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MOLTS: Military Operations Location Tracking System

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Abstract
Aim: This study was carried out to propose the development and implementation of a state-of-the-art location tracking system tailored to the needs of the Philippine Army.
Methodology: The descriptive and quality improvement type of research were directed to accomplish the objectives of the project. The proponent conducted surveys and interviews with the Philippine Army personnel who are assigned to Infantry Battalions and other Philippine Army Major Units to develop a Military Operations Location Tracking System (MOLTS) that will benefit the Military on monitoring and planning combat operations.
Results: The study conducted successful testing and the whole system is functional, reliable, and accurate.
Conclusion: The prototype was developed to automate the manual transmission of location of troops. It improves the situational awareness in the field, assist the commanders during prompt decision making, provide precise location information of military personnel, and overall operational effectiveness.

Keywords: *Military Operations, Location Tracking System, Philippine Army*

INTRODUCTION

The Philippine Army, a pivotal branch of the Armed Forces of the Philippines (AFP), is entrusted with the vital duty of safeguarding and serving the nation. Its core mission is to mobilize, train, equip, and sustain ground forces for support operations, ultimately striving to establish an environment conducive to sustainable development and enduring peace. This project germinated from firsthand experiences as a junior Non-Commissioned Officer in the Infantry Battalion at Quezon Province, immersing in the rigors of infantry life. Central to our responsibilities were patrolling, reconnaissance, rescue, and combat operations within the Battalion Area of Responsibility (AOR). The prevailing manual reporting system, reliant on radio frequency transmissions, revealed vulnerabilities to enemy interference, prompting the need for an advanced location tracking system.

Regrettably, the absence of a comprehensive troop location monitoring mechanism within the Philippine Army has led to lamentable incidents. Operational exigencies demand swift, accurate, and efficient responses; however, the dearth of real-time tracking has, at times, resulted in tragic misencounter, friendly fire, and unfortunate skirmishes with allied forces. The urgency of this endeavor is underscored by harrowing events such as the Marawi Siege, where 11 dedicated Scout Rangers lost their lives due to inadvertent bombings by the Air Force within the main battle area.

This project proposed the development and implementation of a state-of-the-art location tracking system tailored to the needs of the Philippine Army. By harnessing cutting-edge technology, this system aimed to revolutionize troop management, enabling the Production and Operation Section of Battalions to comprehensively analyze the disposition and location of infantry and allied forces within operational zones. By mitigating risks associated with inaccurate reporting, this initiative endeavors to safeguard the lives of the men and women who valiantly combat insurgency and terrorism, ultimately advancing the pursuit of enduring peace for our cherished homeland.

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Objectives

This study was carried out to propose the development and implementation of a state-of-the-art location tracking system tailored to the needs of the Philippine Army.

Specifically, it sought to accomplish the following:

1. improve situational awareness by tracking the movements of personnel in real-time;
2. enhance safety and security with the ability to track the movements of personnel;
3. help in the efficient logistics management by tracking the movements of equipment and supplies;
4. serve as intelligence gathering by tracking the movements of hostile forces; and
5. help in training and evaluation by tracking the movements of personnel during training exercises.

METHODS

Research Design

The descriptive and quality improvement type of research were directed to accomplish the objectives of the project. The proponent conducted surveys and interviews with the Philippine Army personnel who are assigned to Infantry Battalions and other Philippine Army Major Units to develop a Military Operations Location Tracking System (MOLTS) that will benefit the Military on monitoring and planning combat operations.

Data and Process Modeling

To develop the system, the Prototyping Development Model was used to guide the development of the project. The step-by-step process of the development model suits the needs of the proponent to produce an early model and initial outcome of the systems functionality.

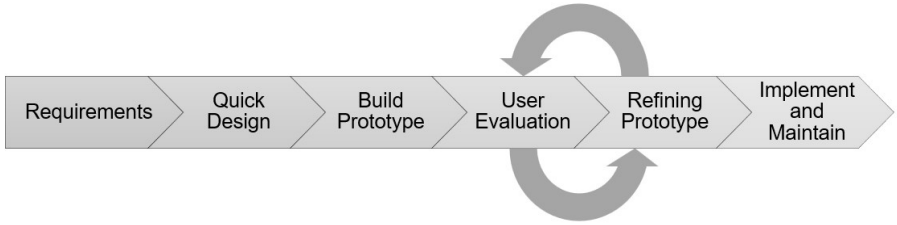

Figure 1. Prototyping Development Life Cycle

Materials

Materials such as software and hardware were considered for building the prototype of the system. They were properly selected to ensure that the requirements result would be accomplished. See Tables 1-2.

Table 1. Software in the Study

Software	Version
Thonny IDE	Version 4.0.2
Python	Version 3.8.0
MariaDB	Version 11.2.0
Apache httpd	Version 2.4.0
Firebase	Version 12.4.1

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Table 2. Hardware in the Study

Description	Unit	Qty	Price	Total
Raspberry Pi Zero W	Pcs	1	1,700.00	1,700.00
Neo-6M GPS	Pcs	1	500.00	500.00
Jumper Wires	40Pcs/row	2	150.00	300.00
Powerbank 10KMaH	Pcs	1	1,000.00	1,000.00
Solar Panel	Pcs	1	700.00	700.00
Toggle Switch	Pcs	2	80.00	160.00
			TOTAL	**4,360.00**

Statistical Tool

The statistical tool that was used in the interpretation of data is percentage. The formula to get the percentage is as follows:

$$CEP = \frac{\sqrt{x_{error}^2 \, y_{error}^2}}{2}$$

Where

X error is the difference between the reported x-coordinate and the true x-coordinate.
Y error is the difference between the reported y-coordinate and the true y-coordinate.

Participants in the Study

The standard number of elements in squad in the military operation is nine, and the prototype is equipped to the squad leader's helmet. One battalion operations officer and one Operation Non-Commission Officer (NCO), one Production NCO, one Assistant Operations NCO, one Communication Electronics Information System (CEIS) NCO, and one Cybersecurity Incident Response (CIR) NCO. These trained military personnel evaluated the acceptability of the prototype.

RESULTS and DISCUSSION

The locating and monitoring of personnel in the field is crucial in the military. By providing real-time, efficient, and accurate birds eye view of the operations and rescue mission can save lives. The researcher's personal experience in the field led to the idea to develop a system that can monitor the troops during the conduct of rescue, patrolling, and combat operations. The system prototype automates the monitoring and locating of troops in the field, also, reduces the process on sending the location thru radio frequency, increase the productivity of the military personnel on terrain analysis, provide secured transmission of location of troops in their area.

Table 3. Summary of Results of Prototype Testing

Test Item	Item Name	Test Result: Passed / Failed
1	MOLTS Device Prototype	Successful
2	MOLTS Web Platform Prototype	Successful

Table 3 illustrates the conducted successful testing of the items. This means that the whole system is functional, reliable, and accurate.

The Global Positioning System (GPS) has developed as a crucial technology in military operations, delivering precise and reliable position data for a variety of purposes. This study provides a thorough examination of the

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findings and discussions around the use of GPS in military contexts. The research considers the benefits, problems, and future possibilities of GPS in military operations, focusing on its role in improving situational awareness, navigation, targeting, and overall mission effectiveness.

Improved Situational Awareness. The utilization of GPS technology has greatly increased military situational awareness. Commanders can make more sound judgments, coordinate unit movements, and respond to threats by precisely locating the relative positions of friendly and hostile forces.

Navigation Accuracy. Military mobility has been transformed by GPS-enabled navigation. Troops, vehicles, and aircraft can navigate with pinpoint precision even in challenging terrain or adverse conditions. This accuracy decreases the possibility of being disoriented and increases strategic maneuverability.

Search and Rescue Operations. GPS technology contributes to the recovery of crashed aircraft, stranded personnel, and calamity survivors. Precise location information speeds up rescue attempts, saving lives in situations of imminent danger.

Cybersecurity concerns. Considering GPS systems are susceptible to spoofing and jamming attacks, there is rising concern about potential military operations interruptions. Anti-spoofing technology advancements and strong encryption are required to prevent such risks.

Incorporation with Other Technologies. By combining GPS with other technologies such as satellite communication, drones, and artificial intelligence, military systems can become more reliable and adaptable, capable of responding to changing battlefield conditions.

Future prospect. GPS innovations in the military have an exciting future. Integration with future technologies, greater anti-jamming capabilities, and enhanced cybersecurity will be critical. Likewise, the military will continue to look into ways to maximize GPS data for decision-making using advanced data analytics and real-time information processing.

Conclusions

The prototype was developed to automate the manual transmission of location of troops. It improves the situational awareness in the field, assist the commanders during prompt decision making, provide precise location information of military personnel, and overall operational effectiveness.

Recommendations

The researcher recommended that the developed prototype be used by the different units of the Philippine Army to accurately monitor the locations and operations of troops. Training programs should also be established to ensure the military personnel are proficient in using the prototype technology, proper usage, maintenance, and troubleshooting.

Also recommend is the investing in this prototype to stay ahead of emerging threats and take advantage of the technological advancements in GPS technology.

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