Advanced Computer Vision-Based Surveillance System for Helmet Detection and Triple Rider Identification on Motorcycles using Machine Learning

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ARTICLEINFO

ABSTRACT

In many countries, the number of motorbike accidents has been steadily rising over time. Over 37 million individuals in India own and operate two-wheelers. As a result, it's imperative to create a system for automatically detecting triple riding and helmet use. So, a machine learning-based technique is used to construct a unique object detection model that can recognize motorcycle riders. When a helmetless rider and triple rides are detected, the number plate is extracted, and the number plate number is recognized using an optical character recognition device. If the bike riders weren't wearing helmets and if they were performing triple rides, then this was the case. With the use of a webcam, this application can be used in real time.

With the help of deep learning, we can categorize the image of the three cyclists in this project. This uses a CNN-based architecture to categorize the image. The initial step in this project's approach is to train the webcam's captured image. The network will then provide the output based on the trained data by taking into account webcam input. 70% accuracy is what this will yield.

Keywords: Arduino Uno, Image processing, RFID, GSM

I. INTRODUCTION

Artificial intelligence (AI) is used in machine learning, which gives computers the capacity to autonomously learn from their experiences. Over the years, the number of motorbike accidents has been rising quickly in many nations. system for automatically detecting headgear wear to improve traffic safety. A machine learning-based technique is used to construct an object detection model that can recognize motorcycle riders. A notification will be sent over GSM to the owner's phone if cyclists are discovered to be riding without a helmet or in a triple formation. The RFID reader will read the tag, obtain the vehicle's information, and relay the owner's vehicle number through GSM.

II. RELATED WORKS

The captured image is given to an optical character recognition (OCR) model, which recognizes the text and outputs the number plate number as machine encoded text. Lokesh Allamki, Manjunath Panchakshari, Ashish Sateesha, and K S Pratheek, "Helmet Detection Using Machine Learning and Automatic Licence Plate Recognition," International Research Journal of Engineering and Technology (IRJET), Volume: 06 Issue: 12 | Dec 2019.

I learned about machine learning and image processing from this study[1]

Visual object identification and image processing are discussed in Viola and Jones' "Robust Real-time Object Detection", published in IJCV 2001.

Operates with integrated images, adboost, and cascade

The system produces face recognition [2].

[1] Robert Girshick In order to detect objects, this article suggests using a Fast Region-based Convolutional Network (Fast R-CNN). In order to effectively classify object suggestions using deep convolutional networks, Fast R-CNN leverages on prior research. Fast R-CNN uses a number of advancements in comparison to earlier work to speed up training and testing and boost detection accuracy. Fast R-CNN obtains a higher mAP on PASCAL VOC 2012 and trains the very deep VGG16 network 9 times quicker than R-CNN. It is also 213 times faster during testing. Fast R-CNN trains VGG16 3 times quicker, runs tests 10 times faster, and is more accurate than SPPnet[3]

Mattias O'Nils1, Consolatina Liguori2, Yali Nie1, Paolo Sommella2, Jan Lundgren: Deep convolutional neural networks (DCNNs) have demonstrated encouraging skin cancer detection outcomes during the last three years. Due to the visual resemblance between benign and malignant dermo scopic images, it is still necessary to increase the accuracy and effectiveness of the automatic identification of melanoma. Additionally, there is a need for quick and efficient computational systems for mobile applications aimed at carers and households. The You Only Look Once (Yolo) algorithms, which are based on DCNNs and used to identify melanoma, are presented in this study. The Yolo algorithms, which include YoloV1, YoloV2, and YoloV3, divide an image into a number of cells after first resetting the size of the input image. Depending on where the thing was found The network will attempt to predict both the class confidence score and the bounding box of the item for the cellp[4]

III.METHODOLOGY

The information will be sent to embedded systems hardware through a USB to Serial Converter in this project in order to identify triple riders and riders without helmets. Here, we'll send the car number details over GSM after obtaining the data from the image processing.
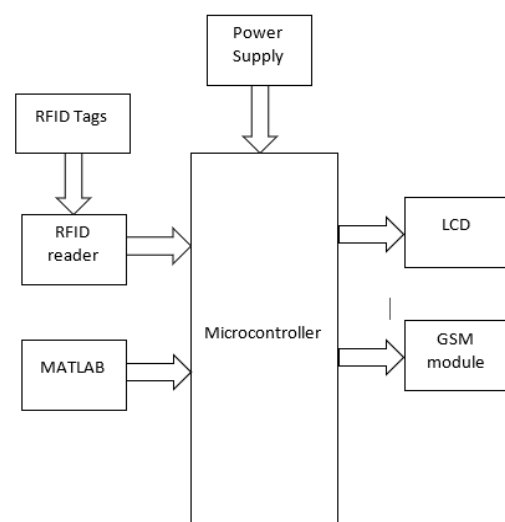

Fig :1

ARDUINO:

Popular microcontroller boards like the Arduino Uno are frequently seen in embedded systems. It is a component of the Arduino platform, which gives

users access to an open-source hardware and software environment for creating interactive electrical gadgets and prototypes. The Microchip ATmega328P microprocessor serves as the foundation for the Arduino Uno. It features 32KB of flash memory, 2KB of SRAM, and 1KB of EEPROM and runs at 5 volts. The microcontroller has a 16 MHz clock speed. Input/output (I/O) pins on the board, both digital and analogue, can be used to connect sensors, actuators, and other electrical devices. There are 6 analogue input pins and 14 digital I/O pins, six of which can be utilised as PWM outputs.
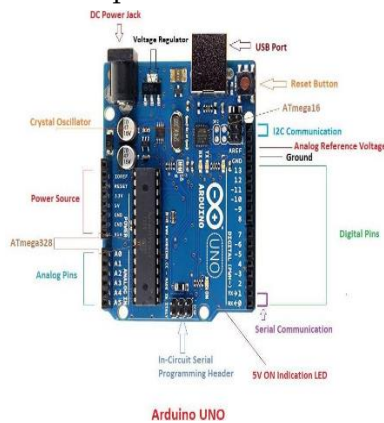
Arduino UNO

Both an external power source or the USB connection can be used to power the Arduino Uno. It can function within a range of 7 and 12 volts thanks to an integrated voltage regulator. There is also a 5V output pin available for external component power. The Arduino programming language, a condensed form of C/C++, may be used to code the Arduino Uno. An intuitive interface is offered by the Arduino IDE (Integrated Development Environment) for authoring, compiling, and uploading code to the board. The capability of the Arduino Uno may be increased by stacking other add-on boards, or shields, on top of it. There are shields for a variety of uses, including Ethernet connectivity, Bluetooth and Wi-Fi wireless communication, motor control, display, and more. The flexible Arduino Uno is extensively utilised in a variety of projects, including wearable technology, robotics, home automation, data recording, environmental monitoring, and general prototyping.

Overall, the Arduino Uno is a versatile development board for beginners that can be used by both

enthusiasts and experts. It is a well-liked option for quick prototyping and embedded system development due to its accessibility, price, and broad community support.

RC522 Reader:

The MFRC522 controller from NXP Semiconductors is the foundation of the 13.56MHz RFID module known as the RC522. The module typically comes with an RFID card and key fob and can support I2C, SPI, and UART. It is frequently used in applications for person/object identification, such as attendance systems.

A transponder or tag affixed to an item that has to be identified and a transceiver, often referred to as an interrogator or reader, are the two essential parts of an RFID system.

A high frequency electromagnetic field is produced by an antenna that is part of a reader. While the tag often lacks a battery because it is a passive device. Instead, it is equipped with a microchip for processing and storing information as well as an antenna for signal reception and transmission.

RFID Tag:

A RFID tag (also known as a dazzling card moulded tag) is depicted in the image. There are many different sizes and forms of RFID labels available. An IC for storing the data, a transmission and receiving device, as well as a modulator, are all included in the Tag. Only a tiny amount of data can be stored on tags because of their small size.

The Automatic Identification and Data Capture (AIDC) innovation conference offers room for RFID. As a result, with almost no human involvement, AIDC techniques identify things, collect data about them, and directly enter this data into PC frameworks. RFID techniques make use of radio waves to do this.

A radio cable, an RFID reader, and an RFID tag or dazzling mark make up an RFID framework's three basic components. For transmitting data to the RFID reader, also known as the examiner, RFID labels have a coordinated circuit and receiving wire. After that, the reader transforms the radio waves into an information structure that may subsequently be used. The information created from the labels is subsequently transferred to a host PC framework via a correspondence interface can be stored in a database and deconstructed afterwards.

LCD:

Liquid Crystal Display is referred to as LCD. Many different electronic products, such as televisions, computer displays, cellphones, calculators, and embedded systems, utilise this flat-panel display technology. LCDs provide a variety of benefits, including low power usage, a small footprint, and the capacity to show text, numbers, graphics, and pictures. There are several different varieties of LCDs, including active-matrix LCDs (TFT-LCDs), in-plane switching LCDs, and twisted nematic LCDs (TN-LCDs). The viewing angles, response times, colour reproduction, and power consumption vary depending on the kind. Thin-film transistor LCDs, often known as TFT-LCDs, are utilised extensively because of their quick reaction times and superior picture clarity.
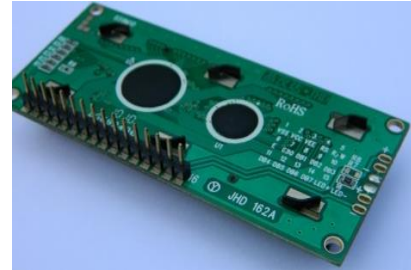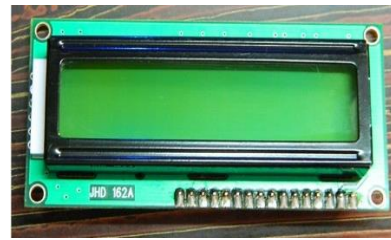
LCDs are frequently employed in embedded systems as visual output devices to provide information, user interfaces, and data readings. Using protocols like I2C or SPI, they can connect to other display controllers or microcontrollers. LCDs can frequently be programmed and controlled more easily with the help of libraries and APIs, which increases their accessibility and adaptability for a variety of applications.

GSM

Global System for Mobile Communications, or GSM, is an industry standard for digital cellular transmission of mobile voice and data services. As a substitute for the first-generation analogue cellular networks, it was initially developed in the 1980s.

Over 80% of mobile networks employ GSM, which runs in the 900 MHz, 1800 MHz, and 1900 MHz frequency bands. Users may take use of the technology's voice quality, security features, and data transfer capabilities, among other advantages. Over time, GSM has experienced a number of improvements, including the addition of quicker data

transmission rates and better security measures. It is still a widely used mobile communication standard and has contributed significantly to the expansion of the mobile sector.

Power supply:

In order to power electronic equipment or circuits, a power source is a machine or a system that generates electricity. It transforms the input power from a source—like a battery or an electrical outlet—into a form appropriate for the unique needs of the devices it is powering. Consumer electronics, computers, telecommunications systems, industrial machinery, and many other types of equipment all utilize power supply.

The devices' power requirements, voltage and current ratings, efficiency, size, dependability, and safety regulations are all things to take into account when choosing a power supply. To guarantee the proper and dependable operation of the linked devices, it is crucial to select a power supply that suits the particular requirements of the application.

MATLAB:

LINPACK (linear system package) and EISPACK (eigen system package) programmes generated matrix software, which was initially made accessible through the creation of MATLAB. Compute, visualise, and the programming environment are all integrated. Additionally, MATLAB is a contemporary programming language environment that supports object-oriented programming, has sophisticated data structures, and has built-in editing and debugging tools. When it comes to tackling technical issues, MATLAB is far superior than traditional programming languages (like C and FORTRAN).

It features strong internal routines that allow for a huge range of computations. Additionally, it offers simple graphics instructions that enable results to be visualized right away. Individual apps are gathered in toolbox-style packages. There are toolboxes for a number of applied science and engineering disciplines, including signal processing, symbolic computation, control theory, simulation, and optimization. A simple data element in the interactive system MATLAB is an array that doesn't need to be dimensioned. Since its initial release in 1984, the software programmed has become widely used in businesses and colleges around the world.

Advantages and Applications

ADVANTAGES

1.Reduces accidents

2.If anyone breaks the rule then message will send to the vehicle owner's number

3.More accurate

4.Reduces traffic violation

APPLICATIONS

1.Road safety surveillance

2.Accident prevention system

IV. RESULTS AND DISCUSSIONS

Figure 1

In this project, the integrates sensors, surveillance system for detection of bike riders With Arduino as the core component, it enables real-time data collection and analysis. The system empowers users with actionable insights to address transformer health monitoring effectively.

Figure:2

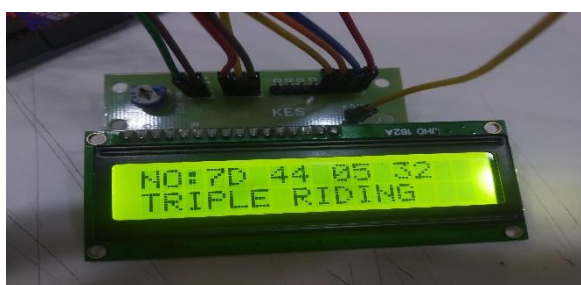The LCD display shows the vehicle number and helmet not wear.

Figure:3

The LCD display shows triple ride indication and vehicle number.

V. CONCLUSION

Real-time processing works nicely with the object detection. to precisely localise and categorise each item class. uses machine learning to find triple riders and helmetless cyclists. Any traffic management departments may use them. Make work simpler, more effective, and accident-free.

VI. REFERENCES

[1]. International Research Journal of Engineering and Technology (IRJET), Volume: 06 Issue: 12 | December 2019, Lokesh Allamki, Manjunath Panchakshari, Ashish Sateesha, and K S Pratheek, "Helmet Detection Using Machine Learning and Automatic Licence Plate Recognition".

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