JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

INFANTRY COMBAT VEHICLE (ICV BMP-2) SYSTEM USING C

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ABSTRACT

This paper outlines the urgent need for a silent overwatch system for infantry combat vehicles(ICVs), specifically targeting the BMP-2, incorporating fuel cell or alternate fuel-based auxiliary power. The system's primary objective is to facilitate silent operation of critical components such as the Commander Thermal Imaging Sight(CTIS), communication equipment and gun traverse.
Crucially, this silent mode operation should be sustained for 6 to 7 hours without depleting the existing secondary batteries of the vehicle. The anticipated prototype technical solution is expected to
deliver a Silent Watch Capability of 6 hours while ensuring seamless integration with the BMP-2 ICV
using a C program. The immediate requirement is to develop a Silent Overwatch System for the BMP-2 ICV, ensuring silent operation for critical components such as CTIS, communication equipment and gun traverse. C program is written to predict the working hours of the system while operating different equipment continuously for 6 to 7 hours without impacting the vehicle's secondary batteries.

I INTRODUCTION

The development of Infantry Combat Vehicles (ICVs) represents a pivotal advancement in modern warfare, providing indispensable support in troop transportation, fire assistance, and engagement with hostile forces. These robustly armored vehicles are purposefully engineered to shield infantry personnel from a myriad of threats, spanning from small arms fire to shrapnel and other hazards prevalent on the battlefield [1]. Armed with a versatile array of offensive and defensive weaponry, including machine guns, automatic cannons, and anti-tank missiles, ICVs possess the capacity to effectively engage both personnel and armored targets alike. Distinguished by their agility across diverse terrains, ICVs are equipped with either tracks or wheels, ensuring adaptability in various operational environments. Furthermore, their amphibious capabilities facilitate seamless navigation across water barriers, streamlining river crossings and bolstering operational agility. Within the strategic landscape, ICVs synergize harmoniously with other armored units, infantry divisions, and supporting elements to achieve mission objectives seamlessly. Prime examples of these vehicles include the globally renowned Bradley Fighting Vehicle, a mainstay in the arsenal of the United States military, and the BMP series, notably the BMP-2 [4], extensively utilized by the Russian military.

The BMP-2, derived from the Russian acronym "Boyevaya Mashina Pekhoty," translating to "infantry fighting vehicle," epitomizes the pinnacle of second-generation infantry vehicle technology. Originally introduced by the Soviet Union in the early 1980s, the BMP-2 not only serves as a reliable transporter of infantry troops but also boasts formidable fire support capabilities, significantly augmenting combat effectiveness on the modern battlefield. In addition to its widespread use by global military powers, the BMP-2 holds significant prominence within the arsenal of the Indian Army, further exemplifying its versatile and enduring utility on the battlefield. As a cornerstone of India's mechanized infantry forces, the BMP-2 plays a pivotal role in enhancing the nation's defensive capabilities and operational readiness [3].Deployed across various theaters of conflict and terrain profiles, the BMP-2 serves as a steadfast asset in India's defense strategy, offering unparalleled mobility, protection, and firepower. Its integration within Indian Army formations underscores its adaptability to diverse operational requirements, ranging from counterinsurgency operations in rugged terrain to conventional warfare scenarios on the plains.

Furthermore, the BMP-2's combat-proven performance in a multitude of operational environments has cemented its reputation as a dependable workhorse within the Indian Army's armored fleet. Whether navigating through dense forests, traversing mountainous terrain, or maneuvering in urban landscapes, the BMP-2's versatility ensures that Indian infantry forces maintain a formidable edge over adversaries.Moreover, the BMP-2's modular design facilitates seamless integration with indigenous upgrades and enhancements, aligning with India's strategic objective of bolstering self-reliance in defense manufacturing. By incorporating state-of-the-art technologies and tailored modifications, the Indian Army ensures that its fleet of BMP-2 vehicles remains at the forefront of modern warfare, equipped to meet evolving threats and operational challenges.

In essence, the BMP-2 stands as a testament to the enduring partnership between the Russian Federation and India, symbolizing a shared commitment to enhancing national security and safeguarding territorial integrity. As a cornerstone of India's armored forces, the BMP-2 continues to uphold its legacy as a versatile and formidable platform, poised to meet the dynamic demands of contemporary warfare.

II. SILENT OVERWATCH IN ICV BMP-2 SYSTEM

"Silent Overwatch" typically refers to a tactical concept where a unit observes an area quietly without alerting the enemy to its presence. In the context of an ICV BMP-2, this could involve using the vehicle for reconnaissance or surveillance purposes while minimizing noise and maintaining a low profile to avoid detection.

To fulfill the requirement of a Silent Overwatch for infantry combat vehicles (ICVs) like the BMP-2, utilizing fuel cell or alternate fuel-based auxiliary power for silent operation while powering essential systems such as the Commander Thermal Imaging Sight, Gunner Thermal Imaging Sight, communication equipment, main armament, gun traverse, and internal dome lights continuously for 6 to 7 hours without affecting the existing secondary batteries of the vehicle, several steps can be taken:

A. Silent Operation Design: Ensure that the auxiliary power system is designed for silent operation, minimizing noise emissions that could compromise the stealth capabilities of the ICV during Overwatch missions.

B. Power Management System: Implement an advanced power management system that optimizes the distribution of power to essential systems such as thermal imaging sights, communication equipment, main armament, gun traverse, and internal dome lights. This system should prioritize power allocation to critical functions while efficiently utilizing the available energy from the auxiliary power source.

C. Battery Backup: Incorporate a separate battery backup system specifically for the essential systems to provide redundancy and ensure continuous operation even in the event of auxiliary power system fail.

III. METHODOLOGY

The methodology for developing the Silent Overwatch System for Infantry Combat Vehicles begins with a meticulous analysis to ascertain the precise power requirements of critical components during silent operation, factoring in various operational scenarios and environmental conditions [2]. This is followed by an exhaustive evaluation of available fuel cell and alternate fuel technologies, prioritizing options with low noise emissions, high energy density, and seamless integration with the BMP-2 platform.Iterative optimization based on test results and user feedback refines the system for enhanced efficiency, durability, and user-friendliness. Comprehensive documentation covering system specifications, installation procedures, maintenance protocols, and operational guidelines is prepared to facilitate standardized deployment and interoperability across ICV units, adhering to relevant military standards and regulations.

Figure 1. Infantry Combat Vehicle

A. PARTS OF ICV BMP-2

In Fig. 1, a comprehensive breakdown is presented illuminating the constituent components of an infantry combat vehicle.

1.Commander thermal Imaging Sight

The Commander's Thermal Imaging Sight (CTIS) is a key component installed on the Infantry Combat Vehicle (ICV) BMP-2.The CTIS provides thermal imaging capabilities to the commander of the BMP-2, enhancing situational awareness and target acquisition capabilities, especially during low-light conditions or adverse weather situations.By integrating thermal imaging into the commander's sight, the BMP-2 enhances its reconnaissance and surveillance capabilities, enabling it to operate effectively both during the day and at night. This technology significantly improves the vehicle's ability to identify potential threats and engage targets accurately, contributing to its overall combat effectiveness on the battlefield.

2.Gunner Thermal Imaging Sight communication equipment.

The Gunner Thermal Imaging Sight (TIS) is an essential component of modern armored vehicles, providing the gunner with enhanced visibility and targeting capabilities, especially during night operations or in low-visibility conditions. Thermal imaging technology allows the gunner to detect and engage targets based on the heat signature they emit, rather than relying solely on visible light. The integration of such equipment in armored vehicles like the BMP-2 significantly enhances their combat effectiveness, enabling them to operate effectively in various environments and lighting conditions

3.Gun traverse

As for the gun traverse, the BMP-2's [4] turret is equipped with a 30mm autocannon (2A42) which is capable of traversing horizontally to engage targets. The traverse mechanism allows the gunner to move the cannon left or right within its operational range, typically controlled by the gunner using manual controls or through the vehicle's fire control system.

TABLE 1: Summary of performance evaluation

S.NO	No of devices in working	Battery time
1.	Commander Thermal light	6 hours
2.	Thermal imaging sight Communication	7 hours
3.	Gun traverse	5 hours
4.	Thermal light and Communication	3 hours
5.	Thermal light and Gun traverse	4 hours
6.	Communication and Gun traverse	2.5 hours
7.	All	2 hours

In figure 2 the table provides a breakdown of various devices equipped within an infantry combat vehicle, along with their respective battery time durations in hours. Each device combination is listed alongside its corresponding battery time, enabling an assessment of the power consumption and operational sustainability of the vehicle's essential components. The devices listed include the Commander Thermal Light, Thermal Imaging Sight Communication, Gun Traverse, and combinations thereof. The table facilitates strategic decision-making regarding device usage and resource allocation based on operational requirements and available power reserves.

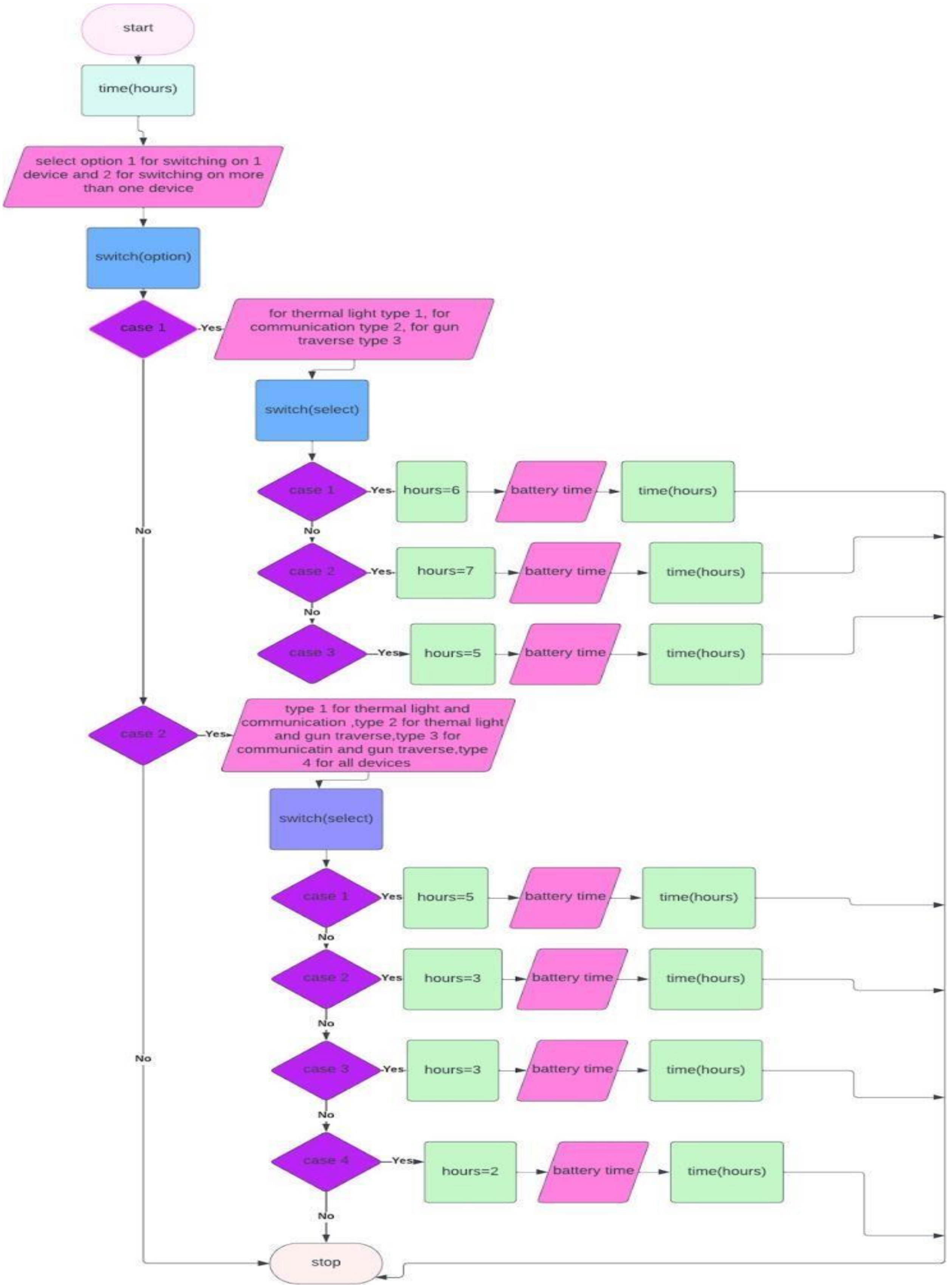

Figure 2: Flow chart of main program

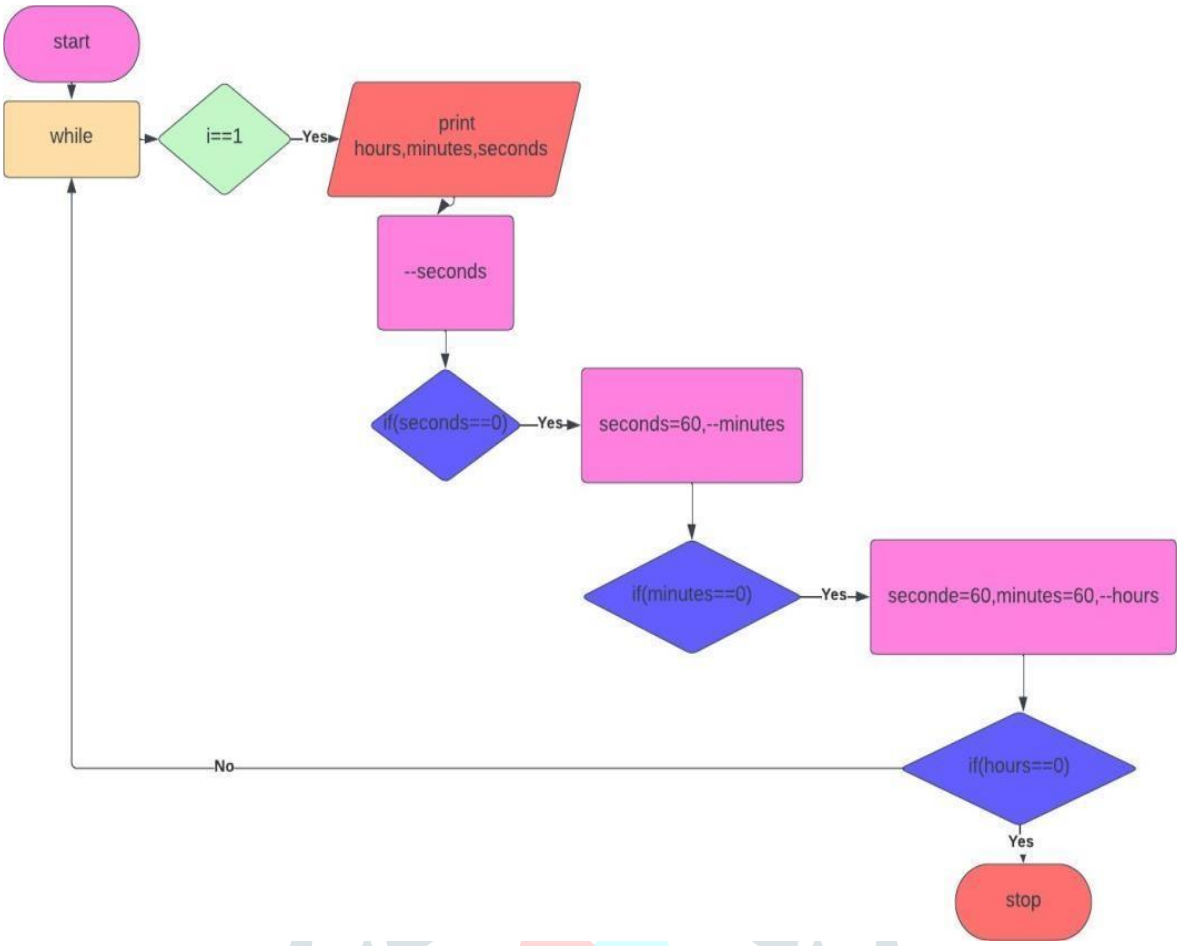

Figure 3: flow chart of sub program

From figure 2 and 3 the provided C program is designed to manage the operation and battery usage of devices within an infantry combat vehicle (ICV). It begins with including necessary header files for input/output operations and the sleep() function. The main() function serves as the program's entry point, prompting the user to choose between switching on a single device or multiple devices. Depending on the user's selection, the program uses nested switch statements to handle device choices. For a single device, the user selects from options such as Commander Thermal Light, Thermal Imaging Sight Communication, or Gun Traverse, with each choice resulting in the corresponding device being turned on and its battery runtime calculated. Similarly, for multiple devices, the user selects combinations of devices to activate, and their collective battery runtime is determined accordingly. Throughout the program, clear prompts and feedback messages guide the user through device operation and battery usage. Finally, once the battery is depleted, the program notifies the user of low battery status and proceeds to shut down. Overall, this program effectively simulates the management of device operation and battery usage in an infantry combat vehicle, demonstrating practical application of programming concepts in a military context.

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IV. RESULTS

```
select an option
Type-->1 if you want to switch only one device
OR
Type--> 2 if you want to switch on two/more devices
Give your option=1


select an option
Type--> 1For switching on comandr thermal light
Type--> 2 For for switching on sight communication euipment
Type--> 3 For switching on gun travers
Give an option:1
switching on comander thermal light
battery usage time
        6 HOURS : 0 MINUTES : 0 SECONDS battery left=0%
*****low battery*****
battery finished
shutting down
```

figure 4: : Outputs obtained from the compiler for the input given (option 1 and again 1)

```
select an option
Type-->1 if you want to switch only one device
OR
Type--> 2 if you want to switch on two/more devices
Give your option=1


select an option
Type--> 1For switching on comandr thermal light
Type--> 2 For for switching on sight communication euipment
Type--> 3 For switching on gun travers
Give an option:2
switching on thrmalal imaging sight communicationbattery runtime
        7 HOURS : 0 MINUTES : 0 SECONDS battery left=0%
*****low battery*****
battery finished
shutting down
```

figure5: Outputs obtained from the compiler for the input given (option 1 and again option 2)

```
select an option
Type-->1 if you want to switch only one device
OR
Type  > 2 if you want to switch on two/more devices
Give your option-1


select an option
Type--> 1For switching on comandr thermal light
Type--> 3 For switching on gun travers
Give an option:3
switching on gun traverse
battery run time
        5 HOURS : 0 MINUTES : 0 SECONDS battery left=0%
*****low battery*****
battery finished
shutting down
```

figure6 : Outputs obtained from the compiler for the input given (option 1 and again option 3)

In figure 4,5,6 the user is asked to select an option: either switching on only one device (option 1) or switching on two or more devices (option 2) . If the user chooses option 1, they are again asked to select which specific device they want to switch on (commander thermal light, sight communication equipment, or gun traverse).Depending on the selected device, the program simulates its operation and battery usage over time.The program continuously displays the remaining battery percentage until the battery is depleted. If the battery reaches a low level (e.g., 50%, 20% or 0%), a warning message is displayed.Once the battery is depleted, the program displays a message indicating that the battery is finished and then shuts down.

```
select an option
Type-->1 if you want to switch only one device
OR
Type--> 2 if you want to switch on two/more devices
Give your option=2


select an option from the given menu
Type -1 for thermal light and communication
Type -2 for thermal light and gun traverse
type -4 for comander thermal light,communication equipment,gun traverse
give your option:1
switching on communication and thermal light
battery run time
        4 HOURS : 0 MINUTES : 0 SECONDS battery left=0%
*****low battery*****
battery finished
shutting down
```

figure 7: Outputs obtained from the compiler for the input given (option 2 and again option 1)

```
select an option
Type-->1 if you want to switch only one device
OR
Type--> 2 if you want to switch on two/more devices
Give your option=2


select an option from the given menu
Type -1 for thermal light and communication
Type -2 for thermal light and gun traverse
type -4 for comander thermal light,communication equipment,gun traverse
give your option:2
switching  on gun traverse and thermal light
battery run time
        3 HOURS : 0 MINUTES : 0 SECONDS battery left=0%
*****low battery*****
battery finished
```

figure 8: Outputs obtained from the compiler for the input given (option 2 and again option 2)

```
select an option
Type-->1 if you want to switch only one device
OR
Type--> 2 if you want to switch on two/more devices
Give your option=2


select an option from the given menu
Type -1 for thermal light and communication
Type -2 for thermal light and gun traverse
type -4 for comander thermal light,communication equipment,gun traverse
give your option:3
switching on gun traverse and communicatio
battery run time
        3 HOURS : 29 MINUTES : 59 SECONDS battery left=50%battery left=0%
*****low battery*****
battery finished
shutting down
```

figure 9 : Outputs obtained from the compiler for the input given (option 2 and again option 3)

```
select an option
Type-->1 if you want to switch only one device
OR
Type--> 2 if you want to switch on two/more devices
Give your option=2


select an option from the given menu
Type -1 for thermal light and communication
Type -2 for thermal light and gun traverse
type -3 for communication and gun traverse
type -4 for comander thermal light,communication equipment,gun traverse
give your option:4
switching on gun travers,thermal light,communication
battery run time
        2 HOURS : 0 MINUTES : 0 SECONDS battery left=0%
*****low battery*****
battery finished
shutting down
```

figure 10:Outputs obtained from the compiler for the input given (option 2 and again option 4)

In figure 7,8,9 and 10 if the user chooses option 2, they are prompted to select combinations of devices to switch on simultaneously (thermal light and communication, thermal light and gun traverse, or communication and gun traverse). The program then simulates the operation and battery usage of the selected combinations in a similar manner to option 1.

V. CONCLUSION

The requirement for a Silent Overwatch system for ICV, particularly the BMP-2, presents a crucial need for enhancing stealth capabilities without compromising operational effectiveness. A C program is utilized to predict the Fuel Cell or Alternate Fuel based Auxiliary Power, offers a promising approach to achieve prolonged silent operation while simultaneously powering critical equipment such as the CTIS, communication devices, and gun traverse.

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