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MILITARY VEHICLE FOR NIGHT SPYING OPERATIONS

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Abstract : Our research focuses on developing a compact and powerful autonomous rover for nocturnal surveillance in military operations. The rover, controlled by the ESP8266 Microcontroller and programmed using Arduino software, navigates preset paths silently and covertly. Components like the L298 Motor Driver Module, Power Distribution Base Board, 12V Li-ion Battery, and CSM-100 RPM-12V motor ensure precise movement, smooth navigation, and extended operational periods. The rover's cutting blade, powered by a motor, aids in clearing obstacles. This project directly enhances military reconnaissance capabilities, providing a quiet and efficient solution for nighttime spying operations. By emphasizing silent and covert surveillance, it contributes significantly to national security efforts.

Keywords - : ESP8266 Microcontroller, L298 Motor Driver Module, Power Distribution Base Board, 12V Li-ion Battery, CSM-100 RPM-12V motor

I. INTRODUCTION

In the ever-evolving landscape of military operations, the integration of cutting-edge technologies has become imperative to address emerging challenges. Our research endeavours into the realm of robotics, a field dedicated to the creation of intelligent machines capable of autonomous task execution. Within the spectrum of military applications, a noticeable gap exists in the effectiveness of techniques tailored for nocturnal surveillance. This lacuna has prompted our exploration of innovative solutions, leading to the development of a small yet formidable rover.

This military vehicle, conceived through our proposed methodology, harnesses the power of advanced components such as the ESP8266 Microcontroller, L298 Motor Driver Module, Power Distribution Base Board, 12V Li-ion Battery, CSM-100 RPM-12V motor, and a cutting blade. Controlled and orchestrated by the ESP8266 and programmed using Arduino software, our rover exhibits the ability to autonomously traverse predetermined paths in darkness. This underscores the critical significance of silent and covert surveillance in the context of bolstering military operations.

At the core of our project lies a meticulous selection of processors and sensors. The ESP8266 Microcontroller serves as the cerebral command center, ensuring the rover's precise movements, while the L298 Motor Driver Module adeptly manages motor functions to facilitate seamless navigation. The Power Distribution Base Board optimally handles power supply, and the 12V Li-ion Battery ensures prolonged operational periods. Propelled forward by the CSM-100 RPM-12V motor, the rover is equipped with a motor driven cutting blade to efficiently clear obstacles along its path.

Beyond the confines of the laboratory, our project carries profound societal implications. It directly addresses the imperative to enhance military reconnaissance capabilities by presenting a quiet and efficient solution tailored for nocturnal spying operations. In doing so, it contributes meaningfully to national security endeavors. As we delve deeper into the intricacies of our research, the following sections will unfold the technical intricacies and applications of our innovative military vehicle designed for night spying operations.

II. INTRODUCTION TO ROBOTICS

Robotics is a branch of engineering and science that includes electronics engineering, mechanical engineering and computer science and so on. This branch deals with the design, construction, use to control robots, sensory feedback and information processing. These are some technologies which will replace humans and human activities in coming years. These robots are designed to be used for any purpose but these are using in sensitive environments like bomb detection, deactivation of various bombs etc. Robots can take any form but many of them have given the human appearance. The robots which have taken the form of human appearance may likely to have the walk like humans, speech, cognition and most importantly all the things a human can do.

Most of the robots of today are inspired by nature and are known as bio-inspired robots. Robotics is that branch of engineering that deals with conception, design, operation, and manufacturing of robots. There was an author named Issac Asimov, he said that he was the first person to give robotics name in a short story composed in 1940's. In that story, Issac suggested three principles about how to guide these types of robotic machines. Later on, these three principals were given the name of Issac's three laws of Robotics. These three laws state that:

- Robots will never harm human beings.
- Robots will follow instructions given by humans with breaking law one.
- Robots will protect themselves without breaking other rules.

III. Goals and Objectives

The main goal of this project is to provide safety to the bomb disposal squad by providing an extra line of defence

Objectives:

1. Provide a remote monitoring and controlling application for analysis of a suspicious packet (or bomb).
2. Allow the user to manipulate the packet using robotic arm.
3. Providing a user-friendly control application..

IV. Hardware & Circuit Description

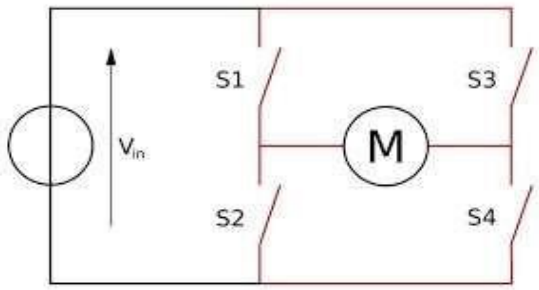
A Microcontroller (or MCU) is a computer-on-a-chip used to control electronic devices. It is a type of microprocessor emphasizing self-sufficiency and cost-effectiveness, in contrast to a general-purpose microprocessor (the kind used in a PC). A typical microcontroller contains all the memory and interfaces needed for a simple application, whereas a general purpose microprocessor requires additional chips to provide these functions.

A microcontroller is a single integrated circuit with the following key features:

- Central processing unit - ranging from small and simple 8-bit processors to sophisticated 32- or 64- bit processors
- Input/output interfaces such as serial ports
- RAM for data storage
- ROM, EEPROM or Flash memory for program storage
- Clock generator - often an oscillator for a quartz timing crystal, resonator

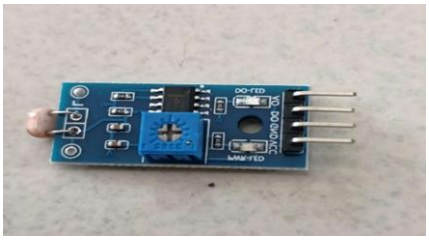
4.1 L298 Motor Driver Module

A motor driver module is a simple circuit used for controlling a DC motor. It is commonly used in autonomous robots and RC cars (L2938N and L293D are the most regularly utilized motor driver chips). A motor driver module takes the low voltage input from a controller like Arduino. This input logic controls the direction of DC motors connected to the driver. To put it in simple words, you can control the direction of DC motors by giving appropriate logic to the motor driver module. The motor driver module consists of a motor driver IC, which is the heart of the module. The IC alone can control the DC motor but using the module makes the interfacing with Arduino easy. This L298N Motor Driver Module is a high-power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control. The L298N motor driver is based on the H-bridge configuration (an H-bridge isa simple circuit that lets us control a DC motor to go backward or forward. Which is useful in controlling the direction of rotation of a DC motor. It is a high current dual full H-bridge driver that is constructed to receive standard TTL logic levels. It can also be used to control inductive loads e.g. relays, solenoids, motors (DC and stepping motor), etc. An H-bridge schematic looks like this:



4.2 LDR NIGHT SENSOR

An LDR (Light Dependent Resistor) night sensor operates on the principle of varying resistance with changes in ambient light. Integrated into a voltage divider circuit, the LDR's resistance alters based on light levels, allowing the circuit to trigger a response accordingly. Widely used in outdoor lighting systems and applications requiring automatic light control, the sensor can activate or deactivate circuits controlling devices like lights or appliances. Some sensors feature adjustable sensitivity through a potentiometer, and integration with microcontrollers allows for more sophisticated automation. Proper wiring, power supply considerations, and attention to documentation are essential for ensuring the correct and reliable functioning of the LDR night sensor in diverse electronic projects.



4.3 DC MOTORS

DC motors include two key components: a stator and an armature. The stator is the stationary part of a motor, while the armature rotates. In a DC motor, the stator provides a rotating magnetic field that drives the armature to rotate. A simple DC motor uses a stationary set of magnets in the stator, and a coil of wire with a current running through it to generate an electromagnetic field aligned with the centre of the coil. One or more windings of insulated wire are wrapped around the core of the motor to concentrate the magnetic field. The windings of insulated wire are connected to a commutator (a rotary electrical switch), that applies an electrical current to the windings. The commutator allows each armature coil to be energised in turn, creating a steady rotating force (known as torque). When the coils are turned on and off in sequence, a rotating magnetic field is created that interacts with the differing fields of the stationary magnets in the stator to create torque, which causes it to rotate. These key operating principles of DC motors allow them to convert the electrical energy from direct current into mechanical energy through the rotating movement, which can then be used for the propulsion of objects.

V. RESEARCH METHODOLOGY

5.1 Input and Output

Each of the 14 digital pins on the Uno can be used as an input or output, using pin Mode (), digital Write, and digital Read functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. In addition, some pins have specialized functions:

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- Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
- External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach Interrupt () function for details.
- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analog.Write () function
- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.
- LED: 13. There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off
- TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.
- The Uno has 6 analog inputs, labelled A0 through A5, each of which provide 10 bits of resolution (i.e., 1024 different values). By default, they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog. Reference () function. There are a couple of other pins on the board:
- AREF. Reference voltage for the analog inputs. Used with analog. Reference ().
- Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

5.2 Communication

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

5.3 POWERING THE ESP8266 NODE MCU

The ESP8266 NODE MCU board can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm centre-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector. The board can operate on an external supply from 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The power pins are as follows:

- VIN. The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- 5V. This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.
- 3V3. A 3.3-volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- GND. Ground pins.
- IOREF. This pin on the Arduino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.

5.4 Power Supply

A lithium polymer battery, or more correctly lithium-ion polymer battery (abbreviated as LiPo, LIP, Li-poly, lithium- poly and others), is a rechargeable battery of lithium-ion technology using a polymer electrolyte instead of a liquid electrolyte. High conductivity semisolid (gel) polymers form this electrolyte. These batteries provide higher specific energy than other lithium battery types and are used in applications where weight is a critical feature, such as mobile devices, radio-controlled aircraft and some electric vehicles.

A 12V Li-ion (Lithium-ion) battery is a rechargeable energy storage solution that provides a nominal voltage of 12 volts. Lithium-ion batteries are known for their high energy density, lightweight design, and relatively low self-discharge rate. They are commonly used in a variety of applications, including portable electronics, power tools, electric vehicles, and renewable energy systems. The 12V rating makes them suitable for powering devices and systems that require a 12V power supply. It's important to note that the actual voltage of a fully charged Li-ion battery can be slightly higher than the nominal voltage, typically around 12.6 to 12.8 volts. When using a 12V Li-ion battery, it's essential to follow proper charging and discharging practices to ensure safety and maximize the lifespan of the battery. Additionally, various types of 12V Li-ion batteries exist, including different chemistries (e.g., lithium iron phosphate, lithium cobalt oxide) and form factors, so the specific characteristics may vary based on the particular battery model.

VI. RESULTS AND DISCUSSION

6.1 Results of Descriptive

Pin Name	Description
IN1 & IN2	Motor A input pins. Used to control the spinning direction of Motor A
IN3 & IN4	Motor B input pins. Used to control the spinning direction of Motor B
ENA	Enables PWM signal for Motor A
ENB	Enables PWM signal for Motor B
OUT1 & OUT2	Output pins of Motor A
OUT3 & OUT4	Output pins of Motor B

12V	12V input from DC power Source
5V	Supplies power for the switching logic circuitry inside L298N IC
GND	Ground pin

The ESP8266 Microcontroller, serving as the brain of the rover, ensures precise and controlled movement, while the L298 Motor Driver Module optimally manages the motors for smooth and effective navigation. The Power Distribution Base Board efficiently handles power supply requirements, and the 12V Li-ion Battery provides extended operational periods, critical for sustained nocturnal surveillance missions.

The CSM-100 RPM-12V motor propels the rover forward with the required speed and agility, while the cutting blade, powered by its dedicated motor, enables the rover to navigate and overcome obstacles with ease. This comprehensive system emphasizes the significance of silent and covert surveillance, aligning with the unique demands of military operations conducted in low-light conditions.

The successful implementation of our proposed method highlights its potential for immediate applications in enhancing military reconnaissance capabilities. The rover's ability to autonomously navigate pre-set paths in the dark underscores its value in providing a quiet and efficient solution for nighttime spying operations. By contributing to national security efforts, our project serves as a testament to the innovative use of robotics in addressing critical gaps in military technology, ultimately advancing the capabilities of nocturnal surveillance for the benefit of military operations.

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