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Force Multiplier Effect of Futuristic Battlefield Preparedness by Adapting the Internet of Things (IoT) Concept

G. Kannan[1], N. Manoharan[2]
[1] NDE centre, R& D division, AMET University, Chennai, India
[2] R&D division, AMET University, Chennai-600 054

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ABSTRACT

The present-day Battlefield environment depicts a scenario wherein various heterogeneous warfighting vehicles/equipment are conglomerated, and the high command takes a decision based on the different inputs and data received from the warfighting entities. This aspect generates voluminous data and communication directives occupying the complete frequency spectrum and moving up and down. This paper proposes a scheme based on the Internet of Things (IoT) philosophy. The primary focus will be to deploy ubiquitous sensing enabled technologies (IoT) in all the battlefield fighting entities. This medium in effect means the interconnection of uniquely identifiable embedded computing-like devices and formulation of an internet infrastructure. The newly proposed IoT devices in all the battlefield fighting entities will gather, infer and understand in-situ commands and data and in turn pass on to the highest decision-making authority. A simple IoT based model will be deployed in the battlefield scenario enhancing the force multiplier effect.

Corresponding Author:

G. Kannan,
NDE centre, R& D division,
AMET University,
Chennai, India.
Email: nde@ametuniv.ac.in

1. INTRODUCTION

The necessity of battlefield preparedness during the onset of war needs no emphasis. The war scenario has changed from the conventional war to a modern war of intelligence [1]. The war operations are carried out by the humanity depending on the competence of technological levels and the available fighting equipment and instrumentation at that given point in time [2]. Both war machinery and instrumentation have gone through sea changes, and there has been a constant change happening the way in which the information collected, and war is fought [3]. This aspect has necessitated a lot of in-depth understanding of the instruments, their deployment patterns, their data formats and bringing of the data from different devices to common denominator for comparison and interpretation [4]. In this paper discussed the Investigation Of The Optical And Electrical Properties Of Tin Sulfide Thin Films [5] and the application of multi-frequency airborne electromagnetic to iron ore exploration [6]. Conventionally efforts are put for individual deployment of this various instruments using different technical features of the device to get the data in its prescribed format; this data, in turn, is represented graphically and pictorially to study, analyze and interpret the data and the Solar driven air conditioning system integrated with latent heat thermal energy storage [7]. Most of the algorithms are used for example A Pre-Compression Algorithm for Optimal Acquisition of Modernized GNSS Signal [8]. The inferences are made based on these interpretations, and conclusions are derived towards the goal of the mission. Similarly, another instrument will be used much in the same way and the Analysis on the growth and characterisation of a non-linear optical single crystal: l-cystine hydrobromide.

The scenario emerges wherein one needs to understand the different instruments, their deployments, their interfaces, their output formats, to collaborate the data and present in a graphical/pictorial way for one to conclude without bias and errors. This calls for considerable work from the experimenters, and they have to be professionally well informed.

2. PROPOSED METHODOLOGY

At this juncture, to alleviate this painful situation a novel method is proposed wherein the whole scenario is aimed to be brought under a single network based on IoT Technology philosophy. This paper envisages IoT technology based instrumentation approach for data acquisition in which the method removes the technological hardships of working with the heterogeneous mix of instruments and acquiring data by designing a common & lighter protocol. The scope includes designing and modelling of suitable IoT sensors for the existing state-of-the-art tools, develop software protocols for IoT sensors, their interface requirements and effect a networked connectivity model. This model is aimed to be unique and superior to the existing Wireless Sensor Network (WSN) model and will be able to specifically cater for applications and solutions that can seamlessly share data for our intended battlefield scenario.

The Internet of Things defines as a worldwide network of smart interconnected objects that enables to monitor data generated in a vast unexplored area. The purpose of this paper is to analyse how to benefit from the IoT to learn from, exploit and optimise the battlefield management. K. Rose in 2015 gave reasons that why IOT is possible. It is possible due to: Ubiquitous Connectivity: Nowadays the connectivity released a guiding architectural document for networking is everywhere due to low cost and high speed pervasive of smart objects (RFC 7452), which outlines networks.

Computing Economics: Driven by industry investment like Bluetooth, Z-wave or Zig Bee to establish in research, development, and manufacturing, Moore's direct device-to-device. This communication model is law continues to deliver greater computing power at commonly used in applications like home automation. Miniaturization: Due to advances in manufacturing, cutting-edge computing and communications technology incorporate into tiny objects. With greater computing power there is an advancement of small and inexpensive sensor devices, which drive many IoT applications. Advances in Data Analytics: Due to new algorithms and rapid increases in computing power, data storage, and cloud services enable the aggregation, correlation, and analysis of vast quantities of evidence; these vast and dynamic datasets provide new opportunities for extracting information and knowledge.

3. A TYPICAL BATTLE FILED SCENARIO

The Future Force unit of action (UA) will be the regular Army's tactical warfighting echelon as reported in the open literature on this subject. Although optimised for offensive operations, the Future Combat Systems (FCS) equipped unit of action (UA) will have the ability to execute a full spectrum of services as shown in Figure 1. FCS will improve the strategic deployability and operational manoeuvre capability of ground combat formations without sacrificing lethality or survivability.

Each will consist of:
combined arms battalions (CABs)
1 non-line-of-sight (NLOS) cannon battalion
1 reconnaissance surveillance and target acquisition (RSTA) squadron
1 forward support battalion (FSB)
1 brigade intelligence and communications company (BICC)
1 Headquarters Company

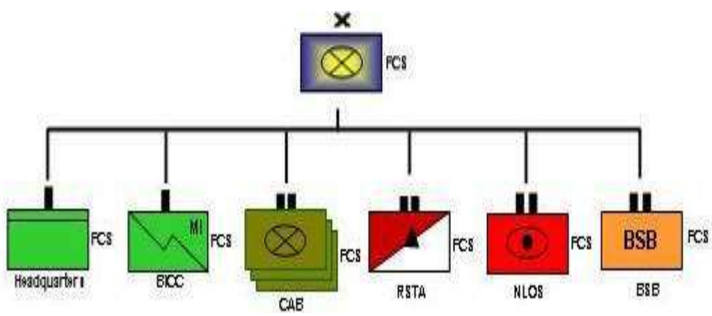

Figure 1. Future Combat Systems (Brigade Unit of Action) Organisational Chart

3.1. Vehicle Adhoc Network (VANET) deployment scheme

VANET characterise by self-governing nodes, which move arbitrarily so that the topology changes. BAVAN is a QoS based VANET routing protocol for establishing digitalised communication between artillery vehicles on the battlefield. Wireless communication devices can be mounted on combat vehicles or carried by armed forces, communicate with each other through IEEE 802.11a/b/g, IEEE 802.11.

The utilised network configuration used for this research can see in figure 2 with Vehicular Ad-hoc Networks (VANET). Most of the research work about operational battlefield systems have been on the issues related to a physical layer, while issues related to network layer such as routing techniques are the relatively new area, thus providing an efficient routing algorithm, which becomes an important task [9]. Optimisation of Biochemical Systems Production using Hybrid of Newton Method, Differential Evolution Algorithm and Cooperative Coevolution Algorithm discussed in [9].

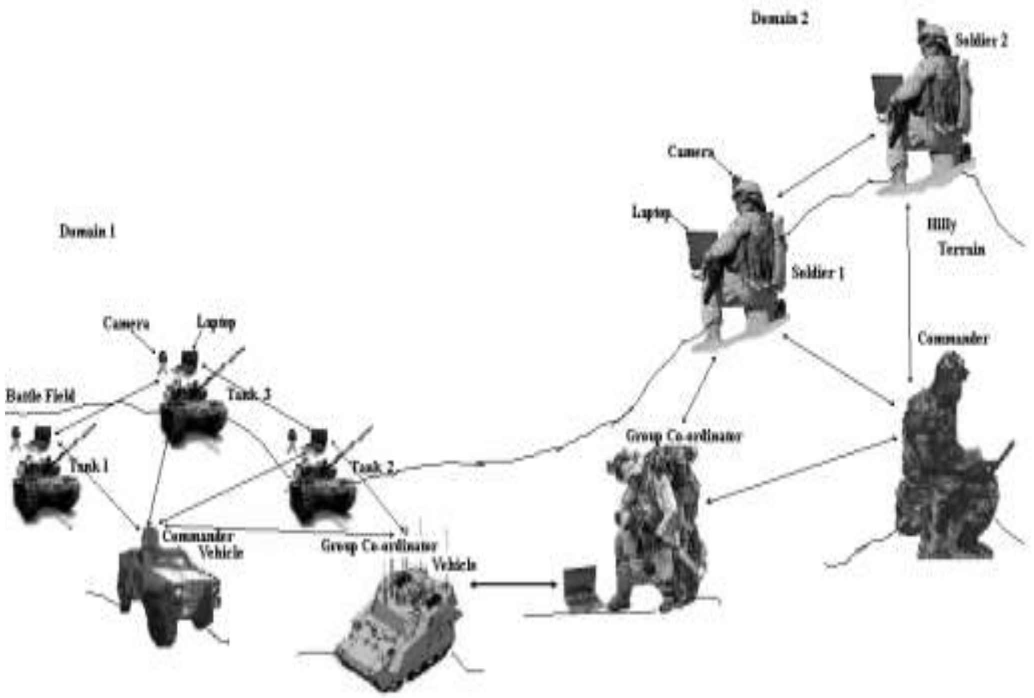

Figure 2. A Vehicular Network Support In Battle Field Environment

The system architecture defined about the corresponding to the network as shown in Figure 3. From particular data acquisition device as that of microcontroller, the sensors are connected to the same relating to the electronic circuit. The physical communication layer consists of the event and network manager which are established through a secure connection using manager. From the microcontroller interconnected electronic circuit in the land, data acquisition undertaking is carried out and respective storage of the values obtained through multiple sensor fusion. The event manager leads to the computation of data and results in deriving the results. With the application service manager coordinating the data from Global Positioning System (GPS) module and the sensor values acquired, the database assists in the storage of data. On hosting and web services, the network manager cohesively used for this purpose. The user –end interface receives the ascertained results through the hybrid application. The significance of outcome lies in the sensor data acquisition based on the framework and architecture of the system.

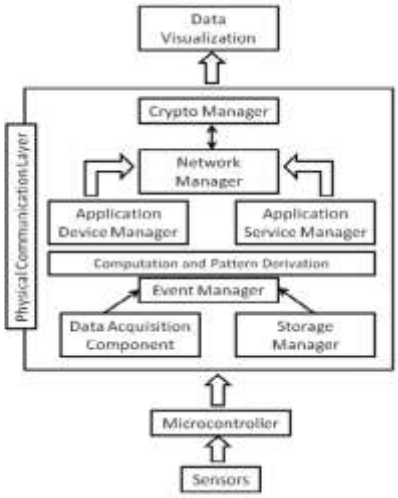

Figure 3. System architecture

3.2. Typical IoT Configuration:

A typical IoT configuration is shown in Figure 4.

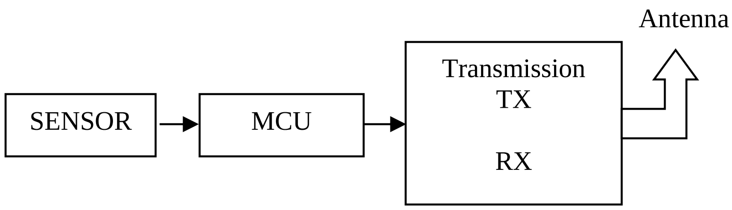

Figure 4. Schematic Diagram of a Typical IoT Configuration

The starting point of IoT is the thing itself. This thing has a low power processor, some embedded operating system. The starting point of IoT is the thing itself. This thing has a low power processor, some embedded operating system and a way of communication (usually wirelessly) using suitable communication protocols. Design and Simulation of Multiple Coil Model for Wireless Power Transmission System discussed in [10].

The primary entity of IoT systems is a processor unit or microcontroller (MCU) that processes data and runs software stacks interfaced to a wireless device for connectivity. Requirements for both the MCU and wireless device are specific to the end application and system requirements. Advanced IoT sensor nodes consolidate sensor functions and use an 8-bit MCU or a 32-bit device to run a small radio frequency (RF) protocol stack. These devices are typically battery powered and connected to gateways to take care of heavier processing and data transmission. The things may connect directly to the neighbouring things or an Internet gateway device. The subsequent level is ‘ingestion tier' – software & infrastructure responsible for managing things and updating the firmware. Then comes ‘analytic level', takes organised data & processes it. Finally, ‘end-user' tier comes where the actual application.

Sensor Nodes are designed typically to transfer small amounts of data and often have to operate on batteries for several years. The devices must also be portable, reliably connected and able to perform under varied environmental conditions regardless of RF interference or physical barriers. Because these devices are part of networks, the setup of systems, integration of sensor data and display of information must also consider. The combined selection of the suitable MCU and wireless or RF connectivity for these devices as well as development tools and software stacks for application development are critical to their successful design.

The complete process of IoT implementation involves the-the phases of-Selecting a Microcontroller (MCU), Selecting the Appropriate Wireless and RF Connectivity Solution, Simplifying Design with Integrated Components, Meeting Low Power Requirements, Accelerating Software Development.

The connected "things" send and receive data through the network relating to various physical characteristics – temperature, moisture level, pulse rate, light level, velocity or revolutions per minute – as well as more complex data such as maintenance requirements, sounds, and static or moving images.

A software system designed intelligently manages the things, and the networks they use organises and stores the vast amounts of data they generate, and processes it and presents it to end users. Research and Application of Development Model of Information Service for IOT of Oil and Gas Production Based on Cloud Architecture discussed in [11].

3.3. IOT deployment in the battlefield scenario

The IoT –deployment model is a typical methodology of ‘on the field implementation' in the battlefield environment wherein the data collected from various fighting entities are sent through wireless mode using a Wi-Fi Router and received in a designated local server for logging in and analysing purposes as shown in Figure 5. This medium is the basis for moving towards the goal of force multiplier effect in the battlefield environment.

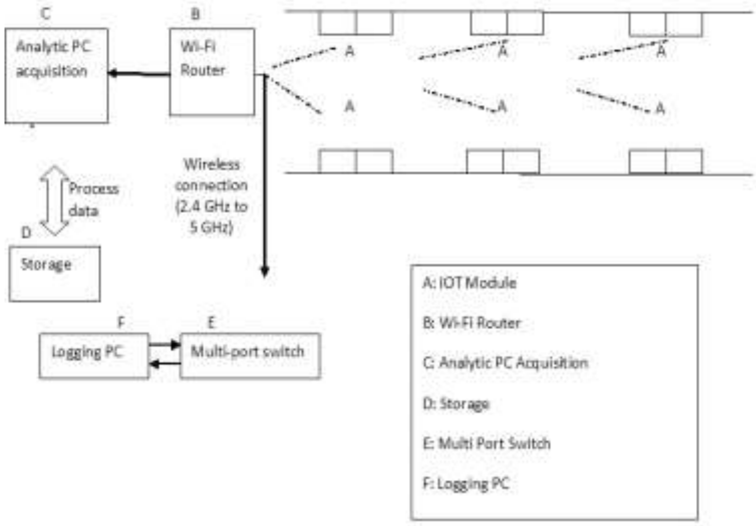

Figure 5. IoT - deployment model

4. CONCLUSION

The IoT is related to Battlefield Management in a war theatre in a way that obtains powerful computing tools through vehicular ad-hoc network and it finds the best practicing channel Hardware resources generate information system integrated into resource pool by using vitalization technology, achieving dynamic distribution of resources and balance of load, significantly improve efficiency of resource using. A Large amount of data obtained by using radio frequency identification, wireless communication, automatic control, information sensing techniques of IoT are handled with VANETs, truly realising smart environment.

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