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A real time algorithm for the m2m-smart warrior system

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Abstract- M2M Communication is characterized by involving a myriad number of smart devices sharing information, monitoring and making efficient and intelligent decision without human intervention. Machine to Machine Communication (M2M-SWS) is a new concept of M2M Communication where entire battle field is not only controlled but also monitored by smart sensors. M2M is going to be a market-changing force for a wide variety of real-time monitoring applications, such as E-healthcare, Homes Automation system, Environmental monitoring and industrial automation as it is supporting to a large number of characteristics and achieving better cost efficiency. In this article we reviewed the different prospect of M2M Communication and introduce a new application scenario - M2M smart warrior system (M2M-SWS) [1]. In this paper an efficient sleep algorithms to control over power consumption in proactive way have been proposed. It is basically a probability based prediction algorithm same as our previous algorithm. In the previous TYM algorithm we used soft hand off method to predict the next location and save power instead we used the target prediction algorithm to predict next location of the Target. The proposed algorithm TYM-2 used for target prediction scheme by using Kinematics rule and theory of Probability so that both major issues i.e. Reliability and Energy efficiency should be covered.

Index Terms- M2M Communication, Smart Warrior System, SWS, Internet of Things, TYM-2.

Introduction

M2M communication is characterized by involving a large number of Smart Machines/devices. The difference between Conventional type communication and Machine to Machine Communication is that M2M do not require any kind of human Intervention. There are so many synonyms of M2N are -IOT (Internet of Things), WOT (Web of things), WOO (web of Object). Satellite navigation system can be known as best known example of M2M Communication, which enables to update traffic information to the driver. M2M communication can be utilized more in the field of E-health care, Security system, Home automation, Agriculture, environmental controlling, disaster management can be revolutionized by the emerging M2M communication. Despite of large range of application and tremendous benefits M2M is still in its infancy and faces many technical issues. These technical issues include –Architecture, M2M software, Efficiency, reliability of the devices [2], [3], [4], [5]. In this paper we have proposed a new application of M2M communication and nomenclature as Smart Warrior System (SWS). This paper discusses the architecture of SWS system and the proposed algorithm achieves the energy efficient and reliable platform of Smart Warrior system. Smart warrior system is a concept of M2M application and can be called as army less boarder.

Motivation to work on this area came after observing the country border scenario. We got news from news channels on 6th January 2013, our neighbor country force crossed the demarcation line and violated ceasefire issues. According to Indian Authority on 8th January 2013 their force crossed the Line of Control (LOC) and killed two Indian soldiers. The incident sparked outrage in India and harsh reaction by the Indian army and government over the news that the body of one of the soldiers had been deheded [According to North, Adrew (9 Jan 2013)BBC[2].

In this paper we are going to mark the actual boarder scenario of India. According to some estimation more than thousand of Intruders enter in Indian boarder from outside. These are only responsible for different types of human trafficking, terrorist activity, Smuggling of drugs, fake currency and arms.

According to the report by Indian official, 12 soldiers and civilian were killed during the skirmish across the border of India. This is not a first issue but a chain actually, definitely the official statics may differs from the actual figure, to understand the proper situation let the clear about the all the issues related with boarder area of India.

India’s border run a total of 15,106.70 km [ministry of home affairs (Department of Border Management)] retrieves 2008-01-09. India’s border with Bangladesh runs 4,096 km.India shares 4096 km long land boundaries with Bangladesh which came into existence after India’s partition in 1947.

Seizers made by BSF (Both incoming and outgoing) since 1990 also gives an indication of the extent of smuggling illegal trade on the indo-Bangladesh border. The figure are given below in the table 1. According to Indian officer Mr. Madhav Godbole who headed the task force on Border management has provided the latest estimates-In his report submitted to the Govt. of India in August 2000 approximately 1.5 crore with about 3 lakhs Bangladeshi entering Indian border every year.To monitor the these activity and for stopping the intruder across the border, it is required to monitor border area by some intelligent mode of communication .M2M communication will play a vital role in the field of field warrior system as a future application.

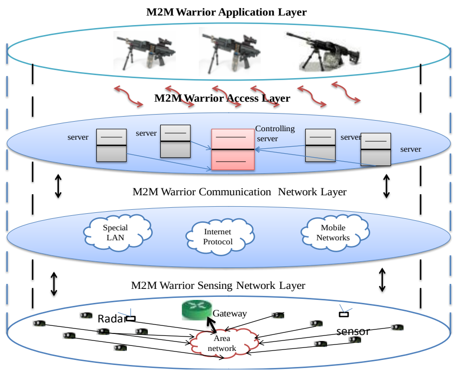

Fig:1. Proposed Architecture of M2M-SWS

Table-1 Seizure Made by BSF (IN INDIA)

Year	Seizures (in rupees)	Year	Seizure (in rupees)
1990	1,01,94,18,280	1997	40,76,60,558
1991	18,89,45,156	1998	34,31,99,127
1992	27,54,33,533	1999	38,33,57,013
1993	31,20,95,210	2000	45,98,66,776
1994	44,22,66,721	2001	55,02,32,426
1995	78,67,31,696	2002	67,88,30,184
1996	44,96,54,193	2003	58,35,6,631
	Total	6,88,12,77,504 (688 crores)	

II. SYSTEM DESIGN

The proposed Architecture for an efficient and reliable Smart Warrior System [6], [7] designed is based on wake up scheduling algorithm protocol. When a M2M node detects the target, it broadcast a wake up message to awaken its neighbor smart nodes.

Our basic aim is to provide an Energy Efficient and reliable environment for the M2M-Samart Warrior system. We divide our algorithm in two parts:

(a) To develop algorithm to achieve an energy efficient system

(b) To develop algorithm to build a reliable system.

We utilize two approaches to increase the energy efficiency during the Active power session [8] of smart M2M nodes:

(a) There should be less number of Active nodes

(b) Schedule their time for sleep pattern.

The above approaches are the key elements of TYM-2 algorithm.TYM-2 is purely based on the prediction of intruder target localization based on two theory of physics i.e theory of Kinematics and Theory of probability.

In our proposed algorithm we have developed a target prediction model on Kinematics rule and theory of probability.

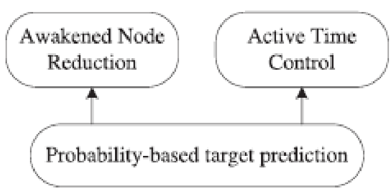

Fig: 2 TYM-2 Design Overview

Both of the above discussed energy reducing approaches element is solely based on result of intrusion prediction. Unlike the existing efforts of the target prediction, in this paper we have taken efforts to develop an Intrusion prediction model for Smart Warrior System based on two specific theory of Physics i.e. Theory of kinematics and theory of Probability.

According to the mentioned assumptions found that there are three components of TYM-2.

a) Intruder localization Prediction

b) Reduction in Number of Active nodes

c) Active node time control

a. Intruder Localization Prediction: based on the strategy of the proposed algorithm the system will predict the physical location of target in advance by two steps:

- The prediction based on Kinematics theory
- The prediction based on Theory of Probability

Based on the overview of the system the physical motion of intruders can be predicted at of particular time in two steps TYM-2.

In two steps:

1. Prediction by theory of Kinematics: To the fulfillment of system requirement with the help of theory of Kinematics, TYM-2 predicts the (vn), ($\overrightarrow{V_{n+1}}$) and ($\overrightarrow{S_{n+1}}$).

Where (vn)- Current Location

($\overrightarrow{V_{n+1}}$)-Predicted Location

and ($\overrightarrow{S_{n+1}}$)-Scalar Displacement

2. Probability based prediction: When the displacement is described with the

$\overrightarrow{S_{n+1}} = (S_{n+1}, \Delta_{n+1})$ Where Δ_{n+1} is the deviation in polar angle.

b. ENERGY EFFICIENCY BY REDUCTION IN ACTIVE NODE

Energy efficiency of TYM-2 is related with the following basic terms

- Awake region of M2M sensor nodes
- Active time of M2M sensor nodes

Awake region of M2Msensor nodes: It is a virtual concept only used for the selection of active sensor nodes, in this region alarm message to be generated and sent to all active node. This is the responsibility of alarm node is to be sent alarm message on detecting a target. In this algorithm we used awake region it is very similar as the cluster based existing algorithm used to control the nodes phenomena and send the alarm message to the sleep node to forward instruction to be wake up (e.g., [10], [9]). The whole work of awake region of M2M sensor nodes is followed by three components i.e Creation of Region, Maintenance of region and Dismissal of region.

The creation is concern about to create awake region .Once smart sensor node detects a target it check their status whether it is in awakened node or in existing awake region .If it found in existing awake region justifies if then by using the election algorithm it broadcast a alarm signal to all the nodes of awake region. If the creation is not acceptable then Dismissal process starts [11].

c. ACTIVE TIME CONTROL- BY ACTIVE NODE TIME CONTROL

Usually there are two ways to improve the energy efficiency of TYM-2 system –by reducing the number of Active M2M nodes [12] and by providing proper schedule of Active and sleep node. We schedule the active nodes by assigning start and end time. The relationship of position of sleep node and the displacement of the intruder during sleep delay is shown in the figure: 2 .From the given figure we can easily understand the process of the alarm node denoted as 0. In this algorithm we make a sleep scheduling decision on the basis of position of node and the predicted location of intruder. The sleep node will have to turn on only when µ. When µ then there is probability of entrance of intruder in the sensing range. When µ then sleep node will be turned as at $t_{alarmed}$ + (d-r- µ)/TS, where we suppose TS = (µ)/TP to be the average speed in the awake region. In both cases, the awakened node needs to keep active until $t_{alarmed}$.

III. Distributed Algorithm

This section, describes the flowchart of TYM-2 through three different procedures.

Procedure-1 is handler for the event detection of target, which can be triggered by an interrupt that is raised on sensing something

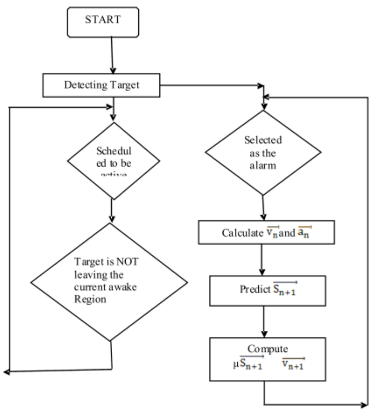

Figure: 3. Flowchart of Procedure 1.

Procedure- 2. Describes a sensor node's actions upon receiving an alarm message. This procedure can also be implemented as an interrupt handler.

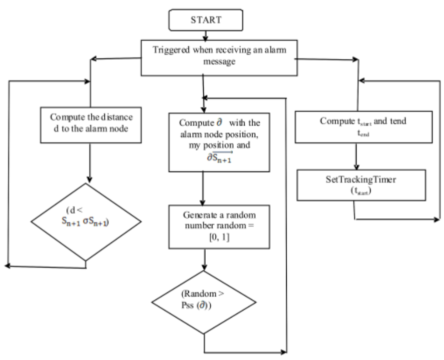

Fig: 4. Flowchart of Procedure

Procedure 3 describes the tracking timer processing procedure, which controls the scheduled wake up/ sleep and the mode.

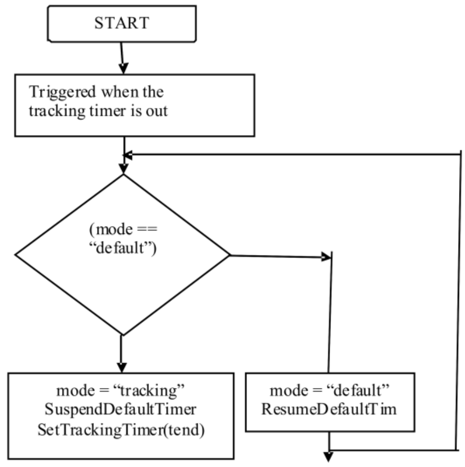

Fig: 5. Flowchart of Procedure 3

Result and Simulation:

In this section the result and simulation of parameter are discussed in detail. C++ is used as tools to carry out the simulation. Performance matrix are dependent on two parameter Energy efficiency and reliability.

All SWS communication systems may have unique features in a rapidly growing environment, and they are generally organized in an architecture similar to that shown in Fig. 1, with the following common characteristic: a massive number of sensor nodes are deployed in the sensing layer to collect useful monitoring data by sensing technologies and real-time processes, and to transmit sensory data to the BS in the application layer without direct human intervention. This characteristic can benefit users from fast growing SWS communications in many promising applications; however, it also brings new Energy Efficient issues to fully deployment of SWS. To successfully deploy SWS communication for the next generation, real-time monitoring applications Energy-Efficiency (2E) requirements must be satisfied.

To achieve the criteria of getting energy efficiency and reliable environment for Smart Warrior System and to track and shoot the target, finding of location is not only important parameter instead of Average detection delay , threshold time, target speed and localization error.

So according to the requirement of the system we have drawn the comparison chart of Extra Energy and Average Detection delay with respect to Node density, Target speed and Localization error as shown in figure 6a-6f.

1. Node density: Figure 6a and 6b shows that the comparison graphs of three existed protocols at various node density and it was found that node density is directly proportional to extra energy and inversely proportional to the detection delay.

2. Target speed: Figs. 6c and 6d shows the simulation results at various target speeds with respect to Extra energy and Average detection delay .As per the given graphs we can observed that the extra energy and average detection delay decreases as the target move faster. With the help of simulation results we can easily conclude that the consistency of faster target is very less with the awakened nodes. Hence the Av detection delay and Extra Energy will be decreases as target move faster. From figure 6 c and 6 d observed that TYM-2 is more suitable algorithm and save more energy with proper reliability of system.

3. Localization error: Figs. 6e and 6f is dedicated to show the simulation at different localization errors. From the figure we can observed that the impact of localization error is very little in TYM-2 as compared to other two algorithm because they awaken all the nodes in an area or a contour. On the contrary, the detection delay of TYM-2 will increase as the error increases, because the target may deviate from awakened.

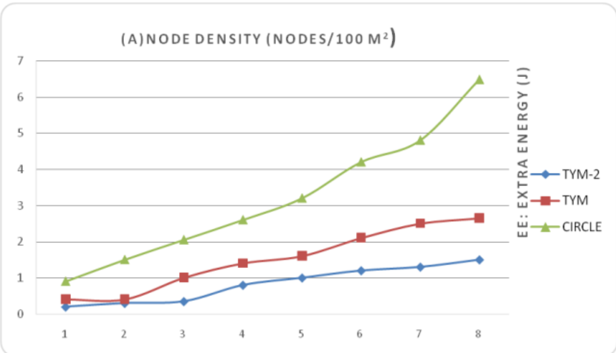

Figure: 6 (a) Performance under various node densities with respect to Extra Energy (Node density vs. Extra Energy)

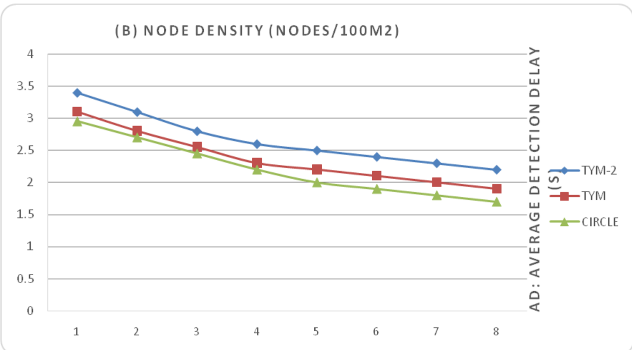

Figure: 6 (b). Performance under various node densities with respect to Average detection delay (Node density vs. Average detection delay).

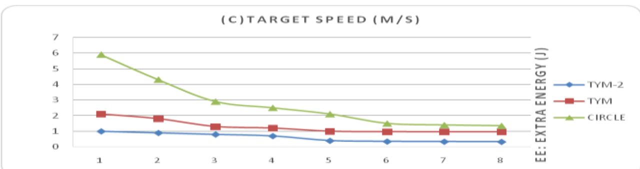

Figure: 6 (c). Performance under various target speeds w.r.t Extra Energy (Target speed vs. Extra Energy).

Figure: 6 (d) Performance under various target speeds w.r.t average detection delay (Target speed vs. Average detection delay).

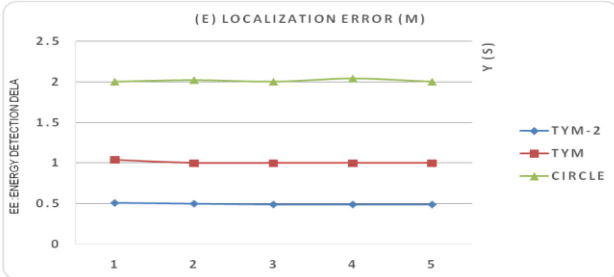

Figure: 6 (e) Performance under localization errors w.r.t. Extra Energy (Localization error vs. Extra Energy).

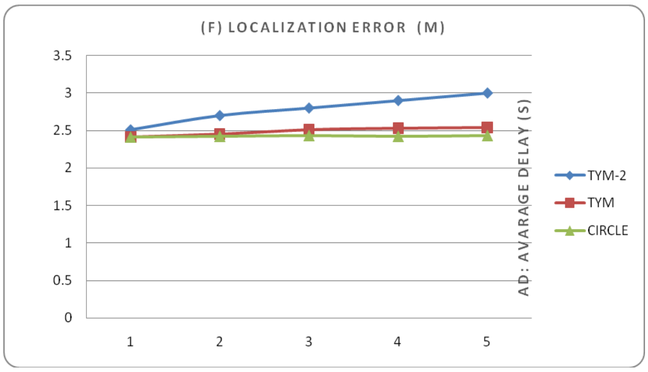

Fig. 6(f). Performance under localization errors w.r.t. Average detection delay (Localization error vs. Average Delay).

Conclusion:

In this paper a scalable cluster-based target tracking framework for energy-efficient and real-time target tracking in large-scale sensor networks has been proposed. The simulation results showed that the proposed algorithm exemplifies the tradeoff between energy efficiency, localization accuracy and latency. The simulation results of the TYM-2 target tracking system validated the efficiency of proposed algorithm. In this paper comparison between the previously implemented target tracking algorithm and newly proposed algorithm has been made and it was found that the proposed algorithm is more appropriate and outperforms the previous schemes.

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