Design And Development of Multipurpose Robot for Military Spying and Patrolling

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Abstract: The world is now experiencing major recent developments in technical, geopolitical, and more particularly related to the security of the individual countries. With the change in geopolitics, the security of every country's sovereignty and territory has become an important aspect, the consequence of which major economics are prioritizing advancements in the defense sector. The combination of artificial intelligence and automation in robotic systems has been extensively utilized in military types of equipment while spying and patrolling are two of the key applications. The present paper proposes the ideation and method of development of such an autonomous robot. The development of an RF-based spy robot with a wireless camera will make it easier to study ground-level activity as per the requirement of the military action. The proposed robotic system has the capability to enter enemy territory discreetly and gather data with the help of a wireless camera comprising a transmission and receiver system. In this evolving world, there are numerous programs that use inherent hardware in these phones, such as Bluetooth, Wi-Fi, and ZigBee technology, to control other devices. Bluetooth technology strives to communicate data wirelessly at a short distance through radio wave transmission, with features to produce ease, perception, and controllability. The proposed robot can further be controlled using Android phone applications thus weekend produce an accurate and technologically advanced robot that can prove worthy of ground-level movements and provide necessary prerequisite access to military actions.

***Index Terms* - Military operation, Spy Robot, ZigBee, Bluetooth wireless transmission, Hardware, Software systems**

I. INTRODUCTION

Currently, the unprecedented changes in geopolitics in the world have made a strong military one of the key priorities of major countries. As a result of which there are many technological advancements being carried out in-ground systems naval systems and air-operated systems of the military. In the current warfares, artificial intelligence machine learning robotics systems have been extensively used on a large level to replace the man system with machines and the machines have been introduced with highly cleverer and intelligent systems which are capable of multiplying the effort of an individual and assist the military in applications where actual human systems cannot be deployed. Such an example of which is the spying and patrolling of border areas wherein there is always a security threat of getting caught while keeping an eye on the territorial changes and adverse advancements in the border areas. One of the research papers by Jignesh Patoliya, proposed the robotic systems wherein the main objective behind developing this robot is for the surveillance of human activities in the war field or border regions in order to reduce infiltrations from the enemy side. The robot consists of a night vision wireless camera which can transmit videos of the war field in order to prevent any damage and loss of human life. Military people have a huge risk of their lives while entering unknown territory. The robot serves as an appropriate machine for the defense sector to reduce the loss of human life and will also prevent illegal activities. It will help all the military people and armed forces to know the condition of the territory before entering it [1]. Another spy robot was proposed by Yadav Ankit et al. wherein the Spying Robot is developed by a combination of various technologies and sources. The study proposed was primarily focused on how the next generation war spy robot is to be made and what the sources or technologies used to make this robot and how this robot would prove helpful in so many ways to the military and other miscellaneous applications. Basically, the project is designed to develop a robotic vehicle named Smart Spy Robot using RF technology for remote operation attached with a webcam application for monitoring purposes. The robot along with a wireless camera can wirelessly transmit real-time video and will give confidential information regarding opposite parties. An 8051 series of microcontrollers have been utilized for the desired operation. The commands need to be sent to the receiver, on the transmitter side with pushbuttons, to control the movement of the Robot to move forward, backward, and change the direction of the robot [2].

Furthermore, the robot proposed by Yadav Priyanka et al. has the main motive to avoid and assist in terrorist attacks and major conflicts. The proposed RF-based spy robot involves a wireless camera that from this it will be easy to examine the actions aimed at people when and while required. This robot can quietly enter the enemy area where it gathers and transmit information via wireless camera. The movement of this robot is wirelessly controlled by a handheld RF transmitter to send commands to the RF receiver mounted on the moving robot. Since human life is always valuable, these robots are the substitution for soldiers in war areas. This spy robot can also be employed at places where the population is highly best including at railway stations, airports, public gatherings, hotels, shopping malls, and others. At the time of major conflicts, it can be also be employed

to collect information from the enemy terrain and monitor that information in a far secure area, safely devise a plan for the counter-attack, Track locations of terrorist organizations, and then plan an attack at a suitable time thereby making surveillance the overall situation [3].

Another innovative development disclosed by Chaitrali Jadhav et al. utilized the Internet of Things for its control which makes it better suitable for operations that involve high risk for humans to enter, especially for some criminal cases, and may prove very beneficial for the military area for spying purposes. This system saves the valuable life of our soldiers. This system makes use of a robotic arm as well as a robotic vehicle to enter army areas. The whole system is controlled via an android application. In the case of a military bomb disposal operation, a client will connect to the server using a TCP/IP link. Once a client connects to the server, the client can issue commands to move the robot in forwarding, backward, right, and left directions [4].

The major innovative prior work in the defined sector of automated robots for military operations provides the window for major development as being one of the major requirements of time in the current geopolitically changing world. Thus, another attempt has been made to introduce robots for spying and monitoring the territories, borders, and desired areas. The present robot includes a combination of hardware and software thereby making it more reliable and trustworthy for ground-level applications. The primary hardware used includes Bluetooth Wi-Fi and Zigbee technology which controls the robotic systems as per the instructions of the operator. Bluetooth technology strives to communicate data wirelessly at a short distance through radio wave transmission, with features to produce ease, perception, and controllability. The proposed robot can further be controlled using Android phone applications thus weekend produce an accurate and technologically advanced robot that can prove worthy oground-levelel inventory actions and provide necessary prerequisite access to the military.

II. Software Requirements Specification

The primary object of the proposal is to introduce the latest developments in the monitoring robots utilized primarily for military and miscellaneous applications. Moreover, manufacturing and the description of key components used in the edition have been discussed for further better understanding. The key assumption to be made while developing the robot is that used Embedded C Technique input used as Sensor responsive data. While the embedded C libraries s like Tensorflow, Keras, OpenCV, and Tkinter were used as dependencies thereby 2 major the output in the form of detecting metallic artilleries, bombs, the distance of the present entities, and the movement at the ground.

While developing the introduced automated robot, a few of the functional specifications included its user-friendliness and adaptability with the operating unit and providing an easy interface to use. Moreover, it was noted that the accessibility or the response time of the robot and its monetization should be quick and with a minimum time lag.

While the robot is dependent on a few other aspects and has certain constraints including user applications that need to be developed in windows OS add the scripts should have been written in embedded C. Moreover, Singleton should we use as the application design pattern to be utilized in the automatic robotic system.

Furthermore, the nonfunctional requirement includes the key considerations of performance requirements to be utilized in the robot system where the functions and the module used need to be working well in all conditions. It also needed to be taken into attention that the performance of encryption of the data that transmitted bidar robot from remote place to the receiver at the operator's place needed to be highly encrypted secured and relatively zero delayed.

The specification of the hardware and software system requirements utilized in the present robot system can be summarized as discussed below.

For Hardware Interfaces;
· Hardware: Intel core
· Speed: 2.80 GH
· RAM: 8GB
· HardDisk: 500 GB
· Key Board: Standard Windows Keyboard

For Software Interfaces;
· Operating System: Windows 10(64 Bit), rasp-bean
· IDE: python IDE
· Programming Language: Python

III. SYSTEM DESIGN AND DEVELOPMENT

The Raspberry Pi being of the least expensive and credit-card-sized computers that plug into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing and to learn how to program in languages like Scratch and Python.
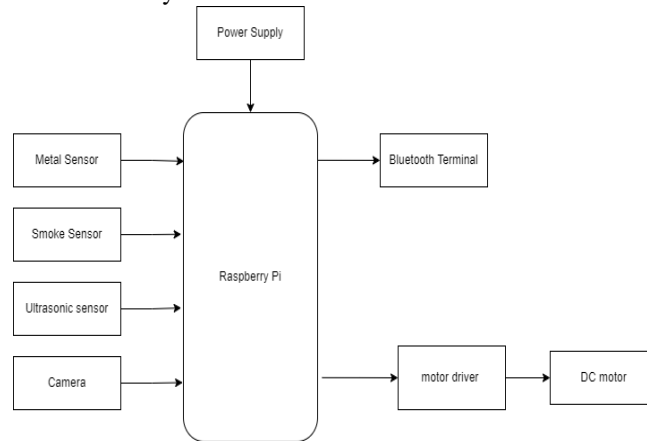

Fig 1: Block Diagram of Raspberry Pi

The circuit diagram of the robotic system which is employed for the presented application can be seen in figure 2, wherein the power supply is given by the lithium-ion battery which can be replaceable with another in accordance to the requirement and working cycle. The metal detector which has been used in the circuit has the prime object to detect the metallic surfaces and decode the message with the help of a converter and transmit the signal to the processing unit. As can be seen in the present circuit ultrasonic circuit has been used to detect the object and calculate its distance from the object's surface to the ultrasonic wave propagating unit. The sound waves are dead converted into numeric form thereby providing the distance between them. Moving further, the global system for mobile communication has been employed which is used the keep track of the robot by the controller from operator's end. For sending and receiving the signals from the sender and receiver Bluetooth system has been employed which provides the operation from the maximum range of distance.
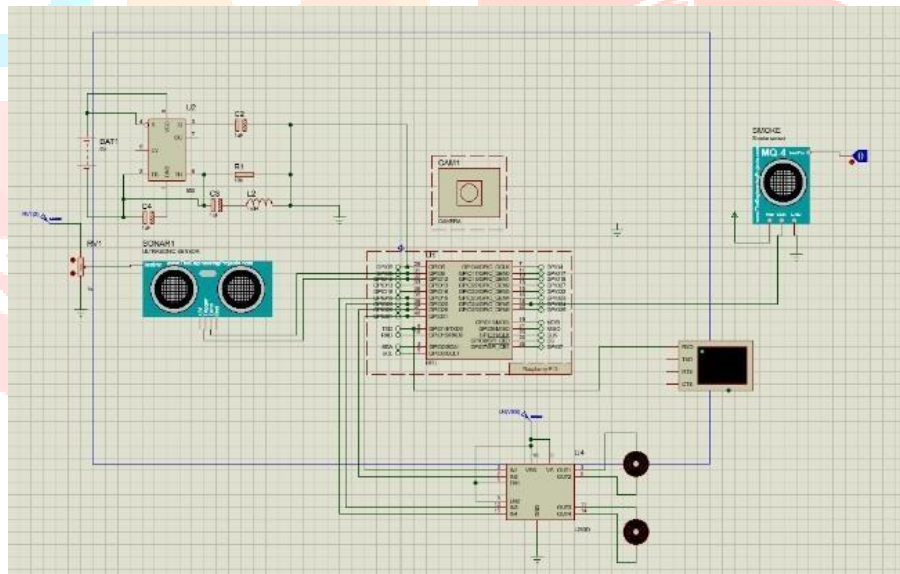

Fig 2: Circuit diagram used for the robotic system.

After implementing all the software and hardware systems in one unit the final output can be seen in figure 3. The presented photograph shows the actual utilization of discussed hardware and software systems. Arduino has been employed to carry out the required functioning of the robot which is coded by the computer system using Python language script.
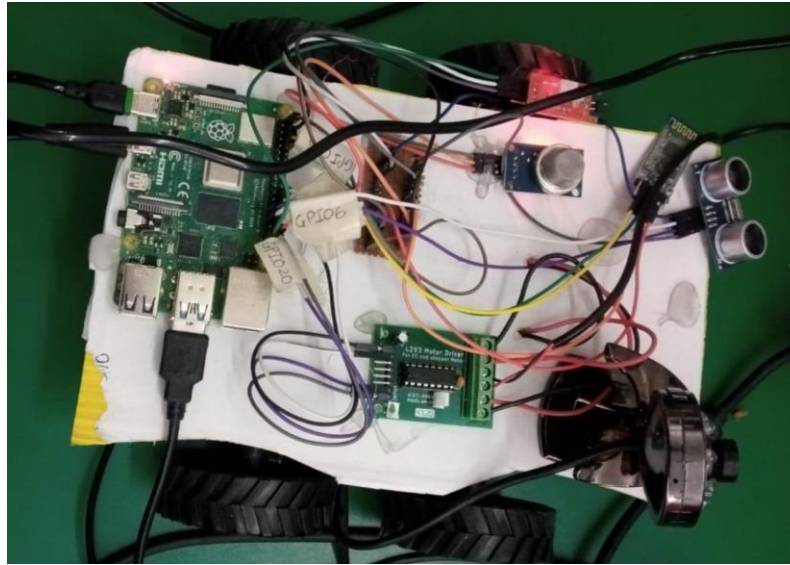
Fig 3: The actual implementation of hardware and software systems

The final product which can be seen in figure 4 includes all the sensors including a metal detector smoke detector ultrasonic sensors global system for mobile communication and the required battery for its functioning.
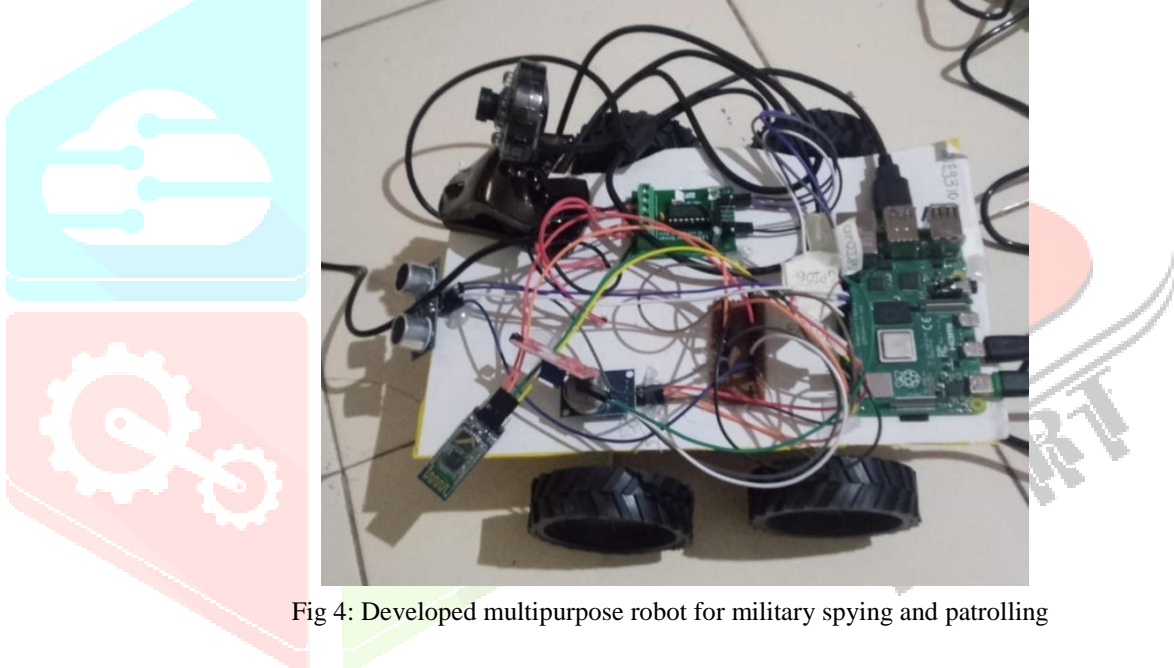

Fig 4: Developed multipurpose robot for military spying and patrolling

IV. DISCUSSION AND CONCLUSION

While the developed product is comparatively small in size it can be extensively used for spying and keeping an eye on the activities and moments of foreign things. Considering its autonomous functioning and being controllable from a remote area makes it more suitable for military operations which is the key application. However, being dependent on an external battery, the robotic system still needs considerable attention with regard to its possibility of getting caught in battery drought conditions. Moreover, the camera being one of the most important parts of the system, its crushing and damage may in endanger the primary object of the proposed spying system. The key application of this kind of autonomous robotic system in military operations can be monitoring the border areas, identifying the location of land mines hidden below the ground level, and monitoring the moment and actions of the foreign units. In addition, the present system can be used in domestic as well as miscellaneous applications to monitor the heavily populated places and most valuable and highly secured areas.

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