PIBOT: MULTI – ENVIRONMENT ROBOT FOR SURVEILLANCE AND LIVE STREAMING USING RASBERRY PI

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ABSTRACT

In today's world, everyone is worried about their safety due to increase in crime rate. This has led to an increase in the importance of surveillance systems In this project raspberry pi is used to make a robot which in turn is used to make a realtime surveillance system possible within a local network. The live streaming is accomplished by using the mjpeg streamer and the server-client model is made using java.

INTRODUCTION

Today each and every one is concerned about their security since the growth rate of crime has increased. This caused people to have started to consider the significance of surveillance systems. Majority of the people are doing IP based installations rather than the analogue because of it being accessible from anywhere. In order to make the IP-based systems affordable for the people having low budget we need to develop a system which is cost effective and portable. This project uses raspberry pi model 'B' for making this real time surveillance possible. The Pi has the capability of installing and processing high resource software's which makes it possible to accomplish the objectives of live streaming & controlling the robot.

LITERATURE SURVEY

Charles Severance, "Eben Upton: Raspberry Pi", Published by IEEE computer society, October 2013

This research develops a Neural Network Robot with Raspberry Pi model, to predict the key Artificial Intelligence outcome "User Satisfaction" using causal factors present during an implementation as predictors.Data for training and testing the models was from across section of firms that had implemented this. In today's era of automation everyone wants to reduce manual efforts so as to improve accuracy and efficiency of real time processes. Recent Researches in Artificial Intelligence using Neural Network uses various algorithms to train the robot to perform multi-purpose tasks as physical condition changes. Automation can be best achieved if we can make judicious use of Internet with everything i.e. INTERNET OF THINGS. Raspberry Pi is currently the best option to have easy Remote Access from anywhere just assigning a Network I.P and have control over every hardware. Recent research showed Graphical Interface along with Command line can be achieved like making a separate GUI which shows all processes taking place in hardware on screen simultaneously in a easy and attractive way.In the present study the data from the earlier study was used to develop predictive models for ANN with Raspberry Pi and outcomes measured in terms of User Satisfaction.Three processing techniques: Python, MATLAB, Artificial Neural Networks (ANN) and OpenCV were tested. Of the three Python was found to be significant. This paper is organized as follows: The literature review and establishes the need and relevance of this research work. Outlines the method used in the research. This section also explains different techniques with specific emphasis on Neural Logic. The results of the modeling and compares the results of the various techniques used. The paper with the direction for continuing research.Robotics technology is emerging at a rapid pace, offering new possibilities for automating tasks in many challenging applications, especially in space explorations, military operations, underwater missions, domestic services, and medical procedures. Particularly, in space exploration, robotic devices are formally known as planetary rovers or simply rovers and they are aimed at conducting physical analysis of planetary terrains and astronomical bodies, and collecting data about air pressure, climate, temperature, wind, and other atmospheric phenomena surrounding the landing site. Basically, rovers can be autonomous capable of operating with little or no assistance from ground control or they can be remotely controlled from earth ground stations called RCC short for Remote Collaboration Center. In essence, the movement of autonomous rovers is not directed by human operators; instead, it is controlled by complex algorithms that allow the rover to traverse paths on multiple terrains while avoiding obstacles and path errors. This capability is more formally known as path-planning in which a rover or any robotic vehicle can perform terrain analysis and select the safest route to travel across. The rover can then proceed towards the goal location over the selected trajectory while avoiding obstacles without previous knowledge of their existence. This paper proposes a path-planning solution for autonomous robotic planetary rover systems based on artificial neural network (ANN). The proposed neural network is multi-layer consisting of three consecutive layers: an input, a hidden, and an output layer. The input layer is made out of two neurons that are fed by the rover's sensors which are designed to detect obstacles of any size and shape. The hidden layer is made out of three neurons and its purpose is to read input data and multiply them by a certain weight and then forward the results to the next layer. The output layer is made out of two neurons that are directly linked to the rover's motors which control its movement and its mechanical operation. The proposed ANN uses a mix of activation functions including Sigmoid for the hidden neurons and linear for the output neurons. Moreover, the model employs a supervised learning approach using the back-propagation algorithm to train the network in offline mode. The proposed artificial neural network is meant to allow the rover system selects the best path through any given ground by predicting the existing obstacles along the path and the harsh structure of the landing terrain. This would allow the rover to navigate autonomously and safely toward its goal location and complete its designed task.

KawserJahanRaihan, Mohammad SaifurRahaman, Mohammad Kaium Sarkar &SekhMahfuz , "Raspberry Pi Image Processing Based Economical Automated Toll System", 2013

Future is all about robots, robot can perform tasks where humans cannot, Robots have huge applications in military and industrial area for lifting heavy weights, for accurate placements, for repeating the same task number of times, where human are not efficient. Generally robot is a mix of electronic, electrical and mechanical engineering and can do the tasks automatically on its own or under the supervision of humans. The camera is the eye for robot, call as robovision helps in monitoring security system and also can reach into the places where the human eye cannot reach. This paper presents about developing a live video streaming robot controlled from the website. We designed the web, controlling for the robot to move left, right, front and back while streaming video. As we move to the smart environment or IoT (Internet of Things) by smart devices the system we developed here connects over the internet and can be operated with smart mobile phone using a web browser. The Raspberry Pi model B chip acts as heart for this system robot, the sufficient motors, surveillance camera R pi 2 are connected to Raspberry pi.During war time, terrorist attacks, mass protesting movements its very important to have surveillance near and surrounding areas. In military scenarios adversary location and territory are important security concerns. Sensitive location areas can be covered with human soldiers so that they can continuously monitor and observe the changes. But humans have restrictions and organizing shifts in adversary areas can give a chance to enemy to get advanced [1]. A huge loss can happen in adversary areas because of human errors. The solution is to get use of advanced technology developed over the years, robot with help of robovision algorithms can observe the location of interest and make proper intimations or actions in time. A huge advantage comes in saving our soldiers or workforce from disaster. Robots with high resolution cameras can monitor over long distance and larger areas. Robot loaded with different sensors can even detect subtle chemical objects hidden that cannot be done by humans. Sensors [1] can also help in localizing the area, communicating with the satellite remotely. Satellite communication can continuously contact robots in non human areas like deserts, hill stations, high altitude areas, snow covered areas, and can recover audio visual feedbacks. So surveillance with robots is a very interesting topic in recent time with great research interest. Recent attacks like a USA twin tower blast with aeroplane, Bombay hotel Taj attack, terrorists entering army posts in Punjab are so different and influences to get more advanced in tackling the situations. As the year passes the technology gets advanced in security and surveillance systems. A more sophisticated electronic devices like closed circuit television (CCTV), security alarms, etc. areentering into market with great pace. A closed circuit TV's with advance technology can be monitored remotely from any place in the world with the help of an Internet connection. Recently Internet of Things IOT applications has gotten more popular. These advancements gives great scope in security and surveillance systems. Even commercial areas have huge applications with surveillance like observing company premises, factory outlet, government offices, international hotel, airports, railway stations, bus stations, etc. The commercial applications have a surveillance system covered to only one particular direction in most of the cases. But in this project we give commands to robot in which direction we want to observe. Even the live streamed data can be recorded on hard disk with the help of digital video recording (DVR).

WidodoBudiharto, "Design of Tracked Robot with Remote Control", 2014

The main problem in computer vision for robot vision is to detect and recognize objects quickly and accurately. Face detection is needed by the tracked robot for understanding the environment, such as military robots for tracking and shooting the enemy. In this paper, we propose a prototype of a tracked robot with video streaming capability and the ability for face recognition using ESP32-CAM. We use a tracked robot as the simulation of a military robot. We propose an algorithm for face recognition controlling the robot using ESP32-CAM. The system can recognize an object from a video streaming run with 4-5 fps. The methods were explained, and experimental results were presentedNowadays, most robotics systems use computer vision and sensors for general purposes, such as for surveillance and obstacle avoidance [1]. Remote-controlled robots for surveillance are also combined with video streaming for wireless operation such as developed by [2]. Robots for military purposes, in general, called an unmanned ground vehicle (UGV) is used to augment the soldier's capability. Many military robots were developed to maintain security and spies in conflict areas or borders based on cameras, firearms, and missiles. The study of the military tank robot system has been carried out, for example, [3,4]. Object detection and recognition are essential tasks in all applications of computer vision. There are many research projects considering the problem of recognizing different objects. Most of these projects work under certain conditions, where there is a finite number of objects and the environment is somewhat controlled. Contours are very well suited where a shape represents an object and they allow a certain level of tolerance since a value of how many objects must be similar can be added [5]. In developing a military robot, to produce autonomous systems, the system must be able to track targets/recognize objects based on computer vision. Robots are also expected to be able to recognize faces/objects that can be enemies to be conquered. Uncertainty is very common in tracking objects based on vision, so the application of probabilistic robotics in the development of intelligent robots is very important [6]. Robotic systems can take many forms, be stealthy or intentionally noisy, cloak themselves and deceive the enemy physically, electronically, and behaviorally. There are fundamental ethical implications in allowing full autonomy for these robotsZim [8] analyzed the use of TinyML for neural network application using Xtensa LX6, the microprocessor inside ESP32. The experiment uses a different number of inputs neurons (9, 36, 144, and 576) with one and two hidden layers. From the experiment, the result shows that data transfer between different types of memory has less impact on the total run time. The advantage of this study is that this robot is controlled using Wi-Fi, to make the connection range wider than using Bluetooth, and use a low-cost controller. The major contribution of this research is to propose an alternative approach that has a cost lower than another model, to be used in the organization that has a limited budget to develop the robot itself. The result of our experiment shows the system was able to recognize an object from video streaming about 4-5 fps. Wi-Fi is a wireless networking technology and stands for "wireless fidelity". Wi-Fi is a high Internet connection and was invented by NCR Corporation/AT&T in the Netherlands in 1991. This research is very important to produce models and methods of a military robot that can be controlled remotely. We present an introduction in Part 1, Part 2 as a concept of object detector.

Brian et al., "Sudo Pi Cooler / Heater", 2014

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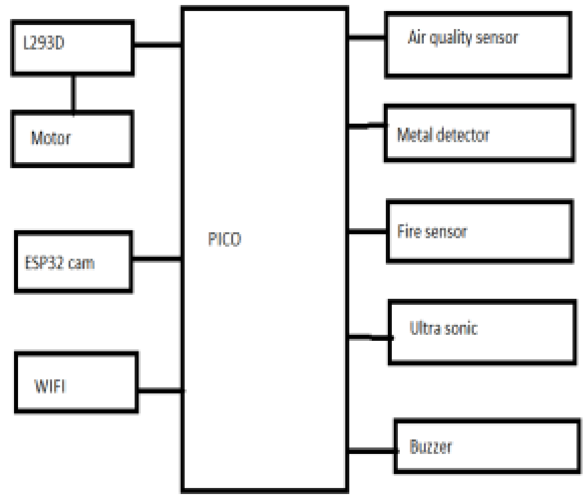
EXISTING SYSTEM

The Raspberry Pi serves as the brain of the robot, handling computation, control, and communication. The physical robot chassis, motors, wheels, and other components would be necessary for the movement of the robot. There are various kits and platforms available for building small robots. The Raspberry Pi Camera Module or a USB camera can be used for capturing live video footage. It's essential for surveillance and live streaming functionalities. Motor drivers or motor control boards are needed to control the movement of the robot. This can involve programming the Raspberry Pi GPIO pins to control the motors. A suitable power source is required to supply power to both the Raspberry Pi and the motors. Depending on the surveillance requirements, additional sensors such as ultrasonic sensors, infrared sensors, or PIR sensors might be added for obstacle detection, motion sensing, etc.For remote control and live streaming, the robot needs a communication module. Wi-Fi or Bluetooth modules can be used for wireless communication. Programming is essential to control the robot's movements, process data from sensors, and handle live streaming. Python is commonly used for programming Raspberry Pi projects. A server or cloud service may be needed to handle the live streaming aspect. Platforms like YouTube, Twitch, or custom servers can be considered. Implementing security features such as encryption for video streaming, secure login mechanisms, and data protection is crucial, especially when dealing with surveillance. A user interface, possibly a web-based control panel, could be developed to remotely control the robot and monitor the live stream. Developing a mobile application can enhance user interaction and control options for the robot.

PROPOSED SYSTEM

It sounds like you're describing a project or system called "Pibot," which appears to be a Raspberry Pi-controlled robot designed for surveillance and live streaming in multiple environments. The name suggests a combination of "Pi" from Raspberry Pi and "bot" from robot. The Raspberry Pi is a credit card-sized computer that can be used for various applications. In this case, it serves as the brain of the robot, controlling its movements, sensors. The robot is designed to operate in different environments, suggesting it might have features to adapt to various terrains or conditions. This could include wheels or tracks for mobility, sensors for environmental awareness, and maybe even the ability to traverse different surfaces. Pibot is equipped with surveillance capabilities, likely in the form of cameras or other sensors. The live streaming feature implies that the robot can transmit real-time video or data to a remote location, allowing users to monitor the robot's perspective remotely. This could be useful for surveillance, remote exploration, or educational purposes. This term suggests that the system is still in the planning or proposal stage. It may not be a fully implemented project yet, and there could be room for further development or refinement. To drive the robot's movement.Including cameras, infrared sensors, or other environmental sensors. To enable remote control and live streaming. Efficient use of power resources for extended operation. Consideration for the physical structure and mobility of the robot.

BLOCK DIAGRAM



HARDWARE COMPONENTS

PICO

The Raspberry Pi Pico is a microcontroller board based on the Raspberry Pi RP2040 microcontroller chip.

Whether you want to learn the MicroPython programming language, take the first step in physical computing, or want to build a hardware project, Raspberry Pi Pico – and its amazing community – will support you every step of the way. In the project, it can control anything, from LEDs and buttons to sensors, motors, and even other microcontrollers.

Features

- 21 mm × 51 mm form factor

- RP2040 microcontroller chip designed by Raspberry Pi in the UK
- Dual-core Arm Cortex-M0+ processor, flexible clock running up to 133 MHz
- 264KB on-chip SRAM
- 2MB on-board QSPI Flash
- 26 multifunction GPIO pins, including 3 analog inputs
- 2 × UART, 2 × SPI controllers, 2 × I2C controllers, 16 × PWM channels
- 1 × USB 1.1 controller and PHY, with host and device support
- 8 × Programmable I/O (PIO) state machines for custom peripheral support
- Supported input power 1.8–5.5V DC
- Operating temperature -20°C to +85°C
- Castellated module allows soldering direct to ier boards
- Drag-and-drop programming using mass storage over USB
- Low-power sleep and dormant modes
- Accurate on-chip clock
- Temperature sensor
- Accelerated integer and floating-point libraries on-chip

DC MOTOR: In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a currentcarrying conductor and an external magnetic field to generate rotational motion.

CAMERA MODULE: A UVC (or Universal Video Class) driver is a USBcategory driver. A driver enables a device, such as your webcam, to communicate with your computer‟s operating system. And USB (or Universal Serial Bus) is a common type of connection that allows for highspeed data transfer. Devices that are equipped with a UVC driver, such as the Logitech Quick Cam Pro 9000 for Business, are capable of streaming video. In other words, with a UVC driver, you can simply plug your webcam into your computer and it‟ll be ready to use. It is the UVC driver that enables the webcam to be plug and play. A webcam with a UVC driver does not need any additional software to work

CONCLUSION

This project can be extended further by making the robot accessible via the internet. This can be implemented by making a android/iOS/windows phone app and then controlling it via the same. The robot can also made to implement the SLAM (simultaneous localization and mapping algos) to make it map the complete environment and then move autonomously after a certain periodic intervals to check everything. Also by giving it the ability to detect and recognize faces it can be made to alert us about any unknown person and take a snap of it and email us the same. It can be made to follow a specific face continuously rather than manually operate it to follow someone like the small children in the age group of1-4 years so that kids are continuously in front of our eyes. Can also take help of sensors to maintain a safe distance from the kids for the safety of the robot.

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