Wildlife Surveillance and Human Life Saver Robot

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***Abstract*— The "Wildlife Surveillance and Human Protection Robot" project is centered around the development of a versatile robotic system aimed at monitoring and safeguarding natural environments while ensuring human safety. The Rocki Bogie model, featuring an ESP32 camera, serves as the project's cornerstone, offering mobility and adaptability across various terrains for effective wilderness surveillance. Equipped with Ultrasonic and IR sensors, the robot navigates challenging landscapes, avoiding collisions with obstacles. Utilizing Omni wheels for silent and non-disruptive movement, it excels in tracking wildlife without causing disturbance. The integrated ESP32 camera employs advanced image recognition to detect animals, providing real-time notifications with GPS locations and images for swift conservation responses. A comparison with traditional four-wheeled robots emphasizes the Rocki Bogie's stability in rugged terrains, ensuring constant ground contact for enhanced performance in wildlife monitoring and conservation efforts. The unique Omni wheeled design contributes significantly to the robot's effectiveness in preserving natural habitats and safeguarding wildlife**.

Keywords— ESP32 camera, Ultrasonic sensor, Arduino Uno, Motor Drives, Battery.

I. INTRODUCTION

In an era defined by technological progress and environmental concerns, the fusion of robotics and conservation has spawned inventive solutions for safeguarding our natural world. The groundbreaking "Wildlife Surveillance and Human Protection Robot" project addresses the critical need for monitoring and protecting wildlife and humans in diverse and challenging environments. Conservationists worldwide grapple with habitat degradation, poaching, human-wildlife conflicts, and climate change consequences, threatening both wildlife survival and human well-being. To effectively tackle these multifaceted challenges, the project leverages robotics, artificial intelligence, and advanced sensors to offer real-time monitoring, data collection, and intervention capabilities. Robotic systems, traditionally used in manufacturing, find a unique role in conservation efforts, providing valuable tools for scientists, wildlife researchers, and conservation organizations. The imperative for real-time monitoring in conservation, tracking wildlife behaviour, population dynamics, and detecting threats, is met by the innovative "Wildlife Surveillance and Human Protection Robot" project. This initiative introduces a state-of-the-art robotic system, based on the Rocki Bogie model and equipped with an ESP32 camera for animal detection, revolutionizing wildlife monitoring and threat response with immediate alerts to protect both wildlife and human life.

II. METHODOLOGY

A research methodology is a systematically programmed approach to conducting a comprehensive research project. In this project, we have incorporated internationally accepted software engineering models. Particularly, the project leverages modern technologies and libraries, including TensorFlow and ESP32, to address the complexities of surveillance and protection in a wildlife conservation context. This implies the creation of database management system (DBMS) which ensure that computer records are kept up to date and made available on demand to those who need them for planning and operational purpose. The level of success achieved in caring out this research work is owed to the methodology adopted. The techniques used in SSADM are logical data modeling, data flow modeling and entity behavior modeling. One of the main features of SSADM is the intensive user involvement in the requirements analysis stage.

Service and Surveillance:

The Wildlife Surveillance and Human Protection Robot operates in two distinct modes: service and surveillance. This approach allows us to provide an integrated solution. We break down the project into smaller, manageable modules, enhancing the clarity and comprehensibility of the system design. It also facilitates an intensive user involvement in the requirements analysis stage.

A. Body

The rotating speed vectors of the entire round wheel are at an angle of 120 degrees according to the motion model that has been created. The primary function of the vector dot product's motion algorithm is to determine the velocity of three omnidirectional wheels using an input velocity vector (including two variables of velocity value and velocity direction).

B. Head

Service robots assist human beings, typically by performing a job that is dirty, dull, distant, dangerous or repetitive. They typically are autonomous and/or operated by a built-in control system, with manual override options. The term "service robot" does not have a strict technical definition. The International Organization for Standardization defines a “service robot” as a robot “that performs useful tasks for humans or equipment excluding industrial automation applications”. It contains a camera on its head which helps to transfer video and audio

C. Motors

To make a good choice of the motor it was established some parameters such as the robot acceleration, desired velocity and an inclination of 10° considering an approximate weight of 20 kg. An electric motor is an electrical machine which converts electrical energy into mechanical energy. The basic working principle of a DC motor is: "whenever a current carrying conductor is placed in a magnetic field, it experiences a mechanical force". The direction of this force is given by Fleming's left-hand rule and its magnitude is given by $F = BIL$. Where, B = magnetic flux density, I = current and L = length of the conductor within the magnetic field. When armature windings are connected to a DC supply, an electric current sets up in the winding. Magnetic field may be provided by field winding (electromagnetism) or by using permanent magnets. In this case, current carrying armature conductors experience a force due to the magnetic field, according to the principle. C motor Commutator is made segmented to achieve unidirectional torque. Otherwise, the direction of force would have reversed every time when the direction of movement of conductor is reversed in the magnetic field.

D. Wheels

Mecanum wheels provide omnidirectional movement for a vehicle without needing a conventional steering system. The robot is built with four Mecanum wheels that have about 15. 24cm.

A Mecanum wheel is based on the principle of a central wheel with a number of rollers placed at an angle around the periphery of the wheel (usually 45 degrees). The angled peripheral rollers translate a portion of the force I the rotational direction of the wheel to a force normal to the wheel direction.

III. CONTROLLER AND ELECTRICAL COMPONENTS

E. ARDUINO

The Microchip ATmega328P microcontroller serves as the foundation for the Arduino Uno, an open-source microcontroller board created by Arduino.cc. A number of sets of digital and analogue input/output (I/O) pins are included on the board, allowing it to be interfaced with other circuits and expansion boards (shields). With a type B USB cable and the Arduino IDE (Integrated Development Environment), the board may be programmed. It includes 14 digital pins, 6 analogue pins, and is programmable. Although it accepts voltages between 7 and 20 volts, it can be powered by a USB cable or an external 9-volt battery. It is comparable to the Arduino Nano and Leonardo as well. By giving the board's microcontroller a set of instructions, you can direct your board's actions. You achieve this by using the Arduino Software (IDE), which is based on Processing, and the Wiring-based Arduino Programming Language.

Fig 1: Arduino UNO

E. SENSORS

An electrical device that monitors and detects infrared radiation in its environment is called an infrared (IR) sensor. William Herchel, an astronomer, made the unintentional discovery of infrared radiation in 1800. He saw that the temperature was highest just beyond the red light as he measured the temperatures of each colour of light(separated by a prism). Since IR's wavelength is longer than that of visible light, it is not visible to the human eye (though it is still on the same electromagnetic spectrum).
Infrared radiation is produced by everything that emits heat (i.e., everything with a temperature higher than about five degrees Kelvin).Two transducers make up an HC-SR04 ultrasonic distance sensor in actuality. One functions as a transmitter, converting the electrical signal into pulses of ultrasonic sound at a frequency of 40 KHz. One operates asa receiver and searches for the pulses being transmitted.
These pulses are received by the receiver, which then generates an output pulse whose width is related to the proximity of the object in front. With an accuracy of 3 mm, this sensor offers excellent non-contact range detection from 2 cm to 400 cm (about 13 feet). It may be immediately linked to an Arduino or any other 5V logic microcontroller because it runs on 5 volts.

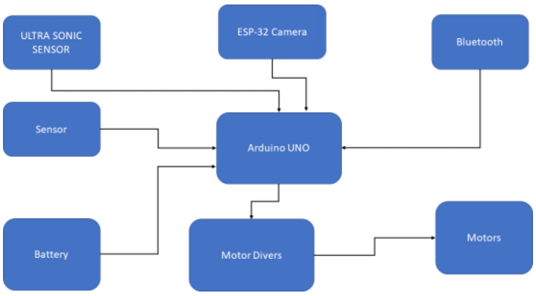

Fig 2: Block diagram

IV. SIMULATION

A. WHEEL SIMULATION

Among all wheeled robots, the four-wheeled robot has the best balance. The three-wheeled robot can move without losing its balance, even though three wheels are sufficient to maintain static stability. Robots with four wheels seldom ever lose stability while moving. Schematic for a two-wheel differential robot. Schematics for a three-wheel robot. Schematics for a four-wheel robot. Robots with four wheels can be controlled through differential steering and a car-like steering technique. Two degree of freedom (DOF) and seven DOF were used to introduce this model

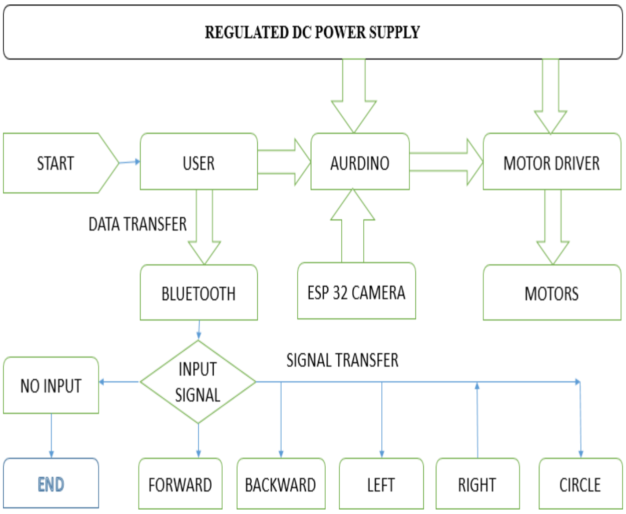

Fig 3: Power distribution

V. CONCLUSION

Omnidirectional vehicles have great advantages over conventional (non-holonomic) platforms. They can crab sideways, turn on the spot, and follow complex trajectories. Robots are taking over tasks which are dull and dangerous. Technology Should be used and implemented for Construction but not for destruction. The place where the robot is used can act as a spy and also acts as a guide for people. Use of this makes things happen in a well-disciplined and well authorized manner.

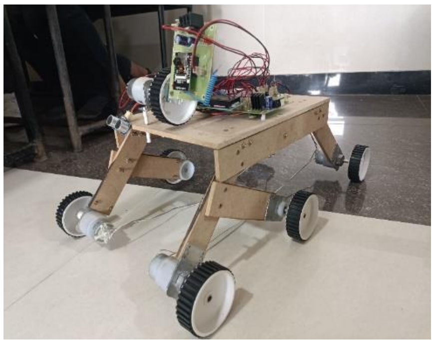

Fig 4: Side view of prototype

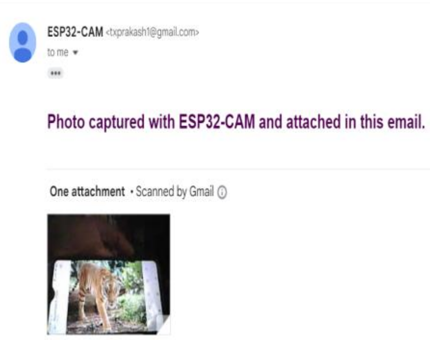

Fig 5: Result

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M. Prats, P. J. Sanz, A. P. del Pobil, E. Martínez and R. Marín, "Towards multipurpose autonomous manipulation with the UJI service robot," Robotica, vol. 25, pp. 245-256, 2007.

Service robots assist human users in day-to-day tasks. A user may give a command such as “Get me the apple from the kitchen” to a service robot. Reasoning about the steps of this task is a classical type of planning problem. The classical approach requires adopting a “closed-world assumption,” presupposing that everything the robot could possibly need to reason about is already represented in its knowledge base. In simulations and laboratory experiments, it is possible to enumerate all of the objects that a robot could interact with in its environment, but in most real-world service robot scenarios – like those that arise when interacting with people in offices or homes – such a complete enumeration is impossible.

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