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Smart Trolley Follower Using Vision Based Technique

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ABSTRACT

This paper introduces a vision-based object tracking robot which is driven by wheels and controlled by a computer along with software. The objective of this paper is to design a robot which is automatically controlled by computer to track and follow a colored object. Emphasis is given on precision vision based robotic applications. Image acquisition by the robot is achieved by ANDROID based camera, and then it is sent to image processing software for further processing. The overall paper describes a visual sensor system used in the field of robotics for identification and tracking of the object.

General Terms: **Object tracking, Object detection, Ultra Sonic sensing**

Keywords: **Image Processing, Android, ATmega- 32(AVR Family, Blobbing)**

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I. INTRODUCTION

Technology is making rapid progress and is making many things easier. As an innovation to reduce human effort is the need for today's world, new methods are being introduced. Smart trolley Follower Using Vision-Based Technique is one such example. In the last decade object tracking using image processing has become very popular because of its capability to solve daily problems and ease of production, e.g. surveillance through cameras, adaptive traffic lights with object tracking, etc. There are many Tracking algorithms with Different techniques. The tracking algorithms while operating in the uncompressed pixel domain has the potential to identify object boundary with pixel accuracy with the help of fully decoded processed image, before segmentation can be performed.

A new approach for object tracking in the compressed domain. Instead of using a single cue to solve this problem, An algorithm which uses object 2-d shape as well as color for tracking objects from video. For that using the blobbing technique to detect the motion of the object. A system which empowers users to detect themselves to a camera as an object to be followed. In the modern world, computers and artificial intelligence have become inevitable in all the fields where precise planning, analysis, calculations are needed. Automation with computers as their agents has become part and parcel of day to day life. They are used in various fields like Artificial Intelligence, Military Services, and Robotics. This paper largely deals with "Smart Trolley Using Vision-Based Technique". It is mainly related to the vision-based Image Processing. This introduces a vision-based object tracking robot which is driven by wheels and controlled by a computer along with software. Emphasis is given on Precision vision based robotic applications achieved by an android camera, then it is sent to image processing software for further processing. The overall paper describes a visual sensor system used in the field of robotics for the identification and tracking of the object.

II. IMAGE PROCESSING

Image processing is processing of images using mathematical operations by using any form of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image. [1]Most image-processing techniques involve treating the image as a two- dimensional signal and applying standard signal-processing techniques.

III. PROBLEM STATEMENT

A new User-friendly smart trolley for Object Detection and Following vision based technique. This will enable us to reduce HUMAN effort by developing a vision based automated machine creation for Object following Concept.

IV. PROJECT OBJECTIVES

It can be then used for various purposes like Super-market, construction lines, factory use, etc. For actual implementation of this object as mount it on a trolley. It is important to know that each real world requirement of the robot would use different intensity of power inputs according to the load.

V. RELATED WORK

Literature survey is the most important step in project development process. Before developing the tool it is necessary to determine the time factor, economy n company strength. Once these things are satisfied, then next steps are to determine which operating system and language can be used for developing the tool. Once the programmers start building the tool the programmers need lot of external support. This support can be obtained from senior programmers, from book or from websites. Before building the system the above consideration are taken into account for developing the proposed system Detection of moving objects in a video stream acquired by an airborne platform, Detecting and Tracking Moving Objects for Video Surveillance. By Isaac Cohen, Gerard Medioni, 1999. This paper is concept of cameras placed on wall with the technology of detecting moving objects has been explained. But the limitation is the scenario with increasing number or more number of objects. Laser-based person-tracking method and two different approaches to person following: direction-following and path-following, Natural Person-Following Behavior for Social Robots, By Rachel Gockley, Jodi Forlizzi, Reid Simmons,2007. It is the idea of a moving thing (trolley) following the human based on the light it is getting as input from sensor. But in real time it will not survivie when used in bulk. Concepts of histogram matching and absolute frame subtraction to implement a robust automated object tracking system, Real time object detection and tracking: Histogram matching and Kalman filter approach, By Mehta M,Goyal C, Srivastava, 2010. It is purely based on Frame Subtraction in which the original database having full domain knowledge of every pixel is given and likewise frame subtraction is carried out. Structure from motion (SfM) is the extension of classical SfM to dynamic scenes with multiple rigidly moving objects, Multi- body structure-from-motion in practice. ByK.

E. Ozden, K. Schindler, and L. Van Gool, 2010. This idea is about two cameras hang on the top and bottom of pole and will detect the object using the height co-ordinates of the object. But the height may reduce or increase according to the distance from the pole**.**

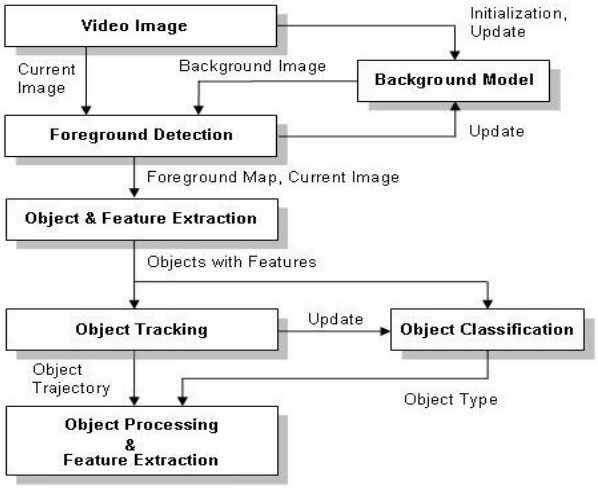

Fig 1. Internal process

VI. OBJECT DETECTION AND TRACKING

Microcontroller: ATmega-32(AVR FAMILY): It belongs to Atmel's AVR series micro controller family. Atmega32 has got 40 pins. Two for Power (pin no.10: +5v, pin no. 11: ground), two for oscillator (pin 12, 13), one for reset (pin 9), three for providing necessary power and reference voltage to its internal ADC, and 32 (4×8) I/O pins.

Blobbing Technique: Blob detection methods are aimed at detecting regions in a digital image that differ in properties, such as brightness or color, compared to surrounding regions. Informally, a blob is a region of an image in which some properties are constant or approximately constant; all the points in a blob can be considered in some sense to be similar to each other Equations.

Object Detection: Object is nothing but any living or non-living thing, and the word detection stands for identifying the object once known to the camera as input.

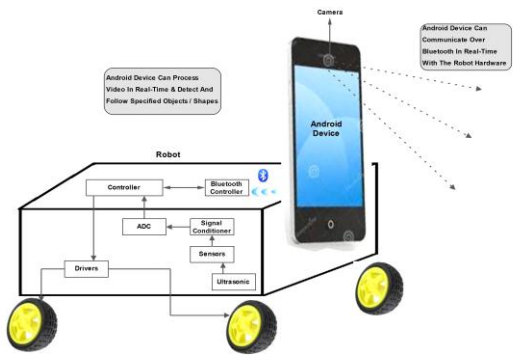

Fig 2. Architecture

Trolley consists of Android Phone, Microcontroller, and Motors which are interlinked. Capturing of Object using Android device camera. Image of the object is captured using the android device camera. Image captured by the camera will be forwarded and processed by the android application to micro-controller. ATmega-32 Microcontroller will apply several image processing algorithms and detect the object. An external Bluetooth is connected to the microcontroller for the linkage between android device and microcontroller. 10 rpm

motors are used and they will follow the instructions properly given by the microcontroller by keeping minimal distance.

Mathematics for Object Detection:

Let S = {U, I, IB, IHSV, ITH, Iblob, ctrlcmd, S, Sval, Sth,F}
Where
U<- U1,U2,U3…..Ui – finite set of users
I <- I1,I2,I3….Ii - finite set of Image frames.
IB <- Ib,Ib,Ib….Ibi – Finite set of blurred images IHSV <- IHSV1 ,…..IHSVi – Finite set of HSV images ITH <- ITH1,.....,ITHi-finite set of threshold images.
Iblob<- Iblob1, Iblob2,…..Iblobi - Finite set of blobs detected
Ctrlcmd<- ctrlcmd1,...,ctrlcmdi….Finite set of commands used to operate trolley
S <- S1,S2,…..i - Finite set ofsensors.
Sval<- Sval1,sval2 … svali .. – Finite values of sensor .SvalTH<-SvalTH1,....SvalTHi-threshold set for each sensors.
F<-- IgrabF(),IBlurF(),IHSVF(),ITHF(),IBlobF(),send_ctrl_cmd(), gr absensor()
Ii<-Igrab()–return one frame-image.
IBluri<-IBlurF(Ii)–returns to the blurred image after removing ofnoise.
IHSVi<-IHSVF(Ibluri)–convert image from RGB model to HSVmodel.
ITHi<- ITHF(Ihsvi) – convert image into black / white.
Iblobi<- IblobF(ITHi) – detect object i.e. blob from image.
Send_ctrl_cmd(ctrl_cmdi).
Svali<-grab_sensor(Si)-Take value of sensors from controller.
YES/NO<- apply _TH(Svali,STHi)
RGB Separation formula:
Col – getPixel() & 0XFFFFFF -> 24 bit pixel is obtained
For e.g. we have to adjust blue, green and red shades of pixels, following formula will adjust the bits as follows:
B(blue)= col&0XFF G(green)=(col>>8)&0XFF
R=(col>>16)&)0XF
Blur – NoiseRemoval
Steps:
1] col- getPixel() 2]RGBSeparation
SumR+=SepRSumG+=SepGSumB+=SepB
AvgR=SumR/9 AvgG=SumG/9 AvgB=SumB/9

VII. CONCLUSION & FUTURE WORK

In Automatic Trolley, the Vision-based technique will help human in many ways including following him/her carrying load and reducing human effort. Likewise, it will also be helpful to some secret agencies in spying process. It gives facilities like trolley stopping, turning left, and turning right. It can be successfully implement the concept of Automatic trolley. It reduces human effort and time required to perform the required task. Also it is efficient to use. Future scope can be overcoming problems like obstacles by using sensors. By using powerful battery and mechanism it can use same concept in different enterprise applications.

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