Multi-Terrain Automatic Controlled Bot Using Rgb-D Sensing Technology

SaniaAfreen, Manish Kumar, Md. NavedKhan, GurijalaVinayak, Caroline El Fiorenza

Abstract: Pixel-wise precision in farm scenes has reliable applications in the smart farming system. Deep learning methodology can enhance accuracy, especially under precision farming technique where the information from the depth map is initiated with low-resolution pictures. However, little research has been already done. We propose a theory for pixel-wise precision of different plant images based on deep learning using RGB-D images. We present in-deep fully convolutional neural network architecture for pixel-wise precision and to use the Continuously Adaptive MeanShift method which is based on RGB data when depth information is not sufficient to avoid false values due to low light. Experimental results show and prove the efficiency of the proposed method.

Keywords: Multi-terrain bot, Browser controlled bot, Smart farming system, precision farming bot, Cam Shit method.

I. INTRODUCTION

As robots are becoming part of our day-to-day life, we came up with the idea of a multi-terrain automatically controlled bot using browser connectivity referred as “Tera-Bot”, i.e., service-oriented robot, and has the potential applications based on smart farming system, which can help humans in many ways, especially agriculture and that can bring ease to life. The existing system was designed in such a way that it can move on multiple surfaces as well as an artificial environment such as bricks. It consists of one or two robotic arms. It is composed of mechanical sensors and control subsystems. Since the robot used a smooth disparity map algorithm (for processing image) it was not that reliable in low light conditions. Secondly, the robotic arm with universal tool mount arrangements can perform multiple functions with precision like seeding, watering and weed detection and removal capabilities. It also has an additional attachment, which is the soil pH sensor that is used to determine the pH level of the soil for fertility and plays a vital role during seeding season. In addition to that with the control of well-founded RGB-D sensors, we will use the Cam Shift algorithm, for detecting images based on the RGB method to avoid false values due to low light. The anti-interfering technology derived from Cam-shift algorithm is invoked, if the depth parameters of the system are found to be irrelevant or not reliable. Different frequencies of light wavelength and most of its parameters are read by different sensors for reading infrared CMOS and RGB CMOS. The Tera-bot uses the perceptual organization for depth image calculation and then combines it with reading given by RGB sensor. This helps in creating 2D as well as 3D images. However, it has certain limitations such as:

A. Since we are applying this technology in farming in farms already covered with crops would be a bit challenging in detecting the difference between crops grown and unnecessary plants.

B. Implementation of such sophisticated algorithms and RGB-D dataset network for testing such indoctrination is way too complex in the real world application.

II. LITERATURE SURVEY

We carried out various surveys conducted upon various types of traditional and native farmers and the algorithms that are more appropriate for the technology that we propose on its corresponding references:

A. We analyzed that target identification and tracking system was implemented using Cam-Shift algorithm. Cam-Shift tracking based on color statistics analysis is a method that is used to remove random fluctuations based on clustering that is found in a vague environment. Initially, the color statistics of the resultant parameter was gained by the RGB-D sensor and processed through nearest point values obtained by globally localized depth parameters that nullify the radiance effects and so does the background color information of the background. When the depth parameter tracking goes off-track, Cam-Shift tracking technique using color statistics analysis is utilized effectively which removes random fluctuations using clustering the values obtained in the vague environment, and jumping into a solution using the readings that are gathered by coupling every single class.

B. The flexible and more compact service-oriented farming robot was created with the capability to run on any terrain and was composed of universal arm tools. They then proposed that instead of previous generations of a bot whose motion was based on wheels or legs, caterpillar track is much more efficient and flexible on multiple terrain conditions. Its flexibility and compactness enhance its performance. Soil sensors were placed as to detect nearby soil properties accurately. The bot has a robotic arm that can consist of the universal tool mount performing as the root for attaching instruments like seed injectors, watering nozzles, sensors, and plows and acted as a universal tool mount. Tera-Bot will have potential applications based on the smart farming system. [2]

C. The semantic arrangement of the input feed using deep learning based on the RGB-D based images was proposed in this paper using a semi-global multiple surface matching algorithm and an overall

Revised Manuscript Received on April 06, 2019.

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Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075, Volume-8 Issue-6, April 2019

regularizing method. A rectified mapping algorithm is gained by the referencing to the Semi-Global Stereo Matching algorithm" which is more useful for smoothing the image obtained. They represent highly complex networks of depth parameters for semantic traffic inflow by creating changes in Alex Net Network. [3]

D. In this research work, we propose an innovative way of approach to registering the key frames of RGB-D image constraints that are built on trait. This technique is inspired from SIFT algorithm as an elucidation functionality for the target. The proposed system is proved to be more accurate in terms of cloud sync integration as well as the quality of the obtained 3D model. [4]

E. Semantic references to the RGB-D vectors were proposed for enhance the accuracy and efficiency of the proposed system. There classifiers are formulated as two levels. In level-1, the set of discriminative 2D and 3D attributes separated from RGB-D images which are coached based on K-Nearest Neighbor algorithm along with SVM classifiers and radio frequencies in the system. The second level states that the conditional random field substructure function is used to represent the individual super pixel rooted on this vector attribute. The simulation outputs worked on the NYUV2 information, reflected the superior precision of the proposed technique over the various techniques. [5]

F. This paper precisely centered recognizing the habitations of humans from depth sensing video recordings. A differential approach to characterization was proposing the combination of mixed depth parameters and RGB readings, and differentiating the activities in the sequence of RGB-D vectors. This is used to pick the differences in the complex values found between two models. In order to increase the efficiency of the relational attributes, they propounded the smallest loss to calculate the classification precision when the attributes were deployed for differentiation. This propounded oversee different attributes that are efficiently used for classification. They formulated the path finder sequences within a least marginal substructure, and resolve the new formation using a coordinate descent algorithm. They propounded technique as extensively calculated on two public RGB-D activity information. They demonstrated that the propounded technique can actually formulate extremely low-dimensional attributes with better discriminating capability. It also shows the efficiency of the performance when one single module is lost in coaching. [6]

III. SYSTEM DESCRIPTION

The system is composed of user end and application end, at the application end we have a multi-terrain farming robot whereas at the user end we have a web browser from where the user can control all the activities. The application consists of an RGB camera and a depth sensing system as discussed.

A. RGB Camera:

It is composed of the infrared laser emitter and the infrared camera. Infrared laser camera originates its own clamorous design of an organized infrared ray. The infrared came works at 30 Hz and data (images) are pushed at the speed of 1200x960 pixels. This image is down stamped at 640x480 pixels, which produces the level of sensitivity up to 2048, and uses USB 2.0 which in the other hand takes almost two thirds of the single hub for data transmission.

B. Depth Sensing System:

The RGB camera that works at the speed of 30 Hz can send data (images) at 640x480 pixels per tunnel. The camera itself is efficient of working color saturation, black reference, white balancing, defect correction, and flicker avoidance. The output of RGB is recorded in the pattern of GR, BG, BR.

IV. DATA ACQUISITION

RGB camera is used to obtain the color image. Using the IR emitter and IR camera depth measurement is obtained. And using organized focused ray computation is accomplished. Then the Cam-Shift algorithm is efficiently utilized and used to execute Mean Shift tasks for the multiple frames of input feeds. The output of the system is the initial frame reference of the incoming feed that is actually acquired as the input. The color probability distribution graph is calculated and gained utilizing the vectors and parameter values of the pictographic values from the goal model. The structure and position of a searching module are started and reinstated with adaptation ability in accordance with the resultant frame resulting such that it positions at the focal location of the subject present in the current image.

Once the positions are known of the target image weeding process can be initiated from the user's end and universal tool mount then pucks of the unnecessary plants.

V. ARCHITECTURAL DESCRIPTION

A. *Capturing:*

The depth calculation is achieved using a sequential focused ray technique. This methodology is rooted in protruding an orientation of pixels and capturing the projection that is caused due to the distortion, which will calculate the pixel depths. The most important step is the calibration of the infrared camera for better representation of this computation (emitter and the IR camera should be kept 7.5cms apart). This computation highly incorporates to the triangular dependence of the emitter, IR camera, and the location of the pixels.

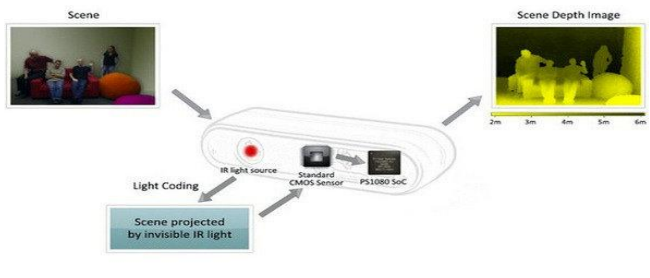

Fig1. Working of depth sensing and RGBD camera

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Fig1. Depicts the working of depth sensing and RGBD camera.

B. *RGBD Representation:*

Original image obtained is an RGB-D parametrical value, i.e., a combination of tri-color channels (I.e., red, green and blue) with depth information. The color channels resemble an 8 bit channel. The depth information can be entitled by a 16 bit integer matrix. To optimize space, the depth sensor depicts a 16 bit integer value but moves the data set with 11 bit integer value. It is capable of measuring the depth ranged between 1 and 10,000, which is represented in millimeters. The various attributes of color (visual) and depth (geometric) variables authorizes us to utilize the RGB-D information to do certain pieces of work that were strenuous before. For example, real-time segmentation of objects, recognition of the postures, etc. Besides the foreseen features, additional to the information depicting visual data such as luminance, geometric data sets including gradients, etc. The visual data set could be computed in an identical way utilizing the traditional image processing algorithm. Whilst the geometric data should be generated using the depth information obtained.

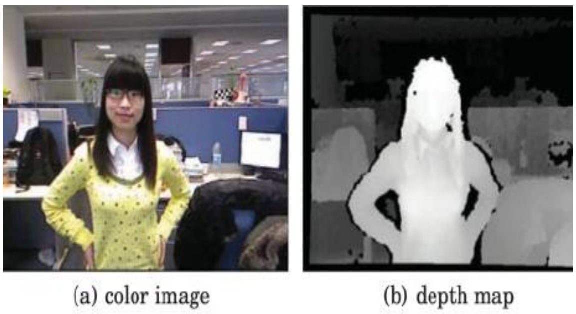

Fig2. Image showing depth mapping

Fig2. Depicting depth mapping done using Cam-Shift algorithm so that no fault values appears in low light.

C. *Filtering:*

The data collected has certain flaws. Disturbances are found in both the RGB values and the depth parameters. Other than that, it is important to calibrate the cameras in order to improvise the efficiency of the RGB image with the depth field information. Thus to filter information, initially, they apply both sided filter over the original depth, in every segment of the frame, in order to collect information with the least disturbance, meanwhile protecting the same from discontinuities. It is a real deal in order to obtain a pixel grid from the traditionally obtained regular grid format. They built a surface with the filtered vertex and they calibrate the normal for an individual vertex. They compare a multi-scale depiction of the surface computation in the pyramid form.

VI. IMPLEMENTATION

Service oriented system as depicted in fig 3. is used to showcase the architectural structure. The figure depicts that end user log in to the system using key/rock identity management generic enabler so that authenticity is maintained, and is able to access data stored by the system through Orion context broker generic enabler using RGBD system with Cam-shift algorithm. Once the data is read is then filtered and calibrated for precision. This data is now stored in the database which can be viewed by the user.

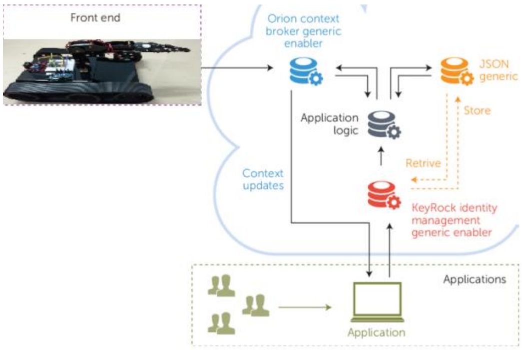

Fig3. Service oriented system

VII. CONCLUSION

We are successfully able to derive an adroit bot that is able to recognize the input image with the real time data feed. We are able to incorporate this mechanism for farming as to find the weeds in between the farming fields. Our Tera-bot can successfully recognize and indicate a weed from a plant that is growing out in the fields. Using our proposed algorithms we are able to achieve our goals after various coaching and tests carried out. The Tera-bot is has achieved greater heights by plucking out a weed out of all the plants on the field using the depth field analysis algorithm that we fed into the system and thereby enhancing the capability of the bot.

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