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Robot for precision farming

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ABSTRACT

Artificial intelligence is the development of computer systems that are able to perform tasks that would require human intelligence. Examples of these tasks are visual perception, speech recognition, decision-making, and translation between languages. The base object in this reference is the agent who is the "actor" taking birth in the software and culminating itself in the hardware body. The connection between those two is that the control of the robot is a software agent that reads data from the sensors decides what to do next and then directs the effectors to act in the physical world. The aim of this project is to build a robot which can be controlled through web application and has features such as object detection, depth perception, etc.

Keywords — Artificial Intelligence, Depth Perception, Image processing, Object Detection, Web Control, etc.

INTRODUCTION

Over the years, robotics has grown in importance. The ever-increasing demand for productivity, labor reduction, and operator and environmental safety have propelled robotics to the forefront of technological innovation. The same idea applies to agricultural robots, where such technologies can help farmers make farming easier, safer, and more profitable, while also offering higher quality goods with less environmental effect. The purpose of this study is to review the current state of the art for vision-based perception in agricultural robots across a wide range of field tasks, including weed identification, crop scouting, phenotyping, disease detection, vision-based navigation, harvesting, and spraying.

The major components of our study, AI Robot, include web- controlled applications, object identification, and depth perception. Web-based apps enable an interactive environment that is user-friendly, platform-independent, and available to everyone. Poor usability, extensibility, and accessibility are common robotics flaws that can be effectively fixed with web-based solutions. The efforts we made to incorporate these benefits of web-based solutions into robotic systems are described in this work.

Electronic parts such as Raspberry Pi, Pi Camera, DC Motor, L293D Motor Driver Module, etc. are used to construct the robot. The Raspberry Pi contains GPIO pins, USB, Ethernet, HDMI, LCD, and a camera that can be used to communicate with the outside world. The Raspberry Pi 3B+ we are utilizing here has a 64-bit ARMv8 quad-core processor and 1 GB LPDDR2, SDRAM.

Modern society places a lot of emphasis on security because it's crucial to protect one's surroundings for the safety of oneself and one's family. However, traditional security cameras have many limitations, including the need to be positioned at a specific angle for clear vision and their limited ability to cover a wide area. They can also only be used from a specific device and are unable to alert the user in the event of an emergency. Detection by detection workers becomes time-consuming and due to the vast area that gets affected it becomes more difficult.

LITERATURE REVIEW

A robot would have to be able to sense its surroundings and move around its environment. A robot needs to power itself, might be solar-powered, electrically powered, or battery-powered.[1] [3] The vehicle can be navigated by MSN and/or smartphone if necessary and displayed its position by RFID readers mounted on the patrolling route.[2] Wheeled robot is the convention type of movement for robots. Algorithms require to control it is slightly complex compare to track robot. Legged robot has robot legs that resemble biological species such as human, animal, and insect. It requires complex algorithms in order to walk.[2][3] The motor for open loop control system is usually having pre- defined settings. There is no return feedback after the action. For closed loop control, sensors embedded inside the mobile robot are used to collect feedback from the environment. This type of control system usually require more complex algorithm for controlling.[4][5][1] System computes color, motion, and shape cues, combining them in a probabilistic manner to accurately achieve object detection and recognition, taking some inspiration from vision

science. The presented approach has been implemented and evaluated on a humanoid robot torso located at realistic scenarios.[2][5] System computes color, motion, and shape cues, combining them in a probabilistic manner to accurately achieve object detection and recognition, taking some inspiration from vision science. The presented approach has been implemented and evaluated on a humanoid robot torso located at realistic scenarios.[6] Cloud robotics is centered on the benefits of converged infrastructure and shared services of a cloud computing environment. In this paper, a system is designed with an autonomous robot to sense environmental data such as temperature, humidity, and air quality and store them on the cloud.[7][2] The app can run on any Android- enabled device and allows for meaningful two-way communication between an Android controller and a robot.[8] Web controlled surveillance robot is much more practical device to be used compared to conventional security surveillance. Uses only one camera to secure a large area and is cost-efficient. Can move to any location within the range of the network and can be accessed globally from anywhere. At the core of system lies Raspberry-pi which is responsible for all the operation.[9][3] Wireless Human Detection Robot is an autonomous robotic vehicle that moves in the earthquake prone area. Main aim of the project is to use a wireless remote controlled robot, which have the sensors that detects the presence of the human being and indicates the presence to the user.[10] [8] [3] This system consists of transmitter and receiver unit. The robot can move in all the directions automatically without controlling it, which makes the system more effective to use is to provide more security.[9] [5].

DEVELOPMENT TOOLS

This paper depicts the project that intends to outline a reconnaissance robot that is intended to enter extremely dangerous zones without its surroundings being aware of its presence (thus the reconnaissance robot) and convey data about its surroundings to a remote server (that may also be controlling it) regarding feature feed. To capture its surroundings, the robot will use a camera. As a result, the mind makes a similar movement to our limbs (actuators).

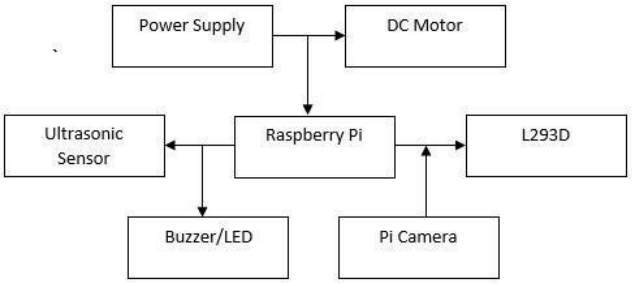

Figure 1 Block Diagram

Figure 1 depicts the hardware architecture of a robot. The Raspberry Pi serves as the system's primary control unit. The power supply circuit is intended to supply electricity to the Raspberry pi 3A and motor driver IC (L293D). dc motors control the robot's forward, backward, left, and right and stop movement. The camera module is used to capture picture frames for images of the farmers and the livestock in the farm. PuTTY is a third-party software that supports the flask framework, which is a python-based system that provides web control.Through the OS, we have encoded the fundamental web server connection.

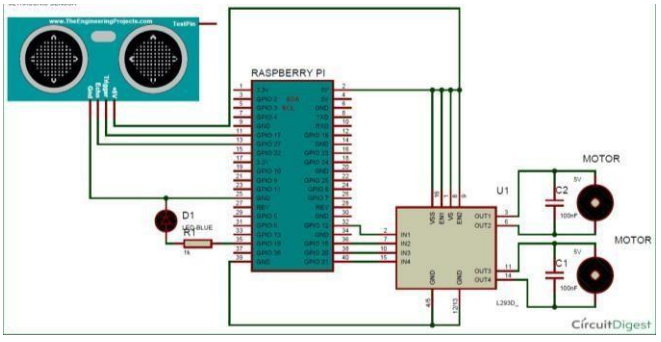

Figure 2 Circuit Diagram

Figure 2 illustrates the circuit diagram of the proposed system. A Motor Driver IC L293D is attached to the Raspberry Pi 3A to power the robot's motors. Motor driver input pins 2, 7, 10, and 15 are connected to Raspberry PiGPIO pins 12, 16, 20, and 21, respectively. To operate the robot, we used four DC motors, one linked to the output pins 3,6,11,14 of the motor driver IC and the other to the output pins 11 and 14 of the motor driver IC.The ECHO and TRIGGER pins are connected to the Raspberry Pi GPIO-27 and GPIO-17 pins respectively .The

ultrasonic sensor is positioned 45 degrees in front of the rover to sense uneven terrain in the farms.

Monitoring of farm resources using web Control
The prototype is equipped with remote monitoring facility for detecting farm and livestock related activities. We built up the 32-Bit OS on the Raspberry Pi and installed the Raspberry Pie imager. We used PUtty, a third-party pieceof software, for this.

All terrain navigation of robotic vehicle using depthperception.
The capacity to perceive objects in three dimensions (including length, width, and depth) and determine how far away they are is known as depth perception. The ultrasonic sensor detects land deformation on the farm and protects the robot from harm.The distant patches will have larger variations in the line orientations, and nearby patches with almost parallel lines will have smaller variations in lineorientations.

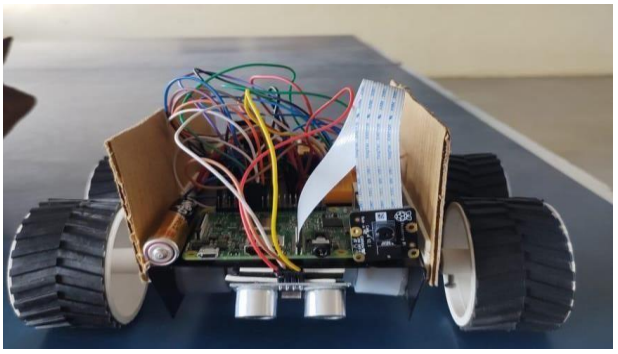

Figure 3 Hardware Representation

Object Detection
We have directly implemented the Open CV and the data set provided by Tensor Flow. Object detection is a computer vision technique for locating instances of objects in images or videos.

Background subtraction is the separation of background and foreground elements. Extracted foreground items are classified as stationary or moving. Investigation of classified items for detecting static regions of the object. Final item classification for accurate background and foreground modelling. The proposed system can recognize static items ina variety of lighting conditions as well as dynamicbackground surroundings.

Frameworks used in the proposed system
1. For object detection, Open CV is used and imported into the Raspbian operating system.

2. The code in the CV segment can be written in any language, however it is generally written in C programming languages.

3. To detect items in the environment, we can utilize OpenCV's Cascade Classifier class in a photograph The cascade classifier detects objects by utilizing a series of characteristics .We must use a trained model that includes the feature of the object that we wish to detect in an image.

4. TensorFlow is essentially a numerical computing software library. Data flow graphs are graphs in which nodes reflect mathematical procedures. The graph's edges reflect the multidimensional data arrays (called tensors) that are transmitted between them.

5. To detect items in an image, we can use the OpenCV Cascade Classifier class. The cascade classifier detects objects by applying Haar characteristics a series of attributes We must employ a trained model that contains the feature ofthe object in the image that we wish to detect.

6. Meanwhile, for web control, we used the Flask (Python) framework. Putty framework, which functions as third-partysoftware and supports Flask framework on Raspbian OS, andthis must be installed first.
7.
8. Flask supports direct backend customization and allows you to construct the webpage using HTML. In processing mode, Unicorn serves as an HTTP server for the Flask application.

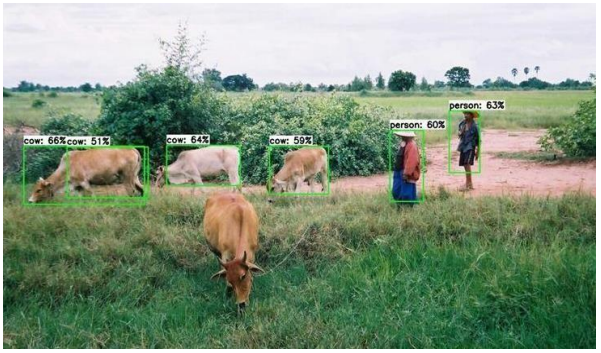

Figure 4 Farmer and livestock detection

A. Flowchart

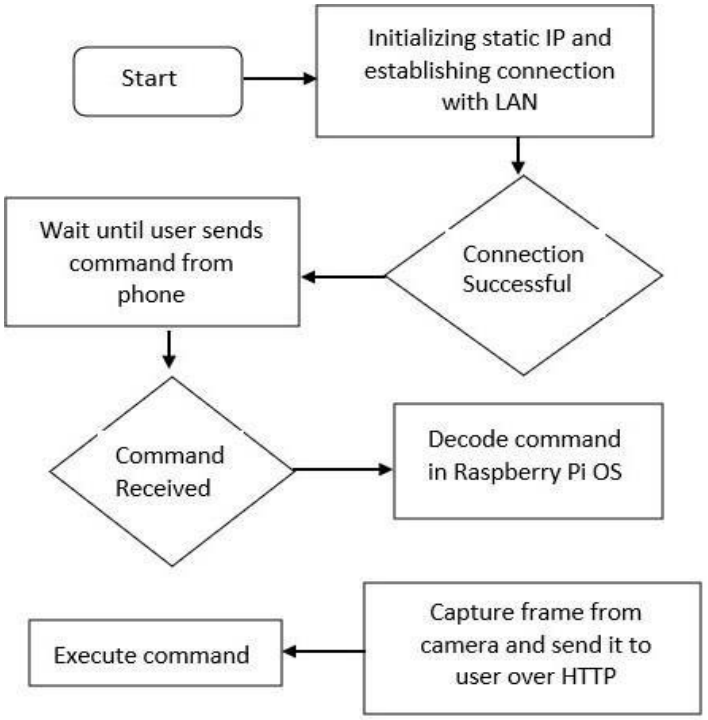

Fig 5 Flowchart of the proposed system

RESULTS AND DISCUSSION

This proposed AI-Robot model can detect objects and perceive depth using a pi cam and a web-controlled application. We have achieved proper robot operation after extensive testing.

In this paper, 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. We can control the robot with the help of laptop/mobile manually. Automatic monitoring can also be done. Our proposed robot is small in size thus maneuvering 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 the surveillance act. This provides highly efficient and a cost- effective robot that replaces human work and reduces human labor and performs monitoring works in a well effective manner.

Encryption and validation systems given by SSH improves security to a more noteworthy degree, in the light of the fact, generally the correspondence happens through a medium, which is unsecured (The Internet). This is majorly because of the way that SSH was made to supplant some frail remote login projects like rlogin, telnet and so forth. And has a bright future. The Android application's ability to remotely manage the surveillance robot opens up a wide

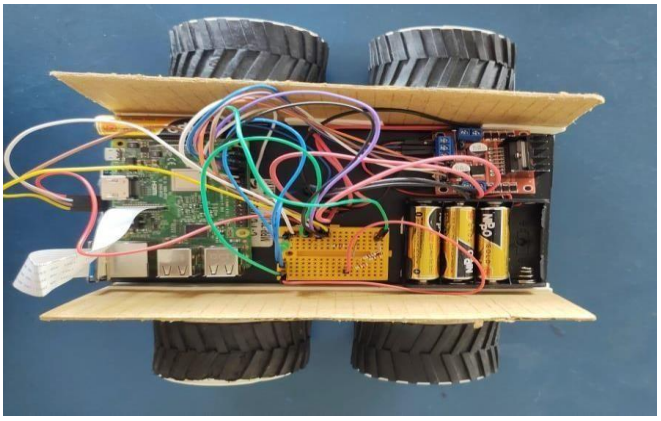

Fig 6 Top View of the Rover

CONCLUSION

The proposed E-com web site mainly consists backend and front end .we are using the node-JS, JavaScript, Mongo-dB, CSS and HTML to design the website. This web provides customer to efficiently handle and simply order what they want. Also the contact us page included to overcome the queries of the customer.

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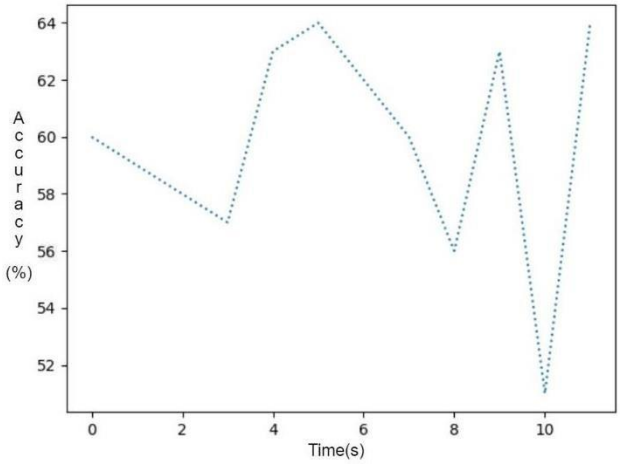

Fig 7 Accuracy graph

The overall average accuracy of our system for 60 sec
is 65.3 percent i.e. almost every object or human that is detected is accurate upto 65%. This accuracy helps the rover detect farmers and animals in the fields.

LIMITATIONS

AI-Robot model needs constant power supply, that's why we have to use power bank to supply to Raspberry pi and 12V battery to supply power to motor driver, On adding these components to chassis, it's weight increases. High initial investment. Robots typically require a large upfront investment. Expertise can be scarce. Industrial robots need sophisticated operation, maintenance and programming.
Ongoing costs.

FUTURE SCOPE

We may enhance AI-Robot by including features like object tracking, gesture control, voice control, and a pick-and-place arm. In practically every sector, surveillance is necessary. It might be an excellent answer to a variety of issues or circumstances when wireless surveillance is required. Due to the fact that it makes use of cutting-edge market technologies, our project has a huge scope. Our program runs on the Android operating system, which is now the most popular OS

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