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Remote Operated Tank Hunter (ROTH)

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ABSTRACT

Terrorism and Insurgency are two of the most important issues facing the world today. Governments and scientists all over the world are working night and day to bring these issues under control. Countries are spending billions of dollars on the development of new defense systems to protect their citizens from terrorism threats. Today, with the advances in vehicle automation, some of the most dangerous and crucial counter terrorism operations are being carried out by sophisticated machines that are not only more effective but also save several human lives. Our project "unmanned ground vehicle" is designed to perform tasks such as border patrol, surveillance, and in active combat, both as an autonomous unit (automated) and in co-ordination (manual) with human soldiers. It is a prototype that illustrates the ever-growing need for advanced technology and precision-driven vehicles that meet the current needs for first line of defense.

Keywords:-
ROTH- Remote operated tank hunter
UGV- Unmanned ground vehicle
CMU-Cell monitoring unit
IMU- Inertial measurement unit
Li-Po- Lithium Polymer battery

INTRODUCTION

A **Remote operated tank hunter** (**ROTH**) is a military robot used to augment the soldier's capability. This type of robot is generally capable of operating outdoors and over a wide variety of terrain[5], functioning in place of humans. ROTHs have counterparts in aerial warfare (unmanned aerial vehicle) and naval warfare (remotely operated underwater vehicles) [2].Unmanned robotics is actively being developed for both civilian and military use to perform dull, dirty, and dangerous activities.

There are two general classes of unmanned ground vehicles:
1. Tele-operated.
2. Autonomous.

Tele-operated:

A Tele-operated ROTH is a vehicle that is controlled by a human operator at a remote location via a communications link. All cognitive processes are provided by the operator based upon sensory feedback from either line-of-sight visual observation or remote sensory input such as video cameras. A basic example of the principles of Tele-operation would be a toy remote control car. Each of the vehicles is unmanned and controlled at a distance via a wired or wireless connection while the user provides all control based upon observed performance ofthe vehicle. [3]

Autonomous:

An autonomous ROTH is essentially an autonomous robot but is specifically a vehicle that operates on the surface of the

ground. [3] A fully autonomous robot in the real world has the ability to: · Gain information about the environment.
· Work for extended durations without human intervention.
· Travel from point A to point B, without human navigation assistance.

OBJECTIVES

The objectives of UGV are:

- The ROTH has been designed to carry out tasks like border patrol, surveillance, and target identification.
- To aid in the efforts of recovery and rescue operations.
- Monitoring in isolated areas.
- To gather and document alterations in the environment within habitable locations.
- To create an inexpensive framework that can be mass produced.
- Portable size which can be easily carried during missions.
- To detect landmines.

BLOCK DIAGRAM EXPLAINATION

Base station: It's a computer system located at a remote place away from the ROTH which controls it using keyboard, mouse for mode control and movement and live video feedback for monitoring the environment.

Keyboard and mouse: They are used to handle the motion of the ROTH and the movement of the turret for wide angle vision. **3G Internet:** Communication medium for system to system interaction so as to control the ROTH wirelessly. **On-board system:** A computer system placed on the ROTH itself which receives the commands and delivers it to the control Unit.

Camera: An image acquiring device which provides the video required for ROTH vision. **Control Unit:** It's the Arduino microcontroller which receives signals from the user and other sensors and performs tasks such as turret movement and ROTH movement.

GPS Unit: A GPS Unit is a navigation system used in autonomous mode to acquire location co-ordinates.

Compass: To acquire the direction to which the ROTH is facing.

IR sensors: The infrared sensors are used in the anti-lock braking system integrated into the autonomous mode.

Servo motor: They are used to control the direction turn of the ROTH and the 2 axis movement of the turret.

DC motor: These are used mainly for the ROTH movement.

Li-PO Battery and voltage regulator: the power source supplying the entire ROTH with voltage regulation to provide optimum power ratings.

Wireless modem: Skydroid to provide wireless data transfer for the ArmCon mode.

IMU: An inertial measurement unit which tracks the orientation of the hand used for hand Gesture control (ArmCon mode).

Ni-Cd battery: It is used to power the CMU and IMU. [3]

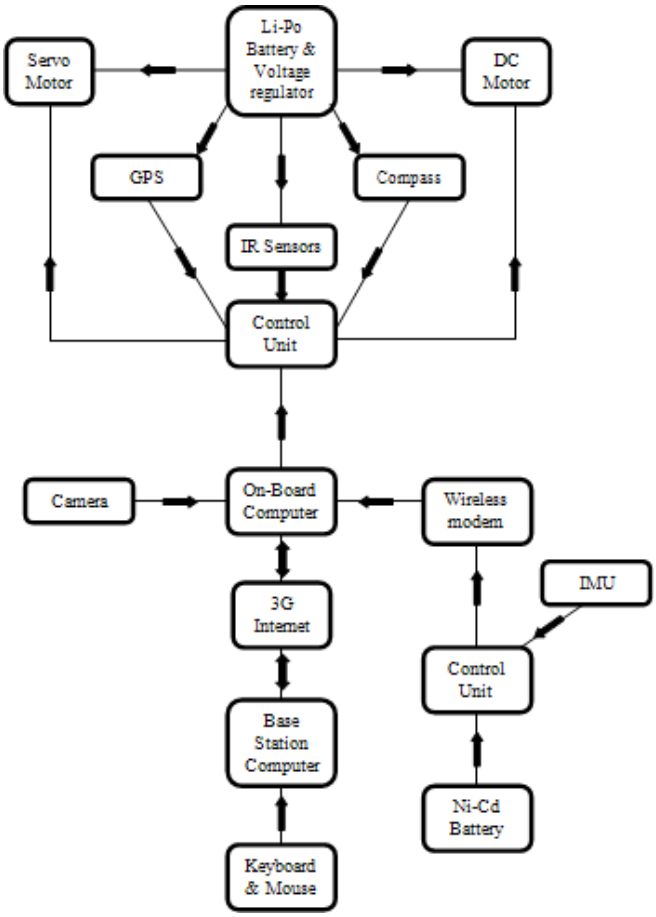

Fig 1 Block Diagram

HARDWARE USED

- ARDUINO MICROCONTROLLER
- SERVO MOTOR
- DC MOTOR
- INERTIAL MEASUREMENT UNIT
- SKYDROID RADIO MODEM
- 78XX IC'S
- ELECTROMAGNETIC COMPASS MODULE · GPS RECIEVER SYSTEM
- H-BRIDGE
- LITHIUM POLYMER BATTERY
- FTDI CHIP
- WEBCAM
- 2X RELAY BOARD
- IR SENSORS
- NICKEL-CADMIUM

ADVANTAGES

1. Data: The benefits of using Tank Hunter UGVs are significant, with a 75% reduction in casualties when compared to traditional, manned anti-tank units.
2. Precision: The precision offered by these UGVs results in a 60% decrease in collateral damage, minimizing harm to civilians and infrastructure.
3. Operational in Hazardous Environments: They can operate in hazardous environments, such as chemical or radio

logically contaminated areas, which would be life-threatening to human soldiers.
4. Cost-Effectiveness: These UGVs provide a 50% cost reduction in terms of maintenance and training when compared to maintaining traditional armored units, making them a cost effective solution for militaries.

APPLICATION

- Provide support to military personnel engaged in live combat situations.
- Assists in monitoring, scouting, and identifying targets.
- Applications related to outer space.
- Farming uses.
- Management in supply chain.
- Assist in furnishing soldiers with necessary provisions.

LIMITATIONS

- Current capacities of the batteries i.e. (Li-PO and Ni Cd). These batteries can power up the system only for a particular duration defined by their current capacities, elapsing which the batteries would drain out leaving the system powerless.
- It is required for the system to have high data rates of 3G internet services for the communication between the base station and ROTH. Failure in providing such high data rates would lead to inefficient processing and thus an unreliable system.
- It is required that the computers that are used on board and the one used in the base station need to have high computational capabilities and high processing speeds.
- GPS used on board to get the current location of the ROTH will not lock onto a value unless and until there is direct line of sight between the ROTH and at least 4 satellites.

CONCLUSION

We have successfully developed a prototype that operates in self-control mode using GPS antenna, magnetic compass, path planning, and obstacle detection algorithms. In this mode, the unmanned ground vehicle (UGV) is capable of autonomously traveling from one location to another without any human intervention or navigation commands. It adjusts its strategies and measurements based on path planning, obstacle detection, GPS antenna, and magnetic compass. We strongly believe that self control robots have great potential for military applications, especially in outdoor operations. This UGV can perform tasks such as surveillance, border patrol, and active combat, either independently or in coordination with human soldiers in manual or automatic mode. Our future work involves developing an arm controlled mode or gesture-controlled mode, in addition to the command control mode and automatic mode.

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