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DROBOT: an application for Defense

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Abstract: DROBOT word is derived from "Drone" and "Robot". This is a modern approach for surveillance at remote and border areas using multifunctional robot based on current internet technology used in defense and military applications. This Robotic vehicle has ability to substitute the solider at border areas to provide surveillance. The Robotic vehicle works both as autonomous and manually controlled vehicle using internet as communication medium. The "Rocker Bogie" mechanism will be used for the DROBOT, it is one of the multi terrain drive mechanism. This multisensory Robot used to detect mines at remote and war field areas. This system also uses Drone which can help in aerial surveillance. An autonomous operation is controlled by sensor. Manual operation is controlled by cell phones used as video camera by initializing video call and change the path of Robot according to real time information of surrounding. This DROBOT provides continuous surveillance.

***Keywords* — Wireless Sensor Networks (WSN); Sensors; GPS;**

I. INTRODUCTION

Robotics has been has been a staple of cutting edge producing for over 50 years. As robots and their fringe hardware become progressively complex, solid and scaled down, these frameworks are progressively being used for military and law requirement purposes.

Military and combat zone applications keep on developing at a quickened pace because of interest filled by government speculation. Over the previous decade, we have seen expanding levels of interest in autonomous vehicles utilized for surveillance and security.

Robots go to war

Mobile robotics plays an undeniably significant job in military issues, from patrol to managing potential explosives. With appropriate sensors and cameras to perform distinctive missions. Robotics help address difficulties presented by the phantom of urban fear based oppression. "Rather than having individuals draw near to dangers, for example, unattended items or vehicle bombs, robots are utilized. In the event that an administrator finishes up a risky item may detonate, the robot could kill that article by shooting to explode it. These equivalent portable automated frameworks are utilized for killing or detonating overlooked weapons and mines after clashes stop.

Mobile robotic platforms utilized in national security applications must move inside unstructured situations. The capacity to work over moving territory and the capacity to self-sufficiently explore in unstructured situations are territories of core interest. Arranging a robot to rise and plunge snags in unstructured situations easily is a structure challenge and uses more power. The framework must have the option to conquer both normally molded snags, for example, stairs and those of an undefined shape, for example, rocks, brought down trees and different random articles. "The structure benchmark is the capacity to go up a 45-degree grade of a level surface or sporadic deterrents. Once in a while the necessity is as much as 50 degrees or more extreme. Specialists must think about the focal point of gravity, torque necessities to rise grades, mass, and payloads when structuring versatile automated frameworks for military purposes.

Securing Security Robots

The security of information transmitted to and from versatile automated stages, especially video, is crucial in military or law authorization activities. "The recurrence of transmitting video must be secure if utilizing a remote association. Transmission is verified the two different ways so nobody or nothing can meddle with the pictures," Goldenberg says. The strategy for picture move isn't in the hands of integrators of these frameworks, as is normally the situation when structuring ordinary mechanical automated work cells. Or maybe, the video transmission framework is incorporated by the end-client, for example, military or law requirement personnel. The nature of pictures must be great

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in light of the fact that those pictures are the main way the administrator realizes what the robot does.

Drone

As technology develops within the military environment; often there will be a transition into the civilian business world with similar technologies but completely different with a wide range of uses. Depending on the market for such technologies, the business community can drive innovation, and create better products that also have military applications. Whether it is the "Tactical to Practical" or the "Practical to Tactical" driving the growth of unmanned aerial vehicles or systems (UAV/UAS), the word "drone" is now commonplace in the military and public life as well.Drones, UAV, or UAS are simply another use of flying robots. Wherever someone currently uses manned aircraft, a drone could possibly be less costly alternatives as in delivering packages to customers, flying over real estate property, of surveying a construction site. Many videographers are finding that in order to stay competitive in the business market, they must be able to produce in-flight videos for businesses, parties, weddings, and other consumer events and business ventures. There are many different payloads that include high resolution, thermal and infrared cameras, like a multi-spectral infrared which is useful for crop inspection. As the technology develops, so with the uses for these highly versatile machines.

A **DROBOT** is a machine that is programmable and capable of carrying out a series of complex actions automatically. Drobot can be guided by an external control device or the control may be embedded within. Most Drobots are designed to perform a task with little regard to how they look. By mimicking a life like appearance or automating movements, a robot may convey a sense of intelligence or thought of its own. An unmanned aerial vehicle (UAV), commonly known as a DRONE, is an aircraft without a human pilot aboard. UAVs are a component of an unmanned aircraft system (UAS) which include a UAV, a ground-based controller, and a system of communications between the two.

Rocker Bogie Suspension has the specialty of being able to climb over obstacles twice the diameter of the wheel, that too without compromising the stability of the rover as a whole. Some features make it a real brilliant design

The mechanism allows to climb over high obstacles, while keeping all the six wheels in contact with the ground. This is only true at the operational speeds of rovers like Curiosity which is around 10 cm/s. The two sides (left and right) move independently, and hence the rover can traverse terrains where the right and left rockers go over different type of obstacles.

The design incorporates independent motors for each wheel. There are no springs or axles, making the design simpler and more reliable. The front and back wheels have independent motors for steering, enabling the rover to turn on the spot without skidding.

II. LITERATURE SURVEY

Jotheess S and HariRagul proposed a paper in 2017[1] in which they have described about The need to develop a highly stable suspension system capable of operating in multi terrain surfaces while keeping all the wheels in contact with the ground. The design has a mechanism that can traverse terrains where the left and right rockers individually climb different obstacles. It is also done to sustain a tilt of over 50deg without tipping over the sideways. In order to go over an obstacle, the front wheels are forced against the obstacle by the rear wheels. The rotation of the front wheel then lifts the front of the vehicle up and over the obstacle.

The Rocker bogie system is the suspension arrangement. The primary mechanical feature of the Rocker Bogie design is its drive train simplicity, which is accomplished by two rocker arms. In order to go over an obstacle, the front wheels are forced against the obstacle by the rear wheels. The rotation of the front wheel then lifts the front of the vehicle up and over the obstacle. The middle wheel is pressed against the obstacle by the rear wheel and pulled against the obstacle by the front, until it is lifted up and over. Finally, the rear wheel is pulled over the obstacle by the front two wheels. During each wheel’s traversal of the obstacle, forward progress of the vehicle is slowed or completely halted. These rovers move slowly and climb over the obstacles by having wheels lift each piece of the suspension over the obstacle one portion at a time. Landmine detection robots are created by various organizations trying to solve the landmine problems. Mine detection sensors are installed onto uniquely designed robots to perform the desired jobs, finding the mines without detonating them.

Bauer & Cook (1997) presented the idea that one might use robots to search a mine field. This obviously is a hazardous duty that would be completed with minimal human input and cost. To facilitate this requirement the control system would be located away from the danger area, and would control the robot automatically from a remote location. The system must be able to compensate for uncertainty in the position and control of the robot.

Shahri &Naghdy (2001) developed a mine detector robot (MDR). At present, there are approximately 110 million land mines scattered around the world in 64 countries. The clearing of these mines take place manually. Unfortunately, on average, for every 5000 mines to be cleared, one mine clearer is killed. The robot arm imitates a manual hand-

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prodding technique for mine detection. It inserts a sharp metal bar (probe) into the soil whose parameters, such as stiffness are unknown and vary depending on the type of soil. An explicit force control scheme is applied as the main control scheme, while an adaptive fuzzy controller is designed to deal with uncertainties and varying environment parameters. Authors have presented simulation and experimental results and validated the proposed control scheme.

Daniels et al (2003) described about the MINETECT, which is a combination of Metal Detector and Ground Penetrating Radar (GPR) mine detectors. Using a radically different patented approach from conventional GPR designs, in terms of the man machine interface, MINETECT offers simplicity of use and affordability, both the key factors in humanitarian demining operations. The ground penetrating radar employs novel operator audio interface techniques. Authors have described the design concept, summarized the trials carried out and provided the conclusions as to the requirements of GPR performance.

F. Klauser and S. Pedrozohave proposed a paper in 2015 that says camera-fitted drones are now easily affordable to the public. The resulting proliferation of the aerial gaze raises a series of critical issues, ranging from the changing regimes of visibility across urban and rural space to the novel risks and dynamics of control implied by current drone developments.

The spread of drone technology in the 21st century has sparked a revealing, if still rather limited, literature that has sought to examine the modalities and technicalities so the deployed aircrafts, and to reflect upon the implications of the extended and redefined possibilities of vision and visualization from above. There are

At least three main aspects to high- light from this body of work.

III. OBJECTIVES

1. Reduces human intervention.
2. Both aerial & ground activities can be performed.
3. Provides better surveillance.
4. Detection of mines & explosives.
5. To cover long distance in short period of time.
6. To operate in congested areas.
7. To provide better safety & guidance for defence troop.

IV. METHODOLOGY

i). The DROBOT

Drobot includes a platform for Mini Drone to takeoff & will be controlled by RF module. An app will be developed to access the live recording of camera. By this we can have a system which can perform the functions of UAV (Unmanned Aerial Vehicle) & UGV (Unmanned Ground Vehicle).

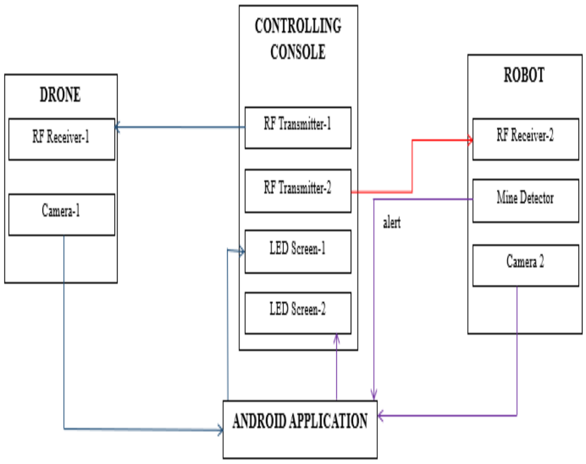

Figure 1: Block Diagram of DROBOT

Drone: It consists of Camera 1 and RF Receiver 1. While recording if any obstacle occurs then drone will release from the platform which is placed on the robot and start to record. RF Transmitter 1 which is present in the controlling console is connected to the receiver. This whole function of drone will work with the help of the android application.

ROBOT: It consists of Camera 2 and RF Receiver 2. It will cover the activities of ground by continuous surveillance with the help of camera while is present in it. RF transmitter 2 is connected to RF transmitter 2 which is present in the controlling console and also the functions of robot is done with the help of android application.

Controlling console: it consists of LED screens both 1 and 2. Live recordings of both drone and robot are displayed in this controlling console. It also consists of transmitters 1 and 2 with the help of this we can request the functions for drone and robot. Receivers which are resent in those will take the signals and process.

Android application: through this we can connect to the available wifi network. If any networks are present it will connect then cameras which are present in drone and robot will open and start to work.

ii). Design of the system

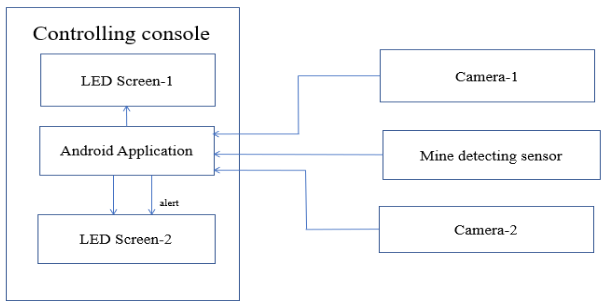

Figure 2: Controlling console

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Controlling console consists of LED screens both 1 and 2 also the mine detecting sensor. Live recordings of both drone and robot are displayed in this controlling console. It also consists of transmitters 1 and 2 with the help of this we can request the functions for drone and robot. Receivers which are resent in those will take the signals and process. While recording if any obstacle occurs then drone is released and live recording is displayed through LED screen 2.

Mine detecting sensor: A mine detector sensor is placed in the Drobot. If any mines are detected then it will give the alert message which is displayed in Screen 2.

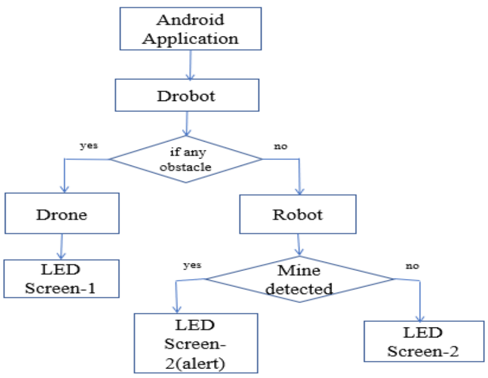

Figure 3: flow chart of drobot

The above figure shows the flowchart of the working of drobot. The continuous surveillance will be available from the robot camera on LED screen-2. If the robot faces any obstacle like trees, walls etc., then the person controlling the drobot can release the drone. Once the drone is released it provides aerial surveillance of that area which will be displayed on LED screen-1. Both the cameras work simultaneously thus helping better surveillance. The robot also has a mine detector which detects the underground mines and explosives, if any explosives or mines are detected then the alert is given to the controlling console on LED screen-2.

iii). Design of Rocker bogie mechanism

The important factor in manufacturing of rocker bogie mechanism is to determine the dimensions of rocker and bogie linkages and angles between them. The lengths and bangles of this mechanism can be changed as per requirement. In the work aim is to manufacture the rockerbogie mechanism which can overcome the obstacles of150 mm height (like stones, wooden blocks) and can climb over stairs of height 150 mm. Also another target is to climb any surface at an angle of 45˚. To achieve the above targets we had design the rocker-bogie model by assuming stair height 150 mm and length 370 mm. Using Pythagoras theorem, find the dimensions of the model. It have both angles of linkages are 90˚.

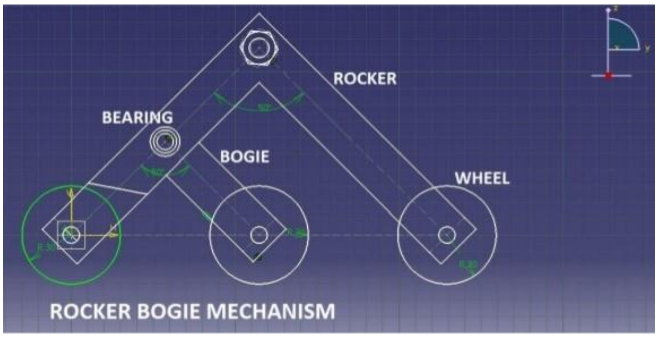

Figure 4. Rocker bogie mechanism

V. RESULTS

Figure 5 .Drobot with Rocker bogie mechanism

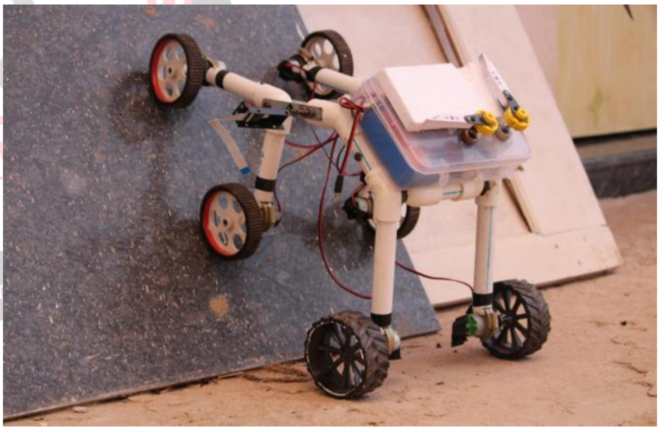

Figure 6. Drobot on angle surface about 75% inclination

Figure 7. Drobot on uneven surface

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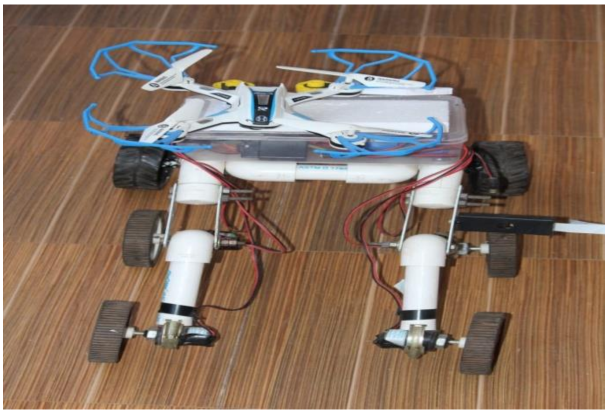

Figure 8. Drobot climbing steps

Figure 9. Metal detecting sensor

Figure10.Aerial view by Drone

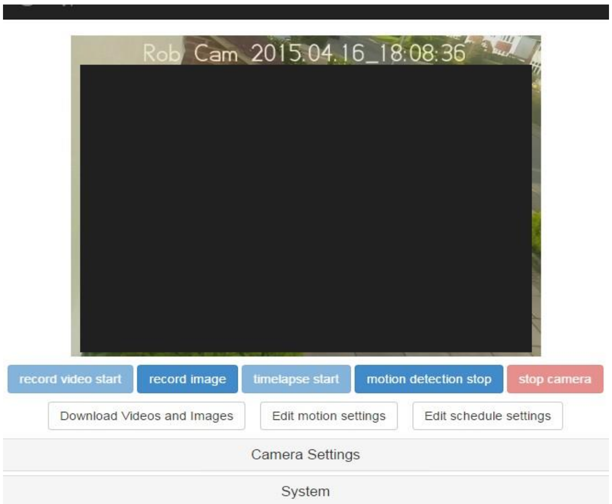

Figure 11.Home page of pi camera

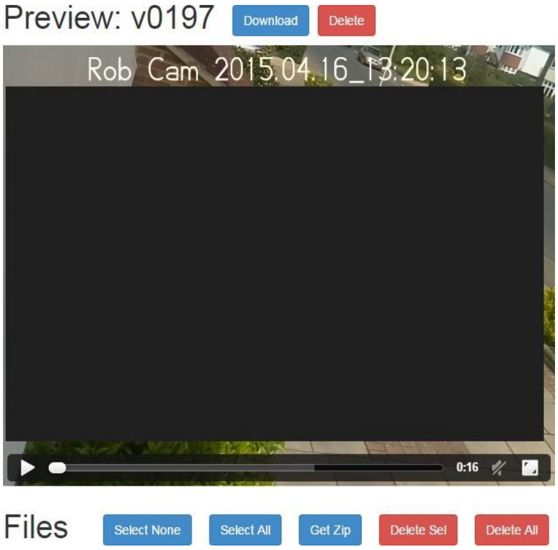

Figure 12. Preview of pi camera

VI. CONCLUSION

The design of model found safe and reliable for various working conditions. All the parameters like Safety, Cost, Reliability, Performance, Durability, aesthetics, Standard dimensions & material are satisfactorily fulfilled .The designed vehicle is able to reduces human intervention and performs both aerial, ground activities. The model can climb the angle up to 60-70˚. It is possible to climb the stair at height of 15 % of height of the vehicle. It also guides the defense troops and alerts if any explosives are detected.

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