Soldier Health Severity Checking using Machine Learning And IOT

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Abstract – *Employing a combination of machine learning and IoT technologies, a system that seeks to forecast the soldiers' health status. The system is made to gather information from medical sensors, and evaluate that information in real time to determine how each soldier's health is doing. Personalized health predictions and severity checking are created from the collected data using machine learning algorithms. This method can assist military personnel and medical workers in promptly identifying soldiers who may need medical attention, allowing for more effective and efficient treatment. In addition, the system can offer insightful information on the general condition of a military unit, empowering commanders to make wise choices regarding troop deployment and mission preparedness. Overall, the Soldier Health Severity Checking system is a promising use of AI and IoT in the field of military healthcare.*

Keywords- Military Healthcare, Medical Sensors, Real-Time Data Analysis, Soldier Health, Personalized Health Predictions, Severity Checking

INTRODUCTION

Soldier health is a crucial component of military operations and the capacity to track and forecast it in real-time can have a big impact on both the troops' well-being and the success of missions. It is now possible to create a complex system for Soldier Health Severity Checking because to the growing number of wearable technologies, medical sensors, the capability of machine learning algorithms, and IoT technologies. The goal of this project is to develop a system that can gather information from a variety of sources, use machine learning algorithms to analyze it, and produce unique health forecasts and severity checking for each soldier. In this article, wearable technology for troops is described that allows for precise location tracking.

As a result, this technology can assist in identifying soldiers who might need medical assistance, offer insightful data regarding a military unit's general health, and empower commanders to make defensible choices regarding troop deployment and mission readiness.

LITERATURE SURVEY

1. Health monitoring and tracking system for soldiers using internet of things (IOT),

Niket Patil, Brijesh Iyer, 2017 International conference on computing, Communication, and automation (ICCCA), IEEE. The article describes a system that uses the Internet of Things (IoT) to track and monitor soldiers' health.

The soldier's body can be fitted with the suggested system, it keeps tabs on their whereabouts and well-being using GPS. This data will be transmitted to the control panel using IoT. The suggested system consists of tiny, transmittable modules, sensors, and wearable physiological equipment. Because of this, it is possible to create a low-cost system that uses the suggested technology to protect irreplaceable human life on the battlefield.

2. Novel wearable device for health monitoring and tracking of soldiers based on LoRa Module,

Yashash Jain, Bhupesh Soni, Ayush Goyal, Chetna Sharma, 2020 Conference on Information and Communication Technology (CICT), IEEE

The internet has altered our way of life, but the internet of things (IoT) is about to transform everything once more. using IoT to check their health on the battlefield.

Body factors including heart rate, temperature, oxygen levels, and GPS position can all be measured by this device.

3. Soldier strap for health monitoring and tracking a proposed solution,

Rahul S G, Rajnikant Kushwaha, Sayantan Bhattacharjee, Agniv Aditya, K Somasekhar Reddy, Durri Shahwar, 2021 Innovations in power and advanced computing technologies (i-PACT).

A military operation's or a military patrol's success depends on information and data, two important components. Monitoring a soldier's condition and

location, along with gathering ground intelligence, is essential during any active circumstances or interactions. In the desired circumstances, the heart rate, temperature, humidity level, and GPS position should all be continuously tracked in order to provide prompt and effective medical or tactical help in the event of any emergency.

4. IOT based soldier health and position tracking system

J Lakshmi Prasanna, M. Ravi Kumar, Chella Santhosh, S V Aswin Kumar, P. Kasulu, 2022, International conference on computing methodologies and communication (ICCMC), IEEE Currently, preserving national security is under the purview of the armed forces. To defend themselves in this regard, their better health and tracking, respectively, are more crucial. The Internet of Things (IoT) and GPS were employed in this study's live track applications to track and monitor the health issues affecting the military.

METHODOLGY

The proposed approach for assessing the health of soldiers using machine learning and the Internet of Things is intended to assess the health of soldiers in real-time. It uses a hardware configuration with a number of sensors, including an Arduino Uno microcontroller, a heartbeat sensor, an ECG sensor, and a lm35 temperature sensor. The microcontroller is connected to the sensors, and the LCD display displays the values. The collected data is then used to make predictions on soldier health severity using logistic regression algorithm.

A Graphical User Interface (GUI) is developed using Flask to provide a user-friendly way of inputting and outputting data. After registration, soldier details such as name, blood pressure, spo2, heart rate, ecg rate, and temperature are entered into the system. Based on the data gathered, the program then forecasts whether the soldier is in a normal or critical state.

A buzzer and vibrator are used to create an alarm system that will alert the appropriate authorities in the event of an emergency. In an emergency, the soldier's whereabouts can be tracked using the GPS module.

The system recommends giving the soldier common medications in urgent situations. This methodology is expected to enhance the monitoring and tracking of soldiers' health, minimize response time in case of a medical emergency, and provide immediate care to those who need it.

The system has the potential to improve the healthcare of soldiers in remote areas where medical facilities are limited. By providing real-time monitoring and tracking,

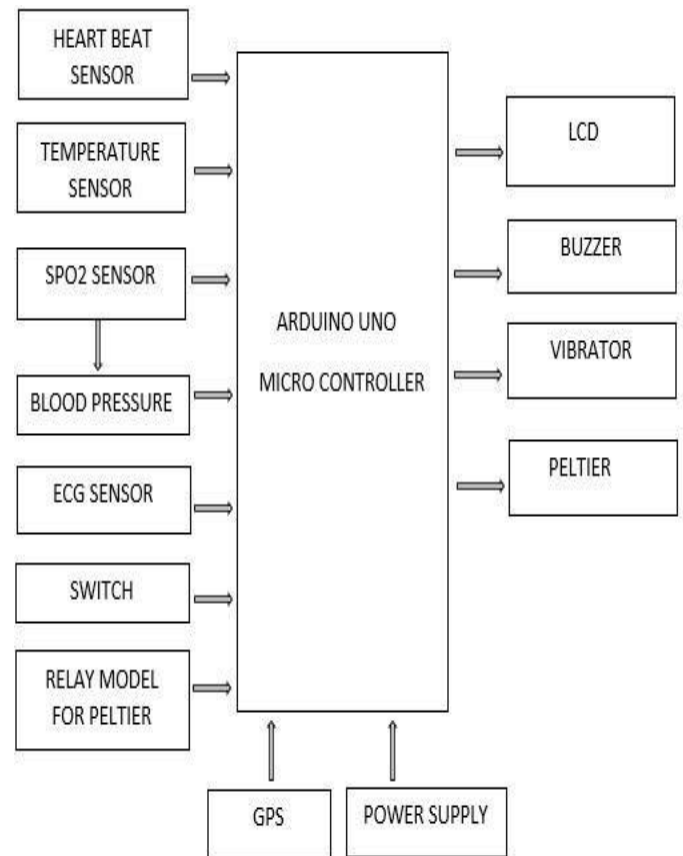the system can help to prevent medical emergencies and save lives.

ARCHITECTURE DIAGRAM

Fig-1 Hardware Architecture

A crucial aspect of ensuring the health and safety of active duty troops is the hardware architecture of the soldier health severity checking system. An Arduino Uno microprocessor, which is part of the system, acts as the central hub for all of the attached devices. The microcontroller is linked to a number of sensors, such as an LM35 temperature sensor, heartbeat sensor, ECG sensor, SPO2 sensor, and GPS module, which gather information on a soldier's physical characteristics and position. The processed data is then presented on a 16x2 LCD screen, giving the soldier's vital signs a real-time readout.

The system also features a Peltier relay model that can be used to regulate temperature in cases of heat or hypothermia. A buzzer and vibrator provide auditory and tactile alerts to draw attention to any critical conditions, and an emergency switch allows troops to send a distress signal in case of an emergency.

With all the necessary parts to gather, examine, and react to data on a soldier's vital signs, the hardware

framework is made to be sturdy, dependable, and portable. Because of its small size, the system is simple to deploy in the field and gives troops the resources they need to keep an eye on their health and well-being while on duty. The system's layout guarantees that troops can access vital information about their health quickly and simply and react accordingly, possibly saving lives and averting long-term health issues.
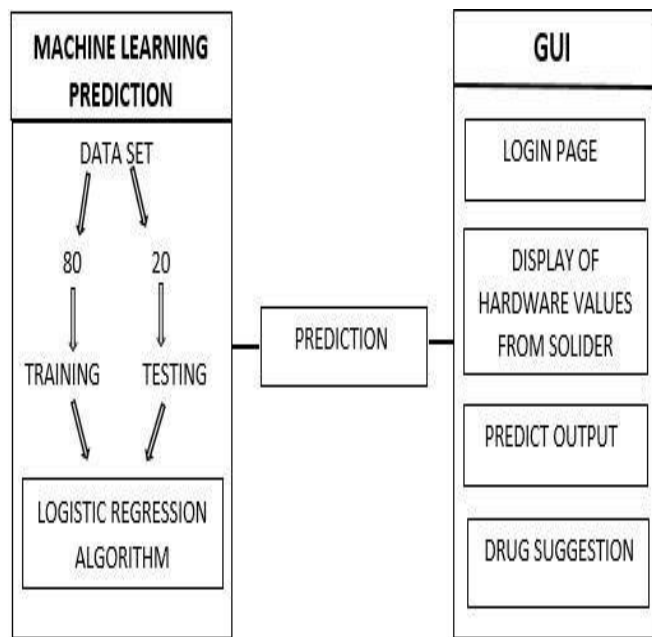
Fig-2 Software Architecture

A crucial component of the total design is the software architecture of the soldier health severity checking system. The system is designed with a graphical user interface (GUI) that makes data entry and browsing simple. Users must enter accurate information in order to access the system, and the GUI shows options for login and registration. Once signed in, users can input information on a soldier's vital signs, such as blood pressure, SPO2, heart rate, ECG rate, and temperature. This information is then sent via an Arduino cable to the Arduino Uno microcontroller.

Using the logistic regression method, the microcontroller analyses the data gathered and determines whether a soldier is in a normal or critical state. The system offers recommendations for generic medications that can be used to treat crucial conditions. The findings are then shown on the GUI in real-time, enabling users to keep track of the soldier's health.

With a straightforward interface that enables users to swiftly and easily access crucial information, the software architecture is created to be efficient and user-friendly. The system's accuracy and dependability are ensured by the use of the logistic regression algorithm,

which also gives people useful information they can use to act appropriately. The system's software architecture plays a crucial role in ensuring that troops on active duty receive the best care and attention possible.

ALGORITHM

LOGISTIC REGRESSION ALGORITHM

A statistical method for binary classification tasks is logistic regression. It forecasts the likelihood that an input will belong to a specific class. The steps of the logistic regression algorithm are as follows:

1. Initialize the weights: Set the initial weight values to zero or a small random value.

2. Calculate the sigmoid function: The sigmoid function is used to map any input value to a value between 0 and 1. It is calculated by dividing 1 by 1 plus the exponential of the negative product of the input and the weights.

3. Calculate the loss function: The difference between the anticipated value and the actual value is measured by the loss function. Cross-entropy loss is the loss function used in logistic regressions.

4. Calculate the gradients: The gradients are calculated by taking the partial derivative of the loss function with respect to each weight.

5. Update the weights: The weights are updated using the gradient descent algorithm, which involves subtracting the product of the learning rate and the gradient from the current weight value.

6. Repeat steps 2 to 5 until convergence: The above steps are repeated until the weights converge to a value where the loss function is minimized.

7. Predict the output: After the weights have converged, the sigmoid function is used to predict the probability of an input belonging to a particular class. If the probability is greater than 0.5, the input is classified as belonging to that class. Otherwise, it is classified as belonging to the other class.

These steps are iteratively applied until the weights converge to a value where the loss function is minimized, and the model can accurately predict the class of new input values.

IMPLEMENTATION

The implementation of the hardware and software components for soldier health severity checking using machine learning and IoT involves several steps.

Hardware Implementation:

The hardware components include sensors for measuring vital signs, a microcontroller for data processing, and other devices for displaying data, alerting, and tracking the soldier's location. To implement the hardware architecture, the following steps are taken:

1. Gather the required hardware components, including lm35 temperature sensor, heartbeat sensor, ECG sensor, and spo2 sensor. These sensors are used to measure the vital signs of the soldier.

2. Connect the sensors to an Arduino Uno microcontroller board. Use jumper wires to connect the sensors to the appropriate pins on the microcontroller board.

3. Connect a 16*2 LCD display to the microcontroller board. This display will be used to show the vital signs of the soldier.

4. Connect a GPS module to the microcontroller board. This module will be used to track the soldier's location in case of an emergency.

5. Connect a buzzer and a vibrator to the microcontroller board. These devices will be used to activate the alarm system in case of an emergency.

6. Connect a relay model for a Peltier device to the microcontroller board. This device will be used to regulate the temperature of the soldier's body.

7. Connect an emergency switch to the microcontroller board. This switch will be used to trigger the alarm system in case of an emergency.

8. Use a USB cable to connect the microcontroller board to a computer. This cable will be used to transfer the sensor data to the software application for processing.

Software Implementation:

The software component involves developing an application that processes the sensor data and provides a prediction of the soldier's health severity. The software implementation involves the following steps:

1. Install the required software tools, including the Arduino IDE, Python, Flask, and scikit-learn library. These tools will be used to develop and run the software application.

2. Develop the software application using Flask, a Python web framework. The application should include a Graphical User Interface (GUI) for data input and output.

3. After registration, the soldier details such as name, blood pressure, spo2, heart rate, ecg rate, and temperature are entered into the system.

4. Process the sensor data using a logistic regression algorithm to predict the soldier's health severity. This algorithm should be trained on a dataset of soldier's vital signs.

5. Check whether the soldier is in normal or critical conditions. If the soldier is in critical condition, the system suggests common drugs to be administered.

6. Use a USB cable to transfer the sensor data from the microcontroller board to the software application for processing. The data is received as a string and is split into individual sensor readings.

7. Display the processed data on the GUI. The GUI should show the soldier's vital signs and the predicted health severity.

8. Activate the alarm system in case of an emergency. The buzzer and vibrator are used to alert the soldier and notify the appropriate authorities.

9. Track the soldier's location using the GPS module in case of an emergency. The location data can be displayed on the GUI or sent to a mobile device.

In conclusion, the integration of various hardware and software components is required for the execution of soldier health severity checking using machine learning and IoT. The hardware consists of sensors for reading vital signs, a microcontroller for processing data, and various devices for data display, alerting, and position monitoring. Creating an application that analyses sensor data and forecasts the soldier's health condition is the software component.

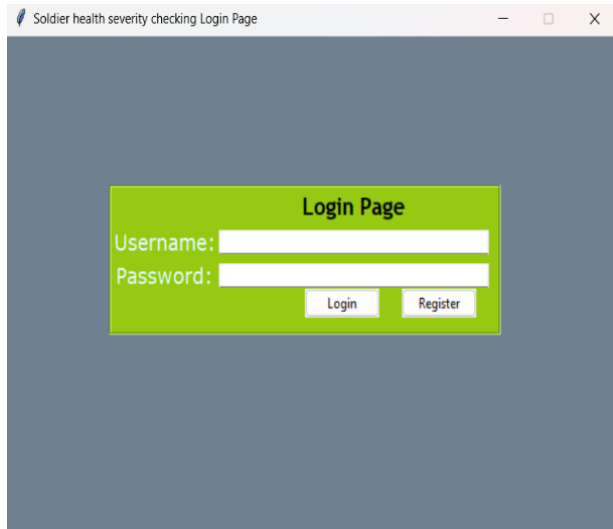**Fig-3** Hardware Implementation

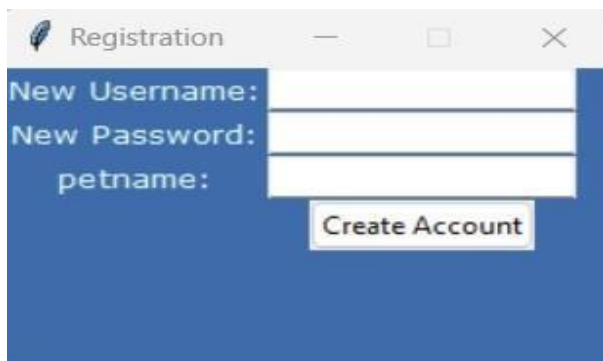## SOFTWARE IMPLEMENTATION

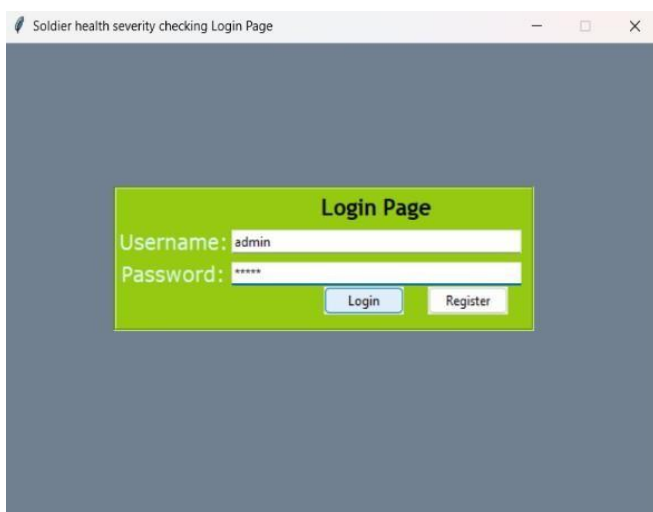**Fig-4** Login Page

Fig-5 Registration for new account

Fig-6 Login page after Registration
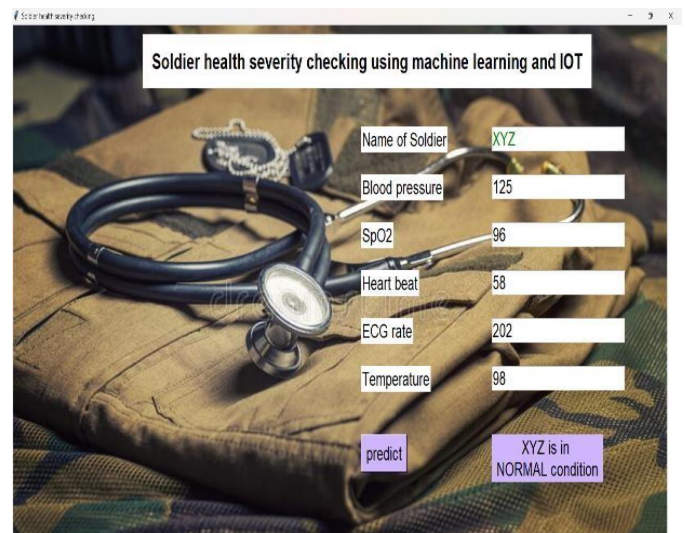

Fig-7 Window after successful login

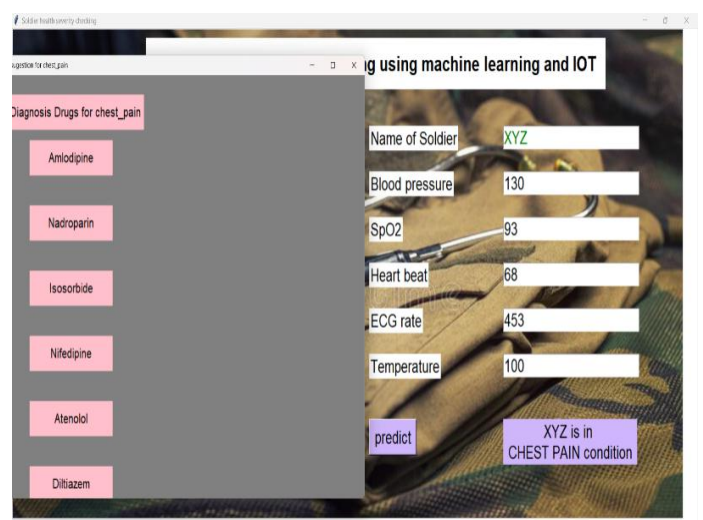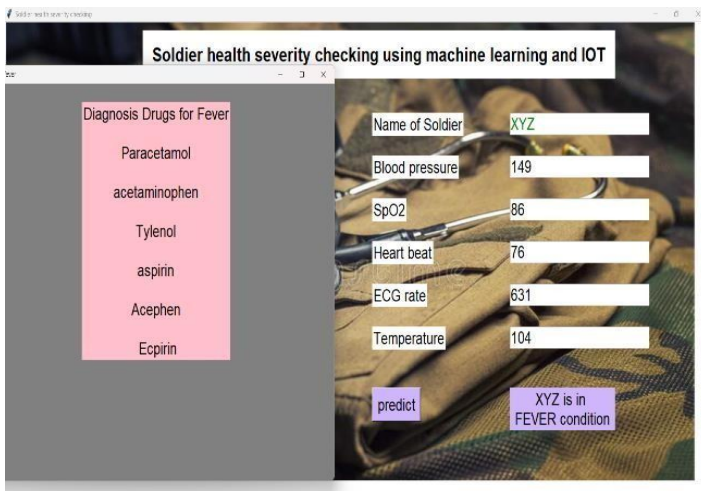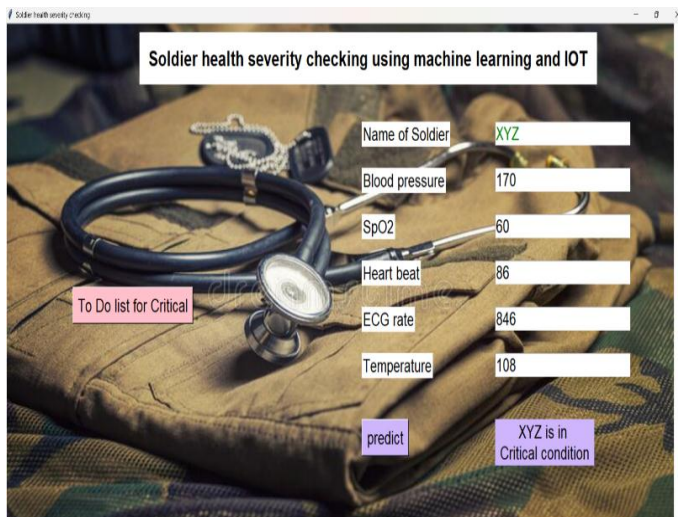**Fig-8** Predicting Normal condition of Soldier

Fig-9 Predicting Fever condition of soldier

Fig-10 Predicting Chest pain condition of Soldier

Fig-11 Predicting Critical condition of Soldier

CONCLUSION

IoT and machine learning technologies have been used to create a soldier health monitoring system, which offers a promising solution for managing soldiers' health and wellbeing on the battlefield. This method is intended to track vital signs, which are important indicators of a soldier's physical health, including body temperature, heart rate, and blood oxygen levels.

The system's hardware design includes a number of sensors, including the lm35 temperature, heartbeat, ECG, and spo2 sensors, which are connected to an Arduino Uno microcontroller, GPS module, buzzer, emergency switch, vibrator, and a relay model for a Peltier device. A logistic regression algorithm is used in the system's software architecture to forecast how seriously the soldier's health is in need of attention.

The system is intended to gather and process data in real-time from a variety of instruments, analyze the data using machine learning algorithms, and forecast the soldier's health. Additionally, the system has a GPS module that allows the authorities to monitor the location of the soldier in case of an emergency and an emergency switch that can be triggered in case of any life-threatening circumstances.

The registration of soldier information such as name, blood pressure, spo2, heart rate, ecg rate, and temperature is one of several stages in the system's implementation. Following registration, the system uses the logistic regression algorithm to forecast the severity of the soldier's health condition. The system recommends common medications to be administered if the soldier is in critical condition, and it also activates the alarm system, which alerts the proper authorities in case of an emergency.

Comparing this method to conventional health monitoring systems reveals a number of benefits. First, it offers real-time vital sign tracking, enabling the early identification of any health issues. Second, it makes use of machine learning methods to forecast how seriously the soldier's health is in need of attention, allowing for prompt medical assistance. In case of an emergency, the system's GPS module allows the authorities to track the soldier's position. The system's portability, lightweight, and ease of use make it perfect for use on the battleground.

The method does, however, have some drawbacks. For instance, the device is battery-powered, which may reduce the amount of time it can be used. For data transfer and analysis, the system also needs a steady network link, which can be difficult in remote locations. Additionally, trained employees are needed to run and maintain the system.

Future study should concentrate on creating new technologies that can extend the system's battery life, enhance network connectivity in remote locations, and make the system's use and upkeep simpler in order to get around these constraints. Future study should concentrate on integrating extra sensors to track other vital signs, like respiration rate and blood glucose levels.

In terms of military health monitoring, the system created for tracking soldier health as part of this project marks a major advancement. This system provides a promising approach for enhancing the administration of soldiers' health and wellbeing on the battlefield by utilizing IoT and machine learning technologies. This system has the potential to save lives and increase the total efficiency of military operations with more development and improvement.

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