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Roboseciot Based Patrolling Robot

Vivek Upadhyay[1], Vaibhav Singh[2], Ankush[3], Saurabh Singh Patel[4], Ms.Sarita Singh[5]

1(Computer Science and Engineering, Raj Kumar Goel Institute of Technology)
2 (Computer Science and Engineering, Raj Kumar Goel Institute of Technology)
3 (Computer Science and Engineering, Raj Kumar Goel Institute of Technology)
4 (Computer Science and Engineering, Raj Kumar Goel Institute of Technology)
5(Asst. Professor (Computer Science and Engineering) Raj Kumar Goel Institute of Technology)

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ABSRACT
The RoboSec robot is a cutting-edge IoT-based patrolling robot designed for security purposes. Equipped with a camera, it captures images and videos of its surroundings and operates using an Arduino board. The robot moves around using various communication modes such as Bluetooth, command line, hand gesture, and Wi-Fi. The live recordingscaptured bythe camera arestoredonaserver,whichcanbeaccessed bythe userfromanydevicethat has access to the server. This innovative technology has enormous potential in the field of security, reducing theneed for human intervention and increasing the level of security in various locations such as offices and warehouses. With further development, the RoboSec robot can include additional features such as facial recognition technology and obstacle detection sensors. Overall, the RoboSec robot is a significant contribution to the field of IoT-based robots and is sure to have a significant impact on the future of security technology.

I. INTRODUCTION

RoboSecisanIoT-basedpatrollingrobotthathasenormous potentialinthefieldofsecurity.Therobotisdesignedtobe asecurityguardinvariouslocationssuchasoffices,homes, and warehouses. It is equipped with a camera that captures images and videos of the surroundings and is operatedusing an Arduino board. The robot moves around using variouscommunicationmodessuchasBluetooth,command line, hand gesture, and Wi-Fi. The live recordings captured bythecameraarestoredonaserver,whichcanbeaccessed by the user from any device that has access to the server.

Robotics is a modern technology that is spreading its arms inalmosteveryfield,andoneofthemostdemandingfields is human security, as robots can work more efficiently than humans. The key and essential components of robotics are control and automation. The added advantages of using robots are long-range visibility and not having risk to human life. We can identify dangerous circumstances by using cameras and various sorts of sensors such as temperaturesensors,gassensors,smokesensors,andsound sensors.,wecanalsodetecthazardoussituations The basic components required for this robot are GSM, Arduino,Node MCU, night vision camera,PIR sensoretc.This robot is set in manual mode, which can move forward,backward,rightorleft.Thenightvision rotatingcamera used in this robot records live events over the area, and the controller can see this live video any time theywant.WhenPIRsensorusedinthisrobotdetects any moving body in the surrounding area, it activatesGSMconnected withit,andGSMstarts sendingnotificationtothe controller on android or PC.

Toenhancethisrobot,onecanmakethisrobotinautomatic mode using PIR sensors and sound sensors, which can detect sound in the surrounding and start moving in the direction of sound. GPS can also be used in this robot to track its location, so that action can be taken quickly by reaching at the exact location. One can also mount a solar panel on the robot for saving battery, as solar panel is rechargeable and can store charges.

II. LITERATURE REVIEW

The use of IoT-based robots in various fields is becoming more common, and the security industry is no exception. Researchers have explored the use of such robots in different

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scenarios, and many studies have demonstrated their effectiveness in enhancing security measures.In a study by [3], the authors explored the use of IoT-based robots in monitoring the environment for early detection of forest fires. The robots were equipped with various sensors and were controlled using wireless communication technologies. The study demonstrated the potential of such robots in enhancing the safety of the environment.In another study by [4], the authors proposed a mobile robot- based security system for indoor environments. The robot was equipped with a camera and various sensors, and the system was designed to detect and respond to security breaches.Theauthorsshowedthattheproposedsystem had a high accuracy rate in detecting intruders.The use of IoT-basedrobotsforsecuritypurposeshasalsobeenexplore din the healthcare sector. In a study by [5], the authorsproposed a mobile robot-based system for patient monitoring in hospital settings. The robot was equipped with various sensors, and the system was designed to monitor the vital signs of patients and detect abnormal conditions. The authors demonstrated the potential of the proposed system in enhancing patient safety.The use of hand gesture recognition technology for controlling robots has also been explored in the literature. In a study by [6], the authors proposed a hand gesture recognition system for controlling a mobile robot. The system was designed to recognize hand gestures and translate them into control commands for the robot. The authors demonstrated the effectiveness of the proposed system in controlling the robot in various scenarios.The potential of using robots for security purposes in outdoor environments has also been explored. In a study by [7], the authors proposed an IoT- based surveillance system for outdoor environments. The system was designed to detect and track intruders using various sensors and cameras. The authors demonstrated the effectiveness of the proposed system in enhancing the security of outdoor environments.In a study by [8], the authors proposed a mobile robot-based security system for museums. The robot was equipped with a camera and various sensors, and the system was designed to detect and respond to security breaches. The authors showed that the proposed system had a high accuracy rate in detecting intrudersandenhancingthesecurityofmuseums.Inast udy by [9], the authors proposed an IoT-based security system forschools.Thesystemwasdesignedtodetectandrespo nd tosecuritybreachesusingvarioussensorsandcameras. The authors demonstrated the potential of the proposed system in enhancing the safety of schools.The use of solar panels forpoweringrobotshasalsobeenexploredintheliteratu re. In a study by [10], the authors proposed a solar-powered mobile robot for environmental monitoring. The robot was equipped with various sensors, and the system wasdesigned to operate autonomously using solar power.In a study by [11].

III. METHODOLOGY

A. WorkingFlowchart

The flowchart shown below depicts the entire operation of the robot.This flowchart is for the manual mode operation. Figure.1 Flow chart of the robot working in manual mode

1) HardwareImplementation

a) Arduino board: Arduino UNO is an open-source platform based on the ATmaga328P microcontroller. The board features a number of input/output pins that may be used to connect to other circuits. .

b) Night vision camera: The camera allows live broadcastingofactivitiesbothduringthedayandat night.A night vision camera detects invisible IR wavelengths, allowinghumanstoviewobjectsindarkenvironm entsusing a camera.

c) Androidphone/PC:This block serves as the controller unit, allowing us to issue commands to the robot and receive notifications from it.

d) PIR sensor: These sensors employ a transducer to emit and receive PIR sound waves or pulses, which provide data about an object's proximity.

e) DC motor: DC motor is used for converting electrical energy into mechanical energy .

f) Bluetooth:Bluetoothmoduleisusedconnectthe robot and android/PC through audrino.

g) NodeMCU: Itisanopen-sourcedevelopment board and firmware that runs on the ESP8266 that connects devicesandinitiatesdatatransferthroughWi-Fiprotocol, andisahardwarebasedonESP-12modulespecifically developed for IOT-based applications

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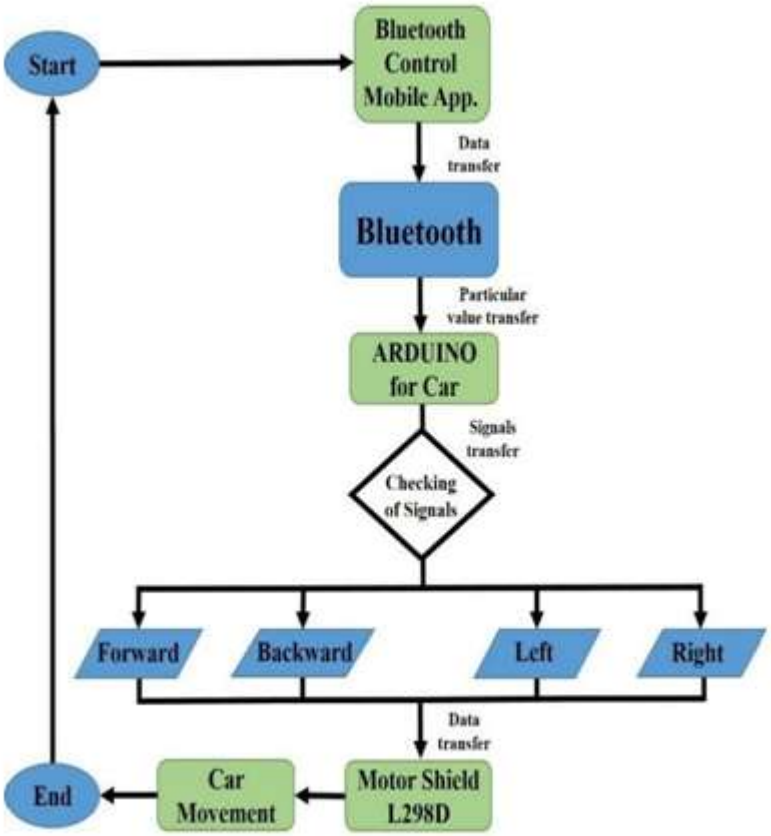

Fig.1 Flowchart of the robot working with Bluetooth module

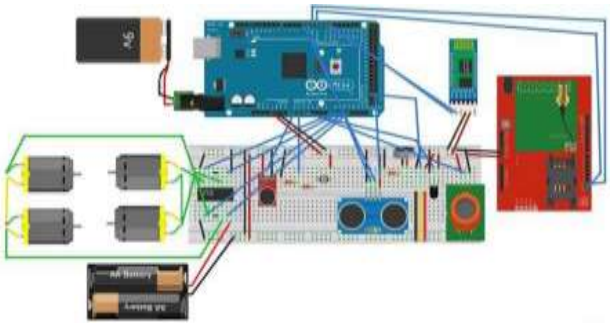

Fig.2Basic circuit diagram

The system is a four-wheeler robot which is equipped with Arduino board, Night vision camera, Arduino phone/PC, PIR sensors, DC motor, IOT server, node MCU. Fig.1 shows the complete basic circuit diagram with all the components and connections.

B. SystemArchitecture&working:

The PIR sensor connected to the Arduino is used todetect theliveobjectintherangeof10-15cm[19].The Arduino is connected to GSM which transmits the data or notification of being alert to the Android /PC. Whenever the PIR sensor detects the live object, the buzzer starts beeping and user can see the live streaming through the camera on android anytime. Fig. Portrays the system architecture of the proposed night patrolling robot.

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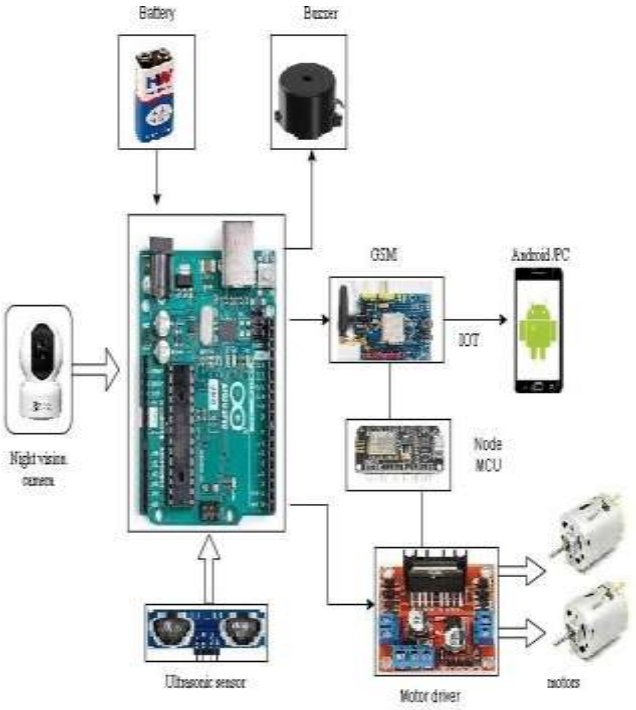

Fig.3Block diagram

C. Communicationinterface

ForcommunicationbetweenIOTdevicesand Androidused in this model, we have used two interfaces of communication that are – GSM and node MCU. GSM is used in this robot for sending and receiving messages. This GSM module is able to receive data from microcontroller/ ArduinoUNOandtransmititintheformoftextmessaget o the host server. Nowthe node MCU used inthis robot does the wireless part of communication. It can send or receive data between two IOT devices wirelessly. It transmits data stored from host server to the Android or PC with the help of host controller interface.

Thus, when the PIR sensor senses any live object, the microcontroller starts communicating with GSM and GSM start sending data to the remote server and a notification is sent to the Android or PC. This is how communication isdone between IOT devices used in this robot [20].

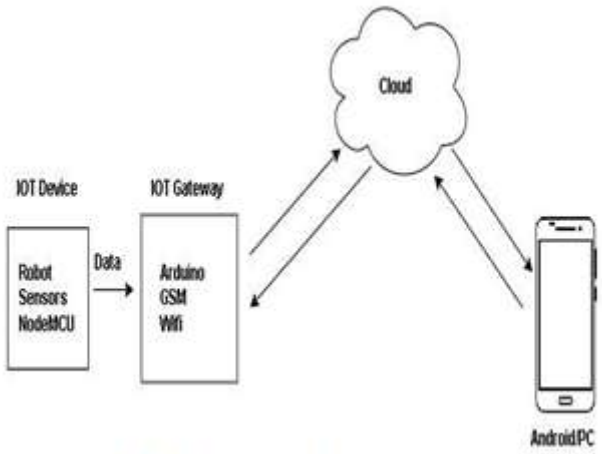

Fig. 4. System Communication

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IV. ALGORITHM FOR ROBOSEC

A. Tobeginwith,wesupplytherequiredpowertothe project,ensuringthatallcomponentsreceiveadequate energy for proper functioning.

B. Followingthat,wecreateaconnectionbetweenthe project'sBluetoothmodule(HC-05)andtheBluetooth feature on the Android phone, enabling seamless communication between the two devices.

C. Onceconnected,wehavetheoptiontocontrolthe machine or system using three different methods: gesture control, voice control, or command control.

D. In the case of gesture control, we maneuver our Androidphoneinthedirectionwewantthemachineor system to move, effectively translating our physical movements into machine actions.

E. For voice control, we employ a set of predefined voice commands to guide the system. For instance, uttering"forward"propelsthemachineforward,"back" reverses its direction, "left" and "right" govern side-to- side movements, and "stop" brings the machine to a halt.

F. Lastly, command control involves entering specific commandsthroughourterminalinterface.Forexample, typing 'a' instructs the machine to move forward, 'b' commands it to move backward, 'c' and 'd' dictate left and right movements, respectively, and 'e' signals the machine to stop. This method provides a more direct and precise way to control the machine's movements.

D.Softwareused

1) Arduino IDE: We have used Arduino IDE (version: arduino-pcb-way version-4.0) which is an open-source platform used for uploading code in Arduino board.

V. RESULT

A. RobotMovement

The movement of the robot is controlled using audrino bluetooth app. The code for robot movement has been uploadedin Node MCU.

TABLEI. TRUTHTABLEOFROBOTMOVEMENT

S. N.	Button	Stage 1	Stage 2	Stage 3	Stage 4	Movement
1.	**V1**	UP-1	DOWN-1	UP-1	DOWN-1	FORWARD
2.	**V2**	DOWN-1	UP-1	DOWN-1	UP-1	BACKWARD
3.	**V3**	DOWN-1	UP-1	UP-1	DOWN-1	LEFT
4.	**V4**	UP-1	DOWN-1	DOWN-1	UP-1	RIGHT

- HIGH-UP-1,*LOW-DOWN-1

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Fig.6Homescreen for controlling robot manually

B. CameraFeedback

The women's safety night patrolling robot works efficiently. The camera mounted on the robot captures the live events and human beings successfully. This camera also recordsaudio which user canlisten. The fig. illustrates the picture captured by camera in day and night.


Fig.7Picture captured by camera in night.

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Fig.8Picture captured by camera in day light.

VI. ADVANCEMENT

There are numerous changes that can be made in thecurrent design to improve the working of the robot. Different types of features can also be added to the robotfor enhancements. Some added features and changes in the patrolling robot are listed below:

- Numerous sensors can be used like gas sensors, temperature sensors, pressure sensors, proximity sensors and many more for extra functions.
- Metaldetectorscanbeusedtodetectthebombs.So, it can be used as bomb diffuser and bomb disposal team.
- Itcanbeusedtodetectintrudersatborders,hence can be used in border security. We can also add audio communication feature so that we can listen the strategy of the intruders.

VII. CONCLUSION

The proposed model is a fully featured robot which can be used for women's safety. The multiple devices used inrobot help in monitoring a particular area and provides security to women's who can never feel afraid even atnight.Now, wecanlaunchthisrobotinmarket witha well-developed app through which robot can be monitored and controlled easily by common people. By this method we can also keep a track on criminals. This is how, women's safety can be improved using night patrolling robot at a greatextent.Thefinalhardwaresetupisshowninthegiven fig below

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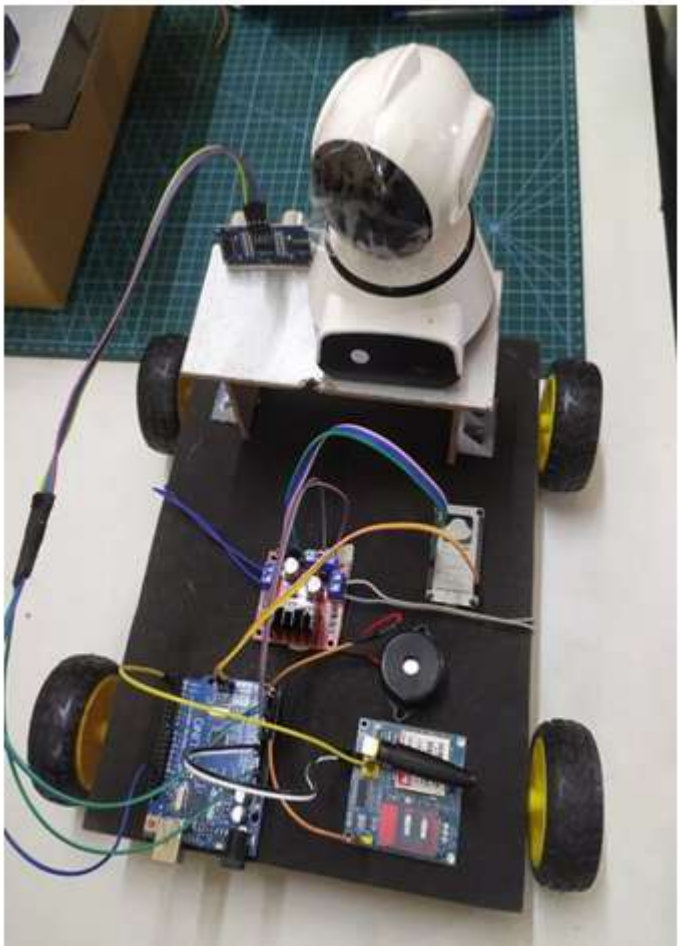

Fig.9Final hardware look of night surveillance robot

VIII. FUTURE SCOPE

The future scope of this project is that we can control the system through image processing i.e capture the image of the person through camera and process it if it is blur and also IoT enables this system to provide more safety to women's.

The future scope is wide and various IoT technologies can enable this system more efficient to use.

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