

Women Safety Night Patrolling System (Android + IOT)

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Abstract

Women's safety has become a critical concern in today's society, especially in urban and semi-urban areas where incidents of harassment and violence are increasing. This project presents the design and development of a Women Safety Patrolling Robot using the concept of Internet of Things (IoT) to enhance surveillance and provide immediate assistance in emergency situations. The proposed system is an autonomous or semi-autonomous robotic vehicle equipped with sensors, a camera module, GPS, and IoT connectivity. The robot continuously patrols designated areas such as streets, campuses, or public places and monitors activities in real-time. It is capable of detecting unusual behavior, motion, or distress signals using sensors and image processing techniques. In case of an emergency, the system sends instant alerts along with live location data to nearby authorities or control centers through IoT platforms. Additionally, features like night vision, obstacle avoidance, and real-time video streaming improve the effectiveness of the system during both day and night operations. This project aims to create a smart, reliable, and cost-effective solution for enhancing women's safety through continuous monitoring, rapid response, and advanced IoT integration..

1. INTRODUCTION

In recent years, ensuring women's safety has become a major challenge due to the rising number of crimes and unsafe situations in public and isolated areas. Traditional safety measures such as manual patrolling and CCTV surveillance systems are often limited by human constraints, lack of continuous monitoring, and delayed response time. Therefore, there is a need for a smart, automated, and efficient system that can provide real-time monitoring and quick assistance. With the advancement of technology, the integration of robotics and the Internet of Things (IoT) has opened new possibilities in the field of security and surveillance. By combining IoT with robotic systems, it is possible to develop an intelligent patrolling system that can operate autonomously and enhance safety measures. The Women Safety Patrolling Robot is designed to patrol specific areas, monitor activities, and detect any suspicious or emergency situations. It is equipped with various sensors, cameras, GPS modules, and wireless communication systems to ensure real-time data transmission and location tracking. In case of any threat or distress, the system can send immediate alerts to authorities, ensuring a faster response. This project focuses on creating a reliable and cost-effective solution that can assist in improving women's safety.

2. Literature Survey

"Smart Motion Detection Surveillance Rover with Night Patrolling for Women's Safety and Monitoring, IJRESM (2021)". 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 (Mouly 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).

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.

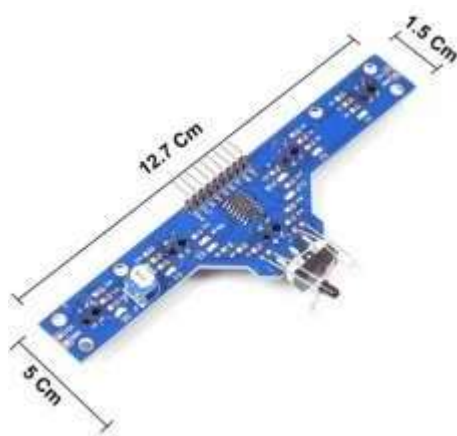
3. METHODOLOGY

If a woman is in dilemma or gets split from friends or family during an outing or someone is following with bad intentions or do not know how to find a way back home then this device with her will guard her and bring assistance when she needs it by giving her current location and health conditions to her associates and control centre through SMS and call. The idea behind this is to provide security to women. Any abnormal activity and small interaction of sound results in the alert of the concerned authority. Then robot automatically

goes to the particular area and captures the image of that area and sends it to the user. It uses a predefined and dynamic line and dynamically generated lines to follow its path while patrolling. Rostops at particular points and moves to the next points if the sound is detected or else the dynamic routing takes place. The system uses an Infrared (IR) based path following system for patrolling assigned areas. It monitors and sensors each area to detect any problem using a combination of two HD cameras. It can monitor and sensors sound on the premises.

4. REQUIREMENTS

1. IR sensor



An IR (Infrared) sensor is an electronic device used to detect the presence of objects, motion, or proximity by using infrared radiation, which is invisible to the human eye. It operates on the principle of emitting infrared light through an IR transmitter (LED) and detecting the reflected light using an IR receiver such as a photodiode or phototransistor. When an object comes near the sensor, the emitted infrared rays reflect back and are received, producing an electrical signal that can be processed by a microcontroller. IR sensors are widely used because they are simple, cost-effective, and provide fast response, making them suitable for applications like obstacle detection, line-following robots, automatic doors, and motion sensing systems. In the Women Safety Patrolling Robot project, the IR sensor plays an important role in enhancing navigation and safety. It helps the robot detect nearby obstacles and avoid collisions during patrolling. If the robot is designed to follow a fixed path, the IR sensor can also be used for line detection and guidance. Additionally, it can assist in detecting the presence or movement of a person in close range, supporting the system in identifying unusual activity. Thus, the IR sensor improves the overall efficiency, accuracy, and reliability of the robot's operation.

2. Ultrasonic Sensor



An ultrasonic sensor is an electronic device that uses ultrasonic sound waves (sound waves with frequencies higher than human hearing, typically above 20 kHz) to detect objects and measure distance. It works on the principle of echo and reflection, where the sensor emits ultrasonic pulses through a transmitter and then listens for the reflected waves using a receiver. By calculating the time taken for the echo to return, the sensor determines the distance between the robot and the object. These sensors are widely used because they provide accurate distance measurement, are not affected by light conditions, and work effectively in both day and night environments. In the Women Safety Patrolling Robot project, the ultrasonic sensor plays a crucial role in navigation and obstacle avoidance. It helps the robot detect objects such as walls, people, or barriers in its path and take appropriate actions to avoid collisions. This ensures smooth and safe movement while patrolling different areas. Additionally, it enhances the robot's ability to operate autonomously by continuously monitoring the surroundings and adjusting its path accordingly. Thus, the ultrasonic sensor improves the reliability, safety, and efficiency of the robot during real-time operation.

3. Raspberry pi



The Raspberry Pi Pico is a compact and low-cost microcontroller board based on the RP2040 chip, designed for embedded systems and IoT applications. It features a dual-core ARM Cortex-M0+ processor, flexible GPIO (General Purpose Input/Output) pins, and supports programming in languages such as C/C++ and MicroPython. The board includes multiple interfaces like UART, SPI, and I2C, allowing it to easily connect with sensors, modules, and other electronic components. Due to its small size, low power consumption, and high performance, the Raspberry Pi Pico is widely used in robotics, automation, and smart device

development. In the Women Safety Patrolling Robot project, the Raspberry Pi Pico acts as the main controller or “brain” of the system. It receives input from sensors such as IR sensors and ultrasonic sensors, processes the data, and makes decisions for robot movement and operation. It controls the motors through a motor driver, manages communication with modules like Wi-Fi or GSM for IoT connectivity, and coordinates the functioning of the camera and GPS module. By efficiently handling all these tasks, the Raspberry Pi Pico ensures smooth operation, real-time response, and reliable performance of the patrolling robot.

4. ESP32-CAM



The ESP32-CAM is a compact and low-cost development board that combines a powerful microcontroller with a built-in camera module, making it ideal for IoT and surveillance applications. It is based on the ESP32 chip, which features a dual-core processor, built-in Wi-Fi and Bluetooth connectivity, and multiple GPIO pins for interfacing with sensors and other components. The ESP32-CAM comes with an OV2640 camera, capable of capturing images and streaming video in real time. Its small size, low power consumption, and wireless communication capabilities make it widely used in smart monitoring and security systems. In the Women Safety Patrolling Robot project, the ESP32-CAM plays a crucial role in visual monitoring and communication. It captures live video and images of the surroundings during patrolling and transmits them to a mobile device or cloud server using Wi-Fi. This enables real-time surveillance and helps authorities monitor situations remotely. In case of any suspicious activity or emergency, the ESP32-CAM can provide visual evidence along with alerts, improving response time and decision-making. Thus, it enhances the overall effectiveness of the system by adding real-time video monitoring and IoT-based connectivity.

5. L298N Motor Driver



The L298N motor driver module is an electronic device used to control the speed and direction of DC motors. It is based on the L298N dual H-bridge motor driver IC, which allows control of two DC motors simultaneously. The module can handle higher voltage and current compared to a microcontroller, making it suitable for driving motors efficiently. It receives low-power control signals from the microcontroller and converts them into higher-power signals required to operate the motors. It also supports functions like forward, reverse, stop, and speed control using PWM (Pulse Width Modulation). In the Women Safety Patrolling Robot project, the L298N motor driver plays a crucial role in controlling the movement of the robot. It acts as an interface between the microcontroller (such as Raspberry Pi Pico) and the motors. Based on the commands given by the controller, the L298N controls the direction and speed of the motors, enabling the robot to move forward, backward, turn left, or turn right. This ensures smooth navigation and proper patrolling of the robot. Thus, the L298N motor driver is essential for accurate motion control and overall functioning of the robot.

6. Battery

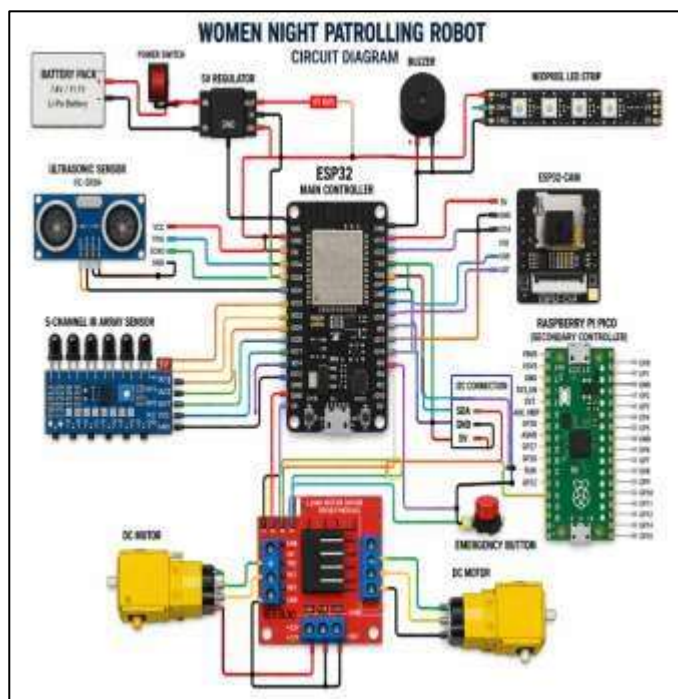


The 18650 battery is a rechargeable lithium-ion battery commonly used in electronic devices and robotics due to its high energy density, long life cycle, and reliable performance. It typically has a nominal voltage of 3.7V and can be recharged multiple times, making it a cost-effective power source. The name “18650” refers to its size—18 mm in diameter and 65 mm in length. These batteries are widely used in applications such as laptops, power banks, electric vehicles, and embedded systems because they provide stable and long-lasting power. In the Women Safety Patrolling Robot project, the 18650 battery serves as the main power source for the entire system. It supplies energy to the microcontroller (Raspberry Pi Pico), sensors, motor driver (L298N), and other modules like ESP32-CAM.

B. Software Requirements

Arduino Software: The Arduino software is an open-source Integrated Development Environment (IDE). It includes a code editor, a message area, a text console, a toolbar with typical function buttons, and a series of menus.

4. DESIGN AND IMPLEMENTATION



The block diagram of the Women Safety Patrolling Robot shows how different components work together to perform surveillance and movement. The power supply provides the required electrical energy to all parts of the system. The Raspberry Pi Pico acts as the main controller, controlling and coordinating the entire operation of the robot. It receives input from the ESP-32 CAM, which is used for capturing images and live video for real-time monitoring and surveillance, an important feature for ensuring women's safety. Based on the data received and programmed instructions, the Raspberry Pi Pico sends signals to the L298N motor driver, which acts as an interface between the controller and the motors. The motor driver controls the speed and direction of the motors, allowing the robot to move in different directions for patrolling. Thus, all components work together to create an efficient system capable of monitoring surroundings and providing enhanced safety through continuous surveillance and mobility.

5. RESULT AND DISCUSSION

The below pictures are the photographs of the project. The first photograph is of the interface of this project from where this robot can be operated and observed. The second and third photographs are images of the patrolling robot.



6. CONCLUSIONS

The *Women Safety Patrolling Robot* project presents an innovative and practical approach to enhancing public safety using modern technology. By integrating components such as sensors, camera modules, and wireless communication systems, the robot can monitor surroundings, detect suspicious activities, and provide real-time alerts. This system reduces human dependency in risky environments and ensures continuous surveillance, especially during night hours. The use of technologies like IoT and embedded systems makes the robot efficient, cost-effective, and scalable for real-world implementation. It can assist law enforcement agencies and improve response time in emergency situations. Overall, this project demonstrates how robotics and automation can play a vital role in creating a safer environment for women and society as a whole.

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