International Journal of Research in Engineering, Science and Management
Volume-3, Issue-5, May-2020
www.ijresm.com | ISSN (Online): 2581-5792


# Plant Irrigation Water Sprinkler Robot

S. Gokul[1*], Y. Mohamed Yasar Arabath[2], T. Pavithran[3], D. Ravi Shankar[4], S. V. Roshan[5]
[1]*Assistant Professor, Dept. of Mechanical Engineering, Sri Eshwar College of Engineering, Coimbatore, India*
[2,3,4,5]*Student, Dept. of Mechanical Engineering, Sri Eshwar College of Engineering, Coimbatore, India*
*Corresponding author: gokul.s@sece.ac.in

***Abstract*: Plant Irrigation Water Sprinkler Robot System Uses a robot with a single sprinkler that moves through the field with a water tank moves throughout the field spraying water all over it. It is like a moving water tank that automatically moves all over the field spraying water through it. The robot can be equipped with geo fencing sensors so it will cover complete fields without needing any manual intervention.**

***Keywords*: Plant irrigation, Water sprinkler robot.**

## 1. Introduction

The limitations of water resources and global population growth have led states and governments worldwide to increase agricultural products per area and optimize soil and water resources productivity with using new irrigation methods.

Generally, current irrigations systems are classified into pressure and gravitational systems; the pressure category includes sprinkler and drip irrigation systems and Gravitational system usually involves furrow irrigation.

Thus, choosing each system could maximize water productivity and minimize costs of keeping farms.

Although, an water Irrigation Sprinkler system could meet the needs with presence and monitoring during the growing season, continual presence of the worker to control irrigation automatic instruments is not economic.

Through advancements in technology and advent of processors and controllers, it will be more serious improving the role of farmer as an observer off-field particularly in the light of new irrigation systems.

## 2. Objectives

- To reduce the cost of irrigation purposes.
- To avoid underground water leaks.
- To reduce the complicated pipe connections.
- To reduce the man power.
- To avoid large power consuming motors.

## 3. Literature Review

S. M. Wange et al., [1] (2018) Presented the "Automatic Water Springler System" is powered by solar energy. The solar energy is absorbed by the solar panel and the energy is stored as electricity in the battery. The battery gives power to the dc motor.

Constantinous Marios Angelopolos et al., [2] (2011) Presented the "A Smart System for Garden Watering Using Wireless Sensor Networks" this system is powered by EC-5 soil sensor shouldered on a Telos B mote. The sensor motes were programmed in Tiny OS. Java Application is used for data collection for the system

Devutt et al., [3] (2017) Presented the Plant Watering Robot "Plant O Bot" this robot is in manual operating system mode and finds any flower pot then its ultrasonic sensors help to find the height of flower pot and the robot adjusts the nozzle and gives 200-400ml of water depending upon the size of pot.

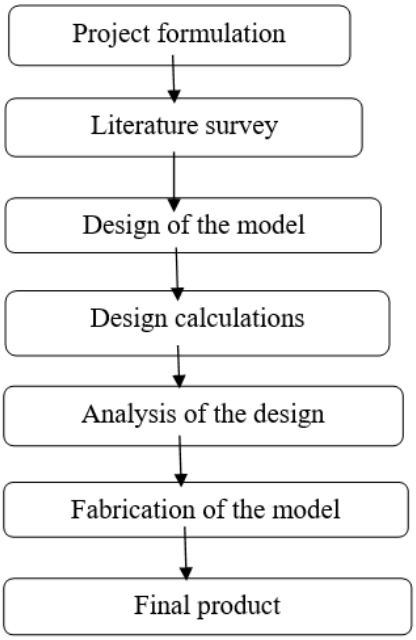
Hema N et al., [4] (2012) Presented the "Plant Watering Autonomous Mobile Robot" this fully automated watering system which uses wireless communication to communicate between the mobile robot and the sensing module. This gardening robot is completely portable and is equipped with Radio Frequency Identification module, a microcontroller, an on-board water reservoir and an attached water pump.

Saeid Jafari et al., [5] (2013) presented the "Towards an Automated Guided Vehicle (AGV) in Sprinkler" the study to propose and develop an automatic guide vehicle (AGV) with the capability to change sprinklers timely and on appropriate positions for sprinkler irrigation classic method. The designed AGV is simulated on computer environment and the results show acceptable outcomes.

Kevin Sikorski [6] "A Robotic Plant Care System" (2003) presented the project was created with the intention to demonstrate Combining robotics with ubiquitous computing. Whenever a plant's condition, such as the moisture content of its soil, would fall out of an acceptable range, the computer could active a robot in the lab. This robot would then locate the plant, water it, and recharge the sensor. Then the robot would automatically return to its maintenance bay, where it would recharge itself, and refill its water supply.

Ayumi Kawakami et al., [7] (2014) "Potpet: Pet-like Flowerpot Robot" that helps users grow plants more effectively and enjoyably. Pot Pet acts autonomously like pets: it automatically moves to sunny places or approaches people when it requires water. Basically, Pot Pet consists of a "real" plant, several sensors to detect plant status, a robot with wheels for mobility, and a microcontroller to control the above devices.

## 4. Methodology




## 5. Components and their Functions

*Keyboard*

There are 4 keys in the remote for controlling the Irrigation Robot. This is interfaced to the controller. The operation of the keys is:

- Forward
- Reverse
- Left turn
- Right turn

*Mild steel*

Mild steel is steel in which the main interstitial alloying constituent is carbon in the range of 0.12–2.0%. The American Iron and Steel Institute (AISI) definition says. Steel is considered to be carbon steel when no minimum content is specified or required for chromium, cobalt, molybdenum, nickel, niobium, titanium, tungsten, vanadium or zirconium, or any other element to be added to obtain a desired alloying effect; when the specified minimum for copper does not exceed 0.40 percent; or when the maximum content specified for any of the following elements does not exceed the percentages noted: manganese 1.65, silicon 0.60, copper 0.60.

*Sprinkler*

An irrigation sprinkler (also known as a water sprinkler or simply a sprinkler) is a device used to irrigate agricultural crops, lawns, landscapes, golf courses, and other areas. They are also used for cooling and for the control of airborne dust. Sprinkler irrigation is the method of applying water in a controlled manner in way similar to rainfall. The water is distributed through a network that may consist of pumps, valves, pipes, and sprinklers. Irrigation sprinklers can be used for residential, industrial, and agricultural usage. It is useful on uneven land where sufficient water is not available as well as on sandy soil. The perpendicular pipes, having rotating nozzles on top, are joined to the main pipeline at regular intervals of time. When water is allowed to flow through the main pipe under pressure with the help of pump it, escapes from the rotating nozzles. It gets sprinkled on the crop. In sprinkler or overhead irrigation, water is piped to one more central locations within the field and distributed by overhead high pressure sprinklers or guns.

*Micro Controller*

Depending on the key pressed the controller will be transmitting the data. Here in this project we are using Arduino Uno microcontroller board. The controllers play a major role in the project, there by the following description mainly focuses about Micro controller and its architecture because it is treated as heart of the project work. Today, there is no such instrument that can function without Micro controller. Micro controllers have become an integral part of all instruments. Many tedious from simple to dedicated tasks are left over to the controller for solutions. The Microcontroller used in this project work is ATMEGA 328P, basically this IC belongs.

*4 Channel Relay*

The 4 Channel Relay Module is a convenient board which can be used to control high voltage, high current load such as motor, solenoid valves, lamps and AC load. It is designed to interface with microcontroller such as Arduino, PIC and etc. The relays terminal (COM, NO and NC) is being brought out with screw terminal. It also comes with a LED to indicate the status of relay. The 4 Channel Relay Breakout is an easy way to use your Arduino, Raspberry Pi, or other microcontroller to switch high voltages and high current loads. The board is both 3.3V and 5V logic compatible and uses 4 digital outputs to control 4 individual relays.

*Dot Board*

Perf board is a material for prototyping electronic circuits (also called DOT PCB). It is a thin, rigid sheet with holes pre-drilled at standard intervals across a grid, usually a square grid of 0.1 inches (2.54 mm) spacing. These holes are ringed by round or square copper pads, though bare boards are also available. Inexpensive perfboard may have pads on only one side of the board, while better quality perfboard can have pads on both sides (plate-through holes). Since each pad is electrically isolated, the builder makes all connections with either wire wrap or miniature point to point wiring techniques. Discrete components are soldered to the prototype board such as resistors, capacitors, and integrated circuits. The substrate is typically made of paper laminated with phenolic resin (such as FR-2) or a fiber glass-reinforced epoxy laminate (FR-4).

*Battery*

This is an important block why because all the components require power supply to be operating. Micro controller requires +5v, relay and DC motors require +12v. In the transmitter a 9v battery is used and a voltage regulator in order to derive the required power supply for the micro controller i.e., 5v. And in the receiver as we require a maximum of 12v we are using a

12v battery to operate the relay and the DC motors. Again voltage regulator is used to derive 5v DC.

*Wheels*

Wheeland carrier, The Wheel of robots is located in Robot hell that has written upon it the name of every robot on earth. The robot Devil uses it to choose which robot will lose their hands to fry. Bender's name is right next to the robot devil's name. Wheeled robots are robots that navigate around the ground using motorized wheels to propel them. This design is simpler than using treads or legs and by using wheels they are easier to design, build, and program for movement in flat, not-so-rugged terrain

*RF Transmitter*

This project is divided into two modules i.e., the transmitter and the receiver (Agrobot). The transmitter i.e., the remote has been equipped with Keyboard and RF transmitter, which have been interfaced using microcontroller Atmega3268P.

*RF Receiver*

A RF Receiver as explained in the block diagram the RF receiver will be demodulating the received signal. The demodulated output will be the actual data signal i.e., original signal that is transmitted from the transmitter. The RF receiver consists of 3 pins. First is ground, second is the output, which is connected to the micro controller and the third, is the Vcc.

*DC Motor*

Permanent magnet DC motor responds to both voltage and current. The steady state voltage across a motor determines the motor's running speed, and the current through its armature windings determines the torque. Apply a voltage and the motor will start running in one direction; reverse the polarity and the direction will be reversed.

## 6. Material Selection

FE 350 MILD STEEL is selected.

Chemical composition of Mild Steel:

CARBON 0.16 to 0.18 % (maximum 0.25% is allowable)
MANGANESE 0.70 to 0.90 %
SILICON maximum 0.40%
SULPHUR maximum 0.04%
PHOSPHOROUS maximum 0.04%
IRON remaining percentage

Mildest grade of carbon steel or mild steel contains a very low amount of carbon - 0.05 to 0.26% Composition.

### *A. 3D Model of the Machine*

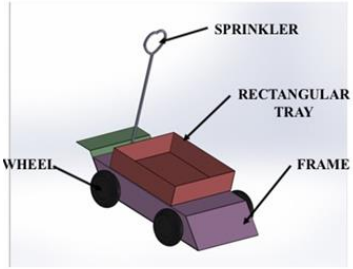



Fig. 1. Design of plant irrigation water sprinkler robot

3DModel and Drafting for Plant Irrigation Water Sprinkler Robot is done using SOLIDWORKS, each and every parts or components in the machine is analyzed using ANSYS software.

## 7. Calculations

*Program coding:*

```
 // Include RadioHead Amplitude Shift Keying Library
#include <RH_ASK.h>
// Include dependant SPI Library
#include <SPI.h>
// Create Amplitude Shift Keying Object
RH_ASK rf_driver;
int a,b,c,d,e,f;
void setup()
{
  Serial.begin(9600);
  pinMode(2,INPUT);
    pinMode(3,INPUT);
      pinMode(3,INPUT);
        pinMode(5,INPUT);
          pinMode(6,INPUT);
            pinMode(7,INPUT);
    // Initialize ASK Object
    rf_driver.init();
}
void loop()
{
   a=digitalRead(2);
  b=digitalRead(3);
   c=digitalRead(4);
   d=digitalRead(5);
  e=digitalRead(6);
  f=digitalRead(7);
 // Serial.println("up");
  if(a==0)
  {
    Serial.println("Forward");
    const char msg = 'f';
    rf_driver.send((uint8_t *)msg, strlen(msg));
    rf_driver.waitPacketSent();
    delay(1000);
}
else if(b==0)
  {
    Serial.println("backward");
    const char msg = 'b';
    rf_driver.send((uint8_t *)msg, strlen(msg));
    rf_driver.waitPacketSent();
    delay(1000);
}
else if(c==0)
  {
    Serial.println("left");
    const char msg = 'l';
```

```
    rf_driver.send((uint8_t *)msg, strlen(msg));
    rf_driver.waitPacketSent();
    delay(1000);
}
else if(d==0)
  {
    Serial.println("right");
    const char msg = 'r';
    rf_driver.send((uint8_t *)msg, strlen(msg));
    rf_driver.waitPacketSent();
    delay(1000);
}
else if(e==0)
  {
    Serial.println("up");
    const char msg = 'm';
    rf_driver.send((uint8_t *)msg, strlen(msg));
    rf_driver.waitPacketSent();
    delay(1000);
}
else if(f==0)
  {
    Serial.println("down");
    const char msg = 'p';
    rf_driver.send((uint8_t *)msg, strlen(msg));
    rf_driver.waitPacketSent();
    delay(1000);
}
}
// Include RadioHead Amplitude Shift Keying Library
#include <RH_ASK.h>
// Include dependant SPI Library
#include <SPI.h>
// Create Amplitude Shift Keying Object
RH_ASK rf_driver;
void setup()
{
    // Initialize ASK Object
    rf_driver.init();
    // Setup Serial Monitor
    Serial.begin(9600);
}
void loop()
{
    // Set buffer to size of expected message
    uint8_t buf[11];
    uint8_t buflen = sizeof(buf);
// Check if received packet is correct size
    if (rf_driver.recv(buf, &buflen))
    {

// Message received with valid checksum
      Serial.print("Message Received: ");
      Serial.println((char*)buf);
      char a=buf;
       if(a=='f')
  {
  Serial.print("HI");

  digitalWrite(5,HIGH);
  digitalWrite(4,LOW);
  digitalWrite(3,HIGH);
  digitalWrite(2,LOW);
  }
   else if(a=='b')
  {
  digitalWrite(5,LOW);
  digitalWrite(4,HIGH);
  digitalWrite(3,LOW);
  digitalWrite(2,HIGH);
  }
   else if(a=='r')
  {
  digitalWrite(5,HIGH);
  digitalWrite(4,LOW);
  digitalWrite(3,LOW);
  digitalWrite(2,HIGH);
  }
   else if(a=='l')
  {
  digitalWrite(5,LOW);
  digitalWrite(4,HIGH);
  digitalWrite(3,HIGH);
  digitalWrite(2,LOW);
  }
 else if(a=='m')
   {
    digitalWrite(7,LOW);
     digitalWrite(6,HIGH);
     }
   else if(a=='p')
   {
     digitalWrite(7,HIGH);
     digitalWrite(6,LOW);
     }
     else if(a=='s')
     {
       digitalWrite(5,LOW);
  digitalWrite(4,LOW);
  digitalWrite(3,LOW);
  digitalWrite(2,LOW);
   digitalWrite(7,LOW);
  digitalWrite(6,LOW);
      }
     a='\0';
     }
}
```

## 8. Working

Actually, this consists of a Rover which moves around and sprays pesticides, water etc. Initially the 12v battery is connected with dc motor and a 4channel relay. This 4-channel relay used for forward, backward, right, left motion of rover. And battery also connected with Arduino board, receiver and one channel relay. In Arduino Uno board all functions are programmed. One channel relay used to on off the sprinkler which is placed at tank on the top of the rover. By filling pesticides or water in tank. Then sprinkler should turn on. It sprays it around. Then the rover motion controlled by transmitter. It sprays wherever the signal is processed manually.

## 9. Conclusion

Thus, we have come up with a low-cost Plant Irrigation Water Sprinkler Robot. The project carried out by us made an impressing task in the field of Agricultural industries. It is very useful for water irrigation from streams or rivers. This project has also reduced the cost involved in the concern. Project has been designed to perform the entire requirement task, which has also been provided.

## Acknowledgement

Our humble thanks to Dr. R. Suresh Kumar, Head of the department (Mechanical), and our Project Supervisor Mr. S. Gokul, Assistant Professor (mechanical) Sri Eshwar College of Engineering Coimbatore, for his valuable advice, permission and encouragement us to carry out this work successfully.

## References

[1] S. M. Wange, Sanket Garudkar, Akshay Pendurkar, Prashant Roopdas, Pranav Bhandari “Automatic Water Springler System,” International Research Journal of Engineering and Technology, Volume 5, no. 6, June-2018.

[2] Constantinos Marios Angelopoulos, Sotiris Nikoletseas, Georgios Constantinos Theofanopoulos, “A Smart System for Garden Watering using Wireless Sensor Networks”, MobiWac '11 Proceedings of the 9th ACM international symposium on Mobility management and wireless access Pages 167- 170 ACM New York, NY, USA, 2011.

[3] Devdutt, Ishlok Vashistha, Vimlesh Singh, Priyanka Bansal, Abhiruchi Passi Plant Watering Robot “PLANT O BOT,” International Journal of Computer Science and Mobile Computing, Vol. 6, Issue. 4, April 2017, pg. 3.

[4] R. S. Kumar, J. Alexis & V. S. Thangarasu, (2017). Optimization of high-speed CNC end milling process of BSL 168 Aluminium composite for aeronautical applications. Transactions of the Canadian Society for Mechanical Engineering, 41(4), 609-625.

[5] S. R. Kumar, J. S. Alexis &V. S. Thangarasu, (2017). Experimental Investigation of Influential Parameters in High-Speed Machining of AMS 4205. Asian Journal of Research in Social Sciences and Humanities, 7(2), 508-523.

[6] S. Ganeshkumar, Thirunavukkarasu, R. Sureshkumar, S. Venkatesh & T. Ramakrishnan. Investigation of Wear Behaviour of Silicon Carbide Tool Inserts and Titanium Nitride Coated Tool Inserts in Machining of EN8 Steel.

[7] S. Kumar, J. Alexis & V. S. Thangarasu (2016). Prediction of machining parameters for A91060 in end milling. Advances in Natural and Applied Sciences, 10(6 SE), 157-164.

[8] R. S. Kumar, V. S. Thangarasu & S. J. Alexis (2016). Adaptive control systems in CNC machining processes--a review. Advances in Natural and Applied Sciences, 10(6 SE), 120-130.

[9] S. Kumar, J. Alexis & K. P. Dhanabalakrishnan (2015). Application of GA & ANN for the optimization of cutting parameters for end milling operation- A comparison. International Journal of Applied Engineering Research, 10(20), 18092-18107.

[10] T. Ramakrishnan & P. S. Sampath (2017). Dry Sliding Wear Characteristics of New Short Agave Angustifolia Marginata (AAM) Fiber-Reinforced Polymer Matrix Composite Material. Journal of Biobased Materials and Bioenergy, 11(5), 391-399.

[11] R. Jeyakumar, P.S. Sampath, R. Ramamoorthi &T. Ramakrishnan (2017). Structural, morphological and mechanical behavior of glass fiber reinforced epoxy nanoclay composites. The International Journal of Advanced Manufacturing Technology, 93(1-4), 527-535.

[12] T. Ramakrishnan & P. S. Sampath, (2017). Experimental investigation of mechanical properties of untreated new Agave Angustifolia Marginatafiber-reinforced epoxy polymer matrix composite material. Journal of Advances in Chemistry, 13(4), 6120-6126.

[13] R. Ramamoorthi, R. Jeyakumar & T. Ramakrishnan (2017). Effect of Nanoparticles on the Improvement of Mechanical Properties of Epoxy Based Fiber – Reinforced Composites - A Review. International Journal for Science and Advance Research in Technology, 3(11), 1251-1256.

[14] T. Ramakrishnan, P. S. Sampath &R. Ramamoorthi (2016). Investigation of Mechanical Properties and Morphological Study of the Alkali Treated Agave Angustifolia MarginataFiber Reinforced Epoxy Polymer Composites. Asian Journal of Research in Social Sciences and Humanities, 6(9), 461-472.

[15] T. Ramakrishnan & P. S. Sampath (2016). Thermogravimetric Analysis (TGA) and the Effect of Moisture Absorption on the Mechanical Properties of New Agave Angustifolia Marginata 3 Fiber (AAMF) Reinforced Epoxy Polymer Composite Material, International Journal of Printing, Packaging & Allied Sciences, 4(5), 3245-3256.

[16] T. Ramakrishnan, K. Sathish, P. S. Sampath &S. Anandkumar(2016). Experimental investigation and optimization of surface roughness of AISI 52100 alloy steel material by using the Taguchi method. Advances in Natural and Applied Sciences, 10(6 SE), 130-138.

[17] K. Sathish, T. Ramakrishnan &S. Sathishkumar (2016). Optimization of turning parameters to improve the surface finish of 16 Mn Cr 5 material. Advances in Natural and Applied Sciences, 10(6 SE), 151-157.

[18] S. Karthik Raja S. Balasubramani, S. Venkatesh, T. Ramakrishnan (2015). Effect of Cryogenic Tempering on Steel, International Journal of Mechanical and Civil Engineering, 2 (6), 98-113.

[19] Yaser H. Alahmadi, Andrzej F. Nowakowski (2016). ‘Modified shear stress transport model with curvature correction for the prediction of swirling flow in a cyclone separator’ - Chemical Engineering Science 147 (2016) 150–165.

[20] Sakura GanegamaBogodage, A.Y.T. Leung (2016). ‘Improvements of the cyclone separator performance by down-comer tubes’ - Journal of Hazardous Materials311 (2016) 100–114.

[21] Xiaofeng Gu, Jianfei Song, YaodongWei (2016). ‘Experimental study of pressure fluctuation in a gas-solid cyclone separator’-Powder Technology PII: S0032-5910(16)30261-3.

[22] MounaLazrag Deisy Lizeth Mejia-Mendez C´ecile Lemaitre Philippe Hugh Emmanuel Stafford Rainier Hreiz Romain Privat Ahmed Hannachi Danielle Barth (2016). ‘Thermodynamic and hydrodynamics study of gas-liquid flow in a cyclone separator downstream supercritical drying’ J. of Supercritical Fluids PII: S0896-8446(16)30223-6.

[23] S. Venkatesh & M. Sakthivel (2017). 'Numerical Investigation and Optimization for Performance Analysis in Venturi Inlet Cyclone Separator', Desalination and Water Treatment, Vol. 90, No. 9, pp. 168-179.

[24] S. Venkatesh, M. Sakthivel, S. S udhagar & S. Ajith Arul Daniel (2018). 'Modification of the cyclone separator geometry for improving the performance using Taguchi and CFD approach', Particulate Science and Technology.

[25] Saeid Jafari, Reza Vatankhah Barenji, and Majid Hashemipour “Towards an Automated Guided Vehicle (AGV)” in Sprinkler Irrigation,” International Journal of Environmental Science and Development, Vol. 4, No. 5, October 2013.

[26] Kevin Sikorski, “Thesis- A Robotic PlantCare System”, University of Washington, Intel Research, 2003.

[27] Ayumi Kawakami, Koji Tsukada, Keisuke Kambara and Itiro Siio, “PotPet: Pet-like Flowerpot Robot”, Tangible and Embedded Interaction 2011, Pages 263-264 ACM New York, NY, USA, 2011
[28] S. Venkatesh, I. Bruno Clement, M. Avinasilingam, & E. Arulkumar (2017). “Design of Experiment Technique for Improving the Performance of Stirling Engine”, International Research Journal of Engineering and Technology, Vol. 4, No. 5, pp. 62-65.
[29] S. Venkatesh, S. Balasubramani, S. Venkatramanan & L. Gokulraj. “Standardization of hpx spool for lead time reduction of string test”, Journal of Mechanical and Civil Engineering, Vol. 2, No. 6, pp. 62-79.
[30] S. Kousalya Devi, S. Venkatesh & P. Chandrasekaran. (2015). “Performance Improvement of Venturi Wet Scrubber," Journal of Mechanical and Civil Engineering, Vol. 2, No. 4, pp. 1-9.