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UNMANNED GROUND VEHICLE FOR MILITARY ASSISTANCE

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Abstract - *One of the most prominent problems faced by the world today is Terrorism. Billions of dollars are spent by Governments and Scientists for the research of new defense systems which are capable of safeguarding citizens from terrorist threats. Nowadays with major advancements in the field of vehicle automation, several dangerous and crucial counter terrorist operations are being handled by sophisticated machines which are not only more efficient but are also responsible for saving several human lives. Our project "Unmanned Ground Vehicle" is built to undertake missions like border patrol, surveillance controlled by human soldiers (manual). It is a prototype illustrating the ever expanding need for sophisticated technology and precision driven vehicles catering to the present day needs for a first line of defense. This prototype can be used as basic model for upcoming UGVs.*

Key Words: *Unmanned Ground Vehicle, Day/Night Surveillance, Metal Detector, Arduino, NodeMCU, RADAR, GPS.*

1. INTRODUCTION

UGV is built to undertake missions like border patrol, surveillance controlled by human soldiers (manual). The vehicle is controlled by a human operator and live video is fed back to the base station. A person from a remote place can comfortably control the motion of the robot wirelessly. This defense system of ours has a control unit (to control mobility). This robot is equipped with **camera** for surveillance in both day and night time. The UGV will be controlled by the controller interfaced with display for live feed. The vehicle has GPS **to** track the path. A RADAR system is used to detect any sudden movements around its environment. Additionally, **metal detector** is used to detect land mines and trace a safe path for the soldiers. In addition, wireless controlled drone **is** set up with the UGV which will be helpful in places where the UGV can't reach.

2. LITERATURE SURVEY

[1] This survey summarizes current research on unmanned vehicles which are used in terrain detection. Various methods are used for indoor and outdoor terrain detection. Most of the research done in this area is novel and this field is still developing as a program of research. However, the research in this field is necessary even though many existing approaches are effective. The findings consists of various methods and algorithms used; the type of hardware and algorithm used to perform the terrain detection; the benefits of each approach span in the use of various sensors and the way the terrain detection is carried out in each of its applications. For autonomous navigation, the vehicle should be equipped with reliable sensors for sensing the environment, building environment models and following the correct defined path.

[2] This paper presents an obstacle detection and avoidance system for an unmanned Lawnmower. The system consists of two (Infrared and Ultrasonic) sensors, an Arduino microcontroller and a gear DC motor. The ultrasonic and infrared sensors are implemented to detect obstacles on the robot's path by sending signals to an interfaced microcontroller. The micro- controller redirects the robot to move in an alternate direction by actuating the motors in order to avoid the detected obstacle. In conclusion, an obstacle detection circuit was successfully implemented using infrared and ultrasonic sensors modules which were placed at the front of the robot to throw both light and sound waves at any obstacle and when a reflection is received, a low output is sent to the Arduino microcontroller which interprets the output and makes the robot to stop.

[3] The outline and usage of a mobile phone worked metal detector is introduced in this paper. Presently days, metal recognizing framework are turning out to be imperative part in securing live and properties of regular citizen and military. This metal detector is connected on mobile phone worked vehicle. For this paper, the metal identifier worked in a way that the metal sensor (Colpitt's oscillator) detects any electrically or metallic object conveyed near it. The metal indicator circuit creates a sound which can hear to the end client through the cell Phone. The vehicle comprises of Arduino board, a L293D interface circuit, and an motor driving framework.

The controlling electronics are associated with the Arduino board. The Arduino board sends signs to the interfacing board L293D that controls the motor driving framework. In the course of a call, if any button is pressed, a tone corresponding to the button pressed is heard at the other end of the call. This tone is called `dual-tone multiple-frequency' (DTMF) tone. The vehicle perceives this DTMF tone with the help of the phone stacked in the vehicle.

3. EXISTING SYSTEM

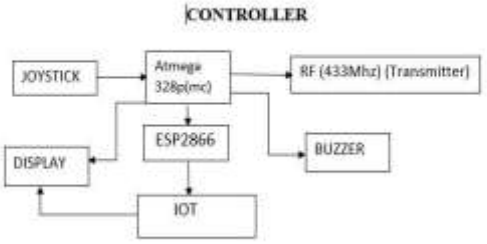
DOGO Tactical Combat Robot. DOGO' is a tactical new robot developed by Israel's General Robotics is introducing a new breed of 'combat robots' at Eurostar 2016, designed to assist combat teams in urban assaults and counter-terror operations. The small, lightweight robot can climb stairs and move across difficult terrain. The robot has certain advantages over the human warfighter.

4. PROPOSED SYSTEM

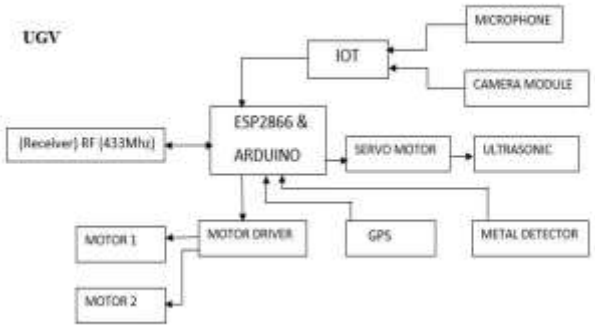
The main objective of the UGV is to serve as first line defense. It can detect land mines in the war field and can trace a safe path for the soldiers. Its HD camera can be used for better surveillance. The UGV is controlled by RF Transmitter and Receiver whose frequency is 433MHz. It is driven by 10Kg torque motor which is controlled by L298N motor driver interfaced with the Arduino. 2MP day/night camera is used to transmit live video to the controller. The camera comes with the motion detection feature, which will be helpful to detect any sudden changes in the environment. The GPS module interfaced with the Arduino broadcasts the current location of the UGV. A metal detector module is interfaced with the Arduino to detect any landmines, which is the primary objective of the UGV. A separate compartment is allocated in the UGV to place a drone inside it, which is useful for aerial surveillance.

5. BLOCK DIAGRAM

Transmitter



Receiver



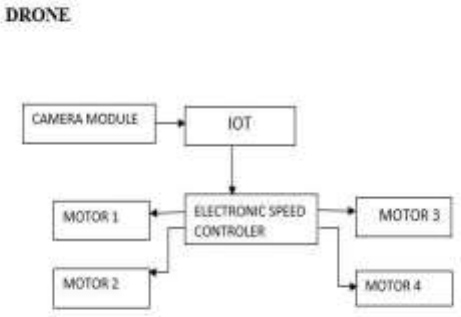
6. HARDWARE REQUIREMENTS

6.1 RF Module:

An **RF module** (radio frequency module) is a (usually) small electronic device used to transmit and/or receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through optical communication or through radio frequency (RF) communication. For many applications the medium of choice is RF since it does not require line of sight. RF communications incorporate a transmitter and a receiver.

6.1.1 Transmitter modules

An RF transmitter module is a small PCB sub-assembly capable of transmitting a radio wave and modulating that wave to carry data. Transmitter modules are usually implemented alongside a micro controller which will provide data to the module which can be transmitted. RF transmitters are usually subject to regulatory requirements which dictate the maximum allowable transmitter power output, harmonics, and band edge requirements.



6.1.2 Receiver module

An RF receiver module receives the modulated RF signal, and demodulates it. There are two types of RF receiver modules: super heterodyne receivers and super regenerative receivers. Super-regenerative modules are usually low cost and low power designs using a series of amplifiers to extract modulated data from a carrier wave. Super- regenerative modules are generally imprecise as their frequency of operation varies considerably with temperature and power supply voltage super heterodyne receivers have a performance advantage over super- regenerative; they offer increased accuracy and stability over a large voltage and temperature range. This stability comes from a fixed crystal design which in the past tended to mean a comparatively more expensive product. However, advances in receiver chip design now mean that currently there is little price difference between super heterodyne and super-regenerative receiver modules.

6.2 Arduino

Arduino is open-source hardware. Most Arduino boards consist of an Atmel 8-bit AVR microcontroller (ATmega8, ATmega168,ATmega328,ATmega1280,ATmega2560) with varying amounts of flash memory, pins, and features. The 32-bit Arduino Due, based on the Atmel SAM3X8E was introduced in 2012. The boards use single or double-row pins or female headers that facilitate connections for programming and incorporation into other circuits. These may connect with add-on modules termed shields. Multiple and possibly stacked shields may be individually addressable via an I^2C serial bus. Most boards include a 5 V linear regulator and a 16 MHz crystal oscillator or ceramic resonator.

Some designs, such as the Lily Pad, run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions. Arduino microcontrollers are pre- programmed with a boot loader that simplifies uploading of programs to the on- chip flash memory. Boards are loaded with program code via a serial connection to another computer. Some serial Arduino boards contain a level shifter circuit to convert between RS-232 logic levels and transistor– transistor logic (TTL) level signals. Current Arduino boards are programmed via Universal Serial Bus (USB), implemented using USB-to-serial adapter chips such as the FTDI FT232. Some boards, such as later- model Uno

boards, substitute the FTDI chip with a separate AVR chip containing USB-to- serial firmware, which is reprogrammable via its own ICSP header. Other variants, such as the Arduino Mini and the unofficial Boarduino, use a detachable USB-to-serial adapter board or cable, Bluetooth or other methods. When used with traditional microcontroller tools, instead of the Arduino IDE, standard AVR in-system programming (ISP) programming is used. The Arduino board exposes most of the microcontroller's I/O pins for use by other circuits. The Arduino Uno provide 14 digital I/O pins, six of which can produce pulse- width modulated signals, and six analog inputs, which can also be used as six digital I/O pins. These pins are on the top of the board, via female 0.1-inch (2.54mm) headers. Several plug-in application shields are also commercially available. The Arduino Nano, and Arduino-compatible Bare Bones Board and Boarduino boards may provide male header pins on the underside of the board that can plug into solderless breadboards.

6.3 L298 H BRIDGE DRIVE

The L298 is an integrated monolithic circuit in a 15- lead Multi watt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage.

6.4 METAL DETECTOR

A **metal detector** is an electronic instrument which detects the presence of metal nearby. Metal detectors are useful for finding metal inclusions hidden within objects, or metal objects buried underground. Usually the device gives some indication of distance; the closer the metal is, the higher the tone in the earphone or the higher the needle goes. The simplest form of a metal detector consists of an oscillator producing an alternating current that passes through a coil producing an alternating magnetic field. If a piece of electrically conductive metal is close to the coil, eddy currents will be induced in the metal, and this produces a magnetic field of its own. If another coil is used to measure the magnetic field (acting as a magnetometer), the change in the magnetic field due to the metallic object can be detected.

6.5 NODEMCU

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12module.

ESP8266 Arduino Core

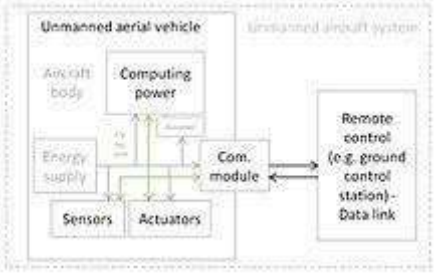
As Arduino.cc began developing new MCU boards based on non-AVR processors like the ARM/SAM MCU and used in the Arduino Due, they needed to modify the Arduino IDE so that it would be relatively easy to change the IDE to support alternate tool chains to allow Arduino C/C++ to be compiled for these new processors. They did this with the introduction of the Board Manager and the SAM Core. A "core" is the collection of software components required by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file for the target MCU's machine language. Some ESP8266 enthusiasts developed an Arduino core for the ESP8266 WiFi SoC, popularly called the "ESP8266 Core for the Arduino IDE". This has become a leading software development platform for the various ESP8266-based modules and development boards, including NodeMCUs.

6.6 GPS MODULE (NEO-6M)

The NEO-6 module series is a family of stand-alone GPS receivers featuring the high performance u-blox 6 positioning engine. These flexible and cost effective receivers offer numerous connectivity options in a miniature 16 x 12.2 x 2.4 mm package. Their compact architecture and power and memory options make NEO-6 modules ideal for battery operated mobile devices with very strict cost and space constraints. The 50- channel u-bloc 6 positioning engine boasts a Time-To-First-Fix0(TTFF) of under 1 second. The dedicated acquisition engine, with 2 million correlates, is capable of massive parallel time/frequency space searches, enabling it to find satellites instantly. Innovative design and technology suppresses jamming sources and mitigates multipath effects, giving NEO-6 GPS receivers excellent navigation performance even in the most challenging environments.

6.7 DRONE

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. The flight of UAVs may operate with various degrees of autonomy: either under remote control by a human operator or autonomously by onboard computers.



7. SOFTWARE REQUIREMENT IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one- click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

8. RESULT

The proposed system is expected to run at speed of 5.7 Km per hour, with its body weighing upto 4 Kg, with the drone included. The dimension of the

UGV is 19x36x10 cm. The range of UGV is 100 m and that of the drone is 10 m. The UGV can last for 6 hours when fully charged and the drone has a flight time of 15 minutes.

9. CONCLUSION

Thus, the proposed prototype can provide detailed information about the war field environment (both ground and aerial environment) in both day and night time. And helps our soldiers to learn about the environment before entering there, which can give us a great advantage during the war. This results in reduced number of deaths and casualties that occur in the war field. This system can also be used during the times of disasters and helps to analyze and survey the places which are sometimes difficult for humans to enter.

10. REFERENCES

[1] Ash win Pais, Jivitesh Gudekar, Pinak Kelkar, Jay Borade, "A Survey on Unmanned Vehicles techniques for Terrain Detection in 3D environment", International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 4, Issue 3, March 2015.

[2]Kolapo Sulaimon, Solomon Uluwole Akinola, Ogunlade Michaele Adegoke, Moses Oluwafemi Onibonoje, "Development of an Arduino-based obstacle avoidance robotic system for an unmanned vehicle", ARPN Journal of Engineering and Applied Sciences, Volume 13, NO.3, February 2018

[3]Rathesh Kumar, Amulya Niraj Khalko, "Design and implementation of metal detector using DTMF technology", International Conference on Signal Processing, Communication, Power and Embedded System, 2016.

[4] V.Abilash, J.Paul Chandra Kumar, "Arduino controlled landmine detection robot", Third International Conference on Science Technology Engineering and Management (ICONSTEM), 2017.