BLUETOOTH CONTROLLED DATA LOGGER ROBOT FOR SOIL TESTING

A MINOR PROJECT – II REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this **18ECP104L - Minor Project II** report " BLUETOOTH CONTROLLED DATA LOGGER ROBOT FOR SOIL TESTING **"** is the bonafide work of " **MUTHULAKSHMI M (927621BEC130) , MONISHA A (927621BEC129) , NANDHINI G (927621BEC131) , NAVANEETHA S (927621BEC134)** " who carried out the project work under my supervision in the academic year 2022-2023 – EVEN.

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PROJECT COORDINATOR

INSTITUTION VISION AND MISSION

Vision

To emerge as a leader among the top institutions in the field of technical education.

Mission

M1: Produce smart technocrats with empirical knowledge who can surmount the global challenges.

M2: Create a diverse, fully -engaged, learner -centric campus environment to provide quality education to the students.

M3: Maintain mutually beneficial partnerships with our alumni, industry and professional associations

DEPARTMENT VISION, MISSION, PEO, PO AND PSO

Vision

To empower the Electronics and Communication Engineering students with emerging technologies, professionalism, innovative research and social responsibility.

Mission

M1: Attain the academic excellence through innovative teaching learning process, research areas & laboratories and Consultancy projects.

M2: Inculcate the students in problem solving and lifelong learning ability.

M3: Provide entrepreneurial skills and leadership qualities.

M4: Render the technical knowledge and skills of faculty members.

Program Educational Objectives

PEO1: Core Competence: Graduates will have a successful career in academia or industry associated with Electronics and Communication Engineering

PEO2: Professionalism: Graduates will provide feasible solutions for the challenging problems through comprehensive research and innovation in the allied areas of Electronics and Communication Engineering.

PEO3: Lifelong Learning: Graduates will contribute to the social needs through lifelong learning, practicing professional ethics and leadership quality

Program Outcomes

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1: Applying knowledge in various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of Engineering application.

PSO2: Able to solve complex problems in Electronics and Communication Engineering with analytical and managerial skills either independently or in team using latest hardware and software tools to fulfil the industrial expectations.

Abstract	**Matching with POs, PSOs**
Arduino UNO,DHT11 Sensor,Soil Moisture sensor	PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO8,PO9,PO10,PO11,PO12,PSO1,PSO2

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ABSTRACT

Agriculture is the most important occupation for the most of the Indian families. It plays vital role in the development of agricultural country. In India, agriculture contributes about 16% of total GDP and 10% of total exports. Soil is the main resource for Agriculture. A Bluetooth controlled data logger robot for soil testing would be a robot equipped with sensors to measure various soil properties such as moisture, temperature, and PH. The robot would use Bluetooth technology to communicate with a nearby device, such as a smartphone or computer, to collect and store data. The robot could then transmit this data to the device for analysis, allowing for efficient and accurate monitoring of soil conditions. This type of robot could be useful for agriculture, environmental research, and other applications where monitoring soil conditions is important. This robot can be controlled with a smartphone using Bluetooth through an Android app. Its three sensors can measure four parameters: temperature, humidity, soil moisture, and ambient light intensity in greenhouses, farms, gardens, parks, etc. Usually robots like robotic hand, agriculture robot, fire-fighting robot, spy robot, snake robot, humanoid, bomb (or mine) diffusing robot operate automatically without any human intervention or are remote- controlled. Remote-controlled robots are mostly wireless. This project provides an solution for testing of soil.

KEYWORDS — Arduino UNO , Soil moisture sensor, Temperature and Humidity sensor

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LIST OF ABBREVIATIONS

ACRONYM		ABBREVIATION
IDE	-	Integrated Development Environment
USB	-	Universal Serial Bus
I/O	-	Input/output
Tx	-	Transmitter
Rx	-	Receiver
VCC	-	Voltage source
GND	-	Ground

CHAPTER 1
INTRODUCTION

Agriculture is the major source of income for the largest population in India and is major contributor to Indian economy. However, technological involvement and its usability have to be grown still and cultivated for agro sector in India. Although few initiatives have also been taken by the Indian Government for providing online and mobile messaging services to farmers related to agricultural queries and agro vendor's information to farmers. Based on the survey it is observed that agriculture contributes 27% to GDP, and Provides employment to 70% of Indian population.

The agriculture must overcome expanding water deficiencies, restricted availability of lands, while meeting the expanding consumption needs of a world population. New innovative applications are addressing these issues and increasing the quality, quantity, sustainability and cost effectiveness of agricultural production. Agriculture is the backbone of Indian Economy. In today's world, as we see rapid growth in global population, agriculture becomes more important to meet the needs ofthe human race. However, agriculture requires good soil for the cultivation of plants. Bluetooth controlled Robot car is controlled by using Android mobile phone , the same robot car canalso be used to control via gesture, obstacle and rf etc. An application has to be downloaded from play store to control the car in forward, backward, left and right directions. This robot can be controlled with a smartphone using Bluetooth through an Android app.Its three sensors can measure four parameters: temperature, humidity, soil moisture, and ambient light intensity in greenhouses, farms, gardens, parks,etc. The purpose of this system is to make the results accurately meanwhile avoiding the physical barriers in the path. Once the device set with everything then it is automatically tests and reports back without human intervention.

This can be done with the help of an Arduino Microcontroller board and with some sensors to sense the soil parameters and some communication modules to facilitate the proposed automated soil tester. The main objective is to speed up the working process through the device developed. Also, making more accurate measurements is another task of this system. Therefore, we can produce better results faster. Automation of soil testing will provide an easy mechanism than the existing testing methods. In this modern world, people prefer to do their work using machines because of the facilitated world of work. Hence, this soil testing with hardware device will reduce the need for human resources

CHAPTER 2
LITERATURE SURVEY

2.1 Bluetooth Controlled Farm Robot

The paper number [4] presents a streamlined approach to future Precision Autonomous Farming (PAF). It focuses on the preferred specification of the farming systems including the farming system layout, sensing systems and actuation units such as tractor-implement combinations. The authors propose the development of the Precision Farming Data Set (PFDS) which is formed off-line before the commencement ofthe crop cultivation and discusses its use in accomplishing reliable, cost effective and efficient farming systems.

The work currently is in progress towards the development of autonomous farming vehicles and the results obtained through detailed mathematical analysis of example actuation units. The reference paper [5] addresses the advanced weed control system which improves agriculture processes like weed control, based on robotic platform. They have developed a robotic vehicle having four wheels and steered by dc motor. The machine controls the weed in the firm by considering particular rows per column at fixed distance depending on crop. The obstacle detection problem has also been considered, sensed by sensors.The whole algorithm, calculation, processing, monitoring was designed with motors &sensors.

The reference paper [6] addresses the current scenario of the world, as most of the countries do not have sufficient skilled manpower specifically in agricultural sector it affects the growth of developing countries. So they have made an effort to automate the agricultural sector to overcome this problem. An innovative idea of their project was to automate the process of sowing crops such as sunflower, baby corn, groundnut and vegetables like beans, lady's finger, pumpkin and pulses like black gram, green gram etc. to reduce the human effort and increase the yield. The plantations of seeds are automatically done by using DC motor. The distance between the two seeds are controlled and varied by using Microcontroller. Itis also possible to cultivate different kinds of seeds with different distance. When the Robot reaches the end of the field the direction can be changed with the help of remote switches. The whole process is controlled by Microcontroller.

The reference paper [7] addresses the advanced system which improves agriculture processes like cultivation on ploughed land, based on robotic platform. They developed a robotic vehicle having four wheels and steered by DC motor. The advanced autonomous system architecture gives the opportunity to develop a complete new range of agricultural equipment based on small smart machines. The machine will cultivate the farm by considering particular rows and specific column at fixed distance depending on crop. The obstacle detection problem will also be considered, sensed by infrared sensor. The whole algorithm, calculation, processing, monitoring are designed with motors & sensor interfaced with microcontroller. The result obtained through example activation unit is alsopresented.

2.2 Automated Soil Tester

A research of "Wireless Monitoring of Soil Moisture, Temperature & Humidity Using ZigBee in Agriculture" is done by Chavan and others in 2014 [3]. The research objective is "Monitoring agricultural environment for various factors such as soil moisture, temperature, and humidity along with other factors can be of significance". However, they used LM35 temperature sensor for their prediction. But, in our system, the DS18B20 temperature sensor is used with ±0.5 ◦C accuracy and waterproof which is better and accurate than LM35. Boopathy and others has done another research on "Implementation of Automatic Fertigation System by Measuring the Plant Parameters" [4].

The objective of the research is to monitor the necessary parameters of agriculture in the horticulture field such as pH, temperature, moisture of the soil. Here, they test the pH by making a liquid soil mixed solution, which is a complicated mechanism when its comes to automation. The proposed system uses a unique customized mechanism to measure the pH in the field. The other study is monitoring the soil using wireless system [5]. The objective of the study is to monitor the level of the soil water content. However, the study says that the researchers are using the EC-5 moisture sensor for moisture analysis and low powered nRF24L01 wireless transceiver with MPC82G516A microcontroller. They test only the moisture of the soil which is not enough to make decision in crop selection and other aspects. We can use low-cost sensor rather than the above mentioned sensors.

Our device is capable of reading all the needed parameters of the soil on the field which immensely helps to make better decision. There is a paper which discusses about controlling the temperature in tea leaves preparation using Arduino Uno and Android

App [6]. The objective of the work is to control the temperature of the chamber in different stages of drying. The researchers are using an Arduino Uno board, HC05 Bluetooth module, LM35 temperature sensor and android based terminal application for this purposes. The monitoring of humidity is one of the other research that have been done in 2011 [7]. The objective of the work is to obtain environmental humidity and temperature information. A combination of humidity and the temperature sensor is used to sense the humidity and temperature information of the environment, and also PCI bus based data acquisition card is used for data collection. There was another study made by Bugai et al. in guiding an automated soil tester using GPS [8]. The aim of the study is to develop and implement a GPS (Global Positioning System) guided automated soil testing device. They have used comprised of a Perspex base, battery pack, servo motors, Unbox GPS module and an ATMega328 Arduino microcontroller. Here they concluded with a drawback of time-consuming to move the Automated Soil Tester between the given points. The velocity is around 0.8 m/s.

However, in the proposed project the time consumption problem has been solved with effective pathfinding algorithm. The digital compass and an efficient GPS module have been used in some GPS guided Automated Soil Tester according to [9–12]. Therefore, the digital compass is used in the proposed system for further enhancement of navigation. The soil sampling techniques were learned from the study [13] which discuss about characterizing and recognizing soil sampling strategies. The algorithm for path planning for the movement of robots is published by Yuksel and Sezgin in 2005 [14]. Their objective is to find the shortest and the low cost path from the given map. Those studies focus on Breadth-first, Dijkstra, and A* algorithms and examine them to use in automated navigation of robot. The above mentioned mechanisms has been taken as basic guideline for finding the path in the proposed system to guide the automated soil tester in the field. The web page on the hosting server can do some operations like read and update data in database. So, the Wi-Fi module has been used for this purpose which has been discussed in the smart home project [14]. Finally, based on the techniques discussed in the literature, it has been decided to use Arduino UNO microcontroller with a DS18B20temperature, Ph and moisture sensors to measure the soil parameters. Further, the GPS module and digital compass are used to navigate the automated soil tester to the given points using a dedicated pathfinding algorithm. Wi-Fi module is fixed with the system to transfer the data from the automated soil tester to the local web server [14]. The local webserver will export the read parameters into a centralized database.

CHAPTER 3
EXISTING SYSTEM

3.1 Bluetooth Controlled Farm Robot

Robotics is a fascinating field of engineering that provides many opportunities for research. In addition, the evolution of technology in recent years has led to intelligent mobile robots. They can be sent in hard places instead of humans either because they are dangerous, either because they are difficult to access. The control of these robots, however, is a difficult task that involves knowledge in different areas such as robotics, automation, programming, electronics, etc. This project strives to develop a robot capable of performing operations like automatic ploughing, seed dispensing, fruit picking and pesticide spraying. For manual control the robot uses the Bluetooth pairing app as control device and helps in the navigation of the robot outside the field. Farmers today spend a lot of money on machines that help them decrease labor and increase yield of crops but the profit and efficiency are very less. Hence automation is the ideal solution to overcome all the shortcomings by creating machines that perform one operations and automating it to increase yield on a large scale. Robotics is the branch of technology that deals with the design, construction, operation, structural depositions, manufacture and application of robots. Robotics brings together several very different engineering areas and skills. Robotics is related to the science of electronics, Engineering, mechanics, mechatronics, and software.

3.2 Automated Soil Tester

Automation is a process which performed without the human intervention. Automation is the way to reduce the human workload and make the job easier and effective. Many industries adopt the variety of automation techniques and deliver the zero defect quality product efficiently. Only a limited number of contributions from computer science is given to agriculture. The agriculture is the base of the human survival. Mankind must ensure the food production at a satisfactory level always. However, there is a potential problem that the human involvement in agriculture is continually decreasing over the years [1].

Automation is one of the solutions to overcome this problem. There are many phases in agriculture, this work especially on how the soil testing can be done without the human involvement in the field. Soil plays a vital role in agriculture by making the crop healthy with more yields. “Soil contain many kinds of nutrients, such as water, air and living organisms that help to create healthy and sustainable gardens and landscapes” [2]. We can improve these qualities by assessing the soil through soil testing and it will give us the soil’s pH, acidity, temperature, electrical conductivity (EC) and soil moisture. There are variety of soil types spread all over the island such as chalky, peaty, sandy, clay, silty and loamy. The soil is made out of 45% of minerals, 25% of water, 25% of air and 5% of organic matters. The suitable soil types are varying crop to crop. Selection of perfect soil according to the crop is an important process in agriculture. The soil from different field must be tested with random samples to determine the type and to select perfect crop according to the parameters learned [3]. It is important to do soil testing to increase the quality of cultivation and to make more yield. The automated soil testing plays a vital role in agriculture rather than the traditional one which solves these kinds of problems. The computer scientist must ensure the contribution of computer science in the agriculture like they do in production, service and other commercial fields. Soil testing is one of the big tasks in agriculture which can be managed using automation techniques with the help of computational methods. The soil properties can be measured with a guided automated soil tester assembled with needed sensors and actuators.

The automated soil testing mechanism may increase the accuracy of the test results and also make the task easy. There are many challenges in developing an automated soil tester to test the soil. The work planned is to do a cost-effective automated guided vehicle to test the soil. We planned to use the Global Positioning System (GPS) sensor to guide the automated soil tester to navigate and test on the desired points (coordinates) of a given filed. Further, we decided to sense the pH using a custom designed mechanism. Recently, there are some research being carried out which explores the possibility for automated soiltesting system, to achieve higher accuracy with least cost.

CHAPTER 4
PROPOSED SYSTEM

Usually, the soil test is performed manually by the experts with a lot of expensive and complex devices or equipment. The manual soil testing mechanism is a challenging task as the processes need to handle much equipment in an awkward and uncomfortable agricultural field. The soil tester (Human) must pick different random locations and record the parameters for further analysis. Automated soil testing device makes the soil testing task easy and gives more number of samples with accurate measurements. The automated soil tester may reach even the places that can’t be efficiently reached by human [4]. Obviously,people who involved in the soil testing process are facing some drawbacks in traditional methods. The traditional soil testing method takes long time to calculate the results. Because, the soil samples are brought to the laboratory for testing purposes. The farmers should wait to plant until they get the final results from the laboratory. Only the experts canhandle the traditional system with the aid of complicated equipment. There are lots of paperworks, and also it is difficult to keep all the records manually for future references Some experts test the soil by touching with their thumb that means they do the visible testing according to the soil color and also tries to feel it through their bare thumb. So they need more experience to predict the results and which may have more chances to give standard errors. Traditionally, the extracted samples were analyzed using different methods for different nutrients and minerals. Many laboratories are using sophisticated instruments that can analyze many nutrients simultaneously. Proving ring, sieve shaker, test sieves, hot plateare some of the equipment traditionally used in a soil testing laboratories.

There are different types of wireless remote-controlled robots like:Fire-fighting robots, which are used as fire extinguishers for spraying water or cardon-dioxide on fire,Bomb (mine) diffusing robots, which are used to diffuse live bombs or mines in a battlefield,Snake robots, which can enter small tunnels or pipelines for search and rescue operations or to find out any problem like leakage in pipelines This robot monitors the ambient parameters in a field. The operator can manoeuvre the robot in a radius of 10 to 30 metres and take measurements to select the best place for plantation. And if plantation is already done, the above-mentioned four parameters can be checked to see whether these are within the threshold levels or not for taking any corrective actions.This project can be modified for some other applications also by just changing the sensors. For example, by equipping the robot with MQ2, MQ3 or similar gas sensors, it can be used to detect leakage of any gas like cardon-dioxide, methane, or LPG.

CHAPTER 5
CIRCUIT AND OPERATION

The circuit operation starts when 12V battery is connected to Arduino Uno board and L293D chip. Initially, both motors (M1 and M2) are at rest and so the robot is also at rest. The servo motor (M3) is at 0° position and soil moisture sensor is in upward position.To move the robot in any direction, command is required from smartphone through Bluetooth based Android application, called Bluetooth Terminal HC-05 by mightyIT.. Enter passkey 1234 or 0000the first time to pair with HC-05 module.

Now you can send commands from the smartphone to robot to move using the app. Following commands given in the table are used to move the robot (all these commands are already set in Android application):When any of the above commands is sent (by sending the character in capital letter), it is received by HC-05 module. The module furthergives this command to Arduino serially through its Tx-Rx pins. Arduino gets this command and compares it with set commands. If they match, the robot moves in the desired direction. Once robot is in motion, it keeps moving (within the range) until command ‘S’ issent to stop it. When robot stops, it moves the servo motor by 90° so that soil moisture sensor can go down into the soil to capture soil moisture value. At the same time, it starts reading sensor values from DHT11 and LDR. It reads analogue voltage output from soil moisture sensor and LDR and converts it to the range of 0-100%. It also reads digital valuesof temperature and humidity from DHT11 sensor. Robot transmits all four values of these sensors to the smartphone through Bluetooth module. It keeps transmitting these values every three seconds till it is stopped by pressing ‘S’ command.. Thus it gives an idea of ambient temperature, humidity, soil moisture, and light intensity in the area. Operation of the circuit is controlled by the program embedded in Arduino Uno microcontroller ATMega328.

Command	Robot Movement
F	Move Forward
R	Move Right
L	Move Left
B	Move Backward
s	Stop Movement

Table .No: 5.1 Robot Movement Comments

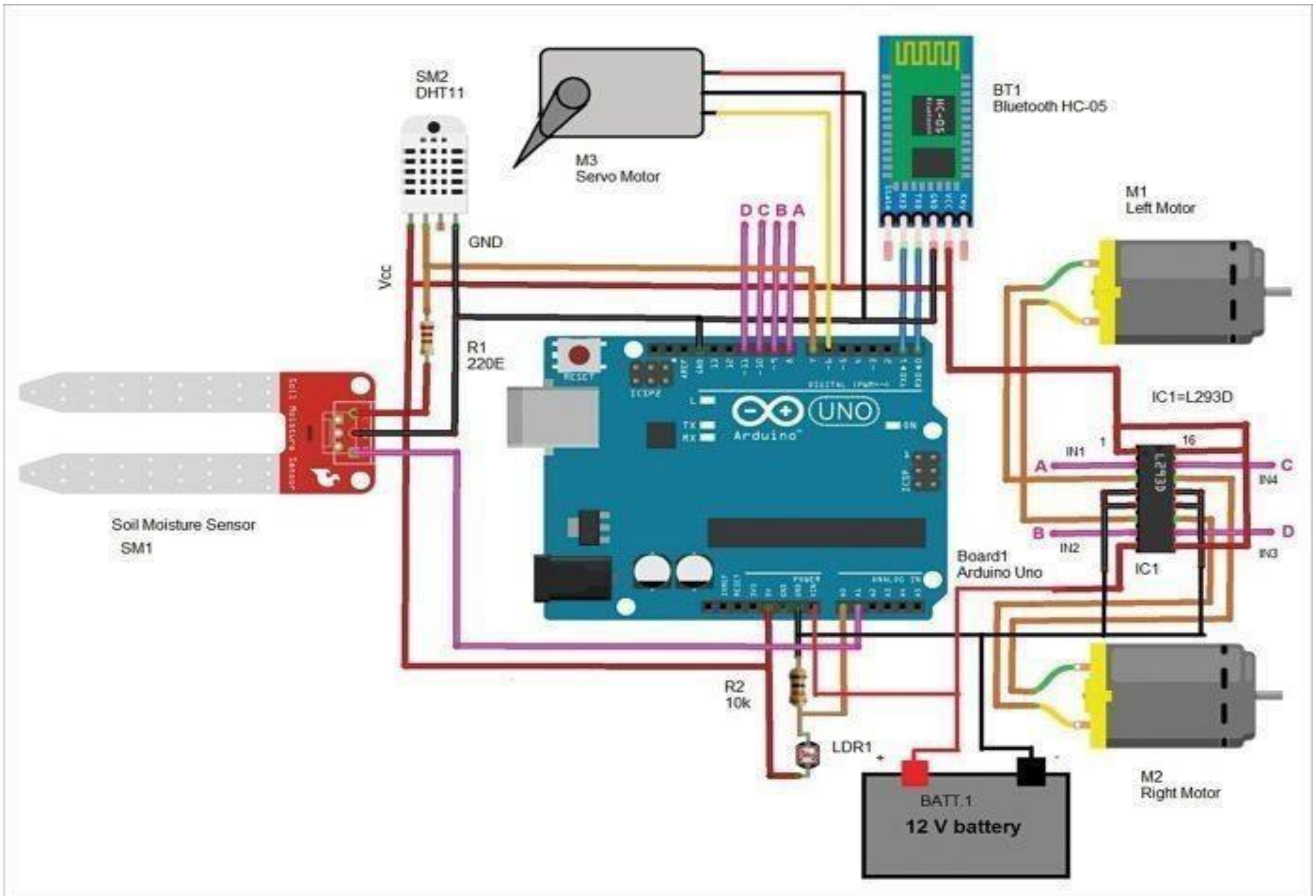

Fig No:5.1 Circuit Diagram

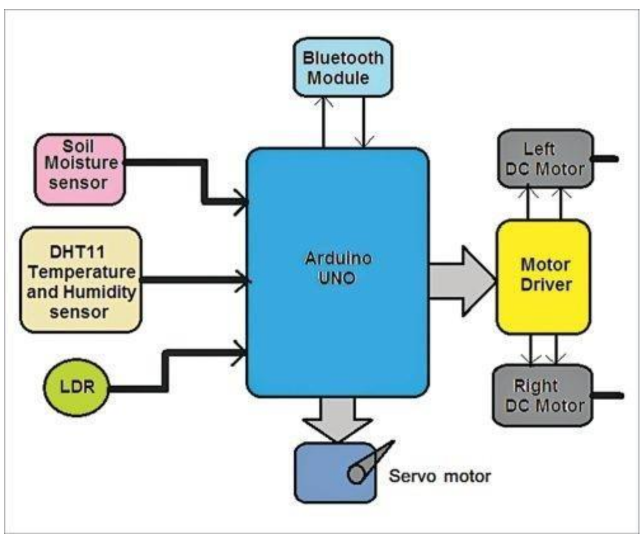

Fig No:5.2 Block Diagram

CHAPTER 6
SOFTWARE REQUIREMENT

The program code (BT_controlled_robot.ino) is written in Arduino programming language. It was tested using Arduino IDE version 1.8.18. Before compiling and uploading the code, make sure you include the relevant libraries, such as DHT_sensor_library-1.4.2 and DHT sensor library version 1.4.3. During testing it was found that without these libraries the code could not be compiled.

Before building the robot, let us first understand its working through the system block diagram shown in Fig. 1 and the circuit diagram in Fig. 2. The major building blocks of the system include the three sensors (soil moisture, DHT11 temperature and humidity sensor, and LDR), an Arduino Uno development board, Bluetooth module HC- 05, DC servo motor, two DC gear motors, and motor driver chip L293D. Let us first understand the role of the major components used in the project.

Arduino IDE is an application that is used to write codes and uploads them to the Node MCU board. In this project, Arduino IDE is used for coding, debugging, and testingthe functionalities of the IOT smart Home Automation system and its components. Arduino IDE has other features, such as a debugging area in case of abnormal conditions to support various Arduino boards, additional libraries, and a serial monitor for communicating with the board. Arduino libraries are usually expressed as dot CPP files based on software abstraction called wiring Arduino uses the bits of C and C++,but the general flow and structure of the code are heavily based around C.

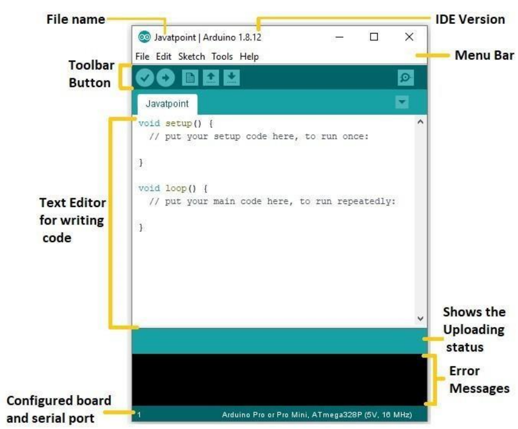

Fig .No: 6.1 Arduino IDE

CHAPTER 7
ARDUINO UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc and initially released in 2010. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltagesbetween7 and 20 volts.

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can communicate with software running on your computer (e.g. Flash, Processing.) The boards can be assembled by hand or purchased preassembled; Then the 12v Ac supply is converted into the 12v dc supply using bridge rectifier.1000uf capacitor is used to change the pulsating dc into pure dc.5v dc output is taken from the voltage Regulator-7805, which consists of 3 pins.

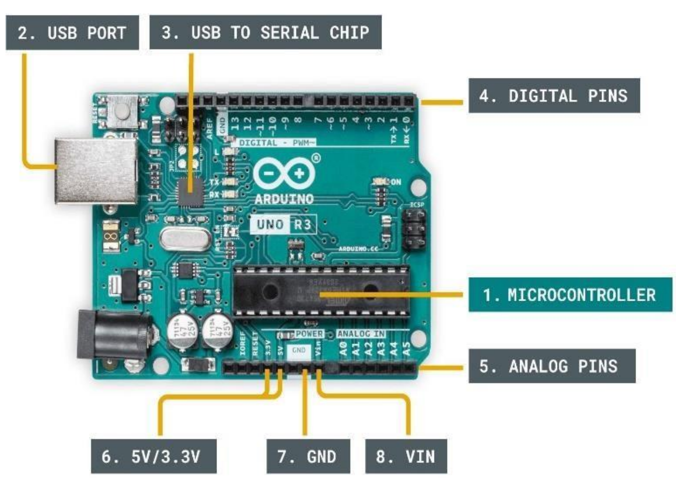

Fig .No: 7.1 Arduino board

CHAPTER 8
HC 05 BLUETOOTH MODULE

The HC-05 is an easy to connect and easy to used Bluetooth module, which is designed for wireless serial connection. The Bluetooth module can be used as master or slave configuration, making it best solution for wireless connection or communication. This module is version Bluetooth communication technology which is great for transferring and receiving data in fast rate

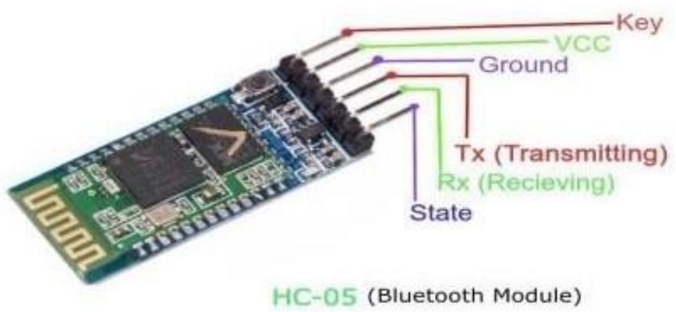

Fig .No: 8.1 HC 05 Bluetooth module

CHAPTER 9
MOTOR DRIVER L293D

Motor driver L293D (IC1) provides sufficient voltage and current to both the motors to rotate them. It amplifies the output of Arduino board (Board1) and drives the motors. The DC motors (M1 and M2) drive left and right wheels of the robot and move it forward, backward, left, and right.

The L293D is a popular 16-Pin Motor Driver IC. As the name suggests it is mainly used to drive motors. A single L293D IC is capable of running two DC motors at the same time; also the direction of these two motors can be controlled independently. So if you have motors which has operating voltage less than 36V and operating current less than 600mA, which are to be controlled by digital circuits like Op-Amp, 555 timers, digital gates or even Microcontrollers like Arduino, PIC, ARM etc..

PIN NUMBER	PIN NAME	DESCRIPTION
1	Enable 1,2	This pin enables the input pin Input 1(2) and Input 2(7)
2	Input 1	Directly controls the Output 1 pin. Controlled by digital circuits
3	Output 1	Connected to one end of Motor 1
4	Ground	Ground pins are connected to ground of circuit (0V)
5	Ground	Ground pins are connected to ground of circuit (0V)
6	Output 2	Connected to another end of Motor 1
7	Input 2	Directly controls the Output 2 pin. Controlled by digital circuits
8	Vcc2(Vs)	Connected to Voltage pin for running motors (4.5V to 36V)
9	Enable 3,4	This pin enables the input pin Input 3(10) and Input 4(15)
10	Input 3	Directly controls the Output 3 pin. Controlled by digital circuits.
11	Output 3	Connected to one end of Motor 2.
12	Ground	Ground pins are connected to ground of circuit (0V).
13	Ground	Ground pins are connected to ground of circuit (0V).
14	Output 4	Connected to another end of Motor 2.
15	Input 4	Directly controls the Output 4 pin. Controlled by digital circuits
16	Vcc1(Vss)	Connected to +5V to enable IC function.

Table.No: 9.1 L293D Pin Configuration

Fig.No:9.1 L293D Pin Diagram

Features of L293D

- Can be used to run Two DC motors with the same IC.
- Speed and Direction control is possible
- Motor voltage Vcc2 (Vs): 4.5V to 36V
- Maximum Peak motor current: 1.2A
- Maximum Continuous Motor Current: 600mA
- Supply Voltage to Vcc1(vss): 4.5V to 7V
- Transition time: 300ns (at 5Vand 24V)
- Automatic Thermal shutdown is available
- Available in 16-pin DIP, TSSOP, SOIC packages

CHAPTER 10
SOIL MOISTURE SENSOR

Soil moisture sensors measure or estimate the amount of water in the soil. These sensors can be stationary or portables such as handheld probes. Stationary sensors are placed at the predetermined locations and depths in the field, whereas portable soil moisture probescan measure soil moisture at several locations. The SM1 soil moisture probe is an extremely flexible system, offering capacitance based measurement of soil moisture plus temperature monitoring. Available in a in a variety of lengths, from 30cm to 150cm, the SM1 features one soil Moisture sensor every 10cm.

Soil moisture sensor (SM1) is attached to servo motor (M3) shaft. This motor moves the sensor up and down to insert it into the soil to check soil moisture content.

HC-05 module operates on 5V received from the Arduino board. It communicates with Arduino board with USART pins Tx (D1) – Rx (D0). So, its Tx pin is connected to Rx pin of Arduino board and vice versa.

0-10 cb (kPa)	Saturated soil.
10-30 cb (kPa)	Soil is adequately wet
30-60 cb (kPa)	Usual range for irrigation
60-100 cb (kPa)	Usual range for irrigation in heavy clay.

Table.No: 10.1 Soil Moisture Range

The Soil Moisture Sensor measures soil water status in centibars (cb) or kilopascals (kPa) of soil water tension. This value represents the energy a plant's root system uses todraw water from the soil.

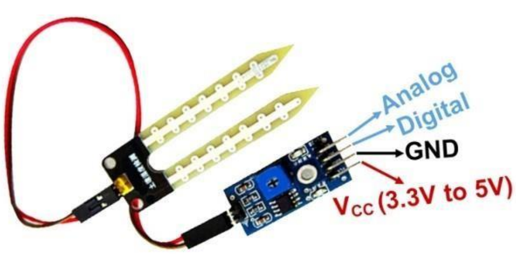

Fig.No:10.1 Soil Moisture Sensor(SM1)

CHAPTER 11
DHT11 SENSOR

DHT11 sensor also gets its 5V supply from Arduino board. Its digital output is connected to digital pin D7 of Arduino.

The analogue output of soil moisture sensor (SM1) is connected to analogue input pin A1 of Arduino board. Its 5V supply also comes from Arduino board.LDR1 is configured in pulled-down mode with 10-kilo-ohm pull-down resistor. Its analogue output is given to analogue input pin A0 of Arduino board.

Digital pins D8, D9, D10, D11 of Arduino board drive DC motors M1 and M2 using L293D chip. These pins are connected to inputs of L293D, and two motors are connected to output of the chip. Servo motor signal (sig) input is connected to PWM output pin D6 of Arduino board. The motor gets 5V supply from Arduino board. The motor supply pin Vss of L293D (pin 8) gets 12V from battery. The Arduino board also gets 12V input at its Vin pin from battery. That is, Vin pin gets 12V input and gives 5V output to all other components

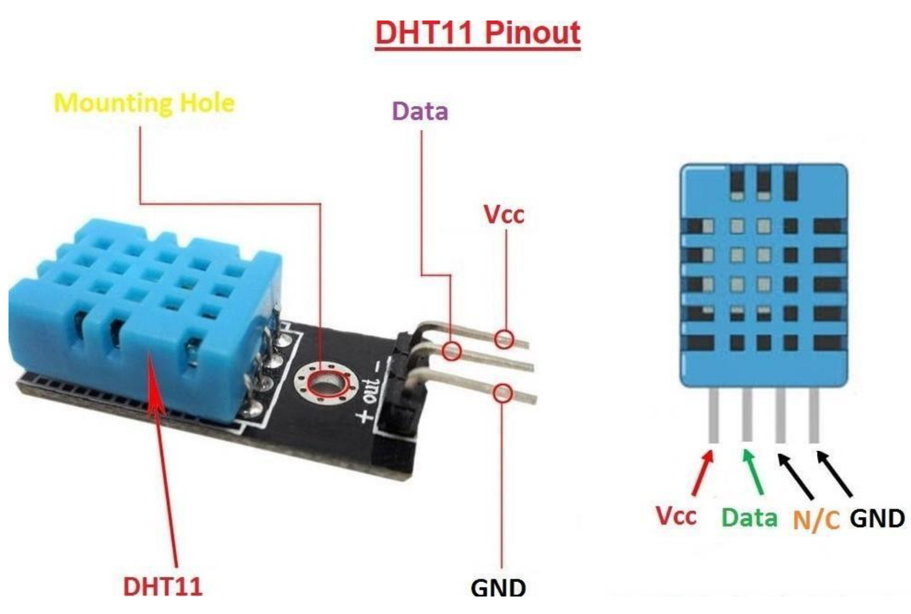

Fig.No:11.1 DHT11 Sensor

CHAPTER 12
RESULT AND DISCUSSION

The circuit can be assembled on a breadboard or general-purpose PCB. On connecting the circuit to a 12V DC supply, the onboard LED on Bluetooth HC-05 will start blinking at a fast rate. When you pair it successfully with your Bluetooth app in your mobile phone, the LED will blink at a slower rate (two blinks per second). Open the Bluetooth Terminal HC-05 app from the mobile phone, select HC-05 again.

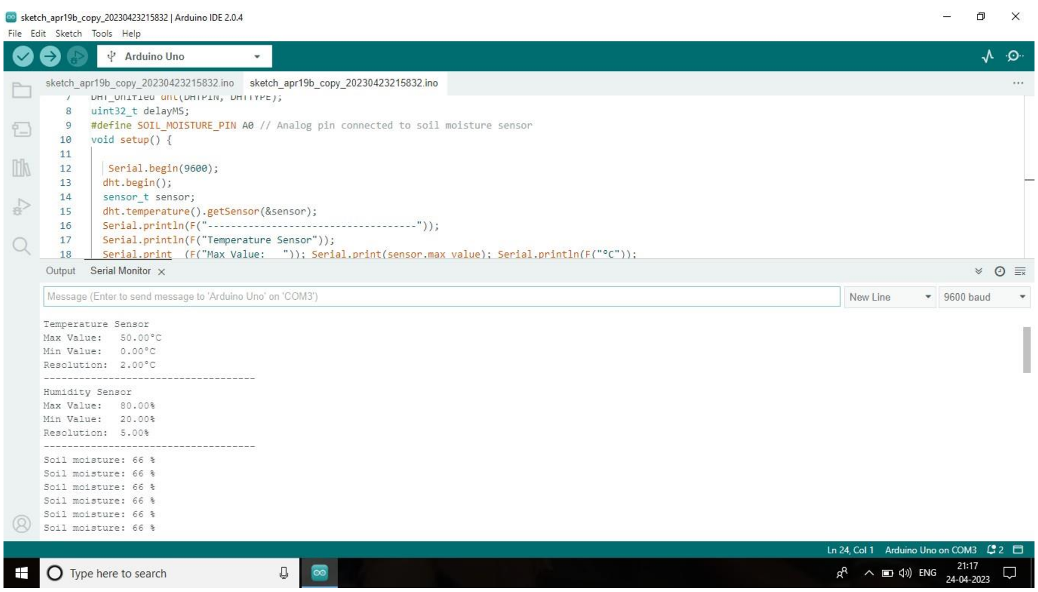

Fig No:12.1

Soil moisture sensor SM1 should be properly fixed to the servo arm/horn using either glue gun or screws. When servo motor pulls out soil moisture sensor from the soil, you can see the moisture level drastically reduces to 5, as shown in Fig. 7.1 indicating that the sensor is out of the soil.

CHAPTER 13
CONCLUSION

1. As too much of sensors and things can make the system bulky and heavy, with further studies the model can be made lighter in weight.
2. In upcoming future the robot can be made fully automatic i.e. the robot will not require any operator.
3. Soil tests are used to determine the soil's nutrient level and pH content. Armed with this information, farmers can define the quantity of fertiliser and the exact type that is needed for application to improve the soil on your farm. This is essential because fertile soils are necessary to grow healthy crops.

CHAPTER 14
APPENDIX

CODE

```
#include "DHT.h"
#include <SoftwareSerial.h>

#define DHTPIN 2     // Digital pin connected to the DHT sensor

#define DHTTYPE DHT11   // DHT 11
#define RX 4
#define TX 3
int sensor_pin = A0;

int output_value ;


DHT dht(DHTPIN, DHTTYPE);

String AP = "Keerthi";       // AP NAME
String PASS = "xxxxxxxx"; // AP PASSWORD
String API = "AD6XYRVGGV5KC63Y";   // Write API KEY
String HOST = "api.thingspeak.com";
String PORT = "80";
String field = "field1";
int countTrueCommand;
int countTimeCommand;
boolean found = false;
int valSensor = 1;
SoftwareSerial esp8266(RX,TX);

void setup() {
  Serial.begin(9600);
  Serial.println(F("dht test!"));
  dht.begin();
  Serial.begin(9600);
  Serial.println("Reading From the Sensor");
  delay(2000);
```

```
  Serial.begin(9600);
  esp8266.begin(115200);
  sendCommand("AT",5,"OK");
  sendCommand("AT+CWMODE=1",5,"OK");
  sendCommand("AT+CWJAP=\""+ AP +"\",\""+ PASS +"\"",20,"OK");
}

void loop() {
  delay(2000);
  float h = dht.readHumidity();
  float t = dht.readTemperature();
  float f = dht.readTemperature(true);
  if (isnan(h) || isnan(t) || isnan(f)) {
    Serial.println(F("Failed to read from DHT sensor!"));
    return;
  }

  float hif = dht.computeHeatIndex(f, h);
  float hic = dht.computeHeatIndex(t, h, false);

  Serial.print(F(" Humidity: "));
  Serial.print(h);
  Serial.print(F("% Temperature: "));
  Serial.print(t);
  Serial.print(F("C "));
  Serial.print(f);
  Serial.print(F("F Heat index: "));
  Serial.print(hic);
  Serial.print(F("C "));
  Serial.print(hif);
  Serial.println(F("F"));
    output_value= analogRead(sensor_pin);

   output_value = map(output_value,550,0,0,100);

   Serial.print("Mositure : ");

   Serial.print(output_value);

   Serial.println("%");
```

```
  delay(1000);
   valSensor = getSensorData();
 String getData = "GET /update?api_key="+ API +"&"+ field +"="+String(valSensor);
 sendCommand("AT+CIPMUX=1",5,"OK");
 sendCommand("AT+CIPSTART=0,\"TCP\",\""+ HOST +"\","+ PORT,15,"OK");
 sendCommand("AT+CIPSEND=0," +String(getData.length()+4),4,">");
 esp8266.println(getData);delay(1500);countTrueCommand++;
 sendCommand("AT+CIPCLOSE=0",5,"OK");
}

int getSensorData(){
  return random(1000); // Replace with your own sensor code
}

void sendCommand(String command, int maxTime, char readReplay[]) {
  Serial.print(countTrueCommand);
  Serial.print(". at command => ");
  Serial.print(command);
  Serial.print(" ");
  while(countTimeCommand < (maxTime*1))
  {
    esp8266.println(command);//at+cipsend
    if(esp8266.find(readReplay))//ok
    {
      found = true;
      break;
    }

    countTimeCommand++;
  }

  if(found == true)
  {
    Serial.println("OYI");
    countTrueCommand++;
    countTimeCommand = 0;
  }

  if(found == false)
  {
    Serial.println("Fail");
```

```
    countTrueCommand = 0;
    countTimeCommand = 0;
  }

  found = false;
}
```

CHAPTER 15
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OUTCOME

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small error can be achieved using the proposed design.

Keywords - Radar, Ultrasonic waves, , Servo motor, Distance and angle measurement

PAPER ID: I151

DESIGN AND SIMULATION OF FREQUENCY SELECTIVE SURFACE (FSS) ANTENNA USING HFSS

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Abstract - Frequency selective surfaces (FSSs) are traditionally formed by two-dimensional periodic arrangement of metallic elements on a dielectric substrate. Depending on the geometry and arrangement of the metallic unit cell, the array might show different functionalities such as band-pass or band-stop spatial filter, absorber, reflect array, and so on. Metamaterials inspired frequency selective surfaces operate based on a different principle that allows superior performance over the traditional structures. For instance, instead of using fully resonant elements as the unit cell of the FSS, nonresonant unit cells with small dimensions are used. The electrical size of the unit cells is decreased to less than l/4 and even in some cases smaller than l/10. These miniaturized elements act as lumped capacitors or inductors and are arranged in a way that they couple to the incident electromagnetic wave. An advantage of this type of FSS is that its frequency behavior can be accurately modelled using lumped element circuit model. Therefore, FSSs with specified functionalities can be designed by the aid of standard circuit-based filter theory. Furthermore, other metamaterials inspired FSSs with different improved functionalities and tunability have also been designed and implemented, such as low-profile second-order band-pass FSS, dual band FSSs with close band spacing, FSS with quasi-elliptical frequency response, and FSSs for high-power microwave and terahertz applications. This chapter will review the progress of the metamaterials inspired FSSs.

Keywords - Antenna array, dual-polarized slot antenna, high isolation, low profile, stable gain, wide band.

PAPER ID: I152

BLUETOOTH CONTROLLED DATA LOGGER ROBOT FOR SOIL TESTING

Dr.Dinesh.E	*Muthulakshmi.M*	*Monisha.A*	*Nandhini.G*	*Navaneetha.S*
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Abstract - A Bluetooth controlled data logger robot for soil testing would be a robot equipped with sensors to measure various soil properties such as moisture, temperature, and pH. The robot would use Bluetooth technology to communicate with a nearby device, such as a smartphone or computer, to collect and store data. The robot could then transmit this data to the device for analysis, allowing for efficient and accurate monitoring of soil conditions. This type of robot could be useful for agriculture, environmental research, and other applications where monitoring soil conditions is important. Bluetooth controlled Robot car is controlled by using Android mobile phone , the same robot car can also be used to control via gesture, obstacle and rf etc. An application has to be downloaded from playstore to control the car in forward, backward, left and right directions. This project provides an solution for testing of soil.

Keywords - Arduino UNO, LDR , Soil moisture sensor, Temperature and Humidity sensor

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Organizing Chair

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