A

Project Report

On

DESIGN AND DEVELOPMENT OF A PORTABLE MEDIA CONTROLLED UNMANNED GROUND VEHICLE

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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CHAPTER 1

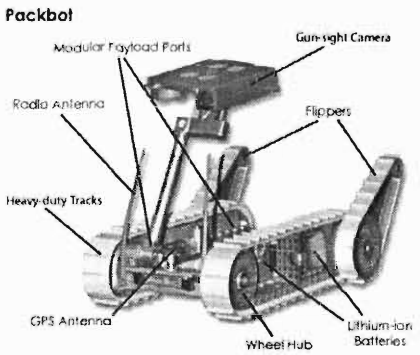
PROJECT OVERVIEW

1.1 INTRODUCTION

Reconnaissance is one of the key activities carried out by the military to explore areas and to gain information about enemy forces or features of the environment.

With the advent of the modern robotics, manned vehicles like tanks and aircrafts are being used for the same purpose. But all these methods present one problem - Risk of losing human lives. As a result, unmanned vehicles both on air and ground have been developed by the military to facilitate instantaneous access to unknown territory while avoiding the risk of losing precious lives.

Our project focuses on Unmanned Ground Vehicles, in short UGVs.



1.2 UNMANNED GROUND VEHICLE (UGV):

A UGV is defined as a ground-based mechanical device that can sense and interact with its environment. It may possess any level of autonomy with respect to its human operator(s), from manual (where the human has complete control) to fully autonomous (where the robot can carry out assigned tasks on its own). UGVs have various sensors, cameras and arms mounted on them. They come in different sizes too. Some like the "Big-Dog" are monsters designed for assault while others like the "Packbot" are so compact, light and robust that one can carry them on the back. They have the ability to negotiate rough terrain, carry heavy loads and send video feed with other related information like GPS coordinated, temperature etc. to a remote location.

Unmanned ground vehicles or **UGV** - which are robotic platforms used to extend human capabilities especially in dangerous environments. UGVs are capable of operating outdoors and indoors and over a wide variety of terrains, functioning in place of humans.

Unmanned robotics is actively being developed for both civilian and military use to perform dirty and dangerous activities. The US Department of Defence estimates the size of this market to be $1.7 Billion over the next five years.

Essentially there are two classes of unmanned ground vehicles:

1. **Tele-operated**
2. **Autonomous.**

Autonomous & Semi-Autonomous UGVs - An autonomous UGV is essentially an autonomous vehicle that operates on the ground without human intervention.

There are semi and fully autonomous unmanned ground vehicles.

With a semi-autonomous vehicle a human drives the robot remotely most of the time. The vehicle's computers and sensors provide 'driver-assist' features that prevent collisions and makes driving the robot easier much as cruise control and anti-collision sensors in some high end automobiles do today. More sophisticated semi-autonomous behaviour has the vehicle driving itself to a predetermined destination over a predetermined route - often re-traversing a route first completed by a human controlling the vehicle remotely. Thus the UGV is driven down range by a human and back by a machine.

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.
- Avoid situations that are harmful to people, property or itself
- Repair itself without outside assistance.

A robot may also be able to learn autonomously. Autonomous learning includes the ability to:

- Learn or gain new capabilities without outside assistance.
- Adjust strategies based on the surroundings.
- Adapt to surroundings without outside assistance.

Tele-operated UGV - A Tele-operated UGV 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 remote control vehicle. Each of the vehicles is unmanned and controlled at a distance via a wireless connection while the user provides all control based upon observed performance of the vehicle.

There are a wide variety of Tele-operated **UGVs** in use today. Predominantly these vehicles are used to replace humans in hazardous situations. Examples are explosive and bomb disabling vehicles. These are used in Home Land Security, SWAT and the Department of Defence. And these Mission Modules are mostly designed for specific applications.

1.3 PROBLEM STATEMENT:

In a hostile environment, activities such as surveillance and explosive disposal demand a high level of skill if they have to be carried out by humans. Moreover, people need to be trained to carry out such activities, consuming time and much monetary expenditure. Also, direct involvement of people in such activities poses considerable risk of losing lives.

UGVs can instead be deployed to carry out these activities remotely while avoiding the risk of losing precious lives. They can move faster than humans, negotiate rough terrain and survive harsh environmental conditions at the same time.

To overcome three main shortcomings observed in various Literature studies and existing implementations of UGV, we define our problem statement in three parts.

1. The rescue robots used these days have a bulky control system with a variety of equipment. Also the people concerned with managing or using such systems must be well trained in order to make maximum use of such systems.

2. Sometimes in the battlefield, it is necessary for UGVs to protect themselves against attacks. But most of the robots lack this capability; hence we intend to introduce a defensive gun mechanism.
3. There are a variety of factors which make field work particularly challenging for robots compared to lab conditions. Conditions which a robot may encounter in a field include: dirt, standing water, rain, intense heat, intense cold, confined spaces, uneven surfaces, the presence of obstacles with unpredictable movement, and hostile agents. There are areas in which larger robots cannot navigate. This is a major problem encountered with UGVs. To overcome this problem, we introduce a concept of "**Baby Robots**".

   Simplicity of design and careful selection of essential features can go a long way in making them an economically feasible option for military needs.

1.4 OBJECTIVES OF THE STUDY

Aim of our project is to design and develop a portable media controlled unmanned ground vehicle, which can be used for rescue missions regarding light conflict operations like terrorist attacks and hostage situations. UGV employs number of sensors as well as camera to observe environmental data and transmit it to a portable media device like an Android mobile.

The UGV is to be designed with the following features:

- Portable light weight control system for UGV which should be simple and intuitive.
- No prior training should be required to control UGV i.e., user friendly GUI for controller.
- The range of operation should be considerably increased using WLAN.