Design and implementation of multipurpose agribot using python & raspberrypi

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***Abstract*—According to Indian economy survey, more than 50% population of India chooses agriculture as their primary occupation. In recent years increased interest has grown for the development of autonomous vehicles like robots in the agriculture. The existing agricultural robots can perform any one basic elementary functions like ploughing, seeding and irrigation system. The proposed robot can be perform all the basic elementary functions along with mud leveling automatically and manually according to the application. This is especially important for workers in the area of potentially harmful for the safety and health of the workers. These robots are used to reduce human efforts and ensuring proper irrigation and efficient utilization of resources and reduce the production cost.**

Keywords—ploughing, mud leveling, seeding, irrigation systems.

I. INTRODUCTION

The main motive for developing agricultural automation technology is decreasing labor force, a phenomenon common in the developed world. The reasons are the need for improved food quality. Robotics and artificial intelligence achievements offer solutions in precision agriculture to processes related to seeding, harvesting, weed control, grove supervision, chemical applications etc. to improve productivity and efficiency. The applications of instrumental robotics are spreading every day to cover further domains, as the opportunity of replacing human operators provides effective solutions with return on investment. When more conservative issues are granted by robotics, heavy chemicals or drugs dispensers, manure or fertilizers spreaders etc. are activities more and more concerned by the deployment of unmanned options. All kinds of agricultural robots have been researched and developed to implement a number of agricultural products in many countries. This agribot can perform basic elementary function like harvesting, planting and the pesticides. The application of agricultural machinery in precision agriculture has experienced an increase in investment and research due to the use of robotics applications in machinery design and task execution. Precision autonomous farming is the operation, guidance, and control of autonomous machines to carry out agricultural tasks. It motivates agricultural robotics. The goal of agricultural robotics is more than just the application of robotics technologies to agriculture.

The multipurpose robots are designed to perform the basic functions required to be carried out in farms. These robots are used for agricultural operation perform autonomously such as ploughing, seed sowing, mud closing and water spraying. The objective of the proposed system are to dig the soil , sowing of seeds, leveling soil and providing irrigation depending on the moisture levels of the soil.

II. LITERATURE SURVEY

The robotic fields are gradually increasing its productivity in agriculture field some of the major problems in the Indian agriculture are raising of inputs costs, accessibility of skilled labors, lack of water resources and crop monitoring. To overcome these problems, the automation technologies with robots were used in agriculture. The automation in the agriculture could help formers to reduce their efforts.

The proposed robot which performs operations like soil moisture testing, seeding, spraying pesticides, ploughing, mud leveling controlled through a smart phone using two modes, which also performs obstacle avoidance operation in the path. Agribot integrated system which uses Wi-Fi to communicate with raspberry pi, mobile, PC to perform above functions. The working of robot is controlled using raspberry pi. It has hexapod body which can move in any direction as per required. It has ultrasonic sensor to avoid the obstacles in the path and soil moisture sensor to detect moisture levels of soil. According to the mode selection proposed, the robot performs the respective tasks manually or automatically. The robot moves all over the crop field based on time, which is further calculated as distance. Different types of motors are used in the proposed system for each functionality. Ploughing and mud leveling functions are controlled by servo motor, seeding is controlled by dc motor and water pump motor is used for irrigation purpose.

Motivation for the research is to decrease human efforts and increase the productivity. Manual agricultural work is highly labor intensive and inefficient in terms of both economy and time. Precision agriculture is a partial solution to overcome these issues and production cost.

III. PROPOSED SYSTEM

The proposed system focused on the design, development and the fabrication of the multipurpose agricultural robot with irrigation system in addition to ploughing, seeding and mud leveling. It is used to control the basic functions that are mentioned above with least changes in the accessories

automatically without effecting cost. The block diagram of the proposed model is shown in Fig 1.

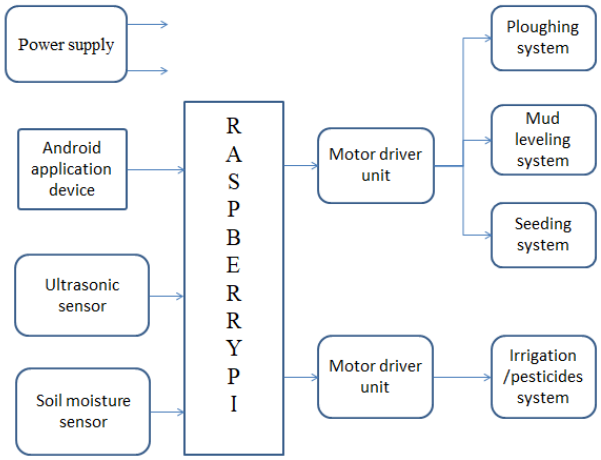

Fig 1. Block diagram

A. *HARDWARE MODEL* :

The whole system of the robot works with the battery. The robot requires a 12V battery to operate the system. The base frame consists of four wheels connected to four arms and rear wheel is driven by the DC motor. One end of the frame cultivator and mud leveler are driven by servo motor which is made to dig the soil and level the soil. The seeds are spreaded through drilled hole on the shaft by the linked mechanism with dug soil processing. A leveler is made to close the seeds and water pump sprayer is used to spray water. A Wi-Fi connected smart phone is used to control the entire operation of robot for ploughing seeding, mud leveling and irrigation system.

The heart of the proposed system is raspberry pi. All the motors and motor drivers, sensors, are interfaced to the raspberry pi to provide various operations like ploughing, seeding, leveling and irrigation. The entire mechanism of the system is controlled by Wi-Fi from android smart phone. The wireless connection of Wi-Fi technology enables the robot to communicate with PC and smart phone.

Ploughing function :

The primary purpose of ploughing is to turn over the upper level of soil, bringing fresh nutrients to the surface, while burying weeds and the remains of previous crops and allowing them to break down. In the prototype model shown above , a servo motor coupled with ploughing device is used for ploughing the field . As the servo motor rotates with an angle of 10 degrees then the device is lowered down and soil is dug up to 1.5 inches. The direction of ploughing device is controlled automatically according to the program.

Mud closing and leveling function :

Leveling means give a flat and even surface to the field. In the prototype model shown above , motor drivers are used to perform leveling and mud closing functions. The mud is closed in the sowed soil and the sliding mechanism is used for leveling.

Seed sowing function :

Seeding is planting seeds in a place or on an object. In the prototype model shown above , a box is used for seed storage and is arranged to sow the seeds when wheels are rotated. The movement of wheels of robot causes the shaft to throw the seeds to the field .

Irrigation function :

Irrigation is the method in which a controlled amount of water is supplied to plants .In the prototype model shown above, water pump is used to spray the water in the field.

B. Software model:

Wi-Fi present in the raspberry pi is connected the android smart phone. Through app the robot is controlled and commanded. First make sure the raspberry pi is paired to smart phone. Once the connection is established then the application will show the connected status. There are 2 modes – auto mode and manual mode. In the auto mode all the functions are executed automatically and in the manual mode the functions are to be commanded manually. The mode selection depends upon the application of user.

IV. METHODOLOGY

Raspberry pi is used to control various operations of proposed system. Pin (4) is used to control the ploughing and mud leveling , pins (17 & 27) is used for seeding , pin (5) is used for moisture sensor to know the moisture levels, Pins (23 & 24) is used for water pumping . L293D is the motor driver for controlling DC motor for proper movement of wheels.

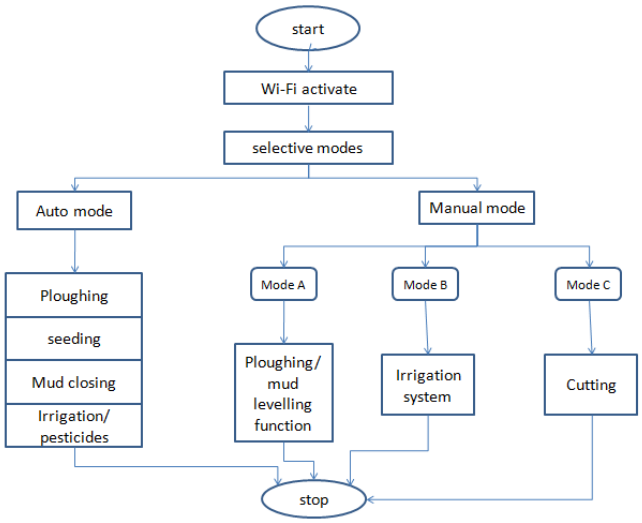

Fig 2 flow chart for the proposed model

The flow chart for the proposed model is shown in fig 2. Developed in two modes , auto mode and manual mode. These modes are selected using android smart phone. According to the required functionality the modes are selected. If the functions are to be executed automatically the mode 1 is chosen through smart phone. If the functions have to execute individually according to the requirement the mode 2 is selected .

V. CONCLUSION

Multipurpose autonomous agricultural robot has successfully implemented and tested for various functions like ploughing, seeding, mud leveling and water spraying. It was developed by integrating agricultural robot with python programming. Various parameters like soil condition, area covered by the robot and weight of the material for leveling are analysed by for different motors. The advantage of multipurpose agricultural robots are reducing human intervention, ensuring proper irrigation and effficient utilisation of resources.

These robots are mainly useful in automated weed control, usage of fertilizers based on soil condition, soil sensors for drip irrigation in rain feed areas. The proposed system is is mainly used for crop establishment, plant care. In future it can be extended by using ultrasonic sensors and cameras for performing the same operations without human operator for measuriing the parameters like soil condition, area covered by the robot and weight of the material for leveling.

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REFERENCES

[1] K Durga Sowjanya1, R Sindhu1, M Parijatham1, K Srikanth1, P Bhargav1 1 Department of Electronics and Communication Engineering, MLR Institute of Technology Hyderabad, India Email: k.durgasowjanya@gmail.com m.parijatham.reddy@gmail.com

[2] Akhila Gollakota, M.B.Srinivas, Agribot-A multipurpose agricultural robot, India Conference (INDICON), IEEE, 2011.

[3] Sandeep Konam, "Agricultural Aid for Mango cutting (AAM)," Electronics & Communication Engineering, RGUKT, R.K. Valley Kadapa, India, 978-1-4799-3080-7 IEEE 2014.

[4] Rasin, Z., H. Hamzah and M.S.M. Aras, 2009. Application and evaluation of high power Zigbee based wireless sensor network in water irrigation control monitoring system. Proceedings of the IEEE Symposium on Industrial Electronics and Applications, Volume, 2, October 4-6, 2009, Kuala Lumpur, Malaysia, pp: 548-551

[5] M. priyadarshini, Mrs. L. Sheela, "Command based self guided digging and seed sowing rover",International Conference on Engineering Trends and Science & Humanities, ISSN: 2348 – 8379, ICETSH-2015.

[6] Shivaprasad B. S., Ravishankara M. N.,B. N. Shoba, "Design and implementation of seeding and fertilizing agriculture robot", International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 3, Issue 6, June 2014.

[7] Amritanshu Srivastava, Shubham Vijay, Alka Negi, Akash Singh, "DTMF Based Intelligent Farming Robotic Vehicle," International Conference on Embedded Systems (ICES), IEEE 2014.

[8] Gulam Amer, S.M.M. Mudassir, M.A. Malik, "Design and operation of Wi-Fi Agribot Integrated system", International Conference on Industrial Instrumentation and control (ICIC), IEEE, 20