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VOICE ASSISTANCE GOODS LIFTER USING RACK AND PINION

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ABSTRACT

In this research paper, a system is being projected that focuses on the robot controlled by the voice which does the lifting of the goods using the Rack and pinion mechanism. As we all know the technology has been in progress since humans have been evolved and in today's world it has been a key to survival. Earlier people used to lift their goods using pulleys to overcome the weight to be lifted and many parts of the world still use this, but for heavy loads, it might be a bit difficult process, hence we have proposed a system which works just on your voice commands. The robot helps the rack and pinion mechanism to move to its desired place which is attached to it so that it can be used to lift heavy loads. The objective of this work is to provide an effective application to a real-time problem. The system will take the voice inputs through the Bluetooth module and will pass on to the Arduino while the rack and pinion mechanism will get its command from the micro-controller. Moreover, this system will be able to bridge the gap between the older techniques and the newer techniques which is easy to control, cheaper & faster. Also, the risk factor will be reduced which is a major problem faced while lifting heavy loads. Rack and pinion give access to up and down motion thus helping in construction work to lift the load up or down depending on the requirement. Such a type of robot provides a helping hand for various multiple tasks. So, in this paper, an attempt has been made to highlight the role of a rack and pinion mechanism using a voice-controlled robot.

Key words: Goods Lifter, Android app, Arduino UNO, Bluetooth module, Microcontroller.

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1. INTRODUCTION

Lift is common and the most important device needed for us in Daily life. We use a lift every day to move goods and people in high buildings such as shopping malls, hotels, and many more workplaces [1].

In this project, the 8051microcontroller based lift system is constructed to simulate as an actual goods lifter in the construction world. The goods lifter control system is one of the important aspects of the electronics control module in the automotive application. We use a rack and pinion mechanism fixed to a moving robot which is completely Bluetooth and voice-controlled assisted by an android App. Our first task was to convert the voice commands to text using Google's speech recognition technology [2]. So that it becomes easy for the movement of robots. Rack and pinion Lifter is constituted of two gears and rack and pinion arrangement. A rack and pinion lifter is applied in most of the industries because of its simple setup, easy to handle, and more work efficiency. Moreover, it can be augmented to the desired level of friction to lift heavier weights.

2. NEED FOR THE STUDY

Our work speaks about the enhancement in the elevator system using Rack and pinion. None of the previous work speaks about rack and pinion elevator system. The need to ameliorate in the elevator system because, while considering allowance to the extension of production space, installation of each unit on the buildings and exterior structure can be done. In this, we are not necessarily required of machine rooms, hoist ways, and overhead loads.

Instead of conventional elevators, the installation of this can be flexibly quick and more cost-cutting while steel support sizes are reduced. Along furthermore, this advanced elevator indulges repeated inspections in order to provide safety in any emergency conditions throughout the evacuation. Moreover, our model is Rack and pinion elevator with voice command moveable via Bluetooth.

3. HARDWARE SET-UP

The hardware set-up with the blocks and the system android are represented in Figure-1 and 2 respectively.

3.1. Arduino Uno

Microcontroller is considered as the brain of the system. Depending upon the type of use we can choose any possible controller according to the specifics needed. Here we choose Arduino Uno as our controller as it's easy to use and as the capability to connect to computers so that it can take the commands and execute them. Arduino Uno consists of 14 input/output pins. It also has a USB interface, a DC power jack, a reset button, and an ICSP header [3].

3.2. HC05 Bluetooth Module

HC-05 Bluetooth module V2. 0 has an EDR (Enhanced Data Rate) of 3Mbps Modulation with a complete 2.4GHz radio transceiver and baseband [4].HC-05 work with the help of serial communication has helped in wireless transmission of signals. It works on 4 pins RX (Receiver), TX (Transmitter), VCC (Power Supply), GND (Ground) [4].

3.3. 8051 Microcontroller (AT89S52)

Intel 8051 microcontroller a very useful part of this project as it is used to control the rack and pinion linear movement. 8051 microcontroller consists of RAM, ROM, Timer, ALU, which

helps in storing data and execute them. It consists of 4 ports as shown in figure. 8051 has a crystal frequency of 11.0592MHz which is best suited for serial communication [5].

3.4. Rack and Pinion

Rack and pinion is a linear actuator which helps in lifting goods. It works on the mechanism similar to the gear system where the rack performs the rotation motion on the pinion which has a linear structure [6].

3.5. Motor Driver

L293D Motor Driver is used to gear the DC motor to give them the direction according to the command. This motor driver has 16 pins among which 4 are input pins and 4 are output pin and 2 Enable pins which makes it possible to control 2 DC motors. This motor driver is designed according to the H-bridge connection which helps in changing the direction of the voltage applied thus making it possible to move the DC motor in a different direction.

3.6. Micro-Geared Dc Motors

This Micro DC Gear Motor with Shaft is ideal and is designed to easily incorporate the encoder. These motors are inexpensive, small, easy to install, and ideally suited for use in a mobile robot car. There are several micro-geared ratios available in the market depending upon the use. This geared system is used to have the directional movement of the motor.

4. WORKING

Initially, there needs to be the pairing of Bluetooth HC-05 with our smartphone. Once the pairing is done, it needs to be connected. Using the app in our smartphone, the phone's microphone is used to detect the voice commands made by the user. The voice commands are then converted to text which are then transferred to the Bluetooth device. This is done using Google's speech-recognition technology, where we process the voice commands and then the speech is converted to text. This text is sent via Bluetooth to the receiver using UART serial communication protocol, which is then forwarded to the Arduino. The serial buffer lets the text be accepted character by character and then is combined again to form a string. The Arduino has words pre-programmed to it (right, left, forward, reverse, and stop) as shown in Table-1 [8]. Our code is in a way that it compares the received text, and whenever it matches with the pre-programmed words, that particular action assigned to the command is executed by the Arduino [7]. The working algorithm is pictorially represented in the figure 3.

Table 1 Functions of different voice commands

Voice Command	Robot Movement
Forward	The robot moves forward
Backward	The robot moves backward
Right	The robot moves to the right
Left	The robot moves to the left
Stop	The robot stops moving

In Rack and Pinion, the two racks parallel to each other mesh to a pinion at the opposite teeth of the pinion providing a circular motion to the pinion. This set up uses a gear-set to transform the circular motion of pinion into the linear motion required for the vertical movements. Similarly, the same operation is done via Bluetooth pairing android app with our enhanced mobile phone. The backend of the app is designed with Microcontroller assembly language using serial communication for the upward and downward motion of goods lifter

with some fixed values. Hence, whenever the command is given it compares with the value assigned and reacts accordingly.

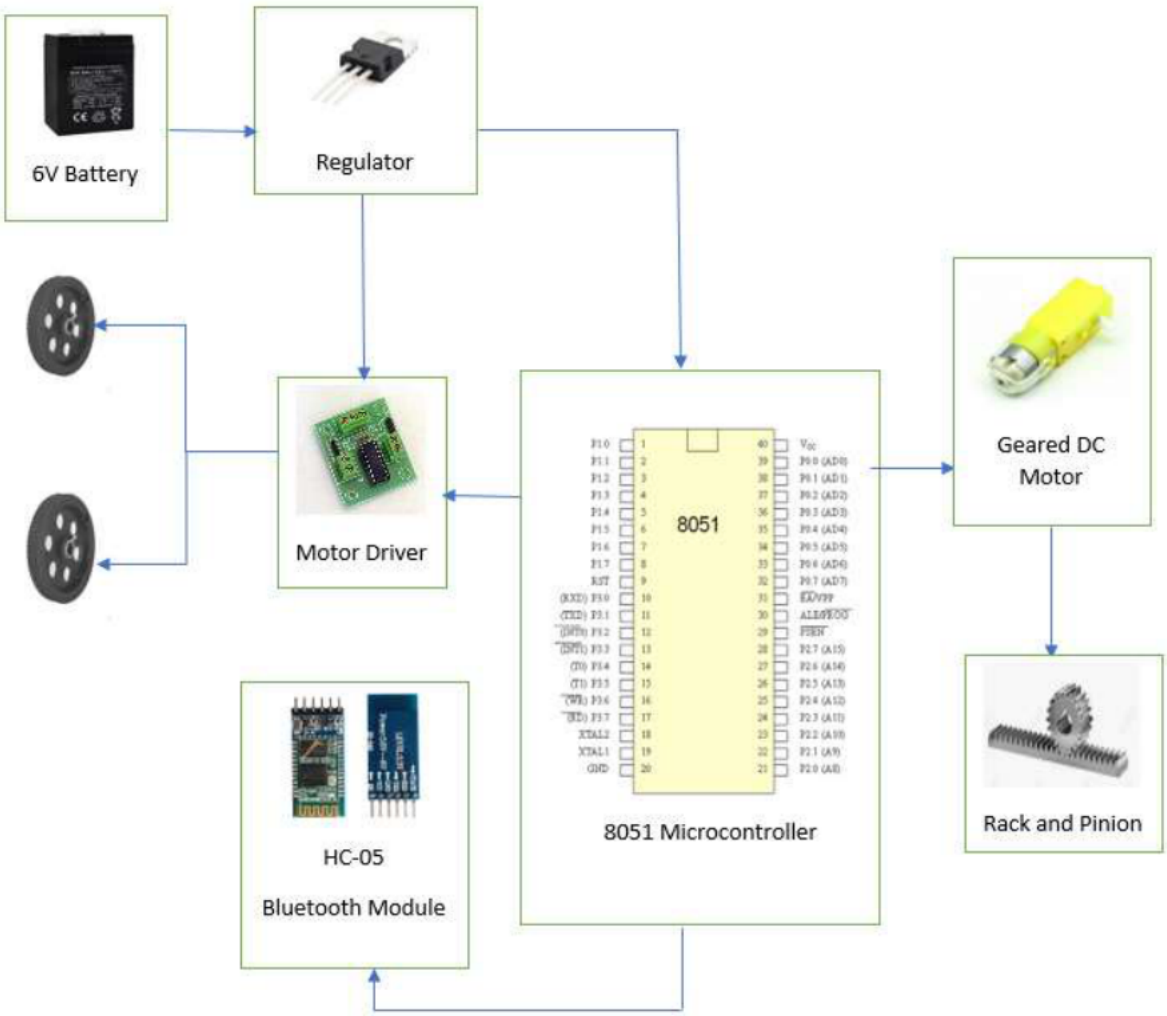


Figure 1 Schematic of the system developed

Figure 2 Android Application

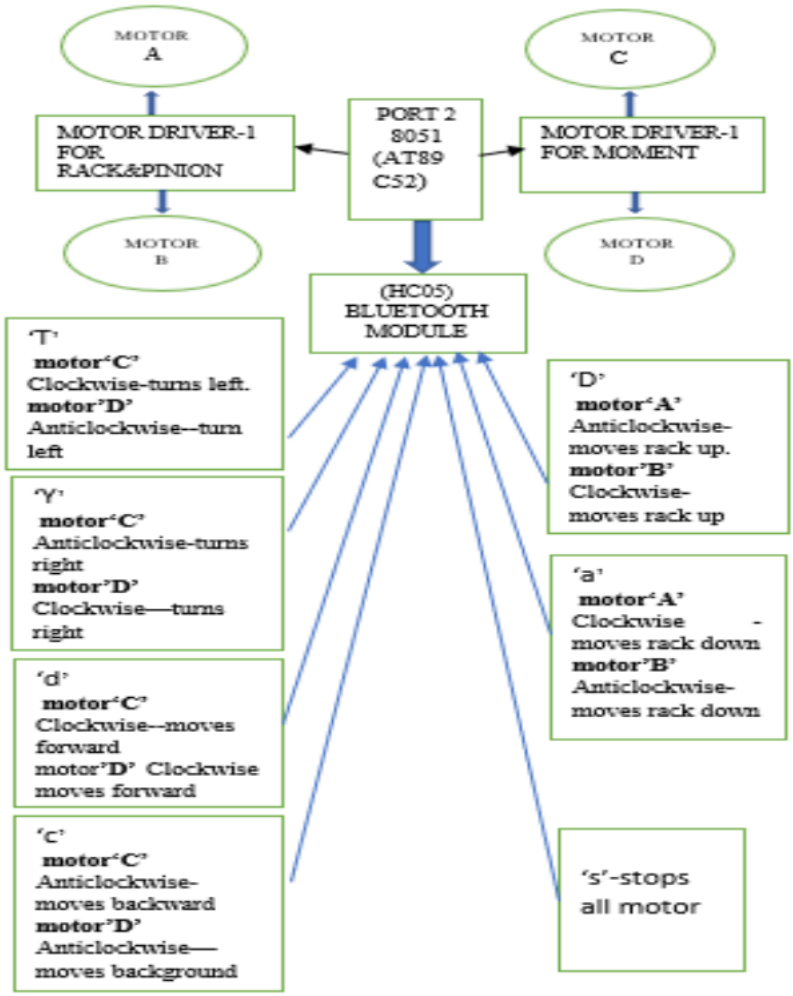


Figure 3 Working Algorithm

The entire circuitry was simulated using Proteus Design Suite and the working of the system was analyzed. The simulation circuit is presented on figures 4.a and b.

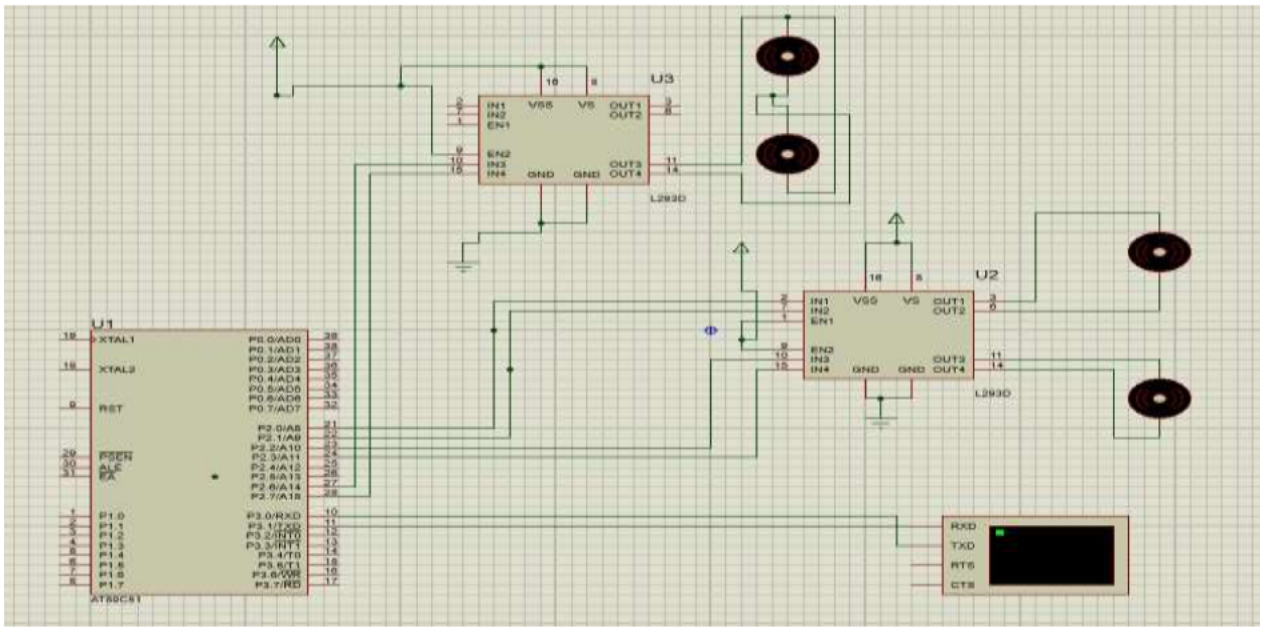


Figure 4.a. Simulated Circuit-a

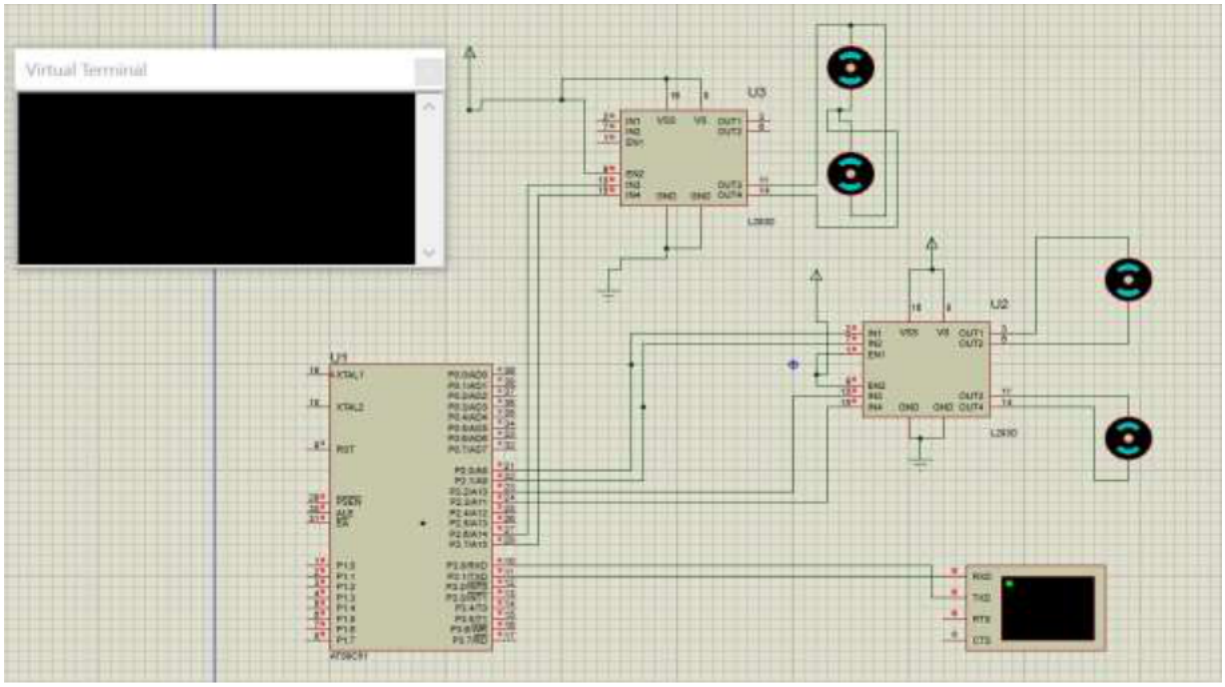
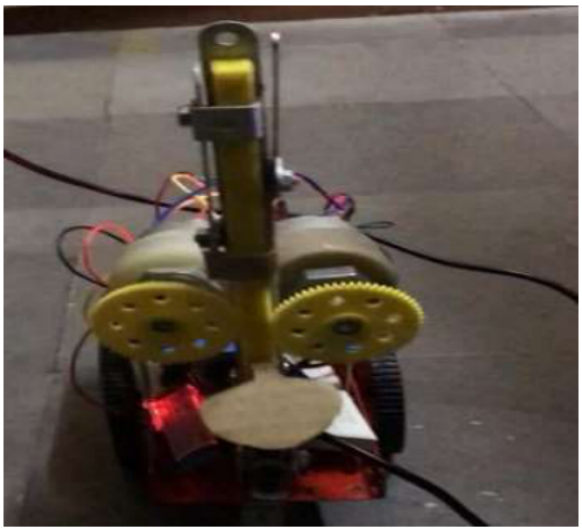


Figure 4.b. Simulated Circuit-b

5. RESULTS

The robot system developed is shown in figure-5. The robot is being operated here independently with the commands that will pre-set in the system software. The robot unit consisting of the hardware part is responsible for the activation of the motors based on the command received through the Bluetooth from our phone and the Arduino is interfaced between the robot hardware and the microcontrollers. Rack and Pinion gears are used to convert rotation into linear motion. The rotary motion applied to the pinion causes it to turn while it moves the rack sideways that turns the robots wheel left or right. Here the pinion rotates about a fixed axis, thus making the rack move on a straight path. The diameter of the gear determines the speed that the rack moves as the pinion turns. The human voice is given as the input to the Bluetooth Transmitter/Receiver. The end outcome will be the movement of the robot acting according to the commands given by the human. Hence that makes operating the robot to the need of the user, helping in the lifting of the goods, thus making it more efficient.



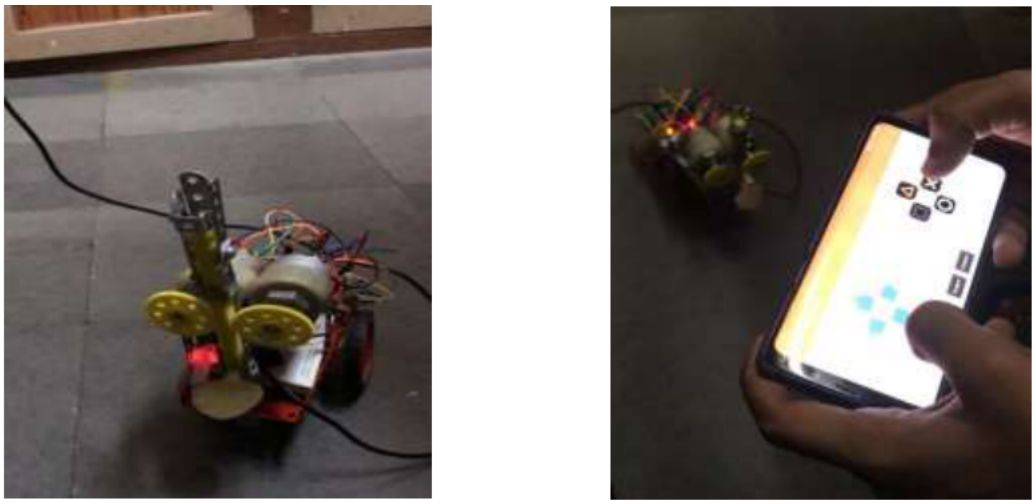


Figure 5 Pragmatic implementation of model

6. CONCLUSION

The primary work of this project work was to develop a Bluetooth controlled robot to lift goods. Our project deals with the mechanism based on the motion of the robot-controlled using Bluetooth commands provided to the Arduino, and the linear motion using rack and pinion to lift the goods using microcontroller 8051. It's the best way possible to lift the weights but it only works with a certain level of friction. If the friction is too high, the mechanism will be subject to more wear than usual and will require more force to operate. The base part of the robot which is controlled using Arduino can move in any direction based on the given command, but the range of the Bluetooth device is quiet less (approx. 10m). However, since these types of robots are based on small scale usage, we can work with Bluetooth module as it also consumes less power compared to a wi-fi module which has a higher range. More advancements can be incorporated depending on a particular use, like the range of the robot can be increased by using other technologies or the linear motion used in rack and pinion can be switched to a robotic arm (both rotational and linear movements of the joints to overcome the load and reduce the friction).

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