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# MULTIAPPLICATION ROBOT

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## Abstract:

This Paper explains to create a robotic arm which works as the things humans cannot do repeatedly. The robotics is the study which consists of electrical engineering and mechanical engineering. Robots have been widely used in various industries for tasks such as manufacturing, logistics, healthcare, and agriculture. However, the development of a multiapplication robot that can perform tasks across different industries is still in its early stages. This Work proposes the development of a multiapplication robot that can be easily reconfigured and adapted to perform different tasks in various industries. The robot will be equipped with advanced sensors, actuators, and software that enable it to autonomously navigate and manipulate objects in different environments. The proposed multiapplication robot has the potential to improve efficiency, productivity, and safety in industries where multiple tasks are performed. Further research and development are needed to bring this technology to the market and realize its full potential.

**Keywords:** DC Motor, Relay, Arduino uno.

## Introduction:

Robotics is a topic that combines electrical and mechanical engineering. The robot utilized here is a wheeled robot. The wheeled robotic arm is extremely energy efficient; the wheels can travel freely and fast across both smooth and hard surfaces. For the legged robots, it took time and required more commands to move forward, backward, or in any direction. However, with a wheeled robot, the commands are simple, and the robot's motions are swift. This wheeled robot can be extremely handy in industrial settings. Because the industries use both smooth and rough surfaces. For the wheels, we employ motors to rotate. The command to the robotic arm is transmitted over Bluetooth. We can utilize a mobile phone to send data or issue commands to the robot. We can operate the robot using an application on our cell phone. The application used. For this, we require a Bluetooth connection between

the phone and the robot. For connectivity, the robot uses a Bluetooth connection. The robot can communicate with the Controller microcontroller, which we utilize in the robot. With Bluetooth, we can control both the robot's wheels and its arm. To accomplish this, we must upload program commands to the chip in the robotic arm's Controller microcontroller.

There will be a battery for connecting the power supply to the robotic arm. The power source provides us with the electrical energy we need to move the robotic arms. Technology has brought about a rapid and huge development in the robotics and automation fields, affecting a wide range of industries. Surveillance is the process of closely monitoring or supervising an individual, group, or other entity, particularly one in custody or under suspicion. Thus, monitoring is mostly necessary in locations such as border crossings, public places, offices, and factories. It is mostly used to monitor activity.

Surveillance can be carried out both indoors and outdoors by humans or embedded systems such as robots and other automation devices. A robot is just an automatic electronic machine that can perform programmed tasks, thereby substituting human labor, producing extremely accurate results, and readily surpassing human constraints. Thus, replacing humans in surveillance sectors is a significant step in robotics. Farming is India's foundation. In our country, roughly 215.6 million acres of soil are irrigated cropland.

According to the Economic Survey, the nation's farm mechanization has to be improved. Pest infestation productivity control plays an important part. Farmers are struggling to manage pest infestations. Pests are unwanted insects or diseases that disrupt human activities by biting, destroying food plants, or making life difficult for farmers. Early pest detection and avoidance is an important aspect of crop management. Understanding pests and their habitats is requiredfor effective pest management.

An automated robotic system has been designed to spray pesticides in limited quantities only when pests are detected, eliminating health concerns for farmers and lowering pesticide waste. The system may also be managed using an Android smartphone,making it more effective and time-saving for operations like fire extinguishing.

**Types of Multiapplication robots:**

Here are the some types of multiapplication robots

1. Universal Robots: These robots are designed to work in a variety of environments andcan perform tasks such as assembly, welding, painting, and material handling.
2. Collaborative Robots (Cobots): These robots are designed to work alongside humans andcan perform tasks such as assembly, packaging, and quality inspection.
3. SCARA Robots: These robots are designed for pick-and-place applications and canperform tasks such as assembly, inspection, and packaging.
4. Cartesian Robots: These robots are designed for tasks that require precise movement andcan perform tasks such as assembly, inspection, and material handling.

5. Polar Robots: These robots are designed for tasks that require high precision and canperform tasks such as assembly, inspection, and material handling.
6. Delta Robots: These robots are designed for high-speed pick-and-place applications andcan perform tasks such as assembly, inspection, and packaging.
7. Articulated Robots: These robots are designed for tasks that require flexibility and canperform tasks such as assembly, welding, and painting.
8. Industrial Robotic Arms: These robots are designed for tasks that require heavy liftingand can perform tasks such as assembly, welding, and material handling.
9. Automotive Robots: These robots are designed specifically for the automotive industryand can perform tasks such as welding, painting, and assembly.
10. Agricultural Robots: These robots are designed for tasks such as crop monitoring,harvesting, and planting in the agricultural industry.
11. Service Robots: These robots are designed to perform tasks such as cleaning, cooking,and hospitality in various service industries.
12. Medical Robots: These robots are designed for tasks such as surgery, patient care, andmedical research in the healthcare industry.
13. Logistics Robots: These robots are designed for tasks such as warehousing, inventorymanagement, and transportation in the logistics industry.
14. Food Processing Robots: These robots are designed for tasks such as food processing,packaging, and inspection in the food industry.
15. Aerospace Robots: These robots are designed for tasks such as assembly, testing, andinspection in the aerospace industry.

## Limitations:

Some limitations for developing a multi-application robot include:

- Complexity: Designing a robot that can perform multiple tasks may require intricate and sophisticated mechanisms, which could increase the complexity of development.

- Cost: Developing a multi-application robot with versatile capabilities may result in higher production and maintenance costs, making it less accessible for some companies orindustries.

- Programming Challenges: Integrating multiple functionalities into a single robot may present challenges in programming and control algorithms, requiring significant expertiseand resources.

- Performance Trade-offs: Trying to make a robot excel in multiple applications could lead to performance trade-offs, where it may not be as efficient or effective in certain tasks compared to specialized robots.

- Size and Weight: Packing multiple tools and equipment onto a single robot may impact its size and weight, potentially limiting its maneuverability and agility in certain environments.

## Method and Methodology:

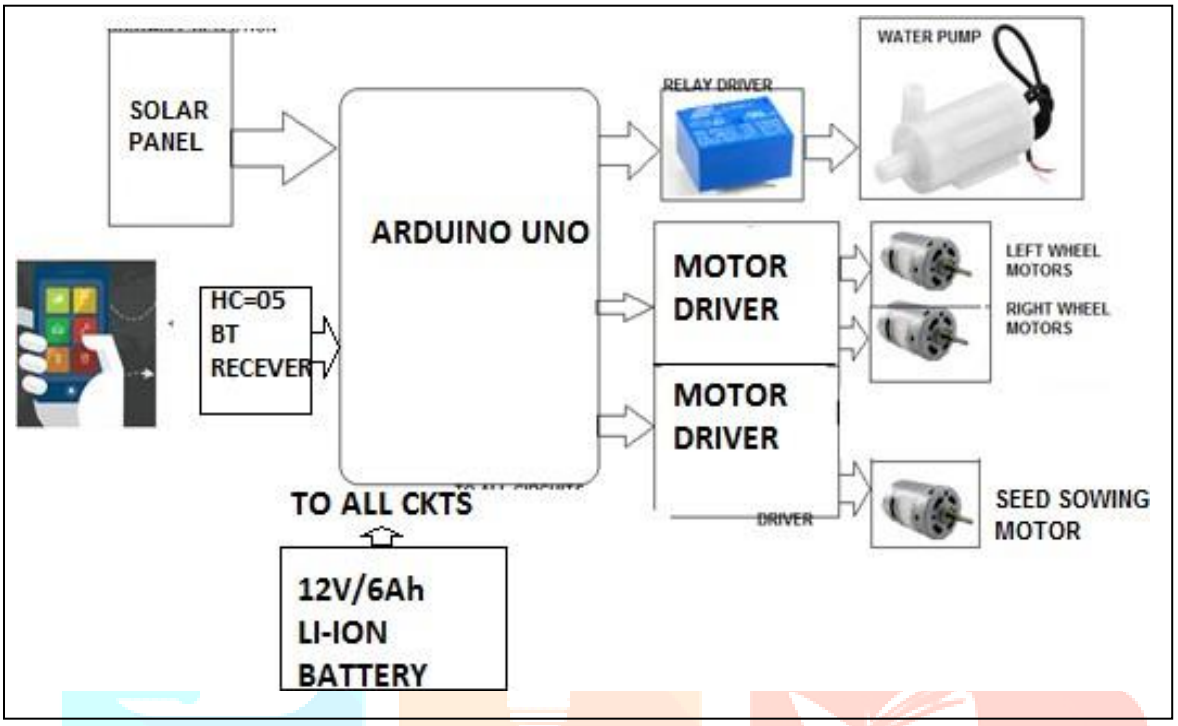
In the Proposed methodology the main part of the paper is the robotic arm, which can pick and place things from one place to another. To control this action, we can move the robotic arm by giving specific commands. The robotic arm is equipped with motors. These motors help to move the arm in desired direction. The motors are controlled with the help of a microcontroller (CONTROLLER). The user interface which is used to control the robotic arm is made on an app. The control is given via the internet to the Wi-Fi module. This acts as the receiver and gives the received signal to the microcontroller. The signal which is given to the robotic arm is actually sent through the internet and hence we can access the robot from any place. However, the app must require a login ID and a password for security reasons, for a particular person to control the robotic arm. The movements which are made by the robotic arm can be recorded and saved. In this way the arm can do the same movements repeatedly whenever needed.

By interfacing Bluetooth module with Controller, we can get wireless operation.By using Controller microcontroller, the cost and complexity can be reduced.

The communication with the robot occurs in a more secured manner. Automatic spraying ofpesticides is used to inject the pesticide into the targeted zone of the crops contaminated.

## Design and Development:

For Design and development of multiapplication of robot key point is firstly to design block diagram, using of essential hardware and software which describe in Robot architecture. also consider the robot communication and control.




**Hardware and software:**

Hardware required

1) ARDUINO UNO
2) Water pump
3) Motors
4) BELTS
5) Battery
6) relay

Software required-

1) Controller IDE
2) Proteus for PCB designing.

## Hardware:

### 1) Arduino Uno:

Arduino Uno is a popular microcontroller development board based on 8-bit ATmega328P microcontroller. Along with ATmega328P MCU IC, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller.

### 2) DC Submergible water pump:

This DC 3-6 V Mini Micro Submersible Water Pump is a low cost, small size Submersible Pump Motor which can be operated from a 2.5 ~ 6V power supply. It can take up to 120 liters per hour with a very low current consumption of 220mA. Just connect tube pipe to the motor outlet, submerge it in water and power Make sure that the water level is always higher than the motor. The dry run may damage the motor due to heating and it will also produce noise.

### 3) D.C. Motor:

A dc motor uses electrical energy to produce mechanical energy, very typically through the interaction of magnetic fields and current-carrying conductors. The reverse process, producing electrical energy from mechanical energy, is accomplished by an alternator, generator or dynamo. Many types of electric motors can be run as generators, and vice versa. The input of a DC motor is current/voltage and its output is torque (speed).

Fig . DC Motor

The DC motor has two basic parts: the rotating part that is called the armature and the stationary part that includes coils of wire called the field coils. The stationary part is also called the stator. Figure shows a picture of a typical DC motor, Figure shows a picture of a DC armature, and Fig shows a picture of a typical stator. From the picture you can see the armature is made of coils of wire wrapped around the core, and the core has an extended shaft that rotates on bearings. You should also notice that the ends of each coil of wire on the armature are terminated at one end of the armature. The termination points are called the commentator, and this is where the brushes make electrical contact to bring electrical current from the stationary part to the rotating part of the machine.

**4) Battery:**

Li-ion Battery

Lithium is the lightest metal, with the highest electrochemical potential and specific energy per weight. Rechargeable batteries containing lithium metal on the anode (negative electrodes) could deliver extremely high energy densities, but cycling caused undesired dendrites on the anode, which might breach the separator and cause an electrical short. The cell temperature would rapidly rise and approach the melting point of lithium, resulting in thermal runaway, commonly known as "venting with flame." The intrinsic instability of lithium metal, particularly after charging, prompted researchers to look into a nonmetallic solution based on lithium ions.

Although Li-ion has a lower specific energy than lithium-metal, it is nevertheless safe as long as cell manufacturers and battery packers take precautions to maintain voltage and current levels stable. Sony introduced the first Li-ion battery in 1991, and its chemistry has since become the most promising and quickest growing on the market. Meanwhile, researchers are working to create a safe metallic lithium battery in the hopes of making it safe.In 1994, it cost more than $10 to manufacture Li-ion in the 18650* cylindrical cell with a capacity of 1,100 mAh. In 2001, the price dropped to $2, while the capacity increased to 1,900mAh. Today, high energy-density 18650 cells deliver more than 3,000mAh,and their prices have plummeted even further.

Cost reduction, increased specific energy, and the absence of toxic materials prepared the way for Li-ion to become the universally accepted battery for portable applications, initially in the consumer business and now increasingly in heavy industry, including electric powertrains for automobiles. In 2009, Li-ion batteries accounted for around 38% of total revenue. Li-ion batteries require little maintenance, which is an advantage that many other chemistries lack. The battery has no memory and does not require exercise to stay in condition. Self-discharge is less than half of nickel-based systems. This makes Li-ion ideal for fuel gauge applications.

The nominal cell voltage of 3.6V may power mobile phones and digital cameras directly, simplifying and lowering costs compared to multi-cell solutions. The disadvantage has been the high cost, although this is leveling off, particularly in the consumer sector.

Lithium-ion batteries employ a cathode (positive electrode), an anode (negative electrode), and an electrolyte to conduct electricity. The cathode is a metal oxide, whereas the anode is made of porous carbon. During discharge, ions travel from the anode to the cathode via the electrolyte and separator; when charged, ions flow from the cathode to the anode. Figure 1 depicts the process.

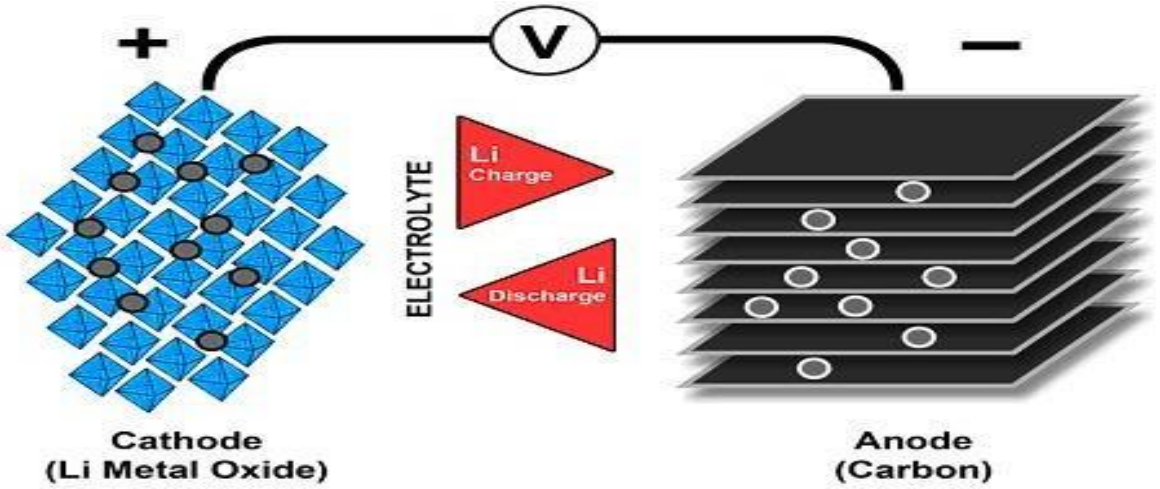



Figure 3

Ion flow in lithium-ion batteries. When a cell charges and discharges, ions travel between the cathode (positive electrode) and anode (negative electrode).

On discharge, the anode oxidizes, or loses electrons, while the cathode reduces, or gains electrons.Charge reverses the movement.All battery materials have theoretical specific energy, and the cathode is principally responsible for high capacity and superior power delivery. For the past ten years or more, the cathode has defined the Li-ion battery.

Common cathode materials include Lithium Cobalt Oxide (or Lithium Cobaltate), Lithium Manganese Oxide (also known as spinel or Lithium Manganate), Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt (or NMC), and Lithium Nickel Cobalt Aluminum Oxide (or NCA).Sony's first lithium-ion battery used coke as an anode (coal product), and since 1997, most Li-ion batteries have used graphite to achieve a flatter discharge curve. Anode development is also ongoing, with different additives, including silicon-based alloys, being tested.

Silicon achieves a 20-30% improvement in specific energy at the expense of lower load currents and shorter cycle life. Nano-structured lithium-titanate as an anode addition has a long cycle life, outstanding load capacities, excellent low-temperature performance, and high safety, but its specific energy is low. Manufacturers can boost intrinsic attributes by combining cathode and anode materials; however, improving one area may compromise another.

Battery manufacturers can, for example, optimize specific energy (capacity) for extended runtime, increase specific power for improved current loading, extend service life for better longevity, and enhance safety for strenuous environmental exposure; however, the drawback of higher capacity is reduced loading; optimization for high current handling lowers specific energy, and making it a rugged cell for long life and improved safety increases battery size and adds to the cost. The separator is said to be

the most expensive component of a battery.

**5) Relay:**

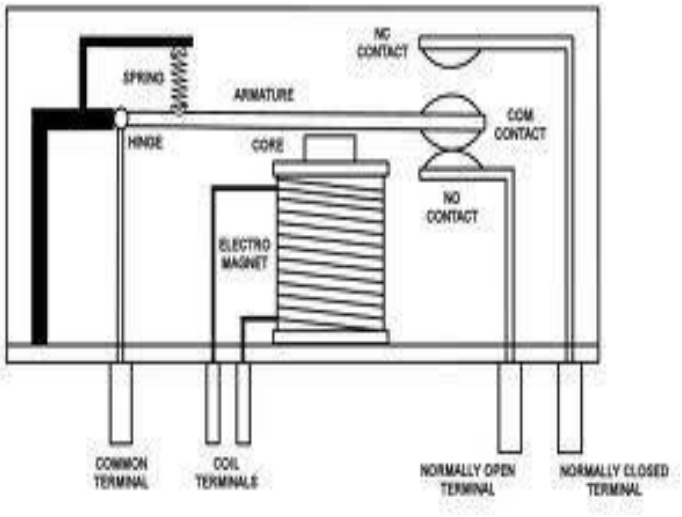
A relay is an electromagnetic device that electrically isolates two circuits and magnetically connects them. They are extremely useful gadgets that allow one circuit to switch another while remaining entirely distinct. They are frequently used to connect an electronic circuit (which operates at a low voltage) to an electrical circuit that operates at a high voltage. For example, a relay can use a 5V DC battery circuit to switch a 230V AC mains circuit. Thus, a simple sensor circuit can power a fan or an electric bulb.


A relay switch is separated into two components: input and output. The input part has a coil that produces a magnetic field when a tiny voltage from an electronic circuit is supplied to it. This voltage is known as the operating voltage. Commonly used relays are available in a variety of operating voltage configurations, including 6V, 9V, 12V, and 24V. The output segment is made up of contactors that connect and disengage mechanically.

Three contactors are present in a simple relay: common (COM), normally closed (NC), and ordinarily open (NO). COM and NC are coupled when the input state is zero. When the operating voltage is applied, the relay coil is engaged, and the COM contact turns to NO.

Different relay configurations are available, such as SPST, SPDT, and DPDT, each with a different number of changeover connections. The electrical circuit can be turned on and off with the right mix of contactors.

Pin Diagram:

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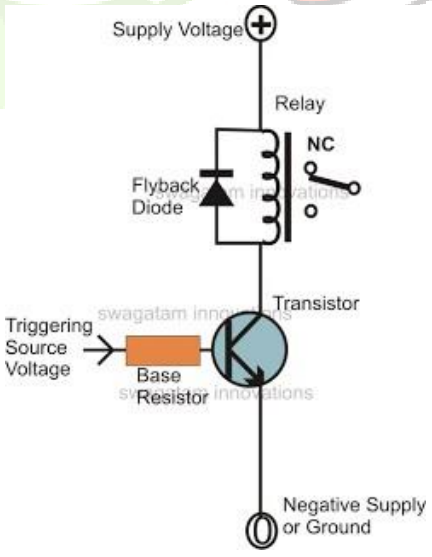
The transistor T1 (BC547) acts as a switch and its collector is connected to a relay. This relay can connect to any other circuit or electrical equipment. When the CONTROLLER is set to 1, the transistor receives the forward bias and turns on. As a result, the collector current flows and the relay's contact switches from NC to NO. As a result, the appliance connected to NO turns on. The resistor R3 is used to test the base current.

Relay driver-




Relays are among the most important components in electronic circuits. Relays serve an important role in implementing operations, particularly in circuits involving high power transmission or mains AC load switching. A relay, as we all know, is an electromechanical device used as a switch. Its function is to switch an external load linked to its contacts in response to a tiny amount of electrical power provided across an associated coil. Essentially, the coil is twisted around an iron core; when a little direct current is

supplied to the coil, it energizes and behaves like an electromagnet.

A spring-loaded contact mechanism placed close to the coil quickly responds and is drawn to the energized coil electromagnet force. During the course, the contact unites one of its pairs and disconnects the complimentary pair linked with it. When the DC power is turned off to the coil, the contacts return to their original position, connecting the preceding pair of complementary contacts, and the cycle can be repeated as many times as necessary. An

electronic circuit will typically require a relay stage to convert its low-power DC switching output to a high-power mains AC switching output.

However, low-level signals from an electrical device, such as those generated by an IC stage or a low current transistor stage, may be insufficient to drive a relay directly. Because a relay demands significantly larger DC currents, which are typically not accessible from an IC supply or a low current transistor stage. To address the aforementioned difficulty, all electronic circuits requiring this service must include a relay driver stage. A relay driver circuit is simply an additional transistor stage attached to the relay that needs to be activated. The transistor is normally used merely to operate the relay in response to commands received from the preceding control stage.

## Software:

For the Arduino Uno board to be programmed, the Arduino IDE (Integrated Development Environment) is necessary.

**Programming Arduino:**

Once the Arduino IDE has been installed on the computer, connect the board to the computer via USB connection. Now, launch the Arduino IDE and pick the appropriate board by going to Tools>Boards>Arduino/Genuino Uno, as well as the appropriate port from Tools>Port. Arduino Uno is programmed using the Arduino programming language, which is based on Wiring. To get started with the Arduino Uno board and blink the built-in LED, load the sample code from Files>Examples>Basics>Blink. Once the example code (seen below) is loaded into your IDE, click the 'upload' button in the top bar. When the upload is complete, you should see the Arduino's built-in LED blink. Here is an example code for blinking:

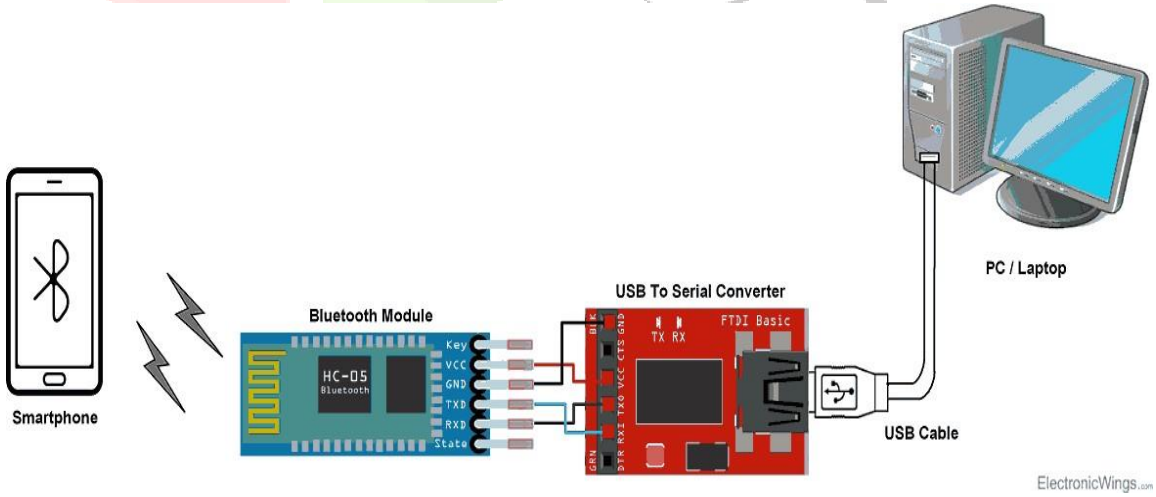
```
// the setup function runs once when you press reset or power the board
void setup() {
  // initialize digital pin LED_BUILTIN as an output.
  pinMode(LED_BUILTIN, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  digitalWrite(LED_BUILTIN, HIGH); // turn the LED on (HIGH is the voltage level)
  delay(1000);                     // wait for a second
  digitalWrite(LED_BUILTIN, LOW);    // turn the LED off by making the voltage LOW
  delay(1000);                     // wait for a second
}
```

## Communication and control:

### Bluetooth communication between Devices

Data can be sent between the Smartphone terminal and the HC-05 Bluetooth module, with the data being seen on the PC serial terminal afterward.The smartphone needs the Bluetooth terminal application for data transmission and reception in order to communicate with the HC- 05 Bluetooth module. Bluetooth terminal programs for Android and Windows are available intheir respective app stores.




Bluetooth Module Serial Interface

So, when we wish to communicate with a smartphone using the HC-05 Bluetooth module, we connect it to a PC using a serial to USB converter. Before we can create communication between two Bluetooth devices, we need to first pair the HC-05 module with the smartphone. To pair the HC-05 with your smartphone, follow these steps: 1. Search for a new Bluetooth device with your phone. There's a

"HC-05" Bluetooth device that you can find. Select "Connect/Pair Device"; the HC-05's default pin is either 1234 or 0000.After pairing two Bluetooth devices, open terminal software (e.g., Teraterm, Realterm, etc.) on your PC and navigate to the port where we attached the USB to serial module. Also, select the default baud rate of 9600 bps. Open the Bluetooth terminal application on your smartphone and connect tothe linked device, HC-05.

It is simple to communicate; all we have to do is type in the Bluetooth terminal application on our smartphone. Characters will be transferred wirelessly to the Bluetooth module HC-05. The HC-05 will automatically send it serially to the PC, which the terminal will show. We can transfer data from a PC to a smartphone in a similar manner.

## Conclusion:

The development of multi-application robots in farming is a crucial step towards revolutionizing the agricultural industry, enabling farmers to increase efficiency, reduce labor costs, and improve crop yields. By integrating multiple functionalities, such as autonomous navigation, precision farming, crop monitoring, and harvesting, these robots can perform a wide range of tasks, from planting to harvesting, while also providing valuable insights on farm operations. With the potential to reduce environmental impact, improve decision-making, and enhance overall farm productivity, multi-application robots have the potential to transform the way we grow our food, making farming more sustainable, efficient, and profitable.

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