**Highlights**

* This work proposes an approach called Elliptic Curve Cryptography (ECC) with the Adaptive Hunter Prey Optimization (AHPO) algorithm for providing data security in IoT.
* The encryption technique ECC provides a robust and lightweight encryption mechanism and the AHPO is employed for optimal key generation and management processes, enhancing both security and efficiency.
* Then, the encrypted data is hashed by the MD-5 algorithm.
* The suggested model addresses the need for reduced computational load and power consumption in IoT environments and maintaining a high level of security.
* Experimental outcomes demonstrate the efficacy of this approach in optimizing cryptographic operations, making it a feasible solution to secure IoT networks.