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Road Autonomous Combat Surveillance High-Tech Artificial Kart (RACSHAK) Bot

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Abstract

Weapons like landmines are potentially harmful for any innocent person in a civilian area. Soldiers are exposed to be fatally injured by unfriendly tactical weapons and heavy ordinates. In a response to such situation, unmanned vehicles can be employed to tackle problem under investigation. Unmanned vehicles [1] are controlled and monitored remotely by any military personnel who need not to be present in the field at same time. These military personnel are thereby saved from landmines and other weapons like IEDCs. Various customizable weapons can be mounted such as machine gun or robotic arm. Defense bot is mounted with special type of arm which can be remotely controlled by military personnel for obstacle removal and also bomb defusing purpose. Robot's compactness helps it to blend in an enemy territory. Camouflaging technique can be implemented to improve its stealth capabilities.

Keywords: Defense Bot, Military, Robotic system.

1. INTRODUCTION

Military bots are autonomous robots or remote-controlled mobile robots designed for military operations which include transport of heavy machinery to forward base in extreme conditions to civilian search and rescue operations [2]. It also involves enemy reconnaissance and surveillance without detection and information gathering of enemy and also fighting enemy. Nowadays, customized drones and bots are made so as to fulfil the conditions required in the aspects of military defence [3]. These remotely operational systems are immune to the threats posed by environments which are encountered by human personnel. To avoid such problems, deployment of Unmanned Ground Vehicle(UGV) systems is preferred. The main advantage of using UGV system is its operation ability in extreme difficult and hostile conditions. Here, as per the project title, we have a custom-built UGV, dubbed as 'War Bot'. This robotic system contains a night-vision camera which proves useful in surveillance in reconnaissance activities even in low-light conditions. This UGV has a special feature of an arm, which can be used for lifting cargo or any other objects. Thus, this provides the bot of 'pick-and-place' feature. Also, this UGV also carries a gun, which can be mounted upon it and its aim controlled remotely for maximum effect. The laser dot is for targeting system which is the main purpose of system.

1.1. Literature Survey

The foundation of this concept was laid by Nicolae Tesla, Serbian inventor living in United States. He built two remotely controlled steel boats of length six feet and equipped with electromechanical radio receiver with actuators connected to the steering system in 1898[4] .During the Second World War, England, Russia and

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Germany further developed this technology and used it for demolition work and explosive works. But due to the high costs involved, further deployment was curtailed. In 1898, this concept was just introduced by Nicolae Tesla on an inventionary basis with a thought that it can become a force to reckon within the years to come. Massive developments in this field saw his dream turn to reality. With the World Wars, it gained massive popularity provided it helped save soldier's lives. Also, equipped with fire-arms, bombs and ammunition, it helped break enemy lines as the War began, thus fulfilling its main purpose. It was also used for Remote Surveillance due to introduction and advancement in the fields of Remote Technologies, Wireless Communication, Camera Technologies, etc. over the years.

The main drawback is delay in response, which is caused due to transmission of commands using Digital Transmission signals. Also, the main disadvantage is absence of adequate ground clearance, which hampers it ability to become an All-Terrain Vehicle (ATV)[5]. This also result in component damage in uneven ground scenarios. Restriction in movement also proves to be a disadvantage. By using Internet we will be able to increase range of the bot, Also operation of bot can be done when it is not in view. The bot has high ground clearance which makes it an All-Terrain vehicle (ATV). Live streaming of camera can be used for different purposes with help of image processing. We can get 3D mapping of a region by the bot. The bot is provided with a gun which can be used to shoot the enemy at distance. The detachable arm can be used for different applications like obstacle removing, pick and place objects etc.

2. METHODOLOGY

2.1 Working of Proposed System

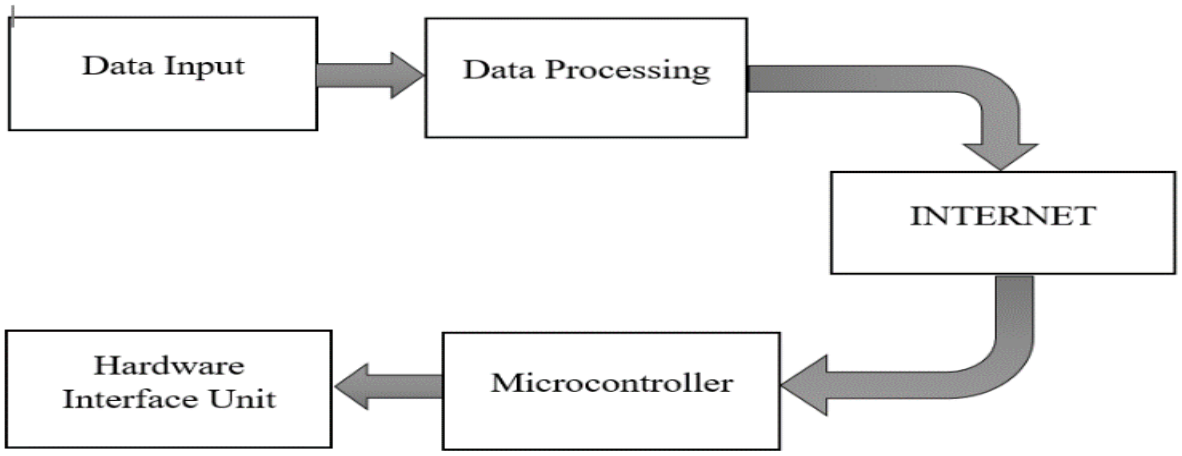

Fig.1.Block Diagram

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Fig 1 describes the general function block diagram. We need a mobile application for control and operation of Defence Bot. The processing unit comprises of a mobile application linked to Internet. Processing unit is core of Wireless Control. The processing of data results in assigning a desired command to specific device. The technique of operation is based on Internet of Things which uses Cloud based Server to transfer data. The range of operation can be increased by using long-range radio frequency module. The microcontroller present at the receiver side receives the data from the Internet Server and generates PWM Signals. The signals upon decoding will be able to drive other hardware present in the system. Motor driver ICs, geared motors and sensor shield etc. are some of the circuit elements contained in hardware unit.

2.2 Working of ARM

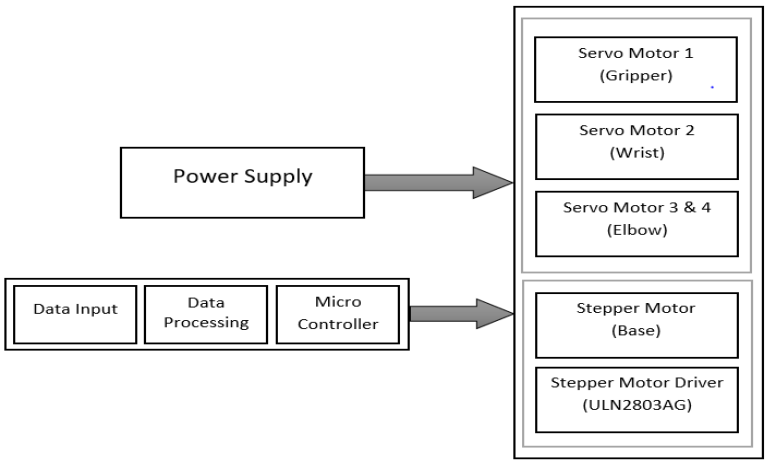

Fig.2. ARM Working Block Diagram

Figure 2 describes the working of the Robotic ARM equipped on the Bot. It requires a power supply of 5V required to activate the ARM. We need a mobile application for control and operation of the ARM. Input is given through app which is processed and given to Microcontroller (Arduino) where the output is given. The ARM has 6 degrees of freedom of rotation, which include a stepper/swivel base, a servo motor in the gripper, a servo motor in the wrist and a servo motor in the elbow. All the motors are master controlled by the Motor Shield.

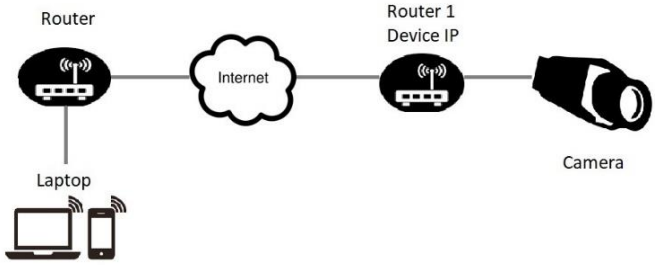

Fig.3. Camera Working Block Diagram

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Figure 3 describes the working of the camera. The bot is implemented with wireless camera. The camera uplinks the data to the Internet using Router. This data can be accessed by user through Laptop by downlinking data from Internet using router.

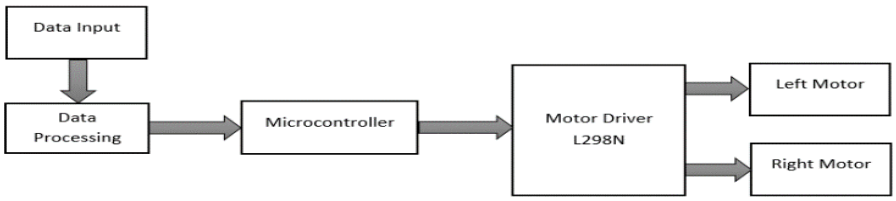

Fig.4. Bot Movement Block Diagram

Movement of the Bot is described in Figure 4. Data Input is given by an app which defines the movement manually obtained from the User. This data obtained is further processed by the app and then given to the Microcontroller. The Microcontroller is connected to the Motor Driver (L298N) which is responsible for regulating and controlling the motors as defined by the User controls. When Bot is set into Forward motion, both the motors are switched into forward motion[12]. For Left direction, only Right motor is activated. Similarly, for Right direction, only Left motor is activated.

2.1 Hardware and software used

Hardware:: Remote Controller, High Power motors and motor driving unit, Rover Chassis, HD Camera with night vision, Arduino Pi 3, esp8266, Robotic ARM.

Software:: Arduino IDE, Java.

3. RESULTS

3.1 Bot Control

The proposed technique is implemented using ESP8266 wifi module, so as to give commands wirelessly over the Internet, thus extending its range of operation. This is further enhanced with the help of a Node MCU Shield used in combination with the ESP. The interface being used is the Blynk Server Application, which provides custom interface for Bot Control by acting as a Remote.

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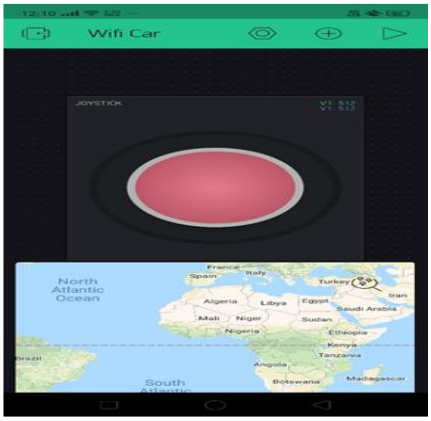

Fig.5. ARM Bot Control using Blynk and Pi Camera

3.2 Camera Control

The proposed technique is implemented using Raspberry Pi and its camera. Pi is connected to Internet and the Camera feed is patched to required device through IP address and Port. This connection is wireless and nearly lag-free, thus enabling fast response.

Fig.6. Live Camera Access

3.3 Gas Sensor

The proposed technique is implemented using MQ2 Gas Sensor to detect gases in large concentrations. The analog output voltage supplied by the sensor varies in proportion to the gas/smoke concentration. The greater the gas concentration, the higher the output voltage; while a smaller gas concentration results in a low output voltage. This change in voltage triggers the buzzer, thus giving us the required output.

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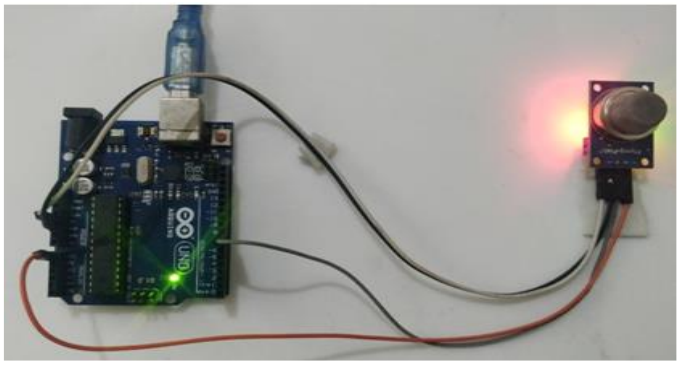

Fig.7. Gas Sensor

3.4 Ultrasonic Sensor

A module having 4-pin sensor name as HC-SR04 Ultrasonic (US) sensor, whose pin are identified as Vcc, Trigger, Echo and Ground respectively. It is a very popular sensor used in many applications for measuring distance of object or sensing objects which are required. The two eyes of module of projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that -
Distance = Speed _Time

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor.

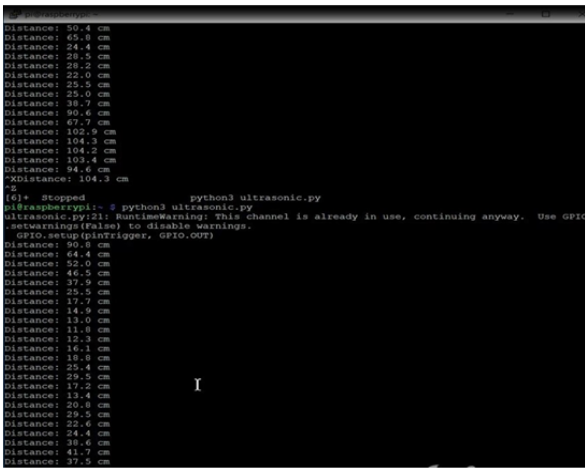

Fig.8. Ultrasonic Sensor Readings

Thus, from this proposal, we will be able to design a machine which can be used in defense operations like remote surveillance, bomb detection and disposal, 2D area mapping and offense operations like unmanned gun firing and seek and destroy operations[9].

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3.4 Bot with ARM control

The arm circuitry is important feature of the Bot shown in figure 9. The ARM is used for obstacle pick and place operation. ARM has 6 degrees of freedom of rotation, which include a stepper/swivel base, a servo motor in the gripper, a servo motor in the wrist and a servo motor in the elbow. All the motors are master controlled by the Motor Shield. For the specific operations, we have to control specific servo control and by doing this we can perform the desired task just by running the code on the command prompt[5]. We just want to enter the degrees at which we want to rotate the servo motor. By using this control technique, we are able to cover the maximum reach of the ground. So we can use the ARM for different operations.

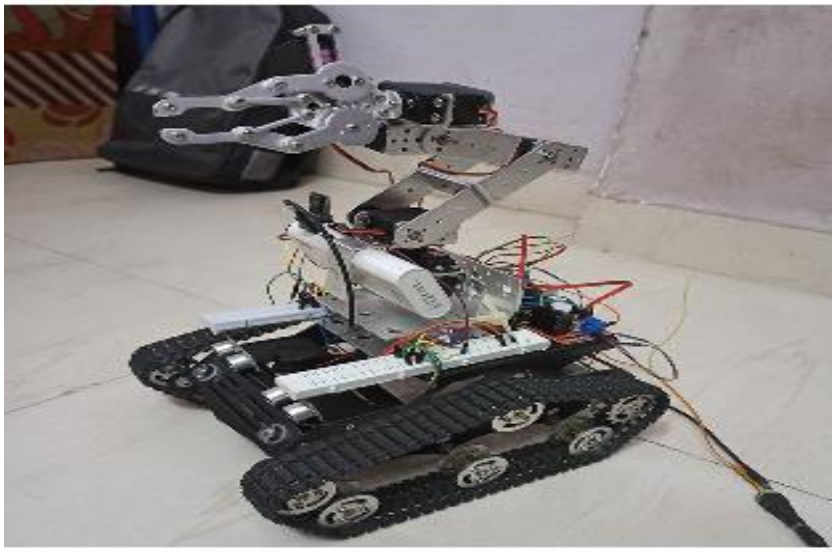

Figure 9.: Defence Bot With ARM

4. CONCLUSION AND FUTURE SCOPE

The machine which can be used in defense operations like remote surveillance, bomb detection and disposal, 2D area mapping and offense operations like unmanned gun ring and seek and destroy operations.

Up until this stage the level of autonomy of the machine is medium, but with the help of the Algorithms we may be able reach level of fully automated machine, where if the machine is in unknown situation it may be able to take decisions like human level of intelligence. Also, night vision specs if enabled onto the machine, can be used in all military conditions thus improving operational availability, compounded with the machine's all terrain ability. The robot can be improvised to transverse vertical surfaces. Its mobility can be improved on air, land and water for stealth operations by certain improvisations. Also further improvisations can enable it to carry heavier loads, thus making it avail the ability to use mechanized guns in future.

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