International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com

ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395

Volume 4, Issue 10 - October 2016 - Pages 94-- 106

EMBEDDED TARGET DETECTION SYSTEM BASSED ON RASPBERRY PI

Appaji.H.Birasal, Chetana H, S.China Venkateshwaralu

[1,2,]Assistant professor, Department of Electronics and communication, Rural Engineering College, Hulkoti, Karnataka, India appaji1906@gmail.com

INTRODUCTION

Visual tracking is one of the most important fields of dynamic computer vision and it provides fundamental technologies to develop real computer vision applications such as human tracking and identification, intelligent transportation, traffic flow measurement and object tracking in smart rooms .Therefore, Detecting and location object used to ease user and save time. This techniques has been developed to achieve more efficient and accurately mechanism. The core of this paper is to fabricate a standalone, real time, low cost, more efficient and accurately embedded tracking system. That is usually composed of image acquisition, image processing library to automatically detect and allocate the object, and measures the error between the center of object area and the reference point the field of view to control the pan tilt DC motors. Most of the recognition systems are based on Pc. However, the portability of PC is limited by its weight, size and the high power consumption. Thus results in that the using of recognition techniques is confined in few fields, and it is inconvenient to use. The way to get rid of the limit of PC is using embedded system based on system on chip (SOC) technology.

A system on chip (SOC) is a single chip, which consist of different integrated circuit to be compatible with other electronic systems, which are very common in the embedded system market because of their low power consumption. Therefore, the implementation of embedded moving target tracking system using system on chip is suitable solution.

Traditional ways for personal identification depend on external things such as keys, passwords, etc. But such things may be lost or forgotten. One possible way to solve these problems is through biometrics, for every person has his special biometric features definitely. Biometrics identification has gained increasing attention from the whole world [1]. Biometrics features that can be used for identification include fingerprints, palm prints, handwriting, vein pattern, facial characteristics, face, and some other methods such as voice pattern, etc

Compared with other biometric methods, the face recognition has the

International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 4, Issue 10 - October 2016 - Pages 94-- 106

following advantages: The face image acquisition requires no physical contact, so face identification system is non-invasiveness Since the face is created in a nearly random morphogenetic process during the gestation, it has little probability to find two people in the world whose face textures are identical. So face recognition is the most accurate method and has the lowest false recognition rate. The face recognition has more stability than other biometric identification methods because the face has much more features than other biometrics and it won't change in people's life. With the advantages of noninvasiveness, uniqueness, stability and low false recognition rate, face recognition has been researched widely and has a broad usage, such as security, attendance, etc. Most of the recognition systems are based on PC. However, the portability of PC is limited by its weight, size and the high power consumption. Thus results in that the using of face recognition is confined in few fields, and it is inconvenient to use. The way to get rid of the limit of PC is using embedded system. The designed EICSRS platform acquires the images and stores them into the real time database , which in turn later used for comparing the faces of the users to provide access to them or to deny the access to a place or to operate a device. Recent technological advances are enabling a new generation of smart cameras that represent a quantum leap in sophistication.

While today's digital cameras capture images, smart cameras capture high-level descriptions of the scene and analyze what they see. These devices could support a wide variety of applications including human and animal detection, surveillance, motion analysis, and facial identification. Fortunately, Moore's law provides an increasing pool of available computing power to apply to real-time analysis. Smart cameras leverage very large-scale integration (VLSI) to provide such analysis in a low-cost, low-power system with substantial memory. Moving well beyond pixel processing and compression, these systems run a wide range of algorithms to extract meaning from streaming video. Because they push the design space in so many dimensions, image capturing are a leading edge application for embedded system research. Most of the capturing systems are based on PC.

However, the portability of PC is limited by its weight, size and the high power consumption. Thus results in that the using of image capturing is confined in few fields, and it is inconvenient to use. The way to get rid of the limit of PC is using embedded system. We analyzed the design method of the image capturing and recognition algorithm, Raspberry Pi board module and its peripherals, implementing based on this platform. The Raspberry Pi has a Broadcom BCM 2835 a System on Chip (SoC). Soc has ARM 1176JZF-S 700 MHz processor, Video Core IVGPU and was originally shipped with 256 megabytes of RAM, later upgraded to 512 MB. It does not include a built-in hard disk or solid-state drive, but uses an SD card for booting and persistent storage. The Foundation provides Debian and Arch Linux ARM distributions for download Tools are available for Python

International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 4, Issue 10 - October 2016 - Pages 94-- 106

as the main programming language with support for BBC BASIC (via the RISC OS image or the Brandy Basic clone for Linux), C, Java and Perl.

PROBLEM FORMULATION

Positional detection is very important towards achieving immersion and presence in different fields in the world. There are many ways to achieve positional detection. One of the most common methods is using optical tracking devices. Target tracking, traffic monitoring, and security and surveillance applications often require following moving objects at high speeds. In many applications, which required multi direction vision, image-capturing systems are mounted on turntables, pan tilt systems, or gimbals that are used to change the orientation of the camera. While effective, these mechanical constraints often limit the speed and precision of camera-based tracking systems. Also, the limitation of using PC for these applications due to its weight, size and the high power consumption. The purpose of this research is build an embedded standalone real time tracking system achieve different requirements about weight, size, power consumption constrains, ability to change its location easily.

SYSTEM OVERVIEW

The implementation of the system hardware consists of mainly Raspberry Pi Model B single board computer, USB webcam, Power supply, Arduino UNO, and pan and tilt DC motors. Raspberry pi selected due to its good technical specification, high performance for data processing and it is cheaper than over single board computers available in the market also commercial USB webcam, interface circuit (Driver circuit 10A), and Arduino UNO. The block diagram of the system is shown in fig 2.1.

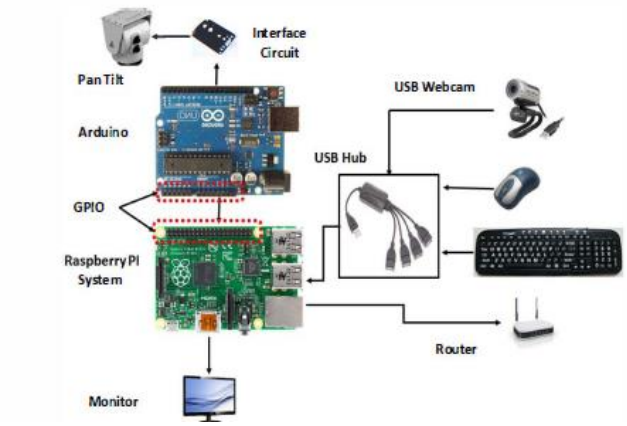

Fig 2.1 The block diagram of experimental setup.

Model B Raspberry pi Board

The Raspberry Pi is a Broadcom BCM2835 SOC (system on chip board). It comes equipped with a 700 MHz, 512 MB of SDRAM and ARM1176JZF-S core CPU. The USB 2.0 port of the raspberry pi boars uses only external data connectivity options. The Ethernet in the raspberry pi is the main gateway to interconnect with other devices and the internet in model B. This draws its power from a micro USB adapter, with a minimum range of 2.5 watts(500 MA). The graphics, specialized chip is designed to speed up the manipulation of image calculations. This is in built with Broadcom

International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 4, Issue 10 - October 2016 - Pages 94-- 106

video core IV cable that is useful if you want to run a game and video through your raspberry pi.

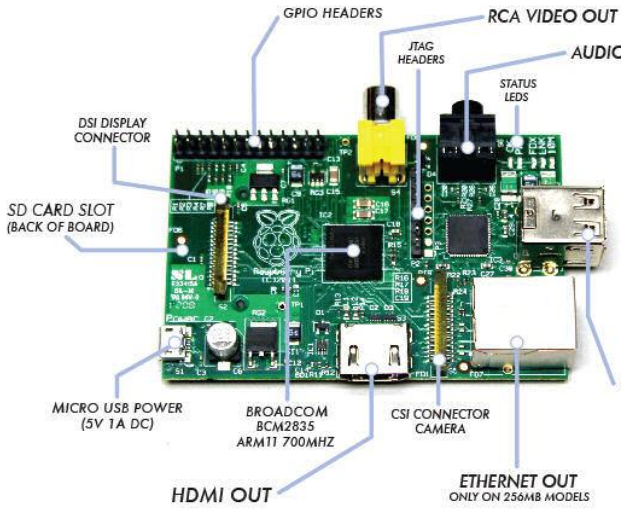

Fig 2.2 Model B Raspberry pi Board

Features of Raspberry PI Model B

- 512 MB SDRAM memory
- Broadcom BCM2835 SoC full high definition multimedia processor
- Dual Core Video Core IV Multimedia coprocessor
- Single 2.0 USB connector
- HDMI (rev 1.3 and 1.4) Composite RCA (PAL & NTSC) Video Out
- 3.5 MM Jack, HDMI Audio Out
- MMC, SD, SDIO Card slot on board storage
- Linux Operating system
- Dimensions are 8.6cm*5.4cm*1.7cm
- On board 10/100 Ethernet RJ45 jack

Advantages

Although Raspberry Pi is as small as the size of a credit card, it works as if a normal computer at a relatively low price. it is possible to work as a low-cost server to handle light internal or web traffic. Grouping a set of Raspberry Pi to work as a server is more cost-effective than a normal server. If all light traffic servers are changed into Raspberry Pi, it can certainly minimize an enterprise's budget.

Disadvantages

Even though Raspberry Pi can perform different tasks, there are some limitations due to its hardware. Because of its processor, it cannot run X86 operating systems. Some common ones like Windows and Linux distros are not compatible. In addition, some applications which require high demands on CPU processing are off-limits. "Model B took 107 ms to complete one calculation of the purely synthetic prime number test; a mid-range desktop Core 2 Duo E8400 took only 0.85ms." (Collins, 2012) Users must not use normal computer standards to judge Raspberry Pi. It can work as a personal computer, but cannot replace it.

Applications of Raspberry Pi

The raspberry pi boards are used in many applications :

- Media streamer.
- Arcade machine.

International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 4, Issue 10 - October 2016 - Pages 94-- 106

- Tablet computer.
- Home automation.
- Computer,
- Internet radio.
- Controlling robots
- Hunting for meteorites.
- Cosmic Computer.
- Coffee and also in raspberry pi based projects.

Arduino Uno

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"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

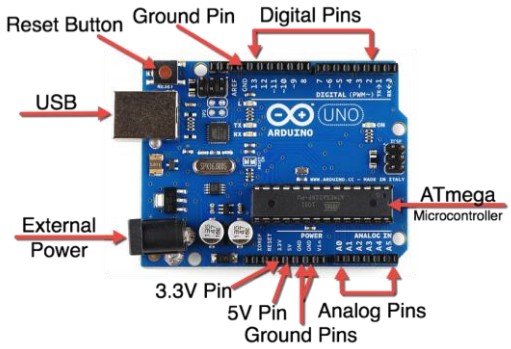

Fig 2.3 Arduino Uno

Features of the Arduino Uno Board:

- It is an easy USB interface. This allows interface with USB as this is like a serial device.
- The chip on the board plugs straight into your USB port and supports on your computer as a virtual serial port. The benefit of this setup is that serial communication is an extremely easy protocol which is time-tested and USB makes connection with modern computers and makes it comfortable.
- It is easy-to-find the microcontroller brain which is the ATmega328 chip. It has more

International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 4, Issue 10 - October 2016 - Pages 94-- 106

number of hardware features like timers, external and internal interrupts, PWM pins and multiple sleep modes.

- It is an open source design and there is an advantage of being open source is that it has a large community of people using and troubleshooting it. This makes it easy to help in debugging projects.
- It is a 16 MHz clock which is fast enough for most applications and does not speeds up the microcontroller.
- It is very convenient to manage power inside it and it had a feature of built-in voltage regulation. This can also be powered directly off a USB port without any external power. You can connect an external power source of upto 12v and this regulates it to both 5v and 3.3v.
- 13 digital pins and 6 analog pins. This sort of pins allows you to connect hardware to your Arduino Uno board externally. These pins are used as a key for extending the computing capability of the Arduino Uno into the real world. Simply plug your electronic devices and sensors into the sockets that correspond to each of these pins and you are good to go.
- This has an ICSP connector for bypassing the USB port and interfacing the Arduino directly as a serial device. This port is necessary to re-bootload your chip if it corrupts and can no longer used to your computer.
- It has a 32 KB of flash memory for storing your code.
- An on-board LED is attached to digital pin 13 to make fast the debugging of code and to make the debug process easy.
- Finally, it has a button to reset the program on the chip.

Advantages

- **Ready to use**

The biggest advantage of Arduino is its ready to use structure. As Arduino comes in a complete package form which includes the 5V regulator, a burner, an oscillator, a micro-controller, serial communication interfaces LED and headers for the connections. You don't have to think about

International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 4, Issue 10 - October 2016 - Pages 94-- 106

programmer connections for programming or any other interface. Just plug it into USB port of your computer and that's it. Your revolutionary idea is going to change the world after just few words of coding

- **Effortless functions**

During coding of Arduino, you will notice some functions which make the life so easy. Another advantage of Arduino is its automatic unit conversion capability. You can say that during debugging you don't have to worry about the units conversions. Just use your all force on the main parts of your projects. You don't have to worry about side problems.

- **Large Community**

There are many forums present on the internet in which people are talking about the Arduino. Engineers, hobbyists and professionals are making their projects through Arduino. You can easily find help about everything. Moreover the Arduino website itself explains each and every functions of Arduino.

- **Debugging**

The Arduino Environment provide easiest debugging environment which is cross-platform and is accepted by every member of the family.

Disadvantages

- **Structure**

Yes, the structure of Arduino is its disadvantage as well. During building a project you have to make its size as small as possible. But with the big structures of Arduino we have to stick with big sized PCB's. If you are working on a small micro-controller like ATmega8 you can easily make your PCB as small as possible.

- **Lack of basic knowledge**

The easy to use hardware/software of Arduino unable a person to learn the basics of many things likes Serial communication, ADC, I2C etc.

- **Cost**

The most important factor which you cannot deny is cost. This is the problem which every hobbyist, Engineer or Professional has to face

Applications of Arduino Uno Board

- **Arduino Based Home Automation System**

The project is designed by using Arduino Uno board for the development of home automation system with Bluetooth which is remotely controlled and operated by an Android OS smart phone. Houses are becoming smarter and well developed by using such kind of advanced technologies. Modern houses are gradually increasing the way of design by shifting to centralized control system with remote controlled switches instead of conventional switches.

International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 4, Issue 10 - October 2016 - Pages 94-- 106

- **Arduino based Auto Intensity Control of Street Lights**

As the intensity is cannot be controlled by using High Intensity Discharge (HID) lamps power saving is not possible in street lights with these lamps as the density on roads is decreasing from peak hours of nights to early morning.

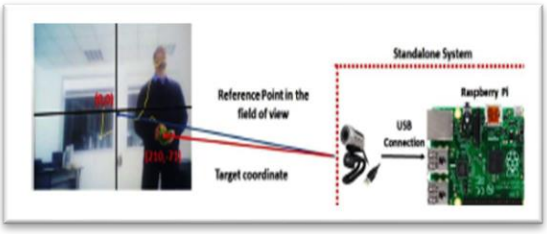

Fig 3.1 Standalone Slow Motion Target Tracker Setup System

TRACKING SYSTEM DESIGN

The Raspberry Pi is a small computer that can run a Linux based operating system from a SD memory card based on system-on-chip technology. lt has a 700 MHz ARM processor and a small Broadcom Video Core IV 250 MHz GPU. The CPU and GPU share 512 MB of SDRAM memory, and you can change the sharing of memory between each according to your use pattern. As shown in Fig. 2, the Pi has one Ethernet, one HDMI, 2 USB 2.0 ports, 8 general-purpose input/output pins, and a UART to interact with other devices. The Pi is quite power-efficient; in addition, it can run off a powered USB port of your computer or your iPhone's USB wall charger. The USB webcam cam is the important component in this research work. OD 203 USB webcam Is used. This camera consists of a high quality CMOS sensor. lt supports up to 25 mega pixels of an image and the frame rate up to 30fps. It also supports video resolution is about 640X480. This Camera Module attached to the Raspberry Pi to the USB port interface, which used to capture the image of the environment.

A Local Area Connection cable plugged in via Ethernet port of Raspberry pi to allow a connection to the Virtual Network Computing (YNC) in order to make a connection with the operating system. USB keyboard and USB mouse used for developing the software in the Raspberry pi.

The monitor connected to the HDMI port of Raspberry pi using a HDMI cable, while the keyboard and mouse connected to the USB ports of the Raspberry pi. The development of the programming in the Raspberry Pi has done by using the Code Block software. Intermediate-Level programming language selected for writing the OS application program for the system is C++ programming language.

The Code Block software IS the Integrated Development Environment (IDE) for C++ and it is already install in the OS. Open CV (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision, which Open CV library for C++ installed to enable the operation of capturing the image has done by the webcam

CONTROL SYSTEM DESIGN

International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 4, Issue 10 - October 2016 - Pages 94-- 106

Arduino Uno is an A Tmega328-based microcontroller operating frequency of 20[MHZ]. The power supply for the Arduino Uno can be either from a USB connection, DC power supply, or both. lt is a high performance device, which has low power A VR 8-bit Microcontroller with 32K bytes in system, and advanced reduced instruction set computing. The proposed tracking system has used Raspberry Pi as a tracker device and Arduino Uno as a control device implementation. The USB webcam was centroid at the center of the pan tilt. Tt is sensitive to the variation of the surrounding colors, resulting in the changes of error signal value. The output value from the color-tracking algorithm varies referred to the number of pixels from the center point to the center of color object in the image frame. Therefore, any changes in the object position will result in the changes of the output value in both vertical and horizontal plan and send this value as a message to the control device. Then, the Arduino Uno read the message from the Raspberry Pi and mapping the error value from the number of pixels to the command signal in order to send this command value to controller. controller generate the control signal in form of PWM to move two DC motor to track the object and reduce the error to zero value as shown in fig.

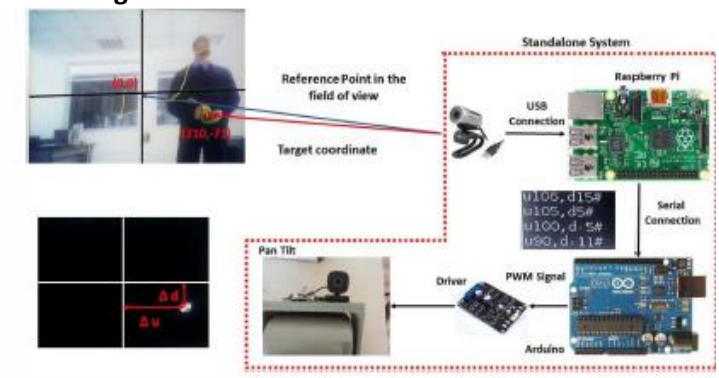

Fig: control system setup

METHODOLOGY OF WORK AND EXPERIMENTAL EVALUATION

In the process of object detection, targeted object, which has obscured due to presence of other object, is one of the main problem faces in image processing field. This is due to the object are not clearly expressing in the image and will assume and eliminated by the program. On color processing, lighting intensity may also affect the original color of object to be not accurate . The light intensity on proposed object makes the background object have almost the similar color as the target object. To eliminate this entire problem, a proper image segmentation process and technique must take into account. The image with 320x240 pixels has used through this study. This image with RGB color has feed into the color processing process. The proposed work is Real time color detection of an object by using Raspberry pi and USB Webcam.

The main objective is to identity the color of an object image and to correspondingly calculate the error between the object and

International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 4, Issue 10 - October 2016 - Pages 94-- 106

reference point in the image frame. Firstly, the object image captured by using a USB webcam. Then the image processing algorithms implemented to identity the color and calculate the difference between center of the object and the reference point in the images frame.

Fig Tracking Algorithm Output View

The object identified and tracking trajectory in 2D plane as shown in the USB webcam video stream. In addition, the error signal will transmit from Raspberry pi to Arduino UNO using Serial Communication Protocol. Arduino UNO is send the stream of control signal, which used to compensate the tracking error, via driver interface circuit to pan and tilt DC motors. Fig.5.1 Tracking Algorithm Output View In this system, Real time Color Tracking algorithm using Raspberry Pi designed and implemented, which have a novel method to make easy to identify the color of an object in image frame. Correspondingly, it send the error value between the center of the object and the reference point in the image frame using serial communication protocol as shown in fig 5.2 .

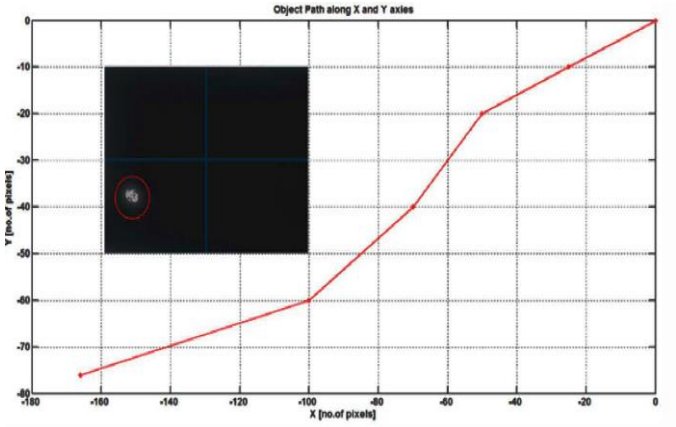

Fig Object path along X and Y axis

System was establish and evaluated using some standard color spaces, and using Arduino microcontrollers to track the object by moving the pan tilt in horizontal and vertical direction in order to have the target in the center field of view of the USB web cam as shown in fig. 5.3

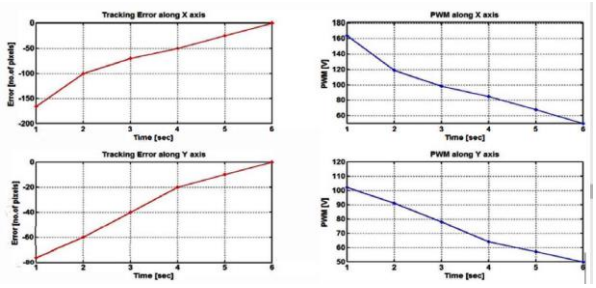

Fig Tracking Error and PWM Control Output

International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 4, Issue 10 - October 2016 - Pages 94-- 106

This system works in standalone mode without the necessity of PC, and it is portable

and less weight to move easily

FUTURE APPLICATIONS

To date, exploitation of smart camera technology has been mainly for industrial vision systems, but a crossover is just starting to take place. Camera technology will begin to enter new applications, for example, in the security and access control markets, in the automotive industry, for collision avoidance, and even – one day – for the toy industry. Even our automobiles may soon be outfitted with miniature eyes. Built into a cruise control system, for instance, such a camera would suddenly alert the driver if it noted a rapidly decelerating vehicle. The cameras could also take the place of the rear view and side-view mirrors, thereby eliminating dangerous blind spots and - in the event of an accident – recording the seconds prior to a collision. Another example would be with intelligent lifts. An office block, with many lifts and floors, may see a lot of people travelling up and down between floors, particularly at high traffic times such as early morning or end of the working day. At the moment, lifts are called by somebody pressing a button and putting in a request for the lift to stop at a particular floor. Connected with smart camera technology, lifts could be routed on demand, working intelligently, stopping only when there was a pre-set number of passengers waiting at a floor – and missing out a floor if too many people were waiting to meet the maximum capacity of the lift.

CONCLUSION

It is a progress of realizing embedded moving target tracker system. We describe our design method in this article. Based on this method, we design the experimental prototype of the embedded moving target tracker system with Raspberry Pi system. This system is smaller, lighter and with lower power consumption, so it is more convenient than the PC-based color recognition system. Because of the open source code, it is freer to do software development on real time operating system under Linux. Experimental results show that it is an effective and acceptable system of using Raspberry Pi board to implement and validate embedded tracker system.

REFERENCE

[1] B. Coifman, D. Beymer, P. McLauchlan, and 1. Malik, "A real - time compute vision syste for vehic1e tracking and traffic surveillance, "Transportation Research. Part C: Emerging Technologies, vol. 6, pp. 271-288, 1998.

[2] J. Gong, Y. Jiang, G. Xiong, C. Guan, G. Tao, and H. Chen, "The recognition and tracking of traffic lights based on color segmentation and CAMSHIFT for intelligent vehicles," in intelligent Vehicles Symposium, 2010, pp. 431-435.

[3] R. Hussin, M. R. luhari, N. W. Kang, R. Ismail, and A. Kamarudin, "Digital image processing techniques for object detection from complex background image, " Procedia Engineering, vol. 41, pp. 340-344, 2012.156

International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 4, Issue 10 - October 2016 - Pages 94-- 106

[4] David Zhang, Joseph P. Campbell, DavideMaltoni, Ruud M. Bolle, "GuestEditorial Special Issue on Biometric Systems", IEEE Transactions on Systems, Man, and Cybernetics-Part C: Applications and Reviews, VOL. 35.

[5] XIE Yonghua, LIU Chuancai, YANG Jinyu(2008). The algorithm based on DDCT and TCSVD of human face feature extraction and recognition". THE COMPUTE ENGENIERING, Vol. 08, No. 1.

[6] G.Yang and T.S. Huang,‖Human face detection incomplete background, PatternRecognition,vol.27,no.1.1994.

[7] M.S.Bayhan and M.Gokmen,‖Scale and pose invariant real time face detection And tracking,Proc.the23rdInt.Symposium on Computer and Information sciencepp.1-6,October 2008.

[8] ZHANG Rui, YU Zhongtang (2008).The method Of human-face recognition based on analyzed of two ranks and doubles two dimensions THE COMPUTER ENGENIERING, Vol. 08, No.5

[9] Raspberry Pi – www.raspberrypi.org

[10] FriendlyARM - *www.**friendlyarm**.net/*