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Women Safety Night Patrolling Robot

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Abstract: ***The Women Safety Night Patrolling Robot is an IoT-based robot system for improving security and surveillance in cities and rural areas. The robot is driven by an ESP8266 NodeMCU microcontroller and controlled through the Blynk app for remote control. It has an L298 motor driver with DC motors for movement and a live-streaming camera for real-time video monitoring. In addition, a buzzer offers a local alert system for instant assistance in case of emergencies. This system provides improved safety for women, particularly in night patrol operations.***
Keywords: Women safety, IoT, ESP8266 NodeMCU, Blynk app, surveillance robot, live video streaming, L298 motor driver, emergency alert, night patrolling.

I. INTRODUCTION

Safety for women is a progressively important issue, particularly in city and rural settings where the threat of crime and harassment is prevalent. To cope with the situation, technological innovation in IoT-based security systems and robot security systems can be an effective method to improve security levels. The Women Safety Night Patrolling Robot aims to ensure real-time monitoring and emergency alert system for safety, thereby ensuring an active style of security.

This robot system is driven by an ESP8266 NodeMCU microcontroller and remote-controlled through the Blynk app. It relies on an L298 motor driver to drive movement and is integrated with a live-streaming camera for real-time video monitoring. For an emergency situation, a buzzer can be triggered to alarm surrounding people and security officers.

The robot is a patrolling unit that can move;thus, it is a good option for patrolling streets, public areas, and remote locations at night. With the combination of IoT and remote monitoring, the system seeks to improve security, discourage potential dangers, and deliver instant help whenever needed.

This project is an economic, independent, and remotely controllable measure to enhance the safety of women and public security.

II. LITERATURE SURVEY

1. Published in 2021: "Smart Motion Detection Surveillance Rover with Night Patrolling for Women's Safety and Monitoring, IJRESM". IoT-based patrol robots play a central role in this research paper for their functionality and efficiency in security purposes. Arduino and Raspberry Pi microcontrollers are preferred due to their versatility and simplicity of integration with motors and sensors, offering powerful processing for handling real-time data (Divya et al., 2021). The sensor integration is essential, with Passive Infrared (PIR) sensors also being commonly utilized for motion detection and cameras providing critical visual observation (Hegde et al., 2021). Environmental sensors such as smoke and heat detectors also provide added security by enabling the robot to react to dangerous situations (Chaithanya et al., 2021). The selection of motors, specifically DC and stepper motors, affects mobility and efficiency of operation, with motor drivers providing efficient power management for long-term operations (Moulya Raju et al., 2021). Communication is also vital, with Wi-Fi and GSM modules providing remote monitoring and real-time data transmission, improving the responsiveness of the robot to security threats (Shambhavi et al., 2021).

2. Published in 2022: "Women Safety Night Patrolling Robot" (Authors: Abhilash Reddy Komatireddy, Kota Ramprasad Reddy, Bargav Boini, Dr. G. Ganesh Kumar). In this research paper on women's safety, as presented by Komatireddy et al. (2022), draws attention to the urgent necessity of innovative solutions for addressing increasing violence and harassment. Current surveillance means, mostly employing CCTV, have limited scope that is only reaction-based and do not offer real-time protection. The authors point out that robotic systems have the potential to greatly improve safety by actively monitoring surroundings and identifying unusual activities. Studies have proven the effectiveness of autonomous technologies that have sensors and cameras, which can alert authorities and assist victims in need. Additionally, advancements in microcontroller technologies like Arduino and ESP32 have made it possible to make inexpensive yet effective safety devices. In general, the incorporation of robotic patrols into women's safety initiatives offers a viable means of minimizing threats and promoting a safer public realm.

III. REQUIREMENTS

A. Hardware Requirement: -

1) ESP8266 NodeMCU: -ESP8266 module makes it possible for microcontrollers to access 2.4 GHz Wi-Fi through IEEE 802.11 bgn. The module can either be utilized in conjunction with ESP-AT firmware to offer Wi-Fi connectivity to external host MCUs or implemented as a stand-alone MCU through the execution of an RTOS-based SDK. The module boasts a complete TCP/IP stack and offers the support for data processing, GPIO reads and controls.

2) L298 Motor Driver: -

The L298N motor driver will regulate the direction and speed of rotation of a DC electric motor. It relies on a L298N PWM system, and this can control voltage through the use of square wave pulses. The broader the pulses, the more rapidly the motor will turn. But the precise pulse width will depend upon the motor that you are powering.

3) DC Motors: -

A direct current (DC) motor is an electric machine that converts electrical energy into mechanical energy. DC motors receive electrical power in the form of direct current, and convert the energy into mechanical rotation.DC motors employ magnetic fields that are a result of the electrical currents produced, which energizes the rotation of a rotor mounted inside the output shaft. The speed and output torque rely on both the electrical input and the motor design. It enables mobility for patrolling.

4) Camera: - In a women's safety patrolling robot, the camera is the central element of surveillance, threat monitoring, and evidence collection, offering real-time visual cues to authorities and possibly discouraging criminal behavior.

5) *Buzzer:* - An audio signaling device such as a beeper or buzzer can be electromechanical or piezoelectric or mechanical type. The primary job of this is to transform the signal from audio to sound. It is generally powered by DC voltage and employed in timers, alarm devices, printers, alarms, computers, etc. Depending on the different designs, it can produce different sounds such as alarm, music, bell & siren.

6) *Lithium – ion battery(12v):* - Here we use the lithium-ion battery. The Lithium Ion Battery serves as the energy storage solution in the women safety night patrolling robot project, enabling the systemto store excess energy for later use. Lithium-ion batteries are renowned for their high energy density, lightweight construction, and rechargeable nature, making them ideal for portable electronic applications.

7) *Chassis and Wheels:* - A robotic chassis is the structural component of a robot that provides a foundation for the robot's other parts and allows it to move. It's sometimes called the robot's frame. Here are some things to know about robotic chassis: The chassis provides a sturdy foundation for the robot's other parts, such as the drivetrain, wheels, and manipulators. It also allows the robot to move around and maneuver. Robot chassis are made from a variety of materials, including metals like aluminum and steel, and plastics like polycarbonate and carbon fiber composites. Metals are often the most efficient and durable option. The texture of the robot's wheels is important because it affects the robot's friction with the ground

B. Software Requirement: -

Blynk App – Used for remote control and monitoring.
Arduino IDE – For programming and uploading code to the ESP8266.
ESP8266 Wi-Fi Library – Enables IoT communication.
Camera Streaming Software (ESP32-CAM Web Server, if applicable) – Allows live video monitoring.

IV. DESIGN AND IMPLEMENTATION

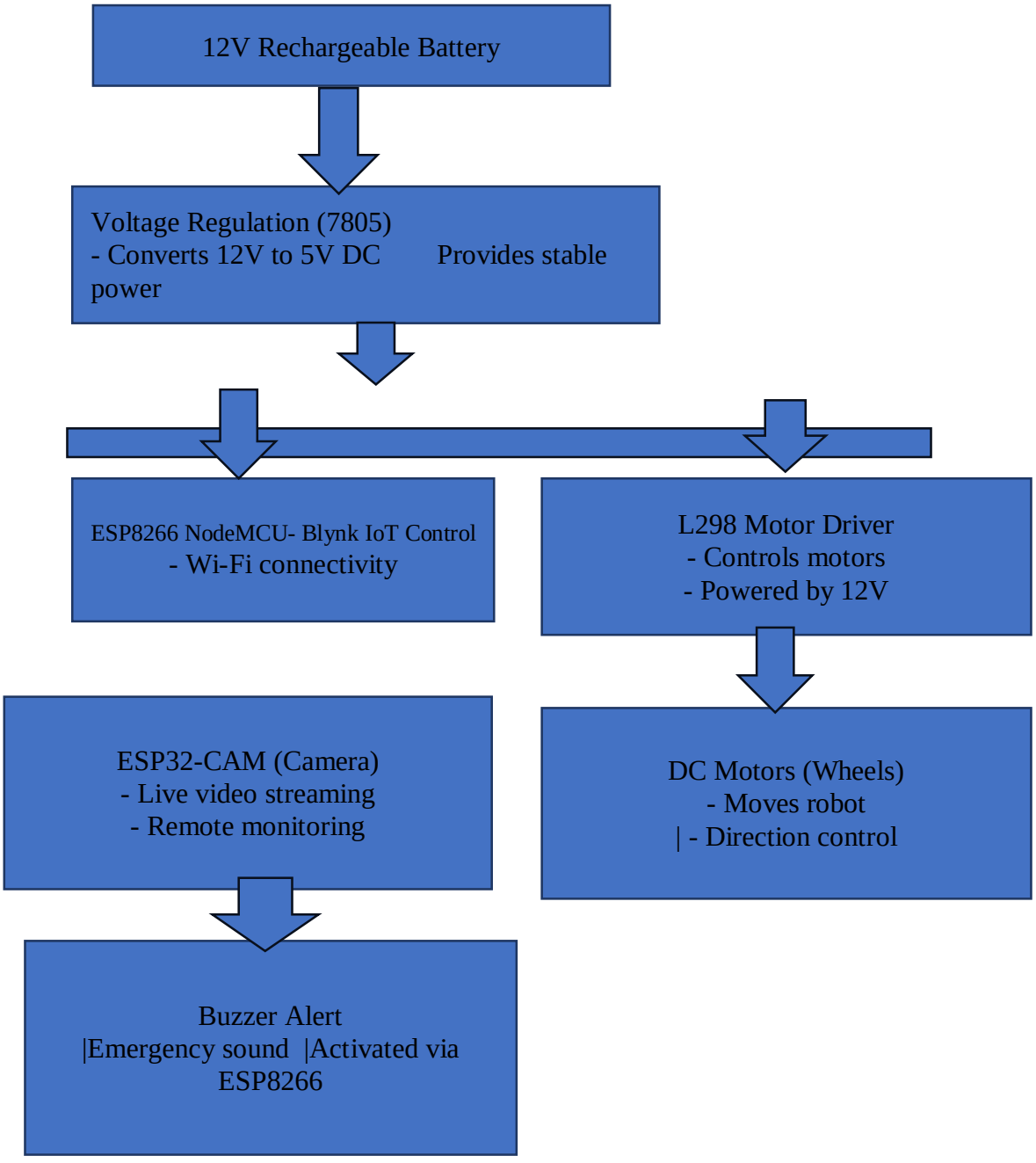


Fig. Block Diagram of night patrolling robot

Working Principle: -

1) Power Source 12V Rechargeable Battery: _- The power source for this system is a 12V rechargeable battery. It ensures the system achieves a voltage value of both L298 motor driver and ESP8266 after being regulated. There is a single pole single throw (SPST) switch, which is put in series for ON/OFF switching of the circuit.
2) Reverse Polarity Protection 1N4007 Diode: -A 1N4007 diode is put in series with the positive terminal of the battery so that it avoids damage due to reverse polarity connection accidentally.

3) Voltage Regulation (7805 Voltage Regulator) The 7805-voltage regulator takes 12V and reduces it down to a stable 5V DC output. This is needed for the ESP8266 and camera module. The input pin (VIN) of the 7805 takes in 12V from the battery, while the output pin (VOUT) gives out 5V to connected components.

4) Capacitor Filtering (1000µF & 10µF) A 1000µF capacitor is used across VIN and GND to filter out any voltage fluctuations in the input voltage. A 10µF capacitor is used across VOUT and GND to stabilize the output 5V and avoid voltage spikes.

5) LED Indicator (Power Status) An LED with a 1KΩ resistor is used on the 5V output as a power indicator so that users can confirm when the circuit is powered ON.

6) .Output Connections: The 5V regulated output is supplied to:

ESP8266 NodeMCU (Microcontroller for IoT control),

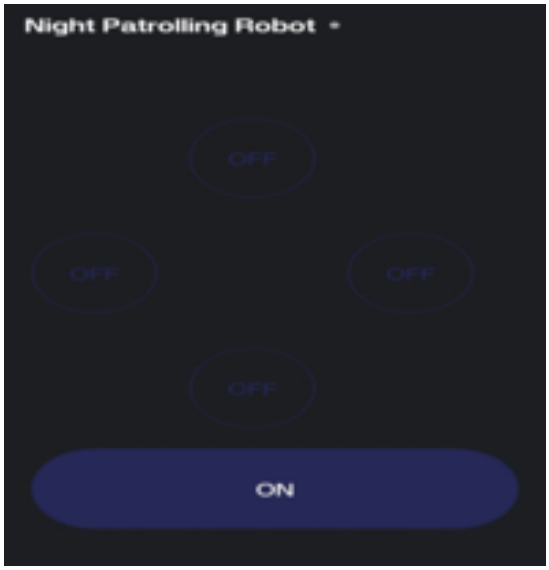
ESP32-CAM (Live video streaming module),

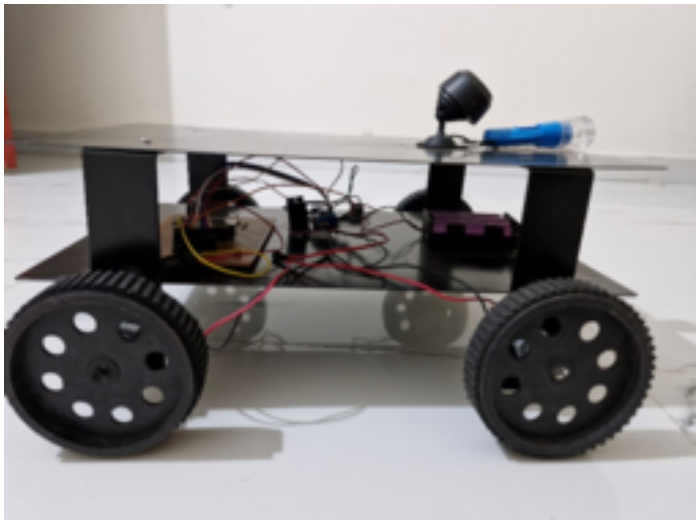
Buzzer (For emergency alerts)

The L298 motor driver is powered directly from 12V, as it requires higher voltage for efficient motor operation.

V. RESULT AND DISCUSSION

The following images are the images of the project. The first image is of the interface of this project from where this robot can be controlled and monitored. The second and third images are pictures of the patrolling robot.





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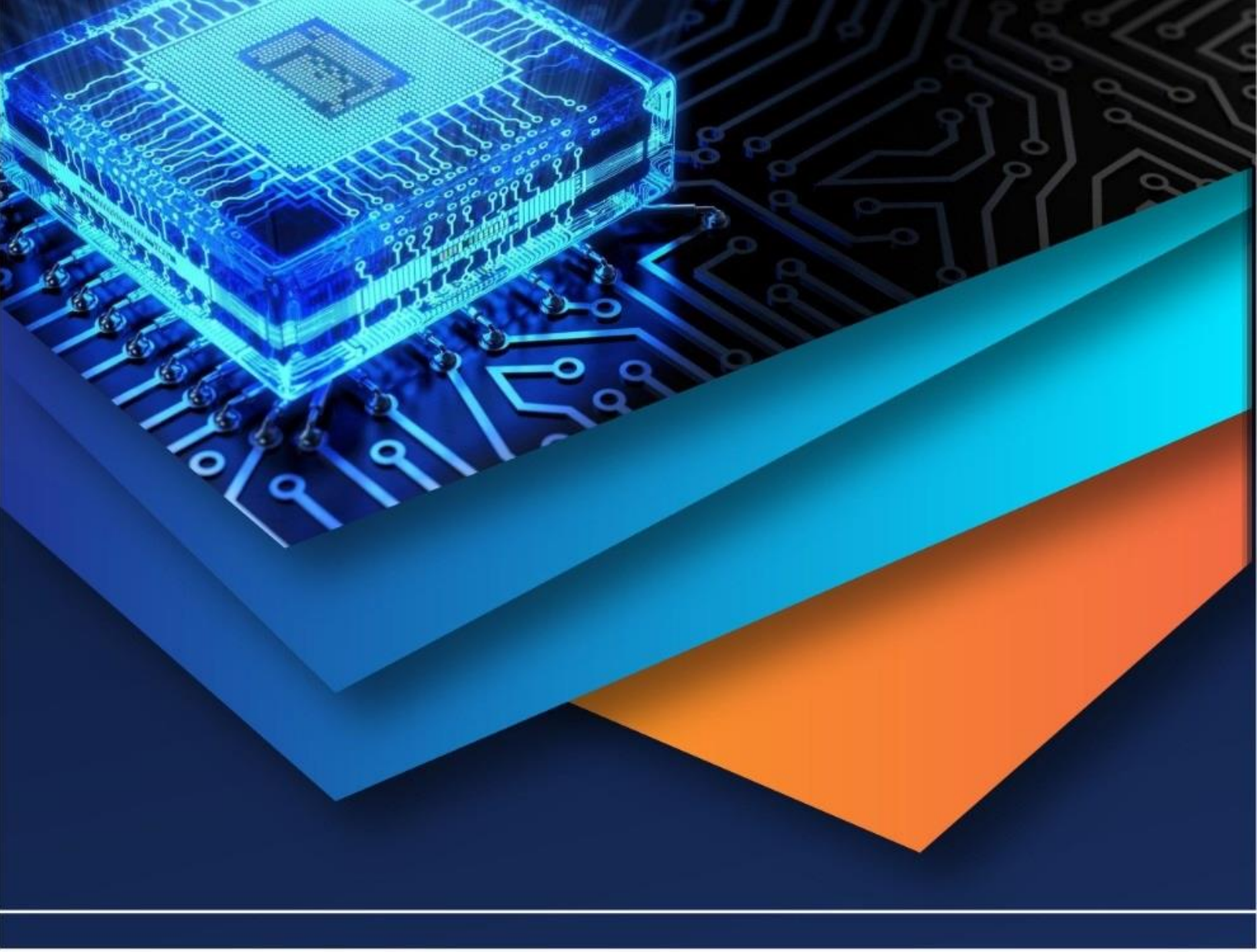

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