Modeling & Controlling of Unmanned Vehicle

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***Abstract*-An unmanned vehicle is controlled by a human operator via a communications link. All actions are determined by the operator based upon either direct visual observation or remote viewing through a camera. These vehicles are used to replace humans in hazardous situations. It is used for ground surveillance, gatekeeper/checkpoint operations, urban street presence, and to enhance police and military services. An unmanned Vehicle is capable of operating outdoors and over a wide variety of terrain, functioning in place of humans. Unmanned vehicles are actively being developed for both civilian and military use to perform dull, dirty, and dangerous activities. There are two classes of unmanned ground vehicles: Remote-Operated and Autonomous. The proposed system gives gain information about the environment and work for extended durations without human intervention. It can travel from point A to point B, without human navigation assistance, avoid situations that are harmful to people, property or itself, unless those are part of its design specifications, it can repair itself without outside assistance, can detect objects of interest such as people and vehicles. It can also learn or gain new capabilities without outside assistance, adjust strategies based on the surroundings, adapts to surroundings without outside assistance.**

Keywords:-Unmanned vehicles, Navigation, Ground Surveillance

I. INTRODUCTION

An unmanned ground vehicle (UGV) is a military robot used to augment the capabilities of an infantry unit, or replace said unit entirely. This type of robot is generally capable of operating outdoors and over a wide variety of terrain, functioning in place of humans.

The UGV is the land-based counterpart to unmanned aerial vehicles and remotely operated underwater vehicles. Unmanned robotics is actively being developed for both civilian and military use to perform dull, dirty, and dangerous activities.

There are two classes of unmanned ground vehicles: Remote-Operated and Autonomous.

1. *Remote-Operated*

A remote-operated UGV is a vehicle that is controlled by a human operator via a communications link. All actions are determined by the operator based upon either direct visual observation or remote viewing through a camera. A basic example of the principles of remote-operation would be a remotely controlled toy car.

2. *Autonomous*

An autonomous UGV is essentially an autonomous robot that operates without the need for a human controller. *Examples of Unmanned ground vehicle technology.*

- Unmanned Snatch Land Rover
- Gladiator Tactical Unmanned Ground Vehicle
- Ripsaw MS1
- DRDO Daksh
- VIPeR
- Nova 5

II. PROBLEM IDENTIFICATION

The UGV technology grows rapidly. Generally UGV is developed for military purpose. This vehicle can drive on the urban environment. The UGV system consists of four parts such as vehicle control system, navigation system, obstacle detecting system and arbitration system.UGV needs to be unusually reliable. If avehicle fails in the danger area the operator either has to abandon it orendure unnecessary risk to recover it.

The direction for further work is to recover the vehicle in case of GPS/Local connection failures as well as if the fuel is limited. A detailed Flowchart can be prepared to overcome these problems.

The flowchart is to be made such that it makes sure that the mission gets completed successfully. In forward path if GPS connection fails then also mission should execute using Local connection.

In Return Path if GPS and Local connections fail then AUTO MODE will make sure that vehicle returns to starting point. In AUTO MODE the system will retrieve the original forward Path and execute that path in Last In First Out(LIFO) mode. This AUTO MODE will play important role to save vehicle from damage and losing the unmanned vehicle.

Proposed work mainly focuses on development of algorithm to recover the vehicle in case of GPS/ Local Connection failures and fuel limitation.

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III. SCOPE OF WORK

Development of algorithm to meet stated objectives:

- The UGV must be able to account for communications breakdowns and be able to continue its mission in the absence of orders. This means that the UGV must be able to plan.
- It is essential that any orders, originating from a human operator, be given immediate priority, unless the orders conflict directly with the current operational guidelines; the machines should revise operational data as soon as the human operator gives updates unless the updates would cause the UGV to break its operational constraints.
- The UGV must maintain a knowledge base of data gathered from the environment and its own state, including fuel levels, damage assessments, battery charging status etc.
- The UGV must continually match its current planning set against the knowledge base and refine its plans based on any data gathered from the comparison. Visual data collection in UGV is more complex than simple image collection. Images must be processed and interpreted in order to have meaning to the UGV.
- A UGV must be able to accept directives from a human operator and make decisions based on those directives and gathered data. The UGV must be able to guess at the outcome of its decisions and continually revise its projected actions based on its guesses.

IV. SYSTEM DESCRIPTION AND METHODOLOGY FOLLOWED

A. Methodology Followed

The aim of the dissertation is to build a robotics research platform for executing various combat military related operations. This project would be a rugged, combat, all-terrain, all weather, portable, tele-operated UGV, autonomous UGV.

UGV must be able to communicate reliably so as to get mission completed successfully. Therefore selection of duplex communication is required.

UGV must be able to calculate distance. Therefore GPS system is incorporated in UGV.

UGV are costly so UGV must return to starting point. Therefore AUTOMODE method is used which retrieves the forward path and execute that path in LIFO Mode.

B. System Description

The System is divided in to two main parts.

1. Mechanical.

2. Electronics.

1. Mechanical:

UGV is a military oriented robot. So it should be capable enough to maneuver on rough surface, rocks, shallow water, slippery sand, should be able to climb steep slopes, should be able to climb stairs and various uneven surfaces. This platform is useful in a variety of civilian and military applications. For example, a robotic platform can search building for structural damage caused by any natural calamity, for search and rescue operation, for surveillance operation etc.

2. Electronics:

The Electronics section of project is most essential as it is the controller of the UGV. The control of UGV is through PC through wireless link. G.U.I. will be designed on the PC so as to aid the operator while operating UGV. The PC will send and receive the data through serial port. The serial port is then interfaced to RS232 to TTL logic converter so as to make the data compatible.

The data will then send the baseband signal to the wireless module for wireless data transmission. The wireless communication is mode used in the duplex communication mode.

V. FORWARD PATH ALGORITHM

Forward path means path from starting place to target place. The system will not respond until target place is given. As soon as target place is specified the system will follow following steps:

1. System will try to calculate distance using GPS.
2. If GPS system is unable to calculate distance then operator has to give distance.
3. In both cases it checks battery status and petrol status.
4. In both cases if distance is not proportional to status of battery &petrol then it will not proceed for mission.
5. In middle of mission if GPS connection is poor then system will take help of local connection.
6. If local connection also is not responding then system will follow Return path flow chart.

VI. RETURN PATH ALGORITHM

Return path means path from target place to starting place. System will wait for operator signal. As soon

as operator signal received system will follow following steps:

1. It will check GPS connection. If GPS connection is available then Navigation is carried using GPS.
2. If GPS connection is not available or not responding then it will navigate using local connection.
3. If local connection is not available or not responding then it will navigate using on board processor and sensor called as AUTO MODE.

If operator is not responding then system will wait for some time. If no reply after waiting time then system will navigate using on board processor and sensor called as AUTO MODE.

CONCLUSIONS

- In Return Path if GPS and Local connections fail then AUTO MODE will make sure that vehicle returns to starting point.
- In AUTO MODE the system will retrieve the original forward Path and execute that path in Last In First Out(LIFO) mode. This AUTO MODE will play important role to save vehicle from damage and losing the unmanned vehicle.

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