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SNAKE SERPENTINE LOCOMOTION ALGORITHM OR HYPERSENSITIVE DATA PACKET TRANSMISSION IN TRUST ARCHITECTURE

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ABSTRACT:With the advent and promotion of globalization, the speed of data transmission is increased tremendously. The hypersensitive data packets are roaming on the information superhighway at very fast speed and such high performance Value Added Applications are used by most of the organization including corporate sector, defense establishments, banking or personal communications. The matter gets serious when the data packets are concerned with highly confidential and sensitive applications which may include an e-banking transaction or a secret deal in defense. A number of algorithms and paradigms has been developed and implemented to shield and transmit the data packets to the other end. This paper proposes an algorithm named snake serpentine locomotion algorithm for the transmission of data packets in the network channels. This algorithm makes use of the S-Shape circuitous movement or undulatory locomotion adopted by the snakes on the surface. On land, the efficient and rapid serpentine movement is possible if there are irregularities on the ground to enable the snake crawl. Networks are always associated with the security issues this paper relates the irregularity of surface to the sensitivity or security issues of the network channels. Similar kind of algorithms has been devised to solve various combinatorial optimization problems including routing, shortest path, packet transmission, assignments and many more. These algorithms subsist with the names as Ant Colony Optimization, Honey Bee Algorithm, Genetic Algorithms, Simulated Annealing and various others whereby the behavior, activities, movements and survival nature of creatures is analyzed. This paper intends to indicate that the data transmission in trust architecture can be secured using the Snake Serpentine Locomotion Algorithm making a series of curves with multiple angles rather than a known straight path.

Keywords: Hypersensitive Packet Transmission, Snake Serpentine Locomotion Algorithm, Security Issues, Security Trust Architecture

INTRODUCTION

Now days, the commercial as well as Defense Applications are facing frequent threats from different source and obviously such highly sensitive applications of public and national interest needs highly secured and consistent architecture so that packets can be transmitted in the network without any peril. Trust is considered as the footing of the relationship which is established by a business organization with their customers, vendors, and employees. All Trust Architectures and Intercept detection technology are not effective. These neither provided security to packet formation nor giving any security during transmission. All Trust Architecture developed till now doesn't provide absolute security and significant features. The VAN sometimes paralyzed and giving a great scope to the intruders/interceptors and other cyber criminals either to damage or alter or misuse the packets during transmission. Most of the fund transfer systems, EDI systems, business applications are using emerging technologies and exposed to vulnerability increases tremendously. Moreover, the cryptographic algorithms used during packet formation and transmission are sometimes responsible for vulnerabilities.

Trust is the establishment of confidence that something will or will not occur in a predictable or promised manner. The enabling of confidence is supported by identification, authentication, accountability, authorization, and availability. To develop the trust between multiple parties, a set of principles or rules is to be offered so that the security of the entire model can be improved.

According to the ITU-T X.509, Section 3.3.54, trust is defined as: "Generally an entity can be said to 'trust' a second entity when the first entity makes the assumption that the second entity will behave exactly as the first entity expects."

An intrusion-detection system (IDS) refers to the tools, methods, and resources to help identify, assess, and report unauthorized or unapproved network activity. The intrusion detection part of the name is a bit of a misnomer, as an IDS does not actually detect intrusions - it detects activity in traffic that may or may not be an intrusion. Intrusion detection is typically one part of an overall protection system that is installed around a system or device - it is not a stand-alone protection measure.

The most common types of threats fall into categories such as:

- Actual or attempted unauthorized probing of any system or data
- Actual or attempted unauthorized access
- Introduction of viruses or malicious code
- Unauthorized modification, deletion, or disclosure of data
- Denial of service attacks

PACKET TRANSMISSION AND SWITCHING

The process by which a networking or telecommunications device accepts a packet and switches it to a telecommunications device that will take it closer to its destination. Packet switching allows data to be sent over the telecommunications network in short bursts or “packets” that contain sequence numbers so that they can be reassembled at the destination. Wide area network (WAN) devices called switches route packets from one point on a packet-switched network to another. Data within the same communication session might be routed over several different paths, depending on factors such as traffic congestion and switch availability.

Packet switching is the transmission method used for most computer networks because the data transported by these networks is fundamentally bursty in character and can tolerate latency (due to lost or dropped packets). In other words, the transmission bandwidth needed varies greatly in time, from relatively low traffic because of background services such as name resolution services, to periods of high bandwidth usage during activities such as file transfer. This contrasts with voice or video communication, in which a steady stream of information must be transmitted in order to maintain transmission quality and in which latency must remain minimized to preserve intelligibility.

The Internet is the prime example of a packet-switched network based on the TCP/IP protocol suite. A series of routers located at various points on the Internet’s backbone forward each packet received on the basis of destination address until the packet reaches its ultimate destination. TCP/IP is considered a connectionless packet-switching service because Transmission Control Protocol (TCP) connections are not kept open after data transmission is complete.

X.25 public data networks are another form of packet-switching service, in which packets (or more properly, frames) formatted with the High-level Data Link Control (HDLC) protocol are routed between different X.25 end stations using packet switches maintained by X.25 service providers. Unlike TCP/IP, X.25 is considered a connection-oriented packet-switching protocol because it is possible to establish permanent virtual circuits (PVCs) that keep the logical connection open even when no data is being sent. However, X.25 can be configured for connectionless communication by using switched virtual circuits (SVCs). An X.25 packet-switched network typically has a higher and more predictable latency (about 0.6 seconds between end stations) than a TCP/IP internetwork. This is primarily because X.25 packet switches use a store-and-forward mechanism to buffer data for transmission bursts, which introduces additional latency in communication. In addition, X.25 uses error checking between each node on the transmission path, while TCP/IP uses only end-to-end error checking.

Frame relay (also called fast packet switching) is another connection-oriented packet-switching service that gives better performance than X.25. It does this by switching packets immediately instead of using the store-and-forward mechanism of X.25 networks. Frame relay also eliminates flow control and error checking to speed up transmission. This is possible because frame relay networks use modern digital telephone lines, which are intrinsically much more reliable than the older analog phone lines on which much of the X.25 public network still depends. Frame relay supports only connection-oriented PVCs for its underlying switching architecture.

Finally, Asynchronous Transfer Mode (ATM) is another packet-switching service in which small fixed-length packets called cells are switched between points on a network.

- Packet switching was designed to provide a more efficient facility than circuit switching for bursty data traffic. With packet switching, a station transmits data in small blocks, called packets. Each packet contains some portion of the user data plus control information needed for proper functioning of the network.
- A key distinguishing element of packet-switching network is whether the internal operation is datagram or virtual circuit. With internal virtual circuit, a route defined between two endpoints and all packets for that virtual circuit follow the same route. With internal datagrams, each packet is treated independently, and packet intended for the same destination may follow different routes.

LITERATURE SURVEY AND RELATED WORK

A number of International Research Papers and Literature has been studied to analyze the algorithms and techniques based on the Meandering Movement of Snake. Following are the extracts of Literature Survey whereby the Snake Movement is implemented in various applications:

Analysis of Snake Movement Forms for Realization of Snake-like Robots*, Shugen MA, JAPAN, Proceedings of the 1999 IEEE International Conference on Robotics & Automation Detroit, Michigan May 1999:* This research aims to discover the mechanism and principle, for the emergence of the snakes ' movement in order to realize, a snake-like robot. In this study, the standard, creeping movement form of a snake, which is the typical, locomotive motion shown by snakes is explained. The called Serpentine, curve in the constant steady-state velocity was derived, for the uniform creeping locomotion of the snake, through, analyzing physiologically its muscle characteristics. Muscular, force was then discussed for this uniform locomotive, curve. The locomotive efficiencies for various creeping movement curves of snake locomotion by analyzing the ratio of the tangential force, to the normal force and the power required for snake locomotion is compared in the paper. The results showed that the proposed Serpentine, curve is more valid as the snake creeping locomotion shape, than the formerly suggested curves.

A Simulator to Analyze Creeping Locomotion of a Snake-like Robot, *Proceedings of the 2001 IEEE International Conference on Robotics & Automation, Seoul, Korea. Shugen Wen J, Yuechao WANG, Hitachi-Shi Ibaraki-Ken:* This paper explains various facts including the movement of the Snakes that are adaptable to, the environment. The snake (its forms and motion) is used to develop a robot. In this study, a simulator to simulate the creeping locomotion of a snake-like robot is developed, in which the robot dynamics is modeled and its interaction, with the environment is considered through Coulomb friction. This simulator makes possible to analyze the creeping locomotion, with the normal-direction slip coupled to gliding along the tangential, direction. Through the developed simulator, we investigated, the snake-like robot creeping locomotion which is generated only, by swinging each of the joints from side to side, and discussed the, optimal creeping locomotion of the snake-like robot that is adaptable, to a given environment

Control of a Creeping Snake-like Robot, *Igor Grabec, University of Ljubljana, Faculty of Mechanical Engineering, ASkerEeva*: The mechanics of an autonomous snake-like, robot comprised of a chain of discrete links is formulated. Creeping caused by a serpentine winding of chain, is considered. Winding is generated by internal bending, moment between the links. The distribution of moment resembles a wave that propagates with increasing, amplitude from the head to the tail. Movement of the, chain on the ground generates friction that is described, by a longitudinal and a transversal force with respect, to a link. The transversal force is assumed to be much, larger than the longitv.dina1 one. Such dependence, leads to propulsion of the robot in the forward direction, if the winding of its body is properly controlled by, internal bending moment. To show this, the non-linear, dynamic equations of the chain are solved numerically. Equations describe forces and moments exerted on, links of the chain. External friction force, internal, bending moment, and damping of flexural chain motion, are taken into account. Parameters of internal bending, moment were varied in order to find a region of stable, movement and optimal propulsion with respect to, average velocity in the forward direction. Stability of, the creeping and movement of the chain head along an, imposed trajectory is achieved by including the distance, from the trajectory in control of internal bending, moment. The performance of this locomotion and its control are demonstrated by calculated trajectories. The, chain movement demonstrated resembles serpentine, creeping of a real snake. The end goal of this research is to develop an endoscope capable of creeping and, performing actions in complex environments such as interior of machines or biological organisms.

Design and Control of a Snake Robot according to Snake Anatomy, *Ahmadreza Rezaei, Yasser Shekofteh, Mohammad Kamrani, Ali Fallah, Farshad Barazandeh, Amirkabir University, Tehran, Iran* The paper explains that the Serpentine Robots are multi-segmented vehicles and based on their physical structure and design, these robots could have great mobility in their movements., This mobility can enable the robot to move around in, more complex environments. The application of these, kind of robots could be very useful in hard to reach, places or hazardous environments. In this paper a serpentine robot is investigated and implemented. Inspired from snake motion, the structure of robot based on the snake's physical, mechanism is implemented. In spite of most designed snake robots, the implemented robot makes use of the friction between the body of the robot and the environment it encompasses to move in.

Tracking Multiple Objects Using Moving Snakes, *Jonas De Vylder, Daniel Ochoa, Wilfried Philips, Laury Chaerle, Dominique Van Der Straeten, Department of Telecommunications and Information Processing, IEEE:* In this paper it is analyzed that the active contours of snakes are widely used for segmentation, and tracking. The ability of a snake to track an object depends, on the movement of the object. If the object moves too, far from one frame to another, the snake risks losing the true, contour location. The subsequent evolution steps are negatively, affected, reporting a false contour that can propagate, to other frames. To overcome this problem a new snake algorithm, has been developed. This new technique, moving, snakes, works in two steps. During the fist step, the snake is, translated as a rigid body towards the contour. This translation, is calculated using the external force field of the image, therefore it does not require prior knowledge about the object, movement. In the second step the actual shape evolution of, the snake takes place

Motion Planning of a Snake-like Robot Based on, Artificial Potential Method, *Changlong Ye, Deli Hu, Shugen Ma, Huaiyong Li, Proceedings of the 2010 IEEE, International Conference on Robotics and Biomimetics, December 14-18, 2010, Tianjin, China:* This paper explains that the interaction between the snake-like robot and, environment produces serpentine action to push the body, forward. A slender body shape made from many modules, occupies a larger scale. In this paper, snake-like robot motion, planning method is analyzed by considering each module's, position and its movement as well as position of obstacles. The Potential Energy Function between each module and obstacles, is established by using artificial potential method as well as the, Potential Energy Function between snake head and the target., With the potential energy function feedback to control the, pendulum angle of serpentine movement, the snake-like robot, motion planning in the obstacles environment is completed. The, adjacent joint adjustment is achieved for movement stability, during obstacle avoidance control. Finally, the simulation, results verified the effectiveness of proposed path planning, method.

Improving Concavity Performance of Snake Algorithms *A. Roubies, A. Hajdu, I. Pitas Dept. of Informatics, Aristotle University of Thessaloniki, Box 451, GR-54124 Thessaloniki, Greece:* Poor convergence to concave boundaries is a limitation in the use of snakes as a contour approximation technique. The external force for active contours, called gradient, vector flow (GVF), has provided a remarkable improvement to this problem. However, the technique requires high computation, time for reliable concavity performance. In this paper, an efficient solution to overcome these drawbacks is proposed. The authors developed a method that directs the snake further into the concavities and saves iterations adding new snake points, further inside concavities. The approach specified by the authors can be applied to other snake models based on external vector fields that provide worse, concavity performance than GVF.,

Adaptive Snake Robot Locomotion: A Benchmarking Facility for Experiments*, S. A. Fjerdingen, J. R. Mathiassen, H. Schumann-Olsen and E. Kyrkjebo,* A benchmarking facility for snake robot locomotion is presented in this paper, including the design of a snake-like robot extended with a sensor setup combining three-dimensional vision and an array of force sensors to register friction and impulse forces. A surrounding, modular environment consisting of a reconfigurable obstacle course and a ceiling mounted camera system is also presented. This enables research into adaptive obstacle-based and non-obstacle-based movement patterns for robotic snakes. Experimental results show possibilities for detailed data analysis of snake robot locomotion. Thus, the facility may be a common reference on which to experiment and evaluate future ideas.

Limbless Locomotion: Learning to, Crawl with a Snake Robot*, Kevin J. Dowling, December 1997*: The summary and conclusions in the paper summarizes the results and contributions of this research and, looks into the future to see what research lies ahead in this area. The old aphorism, "you have to crawl before you can learn to walk", has not applied to, mobile robotics. There have been many walking machines over the decades but very, few crawling machines. In fact, crawling appears to be a harder problem. In this, dissertation, research demonstrated that a snake robot can learn to crawl and it can crawl, in several different ways., The conclusion of this research is that robots can learn to locomote even when they have, no wheels or legs. In this dissertation author provides a general framework to teach a complex, electromechanical robot to become mobile that includes a learning method, metrics for, evaluation, physical simulation and the transfer of results to a robot. The framework and loop of learning, testing and evaluation is certainly applicable to a wide variety of domains for, physical control. For locomotion, all patterns of motion, gaits, can be described in terms, of cyclical or periodic forms and this architecture lends itself well to learning those, modes of locomotion.

PROPOSED ALGORITHM

The Snake Serpentine Algorithm (SSA) is the simulated version of the movement or crawling used by the Snakes to reach the destination. Here, the data packets are transmitted in the network channel using the circuitous motion to make the movement secured and hidden from crackers and spy. In packet switching, the data packets search for the available paths and move on one of the available intermediate nodes using store and forward paradigm. So far the data packets adopt the available path randomly and reach the destination node but in SSA the packets are forced to adopt the twisting path following a particular angle so that the actual location and index can be made hidden from the sniffers.

A much slower method of movement is caterpillar or rectilinear locomotion. This technique also contracts the body into curves, but these waves are much smaller and curve up and down rather than side to side. When a snake uses caterpillar movement, the tops of each curve are lifted above the ground as the ventral scales on the bottoms push against the ground, creating a rippling effect similar to how a caterpillar looks when it walks

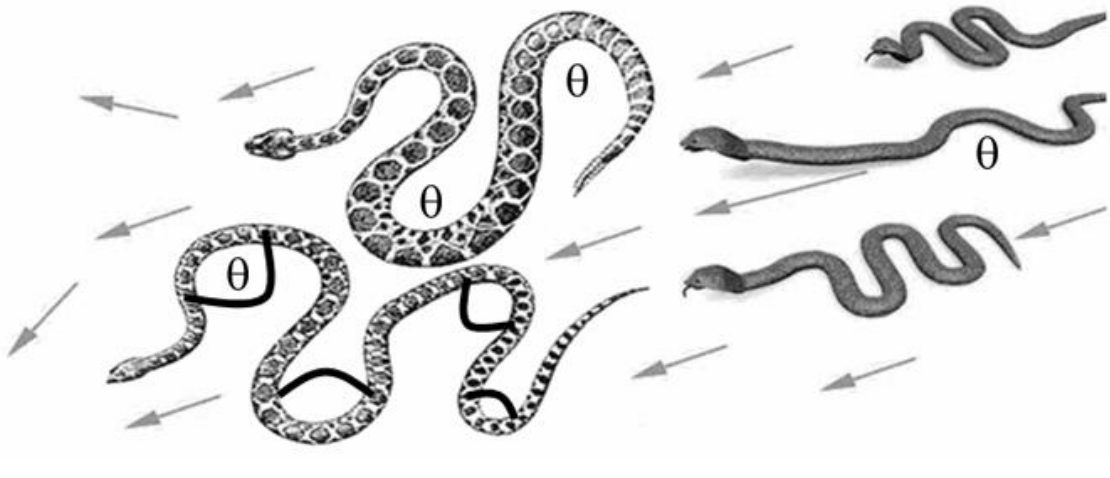

Figure 1: Serpentine Locomotion of the Snake

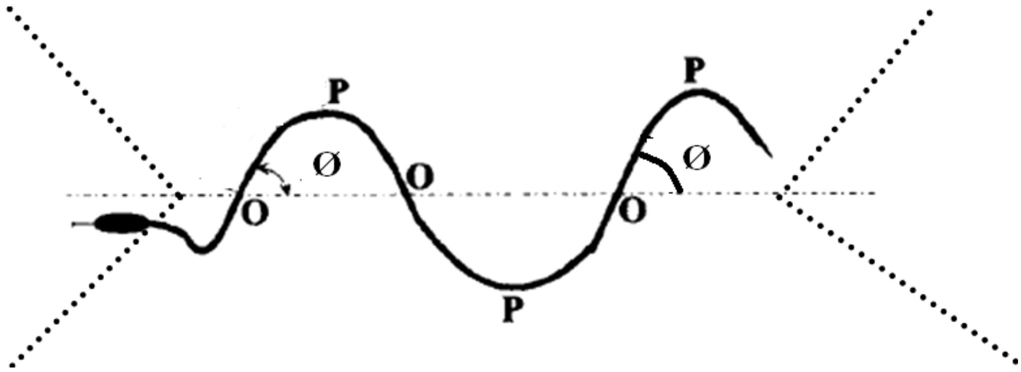

Figure 2: Path followed by the data packet in Snake Serpentine Algorithm

ALGORITHM

Step 1: Organize the Data Packet P and set up at the initial point
a. Encryption (Shielding) of Data Packet P
b. Assignment of Dynamic Key
Step 2: Generate all paths available for data transmission
a. View paths for packet transmission
b. Checking of Address in the Header Field of Packet
Step 3: Set up an initial angle Ø (Around 45 degree)
a. Snake takes the move at 45 degree for rotation
Step 4: Set the direction data packet P to Ø
a. Sight of packet changed to make serpentine move
Step 5: Follow the best path available for the packet P
a. Greedy Method or any Heuristic Search can be used
Step 6: If NODE=GOAL, terminate and Exit
a. In case the destination is found, Acknowledgement is sent to the sender
b. Else same method is followed
Step 6: Goto Step 2

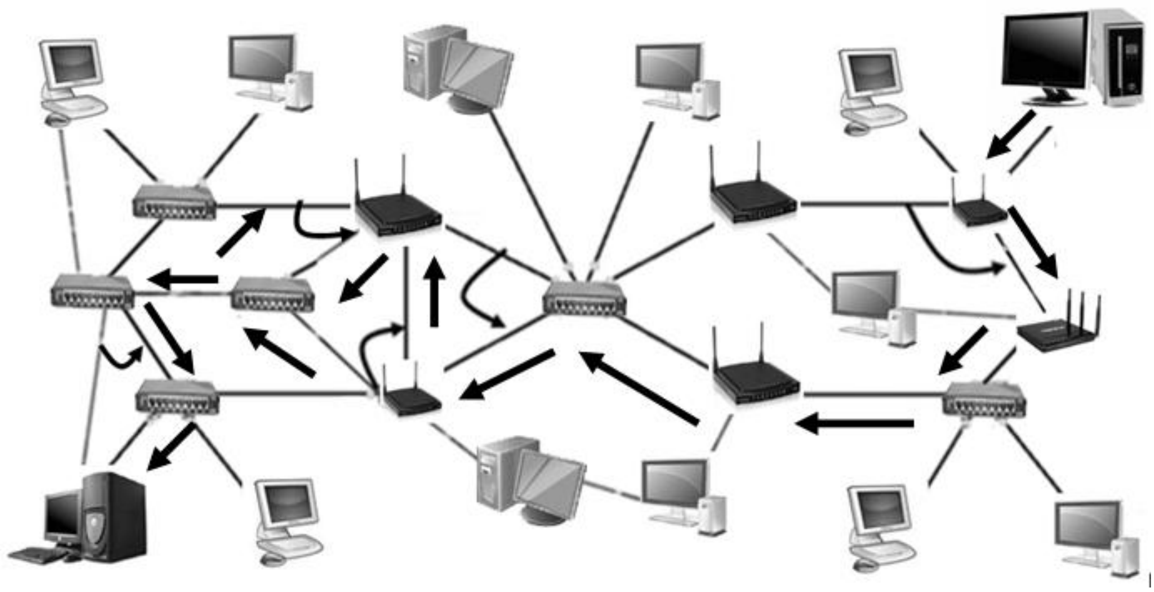

Figure 3: Flow of Hypersensitive Data Packet in a Packet Switching Network

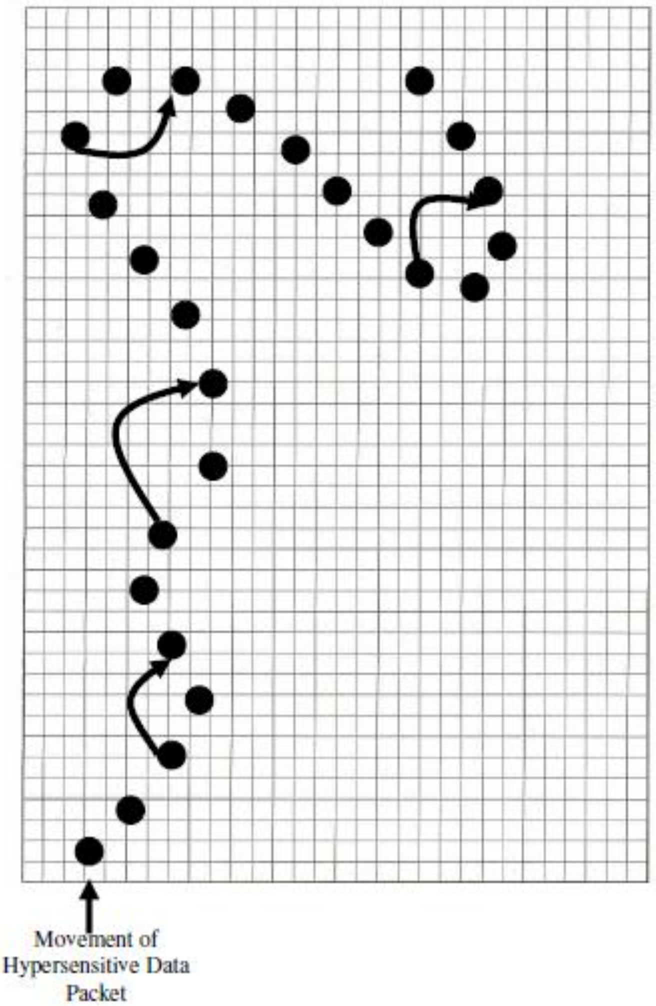

Figure 4: Movement o Hypersensitive Data Packet in a Packet Switching Network

CONSTRAINTS

The aforementioned Snake Serpentine Locomotion Algorithm is an efficient technique to guard the hypersensitive data packets from crackers and network sniffers. The algorithm is proposed to be excellent in performance in case of security but it is recommended to be used for hypersensitive and covert defense and corporate applications because there an additional factor, delay (d). In SSLA, delay factor is more because of the repeated twisting locomotion of the data packets.

APPLICATIONS AND SCOPE OF SNAKE SERPENTINE LOCOMOTION ALGORITHM

- Missile Tracking and Launching Systems
- Air and Soil Traffic Control
- Confidential and Hypersensitive Business Transactions
- Surreptitious Missions

CONCLUSION

The proposed algorithm is applicable in various sectors including secured business transactions, Corporate Applications, Banking, Air Traffic and Defense Applications. In case of defense, the ballistic missiles can be fired in the serpentine motion rather than the classical parabolic path. In this scenario, the missile cannot be detected and destructed by the enemy because of the twisting path. Even if the radar detects the presence of a missile, it will be very difficult to trace the location of missile. A number of algorithms has been devised and implemented in various streams, but there is always the scope of developing new algorithms and paradigms by analyzing the real life scenarios and activities.

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