A

Miniproject

Report on

ROBOTIC CAR FOR SMART IRRIGATION SYSTEMS

Submitted to

CHADALAWADA RAMANAMMA ENGINEERING COLLEGE

In partial fulfillment of the requirements for the award of the Degree of

BACHELOR OF TECHNOLOGY IN ELECTRONICS & COMMUNICATION ENGINEERING

By

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CHADALAWADA RAMANAMMA ENGINEERING COLLEGE

(AUTONOMOUS)

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2018-2022

CHADALAWADA RAMANAMMA ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Electronics & Communication Engineering

Certificate

This is to certify that the project work entitled **"ROBOTIC CAR FOR SMART IRRIGATION SYSTEMS"** is a bonafide work done by **B. SRIPATHI (18P11A0410),** in the Department of **"ELECTRONICS & COMMUNICATION ENGINEERING",** and submitted to ***Chadalawada Ramanamma Engineering College (Autonomous), Tirupati*** is a project work carried out by them under my guidance during the academic year 2020-2021.

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DECLARATION

We are hereby declare that the project work on **"ROBOTIC CAR FOR SMART IRRIGATION SYSTEMS"** done by us under the guidance of **Dr. P. SRINIVASA RAO,** M.Tech, Ph.D **in CHADALAWADA RAMANAMMA ENGINEERING COLLEGE (Autonomous)** is submitted in partial fulfillment of the requirements of the requirements of the award of Degree of Bachelor of Technology.

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that, we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea / data / fact / source in our project report submission.

Signature of the Student

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ABSTRACT

Wheel robotic for irrigation system is more suitable for such a dry lands, even and uneven lands. Here the microcontroller is plays the key role for moving all directions. For this project components are utilizes Arduino UNO microcontroller, chain wheel mechanism, electronic circuit, cardboard and Bluetooth module. It consists of four motors placed in four corners the motor can be controlled by microcontroller with wheel chain mechanism it moves in forward and backward direction. By using wheel chain mechanism for any kind of dry lands with loads can be moved from one place to another place. Here each motor can bear 0.35kgcm torque. In the absence of human, to provide surveillance for the field of implementation. By using this kind of mechanism able to avoid long pipeline and pipeline damages and also power consumption can be reduced by replacing the motors to supply the water to large areas by placing a water tank on a moving vehicle. But also can achieve better things by adding Some more components.

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ABBREVIATIONS

PWM	-	Pulse width modulation
OS	-	Operating system
PIC	-	Peripheral interface Controller
DC	-	Direct current
Rx	-	Receiving
Tx	-	Transmitting
LED	-	Light emitting diode
I/O	-	Input and output

CHAPTER 1

INTRODUCTION TO ROBOTIC VEHICLES FOR IRRIGATION

1.1 INTRODUCTION

Plants are a pleasing addition to any house or patio. At the very least, they add color and interesting shapes to a bland room. In the late 1980s, a study by NASA and the Associated Landscape Contractors of America (ALCA) resulted in excellent news for homeowners and office workers everywhere. This study concluded that common decorative houseplants such as bamboo palms, money plant, snake plant, ficus benjamina, Chinese evergreen and spider plants not only make indoor spaces more attractive but also help to purify the air we breathe by absorbing toxins and acting as little oxygen factories. They've also been proven to reduce stress. Plants simply make us feel better by easing mental fatigue and improving air quality. Therefore plants are an indispensable part of our life. Unfortunately, many plants die each year due to insufficient watering. We've all seen the brown, withered leaves about to fall off. Now a day, due to busy life routine owners either forget to take care of these precious possessions, or they just don't have time to take care about their watering needs. The watering techniques used till date are either, stagnant and not portable or they are very costly. In this case the "Plant Watering Autonomous Mobile Robot" will do the needful by providing a cost-effective solution to this problem. Moreover today, labor and security are the largest factors. More than 30% of the total production costs are spent on wages of the employees. These are the reasons why already many years ago, research was Our main aim is to use an moving robotic car which is operated wirelessly can carry loads to move for far distance to reduce the burden on humans in the fields like Gardens , Nurseries and some irrigation fields .

Moreover today, labor and security are the largest factors. More than 30% of the total production costs are spent on wages of the employees. These are the reasons why already many years ago, research was focused on the automation of the most tedious and repetitive tasks in horticultural (sustainable) activities and crop production.

By adding some smart features we can able to provide watering for plants and observation can be made possible in the field of implementation in our absence. Protection for humans from the harmful chemicals can be achieved.

Smartphone has quite changed the traditional ways of human to machine interaction. Smartphone is now a vital part of a person's life. Android is a software platform for mobile device that includes an operating system, middleware and key applications. Android is a safe and secure operating system. All of its essential tools are combined in software called SDK which stands for Software Development Kit. We know that all manual operations have been replaced by automated mechanical operations. Our main objective of writing this paper is to control the robot by sensing the temperature of the environment using Bluetooth app and view the direction of the car using mobile camera and also find the location of the robot. Bluetooth is used for its various advantages over other wireless technologies. Hardware technology utilized in smart phones has also greatly improved. Hence, we can say that Android smartphones will serve a great benefit for industrial, commercial and other general-purpose applications.

The DC motors are widely used for providing variable speed drive system in industrial applications resembling automation, electrical traction, military instrumentality, fixed disk drives, thanks to their high potency, noise-free operation, compactness, dependability and low maintenance and cost. Many connection technologies are used nowadays such as GSM, GPRS, Wi-Fi, WLANs and Bluetooth. Every technique has its own distinctive characteristics and applications. Among these wireless connections, Bluetooth and Wi-Fi technology is usually enforced. The system hardware consists of a controller equipped with Bluetooth communication module. It'll be connected to the motors and other alternative components of robotic car. When the robot app is turned on and is connected with the current system via Bluetooth, one will operate the Car by giving wireless commands from the app using the functions already programmed in the app. The vehicle will move all four told directions: left, right, front and back. For forward movement, movement of both the motors will be in the same direction and for backward motion; movement of the motors will be in opposite direction. For left and right

movements, either of the motors will rotate and to stop both the motors will stop. Instructions are given to the motors through the mobile app by the user.

1.2 HISTORY OF ROBITIC CAR FOR SMART IRRIGATION

The first development of robotics in agriculture can be dated as early as the 1920s, with research to incorporate automatic vehicle guidance into agriculture beginning to take shape. This research led to the advancements between the 1950s and 60s of autonomous agricultural vehicles. The concept was not perfect however, with the vehicles still needing a cable system to guide their path. Robots in agriculture continued to develop as technologies in other sectors began to develop as well. It was not until the 1980s, following the development of the computer that machine vision guidance became possible. Other developments over the years included the harvesting of oranges using a robot both in France and the US. While robots have been incorporated in indoor industrial settings for decades, outdoor robots for the use of agriculture are considered more complex and difficult to develop. This is due to concerns over safety, but also over the complexity of picking crops subject to different environmental factors and unpredictability.

1.3 DEMAND IN THE MARKET

There are concerns over the amount of labour the agricultural sector needs. With an aging population, Japan is unable to meet the demands of the agricultural labour market. Similarly, the United States currently depends on a large number of immigrant workers, but between the decrease in seasonal farmworkers and increased efforts to stop immigration by the government, they too are unable to meet the demand. Businesses are often forced to let crops rot due to an inability to pick them all by the end of the season. Additionally, there are concerns over the growing population that will need to be fed over the next years. Because of this, there is a large desire to improve agricultural machinery to make it more cost efficient and viable for continued use.

1.4 FARMING AND AGRICULTURE ROBOTS

- Crop-Harvesting Robots.
- Harvest CROO.
- Harvest Automation.

- Weeding Robots.
- Naio Technologies.
- Nexus Robotics.
- Robotic Greenhouses & Robot Farming.
- Iron Ox.

Figure 1.1: Weeding Robots

Figure 1.2: Aerial Imagery and Seed Planting Drones

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Plants are a pleasing addition to any house or patio. At the very least, they add colour and interesting shapes to a bland room. In the late 1980s, a study by NASA and the Associated Landscape Contractors of America (ALCA) resulted in excellent news for homeowners and office workers everywhere. This study concluded that common decorative houseplants such as bamboo palms, money plant, snake plant, ficus Benjamin,

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Moreover today, labour and security are the largest factors. More than 30% of the total production costs are spent on wages of the employees. These are the reasons why already many years ago, research was Plants are a pleasing addition to any house or patio. At the very least, they add colour and interesting shapes to a bland room.

2.2 LITERATURE REVIEW

MUHAMMAD ET AL (2010): A simple approach to Irrigation control problem using Artificial Neural Network Controller. The proposed system is compared with ON/OFF controller and it is shown that ON/OFF Controller based System fails miserably because of its limitations. On the other hand ANN based approach has resulted in

possible implementation of better and more efficient control. These controllers do not require a prior knowledge of system and have inherent ability to adapt to the changing conditions unlike conventional methods. It is noteworthy that ANN based systems can save lot of resources (energy and water) and can provide optimized results to all type of agriculture areas.

PRIYANKA ET AL (2012): involves some sensors, LCD display, GSM and ARM processor. All the sensors will give analog output but our processor will accept only the digital data. So we have to connect all the sensors to the ADC channel pins which are in-built to the processor .LCD will be on field display purpose. GSM module will contains a Subscriber Identity Module (SIM) user can communicate with this SIM-Number. When the particular command activated or given by the user, immediately the corresponding sensor will activates and reads the present reading and immediately sends results to the same user mobile and displays in the LCD panel in the field. Immediately user will take the necessary action if required. Here we are using total seven sensors to monitor the field condition. Those are Temperature, Humidity, Soil moisture, Leaf sensor, PH sensor, Level sensor, Phase sensor. All these devices are connected to the ARM processor. GSM is used for communication purpose, with the help of AT (attention)-Commands we can communicate with the components. For soil module and level sensing applications we are using motors. One motor is used to store water and another is for releasing the stored water into the soil.

SWARUP ET AL (2013) : Smart sensors based monitoring system for agriculture have been used to increase the yield of plants by monitoring the environmental conditions (parameters) and thus providing the necessary information to the clients (farmers). The proposed system is mainly developed for the betterment of farmers. The use wireless sensor network over the wired one helps for deploying it in any type of environment for monitoring, making it flexible and robust. The use of FPGA element facilitates the system for re-configurability and re- programmability according to different environmental condition.

SALEEMMALEEKH ET EL (2013): With the advancement in technology, the world around us in every part of our life getting automated. The manual procedures are being replaced by these automated systems, since they are with energy efficient and consume

less labor work. This paper proposes the advantages of having Wireless Sensor Network technology in Indian agricultural sector, which shows the path to the rural farmers to replace some of their traditional techniques. Here, multiple environmental data such as Humidity, Soil moisture, Soil pH etc. are collected by a set of wireless sensor nodes and applied as input to the Peripheral Interface Controller (PIC). The data is checked continuously by PIC controller and a set of control actions like Irrigation, Soil fertility check etc. are made if they exceed threshold level. After every activity, an evidence message is sent through SMS via GSM modem to the farmer. The module by module design and implementation of the system are given. The system overcomes the limitations of traditional agricultural procedures by utilizing water resource efficiently and also reducing labor cost.

CHAPTER 3
EXISTING METHOD & PROPOSED METHOD

3.1 EXISTING METHOD

In Nurseries and Gardens the water supply requires large pipeline system. And water is pumped by the high powered motors which consumes more power. Some other system like “A Robotic Plant CareSystem” which watered plants in the Intel Lab. The system used laser range finders to locate pot plants in the lab environment. But the system had several shortcomings. Firstly, the system was notcost-effective.

Figure 3.1: Traditional pipeline water sprinkler

Another system with the same purpose is ‘A Smart System for Garden Watering using Wireless Sensor Networks’ .This system waters the potted plants by analyzing their soil moisture using sensors and waters them using the attached valves. The problem with this system is that it is not portable; the valves are always attached to the potted plant spoiling the beauty of the environment. Moreover, each potted plant is equipped with separate sensors and valves for watering, which increases the cost of the system as the number of potted plants increase.

Another system, “PotPet: Pet-like Flowerpot Robot” by Ayumi Kawakami, Koji Tsukada, Keisuke Kambara and Itiro Siio developed in 2011 is a flowerpot-type robot called PotPet. The system enables each plant to physically move autonomously as all plants are placed on the robotic structure equipped with wheels. The PotPet automatically moves to sunny places in search of sunlight. Moreover, it moves around people to grab their attention when in need of water. Plants also express their happiness

when watered either by people or rain. But, this system requires each potted plant to be equipped with all the sensors thus increasing the cost of the system with each newly added pot. Secondly, if there are large numbers of pots moving here and there, the people in the vicinity might get disturbed. And finally, the system doesn't actually water the plants; it just grabs their attention and reminds the user to water the plants making the watering operation manual rather than completely autonomous.

3.2 PROPOSED METHOD

Our system uses a robotic car which is adding with the water sprinkler system. By using this kind of system, there is a possibility to avoid the pipeline damages and power consumption of motors are also reduced.

Figure 3.2: Robotic car with water sprinkler

Instead of using laser kind of detection system, an manual controlling or using RFID(radio frequency identification) kind of system we can able to achieve automation. Man power can be reduced and better results will be obtain. Protection from some animals (small animals and Birds) can be possible by generating sounds.

Even by using Wi-Fi module we can able to achieve wireless control over long range and wireless live for surveillance through using a camera module can be achieved.

We've projected this research work to provide simpler hardware architecture, but with powerful and concise computational platforms required to build the Robot. Our purpose on educational robotics is simple architecture so as to serve the students an elegant idea so that they can build their own robots at low cost and use them as a decent platform for experiments in several courses, also aid the robot's designer to focus on their

research instead of Bluetooth connection infrastructure. The following list shows the typical robot control architecture

CHAPTER 4

FLOW CHART AND DESIGN

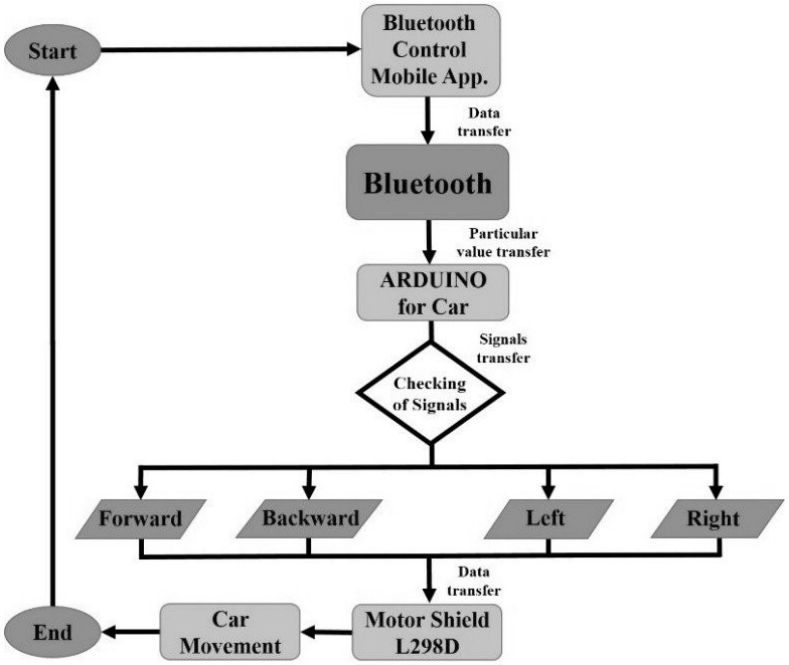

Figure 4.1: Flow chart

4.1 EXPLANATION

A signal processor from the Bluetooth control mobile app is send to the Bluetooth section and the signal is received to the Arduino uno controller and then the signals are performed as per the instruction.

For example if we need forward movement of the vehicle then signal is transferred to the motor shield L298N.

Finally the vehicle movement is achieved and signal will be longest up to its duration and after signal transfer is stopped the movement of the vehicle is also stopped. Similarly for all directions the process is same.

4.2 BLOCK DIAGRAM

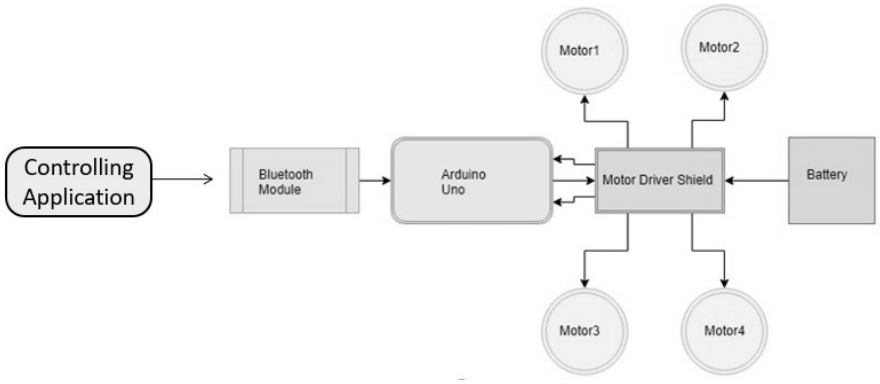

Figure 4.2: Block diagram of robotic car

4.2.1 CONTROLLING OR ANDROID APPLICATION

In this block it consists an android app, the app consists buttons for movement of the car in different directions. These commands are as follows: Left, forward, backward and right. The key references are changed in the application as per our requirements, it depends on how many we using for controlling the directions of the vehicle and additional needs.

Figure 4.2.1: Android application interface

4.2.2 COMMUNICATION AND MICROCONTROLLER BLOCK

In this section it consists of Bluetooth module and Arduino UNO microcontroller. Arduino which is responsible for communicating with android smartphone, usingthe Bluetooth module.The Bluetooth module receives the information coming from the Mobile controller and transmits the data to the Arduino board. The board based on the dumbed instructions gives the output as input for the motor driver.

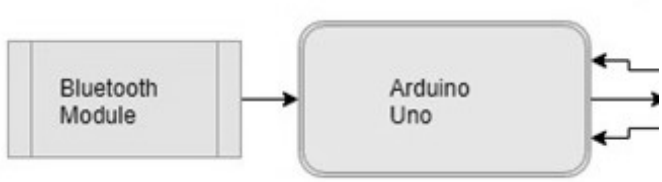

Figure 4.2.2: Communication and controlling section

4.2.3 MOTOR DRIVER BLOCK

In this block it consists of Motor driver (L298n) and DC motors. The motor driver receives the data from Arduino ,based on the instruction received the driver runs the motors to obtain the desired direction like forward, backward, left, right.

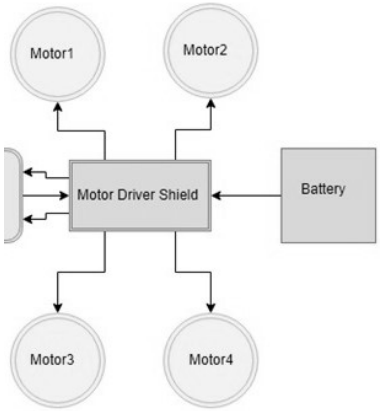

Figure4.2.3: Motor drivers and motors

4.3 CIRCUIT DIAGRAM

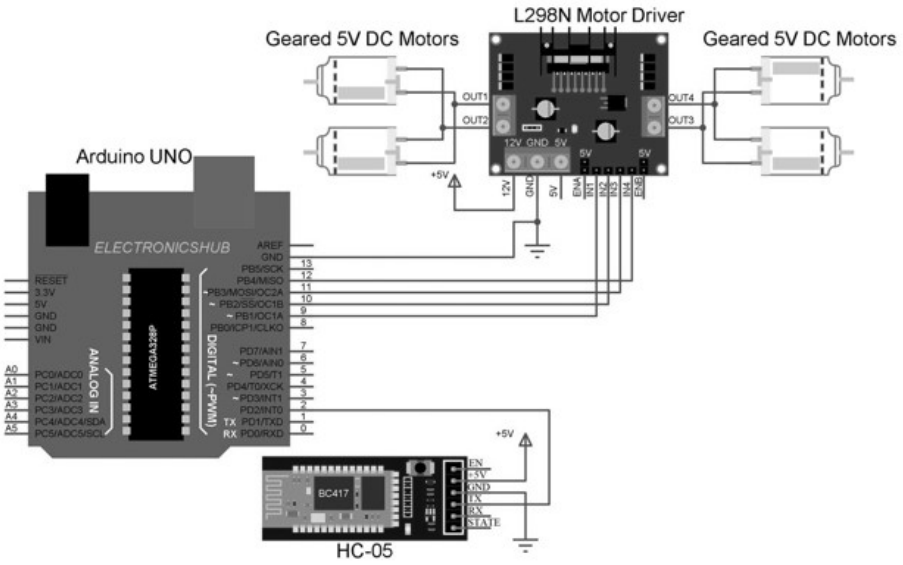

Figure 4.3: Circuit Diagram

4.3.1 CIRCUIT EXPLANATION

Take a closer look on the Wiring Diagram. We could notice the power source, four 1.5 volt batteries connected to the 12V power pin of L298 Motor Drive and ground of Motor Drive and Arduino UNO. This supplies essential power to the circuit. A total of 6 volts is being supplied to this system, where the maximum permissible amount is 12 volts. Digital wires of Arduino are connected with the input1, input2, input3 and input4 of the motor drive. Motors are connected to the either sides of Motor Drive which are the outputs terminals. To complete the power source circuit, 5V of Motor Drive is connected to V_{in} power pin of Arduino UNO. Followed by this, HC05 Bluetooth Module's V_{cc} is connected to 5V pin of Arduino UNO, which supplies power to Bluetooth Module. Ground to Ground connections are also made. Transistor logic pins, Transmitter (TX) and Receiver (RX) of Arduino UNO are connected to RXD and TXD of HC05 respectively. The program is uploaded to Arduino before connecting the Bluetooth.

After all successful connections, switch on the power source. Lights at Motor Drive, Arduino UNO and HC05 would indicate the correct connection. Upon successful connection of your Bluetooth module with any android device, we could

control this device. By passing the command, for example, to move forward we pass ‘F’. This command is transmitted by our device to Bluetooth module, which in turn transmits to Arduino UNO. Arduino receives it and passes same to the Motor Drive through its digital pins. Motor Drive will get this through their input pins and exercise them through their output pins were motor is connected.

Similarly for the remaining Reverse, Left, Right directions can be carry out through the components Arduino UNO , motor driver to motor to achieve the desired direction of the vehicle in the same producer steps .

Here the supply of voltage may vary for different types of motors used, Communication system used here in our system we used Bluetooth which consumes less power when compared to the Wi-Fi communication. No. of digital pins of microcontroller (Arduino UNO) used may get more based on requirement purpose and utilization.

CHAPTER - 5

COMPONENTS USED FOR IMPLEMENTATION OF SYSTEM

5.1 ARDUINO UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc 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 voltages between 7 and 20 volts. The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The ATmega328 on the board comes pre-programmed with a bootloader that allows uploading new code to it without the use of an external hardware programmer. There are many versions of Arduino boards introduced in the market like Arduino Uno, Arduino Due, Arduino Leonardo, and Arduino Mega, however, most common versions are Arduino Uno and Arduino Mega.

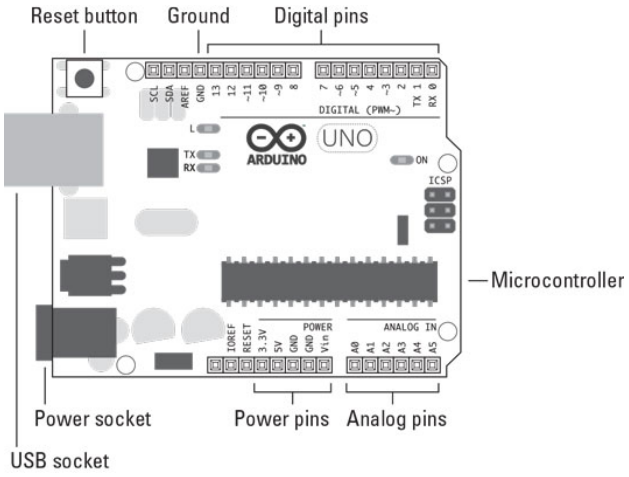

Figure 5.1: Schematic image of Arduino UNO

5.1.1 PIN DESCRIPTION OF ARDUINO UNO

Input /output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. Each of the 14 digital pins can be used as an input or output, using pin Mode (), digital Write (), and digital Read () functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.

In addition, some pins have specialized functions Serial: 0(RX) and 1(TX). Used to receive (RX) and Transmit (TX) TTL serial data External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analog Write () function. SPI: 10(SS), 11(MOSI), 12(MISO), 13(SCK). These pins support SPI communication using the SPI library. LED: 13. There is a built-in LED driven by digital pin 13. TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the wire library.

The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution. By default they measure from ground to 5 volts, through is it possible to change the upper end of their range using the AREF pin and the analog Reference () function. There are a couple of other pins on the board.

AREF Reference voltage for the analog inputs. Used with analog Reference.

Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

5.2 HC-05 BLUETOOTH MODULE

Bluetooth is a short-range wireless technology standard that is used for exchanging data between fixed and mobile devices over short distances using UHF radio waves in the ISM bands, from 2.402 GHz to 2.48 GHz, and building personal area networks (PANs).[4] It was originally conceived as a wireless alternative to RS-232 data

cables. It is mainly used as an alternative to wire connections, to exchange files between nearby portable devices and connect cell phones and music players with wireless headphones. In the most widely used mode, transmission power is limited to 2.5 mill watts, giving it a very short range of up to 10 meters (30 feet).

Bluetooth is managed by the Bluetooth Special Interest Group (SIG), which has more than 35,000 member companies in the areas of telecommunication, computing, networking, and consumer electronics. The IEEE standardized Bluetooth as IEEE 802.15.1, but no longer maintains the standard. The Bluetooth SIG oversees development of the specification, manages the qualification program, and protects the trademarks. A manufacturer must meet Bluetooth SIG standards to market it as a Bluetooth device. A network of patents apply to the technology, which are licensed to individual qualifying devices. As of 2009, Bluetooth integrated circuit chips ship approximately 920 million units annually.

Bluetooth is a standard wire-replacement communications protocol primarily designed for low power consumption, with a short range based on low
cost transceiver microchips in each device. Because the devices use a radio (broadcast) communications system, they do not have to be in visual line of sight of each other; however, a quasi optical wireless path must be viable. Range is power-class-dependent, but effective ranges vary in practice. See the table "Ranges of Bluetooth devices by class".

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration. It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard and many more consumer applications. It has range up to 100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions. It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN). It uses frequency-hopping spread spectrum (FHSS) radio technology to send data over air. It uses serial communication to communicate with devices. It communicates with microcontroller using serial port.

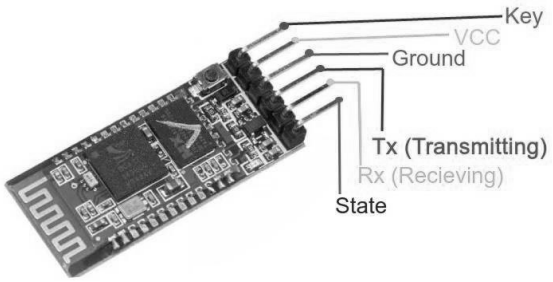

Figure 5.2: HC-05 Bluetooth Module

First Send data from Smartphone terminal to HC-05 Bluetooth module and see this data on PC serial terminal and vice versa. To communicate smartphone with HC-05 Bluetooth module, smartphone requires Bluetooth terminal applicatio
and receiving data. You can find Bluetooth terminal applications for android and windows in respective app store. Before establishing communication between two Bluetooth devices, 1st we need to pair HC-05 module to smartphone for communication. First, search for new Bluetooth device from your phone. You will find Bluetooth device with HC-05name. Second, click on connect/pair device option; default pin for HC-05 is 1234 or 0000.In smart phone, open Bluetooth terminal application and connect to paired device HC-05. It is simple to communicate, we just have to type in the Bluetooth terminal application of smartphone. Characters will get sent wirelessly to Bluetooth module HC-05.

5.2.1 HC05 PIN DESCRIPTION

The HC-05 Bluetooth Module has 6 pins commonly used. They are as follows:

ENABLE:

When enable is pulled LOW, the module is inactivated which means the module will not turn ON and it fails to transmit/receive data (communicate). When enable is left open or connected to 3.3V, the module is enabled i.e. the module remains on and communication also takes place.

VCC:

Supply Voltage 3.3V to 5V.

GND:

Ground pin connected to ground.

Next these two pins act as an UART interface for communication

TXD:

To transmit data from BT memory to device (generally microcontroller or microprocessor).

RXD:

To receive data from device to BT memory.

STATE:

It acts as a status indicator. When the module is not connected to/paired with any other Bluetooth device, the signal goes Low. At this low state, the led (inbuilt in module) flashes continuously which denotes that the module is not paired with another device. When this module is connected to/paired with any other Bluetooth device, the signal goes high. At this high state, the led blinks with a constant delay say for example 2s delay which indicates that the module is paired.

5.3 MOTOR DRIVER L298N

This L298N Based Motor Driver Module is a high power motor driver perfect for driving DC Motors and Stepper Motors. It uses the popular L298 motor driver IC and has the 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. Perfect for driving DC and Stepper motors for micro mouse, line following robots, robot arms, etc. An H-Bridge is a circuit that can drive a current in either polarity and be controlled by Pulse Width Modulation (PWM).Pulse Width Modulation is a means of controlling the duration of an electronic pulse. In motors try to imagine the brush as a water wheel and electrons as the flowing droplets of water. The voltage would be the water flowing over the wheel at a constant rate, the more water flowing the higher the voltage. Motors are rated at certain voltages and can be damaged if the voltage is applied to heavily or if it is dropped quickly to slow the motor down. Thus PWM. Take the water wheel analogy and think of the water hitting it in pulses but at a constant flow. The longer the pulses the faster the wheel will turn, the

shorter the pulses, the slower the water wheel will turn. Motors will last much longer and be more reliable if controlled through PWM.

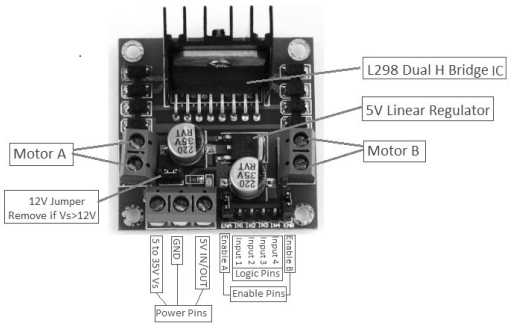

Figure 5.3: Motor Drive L298N

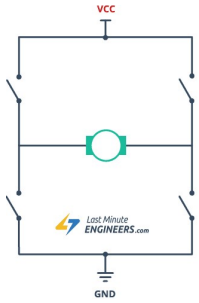

Figure 5.3.1: Working of H-bridge

5.4 JUMPER WIRES

Connecting wires allows an electrical current to travel from one point on a circuit to another, because electricity needs a medium through which to move. In the case of computers, wires are embedded into circuit boards, carrying pulses of electricity that are interpreted as binary signals of zeros and ones.Most wires in computers and electronic components are made of copper or aluminium. Copper is cheap and electrically conductive. Silver has higher conductivity but is far more expensive.

In a basic circuit, the wire comes from one terminal of a power source, such as a battery. It then connects to a switch that determines whether the circuit is open or closed. The wire then connects to the device that is drawing power, allowing it to draw electricity and perform its task. Finally, the wire connects the load back to the opposite terminal of

the power source. Before a current can travel through the wire, the circuit has to be closed; in other words, there cannot be any breaks in the path. Electricity cannot easily travel through air, and if it does there is a risk of stray current leaking into the surroundings and causing damage or failing to power the appliance.

A jump wire is an electrical wire or group of them in a cable with a connector or pin at each end. Wires are used to connect components to each other on the breadboard or other prototype, internally or with other equipment or components, without soldering. Wire connectors could be male or female. A male connector is commonly referred to as a plug and has a solid pin for a center conductor. A female connector is commonly referred to as a jack and has a center conductor with a hole in it to accept the male pin.

Figure 5.4: Jumper Wires

5.5 DUAL SHAFT GEAR MOTOR

An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire winding to generate force in the form of torque applied on the motor's shaft. Electric motors can be powered by direct current (DC) sources, such as from batteries, or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators. An electric generator is mechanically identical to an electric motor, but operates with a reversed flow of power, converting mechanical energy into electrical energy.

Electric motors may be classified by considerations such as power source type, internal construction, application and type of motion output. In addition to AC versus DC

types, motors may be brushed or brushless, may be of various phase (see single-phase, two-phase, or three-phase), and may be either air-cooled or liquid-cooled. General-purpose motors with standard dimensions and characteristics provide convenient mechanical power for industrial use. The largest electric motors are used for ship propulsion, pipeline compression and pumped-storage applications with ratings reaching 100 megawatts. Electric motors are found in industrial fans, blowers and pumps, machine tools, household appliances, power tools and disk drives. Small motors may be found in electric watches. In certain applications, such as in regenerative braking with traction motors, electric motors can be used in reverse as generators to recover energy that might otherwise be lost as heat and friction.

Electric motors produce linear or rotary force (torque) intended to propel some external mechanism, such as a fan or an elevator. An electric motor is generally designed for continuous rotation, or for linear movement over a significant distance compared to its size. Magnetic solenoids are also transducers that convert electrical power to mechanical motion, but can produce motion over only a limited distance.

Electric motors are much more efficient than the other prime mover used in industry and transportation, the internal combustion engine (ICE); electric motors are typically over 95% efficient while ICEs are well below 50%. They are also lightweight, physically smaller, are mechanically simpler and cheaper to build, can provide instant and consistent torque at any speed, can run on electricity generated by renewable sources and do not exhaust carbon into the atmosphere. For these reasons electric motors are replacing internal combustion in transportation and industry, although their use in vehicles is currently limited by the high cost and weight of batteries that can give sufficient range between charges.

The shaft in a motor is a cylindrical component that extrudes out from the motor and its housing. The purpose of the shaft is to convert energy from the motor into the end use application. Precision pins and shafts operate as a function of speed vs torque. When no load is applied to the shaft, it will run at its fastest speed for that voltage with near zero torque. When enough load is applied to the shaft that it stops spinning entirely and its speed becomes zero, it will generate the maximum amount of torque for that

voltage and is said to be operating at stall torque. DC motors are designed to run under low torque and are considered to exhibit optimal performance when the shaft is running at the medium between zero loads and stall torque. If more torque is needed, a gear reducer is often coupled with the motor in order to reduce the shaft speed and increase its torque.

- Low density: lightweight, low inertia.
- Capability to absorb shock and vibration as a result of elastic compliance.
- Ability to operate with minimum or no lubrication, due to inherent lubricity.
- The relatively low coefficient of friction.
- Operating Voltage(VDC): 3~12
- Shaft Length (mm): 8.5
- Shaft Diameter (mm): 5.5 (Double D-type)
- No Load Current: 40-180mA.
- Rated Speed(After Reduction): 300 RPM
- Rated Torque: 0.35 Kg cm

Figure 5.5: Dual shaft motor

5.6 SOFTWARE CODE

```
char t;
void setup() {
pinMode(13,OUTPUT);   //left motors forward
pinMode(12,OUTPUT);   //left motors reverse
pinMode(11,OUTPUT);   //right motors forward
pinMode(10,OUTPUT);   //right motors reverse
pinMode(9,OUTPUT);   //Led
Serial.begin(9600);
}
void loop() {
if(Serial.available()){
  t = Serial.read();
  Serial.println(t);
}

if(t == 'F'){            //move forward(all motors rotate in forward direction)
  digitalWrite(13,HIGH);
  digitalWrite(11,HIGH);
}

else if(t == 'B'){      //move reverse (all motors rotate in reverse direction)
  digitalWrite(12,HIGH);
  digitalWrite(10,HIGH);
}

else if(t == 'L'){      //turn right (left side motors rotate in forward direction, right side
motors doesn't rotate)
  digitalWrite(11,HIGH);
}
```

```
else if(t == 'R'){      //turn left (right side motors rotate in forward direction, left side motors doesn't rotate)
  digitalWrite(13,HIGH);
}

else if(t == 'S'){      //STOP (all motors stop)
  digitalWrite(13,LOW);
  digitalWrite(12,LOW);
  digitalWrite(11,LOW);
  digitalWrite(10,LOW);
}
delay(100);
}
```

5.7 ANDROID SMARTPHONE

Android is a very popular open source operating system (OS), used in mobile devices such as tablets and smartphones. Android has a very user-friendly interface which relies on direct interaction between the user and the device i.e. by using touch gestures. These gestures are like real-world actions, which include swiping, tapping, scrolling and pinching, to control the onscreen objects, together with a virtual keyboard for taking input in text form. In this project, android smartphone has an installed app which is used for controlling the robot unit. The smartphones already come with inbuilt technology to establish connection. The technology we have used is Bluetooth and Wi-Fi.

5.7.1 USER INTERFACE

The user interface, of the overall system, is provided using the custom-made android app Using Graphical User Interface (GUI). The GUI provides user, the various control modes, to Control dynamically the robot unit. When the app is started, we first establish the connection between the app and RC unit using Bluetooth. The Bluetooth and app are paired is easy to control the robotic car, which is also used to send the data to get the current temperature of the environment. The GUI of android provides a user-friendly real-time experience to the user, to control the robot.

5.8 THE ANDROID APPLICATION

An application was developed in the software Android Studio. App can be installed on an Android smartphone to control the RC unit. The app shows buttons for movement of the car in different directions. These commands are as follows: Left, right, forward and backward. The code for the app is written in java.

5.9 SOFTWARE DESCRIPTION

The **Arduino Integrated Development Environment (IDE)** is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards.

The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program *avrdude* to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. By default, avrdude is used as the uploading tool to flash the user code onto official Arduino boards.

Arduino IDE is a derivative of the Processing IDE, however as of version 2.0, the Processing IDE will be replaced with the Visual Studio Code-based Eclipse Theia IDE framework. With the rising popularity of Arduino as a software platform, other vendors started to implement custom open source compilers and tools (cores) that can build and upload sketches to other microcontrollers that are not supported by Arduino's official line of microcontrollers. In October 2019 the Arduino organization began providing early access to a new Arduino Pro IDE with debugging and other advanced features.

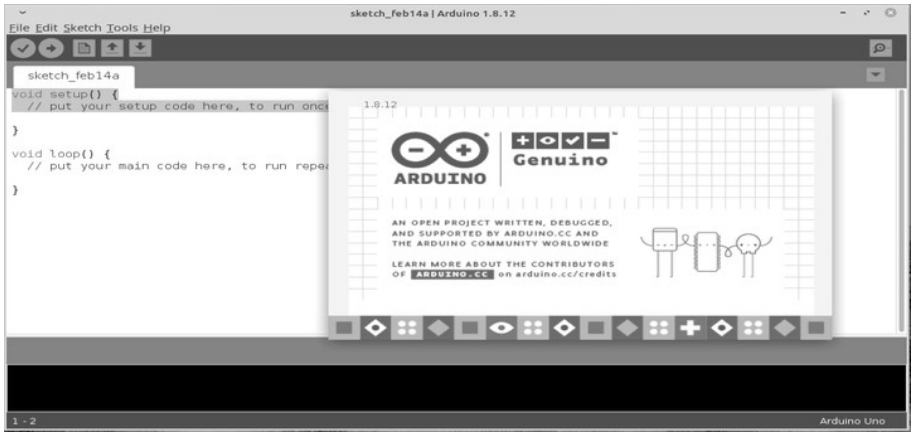

Figure 5.9: Arduino IDE software interface

IDE

The Arduino integrated development environment (IDE) is a cross platform application (for Windows, macOS, and Linux) that is written in the Java programming language. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The source code for the IDE is released under the GNU General Public License, version 2.

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IDE 2.0

On October 18, 2019, Arduino Pro IDE (alpha preview) was released. Later, on March 1, 2021, the beta preview was released, renamed IDE 2.0. The system still uses Arduino CLI (Command Line Interface), but improvements include a more professional development environment, auto completion support, and Git integration. The application frontend is based on the Eclipse Theia Open Source IDE. The main features available in the new release are:

- Modern, fully featured development environment
- Dual Mode, Classic Mode (identical to the Classic Arduino IDE) and Pro Mode (File System view)
- New Board Manager
- New Library Manager
- Board List
- Basic Auto-Completion (Arm targets only)
- Git Integration
- Serial Monitor
- Dark Mode

CHAPTER-6
ADVANTAGES AND APPLICATIONS

6.1 ADVENTAGES

- The main advantage of this project is that it has faster execution when compared to manual execution of the process.
- It is simple, portable and provides high performance. It consumes less power Dryness can be easily detected in soil.
- Permits a non- expert to do the work of an expert.
- Improves productivity by increasing work output and improving efficiency.
- Saves time in accomplishing specific objective.
- This system ensures that the plants do not endure from the strain or stress of less and over watering.
- This system saves labour cost and water up to 70%. The working of this irrigation system covers over 40 crops spanning across 500 acres.
- Protection for humans from Toxic chemical pesticides.

6.2 APPLICATIONS OF PROJECT

We propose an application to detect water deficiency state in soil based exclusively on sensor-provided data. In an Automated Irrigation System, the most significant advantage is that water is supplied only when the moisture in soil goes below a pre-set threshold value.

- This system can be used in roof gardens in highly populated areas where land is expensive and gardening on rooftops seems like the only viable option left.
- The lawns of houses and public buildings can be maintained by these systems, thereby reducing the need for human monitoring.
- The greatest application is in agricultural lands, where farmers are assisted greatly by this. There is no need for the farmer to actually be present during operation.

- Gardens that need to be monitored in the absence of home owners require systems like APIS. Home gardens that are maintained with large effort by home owners require proper observation and maintenance. It can be provided by APIS.
- Irrigation in parks needs to be done even when people are not there to maintain the grass or trees.
- Detection in this manner is cheap, non-invasive and can be applied on a population-wide scale.
- It may apply for dry field land area to carry the water
- The presence of technology in all aspects of life has enabled solutions to real life problem that were either difficult or unfeasible

CHAPTER 7
CONCLUSION AND FUTURESCOPE

7.1 CONCLUSION

Robots and smart phone are a perfect match for us to realize smart living not only at work, but in our homes, with the aid of easily available and widely used technology, the Bluetooth. As the mobile devices are becoming more advanced, using them for controlling Robots and other wireless devices is likely to be a huge trend. It can be concluded that this idea of smart living will let us control our surroundings remotely and wirelessly.

The calculations for the number of pots watered, time required by the system to water the selected set and the water required in millilitres have been depicted. The System performance had been evaluated by plotting a graph between the number of plants watered and the time required by the mobile robot to perform the watering operation indicating that the system is not only cost-effective but also efficient in terms of time.

7.2 FUTURESCOPE

With the ever increasing problems, our knowledge has to expand to adapt better to the changes all around us. In the same way it is hoped that this activity is a small step that would lead us to further enhancements and goals.

In future, we plan to use solar panels along with rechargeable batteries instead of 9V batteries in order to make our system efficient, reliable and self-sustainable in terms of energy consumption. We also plan to incorporate to our system the ability to be managed remotely. This will be done by allowing to access and control the system with the use of web-services (e.g. via Android smart-phones). Plant detection can be done by using a wireless Web Camera instead of RFID tag. This will reduce the cost of the system considerably. Moreover, the same can be used for path planning and obstacle avoidance for the mobile robot. Furthermore, the plant water requirements can also be analysed by extracting the present day temperature and other required values by remote sensing of satellit

CHAPTER -8

RESULT

After simulating the circuit connections, it will used to move any directions like forward, backward, left, and right. Connections were made as per the circuit diagram and the file of the code of Arduino was attached to the Arduino Uno.

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