AI-Robotic Vehicle for Distribution of Pharmaceutical Products

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ABSTRACT
A robotic car is a car with artificial intelligence and the ability to drive itself without any human interaction most especially during the time of COVID-19. The basic operation was achieved using some Arduino components such as solderless breadboard, motor driver module, jumper wires, motor chassis, four tires, Arduino Uno and Arduino IDE, etc built with a microcontroller (ATMEGA328P). This work describes the development from scratch of a complete autonomous robotic car for pharmaceutical purposes. The outcome suggests that the car helps in pharmacies for delivering of pharmaceutical product such as drugs, assists human in a variety of ways in the pharmaceutical product delivery and reduces dispensing errors, leading to efficiencies in dispensary and thereby enhancing pharmaceutical product services.
Keywords: Arduino Uno, Robotic Car Chassis, Motor Drive, Bluetooth Module, Container.

I. INTRODUCTION

Nowadays, robotic-vehicles have been widely used in various kinds of fields like industries, academic, research and development, militaries and so on. The robotic-vehicles are small vehicles designed for spying, surveillance and inspection purposes. Robotic cars are robot vehicles designed to drive themselves without human intervention using sensors to actuate in the environment and they have been extensively studied as one of the top technologies for the future. Robots and artificial intelligence are both evolving fast (Chakraborty, 2016). Years ago, there was no contact with robotic systems and working with autonomous machines was rare, even on places with easy access to advanced technology. This is changing at a fast pace with the improvement of computer performance and the discovery of new technologies and techniques in areas like Artificial intelligence itself, computer vision, instrumentation, embedded controllers, among others. We are a long way from everyday robots in our daily lives, though, but the presence of these machines in our environment has increased and it is a promise for a better future. Among the most broached subjects on robots, the autonomous vehicles, or robotic cars, draw the attention of a lot of different public. Industries robots, the autonomous vehicles, or robotic cars, industries look into it as a tool for the future, while health and safety professional look to autonomous traffic systems as a probable solution for the ever growing numbers of accidents we have today. The idea of having a car that can drive itself is simply too useful. The prospect of no more car accidents, bring able to go to places without having to worry about traffic, or maybe going somewhere by yourself, even if you do not have a license or if you have an inability. No need (or way) for drunk people to drive, fluid traffic even on peak hours. Advanced sensing equipment and the use of lasers and cameras. One of the biggest benefits of a robot car is a substantially lower crash potential when compared to human drives. This car cannot get distracted and senses all angles, so it is much more capable of preventing an accident, unlike human

drivers who can be distracted and can only see several angles at a time. Another reason for this is that the car has sensing equipment capable of noting when objects are too close. The car's artificial intelligence is based on human actions and if an object gets too close, the car will have a human reaction to the object, such as swerving or moving away. As of 2011, a robot car has not been officially released to the public and is still in the testing stages. If such a car does become public, many experts predict it will result in lighter frames because of the substantially decreased possibility of crashing. A fleet of autonomous, electrically powered robot vehicles has started delivering medicine to care homes in London's Borough of Hounslow as part of a public trial. The (Kar, 2019), from U.K. startup Academy of Robotics, will be the first custom-built autonomous delivery vehicle to conduct last-mile deliveries public roads in Britain. Nowadays robotic-vehicles have been widely used in various kinds of fields like industries, academic, research and development, militaries and so on. The robotic-vehicles are small vehicles designed for spying, surveillance and inspection purposes. They can be customized for specific applications and are made with some special features.

A few medical robot research publications were surveyed and the following references had an impact on the design of the smart medical aid robot. (Zukowski et al., (2018)), have presented a humanoid medical assistant and companion robot exclusively for children's hospital. The concentrated on the robot's ability to express and interact with kids by identifying their features and telling stories and presenting instructional movies using visuals and text on the chest display. The Robot traverses through patient rooms on its own, performing simple diagnostic tests such as patients' body temperature or pulse rate.

Chempolil et al., (2021) have developed a prototype using Arduino Uno that assists the hospital nurses. The primary focus of this model is to make medical attendant not deal with the gadgets which were handled by the patients in which data can be passed through a sound framework or a medical attendant will help the underlying directions needed that is in the secluded ward so the patient can do the errand appropriately. With the help of a temperature sensor, they took readings and could supply power to UVC lamp that sterilized the items inside the rooms when exposed for 2 to 3 minutes.

Biswas et al., (2020), have presented an autonomous robot that accompanies the doctors and executes the given instructions. Using a distance sensor, the robot is made to be positioned at a sufficient distance from the doctor. It performs touchless operations using its automatic sanitization property. It also cleanses the necessary components using a UV sterilization system. In present days all mobile phones are Android Phones which is freely available in the market. Every designer has used their mobiles with no cost. Every students are familiar with Smart phones and its features because java programming language is used in their smart phone.

Materials and Method
i. Arduino UNO Board
ii. Arduino IDE
iii. Motor Drive
iv. Bread-Board
v. Motor Gear
vi. Soldering Iron
vii. Gun Glue
viii. Battery Holder
ix. Robotic Car Chassis
x. Connecting Wires.
xi. 5V Power Supply.
xii. 12V battery
xiii. USB Connector

Arduino Uno Board
The Arduino Uno (one) 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 USB cable.

Arduino IDE
The Arduino Integrated Development Environment (IDE) is a cross-platform applications 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 Arduino IDE supports the languages C and C++ using special rules of code structuring.
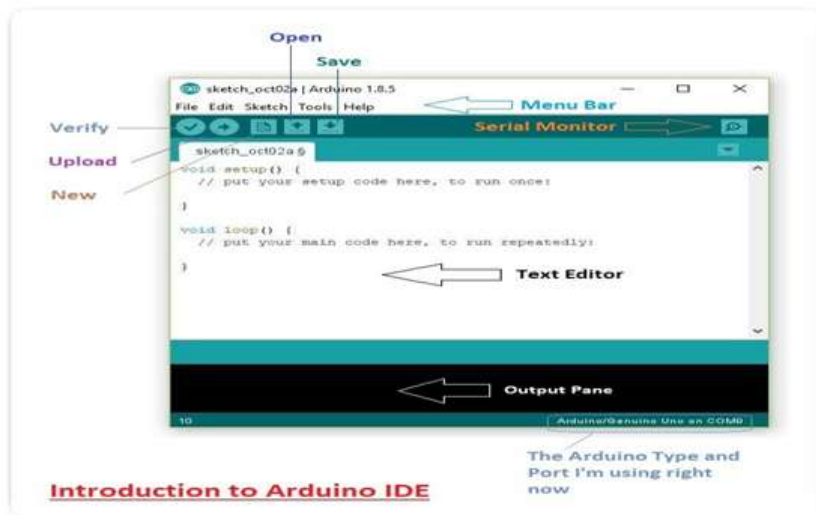
Figure 1 Block diagram of Arduino IDE

Image link
https://docs.arduino.cc/static/4106ba9a36bb5b73bc
95520a96f785ea/a6d36/AEK-CH2-SC2.1-
ARDUINO-IDE.png.

Motor Driver

The motor driver is a module for motors that allows you to control the working speed and direction of two motors simultaneously. This Motor Driver is designed and developed based on L293D IC. L293D is a 16 pin motor driver IC. This is designed to provide bidirectional drive currents at voltages from 5V to 36V.
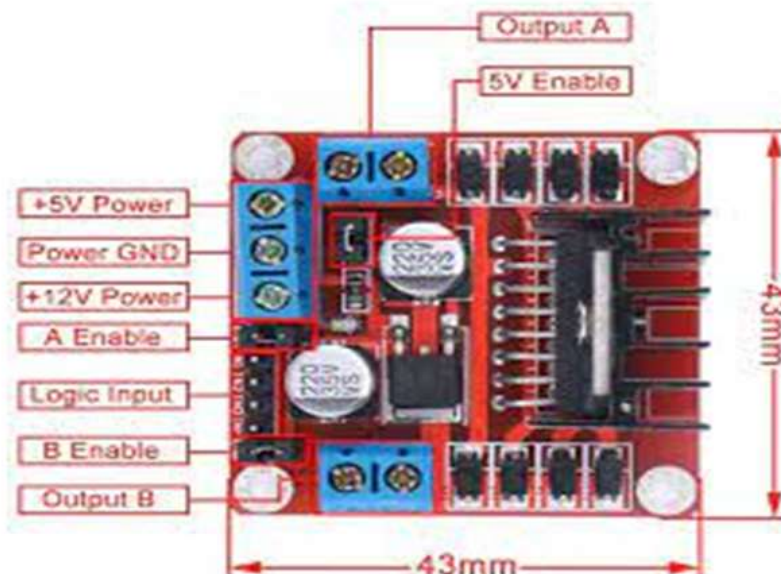

Figure 2 Block diagram of motor Driver

Image link
https://www.researchgate.net/publication/35060
9378/figure/fig1/AS:1008532073766912@161746
4192228/L293D-DC-Motor-Driver-Module.png.

Arduino Motor gear

The motors convert direct current electrical energy into mechanical energy. An external source provides power for the stator of these motors. As a result, the current flowing through the stator creates a uniform field under the

poles. The work of the gear is to move the Robotic car.

Bread-board

A breadboard, or proto-board, is a construction on base for prototyping of electronics. Originally the word referred to a literal bread board, a polished piece of wood used when slicing bread. In the 1970s the solderless breadboard becomes available and nowadays the term "breadboard" is commonly used to refer to this. Solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also popular with students and in technological education. Other breadboard types do not have this property.

Jumper Wires

Jumper wires are used for making connections between items on your breadboard and your Arduino's header pins. It is used to wire up all circuitry systems.

Power supply

The board can operate on an external supply from 7 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than 5volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

USB Connector

USB-C (Universal Serial Bus) is an industry-standard for transmitting both data and power over a single cable. The benefits of USB include increased data transfer rates (DTRs) and faster charging capabilities. USB connectors have a small rectangular shape with rounded edges. Its design is symmetrical and each end of a USB cable has both downstream and upstream connectors.

This means that end users do not need to be concerned with orientation when plugging in a USB-C cable.

Soldering iron

A Soldering iron is a hand tool used to heat solder, usually from an electrical supply at high temperatures above the melting point of the metal alloy. This allows for the solder to flow between the work-pieces needing to be joined.

Gun Glue

The Gun uses a continuous-duty heating element to melt the plastic glue, which the user pushes through the gun either with a mechanical trigger mechanism on the gun, or with direct finger pressure. The glue squeezed out of the heated nozzle is initially hot enough to burn and even blister skin.

Battery holder

The primary function of a battery holder is to keep cells fixed in place safely and securely while conveying power from the batteries to the device in question. External connections on battery holders are most often made by contacts either with pins, surface mount feet, soldered lugs or via a set of wire leads.
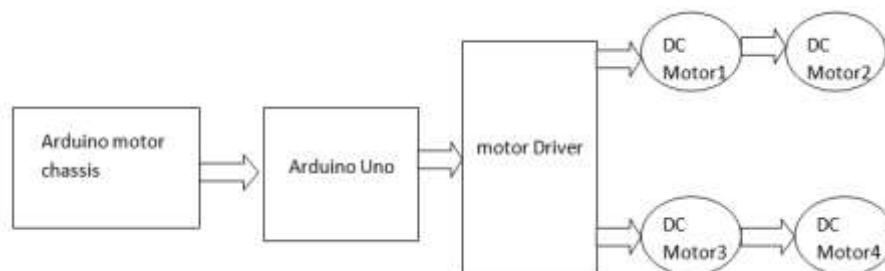
Robotic car chassis

The kit comes with encoder disks so that feed back speed and distance to a microcontroller is easily added.

The Robotic tires

A sensor is attached to the tire to send the tire pressure in real time to a monitoring station located in the cars.

Methodology

It consists of two (2) parts as follows: the programming control and the robotic car.

Figure 3 Block diagram of the implemented project

The robotic car in this work is made to move in four directions using a programming control. The programming control circuit is built around ATMEGA328 microcontroller board, NRF24L01 wireless transceiver module and joystick module. The circuit uses a 5 volts battery bank. The embedded hardware of the robotic car consisting of four DC motors, two L293D H-bridge motor driver IC, 74HC595 shift registers, NRF24L01 wireless transceiver module, servo motor, battery banks, Li-Po batteries & voltage regulators, Servo Motors, wireless transceivers, Li-Po Battery, base station computer and robotic car and a few common components developed on the ATMEGA328 microcontroller board. Movement is achieved by the DC motors interfaced with the microcontroller through serial communication data sent from the remote control. This result is transmitted to an operator at a base station where it is displayed on a screen using an appropriate software called Arduino IDE

Construction and Testing Materials used
The materials used in testing the robotic car are:

Project Board: This is a white electronic kit, which is used to test and construct electronic circuit without soldering the components. It provides room for circuit modification if need be.
Connecting Wires: These are tiny pieces of copper wires about $0.2mm^2$ in diameter. They are used to assemble components together on the project boards.
Battery: The source dc supply is 9volts high watt battery or 12V.
Software: which is the Arduino IDE
Serial Monitor is used to check if the code is running properly**.**

Working Principle of Motor Driver
The Arduino Motor Driver Shield is based on the L298 (datasheet), which is a dual full-bridge driver designed to drive inductive loads such as relays, solenoids, DC and stepping motors. It lets you drive two DC motors with your Arduino board, controlling the speed and direction of each one independently. When voltage is applied, a motor rotates in the forward/reverse direction according to the polarity of the voltage. The rotation speed changes in proportion to the voltage.
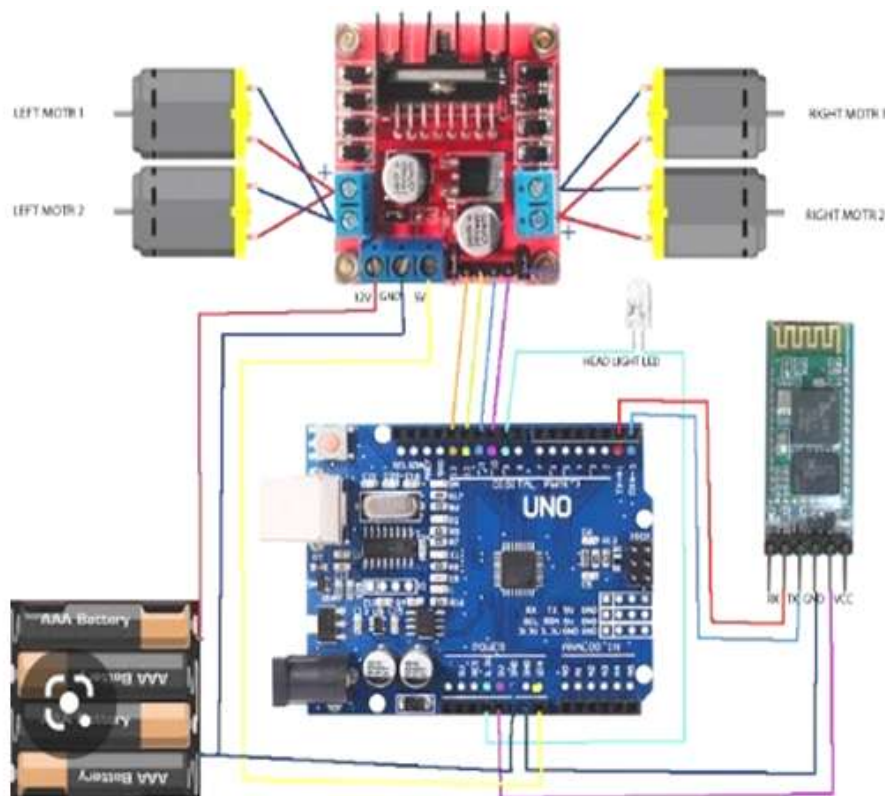

Figure 4 Block diagram of Arduino Motor Driver and Motors

Image link
https://europe1.discourse cdn.com/arduino/original/4X/7/0/a/70af2db6f8bf 91f5f6de485d48cc6d7463647290.jpeg.

Steps on building robotic car
Materials
Four motors, Two wheels, Arduino microcontroller board Uno, Motor driver, Battery holder and 6 volts of batteries, Chassis

Construction
Attach the wheels and motors to the chassis, glue on the battery holder, attach the motor driver circuit, position the Arduino Uno, wired the car and programmed the robotic car.
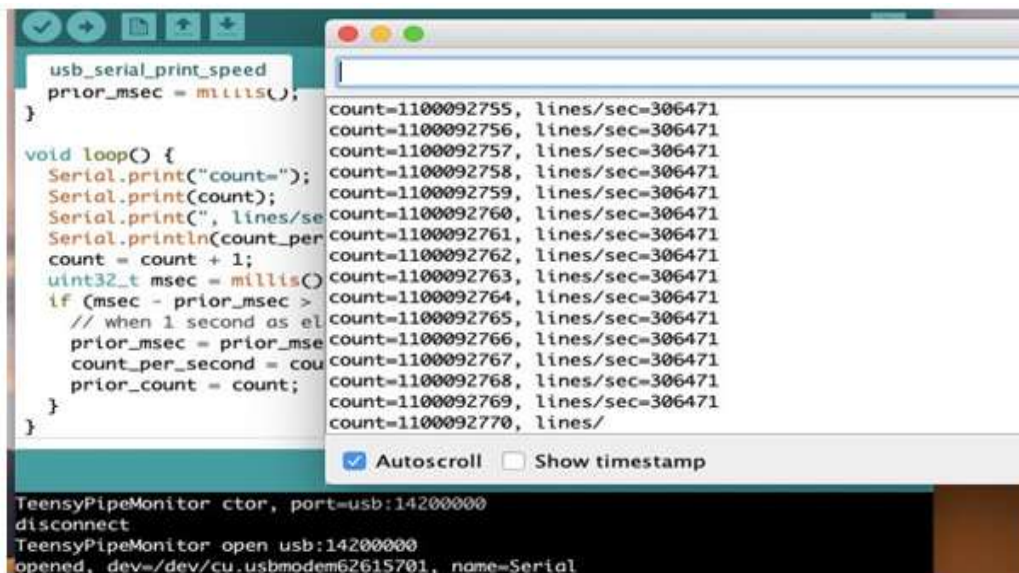
II. RESULTS AND DISCUSSION

Result
During the experimental procedure, serial monitor was used to test if the program run successful and also, it was also used for checking if the program is doing exactly what is meant to do by sending data to the hardware and converting to an output. A serial monitor is found in the Arduino Integrated Development Environment (IDE).

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III.   CONCLUSION

In conclusion, the work aimed at developing the affordable robotic car for delivery of pharmaceutical products using motor driver with the aid of an Arduino Uno. A robotic car that can drive itself was built. This construction and testing was archived after going through several literature reviews of which the principle of robotic car was discussed and the building of robotic car was achieved.

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