JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

AUTONOMOUS MOTION DETECTOR AND TARGET DESTROYER

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Abstract : This project proposes an advanced automated system utilizing a Raspberry Pi for motion detection, target identification, and response initiation. The system leverages a combination of motion sensors, a camera module, and actuators to detect and track movement within a specified area. Upon detecting motion, the system triggers a sequence of events to identify the target and initiate a customized response, such as activating a pointing laser or other mechanisms. The Raspberry Pi serves as the central processing unit, orchestrating the entire process and providing flexibility for integration with various peripherals. This flexibility allows the system to be adapted for different applications, making it a versatile solution. The primary aim is to offer a cost-effective and reliable system that can be utilized in a range of scenarios, including security systems to monitor and respond to unauthorized access, and wildlife protection to deter animals from entering specific areas.

IndexTerms - **Raspberry Pi, automated motion detection, target elimination, sensors, camera, actuators, pointing laser**

I. INTRODUCTION

In today's security-conscious and automation-driven landscape, the proposed system, centered around the Raspberry Pi 3 Model B, presents a forward-looking solution. By harnessing the power of this versatile microcontroller, the system introduces an advanced method for motion detection and target engagement. Through the integration of a camera module, the system efficiently identifies and tracks movement, subsequently directing a laser at the detected target. This innovative approach finds applicability across diverse scenarios, including security systems, wildlife protection initiatives, and automated monitoring systems, underscoring its adaptability and relevance.

II. OPEN CV

OpenCV (Open Source Computer Vision Library) is an open-source computer vision and machine learning software library that offers tools and algorithms for real-time image processing. It includes pre-trained models and functions specifically designed for face detection and recognition in images or video streams

Additionally, OpenCV provides methods for recognizing faces based on detailed facial features, making it a widely used tool in various applications, from security systems to social media filters.

Dlib (Dlib-ml: A Machine Learning Toolkit) is a modern C++ toolkit designed for machine learning and the development of complex software solutions. It features a robust facial recognition module capable of face detection and facial landmark localization, essential for accurate face recognition tasks.

III. EXISTINGSYSTEM

Current security systems primarily use passive infrared (PIR) sensors to detect motion, triggering alarms or notifications upon detection. Some advanced systems may include basic camera modules for visual confirmation but lack sophisticated target identification or automated response mechanisms. These systems often require continuous manual monitoring, making them less effective in real-time threat situations

Additionally, they lack flexibility and customization, limiting their ability to adapt to various scenarios or integrate with diverse peripherals. Thus, existing systems provide basic security functionalities but do not offer comprehensive, automated solutions for effective threat management.

Existing system works with PIR (passive infrared) sensor which detects the motion and alarm the buzzer, which is said to manual monitoring to destroy target.

IV. DRAWBACKSOFEXISTINGSYSTEM

Reliance on PIR sensors results in limited detection capabilities, as they only detect motion based on infrared changes and do not provide detailed information about objects. This leads to a lack of automation, where systems require manual intervention for threat assessment and response

The need for human involvement slows down reaction times significantly. Additionally, these systems have insufficient integration options, limiting their flexibility to incorporate advanced technologies and peripherals.

A graph within a graph is an “inset”, not an “insert”. The word alternatively is preferred to the word “alternately” (unless you really mean something that alternates).

This restriction hinders overall functionality and the ability to enhance system performance. Furthermore, high false alarm rates are a common issue, with non-threatening sources often triggering alarms. This causes unnecessary disruptions and reduces the overall reliability of the security system.

High false alarm rates are a pervasive issue with these security systems. PIR sensors can be easily triggered by non-threatening sources such as animals, weather conditions, or even moving shadows.

These frequent false alarms lead to unnecessary disruptions and can cause alarm fatigue among security personnel. Over time, the reliability of the system is diminished as users may start ignoring alarms, potentially missing genuine threats.

I. METHODOLOGY

The proposed system integrates several key components to achieve automated motion detection and target engagement. At the core of the system is the Raspberry Pi 3 Model B, which serves as the central processing unit..

3.1Method and Process

The Raspberry Pi coordinates the functions of the camera module, the L298N motor driver, the stepper motor, and the 5V Mini Dot Laser Diode Module. The primary function of the system is to detect motion within a specified area using the camera, process the visual data to identify the target, and subsequently point the laser at the target. This method can be adapted for various applications, such as security systems or wildlife monitoring, by customizing the response mechanism.

The motion detection process begins with the camera module, which continuously captures video feed within the designated monitoring area. The Raspberry Pi processes these video frames using image processing algorithms to detect any movement

After detecting motion, the system employs further image processing to identify and track the target. The Raspberry Pi uses advanced algorithms to analyze the characteristics of the detected motion, distinguishing between different types of objects (e.g., human, animal, or inanimate).

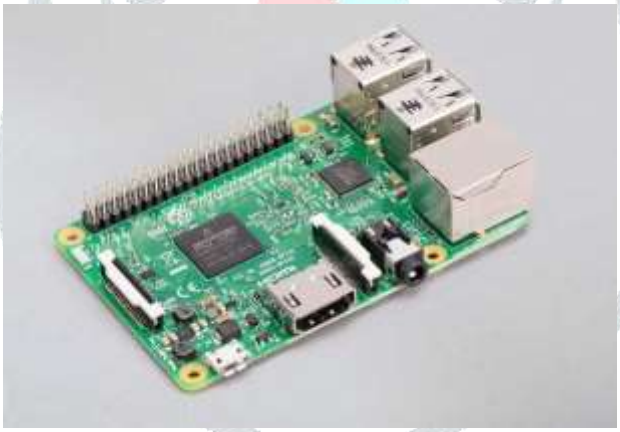

Fig 1.1 Raspberry pi 3 B

The laser pointing mechanism is driven by a stepper motor controlled by the L298N motor driver. The Raspberry Pi sends precise commands to the motor driver to adjust the orientation of the stepper motor, aligning the laser diode with the target..

3.3 Hardware Components

Raspberry Pi 3 :The Raspberry Pi 3 is a versatile and popular single-board computer (SBC) developed by the Raspberry Pi Foundation. It represents a significant advancement over its predecessors, offering improved performance, enhanced connectivity options, and expanded capabilities. Here's a breakdown of its key features:

web camera A web camera, also known as a webcam, plays a crucial role in the face recognition project by capturing live video feed of the surrounding environment,

Fig 1.2 Web camera

3.4 L298N motor driver

The L298N motor driver is a dual H-bridge motor driver integrated circuit (IC) used to control the direction and speed of DC motors and stepper motors. In this project, the L298N motor driver plays a critical role in managing the movements of the stepper motor that positions the laser pointer

Fig 1.3 Motor driver

3.4.1 Stepper motor

A stepper motor is an electromechanical device that converts electrical pulses into discrete mechanical movements. Unlike traditional motors that rotate continuously, stepper motors move in fixed increments, or steps, providing precise control over the motor's position

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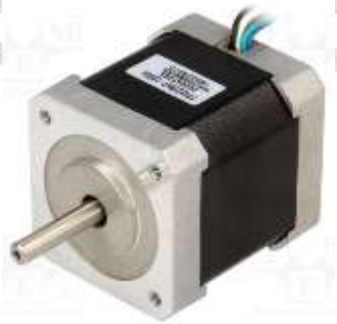

Fig 1.4: Stepper Motor

3.4.2 Laser Diode

The 5V Mini Dot Laser Diode Module 650nm is a compact and powerful laser pointer that emits a visible red laser beam with a wavelength of 650 nanometers. This module is used in the project as the primary mechanism for visually indicating the detected and tracked target

used for the reason of making the analysis statistically feasible.Fama McBeth regression is used to attenuate the problem of errors-in-variables (EIV) for two parameter models (Campbell, Lo and MacKinlay, 1997).If the errors are in the β (beta)of

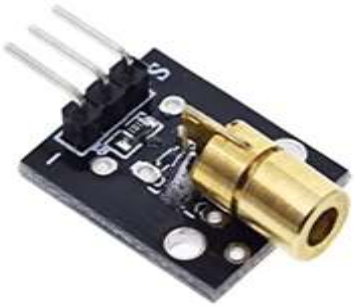

Fig 1.5: Laser module

3.4.2.1 Transformer

The SO12V51000 Micro SMPS Transformer is a compact and highly efficient component designed for use in low-voltage electronic circuits and devices. Its compact design makes it suitable for integration into small electronic devices and circuit boards where space is at a premium

3.4.2.2 Voltage Regulator (LM7805):

The LM7805 is a popular voltage regulator integrated circuit (IC) widely used in electronic circuits to provide a stable 5-volt output voltage from a higher input voltage source. Manufactured by various semiconductor companies, the LM7805 belongs to the 78xx series of linear voltage regulators, known for their simplicity, reliability, and ease of use.

The LM7805 features built-in overcurrent and thermal protection mechanisms, safeguarding against potential damage due to short circuits or excessive temperature. Its standardized pinout and compatibility with various capacitors for input and output filtering make it a versatile and widely adopted solution in the realm of hobbyist projects, educational laboratories, and commercial electronics. Despite its simplicity, the LM7805 remains a cornerstone component in countless electronic designs, offering stable and regulated power supply for a diverse array of applications.

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3.4.3 Software Requirements

Raspberry pi OS: Raspberry Pi OS, formerly known as Raspbian, is the official operating system designed specifically for the Raspberry Pi single-board computers. It is based on the Debian Linux distribution and tailored to the unique hardware capabilities of the Raspberry Pi platform. Raspberry Pi OS is renowned for its lightweight and optimized performance, making it ideal for a wide range of projects and applications.

Raspberry Pi OS is continuously updated and maintained by the Raspberry Pi Foundation, ensuring regular security patches, bug fixes, and feature enhancements. It benefits from a vibrant and active community of developers, educators, and enthusiasts who contribute to its development and provide support through forums, documentation, and online resources.

3.4.3.1 TERMINAL*:*

pip (Python Package Installer):

Functionality: pip is a package management system used to install and manage Python packages, libraries, and dependencies. Usage: To install a Python package using pip, the syntax is typically pip install <package_name>. For example, pip install requests installs the "requests" library. Additional options like --upgrade or --user can be appended to modify the installation behavior.

3.4.3.2 Python

Functionality: python is the command-line interface to the Python interpreter, allowing users to execute Python scripts and interact with the Python programming language interactively.

sudo (Superuser Do):

Functionality: sudo is a command used to execute commands with elevated privileges, typically requiring superuser (root) access.

Usage: To execute a command with sudo privileges, users prepend sudo to the command. For example, sudo apt-get update updates the package repository on Linux systems. Users are prompted to enter their password to verify their identity before the command is executed.

IV. RESULTS AND DISCUSSION

4.1 Results of Descriptive Statics of Study Variables

The implementation of the Autonomous Motion Detector and Target Pointer system using Raspberry Pi 3 Model B, a camera module, L298N motor driver, stepper motors, and a 5V Mini Dot Laser Diode Module has yielded promising results in several key areas:

4.1.1. Accurate Motion Detection

The system demonstrated high accuracy in detecting motion within the specified area. The camera module effectively captured real-time video feed, enabling the detection of any movement. The image processing algorithms running on the Raspberry Pi accurately identified moving objects, reducing false positives and ensuring reliable detection.

4.1.2. Efficient Target Identification

Upon detecting motion, the system successfully identified the target and tracked its movement. The camera module provided clear visuals, allowing the Raspberry Pi to process the images and differentiate between relevant targets and background noise. This capability is crucial for applications such as security and wildlife monitoring, where precise target identification is necessary.

4.1.3. Precise Laser Pointing

The integration of the 5V Mini Dot Laser Diode Module with the stepper motors controlled by the L298N motor driver resulted in precise laser pointing. The system accurately directed the laser to point at the detected target, demonstrating the potential for

Fig 1.6 project output

applications requiring targeted marking or identification. The stepper motors' fine control enabled smooth and accurate positioning of the laser.

4.1.4. Real-Time Operation

The system operated effectively in real-time, with minimal lag between motion detection, target identification, and laser pointing. The processing power of the Raspberry Pi 3 Model B proved sufficient for handling the image processing tasks and motor control simultaneously. This real-time capability is essential for dynamic environments where timely responses are critical.

V. ACKNOWLEDGMENT

Thepreferredspellingoftheword “acknowledgment” inAmericaiswithoutan “e” afterthe “g”.Avoidthestiltedexpression, “Oneofus(R.B.G.)thanks...”
Instead,try“R.B.G.thanks”.Putapplicablesponsoracknowledgmentshere;DONOTplacethemonthefirstpageofyourpaperorasafootnote.

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