

Portable Centre Pivot Irrigation System with Advanced Control through Sensors: A Review

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ABSTRACT

Being hailed as the best mechanical development in farming since the substitution of draft creatures by the tractor, focus rotate water system frameworks inundate crops with a noteworthy decrease in both work and water needs contrasted with conventional water system techniques, for example, flood water system. Over the most recent couple of decades, the sending of focus rotate water system frameworks has expanded significantly all through the United States. Sensors, Relay Module, Microcontrollers have been used to meet the creating eagerness for site-express water framework using center turn and parallel move water framework structures. Sensors are used to control the activity of the irrigation and portable makes it more easy to carry and easy to handle in any field.

KEYWORDS: centre pivot irrigation system; sensors; communication protocol; portable

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INTRODUCTION

Agriculture has always been a centre of concern in terms of production and irrigation. The irrigation for different crops vary with different fields. The methods irrigation of the fields results in the quality of the product. For this, centre pivot irrigation system emerges out as a long term solution for most of the problems.

The system has a fixed centre and a long rod attached to it rotates about the centre with the help of wheels. The sprinklers are hanged along the span and irrigates the field in the circular direction. The span can be varied according to the area of the field.

Albeit 94% of water system on the planet is surface water system, sprinkler water system represents about 63% of the inundated territories in the United States (2012) . The significant explanation behind this extensive level of sprinkler water system in the United States is the notoriety of the middle rotate water system framework^[1].

This task depends on the idea of making the inside turn water system framework compact and programmed with the

assistance of sensors. Rain sensor is used to indicate the necessity to irrigate the field and Moisture sensor is used by detecting how much moisture is present in the soil and if it is less 30%, it will irrigate the field. Bluetooth module is used to move it automatically with the help of smartphone. In this project, input is given on the sensors, the relay module transmit it to give the instruction to the system. Ardiuno programmed with different instructions that controls all the motion.



Figure 1. Centre Pivot Irrigation System

EARLY APPROACHES AND DEVELOPMENT

O' Neill Farms, established in the late 1960's developed a 6000 sections of land spread found only outside of O' Neill, Nebraska that creates a yearly collect of corn and popcorn. Because of the absence of satisfactory precipitation in the fields, the majority of the harvests at O' Neill ranches are watered by focus turn water system framework. Regularly two wells were utilized to nourish the middle rotates need of 700 to1000 gallons for every moment, as per Mike Givens, ranch Manager at O' Neill Farms. It doesn't rain here without question, so we can't rely on it", says Givens." We really have our best yields in years when we don't have a great deal of downpour"^[2].

EXPERIMENT METHOD

^[3]The experiment was carried out on Green Grassland Pasture of General administration of Land Reclamation of Heilongjiang Province in Oct. 21-29, 2013. The soil type was black clay. The physical properties of soil were test on 28th Sept. 2013 and are shown in Table 1.

Table1. Soil physical properties of experimental site

Items	Value	
	Soil depth/cm	
Soil bulk density/g•cm-3	[0, 10]	1.21
	[10, 20]	1.28
	[20, 30]	1.32
Water holding strength/mm•h-1	1 24.5	
Infiltration rate/mm•min-1	0.734	

BASIC PARAMETERES

The center-pivot sprinkling system, which was always used by Green Grassland Pasture of General Administration of Land Reclamation of Heilongjiang Province, was selected as the test model. Its basic parameters are shown in Table 2. Configuration of micro-nozzles was suggested by Nelson Company from USA.

Table2. Basic parameters of center-pivot sprinkling system for

Item	Value
Total length/m	272
Rated flow of the end gun/m ³ •h-1	15.96
Rated pressure of the end gun/PSI	47.9
The terminal booster pump lift/m	22
The power of the terminal booster pump/HP	3
The static water level/m	12
The power of the head water pump/kW	30
Head water pump lift/m	100
Head water pump flow/m ³ •h-1	80
Dynamic water level/m	13

SYSTEM CONSIDERATIONS ^[4]

- The following angles should be considered at the arranging stage:-
 1. Physical Location such as area, shape, topography, soil content etc
 2. Water Supply in terms of flow rate, supply region, quality and discharge.
 3. Irrigating Area to be considered, system power.
- Land Area :-

A regular focus turn framework in the Shepparton Irrigation Region(SIR) has a range of 300 to 400m long and inundates 25 to 50ha. Notwithstanding, they can be as short as single

range of 35m unit or as long as 800m with 18 to 20 tower inundating roughly 200ha.

- Land Shape:-
 - A. Centre Pivot Systems waters a circle, which covers 78% of a square.
 - B. This can be utilized on journal ranches with restricted accessible land.
 - C. End Guns are utilized on Center Pivot to inundate square properties are not prescribed.
 - D. Lateral more frameworks can be an alternatives to floods rectangular regions.

➤ Land Slopes :-
Centre Pivot can inundate essentially undulating area. Some minor earthmoving might be expected to interface despondency regions and give seepage to keep running off from precipitation occasions.

➤ Soil Type:-
Focus Pivots can flood any dirt sort. Be that as it may, sprinklers ought to be chosen to suit soil penetration qualities, as extreme normal application rates can cause spillover.

➤ Wate Supply :-
These framework regularly requires progressively visit, yet lower stream rates over a more drawn out timeframe.

For eg:- when a square of field may be flooded over seven days over a 48 hr period under borefer check water system, asimilar square might be inundated two times every week more than 96 hr with focus turn and sidelong move frameworks.

➤ Framework Capacity :-
The System Capacity of a centre pivot is the rate at which water can be given to the immersed zones, communicated in millimeter per day(mm/d). It is the fundamental criteria of the pumps, funnels and sprinkler configuration depends on the equation utilized as follows,

$$\text{System Efficiency} = \frac{\frac{ML}{\text{day}} \times 100}{\text{Irrigated Area}(ha)}$$

IRRIGATION CONTROL THROUGH SPRINKLERS& SENSORS

Existing centre pivot structures length the headway of development from normal to advanced hydraulic irrigation and utilizing pressurized water through driven machines. As a result of their structure, centre pivot systems are taking a shot at fluctuating geography and have a remarkable range of nozzle discharge in different soil fields. Low intrusion rate of water flow in soils challenge the directors of standard machines with the need to give essentially nothing or no water framework water to specific locales while totally immersing others. The most fundamental strategy to modify the water profundity connected with an inside turn is to alter the middle rotate speed of movement dependent on field soils or all the more as often as possible dependent on field topographic highlights or distinctive harvests. Early overhauls gave a kept arrangement of controls to turn on and off end gun subject to deal with positions.

Particular sprinkler control of water application significance can be developed by using a movement of on-off time cycles

or as it has ended up being known as "beating" the sprinkler through on-off cycles [5].

Modern undertakings in Washington State included equipping centre pivot irrigation system with an exceptionally advanced electronic controller to start water worked solenoid valves in social affairs of 2-4 gushes[6].

A variable stream sprinkler was delivered for controlling water framework water application by King and Kincaid in 2004[7]. The variable stream sprinkler uses an accurately started stick to change the gush opening zone which adjusted the sprinkler stream rate over the extent ranging from 35% to 100% of its assessed stream rate reliant on working weight.

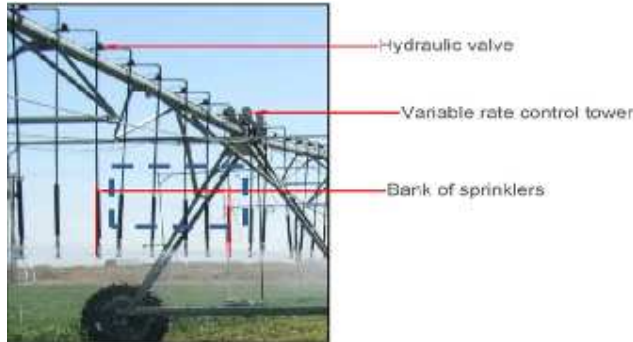


Figure 2. Variable Sprinkler Type Centre Pivot System

Controlling water framework water application significance can in like manner be developed utilizing different manifolds with different estimated sprinkler spouts to contrast water and nitrogen application[8].



Figure 3. Different Sized Nozzles

Later advancement in low-control sensors, battery and remote radio repeat progresses united with advances in Internet developments offer monster open entryways for development and utilization of ceaseless organization structures for cultivating [9].

Programming to control stream and moving sprinkler structures has been facilitated by the help of plant input information and the Time-Temperature Threshold (TTT) curve authorized as the Biologically Identified Optimal Temperature Interactive Console (BIOTIC) for regulating water framework experimented by the USDA in 1996[10].

Bluetooth remote advancement has been balanced in distinguishing and control of cultivating systems. Zhang in 2004 surveyed Bluetooth radio in different provincial

conditions, control usage levels, and data transmission rates [11].

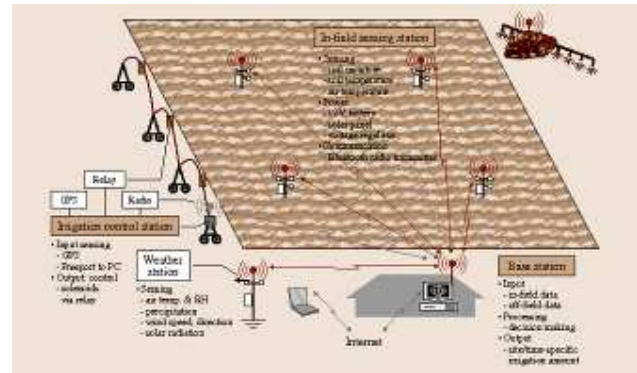


Figure 4. Automation In Agriculture

CONCLUSION

In this paper we analysed the working of the centre pivot irrigation system under different conditions of field, environment, method of irrigation, equipments used for irrigation.

Temperature sensors, control drives, and corresponding traditions have been made to fulfill the required energy for site-unequivocal water framework using center pivot irrigation system and side along movable water framework systems. The center pivot irrigation system has been controlled automatically through microcontroller, solid part relies on the electronic and mechanical control.

Wireless communication has been used for years and new techniques can be applied to control the motion of the system for larger areas of irrigation.

Bluetooth wireless technology can be used to make the centre pivot irrigation system portable so that it can be carried and transported through different areas where water shortage is a major concern.

REFERENCES

- [1] Chenxiao Zhang, Peng Yue, Liping Di, and Zhaoyan Wu. Automatic Identification of Center Pivot Irrigation Systems from Landsat Images Using Convolutional Neural Networks, 20 Sept. 2018.
- [2] [http://www.fwmurphy.com/O'NeilFarms, 1960.](http://www.fwmurphy.com/O'NeilFarms,1960)
- [3] Li Lianhao, Zhang Xinyue, Qiao Xiaodong, Liu Guiming, College of Mechanical and Electronic Engineering, Henan Agricultural University, Zhengzhou 450002, China, Analysis of the decrease of center pivot sprinkling system uniformity.
- [4] [http://agriculture.vic.gov.au/agriculture/farm-management/soil-and-water/irrigation/centre-pivot-and-lateral-move-systems.](http://agriculture.vic.gov.au/agriculture/farm-management/soil-and-water/irrigation/centre-pivot-and-lateral-move-systems)
- [5] Pulse Irrigation through sprinklers, Karmeli and Peri, 1974.
- [6] Evans, et al., 1996; Evans and Harting, 1999, A variable rate pivot irrigation control system.
- [7] King and Kincaid (2004) at Kimberly, ID, Center Pivot Irrigation Control and Automation Technologies, Paper Number: IRR10-9632, An ASABE Conference Presentation.
- [8] Camp et al., 1998; Lyle and Bordovsky, 1981; Roth and Gardner, 1989, Site specific irrigation.

- [9] Beckwith et al., 2004; Camilli et al., 2007; Liang et al., 2007; Coate and Delwiche, 2008; Kim et al., 2007, 2008; Pierce and Elliot, 2008; Vellidis et al., 2008.
- [10] R. T., and S. R. Evett. 2007. Spatial and temporal analysis of crop stress using multiple canopy temperature maps created with an array of center-pivot-mounted infrared thermometers. Transactions of ASABE 50(3): 919-927
- [11] J. R., W. Conaty, J. Neilsen, P. Payton, and S. B. Cox. 2010. Field performance in agricultural settings of a wireless temperature monitoring system based on a low-cost infrared sensor. Comp. and Elec. In Agric. 71: 176-181
- [12] Kim, Y. and R. G. Evans, 2009. Software design for wireless sensor-based site-specific irrigation. Computers and Electronics in Agriculture. 66(2): 159-165.
- [13] Miranda, F. R., R. Yoder and J. B. Wilkerson, 2003. "A site-specific irrigation control system." ASABE Paper No. 031129. St. Joseph, MI: ASABE.

