Advance Surveillance Robot with Robotic Arm Control Over Iot

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Abstract:- Because of the rise in crime, everyone in the modern world is concerned about their protection, which has increased the importance of maintaining a surveillance system. Remote surveillance and monitoring have seen a growing need in emerging times. Through this paper, we put forward a surveillance robot to stroll around in a specified location while relaying real-time data (video) to the base station. This real-time data can then be used by the consumer (human) to guide the robot around. The robotic arm in front can do pick-and-place operations and other tasks, ideal for military and industrial uses.

Keywords:- *Robotic Arm control; L298N motor driver; ESP32 CAM; Arduino; Smartphone.*

I. INTRODUCTION

Humanity's biggest ally is indeed technology. Technical advancements have resulted in sophisticated and evolved civilizations and modern living. Technical breakthroughs have recognized the bounds of progress in both research and living. The possibility of establishing compact working models and in the IoT space, the possibility to do several actions always exists.

Likewise, to assist in various elements of the research process, an extended device for non-contact experiments is critical; a device capable of picking and positioning harmful or hazardous substances without requiring human touch reduces the chance of high-risk factors. In order to deal with these problems, we recommend our surveillance vehicle, which is equipped with an arm and a free-moving claw. Our concept makes the task of researchers and commoners easier by assisting in many pick and place and surveillance activities. The device combines IoT and robotics to provide us with the best of both worlds in terms of precision arm movement and wandering capabilities.

II. LITERATURE SURVEY

The utility of IoT components was vital in the robotics paradigm. With the advancement of IoT, android app technology over the years, there are numerous proposals for how to design and manufacture android, IoT-based systems. For example, Selvam Muthuraman has proposed an Application [1], which is used to regulate the robotic vehicle using a Bluetooth module.

The Arduino IDE, L293D motor driver IC, Wifi module, and servo motors were used to move the robotic vehicle with an arm that is controlled by the mobile application as well as the web IP address for monitoring. The primary objective of[2] is to design a robotic arm that can pick and place various tools and materials safely. These robots are used in surgical procedures, machine handling, and other implementations.

When operating the robot over long distances, surveillance is critical. Although the arm movement and the robot run smoothly. In [3], The robot is not controlled by a camera that is used to monitor its movement over the Internet.

In [4] the paper suggests ESP32 in combination with the Arduino IDE is a good substitute as a control scheme that fulfills the standards very well while using a microelectronic card.

Kunal Borker and his colleagues tested the smartphone controller. The application must store certain strings in software, generates similar strings, and the robot is controlled [5] with a smartphone by coordinating all devices.

In [6], Radio Frequency Identification is an advanced technique with numerous applications. RFID tags offer significant advantages and are flawless for industrial use. RFID tags, in particular, facilitate real-time production and product information collection and computation at any point. The main intention of the research [6] is to examine the implications of concepts like RFID tags tethered to the robot's environment to define its path.

III. PROPOSED METHODOLOGY

We designed the Robot Unit to be fitted with a robotic arm. employing an Arduino and ESP32, a little credit card-sized microcontroller will be used to navigate the robot's movements. and broadcast live real-time video to a ground station via IoT and a Wi-Fi network enabling humans to save their lives during high-risk activities. The robot's primary goal is to roam around in a specified location while relaying real-time data (video) transmission to the ground station. The controller (human) can then utilise this real-time data to aid the robot. The robotic arm in front can do pick-and-place operations and other tasks, ideal for military and industrial uses.

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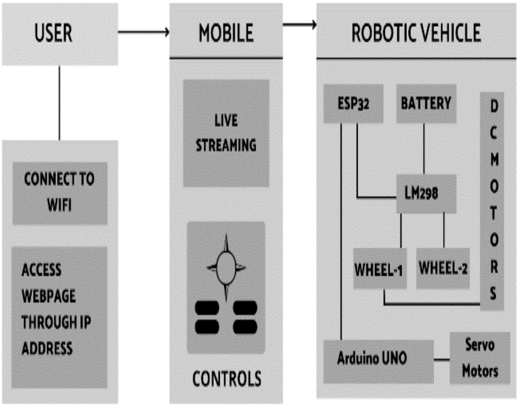

Fig. 1: Architecture of advanced surveillance robot with a robotic arm

A. Required components

a) Arduino UNO:

Arduino UNO is a credit card-sized chip which has control over every part of the robot. Arduino is a cost-efficient and easy programmable tool. It includes 6 analogue input pins and 14 digital Input/Output pins. The Arduino's objective is to provide power to the robot or board.

Fig. 2: Arduino UNO

b) L298 Motor Driver:

The motor driver L293D is an integrated chip that includes dual-channel H-bridge and pulse-width modulations for rotation and speed using encoded data in pulsing signals. This L298N motor driver can drive two motors with voltages ranging from 4.5 to 36V, facilitating it to operate as just a two-wheel vehicle. It also has capacitors to protect against back EMF produced by motors.

Fig. 3: L298 Motor Driver

c) ESP32 CAM:

The ESP32 camera module is built around an ESP32-S chip, a general-purpose microcontroller. Premade modules consist of an actual ESP-32 SoC, external flash memory, and a pre-tuned PCB antenna or an IPEX antenna connector in ESP32-based designs. The ESP32 CAM is programmable; code is installed via serial pins via an FTDI cable.

Fig. 4: ESP32 CAM

d) ESP32 CAM WiFi & Bluetooth module*:*

ESP 32 CAM WiFi & Bluetooth module is a wireless module which contains a 2Mp camera to recognise objects. The robot is controlled through the use of wifi or Bluetooth.. The ESP32 is pre-loaded with low-level device drivers and WiFi and Bluetooth wireless protocol stacks. In some instances, both Bluetooth and WiFi can be utilized. However, we are using WiFi because it has a greater range of coverage.

Fig. 5: ESP32 CAM WiFi & Bluetooth module

e) DC Motors:

DC Motors converts electrical energy into Mechanical energy when powered to current. Mostly DC Motors is used for the wheel movement. Other devices that convert electricity to motion do not produce usable mechanical powers, such as electric motors. DC motors produce mechanical power, or torque, which serves to rotate the wheels. A servo motor is created by combining a direct current motor with servomechanism.

Fig. 6: DC Motor

f) Servo Motors:
Servo Motors convert the mechanical power from electric power when powered with the current. Servo Motors are used to control the rotary angle. Servo motors police arms and jaws.

Fig. 7: Servo Motor

g) Robotic Arm and Jaw:
A type of mechanical arm. It has two grippers that mimic the actions of a simple robotic hand. This arm can be controlled manually by associating with a servo motor.

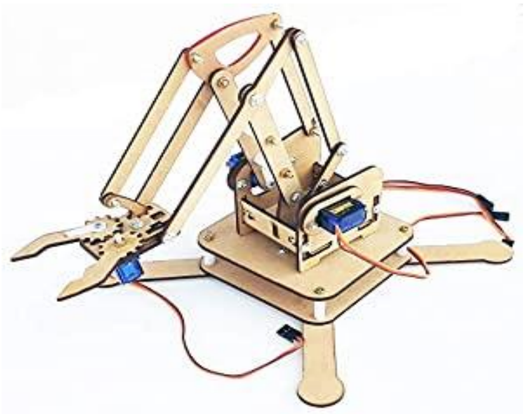

Fig. 8: Robotic Arm and Jaw

h) BO Motor:
Bo motor is a Battery Operated which is a lightweight DC geared motor that produces the maximum torque and rpm at low voltages.

Fig. 9: BO Motor

i) Motor Driver:
Motor drivers bridge the gap between motors and control circuits. The motor consumes a large current, but the circuit continues to run on minimal power signals. Motor drivers transform a minimal current control input signal into an elevated-current signal capable of moving a motor.

Fig. 10: Motor Driver

j) BO Motor Wheel:
High quality plastic wheels to mount or to have movement. The wheels have a certain rpm.BO Wheel has a pin for integrating the BO motor.

Fig. 11: BO Motor Wheel

B. Connections

ESP32 and Arduino are two microcontrollers. The ESP32 microcontroller here has WiFi connectivity, a camera. It receives video feeds, controls the robot motor for vehicle operation, and interfaces through WiFi with your gadgets. Because there aren't enough pins on the ESP32 cam board to command the servo motors, an additional microcontroller, Arduino, is used. The ESP32 connects to WiFi and generates an HTML page. Entering the link on your gadget will take you to the page. By clicking on the link, the user can watch the video feed and issue commands. ESP32 then operates the motors in accordance with the given command. The esp32 receives the servo movement command and sends it to the Arduino via serial communication. Arduino uses the signal to control the servo motors. Because it can generate enough current for motors to run, an LM298 motor driver is used to regulate them. The robot is equipped with two lithium cells connected in series (7.4v 2200mAh). The rear wheels are driven by 100rpm DC motors that are connected to the output pins of the LM298 motor driver.

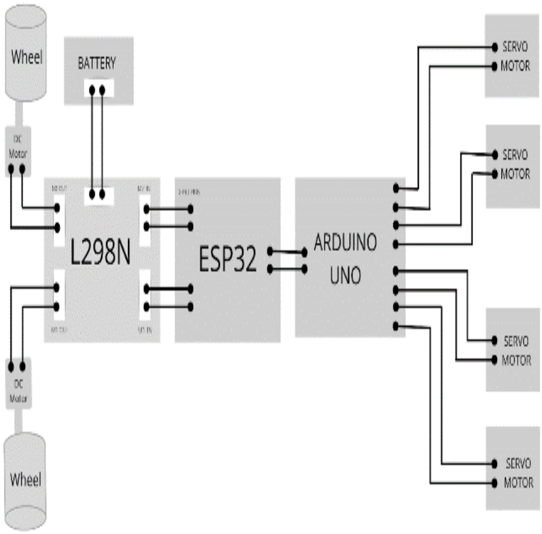

Fig. 12: Connections of the robot vehicle with an arm

IV. RESULTS

Fig. 13: Illustration of designed Robotic vehicle with an arm

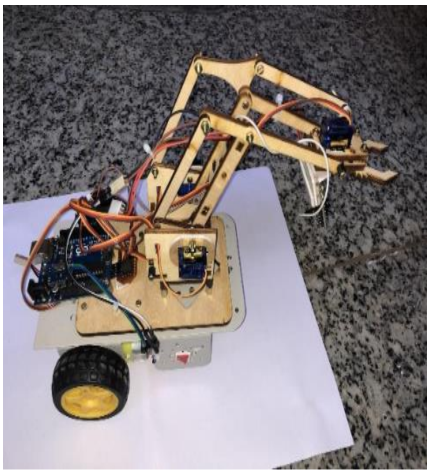

Fig. 14: Illustration of designed Robotic vehicle with an arm

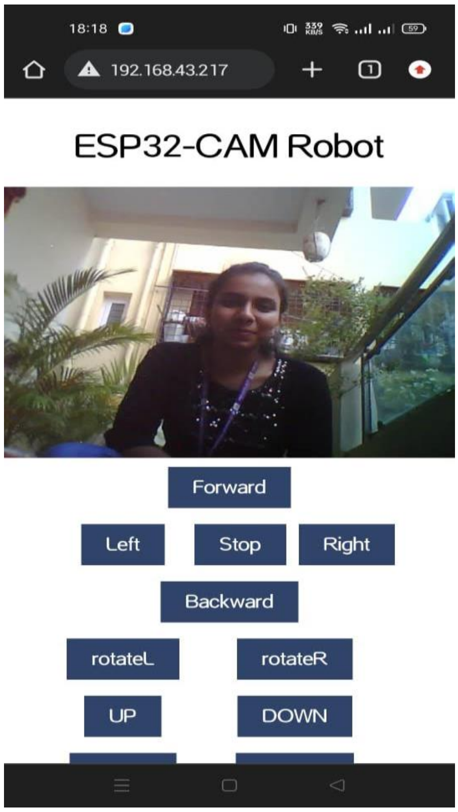

Fig. 15: Graphic user Interface Screenshot with camera and keys to operate the robot

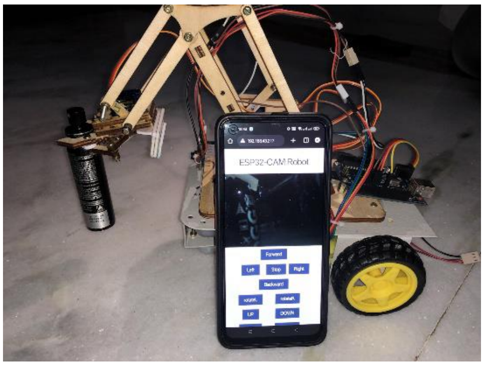

Fig. 16: The camera feed will be visible on the interface

Fig. 17: Arm picking up the object

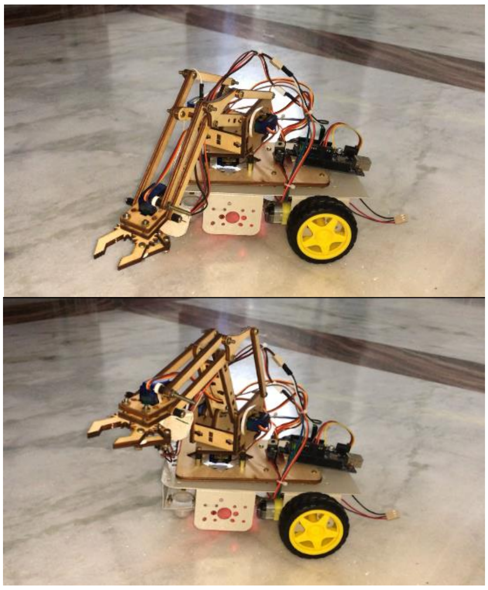

Fig. 18: Designed arm Angle of rotation with Servo Motors

V. CONCLUSION

Although advances in the robotic arms industry have resulted in a higher idea generation, these devices still fall short of ideal usefulness. Because it can handle multiple jobs at once, this Surveillance gadget can eliminate several jobs that require multiple combinations of equipment. Despite its infancy, our model has already demonstrated its ability to reduce many hazardous situations and develop a more refined approach to traditional methods. More research and development will undoubtedly make the device much more sophisticated and capable of carrying out a multitude of tasks on its own.

VI. FUTURE SCOPE

This is our project's first iteration. Our device's entire apparatus has the potency to become fully automated and a self-aware system able to handle far more hazardous debris in the future. The prospects for our device are limitless, as is the reach of our device's versatility. We intend to broaden our design by implementing it in various research facilities and institutes soon.

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