

Women Safety Night Patrolling Robot Using Raspberrypi Pico

Srinivas Bachu^{1*}, Kotha Vijaysree ¹, Bendebhanu Prakash¹, Eruva Nikitha¹, Ranjith Kumar¹

¹Siddhartha Institute of Technology & Sciences, Narapally, Korremula Road, Ghatkesar, Medchal- Malkajgiri (Dist)-500 088, India.

Abstract -The safety of women, especially during nighttime, has become an increasingly pressing concern in modern society. Incidents of harassment and violence often occur in isolated or poorly monitored areas where timely human intervention may not be possible. Traditional surveillance systems, such as CCTV cameras or manual patrolling by security personnel, have limitations in terms of real-time responsiveness and operational consistency. To address these limitations, this project proposes the development of a women safety night patrolling robot powered by Raspberry Pi. The robot is capable of autonomous movement and real-time monitoring using PIR (Passive Infrared) sensors to detect human presence and ultrasonic sensors to avoid obstacles.

.....***_

The core innovation lies in its autonomous patrolling capability, where the robot navigates predefined or dynamically adjustable paths without human guidance. Additionally, the system is equipped with a panic button that, when pressed, sends an emergency SMS containing the GPS location of the robot to pre-configured emergency contacts via a GSM module. A loud alarm is simultaneously triggered to alert nearby individuals and deter potential threats. This multifunctional robot acts as a mobile surveillance unit and an immediate alert system, offering a proactive technological solution to enhance the safety of women in vulnerable locations.

Key Words: 0

1. INTRODUCTION

Robotics is the study of the Design, Development, Function, and Application of Robots. Robots may be used in various circumstances and for various purposes, but many are now used in hazardous environments and manufacturing processes. Since the world faces serious issues regarding women's safety it is inevitable to constitute our work towards it.

The Women Safety Night Patrolling is an attempt to make use of the robots for enhancing Women's safety. It will be a great step towards the rise of automation and Safety. Women safety night patrolling robot makes the best use of its features to work without any problem. It is primarily due to fear of violence against them or being physically or sexually abused. Even in the 21st century where technology is rapidly growing and new gadgets are being developed but still women and girls are facing problems. They often work across ethnic, religious, political, and cultural divides to promote liberty. We know that our society is all aware of the importance of women's safety, but it is also the duty of individuals that they should be properly protected. Women's robot patrolling system is the best way to reduce the probability of becoming a victim of violent crime is to recognize, defend and look up resources to help you in hazardous situations.

2. Literature

"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 (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).

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.

2. 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. Rover stops 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.

3. REQUIREMENTS

A. Hardware

The hardware requirements are as follows -

1. Power Supply: The design of stabilized supplies has been simplified dramatically by the introduction of transformer ICs like the L78xx and L79xx - threeterminal series regulators which give very stable output and include current limiter and thermal protection functions. The regulated power supply consists of a transformer and a bridge rectifier which may be a combination of 4 diodes connected in a very bridge shape.

Bridge rectifier has the utmost efficiency and it's best than other rectifiers that's why we prefer it. This rectifier converts ac into pulsating dc. After the rectifier filter circuit is utilized, usually a capacitor in parallel is employed as a filter or we can use several capacitors in parallel and therefore the number of inductors is unsynchronized. these filters are low pass filters as we required dc at the o/p. Then after capacitor transformer is employed for observing the pure dc o/p. we can use various voltage regulators for obtaining pure dc o/p but we prefer 78xx series voltage regulators as they're simpler, cheaper and easier than others



Circuit diagram of the regulated power supply section

2. Arduino: The Arduino is a family of microcontroller boards to simplify electronic design, prototyping and experimenting for artists, hackers, and hobbyists. Arduinos (we use the standard Arduino Uno) are built around an ATmega microcontroller essentially a complete computer with CPU, RAM, Flash memory, and input/output pins, all on a single chip. The Arduino connects to your computer via USB, where you program it in a simple language (C/C++, similar to Java) from inside the free Arduino IDE by uploading your compiled code to the board. Once programmed, the Arduino can run with the USB link back to your computer, or stand-alone without it no keyboard or screen is needed, just power.



3. ESP32 Camera: The ESP32-CAM is a small size, low power consumption camera module supported by ESP32. It comes with an OV2640 camera and provides an onboard TF card slot. The ESP32-CAM are often widely employed in intelligent IoT applications like wireless video monitoring, WiFi image upload, QR identification, and so on. Open a browser and sort the ESP32-CAM IP address. Press the beginning Streaming button to start video streaming. ESP32-CAM is widely utilized in various IoT applications. it's suitable for home smart devices, industrial wireless control, wireless monitoring, QR wireless identification, wireless positioning system signals and other IoT applications.



L293D Driver

L293D Motor Driver Module is an expansion board or driver module of L293D. L293D IC is a dual half-bridge driver IC, therefore the module drives the motor in any direction and speed. it's compatible with any controllers and processors like Arduino, AVR, PIC, etc and with a straightforward interface. It makes it easy to form a project instead of using an IC.L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive in either direction. L293D may be a 16-pin IC which might control a collection of two DC motors simultaneously in any direction. It implies that you'll be able to control two motors with one L293D IC.

Working: There are 4 input pins for l293d, pin 2,7 on the left and pin 15,10 on the right as shown on the pin diagram. Left input pins will regulate the rotation of the motor connected across the left side and right input for the motor on the righthand side.

Logic Table: Let's consider a Motor connected on the left side output pins (pin 3,6).



For rotating the motor in a clockwise direction the input pins have to be provided with Logic 1 and Logic 0.



5. Motor: DC motors like this are great for battery-powered toys, but you don't find them in many household appliances. Small appliances (things like coffee grinders or electric food blenders) tend to use what are called universal motors, which can be powered by either AC or DC. A universal motor has an electromagnet, instead of a permanent magnet, and it takes its power from the DC or AC power you feed in:

When you feed in DC, the electromagnet works like a conventional permanent magnet and produces a magnetic field that's always pointing in the same direction. The commutator reverses the coil current every time the coil flips over.

When you feed in AC, however, the current flowing through the electromagnet and the current flowing through the coil both reverse, exactly in step, so the force on the coil is always in the same direction and the motor always spins either clockwise or counter clockwise, So it doesn't matter what position the commutator is in at any given moment.



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



Figure- Block Diagram of the patrolling Robot

The construction of the women's safety patrolling robot is done on a metal body. The L293D motor driver is mounted on the Arduino board and the ESP23 Camera is mounted on this metal body and attached to the Arduino board. The motors are attached to the rear part of the metal body and it's wired to the L293D motor driver.

Work-Flow



Motors

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 night patrolling robot using Raspberry Pi presents a modern and effective solution to enhance safety and security for women, especially during nighttime. By combining the power of autonomous robotics, real-time sensing, and emergency communication, the system addresses several shortcomings of existing surveillance and safety mechanisms. It operates independently, navigates obstacles, detects motion, and sends alert messages complete with GPS coordinates, all while producing an audible alarm to deter threats. Though there are a few limitations related to network reliability and sensor accuracy, the system serves as a strong foundation for future development. Potential enhancements such as live video streaming, AI-based anomaly detection, or two-way communication could further improve its utility. This project not only demonstrates the practical application of embedded systems and IoT but also high light show technology can be meaningfully applied to social causes like women's safety.

REFERENCES

1. Abdalla, G. O. E. (2017). Implementation of Spy Robot for a Surveillance System Using Internet Protocol of Raspberry Pi. Proceedings of the International Conference on Recent Trends in Electronic Information and Communication Technology.

- Saito, T., & Kuroda, Y. (2013). Mobile Robot Localization Using Multiple Observations Based on Place Recognition and GPS. IEEE International Conference on Robotics and Automation.
- 3. Tang, C., Xie, Q., Jiang, G., & Ou, Y. S. (2013). Road Detection at Night Based on a Planar Reflection Model. IEEE International Conference on Information and Automation (ICIA).
- 4. Mac Tavish, K., Paton, M., & Barfoot, T. D. (2017). Night Rider: Visual Odometry Using Headlights. 14th Conference on Computer and Robot Vision.
- 5. Han, Z., & Li, T. (2020). Research on Sound Source Localization and Real-Time Facial Expression Recognition for Security Robot. Journal of Physical Conference Series.
- Patroliya, J., Mehta, H., & Patel, H. (2015). Arduino Controlled War Field Spy Robot Using Night Vision Wireless Camera and Android Application. Nirmala University International Conference on Engineering.
- Aishwarya, K., & Gadgay, B. (2015). IoT-Based Smart Multi-Application Surveillance Robot. 2nd International Conference on Inventive Research in Computing Applications.
- Dilliraj, E., Rekha, S., Sindu Priya, & Vedhavalli, A. (2019). RF Controlled Warfield Spy Robot. International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, 8(3).
- Join, E. S., et al. (2015). Human Detection Based on the Generation of a Background Image by Using a Far-Infrared Light Camera. Sensors, 15(3).Singh, D. K., & Kushwaha, D. S. (2017). Automatic Intruder Combat System: A Way to Smartboard Surveillance. Defence Science Journal, 67(1).