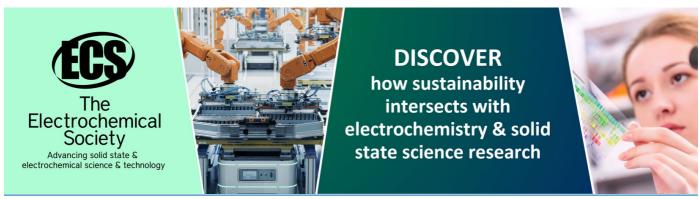**PAPER • OPEN ACCESS**

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Applications of Automation and Robotics in Agriculture Industries; A Review

Amith A Kulkarni,[1] Dhanush P, [2] Chetan B S, [3] Thamme Gowda C S, [4] Prashant Kumar Shrivastava* [5]

[1,2,3,4,5,] Department of Mechanical Engineering, Vidyavardhaka College of Engineering, Mysuru, Karnataka [1]Amith.kulkrni.54@gmail.com, [2] Dhanushp147@gmail.com, [3,] Chetanbs050@gmail.com, [4,] thammegowda.cs@vvce.ac.in,

Corresponding Author Email: er.prashant1986@gmail.com*

Abstract: In this present work, we have discussed about the application of automation and robotics in the various stages of the agriculture industries like irrigation of horticulture land, parks, gardens, and golf courses efficiently and reduce the wastage of water. The uses of automation and smart systems also help in food safety by the selection of appropriate chemicals. The application of multitasking robots is also useful to make it fast and maintain quality. In the smart farming also helps to maintain the humidity, temperature and irrigation process by using the sensors and apps. The aim of this study to identify the opportunities and scope for future automation and the Internet of Things (IoT) in the field of agriculture industries

Keywords- Automation, Robotics, Artificial Intelligence, Internet of Things, Tele-psychiatry

1. INTRODUCTION

Nowadays, automation plays a major role in various type of industries to minimize the human efforts and increase productivity and achieve customer demand and fulfill customer satisfaction. Today, automation used in the different types of industries like Automobile, electronics, electrical, medical, defense and agriculture industries to improve the quality of products and reduce human errors, cost and time. Most of the industries are affected by the control and un-control factors. But for the industrial point of view, there are some limited un-control factors that affect the process because most of the process takes place under manufacturing plants. In the case of the agriculture industry, the output from the agriculture industries mainly based on the different types of aspects that effects on the output directly or indirectly like uncertain prediction of rain, storm, hot and cold waves etc. The conventional agriculture practices is not suitable for this kind of situations. The un-conventional agriculture practices with automation with IoT has been reduce the effects of uncertain factor and help to understand the weather condition that is responsible for increased agriculture output.

2. LITERATURE SURVEY

There are many technologies being introduced in the agricultural field and it is not yet being used in the daily agricultural activities as they are very expensive hence a dependable system with low cost and low power usage was introduced known by the name as UREA spraying arrangement with automated vehicle used for collecting data all by remote sensing hence it very low cost-effective, now by the recent trend of miniaturization of electric components there is an easy way of implementing these, the system captures green field pictures and products hence this type of model was introduced with high-performance quadrotor with brushless DC motor . The UAV can be programmed by an Arduino through network, the UAV has multispectral resolution and it has temperature cameras used for various climate change conditions, the programming of the UAV can be done in such a way that the system handling can be auto-corrected whenever there is an error as the feedback sensors provide regular data acquired by the sensors such as the green field images the UAV consists of accelerometers to calculate the acceleration forces and a gyroscope applied for measurement of angular velocity and combination of these provide independent degrees of freedom tracking

system and the brushless dc .motor to drive the system as it has various advantages over the other motors in terms of life span, efficiency, and has overall higher performance over any other motors and propellers which are used to generate aerodynamic lift force and a speed controller unit which can alter the speed of the motor and should also act as the dynamic brake for the system and moreover a power source to run the system and a radio frequency control system used for various purposes such as voltage regulation and steering control and also take-off and landing. And camera and sensors for data acquisition hence by the combined function of all these parts the UAV can be used for various applications like crop field monitoring and monitoring of growth of plants and moreover the spray system to various fields based on the data the manual operator can drive the UAV to spray the various fertilizers over the required fields with high ease as the design is ecological this type of design can be utilized for the enhancement of the future developments of the various applications of agricultural areas [1].

Moreover, in agriculture where the farmers have to handle various heavy materials such as equipment's for the farming and heavy vegetables, fruits during harvesting time as this process requires hard intensive labor work hence a manipulator is used to handle such heavy material handling process, the agricultural-based manipulator is different from the other manipulator for the following reasons 1) they have different locomotive function 2) working condition and environment is different 3)they have different characteristics as they handle plants as there are two different types of work in the agriculture, they are the selective work and simultaneous work, hence the material handling is designed to be versatile, the design can be done in all the four possible ways that are the polar, Articulated, parallel, and cylindrical type coordinate systems which can be determined based on the end application.

 The second factor to be considered for the design the analysis of the forces such as the kinematic forces because the manipulator will be having mobile platform and heavy material handling in agriculture as the material or target will be either scattered or handled horizontally hence the robot are designed based on the manipulability of condition, and based on the observations the parallel type manipulator are used for material handling of the agricultural applications [2].

 However, the distribution of the chemical droplets on the crop field is very important for the crop development hence a sprayer technique with leveling function performed with the help of four-rod linkage self-leveling suspension and electro-hydraulic auto-leveling technique, as per in the agricultural field providing an better improvement for optimum plant development and use of chemicals is a elusive jobs as the agrochemical contains high concentrated chemicals which can serious environmental hazards hence we require a proper accurate and precise machine for the homogeneous spray applications, the quality of equal distribution of the spray is depended on the factor such as the distance between the nozzles and the crops, in regular sprayer machines the problems they face are due to vibrations, hence to overcome these problems a flexible sprayer boom system which is designed to eliminate the vibrations and the leveling should be properly done. And this can be achieved by minimize the vibration by the suspension and smoothing the tending boom with the hydraulic controller system.

 For the better system two spray system with linked suspension and electro hydraulic techniques have been applied for spray. Apart from that it has been included infrared sensors, hydraulic sensors, and cylinder and controller system. Based on the application the mathematical model and ANSYS simulation can be carried out at the initial based on the outputs of the mathematical model the controller can be designed for the closed-loop system hence the system will show good correspondence to the requirements and the results which will lead to better spraying quality [3].

 Moreover, walking tractors also known as Power wheel that is used for the plowing, tiling, and ground preparation in the small fields, using this type of machinery can overcome many drawbacks from the regular farming conventional machines the overall system of power wheel is considered kinematics, dynamics, and engine dynamics for independent action and the responses are the right and left clutch control signals, data from the inertial measurement unit (IMU) involved to power source permits signal and the analogue matching with integral least squares methods have been used for the validation of the model..

This steering arrangement are responsible for different types of mechanical advantages by this arrangement tractor perform in different types of conditions. Hence these type of power tillers can be used for both dry and wet cultivation, the remote operation of the power wheel controlled via wireless network. The IMU which is mounted at the center senses the angle, longitudinal and lateral acceleration, in the power wheel the power transmit to the wheels by a diesel engine, hence the whole system is driven which leads to the high efficient model for the cultivation of crops for any environment [4].

Thereafter, vision-based control system has been used in agriculture robot for providing the directing through the crop field from the concept of open architecture by using the machine vision system, at higher rate of efficiency which can be highly productive in the field of agriculture, and highly advantageous in material handling, and the combination of autonomous robot along with the navigation can be used to develop a highly intelligent system and it mainly comprises of both cabins. The power supply source, a portable computer and an electronic controller faced in the front cabin and a camera is fixed at front of it for the path detection and storage of the material the rear cabin is used such as water, pesticides, etc. and the encoders can be used for driving the speed of the motor based on the wheel drive used [5,6].

Which can be a front-wheel or rear-wheel drive and different mechanisms can be obtained for the driving of the mechanism of the wheel all of this can be controlled by the electronic control unit as it is the decision-making system based on the data achieved from the data obtained from the images of the camera, the control unit checks the data of the image if the organizing area and the application area to obtain planning data for the further action, this type of system can also adapt to the eco-friendly changes, body position and data of situation and inclinations if any and handle any emergency system. Moreover, to reduce the greenhouse effects in agriculture industries automation and IoT play an important role [7–9].

 For the row guidance a machine vision system is used which has camera to identify the crop plants and based on that they find a suitable precise and established navigation data by the binary output that is also includes the heading angle and the offset from the image based on the coordinate system and the algorithm for the row guidance, the algorithm is written to ladder structure, for the edge recognition and judgement, then image binarization for the suitable for direction, in which the greyscale image is transformed to the binary image for guidance of row, hence based on the machine vision system the efficient autonomous robot can be used for the agricultural application [10].

However, the radio frequency identification is used in many areas of agriculture as it has various configurations such as non-interaction, highly appreciation , high data storage capacity, secure entrance, and easily compatible with any system, RFID based the seed quality grading system based on four subsystems naming 1)seed grade supervision technique in the industries, in this system the breeders can use a tag on which the experiment should be conducted and then taking a portable interrogator to note the information like the irrigation schedule, fertilizer schedule, pests schedule, maturing schedule, and situation for seeding schedule in RFID tag as these data are most essential for the breeders as they maintain the quality in subsequent procedures and then comes the 2) The RFID tag on the seed contains data such as the transport means, time, batches, initial location, final location, store environmental procedures etc. This data is most important for tracking the problems when the quality incident occurs 3)seed management and supervision system, in this system the data in RFID tags and seed packages are highly encrypted and can't be trespassed by the unauthorized and allows only the authorized supervision personnel to read the data 4)seed planting service system in this system as the RFID tag contains all the data and application program updated by the supervisor it allows the farmer to easily identify the quality of the product and also about its storage requirements, planting guidance, etc. which becomes very helpful for the farmers, hence to store all these data a suitable type of RFID tag, the RFID tag is selected based on the frequency range as it ranges from 125KHz to 245GHz based on the end application, and another factor to be considered is the anti-collision of the tags because there will be multiple tags hence care is taken such as using different algorithms for different RFID tag hence the tag collision is reduced and use of RFID is benefitted for the farmers [11]

Amongst various developed technologies for the agriculture the use of IoT(internet of things) is also one the emerging technologies which help in reducing the hard conventional farming method, the technology uses graphic related touch screens with high resolutions for multitasking along with using the external sensors, the system uses an embedded system to control the overall system, the controller unit consists of ARDUINO microcontroller which is from 8 bits to 32 bits, which is used to store the programs for the specific task and then the for the given program the Arduino controller controls the output devices connected to the output terminal of the controller and it can also be controlled with wireless network such as the RFID technology, the IoT is an interconnection of various objects along with wireless network driven by a power source for accomplishing various tasks along using various sensors [12–17].

Moreover, machine vision system for the row guidance mainly based on the mathematical modeling this model analyze the images and segment crops in images to extract target crops the machine uses a least-square method based on the targets of the crop , it houses a navigation technology based on the GPS or machine vision used for the agricultural vehicles the algorithm houses a various working principles for various operations in the machine which uses a a binarization edge system created by Bayes classification technique to division plants of the various steps and soil accurately for the cotton fields and a Hough transformation method was used by merchant find crop racket from the ground pictures and a separation of the 24 bit picture into a binary picture and a stochastic design method applied by slaughter to classify the cotton plants position between the weeds and several other methods.

To remove the intermittent generosity difference of the picture concentration and decrease the properties of fractional shadow and weeds, combining these algorithms a new approach to row recognition was introduced which was robust algorithm and was capable to mathematical morphological picture dispensation algorithms is done for the row guidance as it works in 3 stages 1)pretreatment of the image and simplification and then 2)identification extraction 3)discrimination of segmentation based on these process the machine vision system gives the data which is sent to the control unit and it, in turn, controls the DC motors which drive the wheels and controls the required position and inclination of the vehicle and guides the robot through environmental agricultural applications with high accuracy and precision [18].

Recently, due to increment in the population, the agricultural demands have not been able to meet the demand of the customer, hence to meet the production demand, the production system needs to be optimized it has been observed that inclemency of the environment creation of the organizations named greenhouse gases which controls the properties and features with completing a superior creation in a reduced space and improving harvests and enlightening quality. Recently automation under greenhouse gas has occurred in a confident way, one of it has related to the robotics that supports to achieve the cultivation tasks and helps to reduce the impact on the environment. As the automaton in agriculture starts from preparation of soil and sowing and development of the plant and harvest and then post-harvest and then managing these tasks has higher significance to complete the satisfactory yields and these factors control the environmental variables to maximize the benefits. The use of pesticides with recent new technologies improves the conditions of the use of pesticides as they are the danger to human health and the environment and are costly hence care should be taken to see the rigorous use of inputs through robotic platforms to supervise the work. Hence it allows finding the line of research in agriculture production under controlled condition hence it allows the management of environmental hazards so it highly recommended using automation [19].

Among various natural resources that are consumable water is also one of the most important Factors hence it is required to use an adequate amount of water and also the consideration of all the input resources of water such as rain and irrigation and productions such as the disappearance, transpiration, and drainage. To determine the water balance for the crop cultivation and the adequate amount of .water is decided by the soil sensors, agro-climatic stations these sensors provide approximate measurements these methods provide a typical approach for the measurement of evapotranspiration devices are used for the measurements for the variations in water pots and the data obtained by these equipment's and extra information are applied for agricultural irrigation system with decision making process and the data are regularly gathered for some intervals and based on the data various mechanisms can be used integration of automation, sensor technologies and other various mechatronic fields such as the use of the digital

photography for the irrigation of lettuce and controlling these parameters via a computer to related parameters based on the analysis based on the color analysis can also be achieved along with observing of irrigation supervision by soil moisture sensors is simultaneously performed [20].

However, the use of ICT (information and communication technology) in the agriculture field as that can empower and provide information for the farmer about the various crops, weather, and production farming methods. The ICT will provide the information about the suitable quality of seed and which fertilizer is suitable for the particular seeds. Apart from that, it will provide the information about the plant nutrition and required water according to soil and seeds. The ICT fulfill the information gap and also provide the information how to increase the agriculture production by using this information. The used of automation and IoT with ICT are providing the different types of sensors based application system that will provides you the related information and automated machines reduce the man power and will help to increase the agriculture production [21–23].

3. RESULTS AND DISCUSSION

Agricultural system modernization is one of the important factors for the todays economy to develop, because the country is fully dependent on the factor that the today resource management in agriculture is most complicated, such as the water resource, the agriculture uses 70% of the fresh water hence water management is the most critical part in the agriculture to accomplish, hence to achieve this there are certain areas in agriculture where it is dependent such as the crop section for the soil, in this factor a PH sensor is used to measure the acidity in the solution, an IOT gate way Is used to connect the field devices with the wireless internet networks which could be WAN(wide area network) or it be a remote controlled device, the device can be integration of IOT with cloud computing, sensors and equipment's combined by the cloud computing along with raspberry pi sensor which is a module to which various sensors such as the temperature, humidity, are interfaced and also other will be provision for the GSM established programmed irrigation arrangement for the effective usage of properties and crop organization , and when it comes to the operation of the system initially the user registration is compulsory for the verification and then the admin checks the data provided by the user and allows to control the system, raspberry pi kit take the sensor send the information to Google spread sheet attached to the raspberry pi kit , the Google spread sheets conserving real time info and a data associated to crop protected on the sheets. This process is distributed in modules this proposed system is best suitable for the crop selection based on the soil quality and unwanted water wastage things are completely eliminated [24].

4. CONCLUSIONS

The applications of automation and smart systems in the field of irrigation that will help to make the irrigation process efficient and reduce the wastage of water. The applications of automation and smart systems also helps in food safety to find out the appropriate chemicals and pesticide for agriculture purpose. The automated and smart systems also useful in weed selection and control. The multitasking robots will help to agriculture activities and process and also complete the task within time and maintain the quality of the product and minimize the human efforts. The hybrid farming systems will help us to provide information about the humidity, temperature and water level.
By the better utilization of automation and IoT in field of agriculture we can simplify the agriculture process and it help us to select the suitable weed, crop and pesticides. On the other hand automation and IoT system makes agriculture process more predictable and provide the solutions. These technologies will help to reduce the human efforts and increase the production.

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