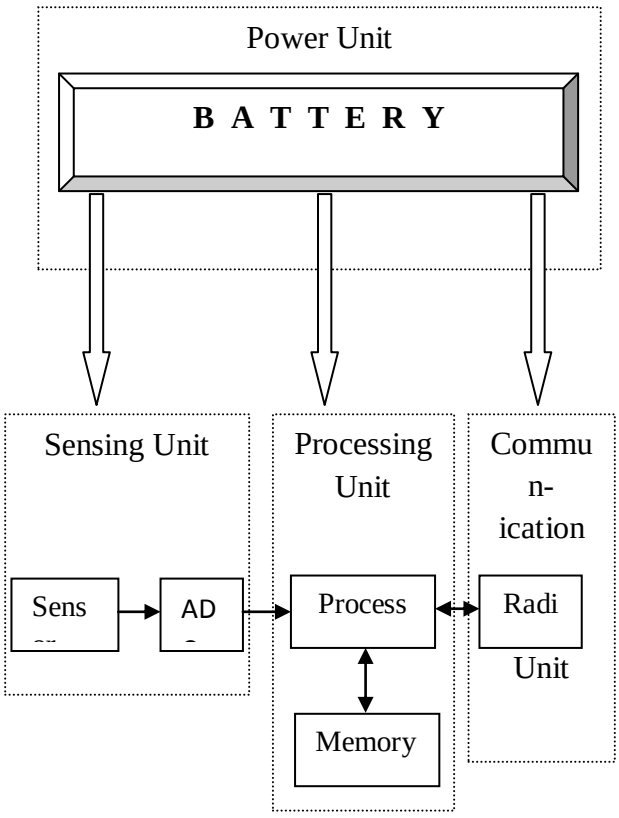

Fig 2: Sensor node architecture.

2. Related Works

A remote system comprising of a substantial number of little sensors. In progressive directing, the whole system is isolated into a few groups. Each group comprises of some source hubs and a bunch head. Sensor hubs, alluded as source hubs, can assemble data from the observing area and send the detecting data to their relating bunch head. The bunch head is chosen from all the sensor hubs in a group as indicated by a few criteria, and is in charge of gathering detecting information from source hubs. Sensors impart data just to group heads and after that the bunch heads convey the amassed data to the handling focus, may spare vitality. In the wake of accepting information from source hubs, the bunch head additionally performs information collection to decrease the information measure before sending information to the sink, which additionally lessens the power exhausted for information exchange [1].

The rest booking plan is additionally consolidated in the convention. The plan is helpful in sparing vitality. Sparing vitality prompts extension of system lifetime. Canny rest planning plan alongside the group of bunch heads convention is a most ideal approach to enhance the vitality proficiency of the system. Enhancing the vitality productivity will at last increment the system lifetime. For correspondence to happens, source and goal is decided for exchanging the information. Figuring of limit esteem is improved the situation separating the accessible hubs. Hubs are then separated according to the computed edge esteem i.e. mean vitality. Appropriately signals are set as 0 and 1. Banner 0 is for rest hubs and banner 1 for dynamic hubs [2].

Trust and notoriety frameworks have a critical part in supporting operation of an extensive variety of appropriated frameworks. A dependability appraisal at any given minute speaks to a total of the conduct of the members up to that minute and must be strong within the sight of different sorts of flaws and vindictive conduct. The principle focus of vindictive assailants are total calculations of trust and notoriety frameworks. WSNs will have the capacity to manage the cost of equipment which can execute more complex information total and trust appraisal calculations [3].

Compressive detecting has seen an expanded premium as of late affability appeal for quick, effective and in-costly flag handling calculations, applications and gadgets the compressive detecting worldview, counts on finding inadequate answers for underdetermined direct frameworks, can recreate the signs CS consolidates the testing and pressure into one stage by measuring least examples that contain greatest data about the flag this wipes out the need to get and store extensive number of tests just to drop a large portion of them in light of their negligible esteem [4].

The group based steering calculation to broaden the lifetime of the systems and to keep up an adjusted vitality utilization of hubs. The grouping plan in a remote sensor arrange empowers a total information of bunch part hubs at the group head and can without much of a stretch give the system adaptability because of hub increment. In each of the many bunches in this system dwells a group head which gathers information from sensor hubs inside its gathering, finishes information collection, and sends them to the sink hub of the system. Such information total can decrease the utilization of hub vitality and the transmission delay when contrasted with multi-bounce directing conventions. The execution of the proposed convention has been inspected and assessed with the NS-2 test system [5].

A productive power sparing plan and relating calculation must be created and planned so as to give sensible vitality utilization and to enhance the system lifetime for remote sensor arrange frameworks. In this article, we propose a grouping calculation to give proficient vitality utilization in such systems. The fundamental thought of this

article is to diminish information transmission separation of sensor hubs in remote sensor arranges by utilizing the uniform group ideas. So as to make a perfect dispersion for sensor hub groups, we ascertain the normal separation between the sensor hubs and consider the leftover vitality for choosing the suitable bunch head hubs. The lifetime of remote sensor systems is reached out by utilizing the uniform bunch area and adjusting the system stacking among the groups [6].

We examine the rest and wakeup approach, keeping in mind the end goal to maintain a strategic distance from the problem area (WLAN) issue, which intends to expand the system lifetime utilizing vitality protection and in addition expanding parcel conveyance proportion (PDR). In this strategy, C-H (group head) has been chosen in view of vitality level and Base-Station remove. Utilizing this method, we can enhance the vitality preservation and PDR up to 63%, when contrast with that of FCA (fluffy bunching calculation) as indicated by their parameters of FND (First Node Dead) and HNA (Half of the Node Alive) parameter for every calculation. Our reenactment comes about demonstrates that the rest and wake-up approach is better and vitality proficient bunching convention in light of their parameters [8].

The collaboration between WSN and the distributed robotics has prompted the making of mobile sensor networks. By introducing mobility to nodes in wireless sensor networks, the capability and flexibility of mobile sensor networks can be enhanced to support multiple mansions, and to address the previously stated issues. The reduction in costs of mobile sensor networks and their expanding capacities makes mobile sensor networks conceivable and useful. Today, many types of research are focused on the making of mobile wireless sensor networks due to their favorable advantage and applications. Allowing the sensors to be mobile will boost the utilization of mobile wireless sensor networks beyond that of static wireless sensor networks. Sensors can be mounted on, or implanted in animals to monitor their movements for examinations, but they can also be deployed in unmanned airborne vehicles for surveillance or environmental mapping. Mobile wireless sensor networks and robotics play a crucial role if it integrated with static nodes to become a Mobile Robot, which can enhance the capabilities, and enables their new applications. Mobile robots provide a means of exploring and interacting with the environment in more dynamic and de-centralised ways. In addition, this new system of networked sensors and robots allowed the development of fresh solutions to classical problems such as localization and navigation beyond that. This article presents an overview of mobile sensor network issues, sensor networks in robotics and the application of robotic sensor networks. [9]

3. Problem Statement and System Model

This paper deals with the networks consist of a collection of mobile sensor nodes that can be moved on their own and can be interacted with the physical environment. The mobile nodes have the ability to compute sense and communicate. The WSN have some of the limitations. Hence we are in the need to move for MWSN.

Limitations of Wireless Sensor Networks

- Possess very little storage capacity – a few hundred kilobytes.
- Possess modest processing power -8MHz.
- Works in short communication range – consumes a lot of power.
- Requires minimal energy – constrains protocols.
- Have batteries with a finite life time.
- Passive devices provide little energy.

The Mobile Wireless Sensor Networks are much more versatile than the static sensor networks. The advantages of MWSN over the static wireless sensor networks include better and improved coverage, better energy efficiency, superior channel capacity, and so on.

This paper also deals with the problem of having the sensors in a static manner. Here the problem is when the sensor are in a static position, it could sense the objects found in a particular environmental limit. Moreover to cover a large distance or maximum coverage area of the environment, a large number of sensors have to be implemented in various geographical limit area. However, all the sensors perform the similar task, increase in the number of sensors leads to the controlling capacity of the system. As there is increase in demand of the artificial intelligence, the sensors play a vital role in the modern world. To avoid these problems, the Wireless Sensor Network can be combined with robotic technology.

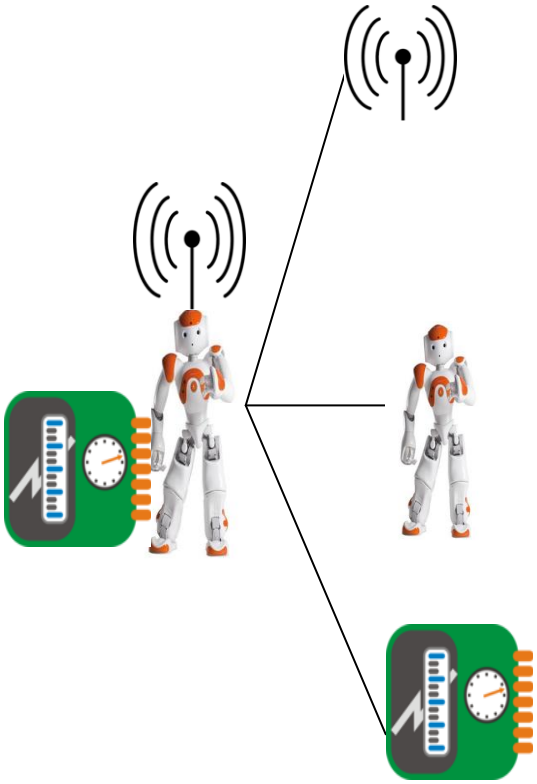

Fig 3: RWSN architecture

Another important technology RUBICON (Robotic UBIquitous Cognitive Network)[10] can be used to combine robotic with WSN. Fig.3 shows the system model for Mobile Robot. This is a MR device, which combines the technology of MHSWN and robotics. We have already know that robots are binded with large number of sensors. But this technology entirely binds the WSN along with the robots. This system requires the following communication requirements:

A. Sensing.
B. Actuation.
C. Data sharing.
D. Messages.
E. Discovery.

A. Sensing:

With a specific end goal to develop and keep up a to-date photo of the condition of the robotic biology and its condition, and to empower coordinated effort between
individuals from the robotic nature (e.g. correspondence of restriction information from the roof camera to the robot), the applications must have the capacity to get information
what's more, occasional notices from each sensor and actuator it wishes for. Keeping in mind the end goal to help unwavering quality, the applications ought to likewise have the capacity to determine the wanted refresh rate and to be educated of the greatest inertness not out of the ordinary by the subsequent updates. The applications must endure the loss of some of these refreshes however all information must be time stamped with a specific end goal to have the capacity to overlook old updates.

B. Actuation:

With a specific end goal to develop and keep up a to-date photo of the condition of the mechanical biology and its condition, and to empower joint effort between the applications must have the capacity to send control guidelines (e.g. new set focuses, new yield values) to each actuator it wishes for. For this compose of transmission, the applications don't require the capacity to convey intermittent updates of control guidelines. Be that as it may, keeping in mind the end goal to help unwavering quality, transmission of control directions ought to be dependable (recognized). What's more, the applications need to be educated of the most extreme expected idleness.

C. Data sharing:

The applications must have the capacity to (non-concurrently) share it sensor information, actuator status and other data among circulated hubs (numerous robots, WSN hubs and different gadgets).

D. Messages:

So as to co-ordinate their activity over appropriated hubs, the applications must have the capacity to send dependable and synchronous control messages to all the hubs it wishes for.

E. Discovery:

The applications require a refreshed picture of every one of the parts accessible in the framework, including all the WSN hubs presently dynamic. Each part ought to have a one of a kind ID and the Control Layer ought to be educated at whatever point any mechanical gadget or WSN hubs join (as they end up agent and interface with the system), or leave the framework (as they get disengaged, breaks, they battery get exhausted or essentially move out.

4. Snow Ball Endurance Algorithm on Mobile Robots

In this section, we are going to combine the mobile robots along with our early work SBEA (i.e) Snow Ball Endurance Algorithm. It is an life time escalation and clone detection algorithm for the robots used in WSN. This algorithm can achieve a high clone detection probability with little or no negative impact on network lifetime and limited requirement of buffer storage capacity. This SBEA is the combination of ERCD protocol and joint-mobility routing algorithm[11]. The ERCD protocol consists of two stages:

Witness selection and
Legitimacy verification.
Optimal hop count routing.
Minimum power over. progress routing.

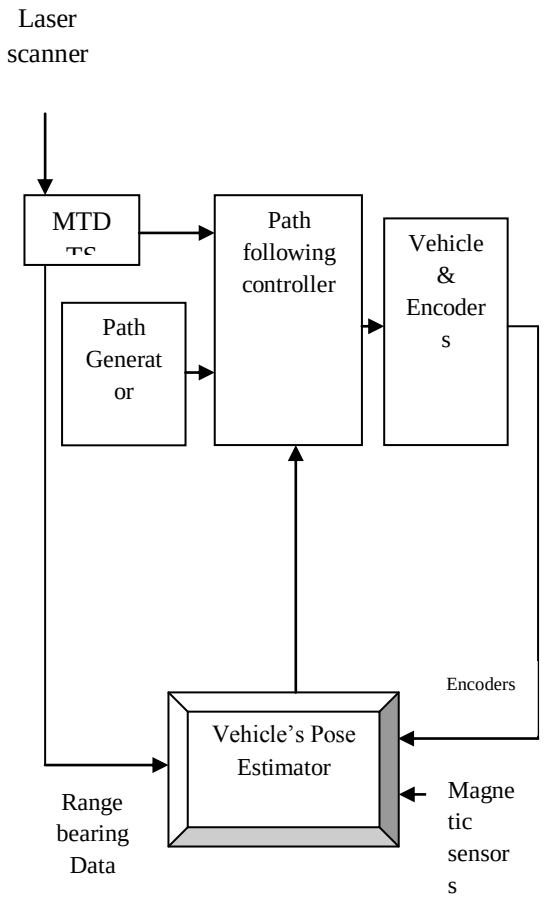

Fig. 4: System model for Mobile Robot

In witness choice, an arbitrary mapping capacity is given to help each source hub which arbitrarily chooses its witnesses. In the authenticity check, a confirmation ask for is sent from the source hub to its witnesses, which contains the private data of the source hub. On the off chance that witnesses get the check messages, every one of the messages will be sent to the witness header for authenticity confirmation, where witness headers are hubs in charge of deciding if the source hub is authenticity or not by contrasting the messages gathered from all witnesses. In the event that the got messages are not the same as existing record or the messages are lapsed, the witness header will report a clone assault to the sink to trigger a disavowal strategy.

In ideal jump check steering, each time the present hub chooses a neighbor hub to advance, with the end goal that separation of the present hub and the neighbor hub is the nearest to the ideal separation. That is, the neighbor that is the closest to the ideal area is chosen. Just neighbors nearer to the goal than the present hub are considered. Course disappointment will be accounted for to the source from the present hub if there does not exist such a neighbor.

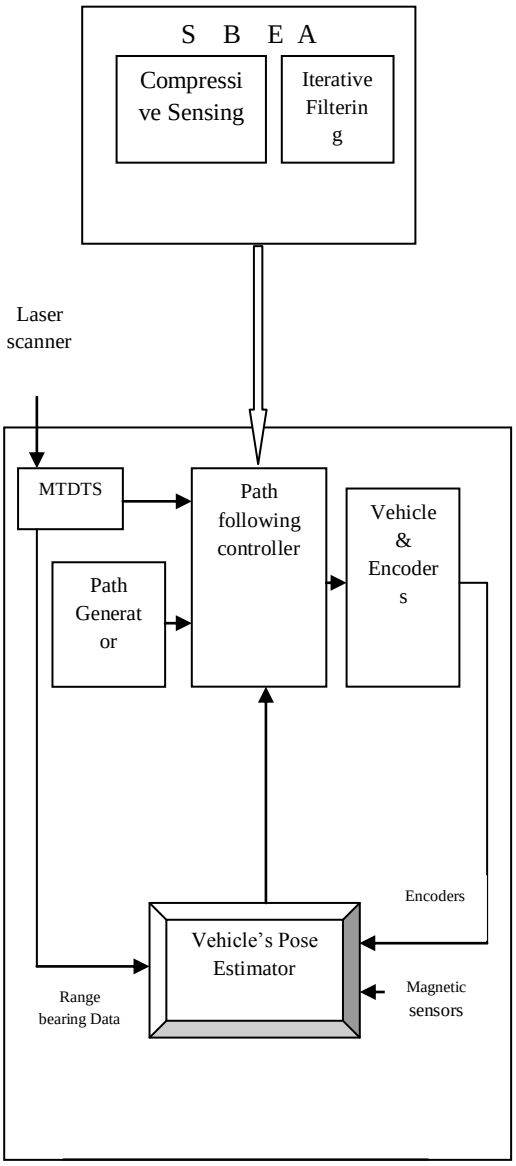

Fig. 5: Architecture for SBEA on MR

In least control over advance directing stage it limits the transmission energy of unit advance in choosing a sending neighbor. The fundamental thought of our second steering calculation is to limit transmission control over advance in each progression. The directing calculation begins at source s. Each time, current hub u on the course does likewise as takes after: If there is no neighbor nearer to the goal than 'u' itself, 'u' reports Route Failure to 's'. Something else, 'u' chooses neighbor hub 'v' which is limited.
Fig. 4 shows the combined architecture of SBEA along with MR. The Compressive Sensing (CS) technique is combined with Iterative Filtering (IF). So, the output or the algorithm obtained from the

SBEA is purely,
Power saver and
Clone detector.

As this SBEA saves the life-time of the sensor, the battery's life-time can be doubled. At the same time it also detects the clone robots found in the cluster of the robots. Hence by combining this technology along with the mobile robots, the genetic replica in the cluster of robots can be easily detected.

5. Conclusion and Future Work

In this paper, we have discussed about the combination of Snow Ball Endurance Algorithm along with the Mobile Robots. This combination is particularly made for the discovery of genetic replication in robots clusters. And also to increase the life time of the sensors used in the robots. Hence it is the added value to the robots. By doing so the cost of the robots can be effective. Also, this paper focused on Mobile Wireless Sensor Networks (MWSN) and robotics which plays a crucial role by integrating it with static nodes. This makes a Mobile Robot, which can enhance the capabilities, and enables their new applications. In future this technology can be implemented in robots with higher capacity.

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