



Ball Tracking Robot Using Image Processing and Range Detection

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ABSTRACT

The variant in horizontal and vertical axis of tracked object generate control signal which is ship to the controller wirelessly. The captured pictures of the item are processed using software MATLAB. Depending on the trade in function of object, right commands are given to the robotic to tune shifting ball. This venture is in aimed to design and increase a cell robot that could tune a transferring ball. Here, we use the camera to capture image of the ball and these frames are processed to music the ball. The capabilities of the ball which includes the color, shape, length may be monitored for monitoring the ball. In our undertaking we use the colour facts of the ball to music the item. Better overall performance of the robotic may be acquired if multiple capabilities are monitored. The movement of the robot is controlled by means of a microcontroller based at the manipulate alerts obtained immediately.

KEYWORDS: Robotic; tracking; variety detection; photograph processing; MATLAB; motor drives; microcontroller; wireless.

INTRODUCTION

The important weakness in surveillance rests on the involvement of human operators, who usually reveal a large wide variety of inputs from cameras. As, these operators will be without problems distracted because of boredom, fatigue, many unseen crime could be appear which might be avoidable if proper surveillance is executed. To overcome this potential trouble, a mobile robotic could be used. A robotic would be capable of travel throughout the regions to be monitored autonomously and continuously, making its personal decisions whilst figuring out for undesirable behaviors or activities, and reply therefore which include generating alarms or sending alerts. Surveillance is for tracking for behaviors or activities on human beings or objects from a distance. Security cameras are taken into consideration to be for maximum normally used device for that motive. The primary programs of these cameras are together with, business manner controlling and monitoring, visitors regulation and crime detection. As, they may be constant specially position using mechanical support they provide only 360 diploma motion to digicam which limits the region of monitoring .

Object monitoring can be accomplished by using identifying and tracking some precise feature of the shifting object along with shade that belongs to the transferring item. Thus trajectories of shifting item can be traced thru this method through the years. Object monitoring the use of pc imaginative and prescient is a crucial element in reaching robot surveillance. The major goal of the item monitoring is to tune the object based at the statistics acquired from video sequences.

In our mission, we decide the region on hobby (ROI) of the shifting target that's accompanied adaptive coloration filter to extract the color statistics and as a result the object is tracked. The essential contribution in this paper is that the introduction on a colour filtering technique that's capable of adaptively identifying the most salient colour feature that belongs to for moving item and the use of this shade characteristic for tracking.

LITERATURE SURVEY

Even even though the history subtraction technique affords the facts of the item to be tracked, it can't offer pleasant result primarily based on transferring digicam. If a transferring digital camera is used, with example, a digital camera mounted on a cellular robotic, heritage subtraction will face disadvantage that the background of picture is constantly converting due to the camera movement. This will lead to fake information on the object to be tracked and cause false type on moving item. This false category will misguide the moving camera gadget to lose music of the goal item. However, present item monitoring strategies the use of cellular robots (shifting cameras) commonly depend upon certain capabilities that belong to tracked items. Even although, the background subtraction based totally approach can easily become aware of moving objects with a desk bound digicam, it can not offer best consequences with a transferring digicam. This is because for heritage subtraction approach extracts the object information by means of distinguishing the differences between moving objects and a "stationary" heritage.

Above technique is legitimate for object with particular color in all situations. A ball monitoring makes use of approach of historical past subtraction. Control indicators are generated simplest after historical past subtraction. During era of control signal the robotic in desk bound or locomotion. The median filter out is locate to cast off noise. Control signals are generated by putting threshold cost for picture .This technique should develop to music the face and for hand correctly the use of shade detection. Background is sincerely identified by using gazing the distance among item and the camera. If distance is small, then length of background with respect to object is small. Likewise if distance is huge then most important portions is heritage. This level on computation complexity has imposed difficulties in real-time packages. So use history subtraction instead of identify the history. Suppose we

observing version within a room, then we are able to truly become aware of the version in room with the aid of subtracting digicam input with a reference photograph. Else we are able to subtract successive photograph taken by way of digital camera. For moving item we use heritage subtraction the use of MATLAB to track a moving ball. In which the original image is converted to grey. Then authentic picture is subtracted with grey scale picture. The heritage picture is having same fee. So ensuing photo heritage is appears to black and tracking ball seems to white.

PROPOSEDSYSTEM

1) BlockDiagram

For proposed robot include both hardware and software part. Hardware part includes ZigBee module wireless communication between robot and computer. Microcontroller Motor driver DC servo motors. The software part includes MATLAB for image processing and MPLAB for embedded software development.

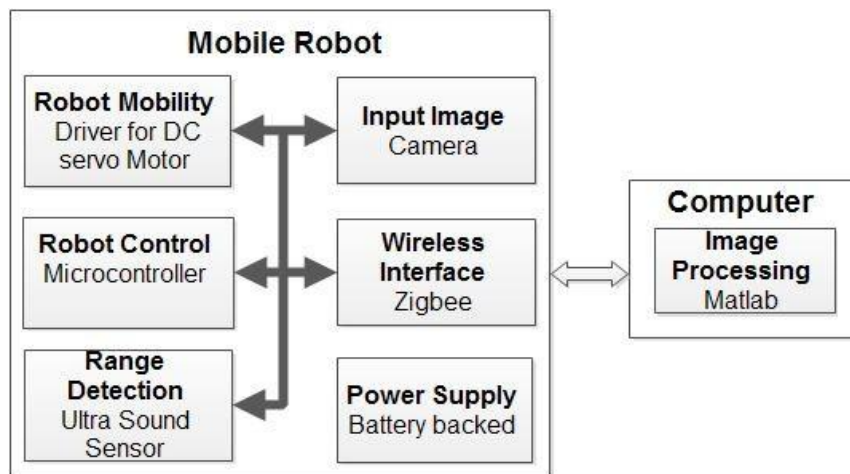


Fig. 1. Block Diagram of proposed system

2) Input Image Phase

It is used to collect shade 640X480 pics. For background subtraction-based totally approach can discover transferring gadgets with a desk bound camera. A transferring object tracking is finished by means of stopping for robot whilst heritage subtraction is performed and the usage of the obtained coloration probability distribution statistics to music for goal. This method assumes that the shade of the tracked item by no means changes. Multi-digital camera shade tracking gives correct target identity The video sequence is acquired with the aid of using an internet cam that is constant in the robot. Webcam is immediately related to the object tracing segment, which is a distant server ready with image processing software program (MATLAB 2012a). The Logitech Web Camera has a hard and fast view and is hooked up to the robot platform.

3) Detection of theObject

The object detection set of rules consists of four most important tiers: extracting frames, extracting shade components, RGB to gray scale conversion, noise elimination, elimination of small objects and subtracting the lower back ground.

It includes separation of shifting foreground gadgets from static background. The set of rules assumes that for heritage is noticeably static in comparison to foreground. As the gadgets actions, some areas on video frames that differ appreciably from for historical past can be considered to be foreground (transferring objects). Number of research in moving object detection has been carried out with many algorithms proposed. In the proposed algorithm is primarily based on colour feature identity for detection and monitoring of item.

The extraordinary ranges are,

- Extracting frames: From the video trade frames are extracted and are similarly processed. The digicam used here is able to taking 30 frames according to second.
- Extracting color components: Each frame includes three fundamental shade matrices R, G and B. Relying on the color of the item to be tracked, we are extracting one coloration matrices or a combination of matrices.
- RGB to gray scale conversion: Each body is transformed to gray scale. It will lessen memory utilization and increases the processing pace.
- Noise Elimination: Noise removal is accomplished to clear out noises resulting from reflections or movement blurs. For noise removal is performed through median filtering operation. Median clear out is used to remove "salt and pepper" noise while preserving beneficial info. Noises due to alternate in history or illumination situation might also misidentify some of background pixels to be as foreground.
- Elimination of small objects: This is to do away with item under a positive pixel length which may in any other case motive

malfunction. MATLAB provides unique function for this operation.

- Subtracting heritage: The gray scale matrices received in step RGB to gray scale conversion is subtracted from colour component matrices. After acting the above operations, the location of the object might be appeared in white colour and background is in black shade. Thereby the item or ball is to be tracked is identified with the aid of the MATLAB

4) Object Tracking

Bounding container is a constructed in function in MATLAB so one can return nearby records of the desired area (right here the object). The information includes co-ordinate values. From those values the centroid is calculated and through analyzing centroid price motion of the robot is controlled.

5) Centroid Analysis

The location, centroid, and speed are acquired with the aid of evaluation on traits of the item. After identity of bounding container (contour) of favored item, then location of object is calculated by means of counting for variety of pixels existed within the tracked bounding field. Centroid is the geometrical center of the bounding container. The centroid coordinates may be located the usage of for center-on-mass with method given beneath. This records is used to locate area of ball and generate control alerts for movement.

Once centroid co-ordinate is observed, the velocity can be obtained by using comparing the centroid's locations among video frames acquired at different time steps. In this approach preceding 4 centroid coordinates are saved to suggest path and shifting route of the tracked ball. Then pace is calculated from the distinction in function and time.

6) Wireless Interface

Wireless Transmission is accomplished Using ZigBee module. In this project serial verbal exchange among for MATLAB processor and microcontroller is performed via ZigBee module. ZigBee is a low-price, low energy, wireless mesh networking popular. This new stage on verbal exchange permits finely-tuned far off monitoring and manipulation. This task focuses on ZigBee as a era innovation which could bring about low price connectivity. ZigBee is a

specification with a set on high level verbal exchange protocols used to create non-public place networks built from small, low-energy digital radios. ZigBee is primarily based on an IEEE 802.15 fashionable. Though low-powered, ZigBee devices can transmit statistics over long distances by using passing statistics through intermediate gadgets to reach extra distant ones. The ZigBee era is widely utilized in wireless manipulate and monitoring applications, for low strength-usage lets in longer existence with smaller batteries, and the mesh networking which promises excessive reliability and large range. ZigBee has been advanced to satisfy the developing call for with capable wifi networking between sever low power gadgets.

ZigBee is used in applications that require most effective a low information charge, lengthy battery lifestyles, and comfortable networking. ZigBee has a facts fee of approximately 250 kbit/s, first-class appropriate with periodic or intermittent records or a unmarried sign transmission from a sensor or enter tool. ZigBee networks are secured with the aid of 128 bit symmetric encryption keys. In domestic automation applications, transmission distances variety from 10 to 100 meters line-on-sight, depending on energy output and environmental function.

7) Range Sensing

There are several techniques to degree distance with none contact. One manner is to use ultrasonic waves at 40 kHz for distance measurement. Using ultrasonic transducers and receiver we degree the quantity on time taken for a pulse on sound to travel to a specific surface and return because the pondered echo. This circuit calculates for distance based totally on the speed and it can measure distance up to two.5 meters.

For range detection an ultrasound transceiver is used. The transmitter sends a burst at 40 kHz, which lasts with a length about 0.5ms. It travels closer to the item via air medium and the echo signal is picked up with the aid of ultrasonic receiver unit, also a 40 kHz pre-tuned unit. The obtained signal, which may be very weak, is amplified numerous instances using a receiver circuit. Weak echoes may arise because of alerts being directly acquired via the aspect lobes. These are unnoticed for actual echo obtained and could deliver for correct distance. That is why we need to have a degree manipulate. The signal receives weaker if the goal is greater than 2.5 meters and will want a higher pulse excitation voltage or a better transducer.

IMPLEMENTATION

Mechanical shape is made up on difficult plastic fabric. The front component constitutes digicam and variety sensor while relaxation constitute mobility controller and energy deliver. The mobility controller used is a PIC microcontroller based embedded machine that is able to sensing distance between item and robotic to avoid collision with object. The microcontroller decodes instructions from the PC that are sending after processing the locating role of transferring Ball. A microcontroller based totally gadget is used to calculate and to hold a steady distance the usage of the statistics available from ultrasonic sensor

$$\bar{x} = \frac{\sum_{i=1}^k x_i}{k} \quad (1)$$

$$\bar{y} = \frac{\sum_{i=1}^k y_i}{k} \quad (2)$$

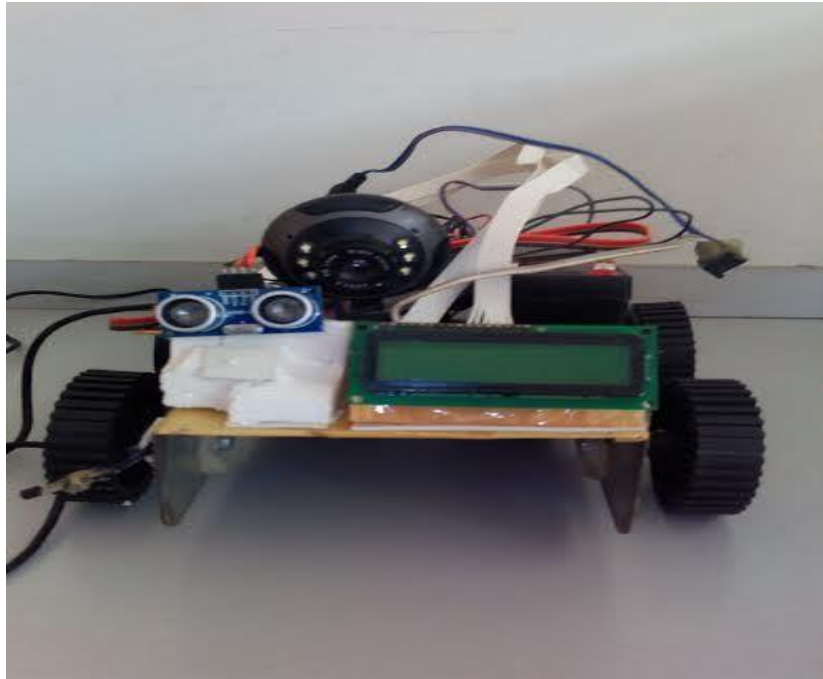


Fig. 2. Implementation of ball tracking robot

RESULTS AND DISCUSSION

Problems solved:

- Reflection from smooth floor aircraft can cause fake item identification. It is rectified through using any non-reflective floor
- Reflecting floor of the tracked object which is avoided by means of eliminating plastic floor on tracked object
- Variation on surrounding illumination which is tackled by means of presenting consistent illumination level.

Problem unsolved:

- Colour converting gadgets can't be tracked.
- Malfunction happens whilst tracking items having identical coloration and size.

TABLE I. ROBOT RESPONSE WITH DIFFERENT BALL MOVEMENTS STYLES

Sl No	Position on ball in frame	Robot Motion	Centroid
1		No Motion	X=200-380 Y=200-300
2		Move Backward	X=200-380 Y=0-220
3		Move Left	X=0-200 Y=200-300
4		Move Right	X=380-640 Y=200-300
5		Move Withward	X=200-380 Y=300-480

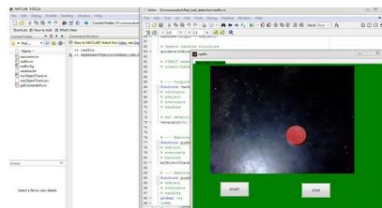


Fig. 3. Screen shot of captured image in MATLAB

CONCLUSION

The undertaking is designed, applied and examined correctly. The response of gadget to extraordinary object moves become satisfactory. Still a few advancement can be protected to for gadget to enhance overall performance. Obstacle avoidance mechanisms may be included. This may be done by sensing the again ground pictures and processing it well. Different active sensors which include infrared sensors and supersonic sensors are employed to degree the variety in actual time between the limitations and robotic. A cellular robotic with diverse kinds on sensors thru ubiquitous networks may be added. A cell robotic composed on TCP/IP community, wireless camera and several sensors in an surroundings may be constructed, and show obstacle avoidance and item tracking techniques vital with providing various offerings desired by way of the human beings.

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