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SURFACE DETECTION USING ULTRASONIC WAVES FOR THE ADVANCEMENT OF ROBOTICS

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ABSTRACT

In today's fast growing information technology and robotics environment, it is very important for a robot (or any other movable and intelligent machine) to be capable of sensing every important data. Information surrounding a robot's physical area needs to be sensed with utmost care so that every single detail can be verified. In our research, we are trying to provide a novel method where a robot can be capable of sensing the shape of its surrounding area where it needs to walk. By doing this, it will not stuck on anything and time will be reduced for it complete its task. At first, it will send ultrasounds around its surrounding. While it will receive the signals back, signals will also hold the shape of the surrounding also. These shapes could be identified by received signals to logical values. Value showing 1 denotes that the specific position have some shaping material. Collecting all the 1s from the plane will collectively prove the shape of the area, which also could be understandable for the robot (or any movable machine).

I. INTRODUCTION

In robotics, the implementation of obstacle avoidance is an opening task for beginning to experiment with a mobile robot. In order to solve this problem it is necessary to implement an manager that relates percepts to actions. One of many approaches contains in directly connecting sensors to motors. Then, infrared or sonar sensors controller robot motors for avoiding obstacles. Initially, a single sensor equestrian on the front of a robot pointing forward is sufficient to measuring remoteness to an unknown object. If a sensor notices an object within certain distance, then the robot turns left or goes right to avoid it. The problem arises when the robot is unable to detect objects with gaps, like those that present large surfaces with supporting legs and significant distance among them, which fall out of the range of the sensors. In our laboratory we have small robots such as the Khepera robot, and we would like to test this robot in a genuine environment. The small robot is 55mm round figure and 30mm height; the battery provides movement autonomy for 45 minutes for the robot body of 80g, two DC motors controller the wheels with a PWM (Pulse Width Modulation). The robot has been built-in with a ring of eight infrared SFH900-Siemens sensors, which are used for calculating ambient light and reflected light. A Motorola microprocessor 68331 controls the robot with a maximum oscillation frequency of 16MHz.At the moment there are available three version of the Khepera being the unique Khepera the most versatile because of extension towers such as a gripper board, 1D and 2D wired and wireless cameras, transceiver panels and the extension board having general Input/Output sockets. Particularly, the last extension turret allows addition extra-sensors that can be programed by software like Lab View or even composed under C or C++. Also, these sensors can be simulated underneath free and commercial applications. One of the main research areas for the Khepera is behavior and evolutionary robotics.

In our case we wish to test the robot in a simulated human environment where the shirking of legged furniture (e.g. a work area) is hard to recognize utilizing lower situated sensors, for example, infrared, guards or even sonar sensors. One arrangement comprises in including additional sensors put in an upper position. Keeping in mind the end goal to take care of this issue we began exploring different avenues regarding the Khepera robot utilizing two various types of sensors. On the lower piece of the robot assortment of the Khepera the ring of eight infrared sensors was utilized to distinguish impacts with vertical level items like dividers in genuine situations. Then again, sonar sensors situated on the highest point of the robot were utilized to maintain a strategic distance from reproduced items like work areas, tables, and seats. Accordingly, we repeated the sort of conduct that human-sized portable robots may experience in the navigation of real environments. As for the robot manager we employ a Neural Network (NN) optimized with Genetic Algorithms (GAs). The use of GAs and Neural Networks proposals a good solution to the problem of displaying a snag shirking conducts in labyrinth like situations. Furthermore, neural systems have numerous applications in apply autonomy because of their advantages as intense classifiers. These preparing units are clamor and shortcoming tolerant, which encourages the robot to be driven in dynamical situations. Notwithstanding, neural systems require the setup of a picked topology, and this can be finished by the utilization of a few general guidelines. Once the topology is picked the weights of the neural controller must be designed. A typical methodology for neural systems depends on the utilization of back proliferation preparing, which is a type of regulated realizing where the system needs to learn a known response to a particular configuration of input data. The general misclassification error is intended and decreased over time when the NN is trained. However, this kind of learning needs the design of training and validation data. On the other hand, the use of genetic algorithms is a form of gradient ascent method that refines at each step of the optimization the value of initial random solutions.

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The optimization of neural controllers with genetic algorithms needs the representation, as a vector, of the weights of the neural controller. Then, a common practice contains of a direct encoding of the neural weights as an array that characterizes the genetic material to be manipulated by artificial evolution. A single neural controller speaks to one of the numerous people that shape a populace, which thusly are possibility for giving a decent answer for the undertaking that is to be understood. Then again, the fittest people of one populace are utilized to breed the youngsters that will be assessed in the cutting edge. Thusly, the nature of an answer ('wellness') is measured to recognize whether a hopeful arrangement is or not a decent answer for the conduct, we are trying to model. If the fitness of all candidate solutions is plotted, we will end up with a convoluted space where all imaginable fitness solutions can be represented. Therefore, mountains and valleys, where landmarks in the mountains characterize good quality solutions and landmarks near valleys are compact solutions, form this fitness landscape.

Challenges of using freehand 3D ultrasound: In freehand 3D ultrasound carries with it the test of working withdata procured in unpredictably separated and situated planes. This issue, identified with insertion and enlistment, adds to that of division postured by the numerous relics show in ultra-sound information. What's more, this methodology shares the normal issues of surface perception and working under clinical imperatives which are connected with every one of the 3D restorative imaging modalities. Spots preparing errands in the connection of a way from the beginning representation (compelled by the obtaining procedure) to the last show or quantitative result (craved by the clinician). Every move for the most part represents a whole area of research, with many underlying problems and solutions.

Ultrasonic and Infrared Sensors: The usage of ultrasonic sensors in robotics is common because they are generally simple to fit into an automated framework. These sensors utilize the acoustics phenomena for acquiring a voltage variety in their yield and are coordinated by two fundamental segments, which are the emitter and the collector. The emitter sends a burst of ultrasonic waves in a straight bearing. The sign goes in a transmission medium, which frequently is the air; if nothing obstructs the sign, it won't skip back. Despite what might be expected if an item that is denser than air risen route of the sign, then an a piece of a sign is retained and whatever is left of sign is reflected back to the sensor. The returned sign, which is identified by the beneficiary, creates a potential distinction in the sensor enter that is relative to the separation from sensor to the item. The voltage is created by the piezoelectric impact of applying weight constrain on the dividers of a part that will deliver an electrical potential distinction between two contact focuses. By and large ultrasonic sensors are utilized to quantify remove and distinguish deterrents. Optic sensors are another sort of sensors for measuring separations, and cases of these sensors are infrared, photograph resistor, and laser sensors.

II. LITERATURE REVIEW

Hongliang Ren et al (2011) Three-dimensional ultrasound can be a successful imaging methodology for picture guided mediations since it empowers perception of both the instruments and the tissue. For automated applications, its real time edge rates make the potential for picture based instrument following and servoing. These volumes can authorize improved instrument representation, remuneration for tissue movement and additionally surgical undertaking mechanization. Continuum robots, whose shape embodies a smooth bend along their length, are appropriate for insignificantly obtrusive methodology. Existing methods for ultrasound following, on the other hand, are restricted to straight, laparoscopic-sort instruments and along these lines are not appropriate to continuum robot following. Around the objective of creating following calculations for continuum robots, this paper introduces a technique for recognizing a robot involved a solitary consistent ebb and flow in a 3D ultrasound capacity. Computational expertise is adept by breaking down the six-dimensional circle estimation issue into two consecutive three-dimensional estimation issues. Reenactment and analysis are utilized to assess the proposed strategy. This paper researches the issue of programmed bended robot location from real time 3D ultrasound pictures, and speaks to our initial move toward accomplishing real time following and picture based servings of continuum robots. Our proposed calculation incorporates a preprocessing pipeline for consequently extricating the bended robot from ultrasound volumetric pictures. It then applies a novel two-stage way to deal with disintegrate the six parameter bend estimation issue into a succession of two three-parameter issues. Adequacy of the calculation was exhibited through reenactment and experiment.The current calculation is constrained to discovery of a solitary portion of steady ebb and flow at the distal end of the robot. While this is specifically appropriate to numerous clinical circumstances given the restricted field of perspective of 3D ultrasound frameworks, our objective is to extend the way to deal with various joined portions of consistent arch. Since both the RANSAC plane identifier and ensuing roundabout parameter estimator are parallelizable calculations, we plan to add to a continuous following strategy utilizing GPU (Graphical Processing Unit) registering and by taking point of preference of the referred to kinematic direction as former data in the estimation process .

Sanghoon Kim et al (2009): A portable robot with different sorts of sensors by means of universal systems is presented. We planned a portable robot made out of TCP/IP system, remote camera and a few sensors in a situation, and show item maintaining a strategic distance from and following routines important for giving different administrations wanted by the individuals. To maintain a strategic distance from obstacles (objects), dynamic sensors, for example, infrared beams sensors and supersonic waves sensors are utilized together and measures the extent continuously between the obstructions and the robot. We concentrate on the best way to track an article well in light of the fact that it gives robots the capacity of working for human. This paper recommends successful visual following framework for moving articles with indicated shading and movement data. The proposed following framework incorporates the item extraction and definition process which uses shading change and AWUPC reckoning to choose the presence of moving article. Dynamic form data and shape vitality capacity are utilized to precisely tract the articles with shape changes.

Paul Mignon et al (2005) A picture accessing calculation has been executed to distinguish needle shape in uproarious medium, for example, US volume. It directly utilizes 3D RANSAC calculation to and an approximate shape. A needle directing methodology in light of the power acting on the needle tip amid insertion will permit needle tip to be guided in the tissue. The needle shape discovery will be utilized as input for needle directing.

III. PROBLEM FORMULATION

In the technically advanced today's robotics, the dismal truth we are still stuck in is the process of giving optimal direction to a machine. Artificial intelligence is one of the most useful and prominent way of achieving such goals. In previous works, the main obstacles was

1. While a robot (or movable sensing machine) get inside a house, it stumble in the wall as it doesn't get the direction as how to move in the room

The solution to this problem is

1. If we use ultrasound to get the shape from the region by the robot, it will send these waves to get the shape of the entered region
2. While receiving the signals, there will be the information of the detected area.

There will also be some noise in the received part as it will be go through an environment which must have some unwanted signals. The find out the noisy part, we will use cross correlation. In signal processing, cross correlation is a measure of similarity between two series.

IV. METHODOLOGY

The flowchart of our methodology is described below:

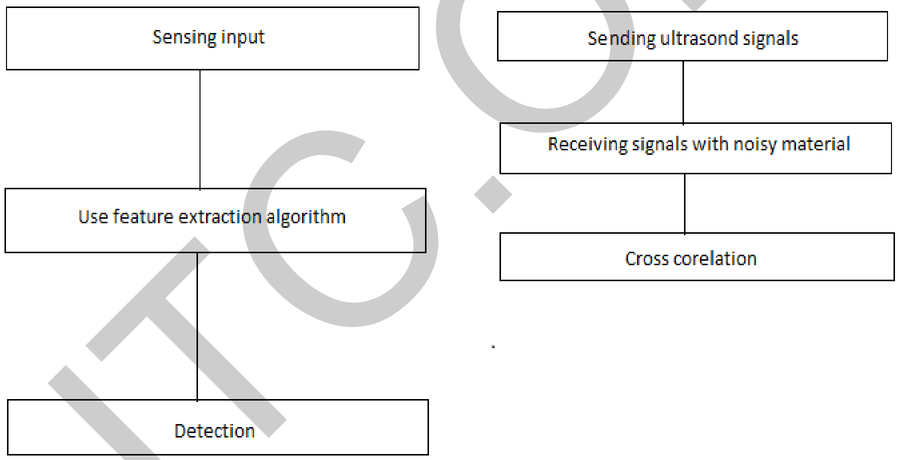

Fig. 1: Flowchart of Extraction Algorithm

The methodology of our research is described below:

1. Create variable to store the signals that has been sent
2. Receive the sign wave and store it
3. Import the signals to Matlab
4. Create zero matrix of n ×m, where n is the size of rows, m is the size of columns
5. Convert the received signals into black & white
6. Implement feature extraction

6.1 For each 90◦ in the search plane, search for the value of 1
6.2 If 1 is found, store the index to a new variable detected
7. Place the whole detected part in a single plane.

V. RESULTS

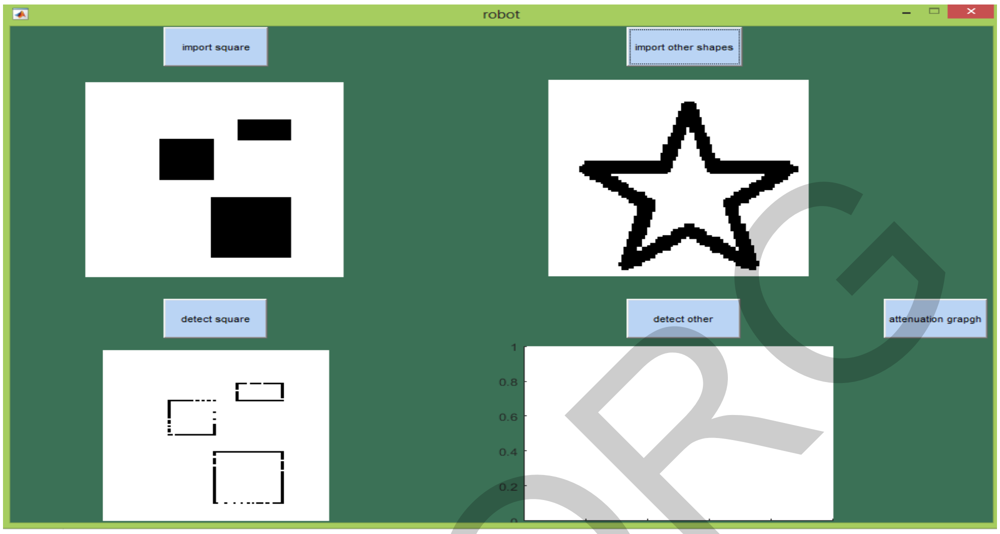

Fig. 2: Results of Physical Region

VI. CONCLUSION

In today's world, quickly developing data innovation and apply autonomy environment, it is critical for a robot (or some other mobile and wise machine) to be fit for detecting each vital information. Data encompassing a robot's physical region should be detected with most extreme care so that each and every subtle element can be confirmed. In our examination, we are attempting to give a novel strategy where a robot can be fit for detecting the state of its encompassing territory where it needs to walk. By doing this, it won't stuck on anything and time will be decreased for it finish its undertaking. In our research, we have implemented successfully the core idea of sensing surrounding area of a robot and also found out the cross co relation of the sent and received signals. The whole scenario has been implemented in Matlab 2012.

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