

# A Survey of Military Application of Wireless Sensor Networks For Soldiers

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**Abstract:** *Wireless sensor network with a large number of sensor nodes can be used as an effective tool for gathering data in different ways. Wireless Sensor Networks (WSNs) with small nodes can use for sensing, computation, and wireless communications capabilities. Wireless sensor networks (WSNs) are a relatively new and rapidly developing technology; they have a wide range of applications including environmental monitoring, agriculture, public health and detect, identify and track adjacent hostile targets in military environments. In this paper we propose an application of WSNs in military environments*

**Keywords:** about four key words separated by commas.

## 1. Introduction

Today wireless sensor networks have been used around the world. Smart Sensors significant progress in recent years has emerged. Accountability sensors of sensing, measurement and data collection form environment and transmission of the sensed data to each other or another user. To The sensors are made with respect to the use of these sensors. They will be cheaper than conventional sensors. Wireless sensor networks for many applications such as military applications, detection of climate change, forest fires, flood detection, agriculture, medicine, virtual fencing applications and business have been used [9], [4]. Stewardship and recognition applications in wireless sensor networks (WSNs) are primarily predestinated to discover, recognize and track adjacent adversary targets in military environments [1]. These applications need the high validity in getting the subtle data on the enemy and they continue energy-efficiency to certify the longevity of their mission. Wireless sensor networks (WSNs) contain a large number of small and light-weight sensor nodes that have the valency of collecting effective environmental information such as acoustic, magnetic, temperature and video information. Each of the sensor nodes is equipped with a small operator, limited memory and wireless communication antenna, and is a battery operated device, which makes it very resource constrained. These sensor nodes are also spread around a region of interest to gather their surrounding information from physical worlds [7]. The deployed sensor nodes connect with each other and

transferred the sensed information to a base station, normally referred to as the sink node, over wireless links. The sink node gathers data from all the sensor nodes, and processes these data to generate the information about the activity in the sensed field. Sink nodes also can act as gateways to other networks or access point for human junction [6]. WSNs have diverse applications such as military, civil and health-care, including forest fire detection, inventory control, energy management, stewardship and exploration, and so on [6], [2]. Especially, stewardship and exploration applications are generally used to see the aims (e.g., enemy and intruder) in a battle ground or a hard area where the human method is infeasible. Wireless sensor networks (WSNs) can support a lot of actual world applications (e.g., military, civil, health-care and so on). In military environments, stewardship and exploration applications are needed to discover, recognize and track adjacent hostile aims. These applications have provisions of high validity for getting the subtle information (e.g., the current position of a intruder or vehicle) and energy proficiency to ensure the longevity of their mission. The features of sanity, self-organizing and fault tolerance make sensor networks suitable for military use. Communications is present in almost all aspects of military operations [12], [5]. It is important in the dispensation of orders and ensures distribution of logistical information, intelligence and data from sensors. Military communications, by any means, must be protected in the area and time where needed [5]. Sensors can detect and possibly measure chemical, biological and explosive vapor, as well as

existence of people or objects. We will use the sensor capabilities as one of key determinants of the type of military application of WSNs. In the cases of battle ground, urban warfare and force conservation, the use of WSNs can decrease the dubiety over where the enemy forces will be expanded or what role they will be performing. Wireless sensor networks can be used by the military for a number of goals such as controlling militant activity in distant areas and force protection. Wireless sensor networks (WSNs) can be used by the military for a number of goals such as controlling or tracking the enemies and force protection. Wireless sensor networks will have a role to play for a number of military purposes like enemy movement detection and force tracking. Being equipped with suitable sensors these networks can enable detection of enemy motion, exploration of enemy force and analysis of their movement and improvement. It is likely that the sensor nodes themselves could be hand deployed in advance of an operation. They could be transported to the area of deployment by vehicle. Therefore the physical size and weight of the sensor need not be a major restriction. In occasional instances sensor nodes may be air dropped or deployed through a rocket launcher and would need to be suitably ruggedized. Some networks are only required to operate for course of days, although generally course of one to two months can be seen as a sensible for military sensor networks. Much research has been done in this field, such as [8, 3, 13, 11, 10]. The rest of this paper is organized as follows. In Section II, we briefly review the medicin definitions for performance evaluations. Section III describes the proposed method. Finally, we draw some conclusions in Section IV.

## 2. Medicine

In medicine, one's pulse shows the tangible arterial palpation of the heartbeat by trained fingertips. The pulse may be touched in any place that allows an artery to be compacted against a bone, such as at the neck (carotid artery), on the inside of the elbow (brachial artery), at the wrist (radial artery), at the groin (femoral artery), behind the knee (popliteal artery), near the ankle joint (posterior tibial artery), and on foot (dorsalispedis artery). Pulse (or the count of arterial pulse per minute) is equivalent to measuring the heart rate. The heart rate can also be measured by listening to the heart beat directly (auscultation), traditionally using a stethoscope and counting it

for a minute. The study of the pulse is known as sphygmology. Pressure waves produced by the heart in systole moves the arterial walls. Forward movement of blood happens when the boundaries are flexible and concordant. These properties form enough to create a palpable pressure wave. Feeling the rate of blood flow into the arteries caused by the contraction of the left ventricle, and the point where the artery passes from the bones, felt close to the skin.

### 2.1 Pulse points of the body

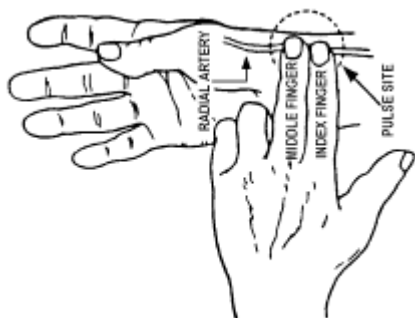
The pulse points of the body are:

1. The radial and radial pulse (RAIDAL PULSE): It is located the outer side of the wrist (the thumb).
2. UlnaPulse (ULNAR PULSE): It is located the inner side of the wrist (pinky).
- 3 Carotid pulse, or neck (CAROTID PULSE): It is located along the outer edge of the trachea in the neck or the jaw.
4. Arm or brachial pulse (BRACHIAL PULSE): It is located between biceps and triceps muscles in the middle and inner elbow.
5. Femoral Pulse (FEMORAL PULSE): Is located in the groin.
6. Popliteal pulse (POPLITEAL PULSE): Is located at the back of the knee. The knees should be bent 120 degree to touch.
7. DorsalisPedis (DORSALIS PEDIS): Is located on the foot and in the middle of the two ankles.
8. (TIBIALIS POSTERIOR PULSE): Is located behind the medial malleolus foot.
9. temporal pulse (TEMPORAL PULSE): Is located on the temples right near the ear.
10. Apical pulse (APICAL PULSE): The same place where doctors are counting heartbeat with a stethoscope.

The radial artery arises from the bifurcation of the brachial artery in the cubital fossa. It runs distally on the anterior part of the forearm. There, it serves as a landmark for the division between the anterior and posterior compartments of the forearm, with the posterior compartment beginning just lateral to the artery.

The artery winds laterally around the wrist, passing through the anatomical snuff box and between the heads of the first dorsal interosseous muscle. It passes anteriorly between the heads of the adductor pollicis, and becomes the deep

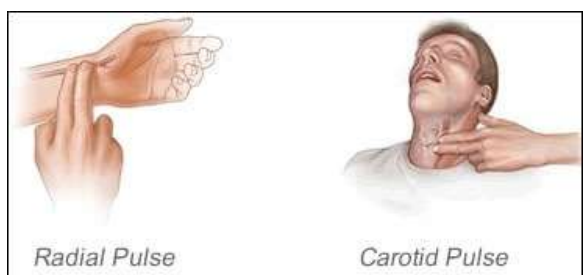
palmar arch, which joins with the deep branch of the ulnar artery. Along its course, it is accompanied by a similarly named vein, the radial vein. (Figure 1)



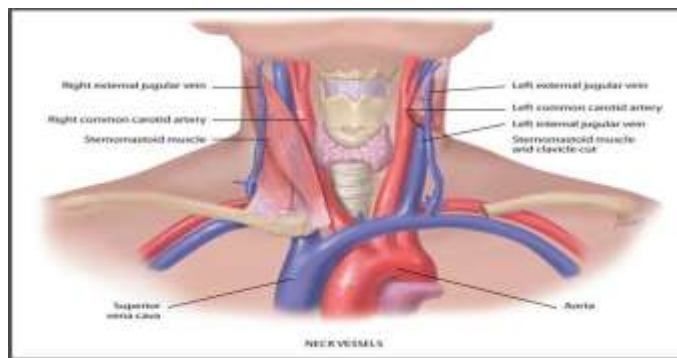
**Figure 1:** Radial Artery

The rate of the pulse is observed and measured by tactile or visual means on the outside of an artery and is recorded as beats per minute or BPM. The pulse may be further indirectly observed under light absorbances of varying wavelengths with assigned and inexpensively reproduced mathematical ratios. Applied capture of variances of light signal from the blood component hemoglobin under oxygenated vs. deoxygenated conditions allows the technology of pulse oximetry.

The carotid pulse is characterized by a smooth, relatively rapid upstroke and a smooth, more gradual downstroke, interrupted only briefly at the pulse peak. These palpable pulsatile changes in the carotid arterial diameter are virtually identical to the intraluminal pressure pulse. (Figure 2). Abnormalities of the carotid pulse may involve an alteration in the amplitude of the pulse peak, a distortion of the upstroke or downstroke, or any combination of these changes. Figure 3 can better show the left and right carotid artery.



**Figure 2:** Radial Pulse and Carotid Pulse



**Figure 3:** Left and right Carotid artery

### 3. The proposed method

The proposed method Imagine in Figure 4, which is part of the battle, 10 allied soldiers are engaged with enemy forces. (Figure 4).

Each of the allied soldiers are equipped with a wireless sensor network. Two sensors are attached to each soldier in the form of a belt. There are sensors in all parts of the belt to feel the soldier's pulse, because if the belt twists the wrist or neck, the pulse survey should be felt without any errors (See Figure 5 and Figure 6).

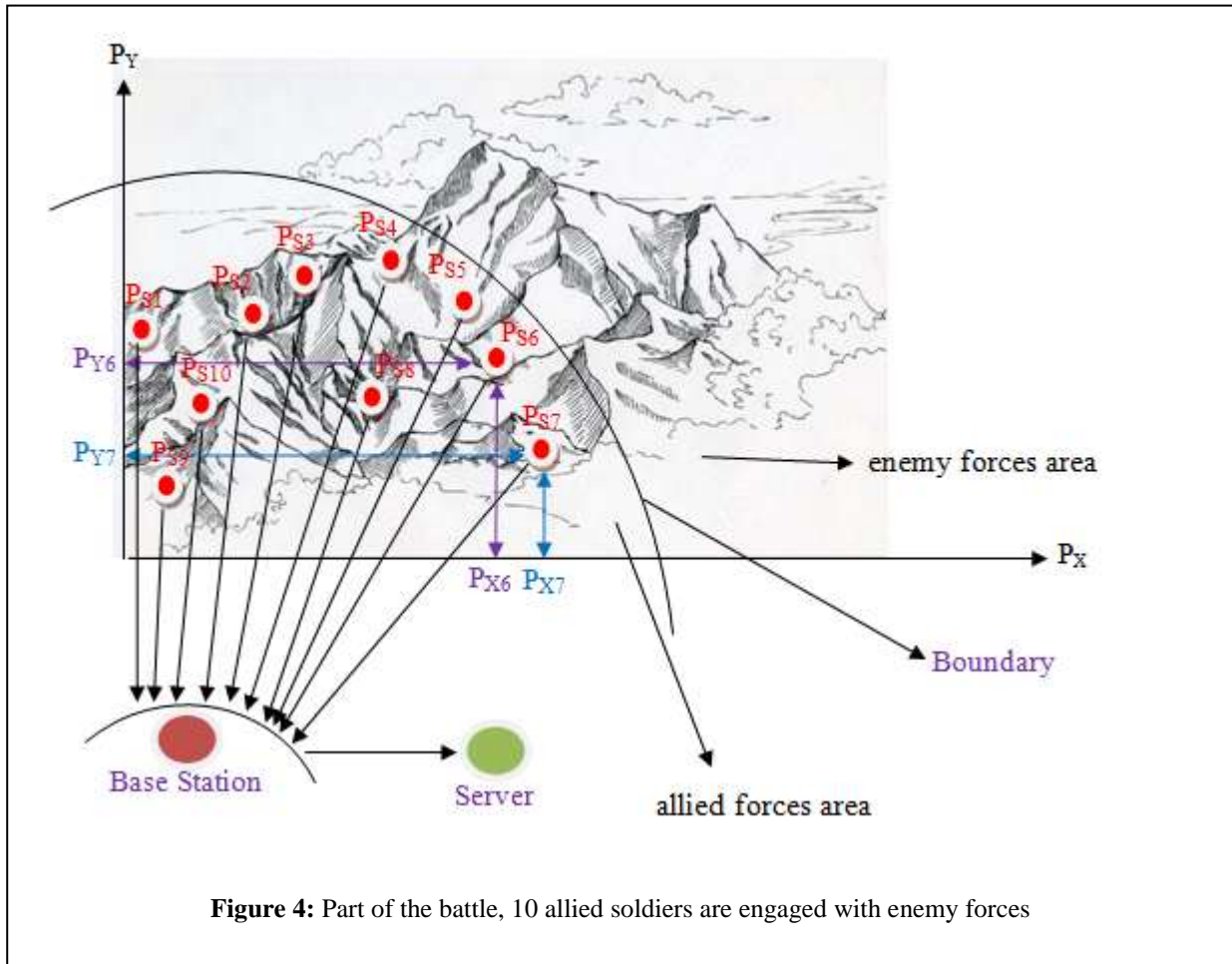
Suppose each of the soldiers in the battlefield wherever they are in the same geographical locations, specific  $P_{\text{Soldier}}$  ( $P_S$ ) soldier is assigned. This point has a latitude and longitude. If these sensors are activated, they can report the latitude and longitude of each soldier to the control room command center. Suppose for two soldiers geographical coordinates is shown by the sensors in Figure 4.



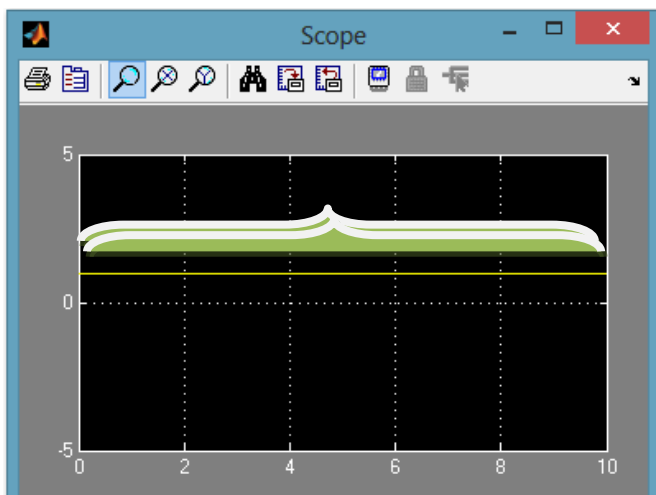
**Figure 5:** The belt to feel the soldier's pulse around soldier's wrist



**Figure 6:** The belt to feel the soldier's pulse around soldier's neck



If these sensors are activated, continuously transmit a waveform to the sink, as shown in Figure 7. (Identified by green color shows soldier is alive).



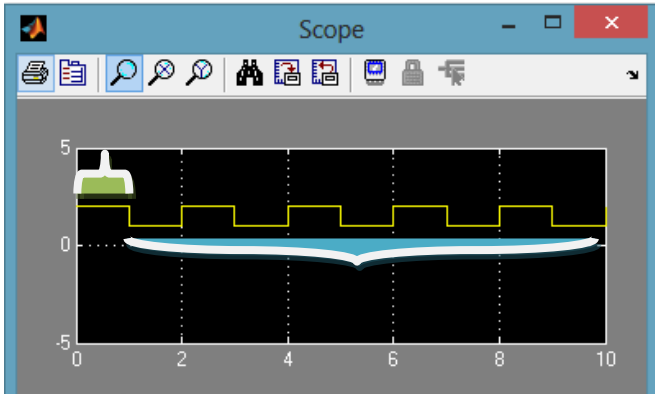
**Figure 7:** Soldier is alive

Then the sink transfers the waveform to the control room command center pass. In the control room command center, the commander can see the message that transmitted from the sink on the screen or on the laptop this message means that the soldier is alive.

With this message the commander could aware the live status of their soldiers at any moment of time and geographical coordinates of the location. If one of the soldiers is wounded (so if does not go away immediately after the shot) can press any key on the sensor on the neck or wrist straps are attached and report his injury to the Central Command.

If the soldier is wounded and press one of the keys on the strap, a wave form as figure 4 would be sent to the sink and would be transferred to the central room.

In the last case and when the soldier was alive (Identified by green color in Figure 8.) the wave form associated with the direct wave. But when soldiers are wounded waveform similar to Figure 8. (Identified by blue color)



**Figure 8:** Alive waveform and wounded waveform

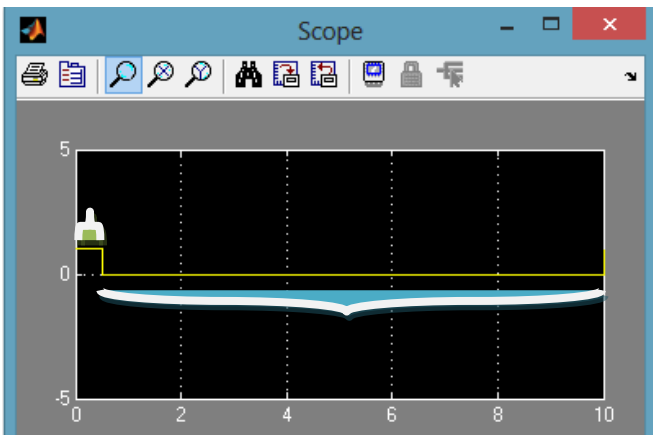
When the commander sees this message, he'd know the numbers of wounded soldiers and would send a team to help them giving their geographical situation and coordinates and to fulfill his duties.

If soldiers destroyed (by shot to sensitive parts of his body) and the beat surveys fails, sensors in active mode, send a waveform similar to Figure 9 to the control room command center.

There are two modes in this situation:

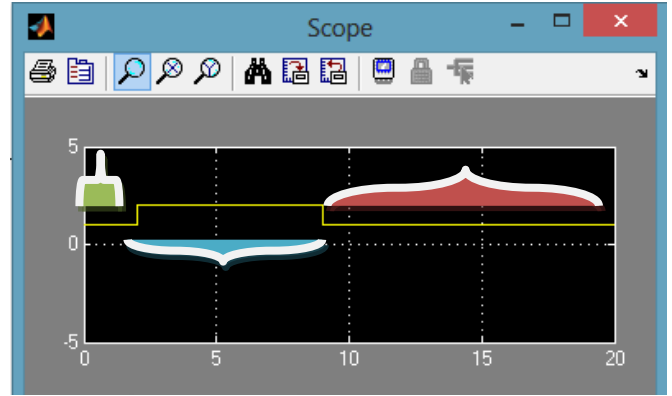
A) The soldier died from being alive. (Figure 9)

(Identified by green color shows soldier is alive and (Identified by blue color shows soldier is dead in Figure 9)



**Figure 9:** The soldier died from being alive

B) the soldier is alive (Identified by green color) and wounded (Identified by blue color), and finally died (Identified by red color). (Figure 10)



**Figure 10:** The soldier is alive and wounded and finally died

However, considering the state of being alive, wounded and died soldiers, the command center could easily become aware of all the soldiers involved in the different scenarios above. In addition, taking into account the geographic coordinates of individual soldiers, the commander can control them all from a distance.

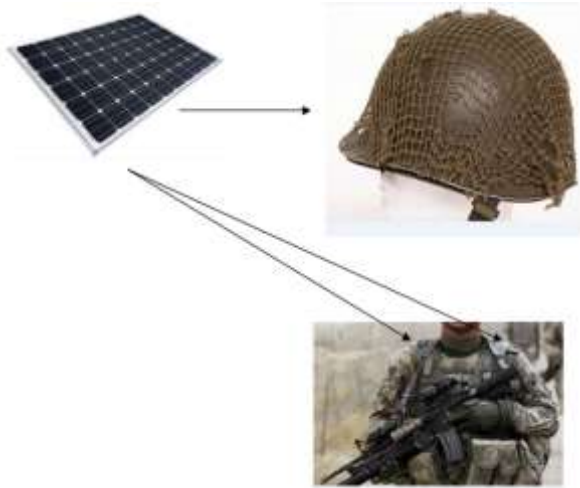
For example, if the commander has 1000 soldiers, is aware of how they can live like this, wounded, dying and geographical coordinates. (Table 1.)

Table 1: Geographical coordinates of soldiers for commander

Total of Soldiers	1000
Number of alive soldiers	686
Number of wounded soldiers	205
Number of dead soldiers	109

As the source energy of the wireless sensor networks is limited, we can use this idea to put solar panels on the iron helmets to save the energy during the day and use it at night and in addition they can use the battery energy.

Because the possibility of a direct hit on the helmet iron soldiers around is less. You can also use solar energy in accordance with the size of the sensors used on the shoulders of soldiers (Figure 11.)



#### 4. Conclusion

In this paper, we have set ourselves the aim of assessing the feasibility of using military tactics to optimise detection operations for WSNs.

The new operational contexts of military engagement have opened view for various applications of WSNs. The capability of a WSN military application depends on the type and capabilities of wireless communications architecture, sensors, appropriate information processing, coverage.

We have presented a application of WSN military applications according to the operation scenario and sensor type for soldiers. We provided a survey of the WSN application classes and considered research and engineering challenges for the next generation of WSNs in military applications.

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