IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Design And Analysis Of IoT-Based Intelligent Robot For Real Time Monitoring And Control

SK.Rasool[1], N.Ramya[2], B.Manasa[3], K. Surya Narayana[4], P.Prasanna[5], P.V.S.Varshith[6],

[1]Assistant Professor, Dept: ECE, VEC, Kavali, Andhra Pradesh-524201
[2,3,4,5,6]UG Students Dept. Of ECE, VEC, Kavali , Andhra Pradesh-524201 India

Abstract : The development of IoT applications with robotics is an ongoing revaluation these days. This project mainly focuses on the security, remote surveillance, and monitoring of our homes done by the surveillance robots. Remote surveillance has become the most important research topic over the past decade. Through this paper we put forward a surveillance robot that can be used in domestic areas and many other places. Robots are becoming important in our day to day life activities as they reduce human labour and probability of error. We can control robots manually or they can be automatic based on the needs of people.

Index Terms – Arduino, Surveillance, ESP8266, IoT.

I.INTRODUCTION:

An Embedded system is a special-purpose system in which the computer is completely encapsulated by or dedicated to the device or system it controls. Unlike a general-purpose computer, such as a personal computer, an embedded system performs one or a few predefined tasks, usually with very specific requirements. Since the system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product. Personal digital assistants (PDAs) or handheld computers are generally considered embedded devices because of the nature of their hardware design, even though they are more expandable in software terms. With the introduction of the OQO Model 2 with the Windows XP operating system and ports such as a USB port both features usually belong to "general purpose computers". [1]Physically, embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants. In terms of complexity embedded systems can range from very simple with a single microcontroller chip ,to very complex with multiple units, peripherals and networks mounted inside a large chassis or enclosure Avionics, such as inertial guidance systems, flight control hardware/software and other integrated systems in aircraft and missiles.

II.EXISTING SYSTEM:

- Already existing systems use robots that have limited range of communication as they are based on RF Technology,[2] Zigbee and Bluetooth.
- Some existing projects use short range wireless camera.
- Some existing robots can only be controlled with a manual mode which needs human supervision throughout the whole surveillance process.

Fig 2.1 : Existing system

III.PROPOSED SYSTEM:

- By interfacing Wi-Fi module with Arduino, we can get unlimited range of operation.
- Robots can be operated in both manual and automatic modes.

- By using Arduino microcontroller, [3]the cost and complexity can be reduced.
- The Communication with the robot occurs in a secured Manner

3.1 BLOCK DIAGRAM:

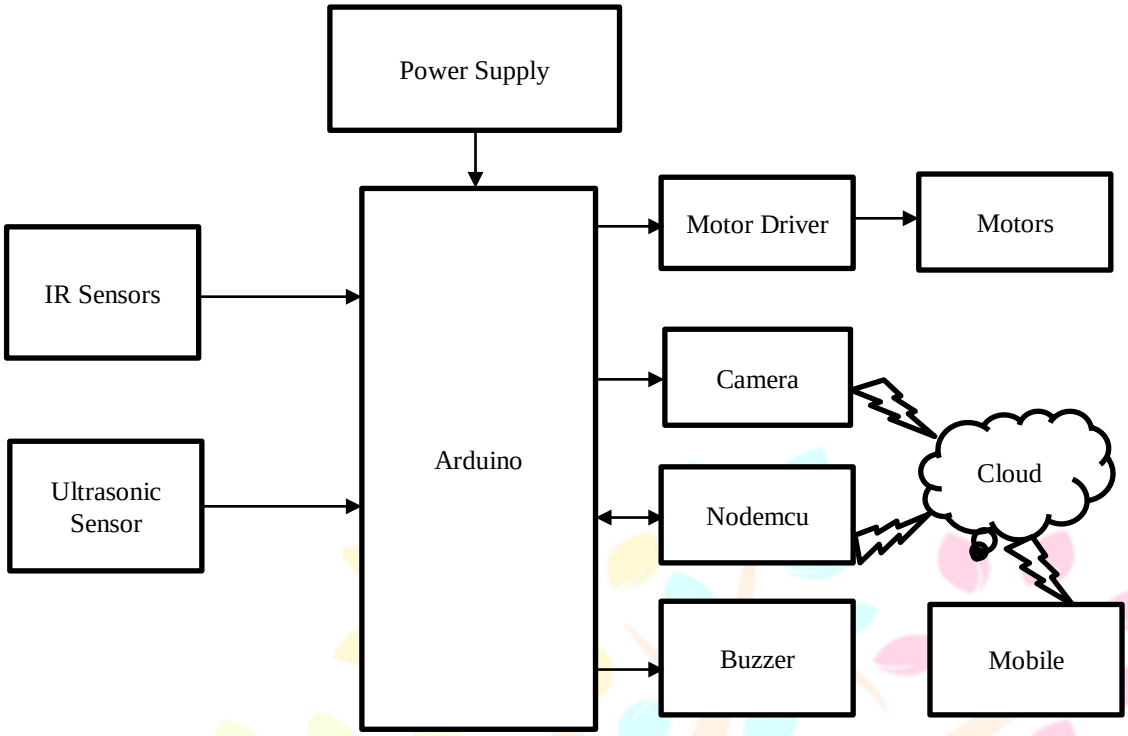


Fig 3.1: Block Diagram Of Proposed System

IV.COMPONENTS DESCRIPTION:

4.1:HARDWARE COMPONENTS REQUIRED:

4.1.1:ARDUINO ATMEGA328P:

The Arduino Uno is a microcontroller board based on the ATmega328P.It has 14 digital input/output pins , [4]6 analog inputs, a 16 MHZ crystal oscillator ,a USB connection ,a power jack, an ICSP header and a reset button.

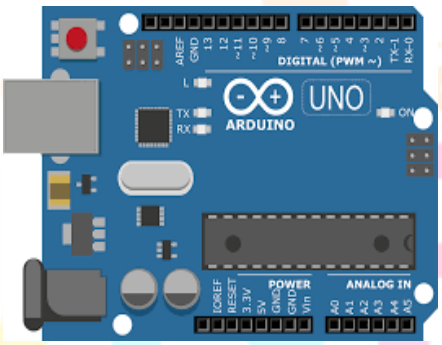


Fig 4.1.1:ARDUINO UNO BOARD

4.1.2:NODEMCU:

The NodeMCU (***N***ode Micro Controller ***U***nit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. [5]The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds.

Fig 4.1.2:NODEMCU

4.1.3:IR SENSOR:

IR sensor is an electronic device that emits the light in order to sense some object of the surroundings. [6]An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum**,** all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.

Fig 4.1.3:IR SENSOR

4.1.4:ULTRASONIC SENSOR:

The ultrasonic sensor (or transducer) works on the same principles as a radar system. An ultrasonic sensor can convert electrical energy into acoustic waves and vice versa. The acoustic wave signal is an ultrasonic wave traveling at a frequency above 18kHz. The famous HC SR04 ultrasonic sensor generates ultrasonic waves at 40kHz frequency.

Fig 4.1.4:ULTRASONIC SENSOR

4.1.4:L293D MOTOR DRIVER:

L293D is a basic motor driver integrated chip (IC) that enables us to drive a DC motor in either direction and also control the speed of the motor. The L293D is a 16 pin IC, with 8 pins on each side, allowing us to control the motor. It means that we can use a single L293D to run up to two DC motors. L293D consist of two H-bridge circuit. H-bridge is the simplest circuit for changing polarity across the load connected to it.

Fig 4.1.4:L293D MOTOR DRIVER

4.1.5:DC GEAR MOTORS:

A gear motor is an all-in-one combination of a motor and gearbox. The addition of a gear head to a motor reduces the speed while increasing the torque output. The most important parameters in regards to gear motors are speed (rpm), torque (lb-in) and efficiency (%). In order to select the most suitable gear motor for your application you must first compute the load, speed and torque requirements for your application.

Figure 3 - DC Gear Motor

Fig 4.1.5:DC GEAR MOTORS

4.1.6:ZEB CAM:

ZEB-Smart Cam 100 is a smart home automation camera once connected to the Zeb-Home App can help you monitor remotely from anywhere. The camera has 2.0 Megapixel, advanced motion detection, 2-way audio, H. 264 Video Compression, Alexa support, ok Google support & more.

Fig 4.1.6:ZEB CAM

4.1.7:BUZZER:

A **buzzer** or **beeper** is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of **buzzers** and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

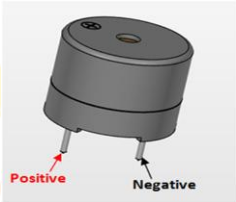


Fig 4.1.7:BUZZER

4.2:SOFTWARE REQUIRED:

4.2.1:ARDUINO IDE SOFTWARE:

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

4.2.2:EMBEDDED C:

EMBEDDED C Programming is the soul of the processor functioning inside each and every embedded system we come across in our daily life,such as mobile phone,washing machine and digital camera. Each processor is associated with embedded software. The first and foremost thing is the embedded software that decides functioning of the embedded system. Embedded C language is most frequently used to program the micro controller.

4.2.3:BLYNK APP:

Blynk is an Internet of Things Platform aimed to simplify building mobile and web applications for the Internet of Things. Easily connect 400+ hardware models like Arduino, ESP8266, ESP32, Raspberry Pi and similar MCUs and drag-n-drop IOT mobile apps for iOS and Android in 5 minutes.

Fig 4.2.3:BLYNK APP

V.RESULT AND DISCUSSION:

Fig 5.1:Working model of proposed system

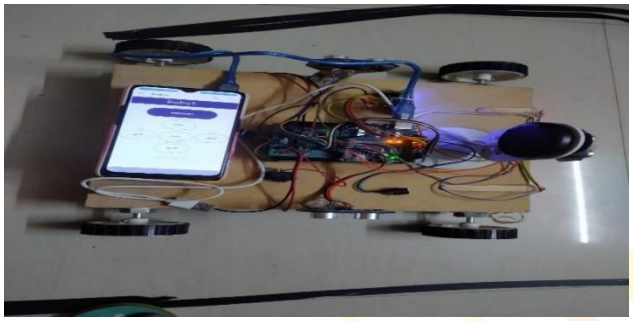


Fig 5.2:Manual mode

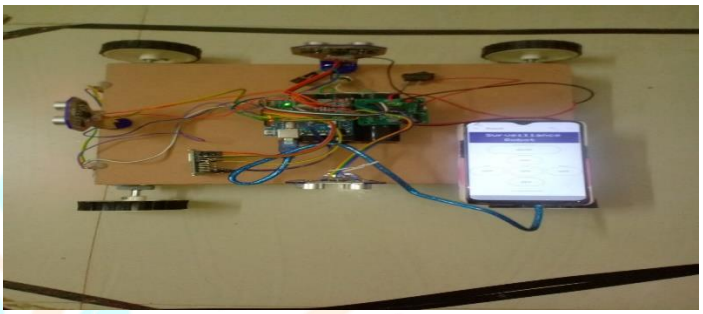
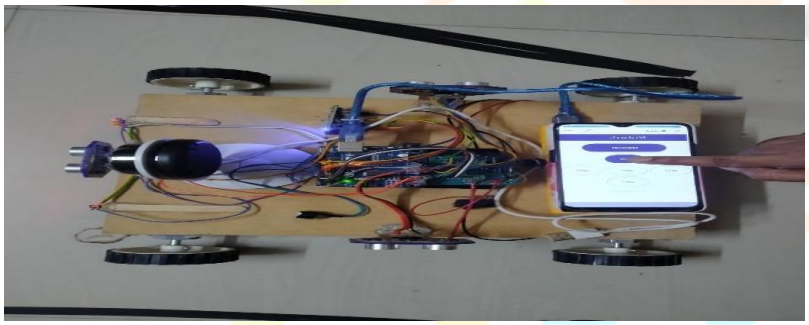


Fig 5.3:Auto mode



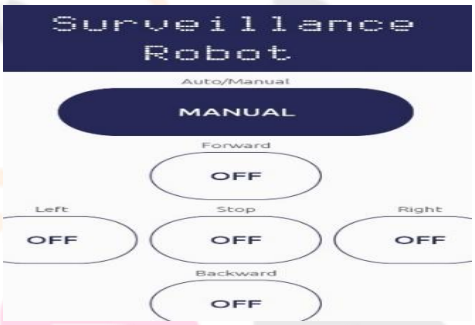
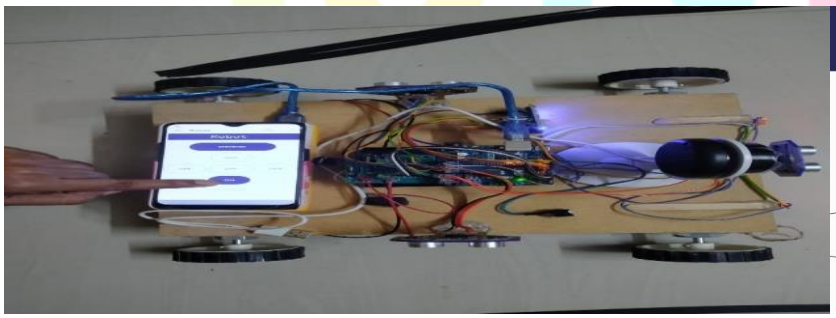


Fig 5.4:Manual mode is operated to move the robot, to detect the object, to start the Buzzer sound in Forward direction



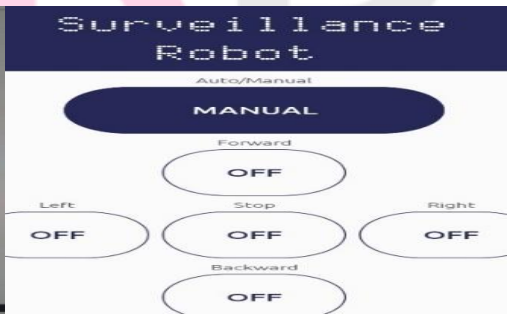


Fig 5.5:Manual mode is operated to move the robot, to detect the object, to start the Buzzer sound in Backward direction

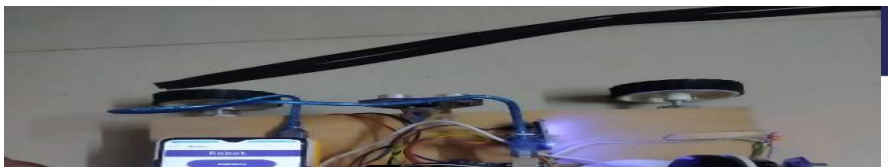


Fig 5.6:Manual mode is operated to move the robot, to detect the object ,to start the Buzzer sound in Left direction

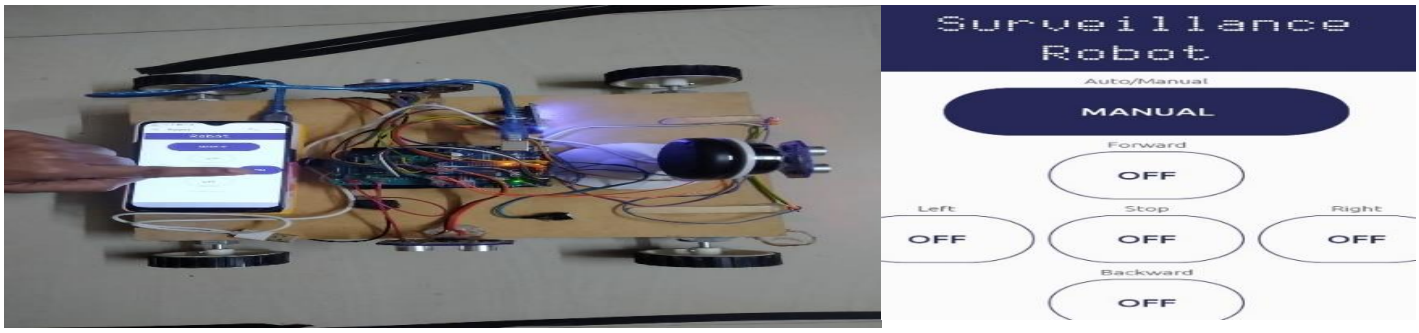


Fig 5.7:Manual mode is operated to move the robot, to detect the object, to start the Buzzer sound in Right direction

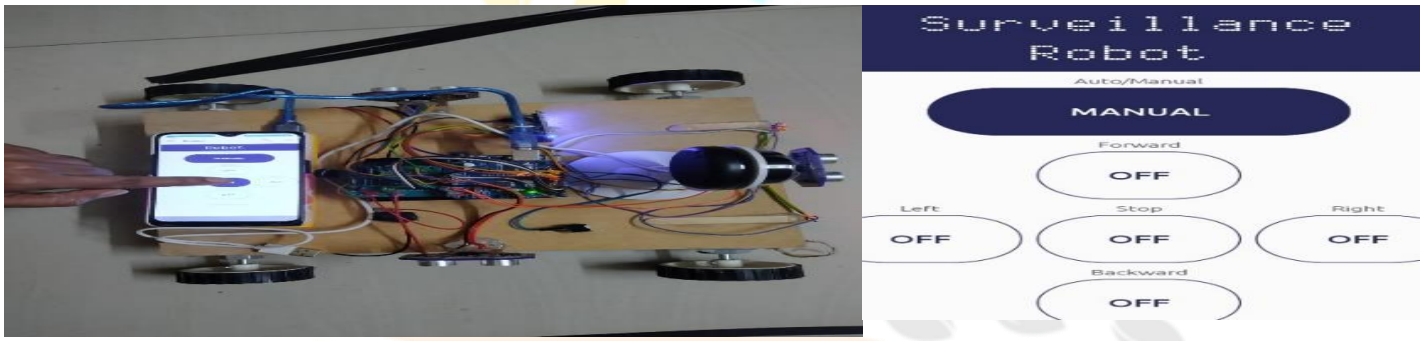


Fig 5.8:Manual mode is operated to move the robot, to detect the object, to start the Buzzer sound in stop direction.

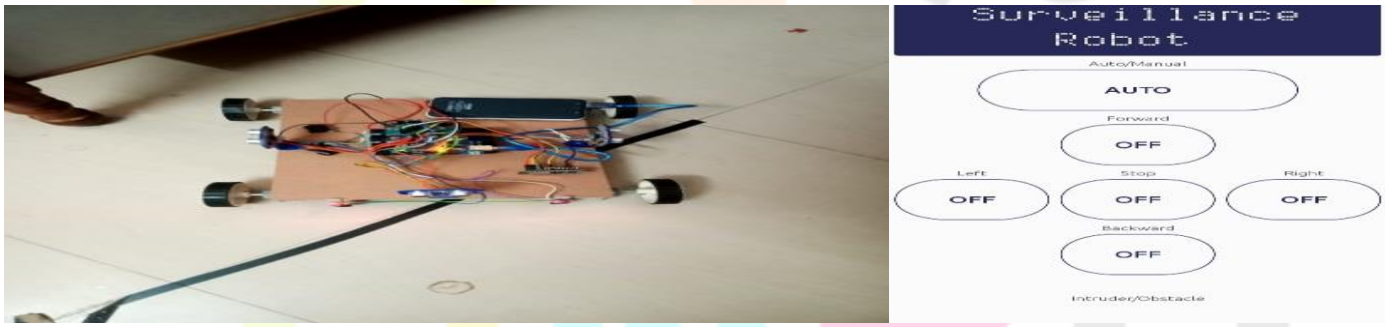


Fig 5.9:Auto mode the path should be created to move the robot in any direction

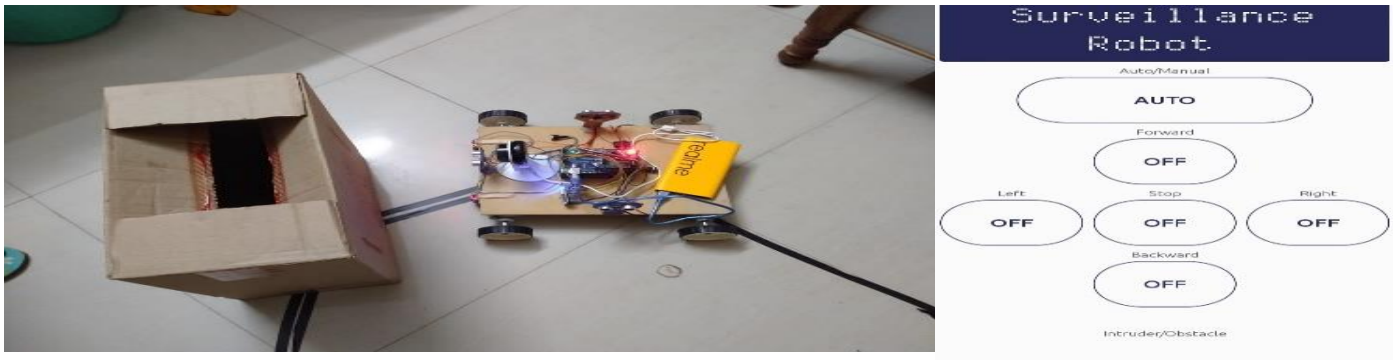


Fig 5.10:In Auto mode the path should be created to move the robot, to detect the object, to start the buzzer sound in any direction

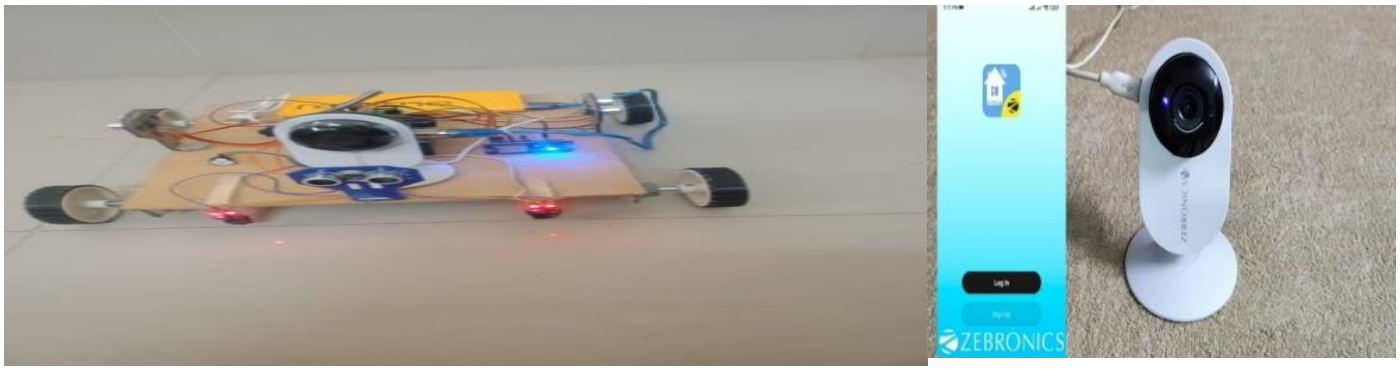


Fig 5.11:Surveillance robot uses the Zeb camera to find the person

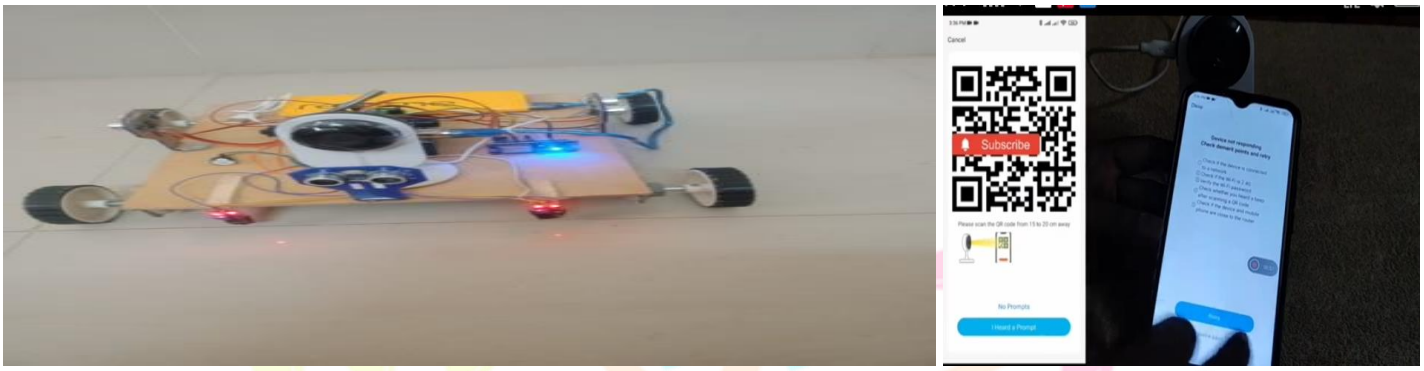


Fig 5.12:Surveillance robot to use the Smart Camera to scan the QR Code

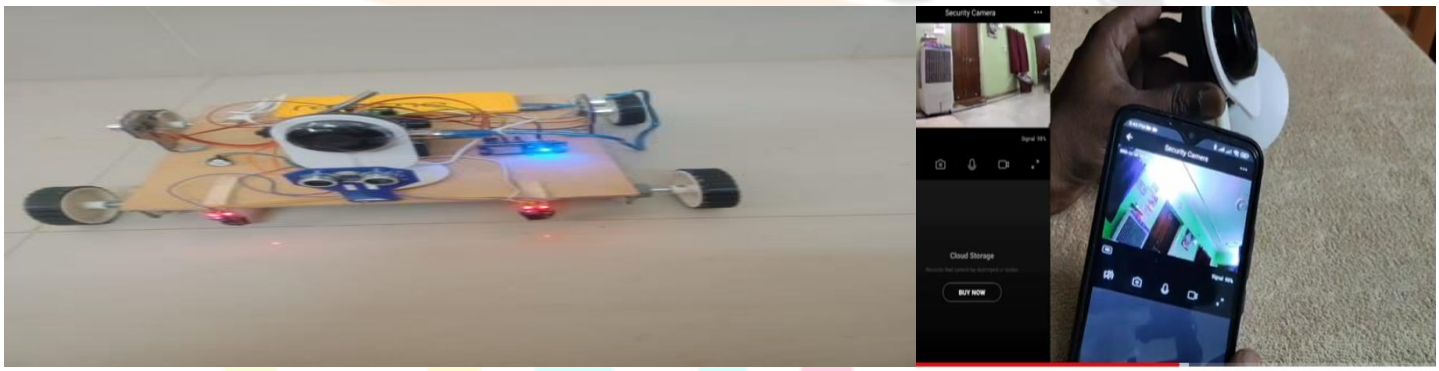


Fig 5.13:Surveillance robot to use the Smart Camera in live streaming features, Audio, Record, Video, Image sensor, day and night vision, messages, 2-way audio, advanced motion detection, indoor and out door

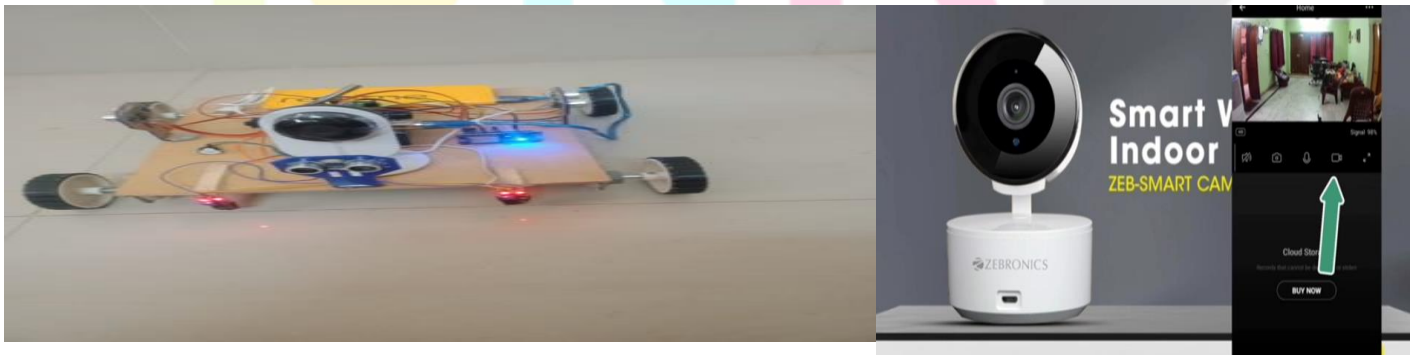


Fig 5.14:Surveillance robot uses the smart camera, this is day vision

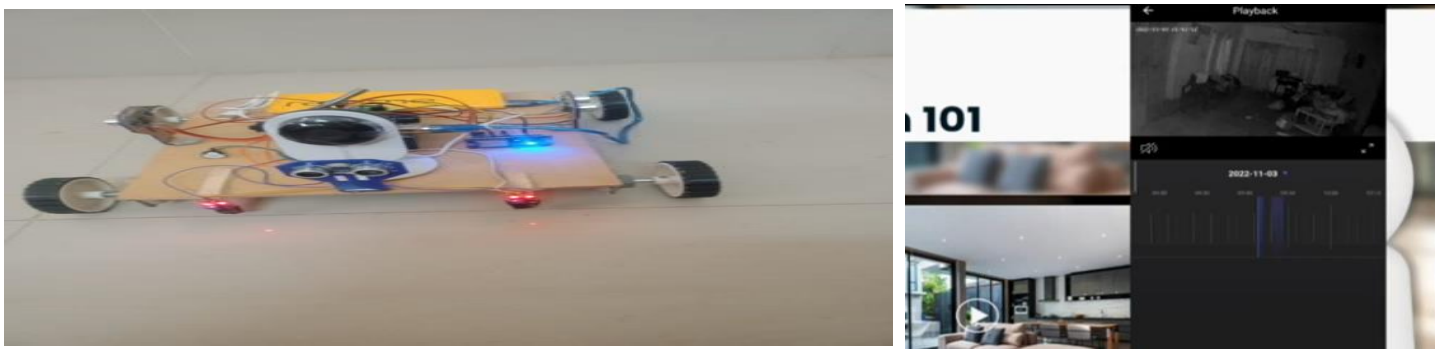


Fig 5.15: Surveillance robot uses the smart camera ,this is Night vision

VI. CONCLUSION :

In this project, the framework for making a robot for surveillance purpose is proposed. It overcomes the problem of limited range surveillance by using the concept of IoT. [7]We can control the robot with the help of laptop/mobile manually and also it can be run automatically by following a path. Automatic monitoring can also be done and can detect intruders with the help of ultrasonic sensors. Our proposed robot is small in size thus manoeuvring into area where human access is impossible. Wireless technology is one of the most integral technologies in the electronics field. This technology is used to serve our project as a supreme part of surveillance act. [8]This provides highly efficient and a cost effective robot that replaces human work and reduces human labour and performing monitoring works in a well effective manner.

VII.FUTURE SCOPE:

In future we can add image processing with which we can identify whether the person detected is a intruder or not.

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7.Singh and Nandgaonkar (2018) performed Arduino based mini robot for surveillance purpose with limited features and functions.

8.Shin et al.(2016) pointed Surveillance robot using web / app client approach, the limitations are robustness was not guaranteed and battery backup problem .Song (2014) suggested Wi-Fi robot for video surveillance with limited features lacking with Technology advancement.