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A Study on Drone Based Mine Detection and Diffusion System: Present Scenario and Potential Prospects

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Abstract: ***Decades-long issues are caused by explosive remnants of war (ERW) and landmines that remain subterranean during times of conflict. Therefore, it is critical to promptly identify concealed explosive devices and secure the former zones of conflict. The sensor is affixed to the drone via a stabilization robot that possesses a bouncing motion that enables the detector to precisely survey the ground.. After knowing location of mines, its getting diffuser destroy by using drones .Due to drones mines detection is getting easy than manually or mobile vehicle tracking. Here we are focusing on GPR (Ground Penetrating Radar) and IR(Infrared)sensor for detecting land mines below the ground also we using a camera to know the precise location of mine. For defusing mine dead-weight is used. Dead-weight is thrown from drone to destroy mines. By using drones it is convenient to cover more area in less time. This research aims to produce a technical reference that increases awareness and understanding of unmanned aerial vehicle (UAV) monitoring in Massachusetts, in addition to evaluating its environmental, mining, and reclamation applications.***

Keywords: Drone, mines, detection and diffusion, GPR, Thermal sensors

I. INTRODUCTION

A Drone is mostly known as UAV(Unmanned arial vehicle). Landmines and other explosive remnants of war (ERW) that are buried beneath the surface of the earth cause major problems in previous war zones for many years. It is crucial to quickly identify any hidden explosive devices and secure the combat zones because of this. While many NGOs and international organizations work very hard to achieve this status rapidly, the process of finding and removing mines is extremely sluggish, even when the number of mines discovered in a year is significant. The stabilization robot that comes with the drone is designed to secure the sensor. Its jouncing movement enables the detector to precisely scan the ground. The processor receives the data from the detecting sensors in order to geotag the mine locations.

The drone is equipped with a range of sensors for detecting mines, such as a metal detector, thermal and ground-penetrating radar (GPR), camera, and magnetometer. Based on the type of terrain being scanned and the anticipated types of land mines (landmines, UXOs, and IEDs), operators can select the appropriate sensor.

The project's goal is to lower expenses, human involvement, and power requirements while simultaneously increasing efficiency and ensuring militant safety.

II. LITERATURE SURVEY

Landmines are a huge threat to human life and a source of economic difficulties in many countries. Because of their unidentified locations and frequent difficulty in detection, landmines are dangerous. A specialized crew with mining knowledge is needed to accurately identify mines.They are also aware of the location and soil characteristics in which mines will be buried. The great bio-diversity of the terrains and environmental conditions in which mines are located, as well as the variety of landmines, make it challenging to develop new and emerging solutions. Mine detection and clearance now require specialized knowledge along with specialized tools and equipment. Thus, the development of new and improved techniques is desperately needed, especially in light of the hazard posed by abandoned landmines in operational areas. An explosive device intended to harm or kill people is called an antipersonnel landmine. Pressure-operated blast mines are intended to detonate when a victim steps directly on them, and they will also detonate if there is a sudden shift in pressure. High frequency radio waves (10-3000 MHz) are emitted into the earth by the Ground-Penetrating Radar (GPR), which subsequently analyzes the signal that is returned by subsurface objects.

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When there are temperature differences between the vicinity of a landmine and the surrounding region, thermal detecting techniques are employed. During the day, the mines or the soil above them tend to be warmer than the surrounding surroundings; but, at night, the heat quickly dissipates, making it easier to detect.

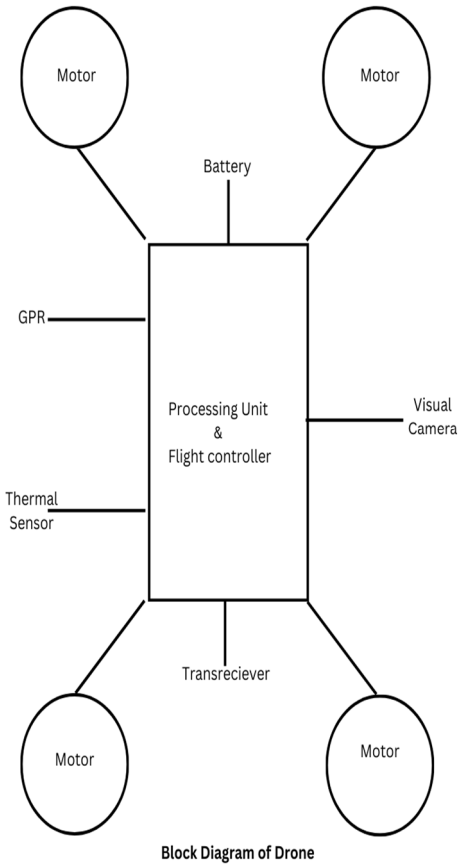
For military purposes, the goal of mine detection during combat operations is to penetrate minefields and clear a limited area for the infantry with the 80–90% necessary efficiency. On the other hand, detection during a humanitarian operation necessitates the complete clearing of the region of all mines and explosives; the survey's accuracy and efficiency must nearly reach 100%.

Regrettably, throughout wars and conflicts, mines were frequently placed without any documentation; as a result, it is now nearly hard to locate previous minefields and to gauge the quantity and kind of mines present. There are other varieties of landmines that have plastic bodies and no metal components, making it extra harder to find them. The economy, infrastructure, civilian population, and anyone attempting to assess them are all at risk from small mines and improvised explosive devices (IEDs) left over from the conflict that do not have any warning indications (Horváth & Szatai, 2020). Depending on the color of the mine body, surface-placed landmines are simple to see and identify. The process of finding landmines that are hidden beneath the surface and invisible to the human eye relies mostly on the size of the area, the characteristics of the terrain, the level of efficiency needed, and the reconnaissance tools that are available. The main techniques for detecting mines include mechanical, biological/chemical, electromagnetic, auditory, or a combination of these mechanisms (Lukács, 2006; Kovács, 2008). The mine probe is a fundamental piece of machinery used in mechanical mine detection.

It is extremely risky to manually determine if an object beneath the surface is a mine or just a harmless object.

Although it is the slowest, this survey method is the most efficient.

The safety and time benefits are the main advantages of airborne detection. Since aerial vehicles follow the terrain and don't make direct touch with the ground while conducting surveys, they are unable to come into direct contact with fuses or mines. Most UAVs are able to climb vertically, therefore they don't require large runways to take off or land. Helicopters and airplanes are not the ideal aerial vehicles for locating minefields in close proximity, and their use is not always required. Drones differ in size as well; they are significantly lighter and smaller. They are inexpensive, easy to use, and able to fly very low, hover, and turn around in small spaces.



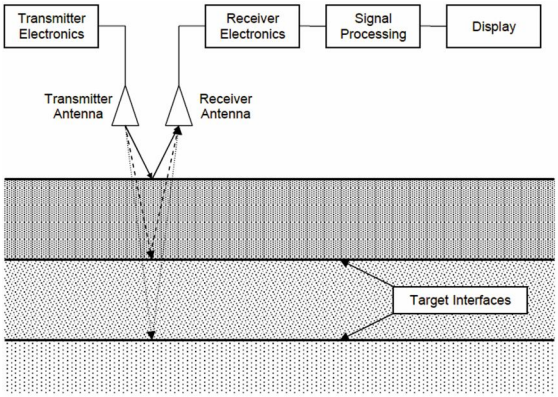
Block Diagram of Drone

They could be a good platform for most mine detection devices.

III. SENSOR DETAILS

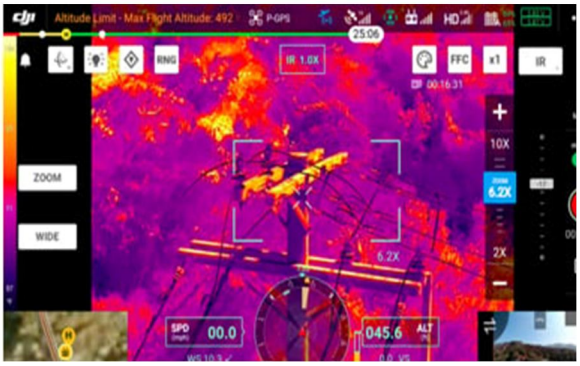
A. GPR(Ground penetrating Radar)

Electromagnetic radiation is released by the transmitter into the surrounding earth and materials. In order to detect objects below the surface, ground penetrating radar records the echoes it receives after sending out a pulse into the earth. Additionally, variations in the composition of the ground material are detected using GPR imaging instruments.Ground penetrating radar systems consist of five primary components: the transmitter, antenna, reception, signal processing, and display units. The radar components are depicted in Figure 1 in a general imaging setup with layers of earth material that are supposedly up to an unknown depth.



B. Thermal sensor

Temperature variations are monitored by thermal sensors. Temperature sensors are used for both general and specialized purposes in numerous process sectors to detect the thermal characteristics of gases, liquids, and solids. Temperature sensors, which can sense or detect any physical changes and thermal changes providing analogue or numerical output at this temperature, are used to measure the heat energy and even coldness released by an object or instrument. The most commonly used primary temperature sensors are thermocouples, semiconductor integrated current (ICs), thermistors, and real-time digital simulators (RTDs). Thermocouples are reliable and have a wide temperature range for detection, making them useful for inexpensive testing. According to their specifications, sensors, detectors, and transducers are electronic devices that have the ability to detect thermal characteristics as well as control and display signal input.



C. Visual sensor (camera)

A visual sensor is an apparatus that, like the human eye, is capable of capturing a two-dimensional image of an object. Visual sensors make use of camera pictures to ascertain the existence, precision, and alignment of pieces. These sensors are not like image inspection "systems" in that the camera, light, and controller are all housed in one unit, simplifying the design and functioning of the unit.

IV. ADVANTAGES AND DISADVANTAGES

Advantages of system is work efficiency increase and less time taking process. In a less time maximum area cover for scanning. And minimum damage happen to surroundings .

Disadvantage of system are it require a skill persons to actually operate system. It is comparably more costlier than actual system. Flight time is totally depend on battery capacity.

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V. RESULT

In this system life thrates is negligible. More work will be done in less time and accurate. . It will also provides greater range and increases the efficiency of defusing landmines.

VI. CONCLUSION

It concluded that, by using drone mine diffusion and detection gets more safe and accurate.

VII. FUTURE ENHANCEMENT

In future by maximizing battery performance drone flight time is increase.also by making changes in sesnsors upgrade version more accuracy is obtain.

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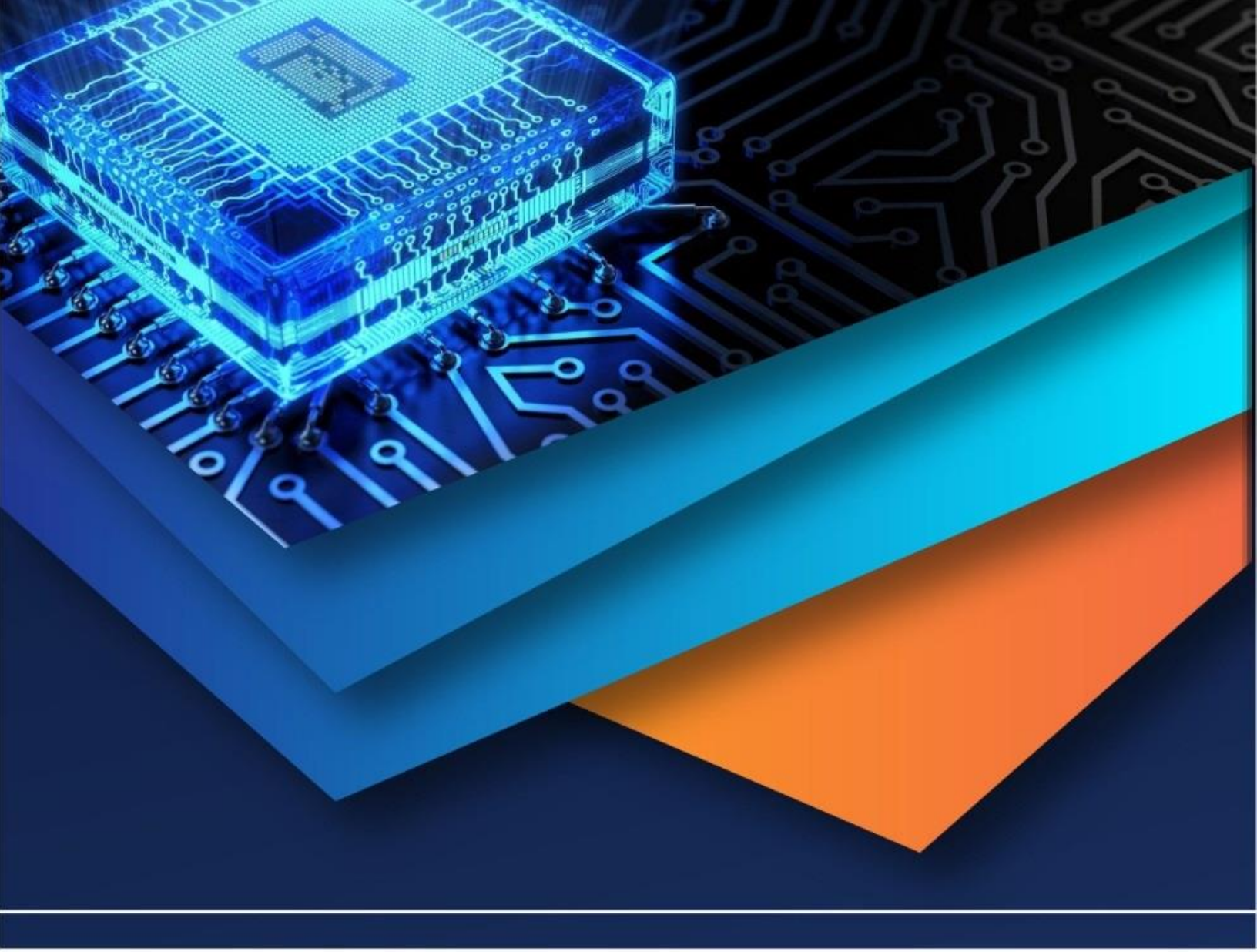
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