Multi Functional Autonomous Robotic System (MARS)

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Abstract - Implementation of robots for hazardous tasks and in diverse field of exploration and production is not a new thing to today's world. Robots have travelled to farthest distance of universe to heights of sky due to their resistance capability. Today robots have been used in place of humans in order to minimize the project cost and recourse requirement. The following project aims to perform multiple robotic tasks with the help of two units which are linked to each other. This system is capable to perform aerial surveillance and ground investigation. Aerial unit performs the task usually done by today's [1] UAV. This paper To develop a autonomous intelligent robotic system capable of doing ground and aerial surveillance, able in recognizing and tracking various objects , can work in hazardous situations also is capable of remote controlling from any part of world .

Index Items- UAV, autonomous intelligent robotic

I. INTRODUCTION

Its has been motive of all technological enhancement companies to provide multifunctional system that can perform diverse operations in field of research , warzone or in scientific studies . This system has been developed to fulfil these motives . Having two units working in different level gives the operator the capability to observe the situation from diverse angle i.e. from ground as well as air .

1.1 Motivation

Many military strategists and theorists have concluded, based on recent history, the nature of future wars will be limited to regional and intrastate conflicts. Large interstate wars such as [2] World Wars One and Two and the Persian Gulf War are not likely to be the wars of the future.

As well the scientific surveys will also use the robotic power to its maximum limit. This opens the wide market for today's robotic products. Either it's supervising the battle zone condition or searching for presence of life in mars. System such as this working together as one unit gives the huge flexibility in terms of operations and performance. Inter data exchange helps the system as well as other connected to work as a one and perform the task in wide ground at fast pace .

1.2 Structure

The system is generally divided into three units the aerial surveyor which provide the aerial graphical and geological data feed through [3] GPS live to its base unit. Video surveillance and picture of the place along with their exact geological reference can be taken. This feature is key component of this system which helps to perform all types of surveillance operations. Aerial unit basically consists of basic heli platform which is connected to android system having GPS sensor and camera unit which transmit data to its base unit via 3g data connection (3g internet). It is controlled by ground operator who receives the data at ground unit screen.

Ground unit is homemade differential drive platform connected having camera unit, infrared sensor, sonar senor and sonic radar. Ground unit consist a windows laptop on it which process all data interpreted by the aerial unit and ground unit sensors. Ground unit along with its sensors is capable of performing various tasks at ground level. The common properties of the systems are the freely distributed and modifiable software and hardware.

II. MARS PROJECT

At the beginning of the project, the main goal was a [5] low-cost platform which can capture aerial images and perform small ground task via base unit by keeping the resource requirement as low as possible and accompanying it within the defined terms.

1.3 Aerial Unit

Aerial unit is the core surveyor of the system which consists of the small helicopter platform, android system with various sensors and a camera integrated in it. Aerial unit platform can be controlled by the automated base unit with addition of few hardware supplements. Since android system is capable to control this unit independently with minor supervision from operator. This feature is still in research stage. After the aerial unit successfully takeoff user can see its location and real time surroundings around the aerial unit through the camera unit connected to android system through internet IP camera transmission and the geographical location of the system can be taken into account for precise location using GPS data feed into base unit via android development kit and lazy droid app from android market place.

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Fig 1.1 Ardunio Mega 328 microcontroller.

SPECIFICATIONS (Aerial Unit)	
Heli platform	Double Horse
Weight	560 Gms
Camera (Galaxy y)	Endless video, Photo, Endless photo, Web camera
Camera Resolution (Galaxy y)	320x240 (video) 1600x1200 pixels (photo)
GPS (Galaxy y)	stock

1.4 Ground Unit / Base Unit

Ground unit uses the differential drive platform which consists a Ultrasonic sensor at front and a camera in elevated form. That sensor is connected to the arduino mega unit which also controls the drive system via data forwarded by the laptop which according to different purpose instruct the base unit to move.

Quantum camera located in base unit is connected to laptop whose video transmission is filtered by openCV graphics library via python and is used fro object tracking and image processing . Ultrasonic sensor is connected to [4] ardunio mega board which triggers the drive system if anything comes in front the base unit . Which helps it to navigate the way through obstacles. Infrared sensor helps to move the base unit in pre defined lines usually helpful in busy area and production line sector . Infrared sensor is also triggered by the ardunio from the laptop via ardunio ide . OpenCV graphics library is used for all graphics filtering and image recognition and object tracking purpose .

Sonic radar is feature that will capable this system with sound listening capability which will help the system to recognise the object with their sound about their location and distance with reference to the base unit . Base Unit is combined with ground unit which together is used for supervision of aerial unit as well as ground surveillance.

SPECIFICATIONS (Base Unit)	
Differential Drive platform	Powered by 2 x DC geared motor
Weight	560 Gms
Camera (Quantum Webcam)	Endless video, Photo, Endless photo, Web camera
Camera Resolution (Galaxy y)	320x240 (video) 1600x1200 pixels (photo)
Ultrasonic Sensor	10 Mtr Sensing capability

III. FIELD TEST

First field test of the aerial unit was carried out in IIT Delhi periphery. In which the unit collected the image samples of the ground with reference to google map studied ahead. The approximate GPS variation was around 5 meter which can further be decreased via using other means of multiple scans. As the work is in progress hence all the potential feature of the system is still to be tested in extreme ground situations.

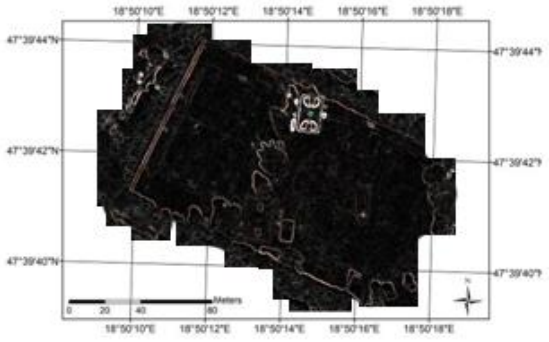

Fig 1.2 Aerial Imagery by Aerial Unit Stitched together with reference to GIS data

IV. CONCLUSION AND FURTHER WORKS

In this paper a brief overview about the multifunctional robotic system was presented , as well as brief overview of the application area . Multifunctional robotic system finds its position more and more concrete with advancing technological implementation in all sector of our life.

Either it is traffic surveillance or battle zone or any scientific survey of location and remote surveying . MARS find its way in all civil , military zones . The main research topics will focus on the sensors and the ortho rectification process in the near future. The results of the used camera are promising from the method point-of-view but the resolution and the limited access to the inner orientation parameters decrease its usability during the data process. The next planned camera will be a light (below the payload capacity of the airplane) compact digital camera with higher resolution and known parameters of the lens. Process of automation of the system and built in radar capability in underway which will give this system powerful capability to work under its own operational data .

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