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# Solar Based Sample Collector Rover Robot

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**ABSTRACT:** Smartphones are one of the most essential things for human life in the 21st century. The rover robot interface with the Bluetooth module HC-05. We can give specific commands to the robot through the Android app installed on the phone. The Bluetooth trans receiving module on the receiving side receives commands and sends them to micro-controller, thus controlling the robot. The aim of this project is to collecting sample or materials robot by giving commands that are used. For forward motion, the robot moves in the same direction and for backward motion, the robot moves in the reverse direction. And also moves to the right and to the left.

**KEYWORDS:** Microcontroller, Bluetooth, Android Application, DC Motor, etc...

## I. INTRODUCTION

Earth, planetary exploration stands as a cornerstone of human scientific and technological achievement. Robotic rovers, specifically designed to traverse the surface of celestial bodies, have played a pivotal role in unravelling the secrets of other worlds. From the Moon to Mars and beyond, these exploratory machines have offered a lens through which we can gaze upon the vastness of space.

Solar power is the term for using the sun energy to power device or electrical system it will provide gentle speed. Rover is a moving platform or vehicle equipped with different electro-mechanical gadgets. It is a hybrid product of electronics and mechanics. Rovers are mainly used for collecting data or materials from places where accessibility is poor or dangerous.

The robot car can be controlled wirelessly via commands directly from the user. The robot can stop more, backward, left, right and forward. micro-controller interface with rover robot Bluetooth module HC-05. Interface with robot, Bluetooth module HC-05, L298D motor driver and DC motor. micro-controller is programmable so we have to do the programming using the embedded 'C' language.

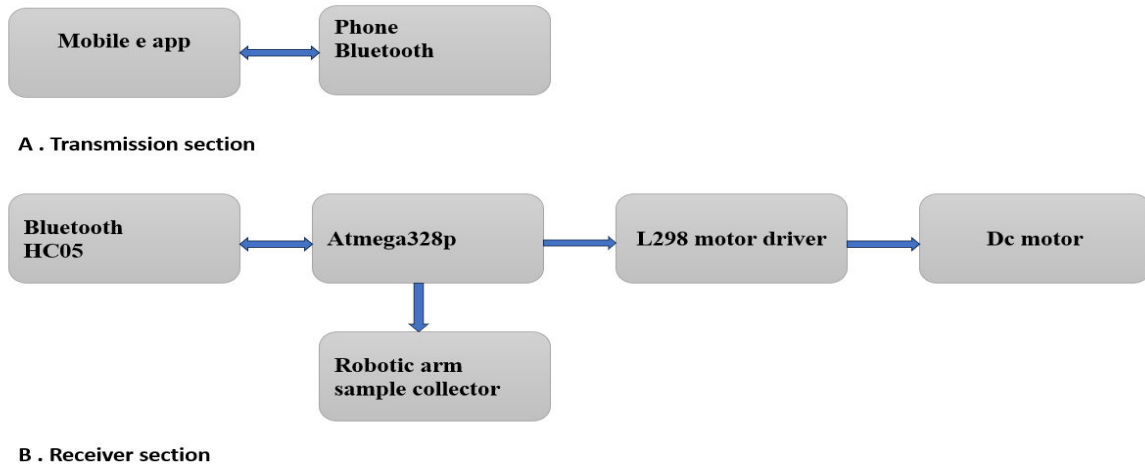
## II. LITERATURE SURVEY

**Research by Araki et al. (2018) [1]** discusses the use of high-efficiency solar panels for sustained power generation, enabling extended missions and reducing the reliance on traditional battery systems. Solar panels integrated into the rover's surface or deployable arrays have been used to maximize energy production, improving rover autonomy and sample collection capabilities. Sample collection mechanisms play a pivotal role in the functionality of rover robots.

**Zheng et al. (2019) [2]** present a comprehensive review of sample collection methods, including drills, scoops, and arms. Solar-based rover robots have been equipped with innovative sample acquisition tools, such as coring systems, scoop mechanisms, and even advanced spectrometers for in-situ analysis. These developments enhance the ability to gather and analyse samples efficiently. Efficient navigation and mobility are essential for rover robots.

**Scharnweber et al. (2020) [3]** highlights advancements in navigation algorithms, machine learning, and autonomous decision-making capabilities. Solar-powered rovers have benefited from improved mobility systems, including enhanced wheel designs, adaptive suspension, and intelligent terrain recognition. These enhancements enable rovers to traverse diverse terrains, collect samples from different locations, and avoid obstacles autonomously.

### III. ARCHITECTURE



### IV. COMPONENTS

#### 4.1 Microcontroller ATMEGA 328P



Figure 4.1: Microcontroller ATMEGA 328P

ATMEGA328P is high performance, low power controller from Microchip. internal and external interrupts, serial programmable USART, a byte-oriented Two-Wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter.

#### 4.2 Motor Driver – L298

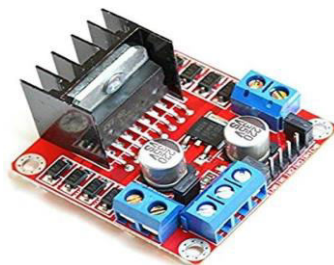


Figure 4.2: Motor Driver- L298

The L298N is a dual H-Bridge motor Driver which allows speed and direction control of two DC motors at the same time

The motors. It has two voltage pins, one of which is used to draw current for the working of the L293D and the other is used to apply voltage to the motors.

#### 4.3 LCD Display – 16X2



Figure 4.3: LCD Display – 16X2

The 16X2 intelligent alphanumeric dot Matrix display is capable of displaying 224 different characters and symbols. The liquid crystal display of (LCD) panel is – designed to project on-screen e\_ information of a microcomputer onto a larger screen.

#### 4.4 Bluetooth Module- HC05

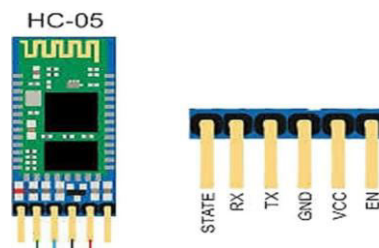


Figure 4.4: Bluetooth Module- HC05

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration. This HIC-05 Bluetooth Module helps to send data from android application to the microcontroller over the wireless Bluetooth connection. Main use of this Bluetooth is controlling the motors.

#### 4.5 DC Motor



Figure 4.5: DC Motor

When kept in a magnetic field, a current-carrying conductor gains torque and develops a tendency to move. In short, when electric fields and magnetic fields interact, a mechanical force arises. This is the principle on which the DC motors work.

#### 4.6 Solar Panel



Figure 4.6: Solar Panel



When the sun shines onto a solar Panel: energy from the sunlight is absorbed By the PV cells in the panel. This energy creates electrical charges that move in response to an internal electrical Field in the cell, causing electricity to flow.

#### 4.7 Battery



Figure 4.7: Battery

For this project, we need 12 v batteries to run this project. W with the help of solar panel., We charge the battery and stored the energy. When the cloudy condition occurred in the environment and also solar panel not worked Due to sun light is not available that time, we use the battery.

#### 4.8 Voltage Regulator IC-7805

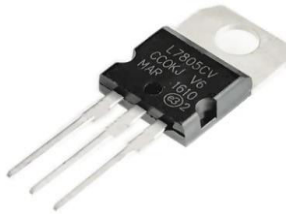


Figure 4.8: 7805 Voltage Regulator IC

The 7805 Voltage Regulator IC is a commonly used voltage regulator that finds its application in most of the electronics projects. It provides a constant +5V output voltage for a variable input voltage supply

### V. FLOWCHART

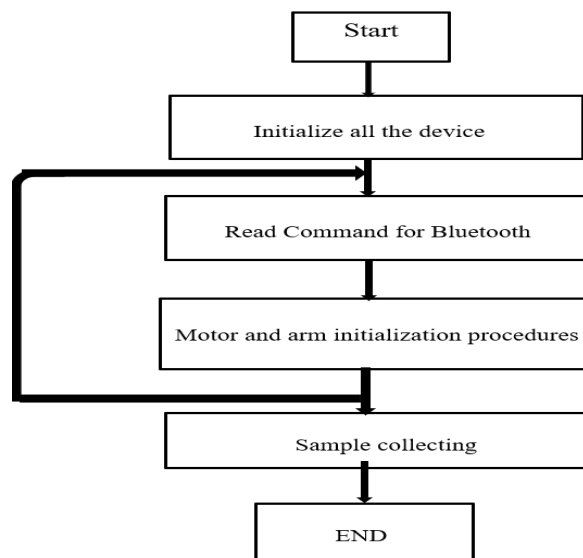


Fig.Flowchart of solar based sample collector rover robot



## VI. WORKING

Steps involved in creating solar based rover robot:

**Gather Components:** Collect all the necessary hardware components including the motor, wheels, battery, microcontroller or controller board and software used Arduino Bluetooth Control.

**Setup controller board:** Choose and configure controller board to control the motors, read command, and communicate with the Android device. Program the microcontroller with firmware that interprets commands from the Android device and controls the rover robot movement.

**Implement Communication Protocol:** Establish a communication protocol between the Android device and the controller board. Define commands for transmitting control signals for rover robot arm.

**Wireless Connectivity Setup:** Choose a suitable wireless technology such as Bluetooth, and configure both devices to communicate over this connection.

**Testing and Calibration:** Conduct testing and validation of the rover's subsystems and overall functionality in environments. Test the entire system to verify seamless communication between the Android device and the robot.

**Deploy and Monitor:** Monitor its performance using the Android application, and make any necessary adjustments or improvements based on real-world usage.

## VII. RESULT

setup the equipment i.e., powers the circuit and giving connections, and connect Bluetooth module with mobile to operate

When we connect our mobile with Bluetooth module with an application, we can operate it and give the commands to it. give the commands to board or to robot using the terminal provided in the application, we can give the commands like

- Left – so that robot turns to left side, by stopping the rotation of left wheel so that it drifts left side
- Right- same happens like in left, but it rotates to right.
- Front-moves forward
- Back-moves backward
- Stop- stops

## VIII. FUTURE SCOPE

The energy consumption is a big issue for SOLERO. This aspect must be taken into account at every level of the system. Not only must the robot choose a path but also consider the energy need for its execution. The design allows the rover to move smoothly across the obstacles and therefore limits the energy needs. Furthermore, speeds between the wheels are essential for optimizing the robot's motion.

## IX. CONCLUSION

This project will try reaching nearly all of our design requirements, and in many respects exceeding original design goals. Furthermore, all components, mechanical and electrical, will be thoroughly tested as a completed system in real-world field-testing conditions to validate their success. Overall, preliminary estimates for the general scope, budget, and timeline, for the project will be closely followed; with the exception if the project goes moderately over budget.

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