



Review Article

NEED TO DEVELOP ROBOT FOR ELECTRONICS WARFARE—A REVIEW

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War robots clearly hold tremendous advantages—from saving the lives of our own soldiers, to safely defusing road side bombs, to operating in inaccessible and dangerous environments such as mountain side caves and underwater. Without emotions and other liabilities on the battlefield, they could conduct warfare more ethically and effectively than human soldiers who are susceptible to overreactions, anger, vengeance, fatigue, low morale, and so on. But the use of robots, especially autonomous ones, raises a host of ethical and risk issues.

Keywords: Need, Robot, Electronics warfare

INTRODUCTION

Robots have traditionally been put to use in environments that are too hazardous for man. Merriam-Webster defines robot as “a machine that looks like a human being and perform various complex acts; a device that automatically performs complicated, often repetitive tasks; a mechanism guided by automatic controls.” ISO describes a robot as “an automatically controlled reprogrammable, multipurpose manipulator programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications”.

Yet all these definitions do give us a rough idea About what comprises a robot, which

needs to sense outside world and act accordingly. There are motors, pully, gears and gear box, lever, chain and many more mechanical system, enabling locomotion. There are sound, light, magnetic field and other sensors that help robot to collect information about its environment. There are processer powered by powerful software that help he robot make sense environmental data captured and tell it what to do next and also microphone, speaker, displays that help the robot to interact with human. Due to all these capabilities of robot, need has been arised to develop system like robot. These paper focuses different issues where robot is efficient than men.

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ELECTRONIC WARFARE

Military Action involving the use of Electro-Magnetic energy to Determine, Exploit, Reduce, or prevent hostile use of the EM Spectrum, and action which retains friendly use of the EM Spectrum. Components of electronic warfare are 1) Electronic Support, 2) Electronic Attack, 3) Electronic Protection.

Electronic Support (ES) is part of EW involving actions taken to search for, intercept, locate and identify radiated EM energy in order to detect, identify and localize threats. Electronic Attack (EA) includes use of EM or directed energy to attack personnel, facilities, or equipment. Electronic Protection (EP) involves actions taken to protect personnel, facilities, and equipment from any effects of friendly or enemy use of the electromagnetic spectrum that degrade, neutralize, or destroy friendly combat capability.

PROBLEM IDENTIFICATION

Drones are playing an increasingly prominent role in modern warfare. At one time, the suggestion that robots would be used on the battlefield might be considered the stuff of science-fiction novels. But as electronic technologies become more and more integrated into our ways of waging warfare, robotic strategies seem more like science and less like fiction. All one needs for proof is to observe the growing sophistication of miniature Unmanned Vehicles (UV), and how more and more organizations—including police departments—are considering their use for general law-keeping and surveillance functions. The main objectives of using robot are:

Where Man Dares Not Venture

Robot have traditionally been put to use in environment that are too hazardous for man .It can draws the information from where the man cannot reach like deep in sea, far away from planet ,in space. A major reason for robots is the fact that they can go more places than a human can. They are efficient and in most case get the job done that a human cannot. And even though a robot that is built to perform in these hazardous environments cost anywhere from a couple hundred thousand to a couple hundred million, no robot cost is worth more than a human's life.

To Rescue, Pronto

Robot also work under precarious condition for search and rescue operation. Able to guide itself through forests, tunnels or damaged buildings, the machine could have tremendous value in search-and-rescue operations. Small flying machines are already common, and GPS technology provides guidance. Common situations that employ rescue robots are mining accidents, urban disasters, hostage situations, and explosions. Rescue robots can be used in the search for victims and survivors as it reduces personnel requirements, reduced fatigue, and access to otherwise unreachable areas.

As Human Can Not Work for 24 Hours

Particular system is to be developed that can fight with enemy without any fatigue. Numbers of factors are there like hunger, thirst, fatigue so human cannot work continuously. Equally important, any type of war always leaves psychological scars on many soldiers and officers. A recent Army survey found that on

third and fourth tours one in four soldiers suffers mental and psychological health problems. Medical specialists say that psychological and mental illnesses will take many years to treat and cost billions of dollars. The specialists bemoan an incompetent medical system that is not equipped to provide long-term care for a large number of wounded and tormented soldiers.

Direct Involvement of Human in War
As alternate efficient system is not available, a huge man power is used for war purpose. It might be useful to stop thinking of war in exclusively human terms. we should define war as a self-replicating pattern of activity that may or may not require human participation. The trend, at the close of the twentieth century, still seemed to be one of ever more massive human involvement in war—from armies containing tens of thousands in the sixteenth century, to hundreds of thousands in the nineteenth and eventually millions in the twentieth-century world wars.

Lack of Manpower

Building a army of man for war is a big challenge. The shortage of officers in the three Services, i.e., army, navy, air force is largely attributable to changes in the socio-economic environment and the resultant change in career preferences, better employment opportunities in other sectors, tough selection procedures and service conditions required for the Armed Forces, difficult service conditions, perceived high risks, etc. A number of steps have been taken to motivate the service personnel to continue in service and to tackle the shortage and attract talented youth to join the Defence Forces or some unmanned

weapon is essential that can work effectively on battlefield.

Technology Requirement of Indian Army

- The apparent success of high technology weaponry in the ongoing wars in Iraq and Afghanistan, are indicative that the war is undergoing a profound transformation. Today, as in the past, technology is fundamentally changing the face and nature of warfare. The opportunities offered by these new or emerging technologies are boundless. There is a need to concentrate on those technologies that are important to the Indian Army for its modernisation requirements.
- The Indian Army remains committed to self-reliance through indigenous developmental efforts. Indian industry over a period has grown in strength and today has the financial capability and the potential to become a partner in defence research and production so that it leads to a self-reliant defence industrial and technological base for the country. An overview of Indian Army's futuristic technology requirements are covered in the succeeding paragraphs. The requirements are dynamic in nature and this list needs to be viewed as an outline guide only.
- **Equipment and Technology Requirements**
The following key program areas have been identified for the futuristic modernisation requirements of the Army:
 - Battlefield Transparency.
 - Combat Systems.
 - Communication Systems.

- Rockets and Missiles Systems.
- Directed Energy Weapons.
- Advanced Material Technology.
- Artificial Intelligence.
- Robotics.
- Nano Technology.
- Bio-technology
- Non Lethal Weapons.
- Combat Modeling and Simulation.
- Nuclear, Biological and Chemical Warfare Defence.

Battlefield Transparency: Indian Army needs to exploit the advances in Information Technology for providing all weather surveillance, collation and instant dissemination of this information to facilitate increased battlefield transparency. The following systems will be required:

- Battlefield Surveillance Radars and Weapon Locating Radars. Battlefield Surveillance Radars and Weapons Locating Radars with capabilities to detect vehicles and personnel movement at varying ranges will be required for the Army.
- Unmanned Aerial Vehicles (UAVs). UAVs with advanced sensors and weapons are going to dominate all facets of the future battlefield hence, the need to acquire the necessary UAV's expertise indigenously. These should be capable of carrying payloads such as weapons, SAR payloads, electro-optical devices, electronic intelligence and communication intelligence.
- Advanced Electronic Warfare Systems. Electronic warfare systems have played a

crucial role in recent conflicts. Various electronic intelligence, communication intelligence, Radio Emitter Location and Jamming Systems integrated with Command and Control centres will provide enhanced battle field transparency to the commanders.

Combat Systems: The combat systems such as battle tanks, infantry combat vehicles etc, are mobile protected platforms designed to defeat similar systems of the enemy. In future, these combat systems will require all-round protection against various forms of threats namely, enemy tanks, Anti-Tank Guided Missiles (ATGM), Armed Attack Helicopters (AAH) and anti-armour mines, etc. The technologies that the Indian Army will require are given as under:

- Develop improved and next generation small arm weapon system.
- Develop a suitable light armoured multipurpose vehicle which combines the essential requisites of mobility, agility, protection, communication, navigation, stealth and observation for reconnaissance.
- State of art night fighting systems.

Communication Systems: The following systems will be required:

- Integrated platforms to support voice, data, image, multimedia applications and networking.
- Real Time Secure Mobile Communication. Real time secure mobile communication links are becoming the backbone of modern warfare. Though some progress has been made in the civilian sector, there is a need to catch up with military applications.

- Indigenisation of critical components in satellite communication.

Rocket and Missile Systems

- **Rocket Systems:** There is a need to develop rocket systems of the range of 120-150 km indigenously with reduced dispersion. The ranges could also be enhanced to 120-150 km by developing Multi Barrel Rocket Launcher (MBRL) systems in the 250-300 mm calibre class. Solid propellants with high specific impulse should be developed for achieving longer ranges with radar based Trajectory Correction Systems (TCS) and inertial navigation systems.
- **Missile Systems:** The aim is to develop missiles with longer ranges and higher accuracies for surgical strikes on high value strategic targets with minimum collateral damage. Anti missile active and passive seeker defence technologies be developed for supersonic cruise missiles, for short range missiles, long range sub-sonic cruise missiles.

Directed Energy Weapons (DEW): The needs of the Army in this field are as follows:

- **Anti UAV Weapon:** DEW for engaging enemy UAV in the 8-10 km range capable of being designated and controlled by appropriate detection and tracking systems.
- **Precision Weapons and Dazzlers:** These should be developed for use by Special Forces/Anti Terrorist forces to make operations swift and surgical with minimum collateral damage.
- **AD Weapons and Air Deliverable PGMs:** Air Defence weapons from ground based

mobile platforms capable of engaging all kinds of projectiles like rockets, mortar/artillery, UAVs, missiles, fighter aircraft, helicopters, PGMs and other stand off armament.

Advanced Material Technology: Carbon composites, advanced ceramics and metal matrix composites are going to be the main structural materials for the future systems. These will enable weapon platforms to be made lighter and tougher. These technologies would find their application in all weapon platforms and support systems, especially in tanks/ICVs, protection suits for armour/personnel, missiles/munitions/war heads, artillery gun barrel/loading/unloading/firing mechanism, communication equipment/systems and so on.

Artificial Intelligence (AI): AI is an inescapable need for numerous military applications. Some possibilities are in the following areas:

- **Imagery Interpretation:** Image interpretation for target identification and classification. Artificial Intelligence techniques could automate the extraction of low-level map features from imagery.
- **Expert Systems:** Expert systems for diagnosis and maintenance of sophisticated weapon systems such as radars and missiles.
- **Intelligent Evaluation of Kill Zone:** Missile – target range and trajectory analysis for evaluation of kill zones and launch time and simulation to assist in qualifying missile performance in various environments.

Robotics: Robotic applications for the Indian Army are as under:

- Robots can be used to assist troops in combat for tasks such as surveillance, reconnaissance, anti mine and anti IED role, urban area combat, casualty extraction, etc.
- Robotic equipment can be used to provide precision targeting support, carriage of ammunition and accuracy. Camera equipped and shock-resistant platforms to fire the guns remotely are possible applications.
- Robotic vehicles equipped with cameras and weapons can be used to perform tasks such as limited/spot surveillance and reconnaissance, etc.

Robotic Military Vehicles: These vehicles are required for a variety of high risk jobs such as mine/IED clearance, obstacle breaching and route opening. Man portable, light weight robotic systems would be required for reconnaissance, surveillance and target acquisition missions for sub-terrain/urban operations. Robotic vehicles are also needed for mine detection/clearing, obstacles breaching, clearing wire obstacles, placing explosives, tactical deception, direct fire and communication relay.

Nano Technology: The applications for Army in the fields of nano technology are as follows:

- **Counter Terrorism Tasks:** Possible applications are unobtrusive micro audio bugs and video recording devices with high capacity data storage to plant at likely meeting places of terrorists, over ground agents and sympathisers, unattended micro ground or air sensors which can be placed in advance and remotely activated on required basis and micro sized energy devices which can power unattended

sensors/audio/video devices and a host of other applications in remote areas or places which require extremely light weight power sources like light weight man portable radars, missiles, UAVs and other systems.

- **Dynamic Camouflage:** Fabric of uniform would act as a screen for displaying terrain specific picture. Fabric would also have switch able surfaces (e.g., cotton and polyester) for comfort and bio-chemical gas detectors for chemical agent warning.
- Other nano applications could include extremely rugged and safe arming and triggering mechanism for appropriate weapon systems, solid lubricants for weapon systems at high altitude areas.

Bio-Technology: Some of the biotechnology applications for the Indian Army are as follows:

- The bio-technological R&D should be extended to bio friendly/green developments, i.e., the development of biodegradable ammunition which causes minimum damage to the environment.
- Lighter food and fuel for carriage by individual combatants.
- Bio production mechanisms to enable soldiers to generate food, fuel and materials from raw materials in the field, allowing for extended operation in remote areas.

Non Lethal Weapons: Sub-lethal or disabling military technology is particularly suitable in an urban or complex environment. Some of the important areas of research in this field having applications for the Army are as under:

- **Stun Grenades:** Low impact grenades which can stun or immobilize adversaries.

- **Acoustic Weapons:** Weapons that emit sonic frequencies to cause such sensations as disorientation, debilitating dizziness and motion sickness or nausea, also generate vibrations of body organs resulting in extreme pain or seizures.

Combat Modelling and Simulation:

Simulation advances will transform military planning and training. Today, virtual reality simulations can enable soldiers to train in high fidelity mock-ups, at substantial reduction in risk and spending. There is a need to exploit a range of tools and products that will enhance the Army's capabilities in the domains of training, development, acquisition and decision support.

Nuclear Biological Chemical (NBC)

Warfare Defence: Indian Army will require protection from Chemical, Biological and Radiological hazards as per the following:

- **Individual Protective Equipment (IPE):** There is a requirement of developing common IPE equipment which can provide individual protection in all kinds of contaminated environment.
- **Collective Protection:** Both fixed and mobile shelters should be portable, easy to assemble and pack, to give NBC protection in all types of terrain.
- **NBC Detection, Alarm and Monitoring:** The equipment should be portable, sensitive and electromagnetic pulse hardened to accurately indicate the radiation dosages and chemical and biological contamination level in real time.
- **Decontamination Equipment:** In future the technology should be developed to provide mobile decontamination station which can decontaminate A and B vehicles, equipment and persons in a "tramline" mode at a faster rates.
- **Calculation of Nuclear Blast Parameters:** The equipment should be able to automatically calculate the various parameters of nuclear blast like cloud and cloud bottom angles, illumination time, flash to bang time for carrying out estimation of yield and to work out down wind hazard distance. It should lend itself to integration with meteorological sensors.

CONCLUSION

There is tremendous scope for industry to participate in the development and production of systems and technologies for the Indian Army. Barring a few major PSUs and some private industries, most Indian industries engaged in production of defence equipment have limited R&D infrastructure and spend little on R&D. There is, therefore, an urgent need for Indian Industry to develop a vibrant defence, R&D and production capability to meet requirements of the Indian Army. The participation of the Indian Industry in the modernization, collaborative research and development and equipping of the Indian Army will provide improved capability and also boost the Indian economy. 🌀

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