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IOT controlled pesticides spraying robot for Smart Agriculture

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Abstract: *This paper gives the idea about how the IoT (Internet of Things) can be applied in the fields of agriculture. Smart farming is a modern technology used to increase the quality and quantity of agricultural products. Farmers in 21st century have access to GPS, soil scanning, data management and IoT technologies. The main objective of smart farming is to ameliorate the quality of human life in terms of comfort, efficiency and productivity. The IoT allows the objects to be observed and accessed remotely across existing networks, creating right set of circumstances for more direct interaction between objects and mobile resulting in enhanced efficiency, precision and productivity. The robot is provided with four wheel movement and a pesticide sprayer which is controlled by a user with the help of IoT technology, which indeed gives the user to control the robot from any location. As the pesticides are very harmful to human body, this robot can be replaced in place of human to apply the pesticides to the field. Apart from preventing the exposure of human being into harmful chemicals, this robot also saves the energy and time of a person which required spraying the pesticide to the fields. The camera gives the visual data of the field which is helpful for the controlling of the robot.*

Keywords: *Agriculture, Internet of Things, pesticide sprayer.*

1. INTRODUCTION :

Agriculture in India constitutes more than 60% of the occupation. It serves to be the backbone of Indian economy. It is very important to improve the efficiency and productivity of agriculture by simultaneously providing safe cultivation for the farmers. India is the largest producer of pesticides in the Asia and ranks tenth in the world pesticide producers list. Operations like spraying of pesticides, sprinkling of fertilizers are very tedious. Though spraying of pesticides has become mandatory it also proves to be a harmful procedure for the farmers. Farmers, especially when they spray pesticides, should take too many precautions like wearing appropriate outfits, masks, gloves etc so that, it does not cause any harmful effects on them. Avoiding the pesticides is also not completely possible as the required outcome has to be met. So, use of robots in such cases gives the best of the solutions for these problems, along with the required productivity and efficiency. Cost effective technology using components such as Micro-controller for the control of agriculture robot, wireless camera to track the path of the robot as well as intruders, motors which facilitate the robot wheels to move and android application in vehicle to make all of the above feasible.

The IoT (Internet of Things) describes the network of physical objects that is things that are embedded with the sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. The IoT can be used in many fields. In this project the IoT is used for the agricultural purpose which is helpful in avoiding hazards chemical exposure on human and it also saves the time, energy of the human.

The robot vehicle will have four wheels which will be connected to gearbox DC motors for the movement in all four directions. The vehicle will be provided with two pesticide spraying nozzles which will be connected to the pesticide tank with a pump. The relay is used to control the operation of the robot. The robot will have camera to tract the movement of robot. The development board and the motor drive module will be used for the electronic purpose. All these components are inter connected with the help of shafts, electric wires etc. The robot is operated using an IoT technology in which a program and a specific apps from android are required. The IoT requires internet connection for both user who control the robot and for the robot which runs on the fields. The main advantage of the IoT is that the user can control the robot from anywhere and will also have a visual data which is provided with the help of camera.

Dr.S.R.Gengaje, in their paper discussed the idea of implementation of agriculture robot for the purpose of pesticide spraying. The wireless Camera mounted on the robot captures the crop video and sends it to the central station. The person sitting at the central station decides on the robot's operation. When the user finds that the crop is defective, the robot will be given a command and the pesticides will be sprayed over the crop. This will be done by RF transceiver; Robots are used for industrial purpose in agriculture. For forming, the main use of robotics is for planting, fruit picking, sprayer is designed to replace human labour. Through replacing human with robots, it will be done through transmitting crop video to central station. Instead central station monitors robot movements and pesticide spraying, using real time processor. This will reduce plants excessive use of pesticide. The real time model can be implemented using ARM LPC2148; the device has the advantage of high speed, quality and reliability. The pesticides tank capacity is based on the farm area.

Philip J.Sammons, Furukawa Tomonari, and Bulgin Andrew proposed in their paper "Autonomous Pesticide Spraying robot for use in a Greenhouse" that an engineering solution includes spraying potentially toxic chemicals in the confined space of a hot and steamy glasshouse to the current human health hazards. This is done by designing and building an independent mobile robot that

used in commercial greenhouses for tools to control insects and prevent disease. The efficiency of this method is shown by the ability of the platforms through maneuver themselves efficiently down the rows of a greenhouse, while the pesticide spraying system efficiently covers the plant with spray uniformly in specified dosage. The result showed that the robot was able to meet the physical set by the national greenhouse horticulture centre, so that it could work in its greenhouses. The robot also meets the time it had to face and economic constraints. The robot could drive up and down the tracks in the greenhouse. The rails are sensed effectively by the Induction Proximity sensors and operated satisfactorily.

Mitul Raval, Supath Mohile and Aniketn Dhandhukia in their paper "Development and Automation of Robot with spraying Mechanism for Agricultural application" proposed a scientific alternative to the current human health hazards including the application of potentially toxic substances in the enclosed environment. This is accomplished by designing and building an autonomous mobile robot for use in commercial farming application for pest control and disease prevention. The efficiency of this system is shown by the ability to navigate successfully down a farm's lines, spray the pesticides efficiently while it is managed from a distance by the former. And this pesticide spraying system efficiently covers the plants in the specified dosage uniformly with spray. Wireless service will remove and even save health problem from tedious work. It's going to have less resource need. Thanks to remote sensing, effective and health conscious service. The farmer is expected to control the robot wirelessly from a distant place with the aid of live spraying feed. It is planned that this robot is an all-terrain robot.

Extensive research on robotics has been carried out in controlled environments such as greenhouse grafting robots, harvesting robots for cucumber and strawberry and tomato. "Jinlin Lin and Tony Ein" in their research paper focuses on the accurate guidance of the agricultural robots in the open field and not in controlled environment such as greenhouse effect. This robot uses a camera and image processing technique for the supervision of the field. The robot uses a guidance line determination method in which three guidance lines are used, 1st line for left crop 2nd line for right crop and the 3rd for the middle segment. First the images are captured and the lines are determined.

The main objective of smart farming is to ameliorate the quality of human life in terms of comfort, efficiency and productivity. The IoT allows the objects to be observed and accessed remotely across existing networks, creating right set of circumstances for more direct interaction between objects and mobile resulting in enhanced efficiency, precision and productivity.

2. METHODOLOGY:

2.1 List of components

2.1.1 Poly Vinyl Chloride (PVC) Board: The PVC board is used as base for the robot. The size of the board used is 460*360*25 mm. These boards will have high strength and durability. Due to the structure of its components molecules, PVC boards are highly strong that they don't undergo any deformation. The boards can survive as long as four decades without any damage. They offer excellent resistance to moisture and water. They can also resist temperature changes and do not expand or shrink with variations in temperature. In simple words PVC boards are water proof and termite proof.

2.1.2 Wheels: Small Cycle Wheels of Dia 220 mm are used in the robot. The rim material, hub material and the spoke material is plastic. The compatible tire is made up of plastic rubber. This plastic rubber tire will help the robot to move in all-terrain region. The wheel used is two coloured that is yellow and black. These wheels have enough strength to carry the robot. Two wheels in the front and two in the rear are used control the direction of the robot. The wheels will be supported by gearbox DC motor to run. They are connected to DC motor with help of shafts, ball bearings and a flange coupling.

2.1.3 Tank: The plastic tank with 10 liter capacity is used to carry the pesticide. The tank will have a cap to cover. The tank will be placed on PVC board and it will be connected to water pump through pipe.

2.1.4 Rectangular Gearbox DC Motor: 12V 30RPM Rectangular gearbox DC motor is high torque motor i.e. 19.83 N-cm with a gear ratio of 149. The main feature of this motor is it has a 27mm long shaft with M4 tapping and a diameter of 8 mm. Normally the motor available in the market is having a shaft length of 20 ~ 22 mm long; but we have customized the shaft of this motor to meet customers' requirements. So it's too easy to mount a wheel or any type of coupling on the shaft. It is lightweight and compact-sized motor with high performance. The applications of this motor are Central air conditioning valve, Amusement equipment, Coin refund devices, Grill, Oven; Peristaltic pump, ATM bank automatic system, Medical equipment, Office equipment, Household appliance, Automatic actuator and many more.

2.1.5 Brass Nozzle: A nozzle is often a pipe or tube of varying cross-sectional area and it can be used to direct or modify the flow of a fluid (liquid or gas). Nozzles are frequently used to control the rate of flow, speed, direction, mass, shape, and/or the pressure of the stream that emerges from them. A nozzle is a device designed to control the direction or characteristics of a fluid flow (especially to increase velocity) as it exits (or enters) an enclosed chamber or pipe. As general, Water Mist nozzles are designed to obtain spray pattern based on more than 99% of exceptionally fine droplets, with single droplet size less than 1000 microns. But this is only a basic standard definition of Water Mist, because many of these nozzles can generate exceedingly small droplets, in the range between 5 to 50 microns. There are many applications where Water Mist nozzles are a key factor for the best result, such Fire Protection systems, Explosion Protection systems, Lumber Drying and Humidification systems.

2.1.6 12V Water Pump: This is 550 Diaphragm Pump 12V Water Pump for Water Spray Fish Tank Reflux Pump. DC 12V 3.5L/Min Micro 550 Diaphragm Water Pump Watering Spray Aquarium Return Pump for Home Garden. The configuration of the bath is according to the saving configuration: 12V2A power supply, bus connector, 4m 7 x 10 silicone tube, a 550 water pump, as for the shower nozzle, you can find a plastic bag, a good quality plastic bag or big cola bottle, The water intake and the amount of water can be equivalent.

2.1.7 Node MCU ESP8266 ESP-12E Wi-Fi Development Board: NodeMCU with CP2102 Wi-Fi board is an all –in-one microcontroller+Wi-fi platform that is very easy to use to create projects with Wi-Fi and IOT (Internet of things) applications. The board is based on the highly Popular ESP8266 WI-FI module chip with the ESP-12 SMD footprint. ESP8266 is a highly integrated chip designed for the needs of a new connected world. It offers complete and self-contained Wi-Fi networking solution, allowing to either host the application or to offload all Wi-Fi networking functions from another application processor. ESP8266 has powerful onboard processing and storage capabilities that allow it to be integrated with the sensors and other applications specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, and the entire solution, including the front-end module, is designed to occupy minimal PCB area.

2.1.8 L298N 2A Motor Driver Module: L298N 2A Based Motor Driver is a high power motor driver perfect for driving DC Motors and Stepper Motors. It uses the popular L298 motor driver IC and has an onboard 5V regulator which it can supply to an external circuit. It can control up to 4 DC motors, or 2 DC motors with directional and speed control. This motor driver is perfect for robotics and mechatronics projects and perfect for controlling motors from microcontrollers, switches, relays, etc.

2.1.9 Channel Relay Module: A relay is an electrically operated device. It has a control system and (also called input circuit or input contactor) and controlled system (also called output circuit or output cont actor). It is frequently used in automatic control circuit. To put it simply, it is an automatic switch to controlling a high-current circuit with a low-current signal. The advantages of a relay lie in its lower inertia of the moving, stability, long-term reliability, and small volume. It is widely adopted in devices of power protection, automation technology, sport, remote control, reconnaissance, and communication, as well as in devices of electro mechanics and power electronics. A relay contains an induction part which can reflect input variable like current, voltage, power, resistance, frequency, temperature, pressure, speed, and light etc. It also contains an actuator module (output) which can energize or de-energize the connection of controlled circuit. There is an intermediary part between input part and output part that is used to coupling and isolate input current, as well as actuate the output. When the rated value of input (voltage, current and temperature etc.) is above the critical value, the controlled output circuit of relay will be energized or de-energized. 5 Volts 4 Channel relay module is an interface board that is compatible with Arduino, AVR, PIC, ARM etc. This module can work in high current like AC250V 10A or DC30V 10A. It controls larger loads and devices like DC motors, AC motors and other AC and DC devices with the digital outputs from controllers and processors. It is a 4-channel relay module, so it can control any 4 devices. Each relay or channel of 4 channel relay module needs 15-20mA driver current and 5 Volts supply.

2.1.10 PVC Pipes: The PVC pipe commonly used for the support for low weight equipments. These pipes will have enough strength to sustain loads which will act on the robot. These pipes are used to support the nozzles for adjusting different heights and inclinations. These pipes are mounted on the PVC base board and supported with the clamps. These PVC pipe will reduce reduces the cost and weight of the robot. These PVC pipes are does not react with pesticide and will not get rust.

2.1.11 Pipe Diaphragm: This pipe diaphragm consists of body with one inlet port and two outlet ports. This pipe diaphragm is made up of brass and it is simple in construction and it is easy to install. This diaphragm can be used to for low and high pressure distribution valve. This diaphragm can be used for low and high pressure distribution valves. This diaphragm can split the water stream from the pump and send that water to the nozzles to spray.

2.1.12 CSK Allen Key Bolts: CSK bolts are flat headed bolt fasteners with hex socket drive into the head. Counter sink bolts have a cone type neck with flat head socket cap bolts are other alias of hex head bolts. Counter sink bolts have cone type neck with flat head hex socket bolts, flat head socket cap bolts countersink bolts dimensions are defined in both metric and imperials sizes with unified natural coarse pitch (UNC), fine pitch (UNF), fixed pitch (UN) and ISO metric thread profile. The CSK bolts are used in this robot is Carbon steel.

2.1.13 Bearing housings: Bearing housings are modular assemblies designed to make it easy to install bearings and shafts, while protecting bearings, extending their operating life and simplifying maintenance. These bearing are able to withstand momentary shock loads, These bearing housings are running with friction at high speed, it is reliable, low cost of maintenance and has no lubrication is required while in service. These are cost effective and low weight compared with other bearing blocks.

2.1.14 Transparent PVC Pipes: PVC is an amorphous polymer and as a result its products are basically transparent. PVC products are non-transparent when they are manufactured using compounding agents that are non-compatible. The haze value is used to measure the transparency of plastic products. The smooth interior surfaces of the clear PVC pipe permit maximum flow rates and minimize accumulation of sediment. It is non-toxic and the smaller the haze value, the higher the transparency, and higher gloss values indicate enhanced gloss. Rigid PVC products that have high transparency are used in construction materials such as day-lighting, transparent partitions for clean rooms, or industrial flat plates, corrugated panels. They are also used in packaging (blisters). Examples of flexible PVC products requiring transparency are wrap films, transparent bags and coating films.

2.1.15 Hexagonal head bolts: Hex bolts, also called hexagon screw head bolts, hex cap bolts, hex-cap screws, or machine bolts, are a very common choice when it comes to construction and repair. Hexagon screw head bolts are made from a variety of materials to accommodate the wide range of applications in which hex cap bolts are used. Hex bolts are used in engineering, the automobile industry and construction of all kinds. The distinct shape of the head of the bolt makes it easy to be gripped with tools from any angle. You can even twist a hex bolt by hand. This makes it easy to loosen and tighten hex bolts from any direction with any tool as you work. Because hex bolts can sometimes spin due to their shape, you made need to hold the bolt head with one wrench and tighten the bolt using a second wrench In most cases, you'll use a wrench or a spanner to tighten or loosen hex bolts. The shape of the head is ideal for use with a wrench.

2.1.16 Ball bearings: Ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this by using at least two races to contain the balls and transmit the loads through the balls. In most applications, one race is stationary and

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the other is attached to the rotating assembly (e.g., a hub or shaft). As one of the bearing races rotates it causes the balls to rotate as well. Because the balls are rolling they have a much lower coefficient of friction than if two flat surfaces were sliding against each other. Ball bearings tend to have lower load capacity for their size than other kinds of rolling-element bearings due to the smaller contact area between the balls and races.

2.1.17 Flange coupling: Flange Coupling is a driving coupling between rotating shafts that consists of flanges one of which is fixed at the end of each shaft, the two Flanges being bolted together with a ring of bolts to complete the drive. High thread count nut and bolt connections are used to secure the flange couplings in place. Flange Coupling is a driving coupling between rotating shafts that consists of flanges one of which is fixed at the end of each shaft, the two Flanges being bolted together with a ring of bolts to complete the drive. A flange coupling meant to bring two tube ends together in a flush, sealed manner. This two-piece coupling unit consists of a keyed receiving side for the flanged end to be fastened to, so it may be married to the opposing tube end, which also has a flanged end. Each flange has either a male or female coupler opening so that when the two ends are brought together, they are aligned without causing resistance or drag in the material being passed through them. This male or female coupling method also creates a stable connection that is resistant to shifting, keeping the flange coupling sturdily in place.

2.1.18 Wing nuts: Wing nuts work like most other nuts: They are designed to hold two or more objects together when used in conjunction with a bolt. You can twist a wing nut onto the end of a bolt to prevent the connected objects from pulling away. Wing nuts feature internal threading, so they can run up and down the bolts with which they are used. The main benefit of wing nuts, however, is their ease of installation and removal. You can install and remove them more easily than other types of nuts thanks to their wings. Traditional nuts have a hexagonal shape, and with six sides, you may have trouble gripping them. Wing nuts offer a more ergonomic design by providing tabs. Rather than gripping the base of a wing nut, you can grip its two tabs.

2.1.19 12V 7.5 amps Battery: For the robot we have used a battery with 12v and 7.5 amps current capacities. It is used to run the pump and rectangular gearbox DC motors. This battery has capacity to run 4 rectangular gearbox DC motors to run the robot and pump to pressurize the pesticide to nozzles. The battery used in this is sealed lead acid rechargeable battery. It has a life of 7.5 hours which means a robot can run upto 7.5 hours using this battery.

2.1.20 12V 1.3 amps Battery: For the robot we have used a battery with 12v and 1.3 amps current capacities. It is used to control the circuit and a mi wireless camera. The battery used in this is sealed lead acid rechargeable battery. It has a life of 1.5 hours which means a robot can operate upto 1.3 hours using this battery.

2.21 Mi Wireless Camera: The Wireless camera is used to get the visual data from the field. This camera has microphone which gives instructions to connect to the application. The camera data is collected using a xiaomi home application. If required the memory card can be used in the camera to store the data. The memory card is optional depending upon the user. It can bend in 90 degrees front and back. This can be used to adjust the camera to the required angle.

3. EXPERIMENTAL PROCEDURES

3.1 Circuit Diagram

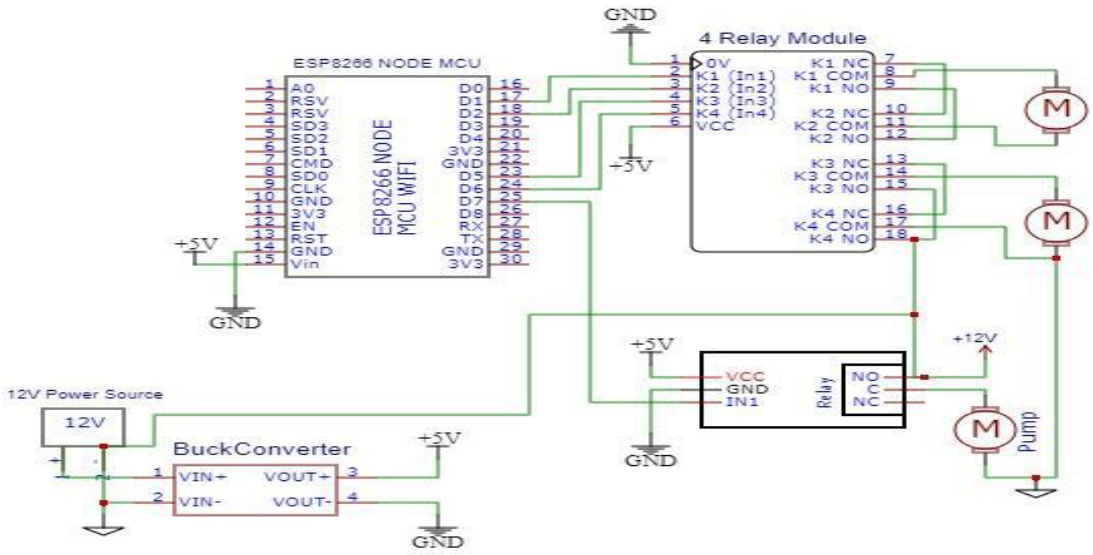

Figure 1: Circuit Diagram

3.2 Arduino Programming:

Arduino Integrated Development Environment (IDE): The open-source Arduino Software (IDE) makes it easy to write code as shown in figure.1 and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software. This software can be used with any Arduino board. The Arduino Integrated Development Environment as shown in figure. 2 is a cross-platform application that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards.

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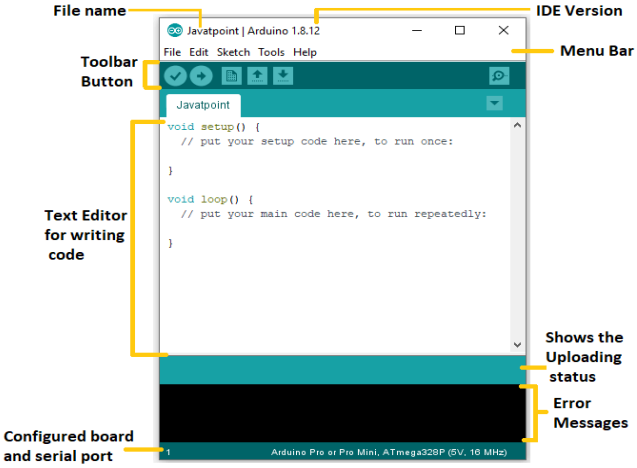

Figure 2: Integrated Development Environment

3.3 Blynk Applications:

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, and it can store data, visualize it and do many other things. There are three major components in the platform:
Blynk App - allows to you create amazing interfaces for your projects using various widgets we provide.
Blynk Server- responsible for all the communications between the smart phone and hardware. We can use our Blynk Cloud or run your private Blynk server locally. Its open-source could easily handle thousands of devices.
Blynk Libraries - for all the popular hardware platforms - enable communication with the server and process all the incoming and out coming commands

Figure 3: Blynk Application

In the Blynk Applications Joystick stick option as shown in figure.3 is used in this project to control the movement of the robot. The switch is also used to turn on or turn off the nozzle. The hardware is Arduino and it is controlled using this application through the program that is written in the Arduino Integrated Development Environment software. The programming language used is C++.

The Arduino program is given below:

```
/* Prints Blynk Connection Details */
#define BLYNK_PRINT Serial

// Libraries:
/* Add JSON Package and Install: esp8266 by ESP8266 Community */
#include <ESP8266WiFi.h>

/* Install: Blynk by Volodymyr Shymanskyy */
#include <BlynkSimpleEsp8266.h>

// Pin Numbers:
#define LeftMtr_RelayPin1 4   //Connect to IN1 of Relay Module, Left Motor Pin1
#define LeftMtr_RelayPin2 5   //Connect to IN2 of Relay Module, Left Motor Pin2
#define RightMtr_RelayPin1 12 //Connect to IN3 of Relay Module, Right Motor Pin1
#define RightMtr_RelayPin2 14 //Connect to IN4 of Relay Module, Right Motor Pin2
#define vPin_JoystickWidget V1  //Blynk Virtual Pin

// Blynk Project Authentication Key:
const char auth[] = "abcdefghijklmnopqrstuvwxyz";
```

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```
// WiFi Credentials:
const char ssid[] = "XYZ";      // Name of your network (Hotspot or Router Name)
const char pass[] = "****";     // Corresponding Password

/* This function will be called every time Joystick Widget
   in Blynk app writes values to the Virtual Pin 1 */
BLYNK_WRITE(vPin_JoystickWidget) {
  int x = param[0].asInt();
  Int y = param[1].asInt();
  int posX, posY;

  Serial.print("X: ");
  Serial.print(x);
  Serial.print(", Y: ");
  Serial.print(y);

  if (x > 400 && x < 600) {
    posX = 0;
  } else if (x > 900) {
    posX = 1;
  } else if (x < 200) {
    posX = -1;
  }

  if (y > 400 && y < 600) {
    posY = 0;
  } else if (y > 900) {
    posY = 1;
  } else if (y < 200) {
    posY = -1;
  }

  if (posX == 0 && posY == 0) {
    // Stop
    Stop();
    Serial.println("\t:: Stop");
  } else if (posX == 0 && posY == 1) {
    // Forward
    goForward();
    Serial.println("\t:: Forward");
  } else if (posX == 0 && posY == -1) {
    // Backward
    goBackward();
    Serial.println("\t:: Backward");
  } else if (posX == -1 && posY == 0) {
    // Left
    turnLeftPointTurn();
    Serial.println("\t:: Left");
  } else if (posX == 1 && posY == 0) {
    // Right
    turnRightPointTurn();
    Serial.println("\t:: Right");
  }
}
void setup() {
  // Define output pins:
  pinMode(LeftMtr_RelayPin1, OUTPUT);
  pinMode(LeftMtr_RelayPin2, OUTPUT);
  pinMode(RightMtr_RelayPin1, OUTPUT);
  pinMode(RightMtr_RelayPin2, OUTPUT);
  Stop();

  /* Begin serial communication with Arduino and Arduino IDE (Serial Monitor) */
  Serial.begin(9600);

  /* Begin communication with Blynk App */
  Blynk.begin(auth, ssid, pass);
}

void loop() {
  Blynk.run();
}

void MotorOFF(int pin1, int pin2) {
  digitalWrite(pin1, HIGH);
  digitalWrite(pin2, HIGH);
}
```

```
// Direction Control
void ForwardDir(int pin1, int pin2) {
  digitalWrite(pin1, HIGH);
  digitalWrite(pin2, LOW);
}

// Direction Control
void BackwardDir(int pin1, int pin2) {
  digitalWrite(pin1, LOW);
  digitalWrite(pin2, HIGH);
}

void Stop() {
  MotorOFF(LeftMtr_RelayPin1, LeftMtr_RelayPin2);
  MotorOFF(RightMtr_RelayPin1, RightMtr_RelayPin2);
}

void goForward() {
  ForwardDir(LeftMtr_RelayPin1, LeftMtr_RelayPin2);
  ForwardDir(RightMtr_RelayPin1, RightMtr_RelayPin2);
}

void goBackward() {
  BackwardDir(LeftMtr_RelayPin1, LeftMtr_RelayPin2);
  BackwardDir(RightMtr_RelayPin1, RightMtr_RelayPin2);
}

void turnLeftPointTurn() {
  BackwardDir(LeftMtr_RelayPin1, LeftMtr_RelayPin2);
  ForwardDir(RightMtr_RelayPin1, RightMtr_RelayPin2);
}

void turnRightPointTurn() {
  ForwardDir(LeftMtr_RelayPin1, LeftMtr_RelayPin2);
  BackwardDir(RightMtr_RelayPin1, RightMtr_RelayPin2);
}
```

The robot is carried and placed in a required place. Then the required quantity of pesticide is filled inside the tank by removing cap of the tank. The tank capacity is 10 ltr so the pesticide can be filled is upto its full capacity. After that the tank should be closed completely using its cap without leaving any air gap to avoid the spilling of pesticide on the robot. Then the PVC transparent pipe which is connected to water pump will be immersed in the pesticide tank through the whole in the cap. After this the nozzle can be adjusted to required height and also to required angle depending on the height and distance of the crop that the pesticide is to be sprayed. The nozzle can be tighten or loosen to obtain required amount and type of spray. Then the Arduino Board and the wireless camera are connected to the Wi-Fi that is mentioned in the program. After this Blynk application and the mi camera applications are opened. Now the visual data of the place that the robot is placed is obtained by the mi wireless camera can be seen in the mi camera app. So the camera can be adjusted to the required angle. The mi camera is very flexible and can rotate upto 180 degrees. It can also cover the place upto to 180degree radius. After this the operator should leave the Wi-Fi device near the robot and can go to his required place. Then by using visual data provided by camera application the operator can control the robot using the Blynk application. The joystick is used to control the four direction of the robot. A switch option is provided in the Blynk application to turn on or off the pump when ever required.

4. RESULT AND DISCUSSIONS:

The operator can start the robot using Blynk application that is by using joystick and can turn on the pump to spray the pesticide. The joystick is connected to motors through relay so when the joystick is operated the motors will operate using the Wi-Fi that is connected to robot. When the joystick is moved upwards all the wheels that is both wheels of front and rear will make a forward movement. When the joystick is moved downwards the robot moves backwards. In the same way when the joystick is moved right the robot turns to right and when joystick is moved to left the robot will take a left turn. If the switch is turned on in the Blynk application then the pump will be turned on by relay which will be working under the Wi-Fi to spray the pesticide and in the same way if the switch is turned off the relay shuts the operation of pump. If we consider a farm with certain length and some lines width after completing each line the pump can be turned off until moving to next line and again it can be turned on after reaching the required place. The robot is having a point turn motion which is very easy to turn the robot without taking any extra curve to move to next line. Here the next line refers to the alternate line to the first line in which the pesticide is already sprayed. The operator can control all these processes at any required distance that he need. As the camera gives the time to time visualizes data of the field the operator, he can look into that and can completely control the robot using Blynk application. After some time if the pesticide inside the tank gets over, the operator can refill it using the same steps that are used in first time.

All these process takes place with the help of Arduino Wi-Fi development board and the Internet of Things. As we create our project in a Blynk application it creates a Blynk server of this project in the IOT cloud. The Arduino is also connected to this

Blynk application using program. So the time to time data from the field can be obtained by the Arduino using Wi-Fi, this data is sent and stored in the IOT cloud of this project. When Blynk application is opened the Blynk server takes all the data related to this project from the IOT cloud and gives all the information or the data that is sent by Arduino. In this way time to time data from the Arduino is collected and sent to Blynk using IOT. As it operated using Wi-Fi and IOT there is limit for the distance to control the robot by the operator.

5. CONCLUSION:

- This paper presented the idea about how IOT can be applied in the fields of agriculture using simple Arduino programming.
- This agriculture monitoring system. IOT controlled robot named agribot will assist the farmers in increasing crop yield and profit also Reduces the human exposure to the harmful chemicals
- By the use of this robot in the agriculture fields we can reduce the spraying time and human efforts.
- The system can be used in the current scenario of Covid-19 to spray chemicals over the city by replacing the pesticide tank by sanitizer tank with human intervention
- IOT is everywhere sort-off in relating devices and gathering statistics.

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