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Onboard Surveillance Camera Robotic Vehicle

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Abstract: ***Surveillance cameras have been integrated with autonomous vehicles for various purposes like monitoring, guarding and spying. This research paper focuses on how to design, implement, deploy and evaluate a robotic vehicle with a surveillance camera system. This study is on both hardware and software architecture, choice of camera, image processing techniques as wellas communication protocol with other devices. Therefore, the suggested system aims at improving surveillance in addition with the number of sensors which can prevent any accident and can increase remote monitoring. The blynk server is used for the transmission of the data of various servers used in the system. Telegram bot is used to perform a two way communication with the system.***

Keywords: Surveillance, Robotic vehicle, IoT, esp32, esp8266, Wireless Communication, Face Recognition.

I. INTRODUCTION

We are living in21st century and this century is the century of technology and one of the major technology of this century is IoT (Internet of Things). In today's scenario one of the major problem of households is the security and surveillance of the home. There are many homes which are or may be vacant in the days due to all working members of family.

To overcome this situation many people use CCTV cameras, but the problem with CCTV cameras is that they are stationary and cannot provide full surveillance.

To overcome this problem we can use IoT and robotics to provide better surveillance for the homes and can make a robot which is integrated with a camera system which can stream the live footage to the owner and provide better mobility.

In this work we are using number of sensors which can provide more information to the owner about the house and can alert the owners before any accident. We are using gas sensors, sound sensor, humidity and temperature sensor and fire sensor to provide alert about them.

In this robot it will have mobility, sensors, camera and facial recognition for the prevention of unwanted people in house.

II. LITERATURE SURVEY

There were some works which focus on this problem and some of them were successful but they have many problems in them some of them were unable to provide mobility because they were stationary and many of them were using raspberry pi which obviously make their product expensive and out of budget of common people and some of them just have a normal camera on the robot and don't have facial recognition system in it. As we have studied many research papers of previous work and we found and tried to overcome the things which were missing in their work and we found that none of them were using such a various range of sensors which can guard the home efficiently.

And we are trying to make this whole project on Esp8266 and Esp32 instead of raspberry pi to makeit cheaper and affordable for all.

III. PROPOSED WORK

We are proposing system which has mobility and ability to stream the camera footage directly to the owner and it uses a number of sensors which can detect gas leakage, fire, smoke and also able to control a high voltage relay giving it IoT capabilities. It can broadcast the reading of humidity and temperature to the owner's device over internet.

It can move with the help of two motors connected with two wheels and all the working will be divided into two or more than two modules, these modules are cheap and will help to achieve same level ofperformance that a more expensive system can provide. This modular feature will help in providing additional accessories in the future development of the robot. The modules are are cheap which make our system affordable for normal users. The hardware updates will be easy due to the module.

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IV. PROPOSED SYSTEM

We are proposing a system in which we are using esp8266 module to control wheels and transmit the data of humidity, fire, smoke, PIR motion and ultrasonic sensors. And it also controls the relay, buzzer and LCD display. It will have esp32 camera module to stream the live footage and facial recognition foe the owner. It will give the access to the known faces and will alert the owner for the unknown faces. We will use blynk server to transmit the data over the different devices. We can use a relay also with facial recognition to perform any action in case of unwanted visit or intruder which can be triggered as per programmed.

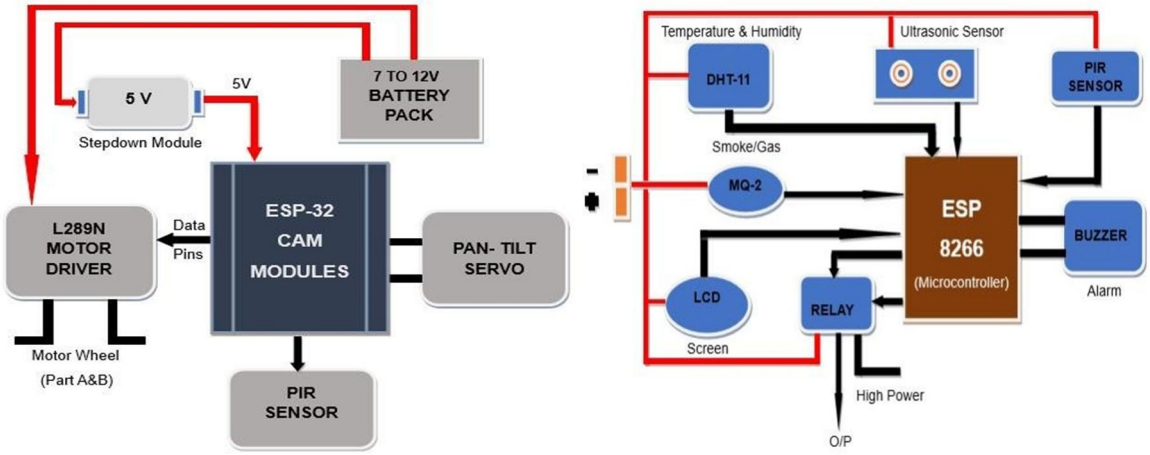


Fig: Architecture of proposed system

V. METHODOLOGY

In this system we are using 4 modules which are working simultaneously to fulfil our purpose. These all modules are backed up by blynk server which enables us to transfer the data ofsensors and camera module wirelessly to our devices.

The working of every module is described below:

1) *Module 1:* It holds Esp32 camera and camera module. And this module helps in streaming camera footage to the user through local hotspot or Wi-Fi. This module also helps in the movement of robot wirelessly from the users device, it also connects to the motor driver with Esp32 and then control the motors which enables the movement of robot. This module also enables the PAN-TILT of the servo motor which helps in the movement of the camera and helps the camera to move 360 degree and do a better surveillance.

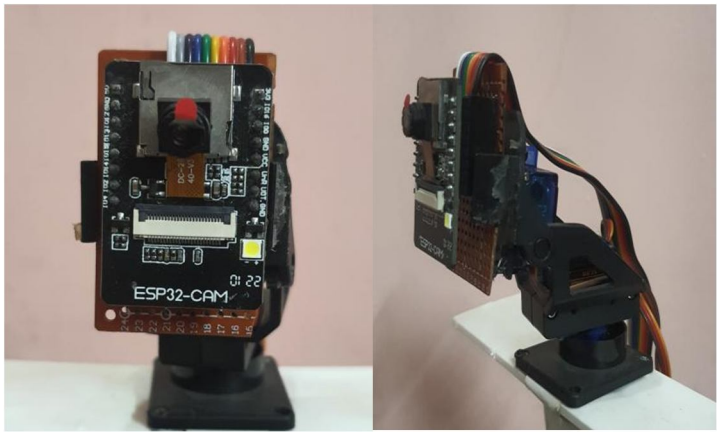


Fig: Esp 32 camera module with PAN-TILT sensor

2) *Module 2:* Module 2 consists of Esp8266 micro-controller board which is integrated with all sensors and control all of their outputs. Such as DHT11 sensor work output the values of temperature and humidity as serial data, Ultrasonic sensor work by sending output measures the distance to an object. A PIR sensor is using in the motion detector such as automatically triggered lighting devices.MQ2 sensor is using the smoke and gas detector. This module receive data from sensors and transmit it to user through blynk server wirelessly.

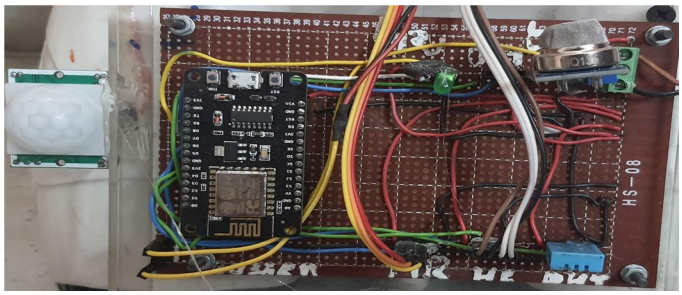


Fig: 8266 micro-controller with sensors

3) *Module 3:* This module plays a crucial part of this whole system, it contains Esp32 camera and uses facial recognition algorithm to provide the access for the known persons and alert for the unknown person or intruders. This module captures the face of the person and if provided access then saves the face in its database and if that face occurs again in front of it the match it from its database, if the face is matched from the database then it will provide access. This module is also capable to trigger a relay to perform any action if needed.

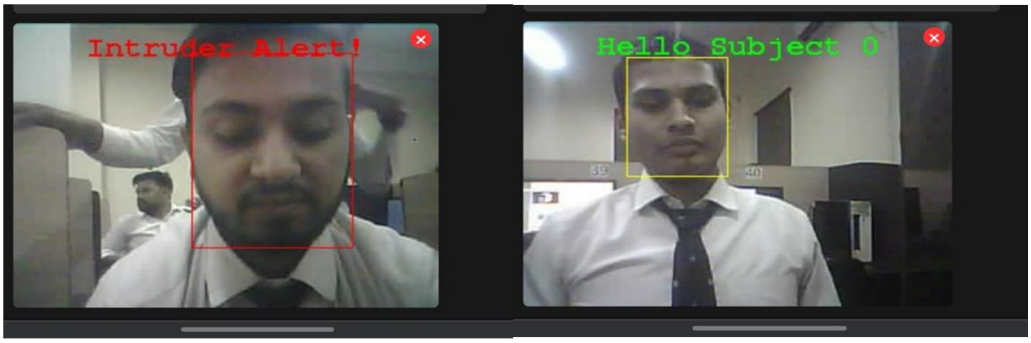


Fig: Output of module 3 with a known and an unknown face

4) *Module 4:* Module 4 consists of Esp32 camera which is used for alert messaging in case of any unusual happening. This module makes the smart use of telegram bot service to send alert messages to the user via internet. This module send the data of temperature, humidity, motion and a image if any motion is detected in-front of it. These all modules are powered by a battery pack of 4 batteries of 7.2 volts each which is further connected with a buck converter to step-down the voltage to 5 volts to provide power supply to micro-controller and camera modules. Micro-controller receives all the data from the sensors and transfer it to the users device through blynk server and telegram bot which makes the efficiency of this project much better.



Fig: Telegram bot and its output

VI. RESULT

This project is working significantly and all the modules are working properly the robot is able to capture any motion occurred in front of it and send it to the telegram bot available at owners device. We can access the data of sensors through the telegram bot, also this all data is transferred through the blynk server and can stream the live footage from robot to our device and can control the movement of our robot. We can know the data of all sensors on a single command and the robot is able to do the facial recognition and it can differentiate between the unknown face and a known face. All the output part of the machine can be fully arranged on a windows machine and can be easily set up to open simultaneously by using windows automation. the output screens work as intended and can be easily used for all modules with movement or to get output when it stands alone as single modules, in the below figure you will be able to see the working of 2 camera module i.e. face recognition and robot driving and control unit , also the output of blynk server is shown here together on a single display we can use multiple displays as per requirement.

VII. CONCLUSIONS

The robot produced will have the most affordable working components with the ability to perform to its counter parts without using high end components like raspberry pi. The chip we use is basically Esp 32 for camera display and esp8266 micro-controller for sensor and data transfer for relay and other active switch. Also the chip accept low cost service of blynk server, thus helping it one of the most affordable service.

A. Future Scope

1) Integration of more advanced modules to support Ai.
2) Integration of voice assistance with home service like amazon alexa.
3) Integration of more standalone modules to support IOT, ie to operate home lighting, ac, fan etc.
4) It can made like amazon alexa with wheel and camera.
5) Create more modules with multiple sensor.
6) Integrating physical moving robotic arm that will increase its mobility.

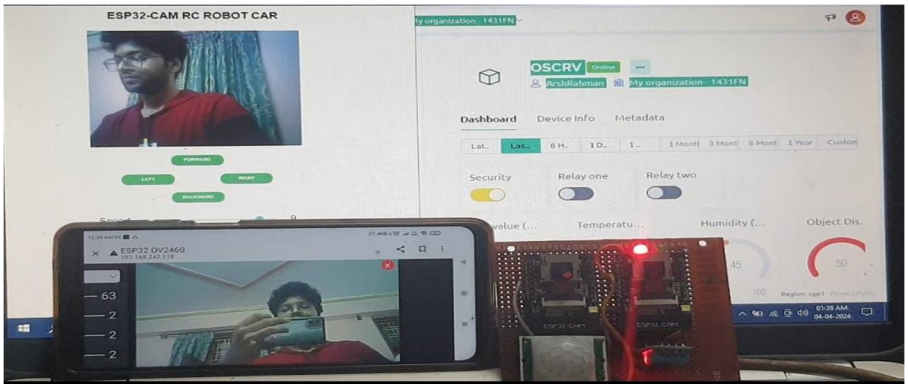
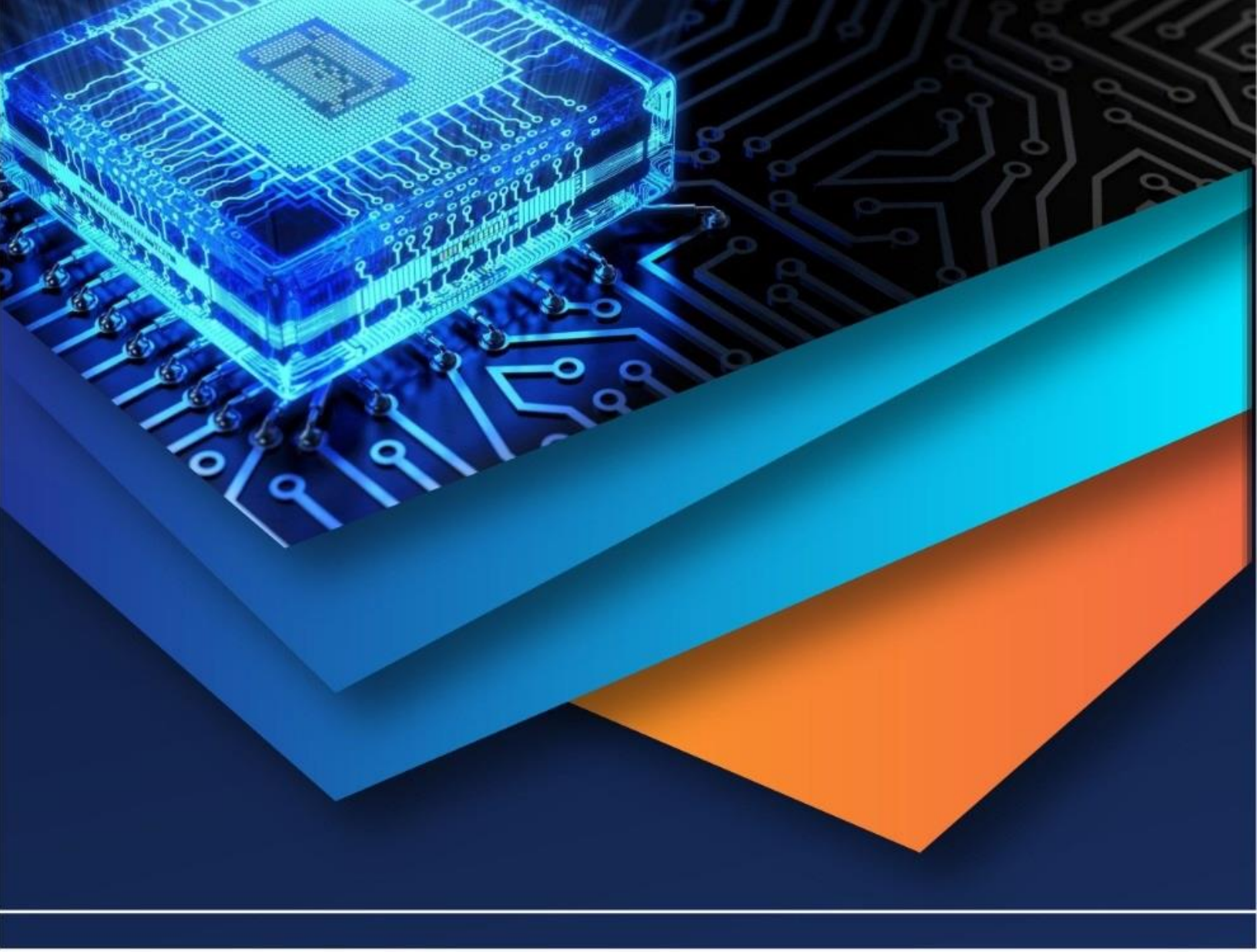


Fig: Final setup on pc

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