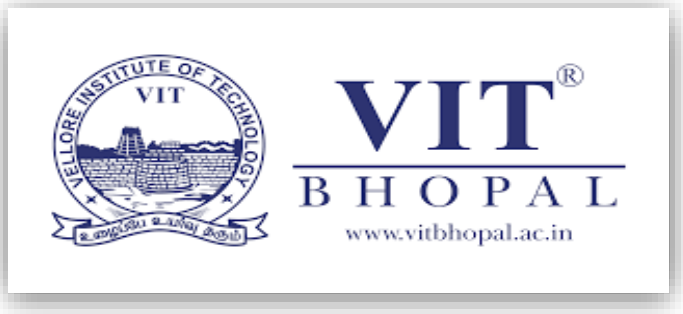

SPY ROBOT

PROJECT EXHIBITION REPORT

Submitted in partial fulfillment for the award of the degree of

Bachelor of Technology in

ELECTRONICS & COMMUNICATION ENGINEERING (AI&CN)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Submitted to

VIT BHOPAL UNIVERSITY (M.P.)

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SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

DECLARATION

I hereby declare that the Dissertation entitled "*SPY ROBOT*" is my own work conducted under the supervision of *Dr. Soumitra K Nayak* at VIT Bhopal University, Bhopal.

I further declare that to the best of my knowledge this report does not contain any part of work that has been submitted for the award of any degree either in this university or in other university/ Deemed University without proper citation.

……

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CERTIFICATE

This is to certify that the work embodied in this project report entitled **"***SPY ROBOT***"** has been satisfactorily completed by **Mr. AKASH VERMA ,Registration No. 20BAC10015 and Ms. TANVI BANSAL, Registration No. 20BAC10021** in the School of Electrical & Electronics Engineering of VIT Bhopal University, Bhopal. This work is a bonafide piece of work, carried out under my/our guidance in the School of Electrical & Electronics Engineering for the partial fulfilment of the degree of Bachelor of Technology.

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AKASH VERMA (20BAC10015)

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ABSTRACT

As an essential constituent of many associations' security and safety precedence, surveillance has established its importance and benefits numerous times by providing immediate supervising of possessions, people, environment and property. This project deals with the design approach of an Embedded Real-Time security System for intruder observation that reinforces surveillance technology to provide essential security to our life and associated control. The proposed robotic unit is used for video surveillance of remote place as well as remotely control of the unit using Bluetooth as medium. Arduino serve the purpose of server as well as the microprocessor for the system. An embedded web server creates an easy way for monitoring & controlling any device which is at remote place. The proposed security solution hinges on our novel integration of cameras into web application. ESP32 Cam operates and controls camera for remote sensing and surveillance, streams live video. This research is focused on developing a surveillance system that helps the property owners to monitor the place to avoid intruders by using ESP32 Camera and WiFi technology for remote control. This Smart Surveillance System presents the idea of monitoring a particular place in a remote area. The proposed solution offers a cost-effective ubiquitous surveillance solution, efficient and easy to implement. The proposed system can be used in military applications just by adding few sensors like infrared sensors so as we can detect the movements. In health care applications the proposed system can be used just by changing the design of the robotic unit.

List of Figures

List of Symbols &Abbreviations

A	**Ampere**
ARM	**Association Rule Mining**
DIC	**Dynamic Item-Set Counting**
DM	**Data Mining**
DHP	**Direct Hashing and Pruning**

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INTRODUCTION

Due to increased need of security most especially in the homes and places of work, there has been a demand for the security systems which are able to protect the man and property which has led to design of spy robot systems with the spy camera and obstacle avoidance technology. A robot is a machine designed to execute one or more tasks repeatedly, with speed and precision. A robot is a mechanical or virtual artificial agent, usually an electro-mechanical machine that is guided by a computer program or electronic circuitry. Robots can be autonomous or semi-autonomous, they have replaced human in performing repetitive and dangerous tasks which humans prefer not to do, or are unable to do because of size limitations, or which take place in extreme environments such as outer space or the bottom of the sea [1]. A spy camera is a device that is capable of capturing video (and sometimes audio) of a location without the subjects' knowledge. These cameras are mainly used for surveillance activities. Surveillance is the process of monitoring a situation, an area or a person.Human surveillance is achieved by deploying personnel near sensitive areas in order to constantly monitor for changes. But humans do have their limitations, and deployment in inaccessible places is not always possible. There are also added risks of losing personnel in the event of getting caught by the enemy [2]. Patrol systems have recently achieved interest to address the concerns about national security. The major problem in protecting long stretches of borders is the need for large human involvement in patrolling the premises. Under the conventional patrol system, even modest-sized areas require large human resources if manual patrolling is considered alone [3]. To monitor the premises in real-time with accuracy and minimize the need for human support, multiple surveillance technologies, which complement each other are required. To address the challenges still facing by the existing surveillance techniques, we introduce the spy robot, a new spying system framework based on ESP 32 camera which can continuously monitor the barracks boundaries to prevent intrusion with minimum human involvements.

LITERATURE REVIEW

- In October, 2017, Tahzib Mashrik, Hasib Zunair, Maofic Farhan Karin Designed and Implemented Security Patrol Robot using Android Application. Their project aimed at designing a low-cost autonomous mobile security robot based on a multisensor system that is user friendly and is also affordable. This project did not have surveillance system to enable the robot operator remotely observe the set target area to take pictures and capture video clips. [8]
- In 2016, singoee sylvestre sheshai designed a raspberry pi based security system whose main aim was to design and develop a security system that included features such as motion detection, image processing and emailing or SMS to facility owner. The system was based on Raspberry Pi SBC. The drawback of this project is that it did not have remote control, so the system required to be remotely controlled. [1]
- The first security surveillance robot was proposed by Everett, H. & Gage, D.W, 1999 in "Mobile Detection Assessment and Response System (MDARS)" [9]. Since then security robots have become a growing interest with increasing developments in research and application.
- Yoichi Shimosasa et al., combining security surveillance and service system together, developed an autonomous guard robot which can guide visitors in daytime and patrol at the night [14].
- In 2014, Sanjana Prasad and his colleagues worked on developing a mobile smart surveillance system based on SBC of Raspberry Pi and motion detector sensor PIR. Their development boosts the practice of portable technology to offer vital safety to our daily life and home security and even control uses.

PROBLEM FORMULATION

Currently, commercialized robots are mainly for safe task that is not included in any destruction crisis and may not bring harm to the robot which can be considered as not designed for being destroyed. We may need to think of the dangerous task is always bringing destruction and the robot may only use for once. However, currently the production cost of a robot that is designed purposely for dangerous task is very expensive, thus, it is not appropriate to be considering as using for one time only. Besides that, a robot for dangerous must be designed with time sensitive manner, which means that it should be more timely precise in doing a task and it should be task specific. As a conclusion, there is very high demand in producing a robot that is low production cost and perform a dangerous task in time sensitive manner. Human surveillance is achieved by deploying personnel near sensitive areas in order to constantly monitor for changes. But humans do have their limitations, and deployment in inaccessible places is not always possible. There are also added risks of losing personnel in the event of getting caught by the enemy. There is also a need for one to keep an eye on the people coming inside the premises of the barracks. Thus all this will lead to the design and implementation of spy robot system which will help to secure lives of personnel in barracks.

PROPOSED METHODOLOGY

Firstly, we program ESP-32 CAM module using ARDUINO UNO & ARDUINO IDE. Next, we generate the IP address of the ESP 32 CAM through WiFi on the Arduino IDE serial monitor.

Further, we connect the ESP 32 cam module to L298N motor driver as per the circuit diagram. Next we connect the 4 BO motors to the the L298N motor driver. We also connect a 12 -20V DC power supply to power the complete setup.

After this, we power the robot through the DC power supply. Once the robot response, we now take the IP address generated on the Arduino IDE serial monitor and paste it on to the browser.

With this we reach to a webpage where we see the live streaming provided by ESP32 CAM module and we also have LEFT, RIGHT, UP, DOWN controls to control our robot.

TIMELINE OF THE PROJECT

- During the first week of the project making , we tried to gather as much information as we can regarding our project . We learnt about new components like ESP 32 CAM module , L298N motor drivers etc. Also we gathered information about what is the need of SPY Robot in current situations.
- In the second week , we assembled all the components required for SPY ROBOT .
- In third week , we selected a 4 wheel car chasis kit that would work as the base for our project and provides easy control.
- By week 4 &5 , we programmed ESP 32 CAM module using Arduino UNO and generated the IP address for the same.
- During week 6 , we connected all the components as per the circuit diagram and assembled everything as per the plan.
- By week 7 and 8, we tested our project on varying voltage supplies and also tried to use LIPO battery for the project. Also we performed testing related to current and voltage needed for our project in the laboratory.
- By week 9 , we had successfully completed our project.

COMPONENTS REQUIRED

1) ARDUINO UNO

2) ESP 32 CAM MODULE

3) L298N MOTOR DRIVER

4) 4 WHEELED CAR KIT

5)4 BO MOTORS

6) JUMPER WIRES

7) SERVO MOTOR

8) SMARTPHONE

9) LAPTOP

10) ARDUINO IDE

11) LITHIUM POLYMER BATTERY

12) ULTRASONIC SENSOR

13) 9V BATTERY

DESCRIPTION

ARDUINO UNO

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself (DIY) kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or Breadboards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

Features of the Arduino UNO:

Microcontroller: ATmega328

Operating Voltage: 5V

Input Voltage (recommended): 7-12V

Input Voltage (limits): 6-20V

Digital I/O Pins: 14 (of which 6 provide PWM output)

Analog Input Pins: 6

DC Current per I/O Pin: 40 mA

DC Current for 3.3V Pin: 50 mA

Flash Memory: 32 KB of which 0.5 KB used by bootloader

SRAM: 2 KB (ATmega328)

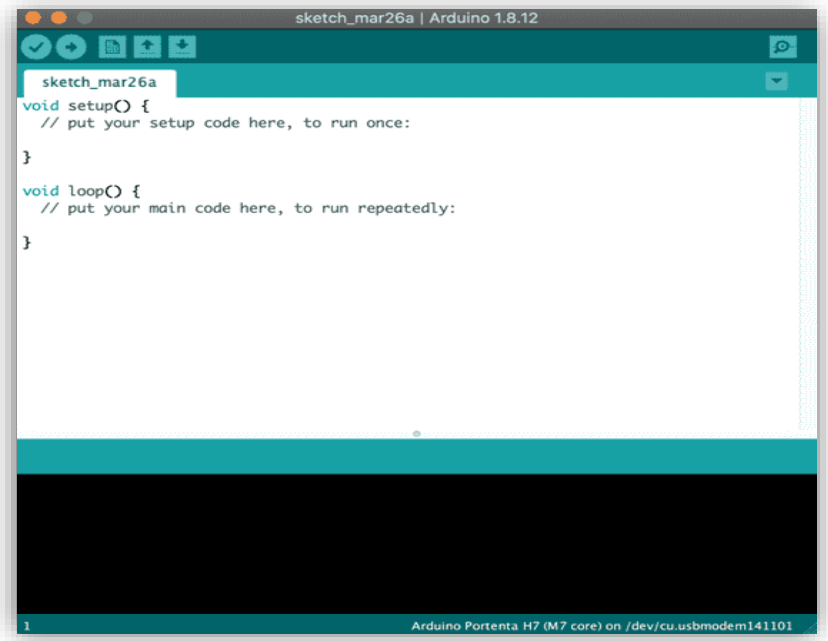
EEPROM: 1 KB (ATmega328)

Clock Speed: 16 MHz

ARDUINO IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The source code for the IDE is released under the GNU General Public License, version

2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.



ESP 32 CAM MODULE

ESP32-CAM is a low-cost ESP32-based development board with onboard camera, small in size. It is an ideal solution for IoT application, prototypes constructions and DIY projects. The board integrates WiFi, traditional Bluetooth and low power BLE , with 2 highperformance 32-bit LX6 CPUs. It adopts 7-stage pipeline architecture, on-chip sensor, Hall sensor, temperature sensor and so on, and its main frequency adjustment ranges from 80MHz to 240MHz. Fully compliant with WiFi 802.11b/g/n/e/i and Bluetooth 4.2 standards, it can be used as a master mode to build an independent network controller, or as a slave to other host MCUs to add networking capabilities to existing devices ESP32-CAM can be widely used in various IoT applications. It is suitable for home smart devices, industrial wireless control, wireless monitoring, QR wireless identification, wireless positioning system signals and other IoT applications.

L298N MOTOR DRIVER

The L298N Motor Driver module consists of an L298 Motor Driver IC, 78M05 Voltage Regulator, resistors, capacitor, Power LED, 5V jumper in an integrated circuit. 78M05 Voltage regulator will be enabled only when the jumper is placed. When the power supply is less than or equal to 12V, then the internal circuitry will be powered by the voltage regulator and the 5V pin can be used as an output pin to power the microcontroller. The jumper should not be placed when the power supply is greater than 12V and separate 5V should be given through 5V terminal to power the internal circuitry.

ENA & ENB pins are speed control pins for Motor A and Motor B while IN1& IN2 and IN3 & IN4 are direction control pins for Motor A and Motor B.

SERVO MOTOR

A **servomotor** is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration.[1] It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

Servomotors are not a specific class of motor, although the term *servomotor* is often used to refer to a motor suitable for use in a closed-loop control system.

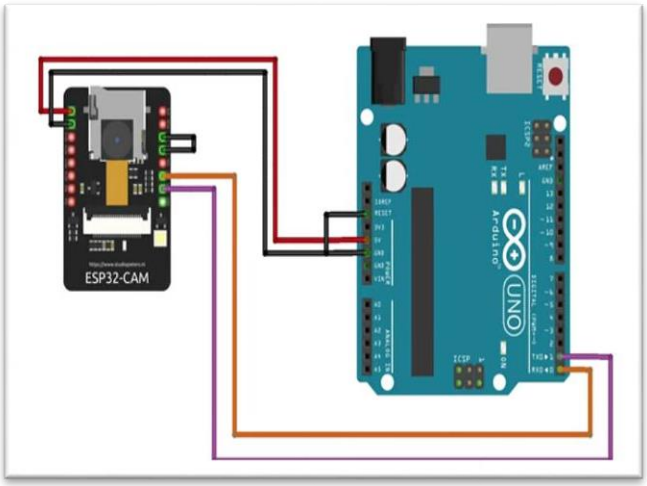
Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing.

ULTRASONIC SENSOR

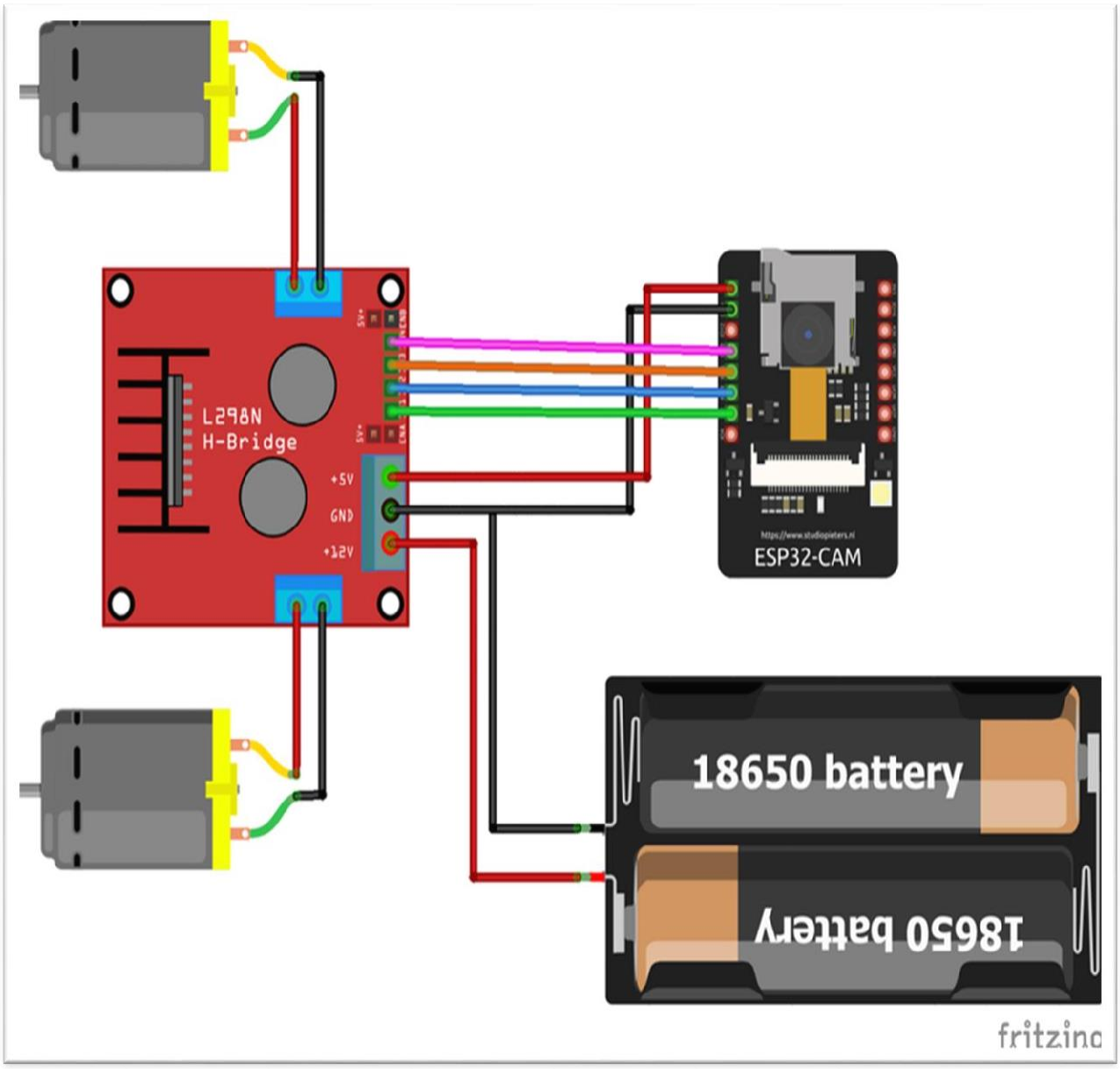
An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e.

the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

CIRCUIT DIAGRAM



ARDUINO UNO	ESP 32 CAM
Reset & GND	GND
5V	5V DC
TX	GPIO1
RX	GPIO3
--	GPIO-GND


L298N
H-Bridge
+5V
GND
+12V
ESP32-CAM
18650 battery
18650 battery
fritzing

CODE

ESP32CAM_Car_2 | app_httpd.cpp | camera_index.h

```
// Select camera model
//#define CAMERA_MODEL_WROVER_KIT
//#define CAMERA_MODEL_M5STACK_PSRAM
#define CAMERA_MODEL_AI_THINKER

const char* ssid = "AkashVerma";   //Enter SSID WIFI Name
const char* password = "MAABHAWAN410";   //Enter WIFI Password



#if defined(CAMERA_MODEL_WROVER_KIT)
#define PWDN_GPIO_NUM    -1
#define RESET_GPIO_NUM   -1
#define XCLK_GPIO_NUM    21
#define SIOD_GPIO_NUM    26
#define SIOC_GPIO_NUM    27

#define Y9_GPIO_NUM      35
#define Y8_GPIO_NUM      34
#define Y7_GPIO_NUM      39
#define Y6_GPIO_NUM      36
#define Y5_GPIO_NUM      19
#define Y4_GPIO_NUM      18
#define Y3_GPIO_NUM       5
#define Y2_GPIO_NUM       4
#define VSYNC_GPIO_NUM   25
#define HREF_GPIO_NUM    23
#define PCLK_GPIO_NUM    22
```

ESP32CAM_Car_2 | app_httpd.cpp | camera_index.h

```
#elif defined(CAMERA_MODEL_AI_THINKER)
#define PWDN_GPIO_NUM     32
#define RESET_GPIO_NUM    -1
#define XCLK_GPIO_NUM      0
#define SIOD_GPIO_NUM     26
#define SIOC_GPIO_NUM     27

#define Y9_GPIO_NUM       35
#define Y8_GPIO_NUM       34
#define Y7_GPIO_NUM       39
#define Y6_GPIO_NUM       36
#define Y5_GPIO_NUM       21
#define Y4_GPIO_NUM       19
#define Y3_GPIO_NUM       18
#define Y2_GPIO_NUM        5
#define VSYNC_GPIO_NUM    25
#define HREF_GPIO_NUM     23
#define PCLK_GPIO_NUM     22

#else
#error "Camera model not selected"
#endif

// GPIO Setting
extern int gpLb =  2; // Left 1
extern int gpLf = 14; // Left 2
extern int gpRb = 15; // Right 1
extern int gpRf = 13; // Right 2
```

```
}

// camera init
esp_err_t err = esp_camera_init(&config);
if (err != ESP_OK) {
  Serial.printf("Camera init failed with error 0x%x", err);
  return;
}

//drop down frame size for higher initial frame rate
sensor_t * s = esp_camera_sensor_get();
s->set_framesize(s, FRAMESIZE_CIF);

WiFi.begin(ssid, password);

while (WiFi.status() != WL_CONNECTED) {
  delay(500);
  Serial.print(".");
}
Serial.println("");
Serial.println("WiFi connected");

startCameraServer();

Serial.print("Camera Ready! Use 'http://");
Serial.print(WiFi.localIP());
WiFiAddr = WiFi.localIP().toString();
Serial.println("' to connect");
```

APPLICATIONS

A. Spying : This robot can help in spying operations

B. Surveillance Device: The robot can be used for surveillance or reconnaissance.

C. Military Applications: This robot can be used on the borders for disposing hidden land mines.

D. Hospitals, Schools: This project can be used in offices , schools , hospitals to monitor activities.

E. Substitute: This can be used as a substitute of conventional CCTV cameras.

F. Alternative: This project can easily work as an alternative of a Drone.

RESULTS

The prototype was built and tested. The power supply of 20V was connected to the SPY ROBOT which supplies power to the ESP 32 CAM Module, L2N8N Motor Driver, ultrasonic sensor. When the commands are received from the phone via WIFI, the robot moves in forward, reverse, right and left according to the command sent via the WIFI. As the robot is in motion, the camera helps to view the place being monitored and the photos are takes and saved on the computer and action is taken accordingly.