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Wireless Video Surveillance Robot using Raspberry PI Pico

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Abstract: *Today closed circuit television (CCTV)surveillance systems are used to keep the peace and keep people safe. Video surveillance systems have some drawbacks, including The image being blurred, the person cannot be automatically detected, The amount of storage space needed to keep the is large for storing the monitoring information, and the price remains relatively high. This project is about designing and controlling a mini robot usinga Raspberry Pi. The design is the goal of the project to construct a smart surveillance system using his Pi Pico for mobile devices. We describe the development and use of a cheap Raspberry Pi-based system monitor that follows a motion detection algorithm. Additionally, the system dramatically reduces memory utilization by using motion detection techniques, saving money on investment. The Raspberry Pi uses a motion detection algorithm to enable live-streaming cameras and motion detection. Your cell phone can be used to see live video cameras in real-time. Additionally, the system dramatically reduces memory utilization by using motion detection techniques, which reduces investment expenses. The Raspberry Pi uses a motion detectionalgorithm to enable live-streaming cameras and motion detection. Any web browser, even those on mobile devices, allows for real-time viewing of live video cameras.*

Keywords: Raspberry pi pico, MicroPhyton, web camera

I. INTRODUCTION

In recent years, wireless communication applications haveplayed an important contribution to automation, medical and security applications, and manual robots have also increased significantly. The majority of applications, humans are exchanged for unattended equiped that collect and transmit data back towards the source station. Embedded systems play crucial function in all application devices, allowing them from a single base station, observe and engage with ongoing work. Wireless surveillance robots play an important role in our daily life. This application is now standardized for differentapproaches by wireless sensor networks. As an alternative to employing conventional wireless CCTV security cameras, customers cannow purchase an low-cost security system using a small supercomputer called the Raspberry Pi. Cameras may transmit and receive data over computer networks and the Internet based on the Network Protocol, so we can provide better service. The sharpness of the camera resolution is also superior to CCTV cameras. All events are captured via a camera module attached to the Raspberry Pi in monitored area and the live streaming can be viewed in real-time from your mobile phone. Video surveillance systems have many blurry images, the inability to automatically detect falling objects on life, and the requirement for a large storage capacity to keep track of data while surveillance. Motion detection has grown in prominence recently due toits prospective uses in a variety of fields, including B.Computer vision researchers are very interested in surveillance techniques like video surveillance, or sign language recognition. To overcome the storage space issue, live camera streaming, and motion recognition techniques are used here. As a result, the system may now analyse the image received fromthe camera and detect when motion has occurred

II. LITERATURE REVIEW

This white paper describes creating and implementing a smart surveillance system using Raspberry Pi and PIR sensors for mobile devices. The increasing mobile technology usage provides crucial protection for residential and other control applications[1]. Intoday's world, security concerns are very high. Security in restricted areas such as secret offices and buffer zones is paramount. Monitoring of such areas currently relies on technology and manpower, but automated

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monitoring is in progress to avoid potential human errors caused by a variety of reasons[2]. The main purpose of the robot is to be able to move in a specific environment and at the same time transmit real-time data (video) over the Internet or Wi-Fi to a ground station[3].This smart security robot With IOT you can stay home on important issues and see the existence of something invader. A ``live stream'' operation in which a camera attached to a robot reproduces the image of a gate crusher[4]. Used to detect the presence of an enemy, this multi-sensory robot captures the enemy with a camera and provides live streaming to authorized persons according to the robot's movements[5].It is also automatically regulated by the Obstacle detection sensor to avoid Collision, and the system issues warning Metal detection time by the metal detection sensor. As the system does Multitasking This can be used for monitoring purposes [6]. Inconvenient to use custom controllers How to operate the robot car and the easiest way to control the robot is Always with your voice. In this paper, we raised our voice against Sensing-based systems that make the control process very complex and Very convenient to use [7]. The software development process is supported by dialogue An agent that captures application functional requirements developed. A web-based prototype was developed as a proof of concept. Suggested procedure. We believe this process will save you time and effort mobile application developer[8]. The smart home is an environment where disparate electronic devices and devices are networked to provide people with ubiquitous intelligent services. It is equipped with sensors, cameras, or actuators to gather information from the environment or to complete appropriate tasks[9]. Personal security and surveillance are hot topics in research and computer vision. CCTV is utilized for security and surveillance. While surveillance can be used to detect crimes, adding facial recognition can enhance the effectiveness of current security and surveillance systems. [10]. Face identification was carried out in three steps: face recognition, feature extraction, and classification. The Viola-Jones algorithm was employed for facial recognition. For feature extraction, the PCA technique was applied. The classification was performed using the Ada Boost algorithm. The detection took 100 ms to complete.

A Raspberry Pi II minicomputer was used to implement this system[11]. Integration Biometrics within the system provides an efficient way to vote without fraud The system will be more reliable, economical, and faster, allowing voters to vote from anywhere Location as a result of smart voting modules accessible from any device using the internet Connectivity.[12].

III. EXISTING SYSTEM

The robot was created utilizing a Raspberry Pi as a controller, and its numerous control mechanisms were implemented using the OpenCV-Python programming language. The L293D motor driver module operates the DC motor through an H-bridge under the Raspberry Pi's GPIO control signals, which are used for general-purpose input and output. The Raspberry Pi gathers signals from all sensor modules, relay modules, and driver modules through GPIO pins. A power board with a 12V supply powers all of the hardware, except the sensor, which requires 5V and is controlled by an LM317 voltage regulator. Gas sensors occasionally require more than 1.5A current, which can the functionality of additional modules.

The gas sensor is therefore powered through the LM317, whose DO pin is connected to the Raspberry Pi. Fire detection works by sensing smoke, heat, flame (light), or a combination of these. Infrared sensors detect obstacles in the environment, while ultrasonic sensors calculate the separation between barriers and the sensor according to the time interval between emitted and reflected waves. Additionally, a USB camera is connected to the Raspberry Pi via its USB port. Instead of a laser cannon acting on intruders, an LED is connected to the relay output as a proof of concept. Live streaming of security camera footage is provided by the robot system, which is managed by an Android app or computer system.

IV. PROPOSED WORK

This project uses the Raspberry Pi, a RISC-based microprocessor architecture type that operates at high frequency and low operating voltage, was used. The Pico controlled all the activities of the web camera via UART communication and the camera visualizes live video. This recent work involves the creation and application of a low-cost mobile robot using mobile phones over Bluetooth.

The robot has two wheels on the back and one freewheel on the front with his webcam attached to provide a live video feed and control the robot's movements with a mobile phone via Bluetooth. can. The robot can move in any of four

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directions, like the up, down, left, and right buttons you see on your phone. The robot is propelled in each direction by two DC motors and the motors are connected via his L293D motor driver IC. On the Raspberry Pi, a motion detection algorithm is put into practice to support both live streaming cameras and motion detection.

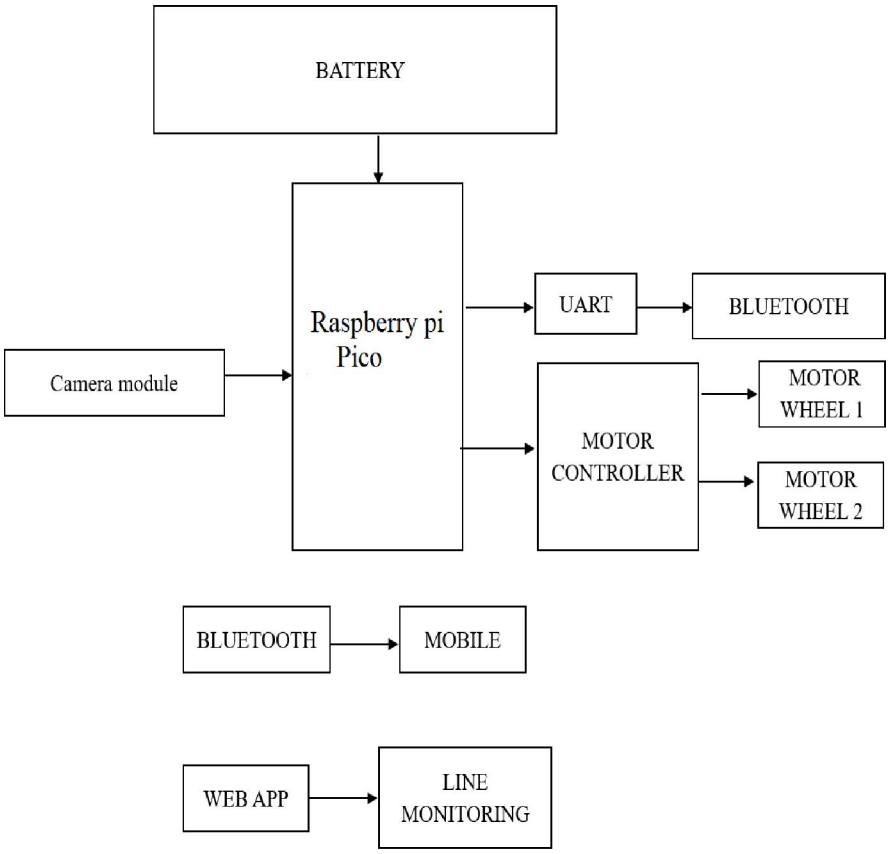

Fig.1. Hardware prototype of the proposed model.

V. HARDWARE DESIGN

5.1 Raspberry PI Pico

The first microcontroller, the Raspberry Pi Pico, runs on the dual-core Cortex-M0+ architecture of ARM and is based on the RP2040 microcontroller processor found in the Raspberry Pi. It works with frequencies up to 133 MHz and packs a lot of features despite its small size compared to other membersof the Pi family. Unlike other Pi boards, which are essentially single-board computers running Linux, The Pico is a cost-effective microcontroller with 2MB flash memory, 16kB on-chip cache, and 264kB multi-bank high-performance SRAM. Compares favorably in terms of performance with established Arduino boards. At just $4 (around INR 300 in India), it competes head-on and speed compared to similarly priced modules. The board layout above shows some of them: RP2040 microcontroller, debug pins, flash memory, boot select button, programmable LEDs, USB connector, and power pins.

Fig.2.Raspberry Pi pico

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5.2 Web Camera

The portable webcam module is small and Raspberry Pi pico. This is often used in applications such as deep learning, image analysis, surveillance, and others. In terms of payload, a surveillance drone's camera is quite limited. However, excluding these modules, the Pi can use a standard USB webcam that looks like this on your computer.

Fig. 3.360 cameraDC Motor Drive:

This dual-channel DC motor driver has two motor channels that can practically concurrently operate two different motors. Every channel has a signal, it Indicates the direction of rotation of the motor, blue means forward rotation and red indicates reverse rotation. Motor voltage ranges from 6.5V to 37V are supported. any motor channel can generate 12A of current continuously, up to the DC motor power supported by the module is 290W, and a DC motor driver may also be used in conjunction with this 2-channel DC motor driver. The engine is simply controlled by an Arduino Microcontroller and a Raspberry Pi.

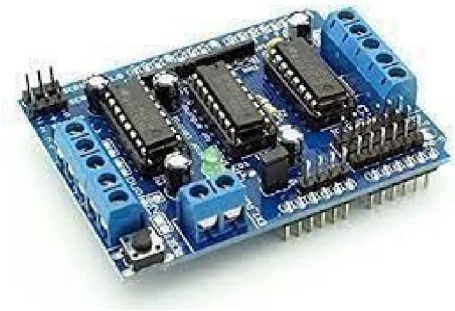

Fig.3. Dc motor driver

VI. SOFTWARE IMPLEMENTATION

THONNY SOFTWARE:

Thonny is a Python Integrated Development Environment designed. It was created by Estonian programmer He Aivar Annamaa. It supports different ways of stepping through code, step-by-step evaluation of expressions, detailed visualization of call stacks, and modes to illustrate the concept of references and heaps. Available as a pip- installable package or a binary package with the mostrecent Python interpreter. It may be set up on Debian, Raspberry Pi, Ubuntu, and Fedora using the package manager of your operating system.

MICRO PYTHON:

Micro Python is a programming language written in C that is designed to operate on microcontrollers and is broadly compatible with Python 3.MicroPython consists of a runtime interpreter for the bytecode produced by the Python compiler. An interactive prompt asking them to run a supported command immediately is shown to the user. Several Python essential libraries are included. Micro Python includes modules that allow programmers to access low-level hardware. Micro Python has an inline assembler and this code runs at full speed but is not portable between different microcontrollers. The source code for the project is available on GitHub under the MIT license.

SERIAL BLUETOOTH TERMINAL:

An Android device is connected to a microcontroller, Arduino, and other devices with a serial/UART interface using a Bluetooth-to-serial converter using the line-oriented terminal/console app known as Serial Bluetooth Terminal. In the

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most common mode, transmit power is limited to 2.5milliwatts and provides a very short range of up to 10 meters (33 feet). Here the UHF radio waves used in the2.402 GHz to 2.48 GHz ISM band. It is primarily used as an alternative to wired connections for sharing files between nearby portable devices.

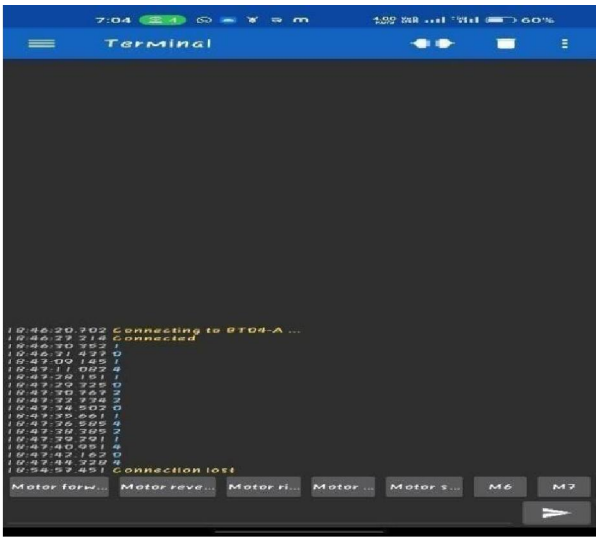

Fig.4.Control for moving the robot

VI. FINAL OUTCOMES OF THE PROJECT

Fig. 6. Hardware prototype of the project

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Fig .7. captured picture 1

Fig.8. captured picture 2

Figures 7 and 8 are the final result of the project. I have photos taken at the scene. When the robot is performing surveillance activities. Therobot can easily track objects and people without the help of wired devices. Very useful for security purposes, easily recognize the activity on the other side without human help.

VII. FUTURE SCOPE

We intend to enhance the motion-detecting algorithm in the future. We can improve the method's performance by taking a few elements into consideration because it depends on a threshold. With a solid solution and a good threshold, the algorithm can accurately identify moving objects, even those that are small and move slowly. The next challenge is to determine the exact number of people in this area and their location so that the receiving end can get accurate information.

VIII. CONCLUSION

The suggested system is made to use a camera to take pictures and record videos for use in testing and training. The approach lowers memory use and Raspberry Pi processing power needs by employing one picture per user for training. As shown in the findings section, the system can function with only minor ambient changes and posture variation. To reduce storage requirements, this project suggests a method for a surveillance monitoringsystem that uses a Raspberry Pi single-board computer. A hosted webpage may show the real-time video that was taken, and that same webpage also has instructions for moving the robot. Overall, this system's design provides an efficient solution for monitoring and surveillance applications that require a low-cost, unmanned device capable of capturing video data in real time, making it an ideal solution for a variety of use cases

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