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MAPROBOT: Mapping in Agriculture Robot Weed Detection and Herbicide Sprayer– A Review

Khushboo Chhikara

M.tech Student, Mechanical and Automation Engineering Department, IGDTUW, Delhi, India
E-mail: kchhikara31@gmail.com

Abstract—*The most important abilities for the automated guided vehicles are: guidance, detection, action and mapping. The mapping in agriculture produces statistic and their spatial variation with a national level of details. The data are subjected to overall consistency and enhance accuracy of integrated database. For the successful and safe navigation the system has to know its path and position within the field. It interprets the surroundings and stores the information regarding such interpretations. Biological features extracted from the processed data are used to generate map. The crop line tracking method is used in which each line in the image is processed separately to find a boundary which divides region corresponding to cut and uncut crops. The mapping stage is interested in the way the service unit interprets the environment and stores the information for the future task performance. The sensors information is used for generating the map of surrounding environment. It is not necessary that one robot can perform all the functions so to overcome this problem we use master-slave method in which master robot perform the function of making decision of sending command to slave robot.*

Keyword*: Weed Detection,Mapping , MATLAB*

1. INTRODUCTION

Agriculture is the spine for human development by yielding food, feed, fiber and fuel. India's population expected to reach 1.6 billion by 2050,so, the demand can not be fulfilled by just doubling the agriculture productivity must rise by 25% to achieve the goal.Farmers are intently interested to make there work carrier by labor saving devices. Recently farmers have started the experiment with autonomous system such as pluming, thinning, mowing, spraying, harvesting and weed removal. An important aspect for the execution of the robotic system is selecting opportune manipulator for specified task to easy out variety of task such as transparency cultivating and selective harvesting. The international competition in agriculture sector, advancement in technology and wide spread appreciation of intelligent machines in agriculture is inventible. The various agricultural robots which are developed for high quality, high speed are transplanting robots, mowing robots, spraying robots , gladding robots, detecting robots and so on. Manufacturing industries and mining have accepted these new technologies very quickly.

Reasons:

i. Many industries use their machinery thought-out the year, but agriculture is seasonal sector.
ii. Because of fixed annual cost, a producer can not afford to invest as much.
iii. Many tasks are performed on rough territory, ambient temperature, humidity, dust, mud etc. hence machine envoirment is difficult to control.
iv. Agriculture products are of varying shapes, sizes, texture, color and hardness.

Fig. 1: Harvesting Robot

2. SYSTEM OVERVIEW

Precision autonomous farming is defined as an operation, control and guidance of autonomous machines to perform agricultural tasks [2]. Currently, most of the self-governing agricultural vehicles are used for agrochemical dispersal, irrigation; harvesting, weed detection, terrain leveling, etc. are manned. The most important abilities of automatic agricultural vehicles can be grouped into following four categories [2]:

1. Guidance - defined as the way of navigation of vehicle within the agricultural field.

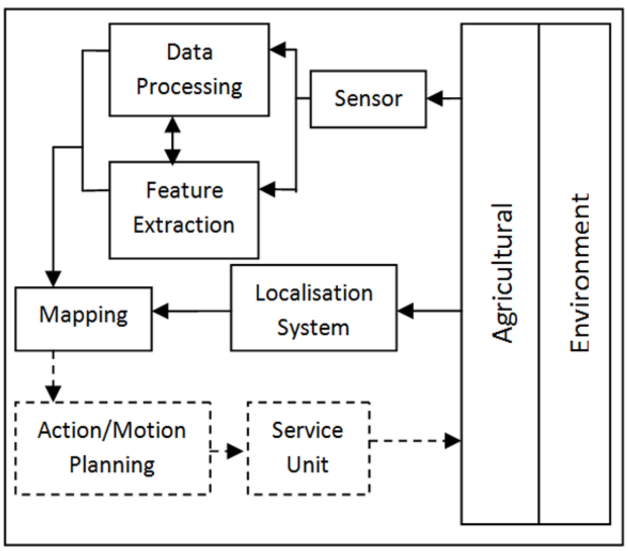
2. Detection - defined as the sensing or extracting of biological features from environment.

3. Action - a mechanism of executing a task for which vehicle is designed.

4. Mapping – the process of locating elements or agricultural field with most relevant features.

2.1 Mapping

The mapping stage is interested in the way the service unit interprets the environment and stores the information for the future task performance. The sensors information is used for generating the map of surrounding environment. For example vision feedback system is used for finding the path in [8] for searching the edge of the object, stereo visual odometry system is used for mobile robots on uneven terrain in [9], and laser range and odometry is used in driving and for creating map in [1]. The main goal of creating and maintaining a map is for improving the performance of service unit in executing assigned tasks. But its worth knowing that the use of mapping stage is unnecessary where reactive navigation (the motion or action is not planned) is used.



3. ANALYSIS AND DESIGNING

This is done with the help of MATLAB. In which, the captured image from the wireless camera is transmitted to the PC or the LCD screen. The detection of the weed can be done by two methodologies followed by MATLAB *i.e.*

i. Segmentation

ii. Feature extraction

3.1 Segmentation

Image segmentation is the process of dividing an image into multiple parts. This is typically used to identify objects or other relevant information in digital images. There are many different ways to perform image segmentation, including:

3.1.1 Thresholding methods

Used to create binay images.

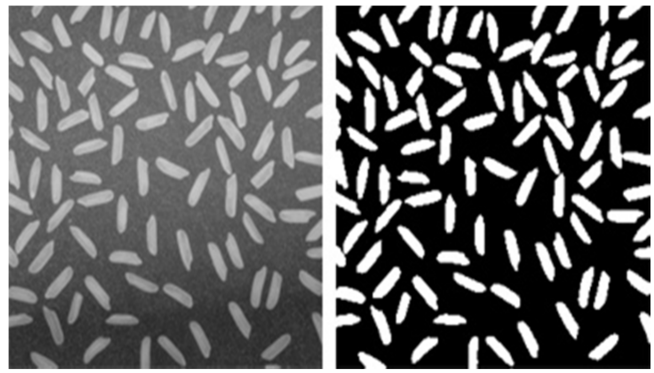


Fig. 3: Threshold

3.1.2 Color-based Segmentation (clustering)

It is the task of grouping a set of objects in a way that objects in the same group are more similar to each other than to those in other groups .

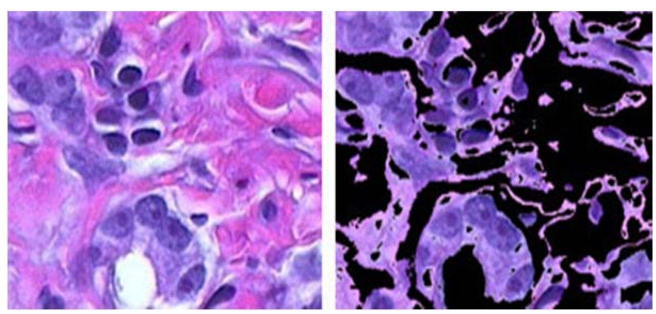


Fig. 4: Clustering

3.1.3 Transform methods (watershed segmentation)

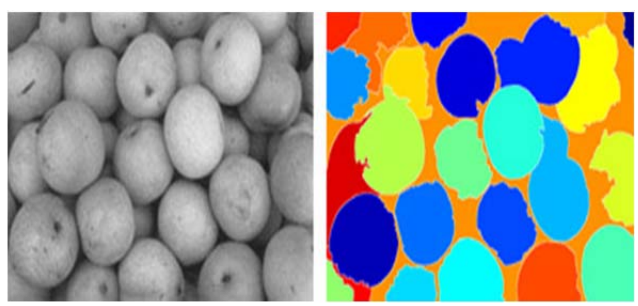


Fig. 6: Watershed segmentation

3.2 Feature Extraction

Feature extraction a type of dimensionality reduction that efficiently represents interesting parts of an image as a compact feature vector. This approach is useful when image sizes are large and a reduced feature representation is required to quickly complete tasks such as image matching and retrieval.

4. CONCLUSION

The work reported in the case study prove that path recognition method was beneficial.

(i) Track the navigation path instantaneously which is reliable and precisely accurate.
(ii) Short lead time and payback periods.
(iii) Machinery efficiency and flexibility is high.
(iv) Lightning is major failure for vision system.

Other Methods :

1. Master-Slave robot system
2. Vision-Based Perception
3. Real-Time Monitoring
4. Path Tracking
5. GPS tracking

REFRENCES

[1] [1] Marcel Bergerman, Silvio M. Maeta, Ji Zhang, Gustavo M. Freitas, Bradley Hammer, Sanjiv Singh and George Kantor , *"Robot Farmers"*, Proc. IEEE, pp 54-63, March 2015.

[2] [2] Fernando A. Auat Cheein and Ricardo Carelli , *"Agricultural Robotics"* , Proc. IEEE industrial electronics magazine, pp 48-58, September 2013.

[3] [3]Yael Edan and Gaines E.Miles, *"System Engineering of agricultural Robot Design"* ,Proc. IEEE, pp 1259-1265, 1994.

[4] [4] Fred E. Sistler, *"Robotics and Intelligent Machines in Agriculture"* , Proc. IEEE, VOL. RA-3, No. 1, February 1987.

[5] [5] Takoi K.Hamrita, E. W. Tollner and Robert L. Schafer, *"Towards fulfilling the robotic farming vision:Advances in sensors and controllers for agricultural applications"*, VOL. 36, No. 4, July/August 2000.

[6] [6] Satoru Sakai, Member, IEEE, Koichi Osuka, Takahiro Maekawa and Mikio Umeda, *"Robust Control Systems of a Heavy Material Handling Agricultural Robot : A case study for Initial Cost Problem"*, Proc. IEEE, VOL. 15, No. 6, November 2007.

[7] [7] Yael Edan, Member, IEEE, Dima Rogozin, Tamar Flash and Gaines E. Miles. *"Robotic Melon Harvesting"*, Proc. IEEE, VOL. 16, NO. 6, December 2000.

[8] [8] Peng Zhang, Junfei Qiao nad Hengyi Zhang, *"Path Planning and Tracking for Agricultural Master-Slave Robot System"*,Proc. IEEE, CCTAE 2010.

[9] [9] Mark Ollis and Anthony Stentz, *"Vision-Based perception for an Automated Harvester"*, Proc. IEEE, pp 1838-1844,1997.

[10] [10] Zhao Bo, Zhang Xiaochao, Zhu Zhongxinag, Song Zhenghe and Mao Enrong, *"A Vision-based Guidance System for an Agricultural Vehicle"*.

[11] [11] Weiwei Kong, Dianle Zhou, Daibing Zhang and Jianwei, *"Vision Based Autonomous Landing System for Unmanned Aerial vehicle : A survey"*.

[12] [12] G.Angel and A. Brindha, *" Real-Time Monitoring of GPS-Tracking Multifunctional Vehicle Path Control and Data Acquisition Based on ZigBee Multi-hop Mesh Network"*, Proc. IEEE, pp 398-400, 2011.

[13] [13] Roland Lenain, Benoit Thuilot, Christophe Cariou, Philippe Martinet, *"Mobile Robot Control in presence of sliding : Application to agricultural vehicle path tracking"*, Proc. IEEE Confrence on Decision and control, 2006.

[14] [14] Fernando Vicente-Guijalba, Tomas Martinez-Marin, Juan M. Lopez-Sanchez, Senior Member, IEEE, *"Dynamical Approach for Real-Time Monitoring of Agricultural Crops"*,VOL. 53, No. 6, June 2015.

[15] [15] *"The Future and Intelligent Machines : Charting the Path"*,Proc. IEEE Robotics and Automation Magazines, September 1997.

[16] [16] D.Durai Kumari,C.Vijaya,S.Jayashree Janani,*"Autonomous navigation of robot for automatic weed detection and herbicide spraying in agriculture"*,ISRA,March 2015.

[17] [17] D.C. Slaughter, D.K. Giles, D. Downey *"Autonomous robotic weed control systems: A review"*. computers and electronics in agriculture" 6 1 (2 0 0 8) 63–78.

[18] [18] Hong Y. Jeon ,, Lei F. Tian and Heping Zhu, *"Robust Crop and Weed Segmentation under Uncontrolled Outdoor Illumination*, Sensors" 2011, 11, 6270-6283; doi:10.3390/s110606270.

[19] [19] S. Kiani, and A. Jafari, *"Crop Detection and Positioning in the Field Using Discriminant Analysis and Neural Networks Based on Shape Features"*, J. Agr. Sci. Tech. (2012) Vol. 14: 755-765.

[20] [20] Kamal N. Agrawal, Karan Singh, Ganesh C. Bora and Dongqing Lin, *"Weed Recognition Using Image-Processing Technique Based on Leaf Parameters"*, Journal of Agricultural Science and Technology B 2 (2012) 899-908.

[21] [21] Xavier P. Burgos-Artizzu , Angela Ribeiro , Alberto Tellaeche , Gonzalo Pajares , Cesar Fernández-Quintanilla *"Analysis of natural images processing for the extraction of agricultural elements"*. Image and Vision Computing 28 (2010) 138–149.