DESIGN OF WIRELESS SURVEILLANCE ROBOT WITH MOTION DETECTION AND LIVE VIDEO TRANSMISSION

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ABSTRACT: Features for automatic motion detection can improve the effectiveness and calibre of monitoring. The goal of this research is to automatically recognize and detect motion in a robot's environment so that a mobile robot may be outfitted for a surveillance mission. A wireless surveillance robot that uses a sensor to detect human presence and alert the user to it. Robots are capable of moving in all directions to expand their sensing area. The robot is programmed to automatically move left, right, forward, and backward in response to impediments. It is a wireless robot that is simple to move around and control. It serves the soldier's security needs quite well.

So, the project "Wireless Surveillance Robot with motion detection and live video transmission" is an autonomous robotic vehicle that can also move in earthquake-prone areas and aid in locating alive people. The primary goal of the project is to deal with challenging situations that people cannot navigate such as darkness, entering small spaces, and finding hidden bombs, among other things.

Key words: Robot, Surveillance, Motion Detection, Video Transmission

INTRODUCTION

Given the current state of conflict between some nations, we are inspired by the idea of leveraging technology to assist our valiant military by lowering casualties by employing an application that can spy on the adversary as well as for security purposes.

The major goal of this research is to cope with challenging situations where people are unable to access, such as darkness, small spaces, and finding hidden bombs, etc. The robot design has been divided into subsystems for planning, control, and sensors. In order to control the movements of the robot and the rotation of a wireless camera, a robotic system has a drive chassis with a drive motor and a drive element.

The robot is the ideal piece of equipment for the military industry, helping to reduce the loss of human life and prevent unlawful activity. The robot is self-powered and equipped with a retracing feature in case there is a base station connection failure. Real-time video and audio inputs from wireless cameras are sent back, and the base station monitor displays them so that appropriate action can be performed.

The below figure shows the reference picture of our wireless surveillance robot.

Fig 1: Reference image

COMPONENTS REQUIRED:

BLUETOOTH MODULE HC-05

The Bluetooth module HC-05 consists of six pins.The six pins are Key,5V, GND, Tx, Rx, and Status. The Bluetooth module has two devices i) amaster device and ii) a slave device. One device connects to the master while the other deviceconnects to the slave. The connection between thedevices takes place as follows:

- One of the pins Tx is connected to pin Rx of the Arduino board while the pin Rx of the Bluetooth module is connected to the Tx pin of Arduino.

- Thus, in a way cross-connection is required for the operation of the Bluetooth module.

- The GND pin is given to the GND pin of Arduino and the power supply pin ofArduino is given to the pin of power.

- In order to have proper communicationthe master device must be connected tothe slave. Once the pairing is done between two devices, the device will to   enter the Password.

- The password will be either 0000 or 1234. Enter the password and both devices will be connected to each other.
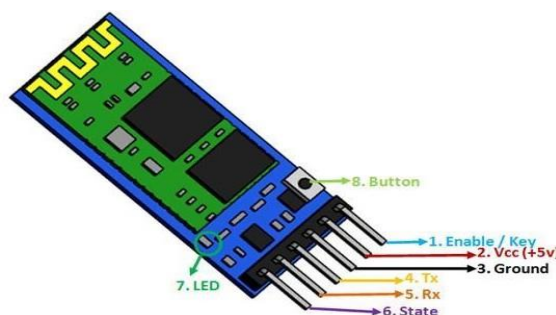

Fig 2 Bluetooth pin

L298N MOTOR DRIVER IC

- Here we used L298N dual-motor driver.
- A motor driver module is a simple circuitused for controlling a DC motor. It is commonly used in autonomous robotsand RC cars.
- L298N is used to control two motors at the same time.
- The L298N motor driver is based on theH-bridge configuration which is useful incontrolling the direction of rotation of a DC motor.
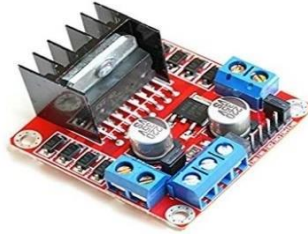

Fig.3 Motor Driver

DOPPLER SENSOR

- In fact, an electronic gadget called a doppler radar or microwave sensor uses electromagnetic radiation to detect exterior movements likecrawling, walking, and running.
- In truth, electromagnetic radiation consists of magnetic fields. And these fields move at the speed of light.
- This sensor can recognize motion usingthe project microwaves and the dopplereffect. These waves bounce off surfacesand go back to the sensor to trigger it.
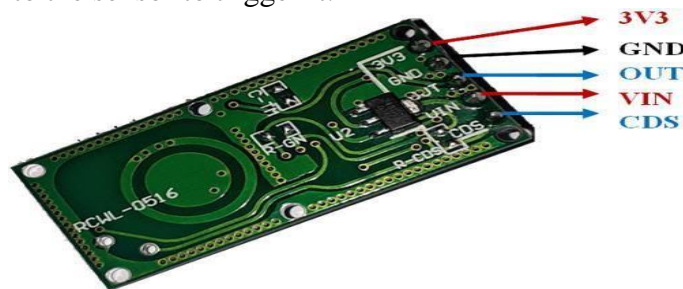

Fig.4 Doppler sensor

ARDUINO UNO

- Arduino UNO is a microcontroller board based on the ATmega328P.
- It has 14 digital input/output pins,6 analog inputs, a 16 MHz ceramicresonator, a USB connection, a power jack, an ICSP header, and a reset button.
- It is an open-source electronics platformused as hardware and software.
- Software

  The following software tools allow youto program your board both online and offline.

1. Arduino IDE
2. Arduino CLI
3. Web Editor
- Hardware

  The hardware listed below is compatiblewith this product.
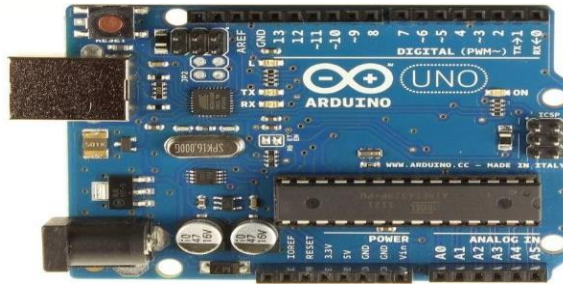
1. 4 Relays Shield
2. Motor shield Rev3

Fig 5 Arduino UNO

LCD DISPLAY

It is a display device used in an embedded system to display information . It contains 32-character space on the screen arranged in 16 columns and 2rows.

Fig 6 LCD Display

BUZZER

- An audio signaling device. It is used asan output device in alarm systems.
- Typical uses of buzzers include alarm devices, timers, and confirmation of user input such as a mouse click orkeystroke.

Fig 7 Buzzer

DC GEAR MOTOR WITH WHEEL

- DC motor is an electrical machine that converts electrical energy into mechanical energy.

Fig 8 DC Motor with Wheels

3D PRINTED ROBOTIC ARM

- This robot arm is made almost entirely of 3D-printed parts that snap together. It has three servo-controlled joints, plus a rotating base and gripper.
- The arm is controlled by a series of buttons that connect an Arduino Uno hidden in the base.
- A simple circuit makes connecting the servos and buttons to the Arduino easy and makes set-up an assembly very quick.

Fig 9 Robotic Arm

WIRELESS CAMERA

- In this project we used ESP32 wireless camera
- ESP32-CAM is a very small camera module with the ESP32-S chip.
- Using the ESP32-CAM module we can build a face recognition system without using any complex programming and any extra components.

Fig 10 Wireless Camera

POWER SUPPLY UNIT

- The power supply unit is part of the hardware that is used to convert the power provided from the outlet into usable power for many parts inside an electrical device.
- Every energy supply must drive its load, which is connected to it.
- There are two types of power supplies existed, AC and DC power supply. Based on the electrical device's electric specifications it may use AC power or DC power.

Fig 11 Power supply

BLOCK DIAGRAM AND WORKING:
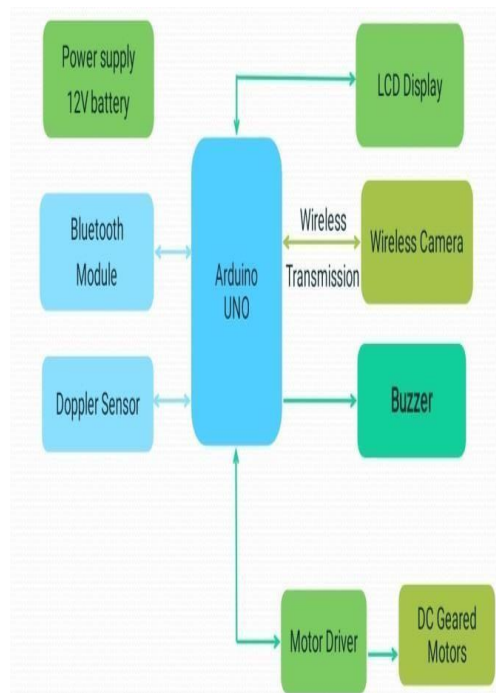
- In this project consists of two parts that are transmitter and a receiver. The transmitter part is which is in the base station and can be controlled from a remote area using Bluetooth as a communication protocol.

- Bluetooth is connected to Arduino. HC-05 Bluetooth is used in this project. It can pair our device with the robot.

- The person at the transmitting end controls the robot of the remote areas using key inputs along with that he can view the situation at the war field here we use a special camera in which we canget the images in the night time.

- The wireless camera shows the path moved by the robot that is displayed on amonitor or a screen.

- A sensor is connected to Arduino and it is used to detect the motion near the robot's environment.

- A robotic arm is fixed to pick the thingsor objects near it. It can work with the help of Arduino.

- This system has the potential to achievehigh performance.

RESULTS

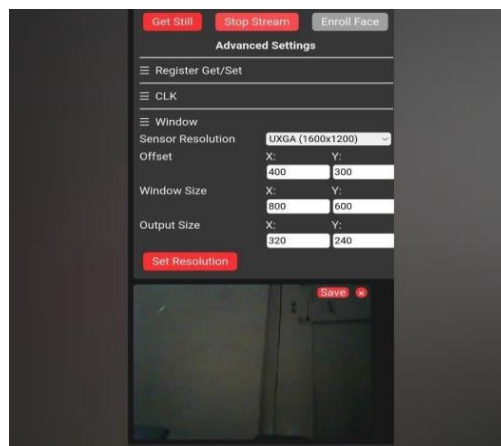Fig 12 Connections of the project

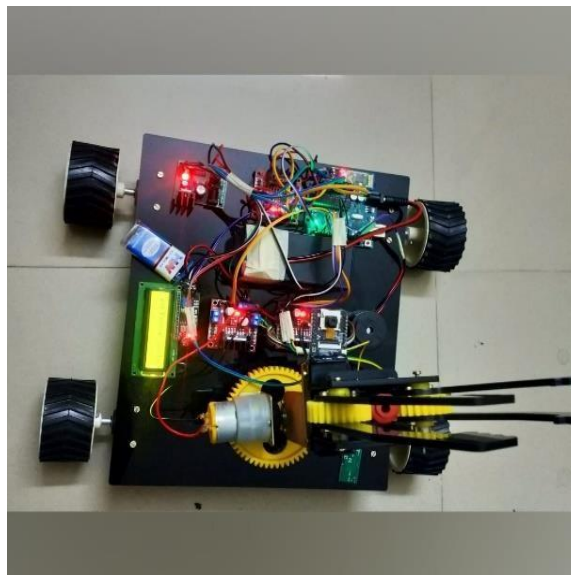
Fig 13 Camera output

Fig 14 Setup of a sensor, arm, wheels, and camera
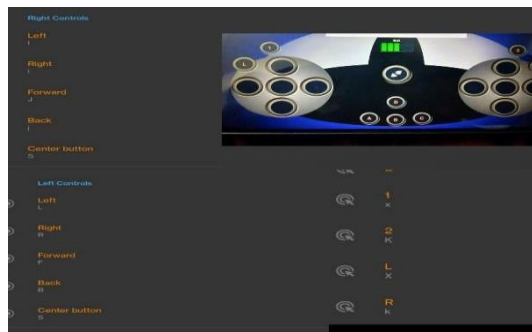
Fig 15 Display of Output

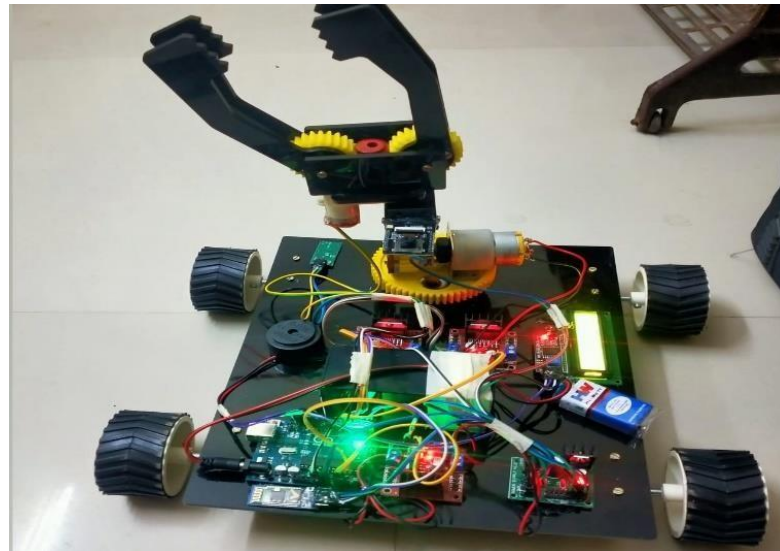Fig 16 Commands for the operation of the robot

Fig 17 Output of the project

ADVANTAGES

1. Wireless control
2. Surveillance System.

3. Vehicle Navigation with the use of 3G technology.
4. Takes use of mobile technology which is almost available everywhere.
5. This wireless device has no foundation of range and can be controlled as far asa network of cell phones.

DISADVANTAGE

In this project usage of relays leads toconsume more power.

APPLICATIONS

- The main purpose for designing this robot is to implement it in the defense sector to sense humans and detect weapons/bombswith humans or buried in places wherehumans cannot fetch them.

- The sensors with smaller range frequenciesare sufficient to install this robot inresidents.

- The sensors with very high frequencies arerequired to install this robot in the IT industry.

- This robot can be installed in banks, especially in the places where jewels are kept (locker area).

- In educational institutions, this robot can play a vital role in the areas of libraries andlaboratories where valuable equipment'skept.

FUTURE ENHANCEMENT

The robot can be scaled down in size. This robot has a range whichis one of its drawbacks. This robot cannot be operated over great distances because ofthe limited range of the Bluetooth module employed here. The inclusion of numerousadditional modules, including Wi-Fi and Zigbee, can expand the range.

There are a number of improvements and modifications that can be designed and increase real-world application practically and functionally, they are: By adopting theaeronautical mechanism in our surveillance robot, it can act as a flying robot.

The robot may eventually have gas sensors to identify dangerous substances in the environment. In order to defuse bombs on the battlefield, the robot might also be equipped with a bomb disposal kit.

CONCLUSION

- In conclusion, a surveillance robot with motion detection and live video transmissionis a valuable tool for security applications.

- The system involves setting up a camera on the robot, along with motion sensors and a wireless communication system.

- The microcontroller on the robot isprogrammed to control the camera and transmit the live video feed to a remote location.

- With this system, real-time monitoring of therobot's surroundings is possible, making it aneffective tool for surveillance and security applications.

- The use of motion detection ensures that thecamera records when motion is detected,reducing the amount of video data that needsto be transmitted.

➢ This helps to conserve bandwidth and reduce storage requirements. The wireless communication system allows for remote monitoring from anywhere with an internet connection, providing flexibility and convenience.

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