DESIGN OF IOT-BASED MULTIFUNCTIONAL CAMOUFLAGE MILITARY ROBOT

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ABSTRACT

In the modern era, a significant portion of a country's GDP is allocated to defense expenditures, primarily aimed at implementing both primitive and high-security measures to fortify border security and protect against trespassers. Within this context, defense organizations are increasingly turning to robotics to enhance operational efficiency and minimize human casualties. Among these advancements, Camouflage Robots have emerged as crucial assets, particularly in mitigating losses during disasters and hostile situations.The fundamental concept of Camouflage Robots involves equipping vehicles with advanced camera systems capable of detecting and adapting to surrounding colors and patterns. These robots are adept at stealthily infiltrating enemy territories, gathering vital intelligence through their camera feeds, and relaying this information to command centers, thereby bolstering national defense mechanisms. By leveraging robotics, the overarching goal is to strengthen defense infrastructure while prioritizing the preservation of human lives.To achieve these objectives, this paper proposes a comprehensive system integrating various technologies, including the Arduino Mega microcontroller, metal detectors, and gas sensors. These components empower the robot to execute multifaceted tasks, ranging from reconnaissance missions to search and rescue operations. By harnessing the capabilities of these sensors and controllers, the robot can navigate diverse terrains, identify potential threats, and swiftly respond to emergencies.In essence, the integration of robotics, particularly Camouflage Robots, represents a pivotal advancement in modern defense strategies. By harnessing the power of automation and sensor technologies, nations can enhance their defensive capabilities, mitigate risks, and ultimately safeguard the lives of both military personnel and civilians. This concerted effort towards leveraging robotics underscores a commitment to innovation and adaptability in the face of evolving security challenges

.Keywords*: Arduino mega, Metal Detector sensor, Node MCU, LM35, GAS sensor, PIR sensor.*

1. INTRODUCTION

In today's rapidly advancing technological landscape, robots have emerged as invaluable mechanical devices with the ability to tackle intricate and arduous tasks independently or in response to programmed commands. The ongoing technological revolution has underscored the increasing preference for utilizing robots over human labor in various domains. This preference stems from the fact that robots excel at performing complex tasks that may be too challenging or hazardous for humans to undertake.

Furthermore, robots possess the unique advantage of being able to navigate and operate in environments that are inaccessible or perilous to humans, thereby enhancing overall safety and efficiency. Their precision and consistency in executing tasks also contribute to higher productivity and reduced error rates. The versatility of robots extends across a wide range of applications, from manufacturing and healthcare to exploration and rescue missions.As we continue to witness the evolution of technology, the integration of robots into our daily lives promises to revolutionize industries and improve the quality of work in many sectors. Embracing these mechanical wonders offers the potential for increased productivity, enhanced safety, and the exploration of new frontiers in science and industry.Defense system is a major asset to any country in this world. Safeguarding the country against the enemies is one of the prioritized things to keep the country's economy, assets, valuable treasures and lives of the people in the safest way. In the defense the most required and the new equipment are the military robots. Nowadays, military robots are considered to be the future of modern military action. At the same time, military robotics is considered to be the game-changing technology that could change the structure and employment of armed forces. Society is aware of the military employ men t of robots today. The last decade has witnessed a surge of military robots on the warfare.

2. LITERATURE SURVEY

1. Prem Kumar. M presented a paper that low power X-bee wireless sensor network and use to propose a new system for tracing out the trespassers and robot took the action on the trespassers that are found while the robot was under surveillance, b y t h is error made by humans can be reduced.

2.Akash Ravindran proposed a system that interfaces between the controller and android, the communication by Bluetooth is established, and it was made by using Bluetooth module that was interfaced using UART protocol. The controlling of robot can be done by the use of android app.

3. Hymavathi proposed a paper for interfacing the X-bee and the implementation of a multipurpose robot by wireless technology, the model can be controlled by using the personal computer (PC) and it navigates through the disaster areas and identifying the enemy.

4. Yadnika Warang proposed a paper on implementation of the robot which has multifunctionality and camouflaged technology by using the smartphone connected by Bluetooth. Additionally, it is based on artificial intelligence and the safety of the Robot.

3. PROPOSED SYSTEM

A Camouflage Military robot is outlined in such a way that it can replicate the color autonomously at different zones with specific spots of the ground surface which allows the robot to mock up as a checkerboard of multiple colors i.e., the various colors it drives over. In the implemented system the movement of the robot can be controlled in any required direction using and smart phone which receives the information from the sensors and camera.

4. METHODOLOGY

The main processor used in the proposed system is Arduino UNO, which is a microcontroller board based on the Microchip ATmega328P. PIR (Passive Infrared Sensor) or PID (Passive Infrared Detector) is used to measure the infrared rays emitted by objects in the field of view by detecting movement/movement of living objects. This sensor uses reflection and radiation properties. Metal detectors are used to find metal hidden inside objects, metal objects buried in the ground, and to detect nearby metal objects such as bombs and weapons. The color sensor used generally detects the color of the ground in RGB scale. A fire sensor or a flame detector is used to detect and respond to the presence of a flame or fire. Fire detection is based on heat sensing most, current fire detection system uses electronic and distributed optical thermal detectors based on thermistors. Thermal sensing based on infrared is a helpful technique, especially appropriate for heat detection of the targeted location. A DC motor which is a class of

rotator electrical machine is used to convert direct current into mechanical energy. Here 2 DC motors are used for the movement of the robot which is controlled with the help of mobile (Android application). For the software implementation, we have used Arduino IDE in the proposed mechanism to program the Arduino UNO board. An integrated development environment (IDE) is a software application that provides comprehensive facilities to computer programmers required for software development. It generally consists of source code editor built-in automation tools and a debugger. Here the robot movement and other sensor data values are displayed in mobile application. For the purpose of live streaming wireless IP address-based Wi-Fi camera is used. The live streaming can be seen using smartphone by making use of an android application V380. This robot has a Bluetooth receiver unit, which receives the commands and give it to the microcontroller circuit to control the motors. The microcontroller then transmits the signal to the motor driver IC's to operate the motors. Bluetooth devices communicate in low power radio waves at a frequency band of between 2.400 GHz and 2.483 GHz.

5. BLOCK DIAGRAM

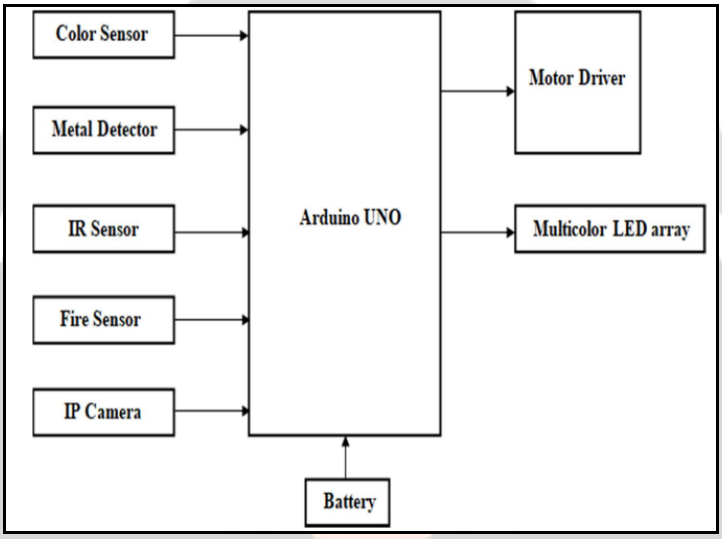

Figure 1: Block Diagram of Camouflage robot

6. SYSTEM DESIGN

System design is the procedure of defining the architecture, components, modules, interfaces, and data for a system to satisfy its unique requirements. Systems design could be seen as the application of systems theory to development of product. System architecture is a conceptual model that describes the structure and behaviour of the system. It comprises of the system components and the relationships describing how they work together to implement the overall system.

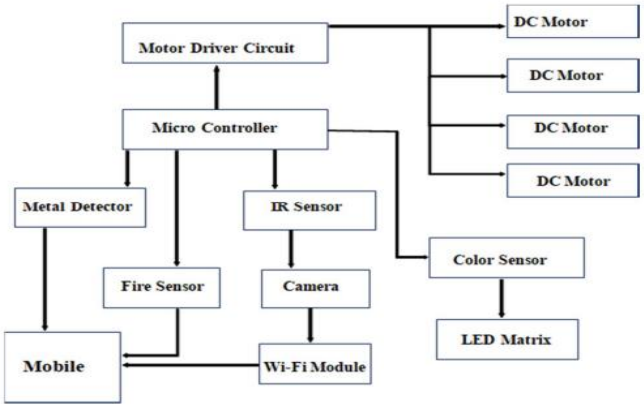

Figure 2: Architectural diagram of Camouflage Army Robot

7. HARDWARE REQUIREMENTS

7.1 Arduino Mega

Arduino Mega 2560 is a microcontroller board based on ATmega2560 (documentation). There are 54 input/output pins (14 of which can be used as PWM outputs), 16 Analog inputs, 4 UARTs (hardware serial ports), 16 MHz crystal oscillator, USB connection and ICSP connector output and a reset button. It includes everything you need to support your microcontroller; Just connect it to your computer with a USB cable or power it with an AC-DC adapter or battery starter. The board can be programmed using the link/function command.

7.2 Ultrasonic Sensor

Ultrasonic sensors emit ultrasonic waves into the air and detect reflected waves from objects. Ultrasonic sensors have many applications, such as intrusion alarms, automatic door openers, and vehicle backup sensors.

7.3 Gas Sensor

A gas sensor is a device that detects the presence or concentration of gas in an area. Depending on the gas concentration, the sensor changes the resistance of the element, producing a different potential difference, which can be measured as the output voltage at the sensor.

7.4 Fire Sensor

A flame sensor is an electronic device commonly used to detect and intervene in the occurrence of fire or flame. The response of the flame detector may depend on its configuration. The alarm system includes natural gas lines, propane and fire extinguishers. This sensor is used in industrial boilers. Its main function is to ensure the operation of the boiler. Due to their flame detection process, sensors respond faster and more accurately than heat/smoke detectors.

7.5 Metal Detecting Sensor

A metal detector is a device that detects nearby metal. Metal detectors can be used to find metal compounds hidden in objects or metal objects buried in the ground. They usually include a handheld unit with a sensor probe that can be moved over the ground or other objects. Metal detectors/sensors are electrical or electronic devices which is used to detect the presence of metal in a variety of situations, from packages to people. Metal detectors can be installed permanently or mobile and rely on a variety of electronic equipment, including popular electromagnetic systems. Its key features include ready-made paper, maximum experience, handheld products and some special options such as permanent products. Metal products can be processed to find the specific metal in a specialized manufacturing process such as wood sawing or injection molding.

7.6 PIR Sensor

All organisms with a body temperature above 0°C emit heat from the body in the form of infrared radiation, also known as thermal radiation. This radiant energy cannot be seen by the human eye. These signals can be detected using PIR sensors specifically designed for this purpose.

7.7 Node MCU

Node MCU is an open-source firmware and development kit that plays an important role in designing your own IoT product using a few Lua script lines. Multiple GPIO pins on the board allow you to connect the board to other devices and are capable of generating PWM, I2C, SPI, and UART serial communications. The main use of Node MCU is to create IoT projects that require wireless connectivity. It is used to build smart home devices, remote sensors, data loggers, and other internet-enabled devices. It initially included firmware running on Espress is Systems' ESP8266 Wi-Fi SoC, as well as a device-based ESP-12 module. Later ESP32 32-bit MCU support was added.

7.8 Buzzer

A buzzer or buzzer is an electronic device that can be mechanical, electromechanical or piezoelectric. The uses of buzzers and beepers include alarm devices, timers and recognition of user input (such as mouse click or keystroke). Buzzer is an electronic model connected to a DC power supply. It is widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment, telephones, timers and other electronic products to create sound. The voltage rating of Active buzzer is 5V and can be directly connected to a continuous sound, this section dedicated sensor expansion module and the board in combination completes a simple circuit design, to "plug and play.

7.9 Led

A light-emitting diode (**LED**) is a semiconductor light source that emits light when current passes through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. It will indicates the vehicles for go, stop and ready to go.

8. SOFTWARE REQUIREMENTS

8.1 Arduino IDE

- Arduino IDE is an open-source software that is mainly used for writing and compiling the code into the Arduino Module.
- It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process.
- The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module.
- This environment supports both C and C++ languages.
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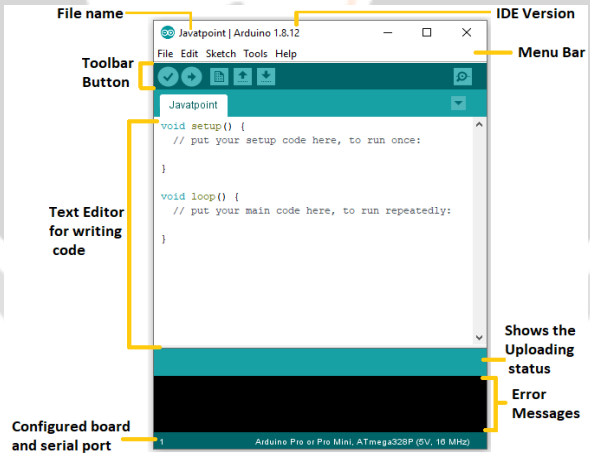

Figure3: Arduino IDE

9. RESULTS

A Military Robot with Camouflaging feature is designed and manufactured as shown in below figure. When IR sensor detects the obstacles, the notification message is sent on android app. When Metal detector detects the metal, the respective buzzer will produce the sound and information sent to the android app. The color sensor senses the color from the surrounding environment of the robot and make changes according to it by framing the color on the LED strips. Fire sensor detects the fire. The camera displays real-time data that can be processed or displayed at the

monitor or mobile phone of the user. It can provide fast and accurate data as the transmission of data takes place through the Wi-Fi module. The movement of the robot can be controlled with a mobile phone.

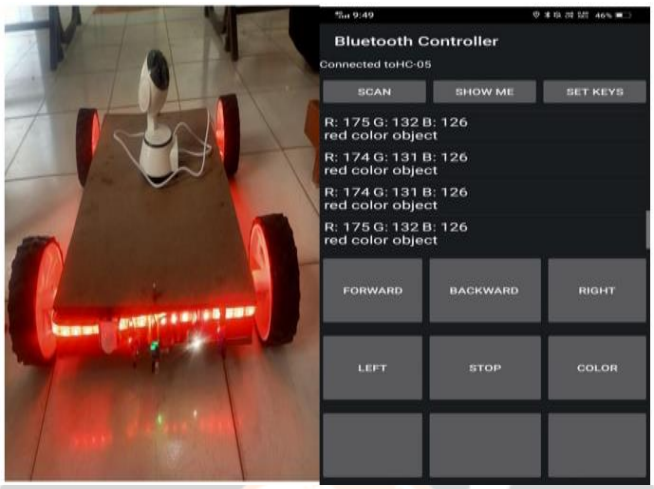

Figure 4: Motor Driver

10. FUTURE SCOPE

The main motivation behind the project was to use a computer to operate the robot. The machine can also recognize the proximity of metal in the same way that the PIR sensor can detect the proximity of the human body, and if the proximity of the human body is detected, it will block the alarm and emit red light. The small machine has been modified so that the robot can move easily by pressing the buttons, and a ring alarm system has been used to distinguish the path of metal products in the mine and give warnings with the help of metal position sensors. The disadvantage of the current job is the lack of awareness about robots. This situation can be prevented by purchasing a GSM module that provides the operating status of the robot. By adding a remote camera to the robot, we can see the world outside our computer using only GPRS and GPS. By combining the thermometer with the robot, we can take the temperature of the dangerous place on the PC. Instead of sending someone there and having problems on the ground, we can send a robot and the temperature sensor there and give the data. The microcontroller and the microcontroller give the data to the mobile phone, and we can receive the data from the PC. By attaching smoke sensors to robots, data for smoke or gas detection in certain areas (coal mines, hazardous areas, etc.) can be obtained. The sensor captures the data and sends it to a small controller, which sends it to the phone and we receive the data to the PC. It is often used for gardening purposes by connecting individual devices to robots. This robot can move left and right according to our direction, so we can use the robot to do some computer gardening work. By connecting terminal equipment and remote cameras to the robot, we can capture targets on the computer. Here we can see the project again using the camera and you can hit the target by pressing the button you want on your computer, so you can observe the situation without hesitation, such as the pause of the Mumbai Psycho Tyrant. It can cause injuries, also our police.

11. CONCLUSION

The proposed framework is a alternate to human life. This proposed robot assists with going about as a security framework and furthermore as a lifeline as human life is in every case more organized. It establishes and assumes a

significant job in watching out for the fields of war and catching the environmental factors. Since it depends on the effect of the Chameleon's shadow change, the robot changes its shading relying upon the general condition and is avoided the knowledge of the adversary. Robot to robot contact makes out of inclusion territory administration. The covering highlight additionally makes it hard to identify the robot through the bare natural eye. Accordingly, in the entirety of the proposed framework gives our security powers some assistance in identifying interlopers. The robot can likewise be utilized in spots of high height where people can't live.

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