

Farmbot-a Smart Agriculture Assistor Using Internet of Things

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Abstract

Savvy cultivating is an idea rapidly getting on in the farming nowadays. Offering high-accuracy crop control, valuable information gathering, automated farming devices and mechanized cultivating procedures, there are plainly many preferences an organized ranch has to facilitate. Robots are assuming to be a critical part in the field of agriculture for making the cultivating process self-governing. In this paper, a multitasking Farm-Bot is proposed to integrate agriculture process in a single robotic application and take decisions with help of cloud services. The proposed IoT framework is organized keeping the belief that various little self-sufficient machines could be more effective than customary huge tractors and human exertion.

In low-cost, the modular robot can perform live streaming of crops, seed sowing, pesticide sprinkling and automatic irrigation. In addition, this venture attempted to monitor parameters associated with plants and crops such as the moisture level, humidity, temperature etc through sensors and upload the same to a cloud database and additionally alert and update the owner of the plantation regarding the same. The information obtained was stored and graphically plotted and processed with APIs. Thus by the proposed Farm-Bot, farmers can able to get updates about the field and by switching onto the desired modes (irrigation, sowing and sprinkling) through dashboard, the energy, salary wages, and water consumption can be reduced to a meaningful extent.

Index Terms:Internet of Things(IoT), APIs, cloud services.

1. Introduction

Agribusiness is considered as the pioneer of life for the human beings as it is the central origin of food grains and other raw materials [1]. Of the many points of interest, IoT conveys to the table, its capacity to advance the trends of current cultivating procedures in agriculture is completely notable. IoT sensors fit for furnishing agriculturists with data about harvest yields, precipitation, pest invasion and soil sustenance which are important to revenue generation and offer exact information which can be utilized to enhance cultivating procedures over time [2]. Traditional strategies rely upon human power for lifting, dragging, weed control, harvesting. People are inclined to work in unsafe condition while splashing chemicals and pesticides. The tractors that minimal the farming actions are bigger in weight and can't move in territory conditions [3].

Development in agriculture is important for the improvement of the financial state of the nation. Inopportunely, various farmers still utilize the regular techniques for cultivating which brings about low yielding of harvests and revenue. In any case, wherever mechanization has been actualized and individuals have been superseded by programmed apparatuses, the yield has been moved onward [4]. Thus the agriculturists have to actualize present-day science and innovation in the agriculture segment for expanding the yield. Monitoring environmental factors aren't sufficient and complete elucidation to enhance the yield of the products. There are number of different components that influence the productivity to an incredible degree. These components fit in mugging of creepy crawlies and pests which can be controlled by showering the product with appropriate pesticides. Besides, assault of wild creatures and feathered creatures at the point when the product grows up. There is likewise plausibility of robberies at the point when the crop is in the phase of collecting. Indeed, even after collecting, agriculturists additionally meet head-on issues away of reaped harvest. Along these defenses, remembering the true objective to give answers for every such issue, it is imperative to make an organized system which will manage all parts impacting the gainfulness in each stage [1].

This paper hence proposes an osteology which is valuable in checking the field information as well as scheming the field operations which gives the adaptability. The paper goes for influencing agribusiness to savvy utilizing robotization and IoT advancements [5][6]. A mechanized farming framework (which utilizes field robot) is exemplified from above issues. Robots can work fretfully in all situations as they are customized to play out the coveted movements using advanced microcontrollers such as Raspberry Pi [7]. The lightweight of the robot is a noteworthy preferred standpoint since they don't minimize the dirt as huge apparatus does. Agrarian Automation with Field Assisting Robot is extremely basic systems, where many instruments are coupled together and the water system framework is completely automated.

2. Related Works

S. R. Nandurkar, V. R. Thool, R. C. Thool proposes a precision farming using wireless sensor network [8]. In their work they focus on the more current situation of diminishing water tables, going away of streams and tanks, flighty condition that shows the dire need of appropriate usage of water. To adapt up to this utilization of temperature and dampness sensor at reasonable areas for observing of products is actualized in their proposed work. The innovative advancement in Wireless Sensor Systems in precision farming made it conceivable to use in observing and control of nursery parameter in exactness agribusiness [9]. After the exploration in the farming field, scientists discovered that the yield of farming is diminishing day by day. Be that as it may, utilization of innovation in the field of agribusiness assumes essential part in expanding the creation and additionally in diminishing the additional labor endeavors. A portion of the look into endeavors are improved the situation advancement of agriculturists which gives the frameworks that the utilization advancements supportive for expanding the agrarian yield. To overcome the defects of the sensor systems a distributed network [10] was designed by Y. Kim. A remote detecting and control water system framework utilizes the conveyed remote sensor for variable rate water system, constant in field detecting, controlling of a site and particularly accurate straight move water system framework to augment the efficiency with insignificant utilization of water was created. The aforesaid framework depicted insights about the plan and instrumentation of variable rate water system, remote sensor system and ongoing in-field detecting and control by utilizing proper programming. The entire framework was created utilizing five in-field sensor stations which gathers the information and sends it to the base station utilizing worldwide situating framework (GPS) where essential activity was taken for controlling water system as indicated by the database accessible with the framework. The framework gives a promising minimal effort remote arrangement and additionally remote controlling for exactness water system [11].

Robotization makes an effective utilization of the power and water and diminishes a great part of the wastage. Brilliant water system framework makes the productive utilization of water. This work shows a shrewd water system framework for horticulture cultivates with the utilization of utensils like Raspberry Pi [12]. Python programming dialect is utilized for robotization reasons. In the investigations identified with remote sensor organize the measured soil related parameters, for example, temperature and stickiness. Sensors were put beneath the soil which speaks with hand-off hubs (relay) by the utilization of viable correspondence convention giving low obligation cycle and henceforth expanding the lifetime of soil checking framework. The framework was created utilizing microcontroller, Universal Asynchronous Receiver Transmitter (UART) interface and sensors while the transmission was finished by hourly examining and buffering the information, transmit it and at that point checking the status messages. The downsides of the framework were

its cost and sending of the sensor readings under the soil which causes constriction of Radio Frequency (RF) signals [13].

3. Smart Agriculture Assistor Frame Work

The outline of the proposed system as shown in Fig. 1 consists of sensing unit such as moisture sensor to measure water content of soil, IR (Infra-Red) sensor to alarm during the cattle or stranger intrusion [14], Ultrasonic sensor to take the direction left or right, a Temperature sensor to detect the increase in temperature if there exists due to an unusual fire in fields. The controlling unit consists of Raspberry Pi which controls the entire process of the smart assisting robot. The robotic unit consists of RPM motors, Rubber wheels, power boards and servo motors. In the proposed framework the microcontroller Raspberry Pi adopted here is the heart of the system. In the present framework, each hub is the combination with various sensors and gadgets and they are interconnected to one focal server by means of remote correspondence modules. The server sends and gets data from client end utilizing web availability. The proposed robot is executed to help ranchers in their rural field. The automated framework can play out numerous operations like pump automating based on moisture, seed spraying, intruder alarming, pesticide sprinkling, and harvesting.

The controlling innovation of the whole framework is Raspberry Pi 3 and a Wi-Fi module is likewise accommodated the manual controlling of the framework. The sensor readings are then sent to the cloud for further decisions. The cloud database moreover alert and refresh the proprietor of the ranch with respect to the same. The assisting robot is made out of 10 motors out of which two are a servo motor and the remaining are DC motors. Four DC motors are joined to the wheels on either side with the end goal that each side is driven by two engines each. The development of the robot is guided by ultrasonic sensors that are settled on the robot's body which consistently sends ultrasonic waves at a long separation [1]. These EM waves while experiencing on a divider or any deterrent sends motion back to the controller that further passes on the robot to stop or else continue moving. It provides manual control also. DC motors are used for rotation of the wheels of the robot. These DC motors are driven by the L293D motor driver to control the direction and speed of the motor. The servo motor 1 is used for seed dispensing in which mini servo tilting is performed for spraying the seeds. Servo motor 2 is meant for the automatic planting of the moisture sensor [15]. It is driven by two modes plant and release. When the controlling unit has not received any commands then the DC motor 1 is kept on running to maintain the soil moisture Sensors associated with the Raspberry Pi board give an intransigence variety at the yield [16]. This flag is connected to the comparator and signal conditioning circuit which has a potentiometer to choose the dampness level above which the yield of the comparator goes high. This yield flag is given to the Raspberry Pi board. If the soil moisture value is above the moisture level then the 3 phase induction motor will be OFF, whereas if the moisture level is low motor will be ON through the relay [16, 17]. For

monitoring the farm at night LDR is used which controls the light automatically. Servo motor 3 is meant for pesticide sprinkling which could be controlled through mobile or dashboards.

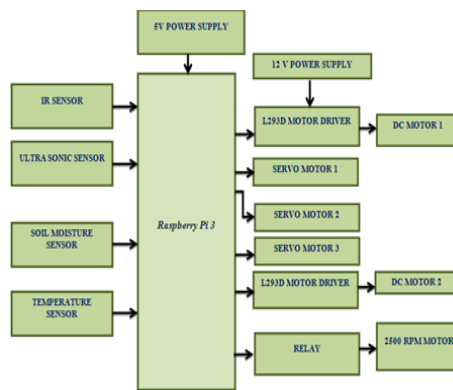


Figure 1: System Architecture

The tasks to be carried out in cloud module are:-

- A. User interaction via cloud.
- B. Integration of assisting robot with cloud.

A. User Interaction Via Cloud

1. Read esteems from the sensors said.
2. Based on certain thresholds it will take action.
3. Upload data to the cloud.
4. Remote control via a webpage. A webpage will be designed for the Raspberry Pi board which has the values read from the sensors being plotted in real time and buttons to trigger actuators as depicted in figure 2.

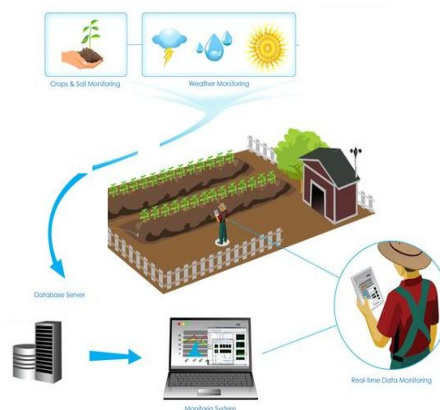


Figure 2: Real time Data Monitoring

B. Integration of Assisting Robot with Cloud

As the Internet of Things is a booming technique nowadays, it connects the sensors, devices, systems, and services. It communicates and covers a variety of protocols, domains and applications [18]. The interconnection of these embedded devices is expected to help the user in automation in agricultural field. In this proposed framework, IoT operates the agricultural robot through communicating the sensors and autonomous motors. It runs the process which covers the building of application and connecting it to the server. The raspberry pi is interfaced with a sensor and reads the data from its GPIO pins. Fig.3 shows the integration of agriculture robot with the cloud. In software section PuTTY is a very versatile tool for remote access to the Raspberry pi 3. Through SSH it can able to make remote connection to the raspberry pi 3. Here, in this framework WAMP server is widely adopted. It stands for Window, MySQL, Apache and php. It works with web server to store the data and run other applications such as MySQL, php, phpmyadmin.

In MySQL it record and store data of the sensor in the database. In phpmyadmin creating web page for the farmers is used to control the raspberry pi 3 robot. Only authorized farmer access the pi and choose the function of the robot. Here farmer communicate with the web server through PuTTY. Raspberry pi 3 and mobile are interchanging the information through the cloud gateway. The data of device thing has to be sent to the local gateway either by multihop way or single hop way.

The data from the application or device are uploaded or store in cloud server through internet. And the farmer can use mobile phones to operate the multitasking robot. Raspberry pi 3 will get command of the farmers from the cloud system like operation of either seed sowing or irrigation and reschedule the activity of the sensors.

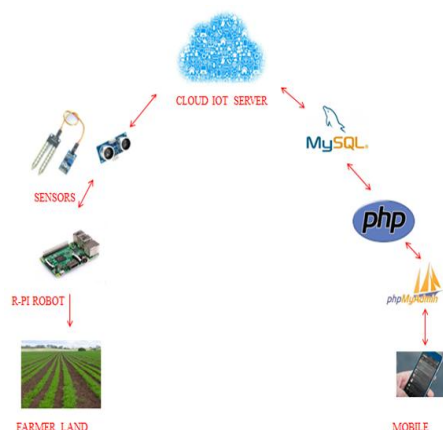


Figure 3: Integration of Assisting Robot with Cloud

4. Conclusion

The sensors and microcontrollers of every one of the modes are effectively interfaced with raspberry pi and remote correspondence is accomplished between different nodes. Venture points on the outline, advancement and manufacture of a multitasking robot which can perform programmed furrowing, seed apportioning and sprinkling. The procedure of the picture can be improvised by preparing in organic product picking which accomplishes a high quality items. Servo component in seed administering permits to control the stream of seeds. This venture aims to diminish the prerequisite of substantial labor and cost of gear, making it reasonable to ranchers. The framework helps in the diminishment of work expenses and limitations on working hours can be altogether made strides. The rural robot is intended to encourage the agriculturists to facilitate their work. Once the idea of computerization in farming is acknowledged, the selection rates will turn out to be high and the expenses of innovation will descend.

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