

NAVIGATION RADAR ROBOT CAR

A Project report Phase-II

Submitted in partial fulfilment of the requirements for the award of
Bachelor of Engineering Degree in Electronics and Communication Engineering
by

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INSTITUTE OF SCIENCE AND TECHNOLOGY

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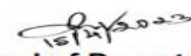
BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of RIDDHI SINGH (39130373) AND RIYA SINGH (39130376) who have done the project work as an individual who carried out the project entitled "NAVIGATION RADAR ROBOT CAR" under my supervision from November 2022 to April 2023.


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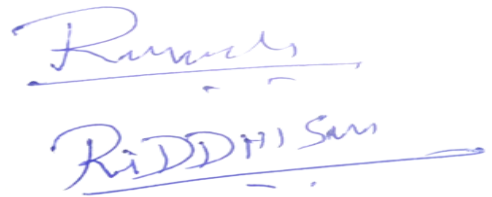
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DECLARATION

We **RIDDHI SINGH** (39130373) and **RIYA SINGH** (39130376) hereby declare that the Project Report entitled “**NAVIGATION RADAR ROBOT CAR**” done by us under the guidance of **Dr. V. VIJAYAKUMAR, M.Tech., Ph.D.,** at Sathyabama Institute of Science and Technology, **Chennai- 600119** is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Electronics and Communication Engineering.

The image shows two handwritten signatures in blue ink. The top signature is 'Riddhi Singh' and the bottom signature is 'Riya Singh'. Both signatures are written in a cursive style and are underlined.

DATE:

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SIGNATURE OF THE CANDIDATES

ACKNOWLEDGEMENT

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ABSTRACT

Navigation process extremely use for examining the area, people, etc. This intensively used for military purpose, as we know, for the safety of the nation's border and enemy territory surveillance is crucial. The radar technology is used for monitoring the area, with the help of radar we can detect the presence object. Navigation is completed through the usage of deploying employees close to sensitive areas to continuously display for changes. The primary objective of developing this robot was to reduce the risk of human life by keeping an eye on human activities on the battlefield or learning about the situation in the event of a disaster. The robot with the digital camera with multi-sensor capabilities, night vision, and wireless real-time video transmission. With the assistance of IoT technology, this robot is collected data from remote terrain and monitor that data in a far more secure location. Because of its adaptability to changing needs and simplicity, it is frequently utilized. In robotic car high-speed image transmissions are essentially used to transmit video. The robotic will function a suitable gadget for the protection region and also will prevent unwanted activities. Before entering the territory, the robot will assist the police or military/armed forces in determining its condition.

Keywords: Arduino, Bluetooth module, Ultrasonic Sensor

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CHAPTER 1

INTRODUCTION

1.1 GENERAL INTRODUCTION

Nowadays, robots are becoming a platform to develop or discover a machine to ease the work of human. A robot basically is an intelligent device designed to help humans in almost every relevant or irrelevant field. The robots have no fixed shape, neither are been specified for any particular field or for any particular work. They can be made or converted into any form depending upon the area of application. Most likely, nowadays robots are made with the help of additional technologies like instead of connection oriented; robots are being built with a total connection less motive i.e. wireless one. Also, with the help of surveillance motive, different situations, regions describing various difficulties can be monitored easily. Hence to enhance these features in a better manner, we have implemented a wireless surveillance robot to monitor environmental situations in an efficient way.

The roots of foundation of robotics belong back in 1950s; more than six decades has passed since then, and robotic evolution has been running unparalleled. Today we can feel the presence of robots everywhere and in every field whether it is medical, military, education or governance and so on. Robotics has become a helping hand for humans, and they are making our life easier, better and faster. Robotics is a boon for human kind, because robotic machines are giving alternatives, which is providing a great support to physically impaired people. This proposal focuses in the problems faced by especially abled people who wish to drive their vehicle on their own but they cannot because of the natural cause. In this proposed project, the emphasis is on voicecontrol of robot with automatic braking, speed slow down and avoidance of obstacles automatically or manually (through voice command). In this model, we will use an android app to pass on the voice commands to the Arduino through Bluetooth communication using Bluetooth module. Ultrasonic sensor will act as the obstacle detector, which will act as a mediator for Arduino microcontroller (or the CPU) and the proximal environment, and it would eventually lead to slowing down the vehicle or to fully break its motion. The existing system includes a robot which works same like othertraditional robots and have a lot of drawbacks, such that a robot works within specific means of technology, false reliable, etc.

The existing system is very vulnerable to get in touch with area facing difficulties and no fulfilled mechanism is available. It is also very time consuming to address the issue and resolve the same. In our proposed piece of work, the robot fulfills the issues given above. It is very useful for monitoring in areas where there is no internet connection and also the collapse of the communication system during any disaster.

RADAR system is an object detection or tracking system which uses radio waves to decide or get the range, height, heading, or speed of items or objects. Radar frameworks or systems arrive in an assortment of sizes and have distinctive performance particulars. Some radars are utilized for aviation authority at air terminals and others are utilized for long-range observation and early cautioning frameworks. There are some ways to show radar working data. There are also some modified radar systems that have advance technology for handling the systems. These modified systems are used at higher levels to get or extract helpful or important data.

1.2 PROBLEM STATEMENT

The ineffective approaches that the current system suggests, as well as the incorrect classification of the outputs, are the key issues that we are attempting to address here. Additionally, the dataset used was incorrect and unsuitable.

1.3 OBJECTIVE

- Can be used for spying purpose.
- Can be used for surveillance purpose, both day and night.
- Can also be used during disaster situations.
- Can be controlled using any mobile phones.
- Reduce the risk of human life and will prevent illegal activities.
- Can be used to do the work which are impossible by humans.

Often, the robots are used to do work that could be done by man. However, there are many reasons why robots are better than humans in performing certain tasks. Looking with the same, this project provides a wireless robot with a better surveillance means to address any difficult situations in the environment. Besides this, the obvious advantage of not having to risk any personnel, land and air, this robot can also look for

details that are not visible to humans. It is possible to obtain distance information to specific area by providing the high-resolution cameras and various sensors.

Robots are frequently used to perform tasks that could be done by humans. Nevertheless, there are numerous reasons why robots outperform humans at certain tasks. In the same way, this project gives a wireless robot a better way to monitor the environment and deal with difficult situations. Besides this, the obvious gain of no longer having to hazard any employees, land, and air, this robot also can search for information that is not seen by humans. It's far feasible to achieve distance information to a particular area by offering high-decision cameras and numerous sensors.

With the development of automation technology, automation begins to develop from simple system control to complex system control and advanced intelligent control, and that too in various fields. An intelligent car is based on the automobile as the background, including automatic control, sensor technology, computer, machinery, and other disciplines of design. An intelligent car integrates a complex integrated system, which can realize environment perception, self-planning, and self-decision functions. It can make full use of computers, sensors, information, communication, artificial intelligence, automatic control technology, and high-tech complex technology. As demand for autonomous projects increases, the use of the sensor increases. The sensor is a complex device that converts physical parameters (e.g. temperature, pressure, humidity, speed, etc.) to a signal that can be electrically measured. They are very important to robots. It offers robot remote access and decisions about the desired environment.

The project is designed to build an obstacle avoidance robotic vehicle using ultrasonic sensors that will move according to the code assigned and will a free space, navigating from any obstacle on its way. The so-called obstacle avoidance system is made to use the advanced range finding device in front of the autonomous car. When the car faces an obstacle, it can locate and respond to the location sensor and enter the Arduino through the data transmission starting the core processing. Ultrasonic sensors are known for their reliability and great versatility in the industry. Ultrasonic sensors can be used to solve the most difficult tasks involving object detection or level measurement with millimeter accuracy because the measuring method works reliably in almost all conditions.

In this project, a robotic vehicle that moves in different directions like forward, backward, left, and right are designed and built to avoid the obstacle when it receives the sensor input that the object is detected.

Sensors are devices that convert energy forms into electrical energy. The sensors serve as a bridge connecting the environment and various electronic devices. The environment can be any physical environment such as military areas, airports, factories, hospitals, shopping malls, and electronic devices can be smartphones, robots, tablets, smart clocks. These devices have a wide range of applications to control, protect, image and identification in the industrial process. Today, there are hundreds of types of sensors produced by the development of technology such as heat, pressure, obstacle recognizer, human detecting. Sensors were used for lighting purposes in the past, but now they are used to make life easier. Thanks to technology in the field of electronics, incredibly fast developments are experienced. In this respect, it is possible to develop a new invention or a new application in every day and make life easier. Today, robot systems are developed with the use of artificial intelligence algorithms. The robotics field is one of them. The most important part of the robot is the perception. Perceive of the environment will be important for a robot design. For instance, it is very important to identify explosives by a robot to detect a terrorist in the military field by using sensors. A robot has to perceive some variables (like heat changes) around it, interpret it, and then decide to act accordingly. In this article, remote and autonomous controlled robotic car has been presented in terms of obstacle detection and avoidance by using sensors. The connection between the robot and the Android device has been established via Bluetooth technology. The incoming data will be processed by Arduino Uno and according to the input value of the user, robot action can be performed. There are two main modes that control the robotic car by Android application (mobile phone). These are user control mode and automatic mode. A menu with buttons has been seen on the screen to select the actions. These buttons will be used to move the robotic car forward, backward, right and left, stopping the car and switching to automatic mode. By selecting automatic mode, the user leaves the robot control and the robot finds its way without hitting the obstacles.

In the transportation system, an autonomous vehicle is to improve safety system, economic and environmental benefits. An autonomous vehicle, driving functions become automated, it reduces crashes, energy consumption, costs of congestion and

pollution. An autonomous vehicle is capable of sensing its environment and navigating without driver. An autonomous vehicle faces more challenge like obstacle detection. Obstacle detection is very much important for an autonomous vehicle. Obstacle detection is to sense any obstacles present or absence on the search environment. In order to sense the environment, an autonomous vehicle uses a combination of sensors, including lidar, radar, cameras, ultrasonic, and infrared. To detect obstacle (obstacles may be tree, buildings etc..) on the search environment by using sensor devices in order to avoid accidents/collisions.

CHAPTER 2

LITERATURE SURVEY

2.1 INFERENCE FROM LITERATURE SURVEY

Design of Wireless Video Surveillance Robot using Raspberry-Pi in 2019 by G.R.Sri Sudharsna, A.Srinivasan Video Surveillance plays the key role in security systems.

Wireless video surveillance will be the surrogate for the standby surveillance systems. The proposed video surveillance robot can be moved in any direction according to the instructions from the webpage and it streams the captured video lively over the webpage. Raspberry –pi is the heart of this robot. Two software modules, “MOTION” and “FLASK” are incorporated to get the live streaming and to transfer instructions from the webpage to Raspberry-pi. It can be used in small level military applications, monitoring systems in residence, hotels. Keywords: Wireless Video surveillance, Raspberry-pi, Motion, Flask Tremendous development of the Technology yields the unassailable security systems. Video Surveillance is the process of monitoring a particular range of area, persons, etc.

Security play the most pre-eminent role in day-to-day life. This wireless video surveillance robot can be accessed easily anywhere. This wireless video surveillance robot consists of Raspberry-pi which is the key component that drives the robot to yield the valid streaming. The sub components of this robot are Webcam, DC motors, Motor driver IC(L293D) , Chasis, Power Bank . Ease of access of the robot can be made by incorporating the Internet of Things concept. This wireless video surveillance robot can be accessed and the live streaming can be observed in the webpage by feeding the IP address of the Raspberry-pi. The Raspberry-pi and the PC/Mobile through which the robot to be accessed should be connected to the same network (WI-FI).

This robot is designed in a way that it can be accessed anywhere. The coverage range for the video surveillance is not limited as the robot is mobile. The system consists of two segments, hardware segment and software segment. Hardware segment comprises the robot setup with the Raspberry-pi and the software segment comprises of the HTML and PYTHON code. HTML code should possess the hyperlink for the robot controls in the python code. This wireless video surveillance robot requires

both hardware and software. Major part of building up this robot lies in the coding part. Coding for accessing robot is done in PYTHON and for live streaming is done in HTML.

Raspberry-Pi Raspberry-pi incorporated in this robot is Raspberry-Pi 3 Model B. This has been employed to process the code and to send signals to the Motor Driver IC L293D regarding the direction of motion of the robot, to enable the live streaming by processing the HTML code. Web Camera is also connected to it. Power supply for this can be provided by the power bank. Web Camera Web camera utilized should be USB compatible as it gets connected to the Raspberry-pi. It captures the motion in the direction of the robot. It continuously captures the motion and streams in the webpage via the Raspberry-pi.

Motor Driver Ic (L293d) This is a 16-pin IC which drives the DC motor in the direction as instructed by the user in the webpage, via the Raspberry-pi. It gets the power from the Raspberry-pi. Dc Motor DC motors with the power supply requirement of 12V is employed in this robot. It is to move the robot in the direction instructed by the user. Two DC motors are employed in it. Power Bank Power bank is to fulfil the power requirement for the Raspberry-pi. Power bank with the features of 5 V, 1.5 A current and the battery power rating of 32 WH

Putty Software Putty is an open source terminal emulator, serial console, network file transfer application. It is an amazing tool to access the Raspberry-pi (remote computer). In this software, the python code is run then only the webpage opens with live streaming and instruction labels.

Mobaxterm Mobaxterm is also a tool to access the remote computer. Here it visualizes the Raspberry-pi files by having a Raspbian OS as a virtual OS in our PC. **Motion Module** It is a software module that can be installed using Putty, to provide a live streaming over the webpage. **Flask Module** It is a software module that can be installed using Putty, which can transfer the commands by the user from web page to the Raspberry-pi.

Video Surveillance Robot Control using Smartphone and Raspberry Pi in 2016 by Ashish U. Bokade and V. R. Ratnaparkhe.

This paper proposes a method for controlling a wireless robot for surveillance using an application built on Android platform. The Android application will open a webpage which has video screen for surveillance and buttons to control robot and camera.

Android Smartphone and Raspberry pi board is connected to Wi-Fi. An Android Smartphone sends a wireless command which is received by Raspberry pi board and accordingly robot moves. The Video Streaming is done using MJPG streamer program that gets mjpeg data and sends it through a HTTP session. The Raspberry pi programming is done in python language. The experimental result shows that the video streamed up to 15 frames per second. Index Terms—Android Application, Robot, Raspberry pi, Surveillance.

Raspberry Pi Raspberry pi 2 Model B is used which delivers 6 times the processing capacity than its previous version. In [4-7] it is stated that this Pi board has an upgraded Broadcom BCM2836 ARM Cortex-A7 900MHz processor. This board also has an increased memory of 1Gbyte LPDDR2 RAM. The Pi Board boots from Micro SD card which runs a version of Linux operating system. The Raspberry Pi board takes power from Micro USB socket of 5 Volts, 2 Amperes. The Board itself has a 10/100 BaseT Ethernet socket and 4 numbers USB 2.0 connector. The board has 40-pin 2x20 strip expansion header of which each pin spaced 2.54mm. This 40-pin provides 27 GPIO for connecting input output devices as well as +3.3, +5 Volts and GND supply lines. The board also has 15-pin MIPI Camera Serial Interface for interfacing RaspberryPi camera module.

The architecture of robot hardware. The robot is built using mechanical and electrical components. The main controlling unit of the system is Raspberry Pi. Power supply circuit is designed to provide power to Pi board and motor driver IC (L293D). Two dc motors are used to control the forward, backward, left and right movement of robot. Camera module is used to take picture frames for video. Tilt motion of camera is controlled using servomotors to provide the wide capturing area. Wi-Fi dongle is used to connect Raspberry Pi to the Wi-Fi Router. The camera is mounted at the center of the chassis on a robotic arm. The movement of the arm is controlled by servomotor. The motor driver IC and other signal conditioning circuitry including power supply is designed on a PCB. To reduce the complex connections a 2 x 20 header cable is used to provide all the GPIO connections from Pi to PCB. A 12 volts battery is there inside the chassis to provide required power supply to the system.

Motor driver IC allows DC motor to run in either clockwise or anticlockwise direction. L293D works on H-Bridge principle. There are two H-Bridges in IC. There are two Enable pins which are connected to logic 1. There are two supply pins; VSS

which is connected to +5 volts and VS which is connected to +12 volts. The higher voltage +12 volt provides current to DC motor. There are four input pins, each of two pins control a single DC motor. By changing the logic level on two pins like “0 and 1” or “1 and 0” the motor rotation direction has been controlled

Spy Robot Surveillance System using IoT Apsara , Amrithha , Ramya , Mrs. R. Chitra in 2020.

Surveillance literally means to watch from a distance. Surveillance cameras and facial recognition are used to monitor public and private spaces and to identify people. The effectiveness of this technology is up for debate, but it is nevertheless becoming both more pervasive and more invasive. So, this paper proposes a surveillance robot which can move and has multi-sensory capabilities inbuilt. The main motive of the paper is the surveillance of human activities in remote areas where human intervention is difficult or risky. The robot is used to collect information from the remote terrain and monitor that information at a far secure place with the help of IoT technology. Keywords: Raspberry Pi 3, PIR Sensor, IR Sensor, Webpage, DC Motor, Python, IoT, HTML, PHP.

This paper involves the implementation of a surveillance system using a robot which is IoT enabled. The whole system is divided into two parts: Hardware and Software. The hardware is the moving robotic prototype which is used for sensing, capturing and transmitting the captured data through IoT. The software consists of a webpage with the required user interface to manually control the robotic movements, to receive the data from the hardware module and to notify the user of any intrusions. The hardware is mainly controlled by the Raspberry Pi 3 microcontroller. It is the brain of the robotic module that takes care of all its functions such as sensing, movements (both autonomous and manual movements), data transmission, camera control and communication between the module and the user. It acts as a wireless computer with LAN, Bluetooth, GSM and internet connectivity for data transmission. The movements of the robot are controlled by two DC motors which in turn is interfaced to the RaspberryPi 3 board. The module is powered by a battery.

The robotic base module is also implemented using, webpage and an android application through which the robot can be controlled. The robot is controlled by the buttons available on the webpage. Also, the live streaming and auto-pilot facilities are available on the webpage. The webpage is built using two different languages namely,

HTML and PHP. HTML is used for frontend components and PHP is used for backend operation. The captured image via the camera in the robotic setup is delivered to the user as an image attachment with email. The SMTP module programmed in the raspberry pi automatically signs-in to the given mail id. It attaches the captured image and sends it to the required user. This part is established by IoT. The results are captured and the required data is presented.

Juan G. Parada-Salado, Luis E. Ortega-García, Luis F. Ayala-Ramírez, Francisco J. Pérez Pinal [2018]

Presented a concept on design and construction of a land wheeled autonomous mini-robot (LWAMR) for in-door surveillance. The LWAMR can be autonomous by using a position, speed and distance sensor. In addition, it is capable of sending images and video in real-time by using a spycam, which is controlled by a servomechanism. Details of the design, control algorithm, communication, and human-machine interface (HMI) are given. HMI was implemented in LabVIEW and it is used for monitoring remotely the LWAMR health and surveillance. Communication between the HMI and the LWAMR system was carried out by means of RF transceivers. Results show the effective implementation of this kind of LWAMR system.

Advantages of the presented LWAMR are low cost, versatility, modularity, robustness and remote (or not) operation by using a mobile device HMI. [3] S M Ashish, Madhurya Manjunath, Ravindra L, Mohammed Nadeem, Neelaja K [2018] proposed a concept about a Raspberry Pi based automated robot which fulfils the purpose of surveillance. The robot provides autonomous movement around the facility where it is deployed and will move around the obstacles in its way by detecting them. It detects any kind of human emotions in the facility and alerts the registered users through SMS alert. It also captures the image of the commotion by using a Pi camera.

T. Saravanakumar, D. Keerthana, D. Santhiya, J. Sneka, D. Sowmiya [2018]

The main objective of this paper is to develop a virtual environment for detecting suspicious and targeted places for the user without any loss of human life. It is based on the development of a robot vehicle for observing/spying suspicious objects. It can continuously monitor the objects. The robot can move in every direction (left, right, forward and backward). It is used for video surveillance and remotely controls the particular place using Wi-Fi as a medium. The webcam which is placed on the robotic

unit will capture the video and it transmits lively to the remote end. The major application of this paper can be analyzed using an HTML web page which can be used to control the movement of the robot. L293D is a quadruple dual H-Bridge motordriven IC.

Harshitha R, Muhammad Hameem Safwat Hussain [2018]

By means of this paper, the author puts forward a surveillance robot which can be integrated into any kind of household. The base controller of the bot will be the powerful Raspberry Pi 3 Model B. A webcam attached to the Pi monitors the area and sends a notification when any trespassing or obstruction is detected. The camera also possesses a face recognition algorithm which will possess the ability to identify the person responsible for the motion triggering. If it is authorized personnel, the on-board voice assistant will start talking with the person. The notification will be sent only when it's unauthorized personnel and will contain pictures clicked of the trespasser and also activate live streaming of the webcam feed. The live streaming ability of the Pi allows the camera feed to be analyzed from any location using the internet. With such a system, every user will feel more sheltered while they're not at their place of residence or when they've left their children and old ones alone at home.

Muhammad Hamza, M Atique-ur-Rehman, Hamza Shafqat, Subhan Bin Khalid [2019] proposed an idea about a platform to remotely control a surveillance robot over the internet. It will enable us to monitor the activities in the remote and sensitive areas. In traditional security systems, fixed locations are used for monitoring and spying purposes. For such cases, our robotic system is mobile and it can go into those areas where human access is risky, impossible or not suitable and provide us with the footage of those locations. The camera mounted on the robot keeps on capturing the video. This live video from the robot will be streamed on the webpage and it will be used for both surveillance and controlling the robot movement accordingly. The movement algorithm of the robot is implemented using CGI scripts and the monitoring is done by utilizing the MJPG video streamer. The aim is to control the robot from anywhere in the world via webpage and to make the delay time as little as possible.

Raspberry Pi 3: The Raspberry Pi 3 Model B is the latest version of the Raspberry Pi computer. The Raspberry Pi is the cheapest board, it doesn't have a case, and is simply a credit-card sized electronic board of the type which might be inside a PC or laptop but much smaller. It acts as the controlling core of the system. Robotic

Setup: The Robotic setup is a casing that houses the microcontroller board, various sensors, mounted on wheels used for navigation which is driven by DC motors.

IR Sensors: IR (Infrared) Sensor works by emitting infrared signal/radiation and receiving the signal when the signal bounces back from any obstacle. In other words, the IR Sensor works by continuously sending a signal (in a direction) and continuing receiving the signal, it comes back by bouncing on any obstacle in the way. PIR Sensors: PIR (passive infrared) motion sensor detects any movement of objects, human or animals.

Every object with a temperature above absolute zero emits heat in the form of infrared radiation. PIR motion sensor detects a change in the infrared radiation impinging on it. When any object or human passes in the front of the PIR sensor, the temperature in the sensor's field of view will rise from ambient temperature to object temperature and then back again to ambient temperature. PIR sensor converts this temperature change into the change in output voltage and that change in voltage is considered as motion detected. Pi Camera: The Raspberry Pi Camera v2 is the new camera board released by the Raspberry Pi Foundation. The Raspberry Pi Camera Module v2 is a high quality 8 megapixel Sony IMX219 image sensor custom designed add-on board for Raspberry Pi, featuring a fixed focus lens. It is used for the acquisition of images and videos from the surveillance area. SDIO Card: Secure Digital I/O Card is a version of the SD Memory Card that adds wireless transmission to any compatible device.

Introduced in 2001, the first SDIO card on the market was a Bluetooth card. Wi-Fi and ZigBee cards followed them. Graphics Accelerator: A graphics accelerator is a piece of dedicated hardware designed and used to rapidly process visual data. It is a chipset attached to a video board to which a computer program can offload the sending and refreshing of images to the display monitor and the computation of special effects of common images and videos. Web Page: A web page is a document that is suitable to act as a web resource on the World Wide Web. In order to graphically display a web page, a web browser is needed. This is a type of software that can retrieve web pages from the Internet. When accessed by a web browser it may be displayed as a web page on a monitor or mobile device. The webpage has necessary buttons to facilitate the manual remote control of the system. It also enables the user to view the received images or videos.

Surveillance System Using Robotic Car Neha Joisher K.J Somaiya Institute of Engineering[2018]. Video surveillance is the process of monitoring a situation, an area or a person. This generally occurs in a military scenario where surveillance of borderlines and enemy territory is essential to a country's safety. 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. We have developed a robot which can be used for video surveillance & monitoring which can be controlled through a GUI. The control mechanism is provided with a video transmission facility. The video transmission is practically achieved through high-speed image transmission. Initially, the robot will be equipped with a camera which will capture the scenes and transfer the images to the server on which the user will be controlling and watching the live feed. Keywords— Surveillance, Raspberry pi, Robot.

This project will make a remote-control car which has a view via an attached camera. In this project a remote-control car to be driven from a computer in a remote location. The car can be driven remotely while viewing its perspective through a camera mounted on the car as shown in the figure[1]. The car also utilizes a pan tilt motor that moves the camera around so that the user can see everything going on from where the car is. We implemented this project at our university where the wifi network was obtainable across the entire campus. This will allow us to drive the car anywhere that it could connect to the wifi. Realistically you can implement this project and control the car from your computer anywhere that is within reach of that wifi signal. Raspberry pi model 3 Raspberry pi is a small credit-card sized computer capable of performing various functionalities such as in surveillance systems, military applications, etc. Raspberry pi Wifi module This make your Internet of Things device cable-free by adding WiFi. Its advantages include low cost, but high-reliability wireless link. Raspberry pi camera module The Camera Module is a great accessory for the Raspberry Pi, allowing users to take still pictures and record video in full HD.

Kyunghoon kim ; Soonil Bae ; Kwanghak Huh presented “Intelligent surveillance and security robot systems” published on 28 Oct. 2010 IEEE Workshop on Advanced Robotics and its Social Impacts which was held at Seoul, South Korea. This paper presents for this are also costly. Another point is that the signal strength

may not be strong enough to reach every area, leaving portions of the location unmonitored. Also, bad weather can interfere with the signal of these systems. The purpose of the proposed system will be to eliminate the drawbacks of a new security solution that integrates vision, intelligent algorithm and robot technology. While conventional security solutions rely on human operator's vigilance on the images provided by cameras, the proposed solution uses machine intelligence to compensate for human factors and robots to provide immediate counter response. User specifies the desired position by utilizing the real time Web based visual interface. The autonomous robot moves to that location avoiding obstacles.

2.2 OPEN PROBLEM IN EXISTING SYSTEM

2.2.1 Wireless Controlled Surveillance Robot

A mobile robot is a machine that is placed or mounted on a movable platform and can be with the help of certain instructions. In today's world, a lot of fields use mobile robots. Many of the complex robots we now see originated from simpler mobile robots. This technology has increased many new applications in the industry. The combination of mobile devices and robots are leading to new ideas in lots of fields. Mobile devices are now being used in many industrial applications this is mainly because of the reason that they are portable and have a longer battery life as compared to a laptop. Also, they have a convenient data plan through a cell phone carrier as we can interact with the mobile robot once the connection is established.

Mobile Robots: Mobile robots can be classified into different types. The tracked robot is the robot that uses tracks to move around. However, such robots are costly to build. Also, they are not as flexible as wheeled robots. Wheeled robots are robots that use wheels for moving. Such robots can move only on smooth flat surfaces. The third type is the legged robots which are based on human form. They have legs that help them to move around. These robots are very difficult to design.

Limited Frequency Range: The frequency range used for typical RF communication is near about 3KHz-3GHz. The use of a channel separator increases the reliability but decreases the actual usable working frequency range.

Limited Functions: The limited number of channels causes a smaller number of combinations and thus there are fewer numbers of available functions.

Limited Working Range: The working range of RF circuits with transmitters and receiver is very small. It starts from a few meters to a few kilometers. The working varies from circuits to circuits, but mainly depends on the values of physical components used in the circuit. Mainly Wi-Fi and Wi-Max wireless services are used in RF transmitter and receiver circuits. The following table shows the actual working range of different wireless standards that can be used in wireless communication.

Reliability of Operation: The RF circuits are very prone to errors due to external conditions such as EMI (Electro-Magnetic Interference), medium saturation, absorption due to repetitive reflections from surface. Hence the output recovered is not always what is expected. This might be a serious problem when working with scientific experimental components.

Security reasons: This is the main disadvantage of using a RF circuit and the main reason why RF circuits are not preferred today. The RF frequency band is available for almost all the users for data communication. So there might be a scenario where more than one user is trying to accommodate channel for its own communication. In such case the frequency band may get interference from another user. Or worst case would be, some user intentionally trying to jam our communication network. The RF jammer circuits are very easy to design; hence the question of security arises when RF circuit is used in the circuit. This security loop hole can be very dangerous when the robot is being used for very confidential purposes. In areas of military these security threats can produce disastrous outcomes.

2.2.2 Surveillance Security Robot with Automatic Patrolling Vehicle

The word surveillance may be applied to observation from a distance by means of electronic equipment (such as CCTV cameras), or interception of electronically transmitted information (such as Internet traffic or phone calls). It may also refer to simple, relatively no- or low technology methods such as human intelligence agents and postal interception. Surveillance is very useful to governments and law enforcement to maintain social control, recognize and monitor threats, and prevent/investigate criminal activity. However, many civil rights and privacy groups, such as the Electronic Frontier Foundation and American Civil Liberties Union, have expressed concern that by allowing continual increases in government surveillance of citizens we will end up in a mass surveillance society, with extremely limited, or non-

existent political and/or personal freedoms. An automatic patrolling vehicle acts as a security patroller in the security system, which can monitor those dead zones of the traditional fixed surveillance system. The remote monitoring capabilities can also be enhanced by using the wireless network and the face detection system is adapted to record and analyze the invaders.

1. Limited for only single stair
2. Limited angle detection (not able to detect faces under critical angle)
3. System itself having some limitations of capturing

2.2.3 Android Based Security and Remote Surveillance System

Now a day mobile device is integrated with our everyday life. The security and remote surveillance system are increasingly prominent feature on the mobile phone. The modern home is integrated with many automation technologies. The user can control door lock, light, air conditioner and other devices using remote control. According to Khan, The Access control system used to allow only authorized members while the user away from their house. When the system gets wrong password in three times than it signals to the door alarm. But this technology is very effective when using internet capable mobile devices.

1. Limited Working Range
2. Security reasons
3. Limited angle detection

2.2.4 Smart Phone Controlled Robot

The basic function of Bluetooth serial module is replacing the serial port line by connecting one to Bluetooth master device and the other connecting to slave device. Today, robots are enjoying resurgence. As computer processors are getting faster and inexpensive, robots can afford to get smarter. While, researchers are working on ways to help robots move and think more efficiently. Since most robots in use today are designed for specific tasks, our goal is to someday make universal robots that are flexible enough to do just about anything a human does and more.

1. No provision for video streaming
2. No dedicated app
3. Control using already developed application

CHAPTER 3

REQUIREMENTS ANALYSIS

3.1 SYSTEM DESCRIPTION

Today most of the Smart phones are based on the Android platform. It has almost all the features that are available in computer or laptop. So, the controlling of robot using smart phone makes the system efficient and reliable. A Wi-Fi dongle is used for connecting Raspberry Pi to Wi-Fi router. The Wi-Fi router is connected to local area network (LAN) for providing internet connectivity to the Pi. Fig. 6 depicts the workflow of system. As soon as the Raspberry Pi gets power it starts initializing the IP address allocated to the web server and establishes connection with the LAN. Once it gets connected successfully, it remains idle until the user sends any command to it. After receiving command, the Raspberry Pi decodes the command and starts capturing the video with required robotic motion.

3.1 SOFTWARE REQUIREMENT

A. For Android App Development Nowadays, Android phone are used by most of the people in almost every part of world. Developing an android application is a complex task and need knowledge of software. For developing an application, the system needs JAVA and Android Studio.

Besides this there are many web-based tools available for developing android application like MIT AppInventor. In we got that AppInventor is jointly developed by MIT and Google and it has gained popularity as a learning tool and a way by which students can practice creative innovations. AppInventor is a visual, block-based development environment which does not require any prior programming knowledge.

B. For Embedding Code in Arduino, Python language is used. Python language is easy-to-learned since it has a small set of keywords and clearly defined syntax. The diverse set of libraries for Python is portable and compatible with almost all operating systems like Windows, UNIX, and Macintosh. Its programming is 4 times shorter than languages likes JAVA. There is no need to declare any type of arguments or variables. It uses simple functions and variables without defining classes.

C. For streaming video on web MJPG-streamer application is used for video streaming over HTTP. It is a command line application for Linux used to stream JPEG picture file

over an IP based network taken from webcam. It streams up to 960 x 720 pixel images at a high frame rate (≥ 15 frames per second). Along with this libv4l library is needed which is installed by using following command “sudo apt-get install libjpeg8-dev image magick libv4l-dev”.

3.1.1 Android Studio

Android Studio is that the official IDE for android application development, supported IntelliJ idea. On prime of the capabilities you expect from IntelliJ, android Studio offers: Flexible Gradle-based build system Build variants and multiple apk file generation Code templates to assist you build common app options Rich layout editor with support for drag and drop theme piece of writing lint tools to catch performance, usability, version compatibility, and alternative issues. Pro Guard and app-signing capabilities. Built-in support for Google Cloud Platform, creating it straightforward to integrate Google Cloud electronic communication and App Engine.

3.1.2 Arduino IDE

The Arduino integrated development environment (IDE) could be a cross-platform application written in Java, and derives from the IDE for the process programming language and also the Wiring projects. It's designed to introduce programming to artists and different newcomers unfamiliar with code development. It includes a code editor with options like syntax highlighting, brace matching, and automatic indentation, and is additionally capable of compilation and uploading programs to the board with one click. A program or code written for Arduino is named a "sketch". Arduino programs are written in python.

The Arduino IDE comes with a code library referred to as "Wiring" from the first Wiring project that makes several common input/output operations a lot of easier. The users would like solely to outline 2 functions to create a possible cyclic government program: setup (): a function run once at the beginning of a program that may initialize setting loop (): a function referred to as repeatedly till the board powers off+ programming languages.

3.2 HARDWARE REQUIREMENTS

1. Arduino UNO

Arduino is an open-source hardware and software platform that is designed for building electronics projects. It consists of a microcontroller board that can be programmed to control different electronics components such as sensor, motor, light and more. The software used to program Arduino boards is also open-source and can be downloaded for free from the Arduino website.

One of the main advantages of using Arduino is its simplicity and ease of use. The platform is designed to be user-friendly and accessible to people with little or no programming experience. Arduino boards come in different size and shapes, with varying number of input and output pins, to fit different project requirements.

Arduino can be used to build a wide range of projects, from simple LED light that turn on and off to complex robots that respond to sensor inputs and perform complex task. Some common applications of Arduino include home automation, robotics, wearable technology, and interactive art installations.

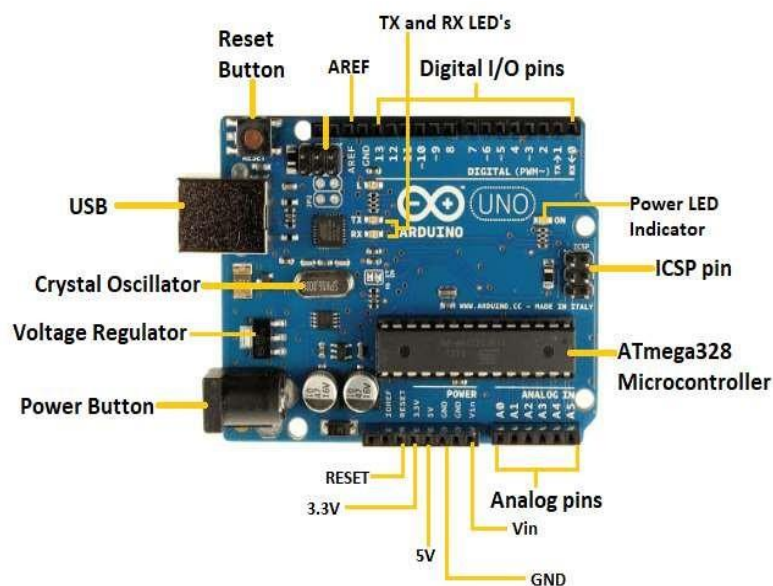


Fig 3.1 Arduino UNO

ATmega328 Microcontroller- It is a single chip Microcontroller of the Atmel family. The processor code inside it is of 8-bit. It combines **Memory (SRAM, EEPROM, and Flash)**, **Analog to Digital Converter**, **SPI serial ports**, **I/O lines**, registers, timer, external and internal interrupts, and oscillator.

ICSP pin - The In-Circuit Serial Programming pin allows the user to program using the firmware of the Arduino board.

Power LED Indicator- The ON status of LED shows the power is activated. When the power is OFF, the LED will not light up.

Digital I/O pins- The digital pins have the value HIGH or LOW. The pins numbered from D0 to D13 are digital pins.

TX and RX LED's- The successful flow of data is represented by the lighting of these LED's.

AREF- The Analog Reference (AREF) pin is used to feed a reference voltage to the Arduino UNO board from the external power supply.

Reset button- It is used to add a Reset button to the connection.

USB- It allows the board to connect to the computer. It is essential for the programming of the Arduino UNO board.

Crystal Oscillator- The Crystal oscillator has a frequency of 16MHz, which makes the Arduino UNO a powerful board.

Voltage Regulator- The voltage regulator converts the input voltage to 5V.

GND- Ground pins. The ground pin acts as a pin with zero voltage.

Vin- It is the input voltage.

Analog Pins- The pins numbered from A0 to A5 are analog pins. The function of Analog pins is to read the analog sensor used in the connection. It can also act as GPIO(General Purpose Input Output) pins.

2. Power supply

The board can operate on an external supply from 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

3. Ultrasonic sensor

An ultrasonic sensor is a device that uses sound waves with a frequency above the range of human hearing to detect objects and measure distances. These sensors work by emitting high-frequency sound waves from a transmitter and then measuring the time it takes for the sound waves to bounce back off of an object and return to the

sensor. By calculating the time delay between the emitted sound wave and the received echo, the sensor can determine the distance to the object.

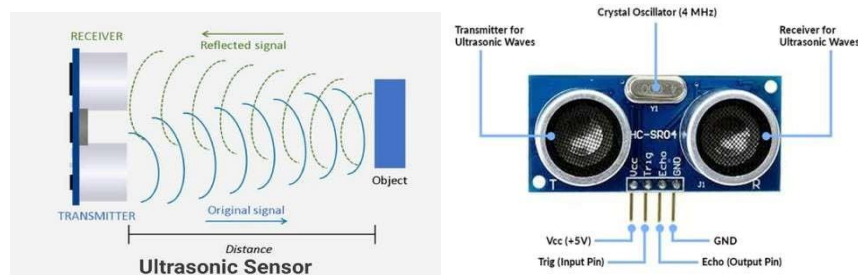


Fig 3.2 Ultrasonic sensor

Ultrasonic sensors are commonly used in a variety of applications, such as in robotics for obstacle avoidance and distance measurement, in automotive parking sensors, and in medical imaging for imaging internal organs. They are also used in industrial applications for level measurement, object detection, and distance measurement. There are different types of ultrasonic sensors available, including those that operate at a single frequency or those that use multiple frequencies, and those that have narrow or wide detection angles. Some sensors also have advanced features like temperature compensation, automatic gain control, and signal filtering.

4. Bluetooth

It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard, and many more consumer applications. It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions. It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network ([PAN](#)). It uses frequency-hopping spread spectrum ([FHSS](#)) radio technology to send data over air. It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART).

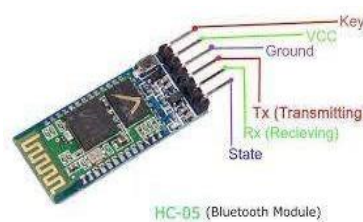


Fig 3.3 HC-05 Bluetooth Module

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration.

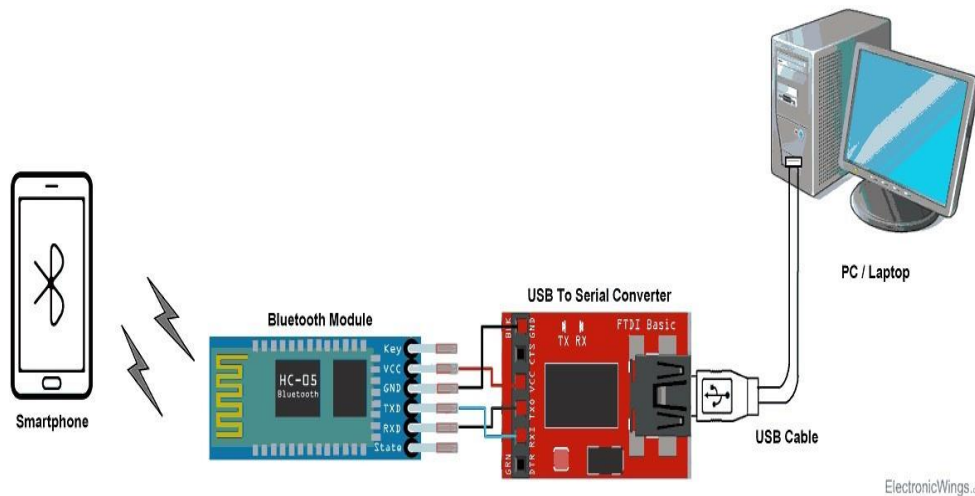


Fig 3.4 Bluetooth Module Serial Interface

HC-05 has **red LED** which indicates **connection status**, whether the Bluetooth is connected or not. Before connecting to HC-05 module this red LED blinks continuously in a periodic manner. When it gets connected to any other Bluetooth device, its blinking slows down to two seconds.

This module **works on 3.3V**. We can connect 5V supply voltage as well since the module has on board 5 to 3.3 V regulator. As HC-05 Bluetooth module has **3.3V level for RX/TX** and microcontroller can detect 3.3 V level, so, no need to shift transmit level of HC-05 module. But we need to shift the transmit voltage level from microcontroller to RX of HC-05 module.

The data transfer rate of HC-05 module can vary up to **1Mbps** is in the **range of 10 meters**.

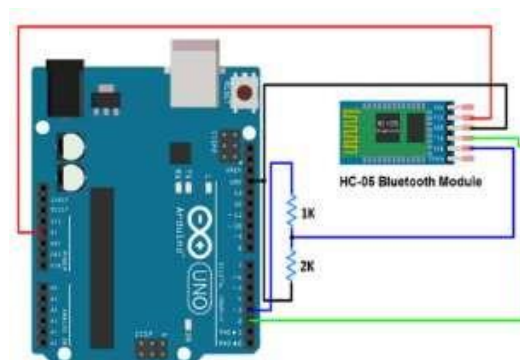


Fig 3.5 HC-05 Bluetooth Module interface with Arduino

5. ESP32-Cam Module

The ESP32-CAM module is a small-sized camera module that integrates an ESP32-S chip and a camera sensor. It allows for capturing and transmitting images and video over Wi-Fi or Bluetooth.

The ESP32-S chip is a powerful microcontroller with Wi-Fi and Bluetooth capabilities, making it ideal for Internet of Things (IoT) projects. It can run at up to 240 MHz and has 520KB SRAM and 4MB flash memory.

The camera sensor on the ESP32-CAM module is an OV2640, which is a 2-megapixel camera with an image sensor that supports up to 1600x1200 resolution. It can capture JPEG and BMP images and stream video in MJPEG or H.264 formats.

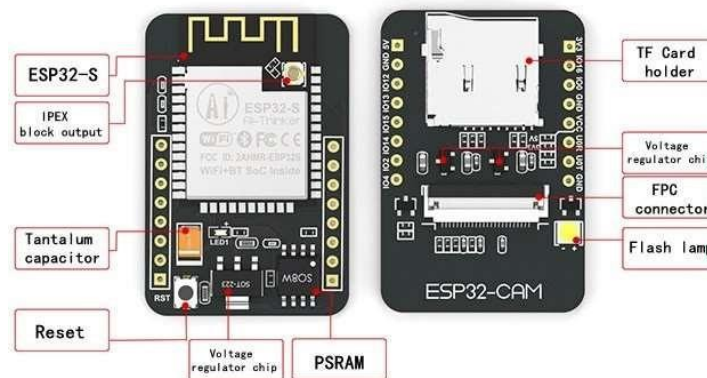


Fig 3.6 Esp32 Cam Module

The module also includes a microSD card slot, which can be used to store captured images or videos. The ESP32-CAM can be programmed using the Arduino IDE and supports a variety of libraries that make it easy to interface with the camera sensor and the Wi-Fi and Bluetooth modules.

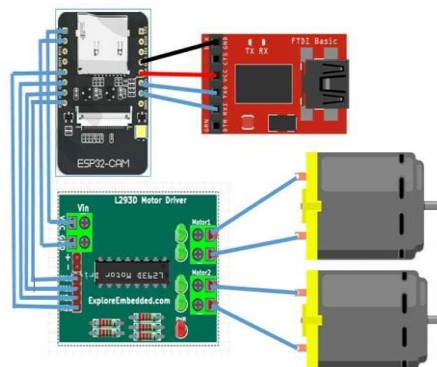


Fig 3.7Connections for ESP32- Surveillance Camera

Overall, the ESP32-CAM module is a powerful and versatile camera module that can be used in a wide range of projects, from home automation to robotics to security systems.

6. Led light

LED stands for "light-emitting diode". It is a type of semiconductor device that emits light when an electric current pass through it. LEDs are commonly used in a variety of applications, including lighting, displays, indicators, and more.

Compared to traditional incandescent bulbs, LEDs have several advantages, including lower energy consumption, longer lifespan, and smaller size. LEDs also produce less heat than traditional bulbs, making them more energy-efficient.

LEDs are available in a variety of colors, including red, green, blue, yellow, white, and more. The color of an LED is determined by the materials used in its construction. LEDs can be controlled with varying levels of brightness using pulse-width modulation (PWM) techniques. This allows for smooth dimming and brightness control, making LEDs suitable for a variety of lighting applications.

Overall, LEDs are a versatile and energy-efficient lighting technology that has revolutionized the lighting industry.

7. L298 Motor Shield

L298 motor shield is a dual full bridge driver designed to drive inductive load i.e. stepper motor, relays & solenoids. It gives you the control to drive two DC motor with arduino microcontroller and provide you the royalty to control the direction and speed of the motor.

The L298 is an integrated monolithic circuit in a 15-lead Multiwatt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors.

Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage.

5V (from Arduino) Logic control voltage 4-8V ~ 35V (from external power source) motor driven voltage 36mA >= Logic supply current I_{ss} 2A >= motor driver current I_o 25W
Maximum power consumption (T=75°C) P_{WN}, PLL
Speed control mode High 2.3V <= V_{in} <= 5V Low -0.3V <= V_{in} <= 1.5V

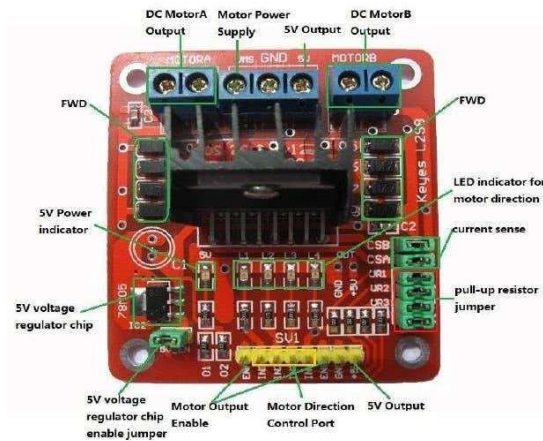


Fig 3.8 L298 Motor Shield

8. Motor driver module

A motor driver module is an electronic component used to control the movement of electric motors in various applications. The motor driver module consists of a microcontroller, a motor driver IC, and other associated circuitry. It is designed to accept input signals from a microcontroller or other control system and use those signals to control the speed and direction of one or more electric motors.

The motor driver IC is a critical component of the motor driver module, and it is responsible for translating the input signals into the proper output signals to control the motor. The motor driver IC can control various types of motors, including DC motors, stepper motors, and servo motors.

Motor driver modules come in various configurations, depending on the application requirements. Some motor driver modules are designed to control one motor, while others can control multiple motors simultaneously. They can also have different voltage and current ratings, which determine the size and type of motor that can be controlled.

Motor driver modules are widely used in robotics, automation, and other applications that require precise control of motor movement. They are an essential

component in many modern devices, including drones, 3D printers, and CNC machines.

9. Dc Motors

A DC motor, or a direct current motor, is a type of electric motor that converts electrical energy into mechanical energy. DC motors operate on the principle of electromagnetism, where a current-carrying conductor (usually a wire) placed in a magnetic field experiences a force that causes it to rotate.

DC motors consist of two basic parts: a stator (the stationary part) and a rotor (the rotating part). The stator contains a set of magnets or electromagnetic coils that produce a magnetic field, while the rotor contains a set of conductors that are arranged in such a way that they rotate when subjected to the magnetic field.

When a DC voltage is applied to the motor, a current flows through the conductors in the rotor, creating a magnetic field. This magnetic field interacts with the magnetic field of the stator, causing the rotor to rotate. By controlling the voltage and current applied to the motor, the speed and torque of the motor can be adjusted.

DC motors are widely used in various applications, including industrial machinery, electric vehicles, robotics, and more. They are popular due to their simplicity, reliability, and ease of control. They can also be used with a motor driver module to enable precise control over speed and direction. DC motors come in various sizes and types, including brushed and brushless DC motors, which have different characteristics and are used for different applications.

10. LDR sensor

An LDR (Light Dependent Resistor) sensor is a type of photoresistor that changes its resistance in response to changes in light levels. LDR sensors are often used in light-sensitive devices, such as automatic street lights, outdoor advertising billboards, and ambient light sensors in smartphones.

LDRs are tiny light-sensing devices also known as photoresistors. An LDR is a resistor whose resistance changes as the amount of light falling on it changes. The resistance of the LDR decreases with an increase in light intensity. This property allows us to use them for making light sensing circuits.



Fig 3.9 LDR Sensor

The resistance of an LDR sensor decreases as the amount of light falling on it increases, and increases as the light decreases. This property makes LDR sensors useful in detecting the intensity of light in a given environment. LDR sensors can also be used to distinguish between light and dark environments, making them useful in applications such as automatic lighting systems and security systems.

LDR sensors are relatively simple and inexpensive, making them popular in a wide range of applications. They are often used in combination with other sensors, such as temperature and humidity sensors, to provide more accurate data for environmental monitoring and control.

CHAPTER 4

DESCRIPTION OF PROPOSED SYSTEM

4.1 METHODOLOGY WITH BLOCK DIAGRAM

Any robot's structure, or body, on which its whole control circuits and actuators are to be attached, is a basic requirement. The fundamental goal of our design is to move the device in response to the button. As a result, we created a simple robot that can go forward, backward, left, and right by simply pressing a button.

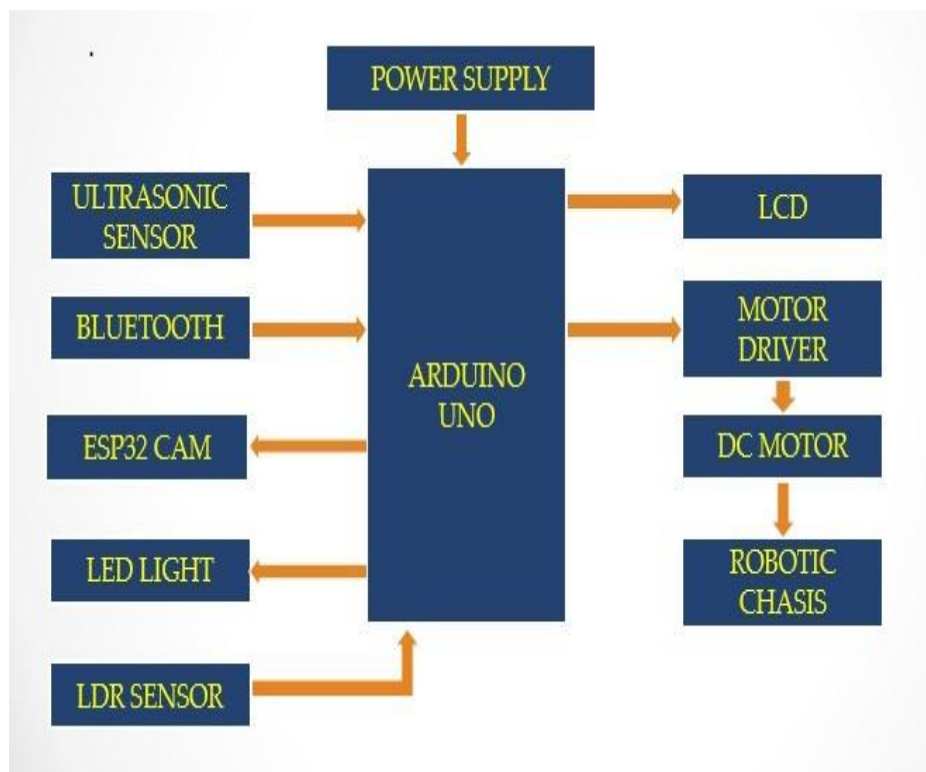


Fig 4.1 System Block Diagram

The surveillance bot ESP32-CAM module has an ESP32-S processor, an OV2640 camera, and a microSD card slot. Images captured by the camera can be stored on a MicroSD card slot. The HTTP communication protocol will be utilized to receive video streaming from the OV2640 camera via a web browser in this case. As indicated in the image above, the web page will also feature buttons to move the car in the Left, Right, Forward, and Reverse directions. Disconnect GPIO 0 from GND after uploading the code. Use a baud rate of 115200, open the Serial Monitor. On the ESP32-CAM, press the RST button on the on-board RST button.

The IP address of the ESP32-CAM should be displayed in the Serial Monitor. Remove the FTDI programmer from the ESP32-CAM. Connect the ESP32-CAM to the Pan/Tilt platform again, switch on the power, and hit the RST button on the ESP32- CAM on-board.

You should open up your router settings. There you will find some settings, including something along the lines of Forwarding or Port Forwarding. The important thing to note here is the "Port Range" and the "Device" or "IP address". In "Port Range" you should type 80-81. For "Device" you should select your ESP32-CAM device. In some routers you should put the IP address of your ESP32- CAM instead of a device name.

The live video captured by the camera will be sent to the android application by which we will decide the movement of our vehicle.

4.2 EXISTING SYSTEM:

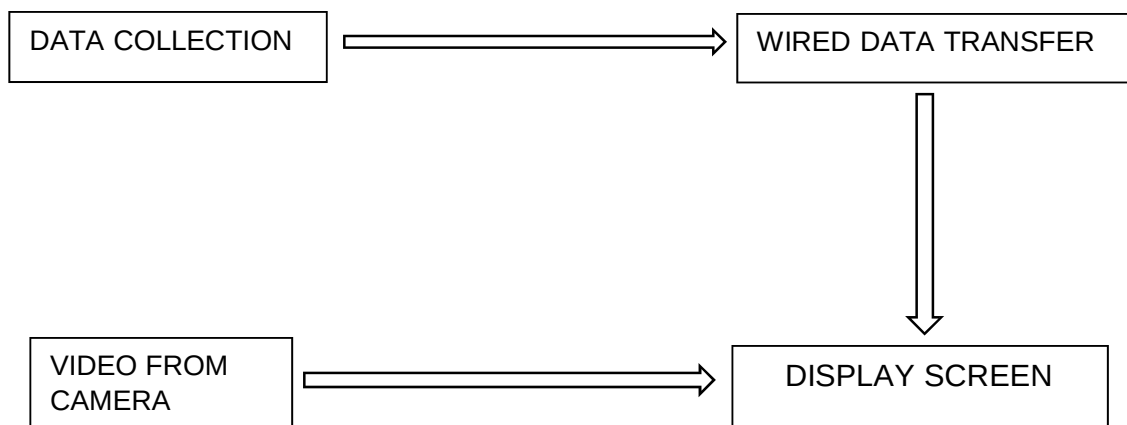


Fig 4.2 Existing System Block Diagram

- Earlier robotic car was only used for driving or racing purpose.
- The communication between the receiver and transmitter is not accuracy or stable.
- Range of transmitting the signal is low
- The battery used in the existing system is non-reusable.
- This model can be accessed using either computer application or transmitter joy stick

4.3 PROPOSED SYSTEM:

- It can be used for both surveillance and patrolling the area.
- The improved version of camera is used in the robot for clear and high-quality video transmission.
- Reusable and durable batteries are used in the robot for long time running of the system.
- With internet facility it can be controlled using a browser itself with the help of URL.
- Lighting system is also used in this model for better video delivery.
- Communication between the transmitter and receiver is stable and can be controlled for long range.

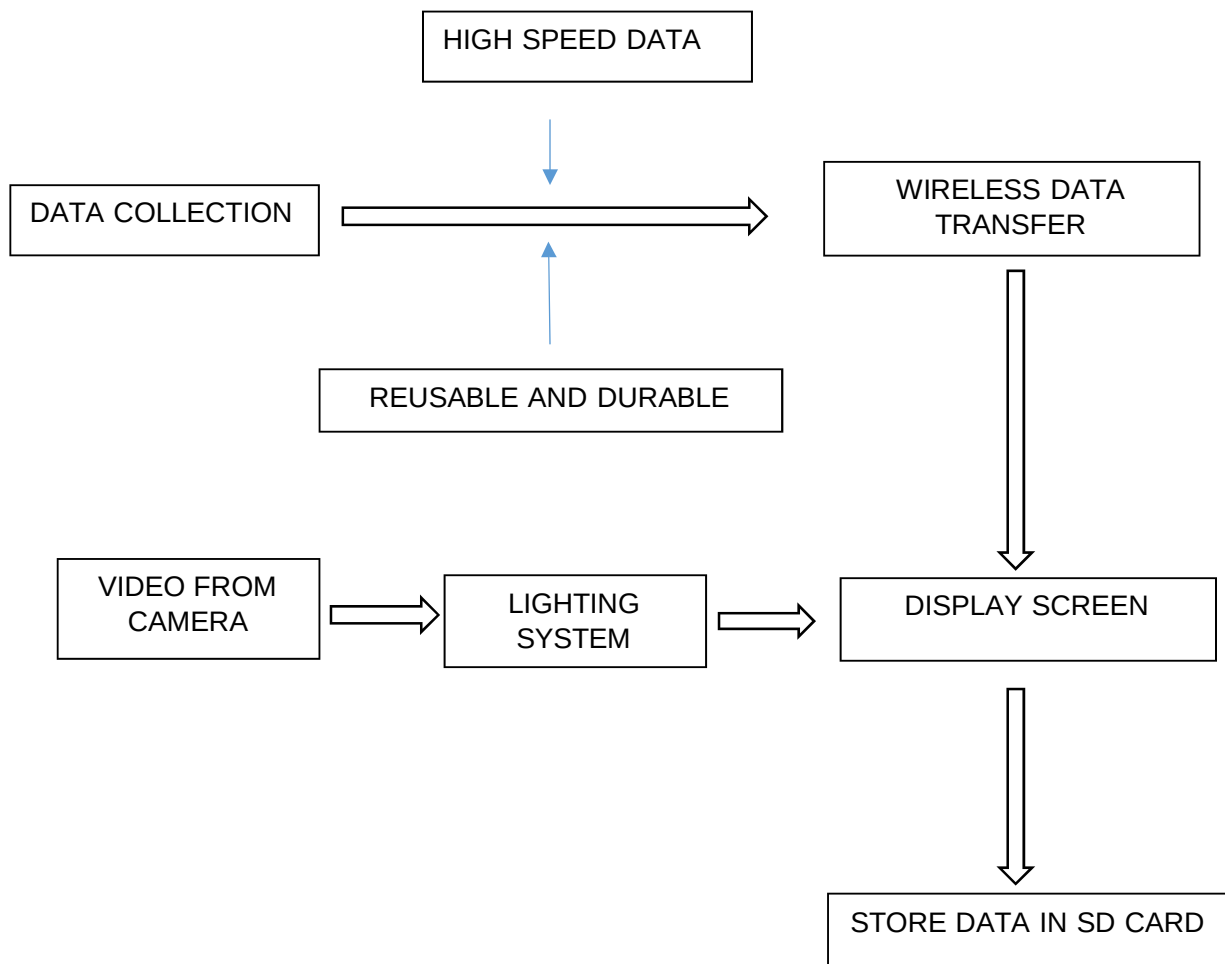


Fig 4.3 Proposed System Block Diagram

4.4 SOFTWARE TO OPERATE PLAN

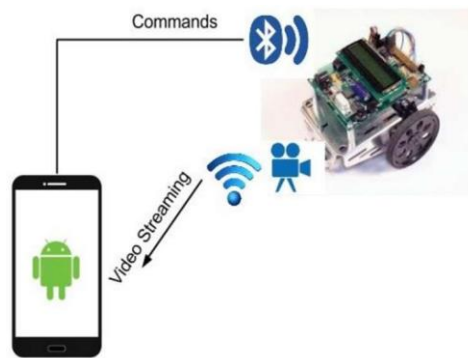


Fig 4.4 Software Architecture Design

IDE, which stands for Integrated Development Environment, is an official Arduino.cc software that is primarily used for authoring, building, and uploading code to the Arduino device. Almost all Arduino modules are compatible with this open source software, which is simple to install and begin compiling code on the fly.

Arduino mega board is used for the robot. A Bluetooth module is connected to the Arduino board. The android application establishes a connection with the Bluetooth module on the Arduino board. Once connection is successfully established, the user can send controlling commands through the GUI of the android application. The command sent from the mobile application is received by the Bluetooth module which transmits it through serial communication to the Arduino board.

Python programming language used in writing the codes in Arduino IDE platform. The 4-Channel RF module initiates whatever decision microcontroller takes. The microcontroller executes action to effect motor driver that controls the wheels. The sequence of operations starts from the RF module to the Arduino Uno, to the motor driver and finally, to the wheels.

CHAPTER 5

IMPLEMENTATION DETAIL

5.1 DEVELOPMENT AND DEPLOYMENT SETUP

The project is designed to control a robotic vehicle using an android application. Bluetooth device is interfaced to the control unit on the robot for sensing the signals transmitted by the android application.

PHASE I: DESIGN OF MECHANICAL SYSTEM OF THE ROBOTIC CAR:

- Designing the circuit of the robotic car with lighting system.
- Now the components are connected accordingly based on the circuit design.
- At the end of phase 1 the mechanical system of the robotic car is completed.
- Testing and validation is done at the end of phase.

PHASE II: DESIGN OF CAMERA SYSTEM WITH SENSORS USING ARDUINO UNO:

- Now the camera system of the robotic car along with sensors is connected to main system using Arduino Uno microcontroller.
- At the phase 2 the camera system with sensors is connected to main system of the robotic car.
- Testing and validation is done at the end of the phase.

PHASE III: DESIGN OF ANDROID APPLICATION AND FINAL EXECUTION OF THE ROBOTIC CAR WITH LIGHTING SYSTEM:

- Now an android application is designed and implemented to control the robotic car system.
- Final testing and validation are done at the end of the phase.

INSTALL THE FOLLOWING LIBRARIES IN THE ARDUINO IDE

- AsyncTCP Library
- ESPAsyncWebServer Library

5.1.1 INSTALLING ESP32 BOARD ON ARDUINO IDE

We will program the ESP32-CAM using Arduino IDE. For that, we have to install the ESP32 add-on on Arduino IDE.

To install the ESP32 board in your Arduino IDE, go to File> Preferences

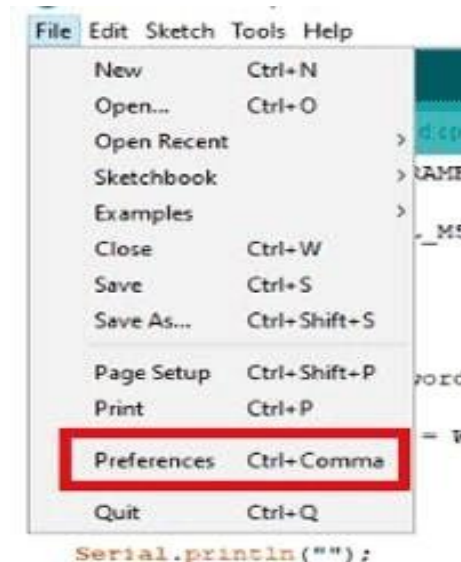


Fig 5.1.1 Step 1 Installing ESP32 board

Now copy the below link and paste it into the 'Additional Board Manager URLs' , as shown in the image below. Then, click the "OK" button:

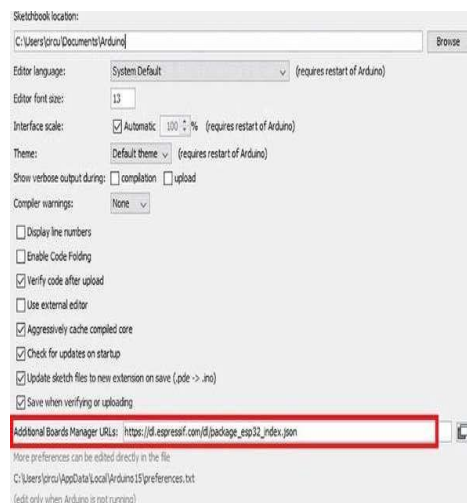


Fig 5.1.2 Step 2 Installing ESP32 board

https://dl.espressif.com/dl/package_esp32_index.json

Now go to Tools > Board > Boards Manager

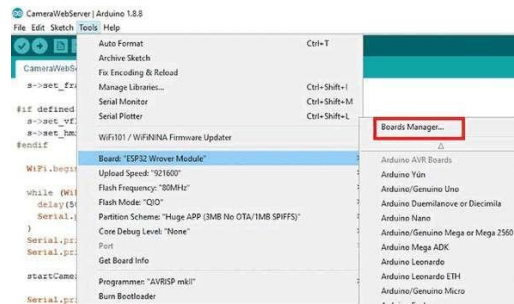


Fig 5.1.3 Step 3 Installing ESP32 board

In Boards Manager search for ESP32 and install the “ESP32 by Espressif Systems”.

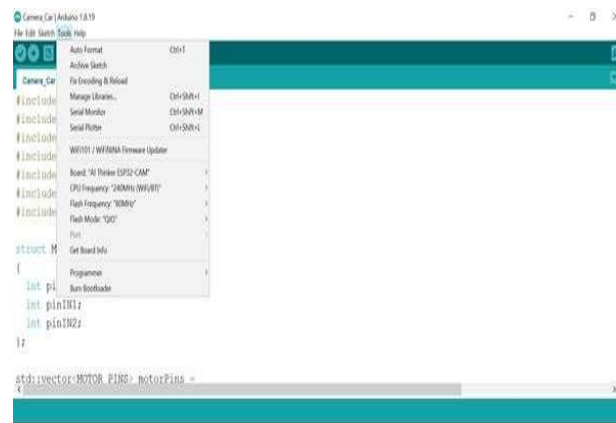


Fig 5.1.4 Step 4 Installing ESP32 board

Install the latest version of it. Apply all the settings shown in the picture below.

Now you are ready to upload the code.

5.2 ALGORITHMS

The firmware code is the program that drives the microcontroller board. The firmware code of the designed system was written following these steps:

Step 1: Execute Single loop run-time process

Step 2: Ask or wait for remote input

Step 3: Is there Remote input?

Step 4: If No, go back to step 2; if yes, go to step 5

Step 5: Check which button was pressed

Step 6: Check how the button was pressed; Long press or short press

Step 7: If long press, go to 8; if short press go to 9

Step 8: Call up function/process assigned to short press of a particular button input remote.

Step 9: If Transistor-Transistor Logic protocol is ON, activate streaming at a static IP address.

5.3 TESTING

5.3.1 Remote Control Distance Test

Before the system is coupled, the remote sensing module was tested to ensure that all four channels are in good working condition. The four channel 433MHz RF module has an inbuilt reliability test to ensure that it is in proper working conditions. The Receiver module has an inbuilt LED, which is connect to the four channels. When a Channel button is pushed on the Transmitter module, the corresponding LED is turned ON.

5.3.2 Mobility Test

The mobility test was done to determine the effectiveness of the motor driver IC deployed to perform the mobility operation. The four output pins of the Motor Driver Module were read with a multimeter to ensure that the switching operation was done accurately. The common the terminal of the multimeter was placed on the ground pin of the Arduino Uno microcontroller, and the signal the terminal connected to the output pins of the motor driver IC.

5.3.3 ESP32 setup & Wi-Fi connectivity test

The Arduino IDE was configured to be compatible with the ESP32 CAM board for effective code upload. The IDE was configured by installing a JSON file in the “Additional Board Manager URLs” field located in the “preferences” section’s dialogue box. The Wi-Fi configuration code was uploaded to the board through Local Area Network (LAN) setup. The ESP32 board runs the Wi-Fi code successfully which automatically connected to the LAN.

5.3.4 ESP32 CAM board camera test

The ESP32 CAM board camera was tested also. The IP address of the robotic vehicle changes as network disconnection and reconnection. This was not seen as a problem because the system alerts the control station (connected phone or laptop) to the change and sends the new IP address.

5.4 Application

There are many situations, like mining accidents, urban disasters etc., that require the usage of remotely controlled surveillance robots for assessing the harm and developing the strategy, for viable access points and evacuation exits required to face the task and save lives. Human surveillance is carried through skilled work forces in close sensitive regions of war area or adversary territory in order to constantly look for changes. Whereas there's usually added risks of losing work force in the time of getting caught by the adversary. With developed technology in pasted years, there it is possibility to keep the important regions under surveillance remotely by the use of robots instead of human. Some regions want to be positioned under video surveillance for a brief time, and consequently equipping them with desk bound CCTV systems isn't always viable. Such demanding situations regularly rise up in agricultural settings. For example, the fields may only need to be positioned under video surveillance whilst the vegetation are attaining maturity. Surveillance of pastures is effective only when farm animals are roaming round them. In addition, pastures, fields, and hills which can be most desirable for surveillance do now no longer, in maximum cases, have an energy supply. For the agricultural sector, cellular video surveillance by the usage of the

Surveillance Robot Car is a lot more helpful than opting for desk bound surveillance structures. Mobile robots do now no longer require setting up highly-priced infrastructure, setting up poles, or laying down cable and hence becomes much more convenient and economical.

CHAPTER 6

RESULT AND DISCUSSION

The surveillance robot will be designed to deliver a reasonable level of efficiency and simplicity, providing each user with a streamlined user experience. The surveillance robot is aimed at providing monitoring inclusive of vision, motion. The surveillance robot can be customized to fuse seamlessly to any warehouse, go down or multi dwelling units. Based on modular designs and complete scalability, the surveillance robot is designed to be expandable and allow for future control upgrades, thus enhancing the accessibility of the user and providing an efficient way out of the tradition system

In this research paper we have mentioned that our system is designed consisting following components such as, a LED light, LDR sensor, an ultra-sonic sensor and a Arduino UNO. The developed system was tested by placing obstacle at various distances across its path. The responses of sensors were evaluated individually, since they were positioned on different part of autonomous car.

The accuracy and probability of failure are given as:

$$T_0 = A_1 + A_2$$

$$A_1 = A_2 = O_a / T_0$$

Where,

A_1 = Accuracy of LDR sensor

A_2 = Accuracy of the ultrasonic sensor

O_a = Total number of obstacles divided

T_0 = Total number of obstacles detected

The Probability of failure (P_f) given as:
$$\frac{\text{Total number of Failed Detection and avoided}}{\text{Total number of objects detected}}$$

The percentage (%) accuracy and probability of failure is calculated as follows:

$$\% \text{ Accuracy} = (17/20) * 100 = 85\%$$

$$P_f = 3/20 = 0.15$$

Therefore, an accuracy and the probability of failure of 85% and 0.15 were obtained.

We have two results i.e. the hardware and the software result. The hardware includes the robot which runs on DC motors. The input to the motors is provided by the

L293D motor driver shield. The input to the driver shield is provided by the Arduino board.

The navigational inputs are given by the user to the Arduino board using the android application via Bluetooth. The Arduino board, on receiving the signal, processes it and produces the appropriate output. The communication between the android application and the Arduino board takes place using the Bluetooth module which is interfaced with the Arduino board. It provides serial communication between the application and the Arduino.

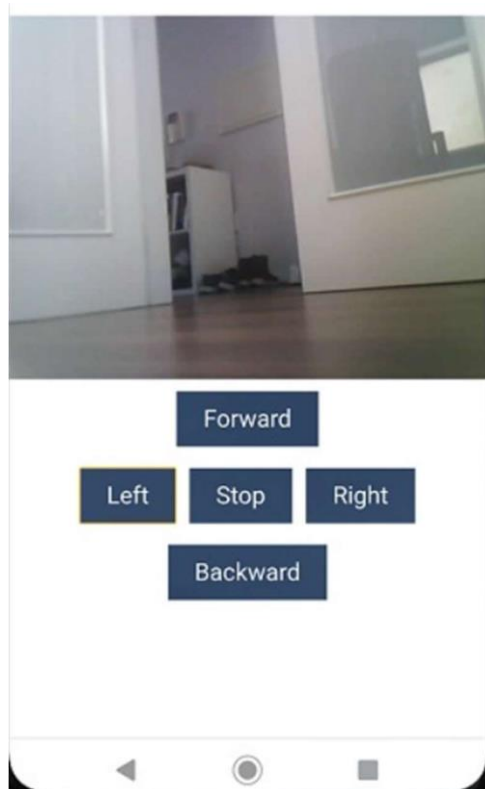


Fig 6.1 ESP-32 Cam Result

The major goal of this study is to create a method for conducting surveillance investigations in residential settings. Nowadays, mechanisms play an important part in our day-to-day operations, decreasing human labor and mistake.

Robots can be operated manually or automatically, depending on the situation. This mechanism is designed to wander around and collect audio and video data from the environment before sending it to the user. During this project, the mechanism will be controlled by a mobile or portable computer via the Internet of Things (IoT), and live video streaming will be available both during the day and at night thanks to a wireless camera provided by the Rover. The ESP 32 camera chipset interfaces with the mechanism, allowing it to be operated manually through a Wi-Fi network.



Fig 6.2 Hardware Output

Robot vehicle Motion Models	Wheel configuration			
	Multi meter reading for each wheel: Voltage(V)			
	Right 1	Right 2	Left 1	Left 2
Forward Motion	4.95	0	4.97	0
Reverse Motion	0	4.85	0	4.91
Right Turn	2.45	0	4.95	0
Left Turn	4.98	0	2.37	0

Table 1: Test Results for the motor driver IC setup

CHAPTER 7

CONCLUSION

7.1 CONCLUSION

One of the main goals of an autonomous vehicle is to find an obstacle and keep track of the robot and the lane. The literature's various studies and research have been categorized and summarized in this chapter according to the methodology and application of a particular technique. The navigation radar robot will be built with a reasonable amount of efficiency and ease of use in mind, making it easier for each user to use. This project will be helped in hostile environment, defence and security sector of the country. Navigating through a cluttered environment in search of the best route from the starting position to the target position is the goal of navigation. The robot's surroundings are continuously monitored by a camera, which transmits video data to the control panel. The use of this navigation robot is to provide motion and vision monitoring.

In this work, the framework for creating a automaton for police work purpose is proposed. It overcomes the matter of restricted vary police work by mistreatment the concept of IOT. The automaton will be controlled with the assistance of mobile manually. Our projected automaton is tiny in size so maneuvering into space wherever human access is not possible. Wireless technology is one in every of the foremost integral technologies within the natural philosophy field.

This technology is employed is a supreme a part of police work act. This provides extremely economical and a price effective automaton that replaces human work and reduces human labor and performing observance works during a well effective manner. Certain places are only for gathering information and monitoring, thus this surveillance car bot can surely be used; with advanced upgrades, we can provide data instantly and carry out military action as needed. The roots of foundation of robotics belong back in 1950s; more than six decades has passed since then, and robotic evolution has been running unparalleled. Today we can feel the presence of robots everywhere and in every field whether it is medical, military, education or governance and so on.

7.2 FUTUTE WORK

In any circumstance involving technology nowadays is a must, robots is one of the future necessity, virtual safety is a requirement. Regularly Patrolling the streets to keep people safe and assist in notifying the authorities as soon as possible.

There is a very slim probability of receiving inaccurate or biased information. Identifying, collecting, and rapidly submitting information to authorities if it matches any person's criminal history in its criminal database. For instance, if some criminal is on the run, the bot can send police a message with its last location. It can be used to monitor traffic rules, persons wearing helmets or not, and car seat-belts. In Covid circumstances, people wear masks and maintain social distance.

Surveillance is needed in almost every field. It could be a great solution to various problems or situation where wireless Surveillance is needed our project has tremendous scope as it uses the latest technology in the market. Our application uses the android OS which is currently the most used OS and also has a great future scope. The Surveillance robot can be controlled remotely using the android application; this gives it a huge scope for future application. Using real-time servers, to control the robot from anywhere in the world. We can create self-propelled patrolling robots that move at regular intervals without the need for an android application to operate them.

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APPENDIX

A. SOURCE CODE

```
//L293 Connection
const int motorA1 = 3;
const int motorA2 = 4;
const int motorAspeed = 5;
const int motorB1 = 7;
const int motorB2 = 8;
const int motorBspeed =6;

//Useful Variables
int state;
int vSpeed=200; // Default speed, from 0 to 255
void setup() {
  // Set pins as outputs:
  pinMode(motorA1, OUTPUT);
  pinMode(motorA2, OUTPUT);
  pinMode(motorB1, OUTPUT);
  pinMode(motorB2, OUTPUT);

  // Initialize serial communication at 9600 bits per second:
  Serial.begin(9600);
}
void loop() {

  if(Serial.available() > 0){
    state = Serial.read();
  }
  Serial.println(state);
  //Change speed if state is equal from 0 to 4. Values must be from 0 to 255 (PWM)
  if (state == '0'){
    vSpeed=0;}
  else if (state == '1'){
```

```

vSpeed=100;}
else if (state == '2'){
vSpeed=180;}
else if (state == '3'){
vSpeed=200;}
else if (state == '4'){
vSpeed=255;}
//If state is equal with letter 'F', car will go forward!
if (state == 'F') {
digitalWrite (motorA1,LOW);
delay(1);
digitalWrite(motorA2,HIGH);
delay(1);

digitalWrite (motorB1,LOW);
delay(1);
digitalWrite(motorB2,HIGH);
analogWrite (motorAspeed, vSpeed);
analogWrite (motorBspeed, vSpeed);
}
//If state is equal with letter 'I', car will go forward left
else if (state == 'I') {
digitalWrite (motorA1,LOW);
delay(1);
digitalWrite(motorA2,HIGH);
delay(1);

digitalWrite (motorB1,LOW);
delay(1);
digitalWrite(motorB2,HIGH);
analogWrite (motorAspeed, 0);
analogWrite (motorBspeed, vSpeed);
}
//If state is equal with letter 'G', car will go forward right

```

```

else if (state == 'G') {
digitalWrite (motorA1,LOW);
delay(1);
digitalWrite(motorA2,HIGH);
delay(1);

digitalWrite (motorB1,LOW);
delay(1);
digitalWrite(motorB2,HIGH);
analogWrite (motorAspeed, vSpeed);
analogWrite (motorBspeed, 0);
}
//If state is equal with letter 'B', car will go backward
else if (state == 'B') {
digitalWrite (motorA1,HIGH);
delay(1);
digitalWrite(motorA2,LOW);
delay(1);

digitalWrite (motorB1,HIGH);
delay(1);
digitalWrite(motorB2,LOW);
analogWrite (motorAspeed, vSpeed);
analogWrite (motorBspeed, vSpeed);
}
//If state is equal with letter 'J', car will go backward left
else if (state == 'J') {
digitalWrite (motorA1,HIGH);
delay(1);
digitalWrite(motorA2,LOW);
delay(1);

digitalWrite (motorB1,HIGH);
delay(1);

```

```

digitalWrite(motorB2,LOW);
analogWrite (motorAspeed, 0);
analogWrite (motorBspeed, vSpeed);
}
//If state is equal with letter 'H', car will go backward right
else if (state == 'H') {
digitalWrite (motorA1,HIGH);
delay(1);
digitalWrite(motorA2,LOW);
delay(1);

digitalWrite (motorB1,HIGH);
delay(1);
digitalWrite(motorB2,LOW);
analogWrite (motorAspeed, vSpeed);
analogWrite (motorBspeed, 0);
}
//If state is equal with letter 'L', wheels will turn left
else if (state == 'L') {
digitalWrite (motorA2,HIGH);
delay(1);
digitalWrite(motorA1,LOW);
delay(1);

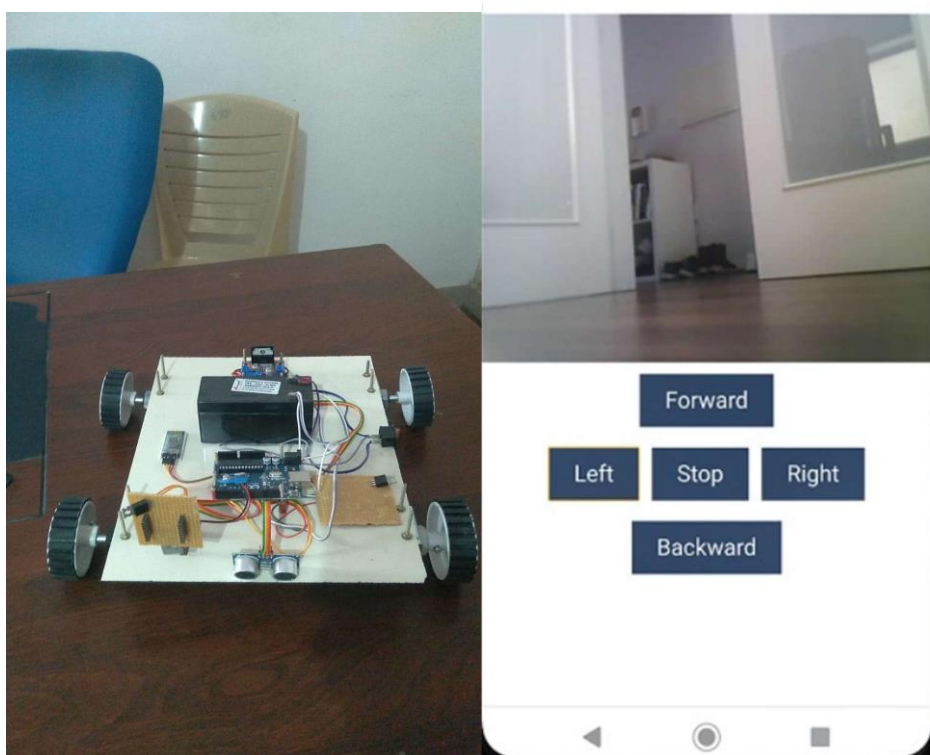
digitalWrite (motorB2,LOW);
delay(1);
digitalWrite(motorB1,HIGH);
analogWrite (motorAspeed, vSpeed);
analogWrite (motorBspeed, vSpeed);
}
//If state is equal with letter 'R', wheels will turn right
else if (state == 'R') {
digitalWrite (motorA2,LOW);
delay(1);

```

```
digitalWrite(motorA1,HIGH);  
delay(1);
```

```
digitalWrite (motorB2,HIGH);  
delay(1);  
digitalWrite(motorB1,LOW);  
analogWrite (motorAspeed, vSpeed);  
analogWrite (motorBspeed, vSpeed);  
}  
//If state is equal with letter 'S', stop the car  
else if (state == 'S'){  
analogWrite(motorA1, 0); analogWrite(motorA2, 0);  
analogWrite(motorB1, 0); analogWrite(motorB2, 0);  
}  
}
```

B. SCREENSHOTS



OUTPUT SCREENSHOT



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Navigation Radar Robot Car

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Abstract: Navigation process extremely use for examining the area, people, etc. This intensively used for military purpose, as we know, for the safety of the nation's border and enemy territory surveillance is crucial. The radar technology is used for monitoring the area, with the help of radar we can detect the presence object. Navigation is completed through the usage of deploying employees close to sensitive areas to continuously display for changes. The primary objective of developing this robot was to reduce the risk of human life by keeping an eye on human activities on the battlefield or learning about the situation in the event of a disaster.

The robot with the digital camera with multi-sensor capabilities, night vision, and wireless real-time video transmission. With the assistance of IoT technology, this robot is collected data from remote terrain and monitor that data in a far more secure location. Because of its adaptability to changing needs and simplicity, it is frequently utilized. In robotic car high-speed image transmissions are essentially used to transmit video. The robotic will function a suitable gadget for the protection region and also will prevent unwanted activities. Before entering the territory, the robot will assist the police or military/armed forces in determining its condition.

Keywords: *Arduino, Bluetooth module, Ultrasonic Sensor*

I. Introduction

Nowadays, robots are being used as a platform to create or discover machines that make human work easier. The term "robot" refers to an intelligent machine designed to assist humans in nearly all relevant and nonrelevant fields. The robots have no predetermined shape and have not been designed for any particular work or field. They can be made or changed into any shape, depending on where they are

used. Most likely, additional technologies are used to create robots today, such as connection-oriented. Robots are being built using a wireless connection as their sole motivation. Additionally, various situations and regions describing various difficulties can be easily monitored with the assistance of surveillance motives.

We have therefore implemented a wireless surveillance robot to effectively monitor environmental conditions in order to improve these features, with the help of navigation system different situations and area describing various difficulties can be monitored without difficulties. Consequently, to enhance these features in better manner, capabilities we use wi-fi in surveillance robot to monitor the situation.

II. Aim and Objective

The existing system includes a robot that works the same as other traditional robots and has a lot of drawbacks, such that a robot working within specific means of technology, false reliability, etc. In addition, addressing and resolving the issue takes a lot of time. The robot solves the aforementioned problems in the work we propose. It is extremely useful for monitoring areas without an internet connection as well as in the event of a disaster when the communication system fails.

- Classification of objects distinction between humans and object.
- Suitable for outdoor and indoor (independent from light and weather conditions).
- Anonymous movement tracking of persons or object.
- Can be controlled using mobile phone.

- Can be used to complete tasks that cannot be completed by humans.

Robots are frequently used to perform tasks that could be done by humans. Nevertheless, there are numerous reasons why robots outperform humans at certain tasks. In the same way, this project gives a wireless robot a better way to monitor the environment and deal with difficult situations. Besides this, the obvious gain of no longer having to hazard any employees, land, and air, this robot also can search for information that is not seen by humans. It's far feasible to achieve distance information to a particular area by offering high-decision cameras and numerous sensors.

III. RELATED WORK

Using Ultrasonic Sensor and Arduino Uno, many projects have been designed to use for navigating the area.

G.R.Sri Sudharsna and A.Srinivasan, designed a wireless video surveillance system. In his line of employment, video surveillance is crucial to security measures. The current surveillance structures will be substituted by WIFI video surveillance. The proposed video surveillance robots are movable in any direction and actively stream the recorded footage there, according to the website's instructions.

Two software modules, "MOTION" and "FLASK," are combined in order to obtain the live streaming and send commands to the Raspberry Pi from the website. It can be used in small-scale navy applications as well as home and resort monitoring systems. Due to its design, this robotic can be accessed from anywhere. Insurance options for video surveillance are unrestricted because of the robot's mobility. The two halves of the device are the software segment and the hardware segments. The hardware phase includes the Raspberry Pi robot setup, while the software phase includes the HTML and the Python code. Python code should contain a link to the robot controls in HTML code. This robot includes a component called the Raspberry Pi three model B. In order to make live streaming possible by processing the HTML code, this was used to process the code and send signals to the Motor Driver IC L293D regarding the robot's motion direction. It is also connected to Web Camera. The power bank might be able to supply power.

V. R. Ratnaparkhe and Ashish U. Bokade created the video surveillance robot. In his work, he developed a software based on the Android platform for controlling a wireless robot for surveillance. The Android app will launch a website with buttons to control robotics and a digicam and a video display screen for surveillance.

The wifi is connected to both the smartphone and the Raspberry Pi board. The robot moves as a result of a wireless command sent by an Android phone and received by a Raspberry Pi board. The MJPG streamer program is used to stream the video. It takes mjpeg data and sends it over an HTTP session. Python is the programming language for the Raspberry Pi. The experimental outcome demonstrates that the video streamed at a rate of up to fifteen frames per second.

The IoT-based Spy Robot Surveillance System was developed by Apsara, Amrithha, Ramya, and R. Chitra. The device is made up of two parts: software and hardware devices. The software comes with a website that gives you the personal interface you need to manually control the robot's movements, get records from the hardware module, and let the user know if there are any intruders. The prototype of the transferring robot is the hardware, which is used to sense, take pictures, and send the records it captures over the Internet of Things. The Raspberry Pi three microcontroller is used to particularly manage the hardware. All of the robot module's capabilities, including sensing, moves (both independent and guided movements), statistics transmission, digicam manipulation, and user-module communication, are managed by this far-flung brain. It transmits information via LAN, Bluetooth, GSM, and the internet, making it a wireless computer. The robot's actions are controlled by two DC motors that are connected to the Raspberry Pi three board. A battery provides power to the module. A webpage and an Android application are also used to implement the robotic base module, through which the robot can be controlled. The buttons on the website are used to control the robotic. The website also provides facilities for vehicle-pilot and live to stream. A personal home page and an exclusive programming language, HTML, are used to build the website. PHP is used for backend operations, while HTML is used for frontend components. The user receives the captured image as an email attachment as a result of the robot's camera setup. The mail identification that was provided is frequently detected by the SMTP module that was programmed into the Raspberry Pi.

Surveillance System Using Robotic Car by Neha Joisher K.J Somaiya. In this paper control vehicle that has a view through a connected digital camera. In this challenge, you must control a remote-controlled vehicle from a computer in a faraway location. Through a camera that is mounted on the vehicle, it is possible to drive the vehicle remotely while simultaneously observing its perspective.

This may make it possible for us to exert pressure on the car wherever it is able to connect to the Wi-Fi. In all likelihood, you will be able to force this operation and control the auto-out of your laptop wherever that wifi sign is visible.

Kim Kyunghoon, Bae Soonil, and Kwanghak Huh presented "Intelligent surveillance and security robot systems," which was published on October 28, 2010, during the Seoul, South Korea, IEEE Workshop on Advanced Robotics and its Social Impacts. The presentations for this paper are also expensive. Another issue is that the signal strength may not be strong enough to reach all of the location's areas, making it impossible to monitor them all. Bad weather may also make it harder for these systems to send signals. The proposed system will address the shortcomings of a new security solution that combines robot technology, intelligent algorithms, and vision. In contrast to conventional security solutions, which rely on the vigilance of camera images by human operators, the proposed solution 20 uses machine intelligence to compensate for human factors and robots to provide immediate counter-response.

IV. DESCRIPTION OF PROJECT

EXISTING SYSTEM:

- In the past, riding, and gaming were the primary uses for robotic vehicles.
- The receiver and transmitter's data exchange are sluggish and inaccurate.
- There is a limited selection of signal transmission methods.
- The battery in the current device is disposable.
- This version is accessible via a transmitter joystick and a laptop application.

PROPOSED SYSTEM:

- This radar car used for both observation and patrolling the region.
- For accurate and high-quality video transmission, the robot uses an upgraded version of the camera.
- Reusable and durable batteries are used in the robot for the long-time running of the system.
- A lighting system is also featured in this model for improved video distribution, and it has internet functionality so that it can be managed directly from a browser with the support of a URL.

V. REQUIREMENTS

HARDWARE

Arduino UNO, Power supply, Ultrasonic sensor, Bluetooth, Esp32 cam module, Led light, LCD, Motor

driver module, Dc motors, Robotic chassis, LDR sensor

SOFTWARE

Arduino IDE

VI. METHODOLOGY

PHASE I: DESIGN OF THE MECHANICAL SYSTEM OF THE ROBOTIC CAR:

- Designing the circuit of the robotic car with the lighting system.
- Now the components are connected accordingly based on the circuit design.
- At the end of phase 1 the mechanical system of the robotic car is completed.
- Testing and validation are done at the end of the phase.

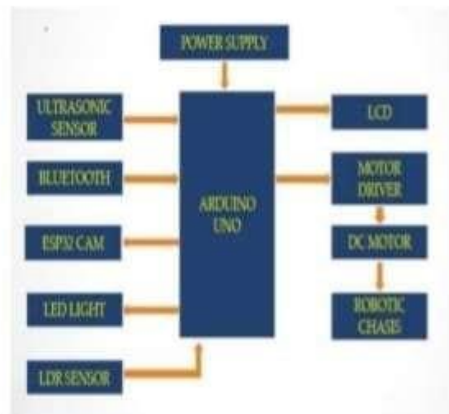
PHASE II: DESIGN OF CAMERA SYSTEM WITH SENSORS USING ARDUINO UNO: 25

- Now the camera system of the robotic car along with sensors is connected to the main system using an Arduino Uno microcontroller.
- In phase 2 the camera system with sensors is connected to main the system of the robotic car.
- Testing and validation are done at the end of the phase.

PHASE III: DESIGN OF ANDROID APPLICATION AND FINAL EXECUTION OF THE ROBOTIC CAR WITH LIGHTING SYSTEM:

- Now an android application is designed and implemented to control the robotic car system.
- Final testing and validation are done at the end of the phase

VII. BLOCK DIAGRAM



VIII. RESULT

The surveillance robot will be built with a reasonable amount of simplicity and efficiency in mind, making it easier for each user to use. The purpose of the surveillance robot is to provide motion and vision monitoring. The surveillance robot can be made to fit into any warehouse, shed, or complex with multiple units seamlessly. The surveillance robot is designed to be expandable and allow for future control upgrades based on modular designs and complete scalability. This makes it easier for users to use and provides an effective way out of the traditional system.

We have mentioned in this research paper that the components of our system are an LED light, an LDR sensor, an ultrasonic sensor, and an Arduino UNO. By placing obstacles at various distances along the system's path, it was tested. Because the sensors were on different parts of the autonomous car, their responses were evaluated one at a time.

The accuracy and probability of failure are given as:

$$T_o = A_1 + A_2$$

$$A_1 = A_2 = O_a / T_o$$

Where,

A₁ = Accuracy of LDR sensor

A₂ = Accuracy of the ultrasonic sensor

O_a = Total number of obstacles divided

T_o = Total number of obstacles detected

The Probability of failure (P_f) given as:

$$P_f = \frac{\text{The overall number of missed and avoided detections}}{\text{Total number of objects detected}}$$

The percentage (%) of accuracy and failure probability are computed as follows:

$$\% \text{ Accuracy} = (16.3/20) * 100 = 81.5\%$$

$$P_f = 3.7/20 = 0.18$$

Therefore, an accuracy and the probability of failure of 81.5% and 0.18 were obtained.

IX. CONCLUSION

One of the main goals of an autonomous vehicle is to find an obstacle and keep track of the robot and the lane. The literature's various studies and research have been categorized and summarized in this chapter according to the methodology and application of a particular technique. The navigation radar robot will be built with a reasonable amount of efficiency and ease of use in mind, making it easier for each user to use. This project will be helped in hostile environment, defence and security sector of the country. Navigating through a cluttered environment in search of the best route from the starting position to the target position is the goal of navigation. The robot's surroundings are continuously monitored by a camera, which transmits video data to the control panel. The use of this navigation robot is to provide motion and vision monitoring.

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