

Indoor and Outdoor Navigation Assistant System for Visually Impaired People using Yolo Technology

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Abstract - Good vision is a precious gift but unfortunately loss of vision is becoming common now a days. To help the blind people the visual world has to be transformed into the audio world with the potential to inform them about objects as well as their spatial locations. Objects detected from the scene are represented by their names and converted to speech. In this work, assistive system for blind is suggested, to let him knows what is around him, by using YOLO for detecting objects within images quickly based on deep neural network to make accurate detection, and Open CV under Python. The obtained results indicated the success of the proposed model in giving blind users the capability to move around in unfamiliar indoor outdoor environment, through a user. This project involved Artificial intelligence to detect and analyze objects and send details via speaker In the proposed work, we solve the existing system problem by using dark net YOLO techniques that are used to reduce the recognize time of multi objects in less time with best time complexities.

Keywords- Assist Blind, Open CV, Python, Deep Neural Networks, YOLO

I. INTRODUCTION

One of the major daily problems encountered by visually impaired people is unsafe mobility. They fail to detect and avoid obstacles in their path, thus causing them emotional suffering, undercutting their independence, and exposes them to injuries. A recent World Health Organization (WHO) statistics show that there are approximately 253 million individuals around the world who are visually impaired. There are 217 million individuals with vision impairment, while 36 million people are blind. The visual impairment is turned into a matter of great concern as the number of visually impaired people tends to increase by 2 million per decade. The number of blind people is estimated to double by 2020. People with vision impairment and vision ailments need help to perform day-to-day tasks, such as walking and exploring unfamiliar environments.

Vision impaired individuals need assistance to perform their daily schedule, particularly in navigation. When individuals with vision impairment are in new or unfamiliar environments, they need to identify obstacles and other interferences to allow a secure navigation. Research is focusing on this problem to develop supporting devices or assistants for individuals with visual impairment. Some navigation devices and systems are currently available for the blinds and visually impaired people. Seeing-eye dogs and white canes are the most important devices. However, their performance is limited in terms of speed, coverage and the ability which are generally available for people with actual eyes. A cane can only detect obstacles at knee level and cannot detect head level obstructions. In addition, it can only detect an obstacle within a short range (1 m). Seeing-eye dogs are a great navigation tool, but unable to detect overhanging obstacles, and need intensive training which is a tedious job for the visually impaired. Furthermore, the cost of seeing-eye dogs is very high compared to other aids. The need of navigation help among blind people and a broader look at the advanced technology becoming available in today's world motivated us to develop this project. Technology is something which is there to ease tasks for human beings. Hence, in this project, we use technology to solve the problems of visually impaired people. The project aims to help users in navigation with the use of technology and our engineering profession motivates us to use the technology we have.

II .EXISTING SYSTEM

In this existing system blind people using ultrasonic sensor. Ultrasonic sensor fixed in blind people stick, if any object detect by ultrasonic in front of blind people, buzzer will be on. And a Sensing Module with Arduino as the microcontroller and Ultrasonic Sensor and IR Sensors at different positions so that it can properly detect the obstacles are used. OpenCV based object detection implemented. But it could not find object accurately Object recognition done with mat lab software. But it's a simulation output. A road surface smoothness detection systems capable of detecting obstructions in front of a person and generating a warning that notifies users but is unable to detect potholes on the road surface. The system developed was able to identify potholes but was only modeled in simulation.

DRAWBACKS

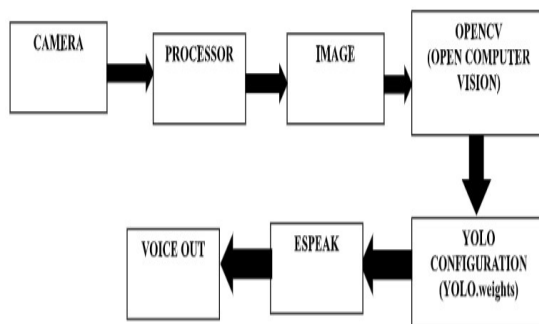
- It's a simulation software. So we could not implement in real-time
- Output accuracy low

III. PROPOSED SYSTEM

In this proposed system we will find objects in real time using AI, OPENCV, YOLO (You only live once).After acquisition of image it has to be per-processed and compressed. Various daily use objects' images are used to train the model. It is trained by performing feature extraction on the image to obtain the required pattern in the image. Followed by feature fusion and dimension reduction to compress the image for reliable and real time performance. Then this YOLO data-set is used to train the classifier. Comparing the performance of various classifiers we select the optimum one, and thus the object recognition model is achieved. Now any test image may be given to this model which will be classified into one of the classes the model has been trained into.

ADVANTAGE

- YOLO is extremely fast
- Accuracy high
- Implement to any processor with its dependencies
- Low cost



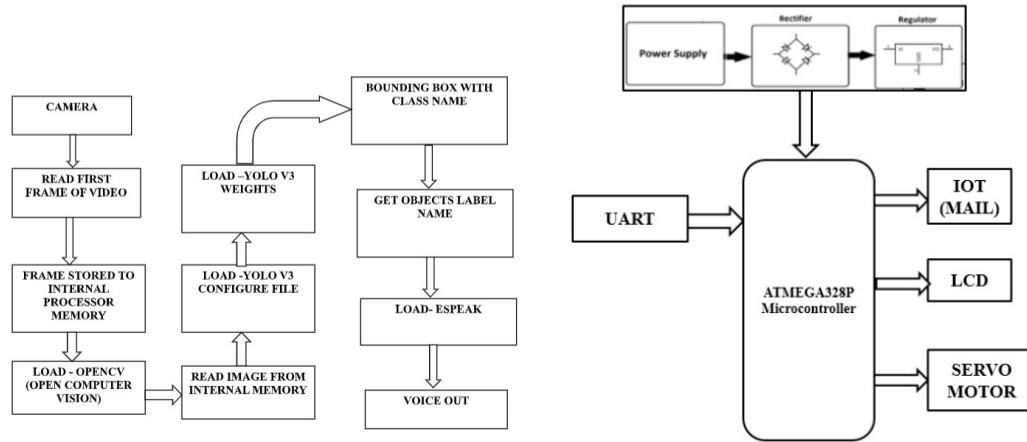
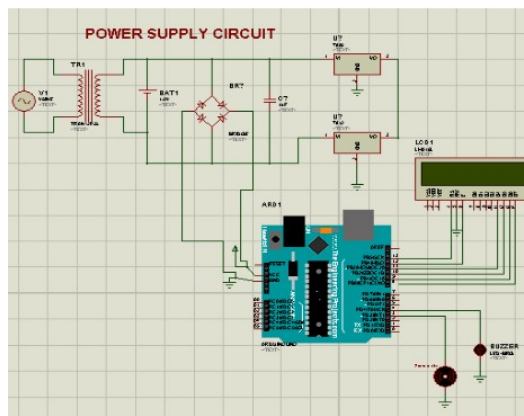


Fig.1.Proposed system block diagram

EXPLANATION

- The image processed output is given to the hardware system consist of ATMEGA328P micro-controller.
- If the person detected is authorized the micro-controller gives signal to servo motor to open the door.
- If the person detected is unknown or unauthorized then the door will not open and this information is sent as mail to the registered mail Through IOT and also displayed on LCD display.

CIRCUIT DIAGRAM



PROCESSOR

The processor is a chip or a logical circuit that responds and processes the basic instructions to drive a particular computer. The main functions of the processor are fetching, decoding, executing, and write back the operations of an instruction. The processor is also called the brain of any system which incorporates computers, laptops, smart phones, embedded systems, etc. The ALU (Arithmetic Logic Unit) and CU (Control Unit) are the two parts of the processors. The Arithmetic Logic Unit performs all mathematical operations such as additions, multiplications, subtractions, divisions, etc and the control unit works like traffic police, it manages the command or the operation of the instructions. The processor communicates with the other components also they are input/output devices and memory/storage devices.

WEB CAM

A webcam is a video camera that feeds or streams its image in real time to or through a computer to computer network. When "captured" by the computer, the video stream may be saved, viewed or sent on to

other networks via systems such as the internet, and email as an attachment. When sent to a remote location, the video stream may be saved, viewed or on sent there. Unlike an IP camera (which connects using Ethernet or Wi-Fi), a webcam is generally connected by a USB cable, or similar cable, or built into computer hardware, such as laptops. The term "webcam" (a clipped compound) may also be used in its original sense of a video camera connected to the Web continuously for an indefinite time, rather than for a particular session, generally supplying a view for anyone who visits its web page over the Internet.

OPEN CV

Open Source Computer Vision Library' initiated by some enthusiast coders in '1999' to incorporate Image Processing into a wide variety of coding languages. It has C++, C, and Python interfaces running on Windows, Linux, Android and Mac. Officially launched in 1999 the Open CV project was initially an Intel Research initiative to advance CPU-intensive applications, part of a series of projects including real-time ray tracing and 3D display walls. The main contributors to the project included a number of optimization experts in Intel Russia, as well as Intel's Performance Library Team. Disseminate vision knowledge by providing a common infrastructure that developers could build on, so that code would be more readily readable and transferable. Advance vision-based commercial applications by making portable, performance-optimized code available for free – with a license that did not require code to be open or free itself.

YOLO

You Only Look Once (YOLO) is a network that uses Deep Learning (DL) algorithms for object detection. YOLO performs object detection by classifying certain objects within the image and determining where they are located on it. For example, if you input an image of a herd of sheep into a YOLO network, it will generate an output of a vector of bounding boxes for each individual sheep and classify it as such.

YOLO ALGORITHM

Once you insert input an image into a YOLO algorithm, it splits the images into an SxS grid that it uses to predict whether the specific bounding box contains the object (or parts of it) and then uses this information to predict a class for the object. Before we can go into details and explain how the algorithm functions, we need to understand how the algorithm builds and specifies each bounding box. The YOLO algorithm uses four components and additional value to predict an output.

1. The center of a bounding box (b x b y)
2. Width (b w)
3. Height (b h)
4. The Class of the object ©

The final predicted value is confidence (p c). It represents the probability of the existence of an object within the bounding box. The (x, y) coordinates represent the center of the bounding box. Typically, most of the bounding boxes will not contain an object, so we need to use the p c prediction. We can use a process called non-max suppression to remove unnecessary boxes with low probability to contain objects and those who share big areas with other boxes.

YOLO V3

YOLO V3 is an incremental upgrade over YOLO V2, which uses another variant of Dark net. This YOLO V3 architecture consists of 53 layers trained on Image net and another 53 tasked with object detection which amounts to 106 layers. While this has dramatically improved the accuracy of the network, it has also reduced the speed from 45 fps to 30 fps.

DARKNET

Dark net is a little awesome open source neural network written in C. Is fast, slim and friendly to use. In particular, if you are interested in a fast and small classifier you should try Tiny Dark net. I'm using it in

conjunction with a Bayesian network in order to classify a huge amount of images (using my slow pc) in a fast and reliable way (maybe I'll explain more in another post). You should also use Nightmare the counterpart of Deep Dream. Like I did in a previous post, I wanted to analyze the community of projects surrounding Dark net. In this exploration I'm using the fork action in order to obtain a network. As second step I'm using a community detection method and some metrics in order to obtain interesting clusters.

SOFTWARE REQUIREMENTS

H/W SYSTEM CONFIGURATION:-

- Processor - Pentium – IV
- RAM - 4 GB (min)
- Hard Disk - 20 GB

S/W SYSTEM CONFIGURATION:-

- Operating System: Windows 7 or 8
- Software: Python Idle

SOFTWARE ENVIRONMENT

PYTHON TECHNOLOGY

Python is an interpreter, high-level, general-purpose programming language. It supports multiple programming paradigms, including procedural, object-oriented, and functional programming. Python is often described as a "batteries included" language due to its comprehensive standard library.

Python has been successfully embedded in many software products as a scripting language, including in finite element method software such as Abaqus, 3D parametric modeler like FreeCAD, 3D animation packages such as 3ds Max, Blender, Cinema 4D, Light wave, Houdini, Maya, modo, MotionBuilder, Softimage, the visual effects compositor Nuke, 2D imaging programs like GIMP, Inkscape, Scribus and Paint Shop Pro, and musical notation programs like scorewriter and capella.

Python is commonly used in artificial intelligence projects with the help of libraries like TensorFlow, Keras and Scikit-learn. As a scripting language with modular architecture, simple syntax and rich text processing tools, Python is often used for natural language processing. Many operating systems include Python as a standard component. It ships with most Linux distributions, AmigaOS 4, FreeBSD (as a package), NetBSD, OpenBSD (as a package) and macOS and can be used from the command line (terminal). Many Linux distributions use installers written in Python: Ubuntu uses the Ubiquity installer, while Red Hat Linux and Fedora use the Anaconda installer. Gentoo Linux uses Python in its package management system, Portage. Python is used extensively in the information security industry, including in exploit development. Most of the Sugar software for the One Laptop per Child XO, now developed at Sugar Labs, is written in Python. The Raspberry Pi single-board computer project has adopted Python as its main user-programming language.

PANDAS

In computer programming, pandas is a software library written for the Python programming language for data manipulation and analysis. In particular, it offers data structures and operations for manipulating numerical tables and time series. It is free software released under the three-clause BSD license. The name is derived from the term "paneldata", an econometrics term for data sets that include observations over multiple time periods for the same individuals.

CSV READER

CSV (Comma Separated Values) is a simple file format used to store tabular data, such as a spreadsheet or database. A CSV file stores tabular data (numbers and text) in plain text. Each line of the file is a data record.

Each record consists of one or more fields, separated by commas. The use of the comma as a field separator is the source of the name for this file format. For working CSV files in python, there is an inbuilt module called csv.

ARDUINO IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino board. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. [4] The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program argued to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board.

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

LIBRARIES

Libraries provide extra functionality for use in sketches, e.g. working with hardware or manipulating data. To use a library in a sketch, select it from the Sketch > Import Library menu. This will insert one or more #include statements at the top of the sketch and compile the library with your sketch. Because libraries are uploaded to the board with your sketch, they increase the amount of space it takes up. If a sketch no longer needs a library, simply delete its #include statements from the top of your code.

There is a list of libraries in the reference. Some libraries are included with the Arduino software. Others can be downloaded from a variety of sources or through the Library Manager. Starting with version 1.0.5 of the IDE, you do can import a library from a zip file and use it in an open sketch.

CONNECTING THE ARDUINO

Connecting an Arduino board to your PC is quite simple. On Windows:

1. Plug in the USB cable - one end to the PC, and one end to the Arduino board.
2. When prompted, select "Browse my computer for driver" and then select the folder to which you extracted your original Arduino IDE download.
3. You may receive an error that the board is not a Microsoft certified device - select "Install anyway."
4. Your board should now be ready for programming.

When programming your Arduino board it is important to know what COM port the Arduino is using on your PC. On Windows, navigate to Start > Devices and Printers, and look for the Arduino. The COM port will be displayed underneath. Alternatively, the message telling you that the Arduino has been connected successfully in the lower-left hand corner of your screen usually specifies the COM port it is using.

PREPARING THE BOARD

Before loading any code to your Arduino board, you must first open the IDE. Double click the Arduino .exe file that you downloaded earlier. A blank program, or "sketch," should open. The Blink example is the easiest way to test any Arduino board. Within the Arduino window, it can be found under File- > Examples-> Basics-> Blink. Before the code can be uploaded to your board, two important steps are required.

1. Select your Arduino from the list under Tools-> Board. The standard board used in RBE 1001, 2001, and 2002 is the Arduino Mega 2560, so select the "Adriano Mega 2560 or Mega ADK" option in the dropdown.
2. Select the communication port, or COM port, by going to Tools->Serial Port.

LOADING CODE

The upper left of the Arduino window has two buttons: A checkmark to Verify your code, and a right-facing arrow to upload it. Press the right arrow button to compile and upload the Blink example to your Arduino board. The black bar at the bottom of the Arduino window is reserved for messages indicating the success or failure of code uploading. A "Completed successfully" message should appear once the code is done uploading to your board. If an error message appears instead, check that you selected the correct board and COM port in the Tools menu, and check your physical connections. If uploaded successfully, the LED on your board should blink on/off once every second. Most Arduino boards have an LED prewired to pin 13. It is very important that you do not use pins 0 or 1 while loading code. It is recommended that you do not use those pins ever. Arduino code is loaded over a serial port to the controller.

IV.HARDWARE REQUIREMENTS

POWER SUPPLY CIRCUIT

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others. Power supplies for electronic devices can be broadly divided into linear and switching power supplies. The linear supply is a relatively simple design that becomes increasingly bulky and heavy for high current devices; voltage regulation in a linear supply can result in low efficiency. A switched-mode supply of the same rating as a linear supply will be smaller, is usually more efficient, but will be more complex.

TRANSFORMER

Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC and this is one of the reasons why mains electricity is AC. Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage (230V in UK) to a safer low voltage.

ARDUINO UNO

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion Boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Adriano Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the

hardware are also available. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. The ATmega328 on the Arduino Uno comes preprogrammed with a boot loader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol. The Uno also differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

SPECIFICATION

- ✓ Microcontroller: Microchip ATmega328P
- ✓ Operating Voltage: 5 Volt
- ✓ Input Voltage: 7 to 20 Volts
- ✓ Digital I/O Pins: 14 (of which 6 provide PWM output)
- ✓ Analog Input Pins: 6
- ✓ DC Current per I/O Pin: 20 mA
- ✓ DC Current for 3.3V Pin: 50 mA
- ✓ Flash Memory: 32 KB of which 0.5 KB used by boot loader
- ✓ SRAM: 2 KB
- ✓ EEPROM: 1 KB
- ✓ Clock Speed: 16 MHz

LIQUID CRYSTAL DISPLAY

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. An

SERVOMOTOR

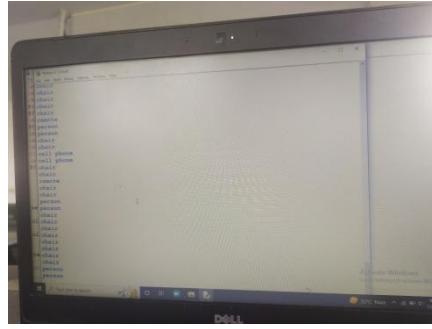
A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

NODE MCU

Node MCU is an open source Lua based firmware for the ESP8266 Wi-Fi SOC from Espressif and uses an on-module flash-based SPIFFS file system. Node MCU is implemented in C and is layered on the Espressif NON-OS SDK.

EXPERIMENTAL RESULT





V.CONCLUSION

The project started with the motivation and the idea to solve the problems of visually impaired people. Many methods were found to implement object detection and the usage of Open CV Library and YOLO was the best choice. We present a visual substitution system for blind people based on object recognition in frames. This system uses Yolo configuration, weights and features matching for object identification. We devote the experimental part to test the application in order to detect some objects in some frames with different conditions. This project presents a novel navigation device for the Visually impaired groups to help them reach the destination safely and efficiently. When it detected it alert the visually impaired people through the buzzer.

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