ISSN 2229-5518

Theoretical Approach for Designing Shape- Servoing On Visual Sensing

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Abstract- In this work, we designed shape-servoing on visual sensing. We implemented with the Tokamak Simulation device and Degree of Freedom (DOF) Object Frames. The methodology used is the Spiral methodology. Our results show that designing a controller system from the approximated image motion will lead to the computation of the acceleration important to lessen the tracking error in the robot, as well as promoting efficiency for target tracking. This work could be beneficial to the controllers of robotic devices using sensor to gain considerable attention, the health sector to change a vast variety of health care practices and to any other organization that deals with visual sensing.

Keywords: Visual sensing, Controller system, Servoing, Robots

1. INTRODUCTION

1.1 Background to the study

Visual sensing deals with visual sensors network devices capable of processing and fusing images of a scene from a variety of viewpoints into some form more useful than the individual images. A visual sensor network maybe a type of wireless sensor network. The network consists of the cameras themselves which have some local image processing, communication and storage capacities and possibly one or more central computers where image data from multiple cameras are further processed and fused. The Visual sensor networks provide very high services to the user so that the large amount of data can be separated into different information of interest using specific queries (Feddema & Mitchell, 2017). In visual Sensors, surveillance cameras are placed in a position indicating the direction in which the situated motion is done thereby giving room for a larger amount of visual information to be captured and processed independently from other information from cameras in the network. In application, visual servoing involves area surveillance tracking and environment monitoring. The surveillance cameras have the capabilities as a 3D dense sensor system which it uses to build the data captured in the scene of operation. It can be able to accumulate the data over a period of time so that the operators can view the events as they filter into the sensors (Sanerson & Neuman, 2015).

1.1 Statement of the Problem

Visual Servoing involves a controlling device to control a chain of distinctive attribute placement on the surface of the image to the desired location by controlling the motion of a robot exploiter in uncalibrated environments. This controlling device is designed to accommodate data from the known camera parameters as well as the unknown robot variables. Hence the captured information will be vase without pinpointing the actual action of concern based on the fact that the unknown camera and robot variables appear linearly in the closed-loop dynamics of the system, with a full consideration of dynamic responses of the robot exploiter, the best selected view of event cannot be captured.

1.2 Aim and Objective of the Study

The aim of this work is to design a prototype for shape-servoing on visual Sensing. To achieve this aim, the following objectives will be to:

1. examine the different dimensions involved in visual sensors.
2. analyse the fundamental configurations of visual robots
3. determine the best viewing path of the object

1.3 Significance of the Study

This work could be beneficial to industrial robots developers, AI experts and to the research communities who deal with visual sensing. Considering the use of shape servoing technique, the benefit of this work can be summarized in the following ways

1. the manipulating device (Robot) is programmed to act in a specifically defined pattern
2. Information capturing becomes easy and more effective depending on the query given

1.4 Scope of the Study

The scope of this work focuses on the use of shape servoing on visual sensing to capture images and action in a specified environment using surveillance cameras and interconnecting different users that can query the database based on the required information needed.

1.5 Limitation of the Study

This study will be able to address a lot of issues surrounding Visual sensing as well as the different configurations used. However, this work does not include the operations of the various sub visual sensing techniques.

2. LITERATURE REVIEW

2.1 Overview of visual Sensors

Visual sensor networking involves spatially distributing smart surveillance cameras to strategic places which will be used for high level of analysis which will involve the use of object recognition and other techniques (Basri,2017). All the cameras in the network are intelligently analysed by tracking the different objects from all the networked cameras at different locations. Indicators present in the cameras acts as sensors in the transmission of relevant information depending on the query given. Researchers have taken interest in this area and have come up with some findings and innovation in order to improve on the system to suit their needs.

2.2 Related Works

Yirong Z (2011). Presented a work on visual Sensing Method based on texture analysis for automatic seam tracking systems. In his work he developed a key technology which is the seam tracking. The seam tracking technology involves an automated welding process and post welding NDT. He concluded that the manual monitoring techniques are biased causing low efficient seam tracking. The author was able to conduct some experiments, and the results show that the proposed method can satisfy the requirement of seam tracking. The limitation of the research was that the seam tracking can only take place in a particular location at a time.

Fang p (2015). Presented a work on visual sensing for Urban flood monitoring. In his analysis he combined the existing system with the traditional hydrological surveillance cameras which have the ability to sense and analyse motions in the environment. The author compared the two results and concluded that the combination has better result due to the increasing climate extremes. The combination of the existing visual sensing method and the traditional hydrological monitoring cameras can help solve the problem of frequent flood events.

Kureta M (2014). Presented a work on Neutron Visual Sensing techniques. In his work he deduced that neutron Visual sensing technique is a technology used to extort images in a non-destructive and visualized process. It technology uses 3D CT and High-speed beam techniques. The result of the work shows that captured images appear clear with high visualization.

Brenizer J.S (2013) presented a work on a review of significant Advances in neutron of imaging from conception to the present. In his review, he summarizes the past events of neutron imaging with a focus on the important events and developments in the neutrons. The author employs different standards in the development of neutron images. His result shows that there are improved imaging devices for medical communities and has a major impact on them. The study is limited by the availability of high intensity neutrons and its portability.

Sahu UK (2015). Presented a work on shape features for image-based servo-control using image moments. In his work, he obtained an interacting matrix with a lower set of features, he used cameras that were positioned in strategic places. He used parameters that are invariant to translate, rotate or scale in the control scheme. The objective of the visual servoing is to regulate a dynamic system using the data extraction method. Some of the applications that the image- based servo-control can be applied are automated machining, remote surgery and image based visual servoing.

3. MATERIALS AND METHOD

3.1 Design model of shape servoing on Visual Sensing

The concept of visual sensing entails different features that enables the sensor to fully analyse the entire process of visual sensoring. In this process, there are different sections. The first section of the model is the input section which contains the 3D Geometry which functions as a base on CMM measurements. The next segment of the input section is the part tolerance which takes care of the false tolerance of the system and lastly the assembly processes which assembles the functional components after which the model construction is done followed by the model variations.

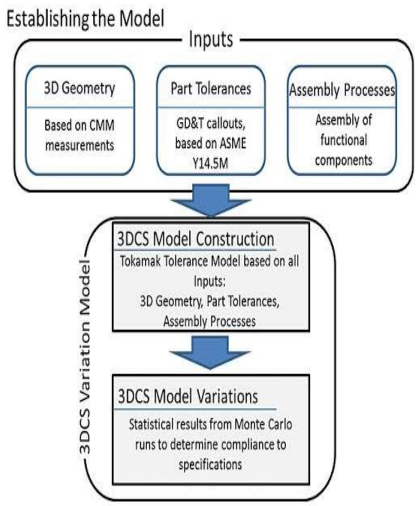

Figure 1: The visual servoing Platform. (Source: (Taylor, 2016))

3.2. Analysis of the existing System

The visual Servor system makes the resulting applications often not portable and cannot be easily adapted to other environments. The Software design allows proposing vision and control sub system (Hutchinson et al, 2019). The surveillance camera is placed in a strategic in the environment to be monitored and events captured. Once the image is captured by the robotic subsystem through the Robert controller device, the information is transmitted to the vision sub system and to the esitimator which filters and analysis the information noted all points of interest based on the queries. The Estimator is also responsible for capturing moving objects. The system thus has the ability to independently position and combine together an image processing library that allow tracking of simulated segments. The measuring instrument used is a visual motion which has the ability of biological vision systems with many functionalities. The most pronounced function of the measurement in a sudden movement in a scene might indicate an approaching predictor or a desirable prey. (Ellene , 2008). The fast expansion of variables in the visual system can regulate an object to interface with the observer.

Discontinuities in motion often occur at the locations of object boundaries and can be used to carve up the scene into distinct objects.

3.3 Description of the Existing System

Visual Servoing is, in essence, a method for robot control where the sensor used is a camera (visual sensor). The visual servor system functions as a monitoring device and a detector. It is concerned with two major aspects and they are the robotic subsystem and the visual control sub system. The visual sub system is responsible for helping robots identify the surrounding and take appropriate action. Robots analyze the image of the immediate environment imported from the visual sensor (Hashimoto, 2016). On the other hand, the Vision and control subsystem which is also known as the perception subsystem is responsible for the collection of data to aid in spot detection and obstacle observance of the robot. The other aspect includes the robot controlling device which determines whether the vision system provides set-points as input to the machine and checks for errors in the transmitted signal of image features.

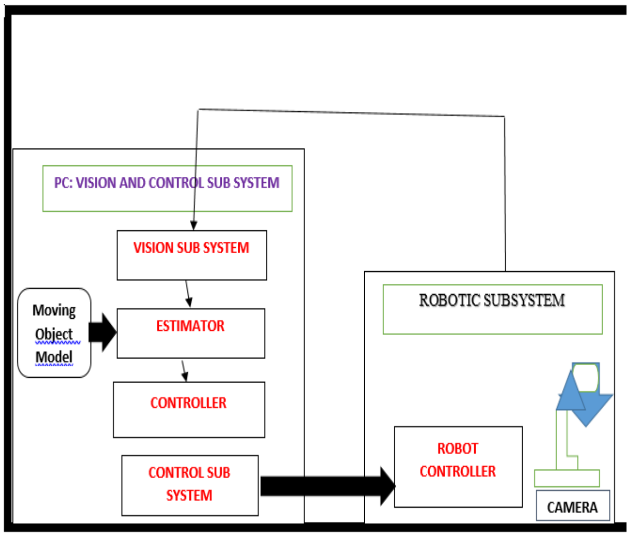

Figure 2: Existing System architecture of the Visual servoing system. (Shafin Z (2018))

The existing system is made up of different components and they include the following

1. **Camera**: The camera functions as a digital capturing device that does the first hand information storage.
2. **Robot controller:** The Robert controller just as the name implies, helps to *control* the motion of a *robot* during capturing
3. **Vision subsystem:** The Vision subsystem handles navigations and grasping of all positions of the robot even while in motion,
4. **Estimator:** The Estimator can also be known as the manipulating device. It is the component that enables the robot carry out its actions
5. **Controller:** The controller regulates all the manipulations of the system and returns feedback to the administrators.

3.4 **Proposed system**

The focus of this work is on the use of shape servoing on visual sensing to analyse the operation of a Robert and its activities in order to improve on its performance if the need arises. Several researches have already partially addressed the capacity of the system as well as its limitations. In contrast to the existing system, shape servoing on visual sensing exposes the fact that an additional confirmation is essential in driving the solution closer and managing the limitation expressed by the existing system. The proposed system introduces a new configuration which includes the Eye-in-hand, or end-point closed-loop control, where the camera is attached to the moving hand and observing the relative position of the target.

3.5 Analysis of the proposed system

The proposed system as shown in figure 3.2 is designed in such a way that it will solve the problem experienced in the existing system which is not capturing the best motion due to poor configuration on the robots. The Eye-in-hand configuration entails the use of a camera in a robot control loop which is strictly mounted in a suitable position where best position capturing can be done. The system presented carries out two different tasks the first task is a positioning task. In the positioning task, the work done is such that the image can be captured globally, and the second work done is that of tracking, the robots keep track of the actions in its immediate surroundings, records it individual and stores it as one of its report. The control law stability proves that several schemes are combined in the comparison of experimental results.

ISSN 2229-5518

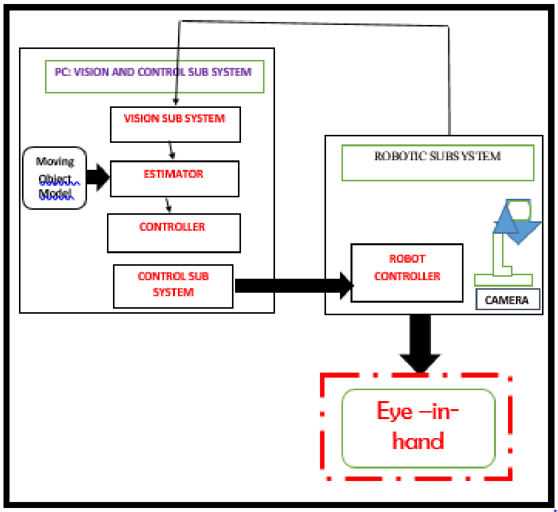

Figure 3: Proposed architecture of the Visual servoing system.

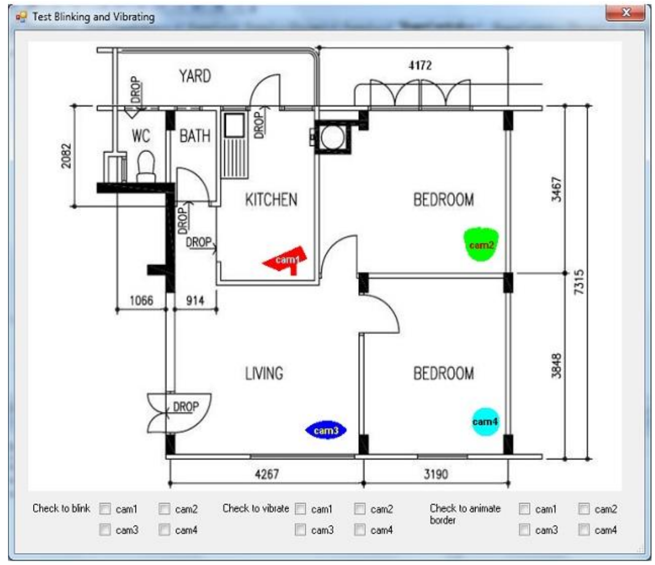

Figure 5: Building plan for Surevelliance

4 Results/Discussion

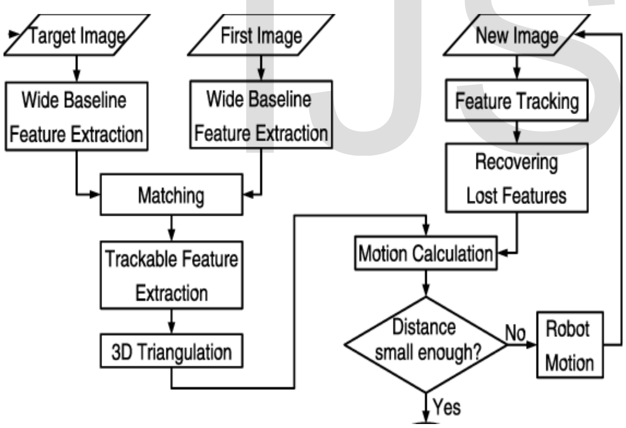

Figure 4: A flow chart of shape-servoing using visual sensing

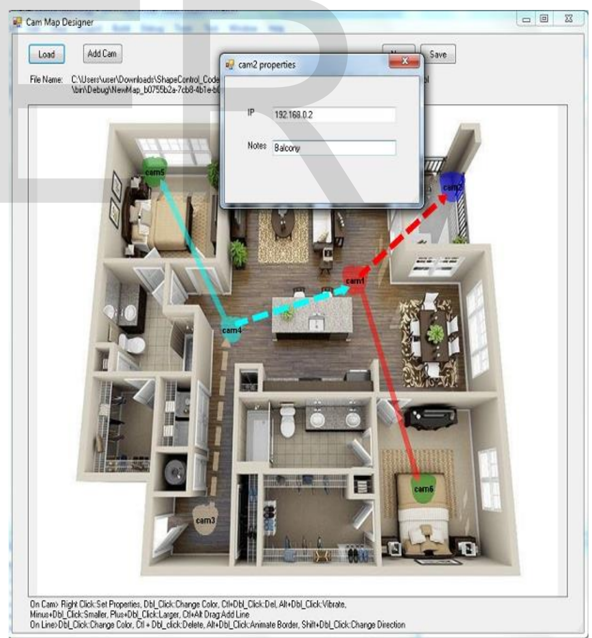

Figure 6: Movement of manipulator from point to point.

4.1 Tokamak Simulation

The tokamak simulation is a 3D global flux- driven turbulence code used to simulate dynamic experiments. It checks for the shape, position, flux contour and magnetic measurements match experiment metal data well.

4.2 Contribution to knowledge

The proposed system functions differently from the existing system in terms of its functionality and the presence of an additional configuration. The system performs its operation using the eye-in- hand configuration which promotes best image capturing and immediate data processing amongst the chain of connected computers in that network.

5. CONCLUSION

Object recognition can intelligently be effectively done by tracking of objects (such as people or cars) through a scene and even determine what they are doing so that certain activities could be automatically brought to the operator's attention. The network automatically selects the best view of a life event by using the eye in hand configuration.

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