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AUTONOMOUS ROVER FOR GROCERY DELIVERY

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Abstract: ***Online food delivery has a tremendous growth these days, but it also comes with lot of maintenance. With the constantly growing fuel prices and increase in demand for the food delivery agents, it has become a great task to make profits. The autonomous rover solves this problem and it also brings huge profits by avoiding fuel charges and delivery agent salaries.***

I. Introduction:

The idea is to build a rover that can deliver food without having the need of operator and maintenance. The rover can have the payload up to 4 kgs and Runtime up to 2 Hours. Which is sufficient to deliver the food on time and return to the nearest station. The rover is also equipped with GPS and wireless camera so that the technical team can monitor the analyze the data. The rover has the enough ground clearance to avoid damage underneath and can pass through slush and bumpy roads.

II. Working:

a. Mechanical Part

The rover has the 6 pods (6 legs). The 6 powerful DC motors (12v) along with 3-inch wheels are attached to the pods. This mechanism helps the rover to climb the huge stones or bumps, even climb stair. The upper part of the body holds the cabin for payload and lower end of the body consists of electronic components. The body is designed such a way that the one side of the body is fixed with 2 bolts and the other end of the body is made to rotate freely along the pods, so that the body acts as natural suspension. In this way the rover can easily climb and maintain stability.

b. Electronic Part

The rover is powered by 3-cell LiPo battery (14v) that provides sufficient power for one round trip. The rover is also equipped with a micro controller, motor driver, Ultrasonic Sensors, Wireless camera, GPS module, IR Sensor, Raspberry pi, pi camera, LTE module.

1. Raspberry pi:

The Raspberry pi is a single board computer. It is typically used my computer and electronic fields. It has become more popular due to is low cost, open design and modularity. It also comes in variety of versions, allows the user to focus only on the objective. There are many peripherals that can be attached to this minicomputer. The few peripherals that used in this project are Pi cam, LTE module and GPS module.

2. Pi Camera:

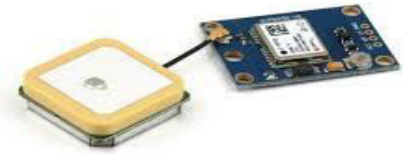
Camera Module has a Sony IMX219 8-megapixel sensor (compared to the 5-megapixel OmniVision OV5647 sensor of the original camera). The Camera Module 2 can be used to take high-definition video, as well as stills photographs. it's a leap forward in image quality, colour fidelity, and low-light performance. It supports 1080p30, 720p60 and VGA90 video modes, as well as still capture. It attaches via a 15cm ribbon cable to the CSI port on the Raspberry Pi. It can be accessed through the MMAL and V4L APIs, and there are numerous third-party libraries built for it, including the Picamera Python library.

3. LTE Module:

SIM7600EI is a complete multi-band LTE-FDD/LTE-TDD/HSPA+/UMTS/EDGE/GPRS/GSM module solution in LCC type which supports LTE CAT1 up to 10Mbps for downlink and 5Mbps for uplink data transfer. Designed in the compact and unified form factor, SIM7600E-H module, which allows the customer to design their application once for different technology and benefit from great development time-saving.

4. GPS Module:

Global Positioning System (GPS) determines accurate position by receiving signals from satellites in space and ground stations on the land. The GPS module uses Radio waves or Radio Signals sent from satellite and these signals are received by ground stations on Earth. The accuracy of the GPS can me nearly 12-25 meters. It does not specifically requires any other communication medium.



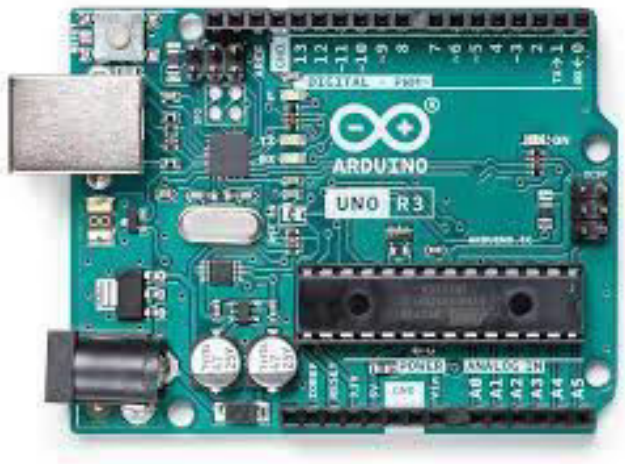
III. Programming Part

The micro controller is programmed using C and can be interfaced with other components, so that it can communicate and collect that data from the other sensors.

a. Arduino:

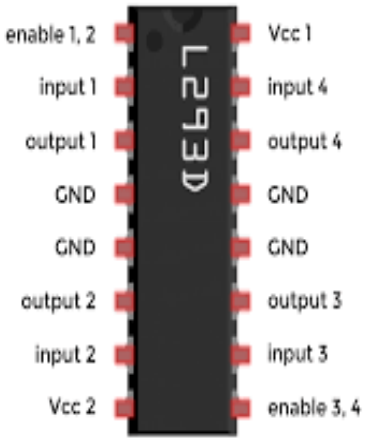
Arduino is a single board open-source electronic platform which allows users to interface various other modules such as, IR sensor, Ultrasonic sensor, Speed sensor, etc. It is very affordable is easy to use. This single-board small micro controller can hold up to 4MB of RAM and can be reprogrammable.

The Arduino comes in many versions out of which the popular Arduino is Arduino UNO. It consists of 14 Digital Signal pins and 6 Analogue Signal pins. The 5 pins in Digital Signal series are used for PWM (Pulse Width Modulation). The Input Pins are used to read input data and output pins are used to produce output. However, there are no specific labels for these pins. By mentioning state of the pins i.e., HIGH/LOW INPUT/ OUTPUT; the user can determine READ/WRITE function.



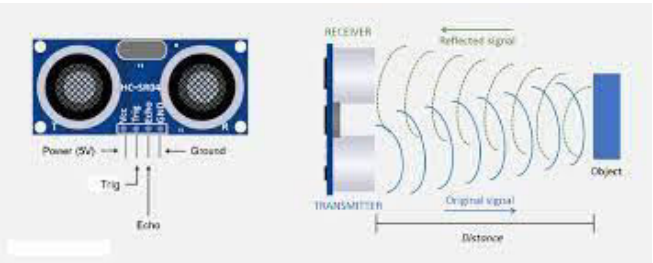
b. Motor Driver:

The L293D IC receives signals from the microprocessor and transmits the relative signal to 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.



c. Ultrasonic Sensor:

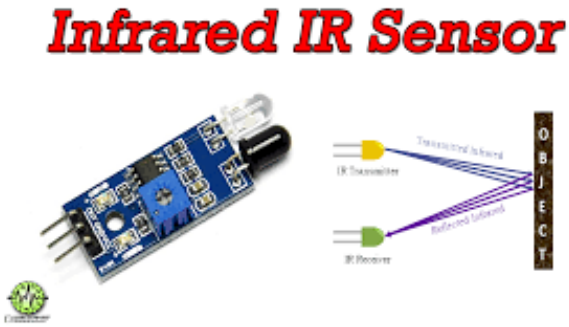
Ultrasonic sensor is an instrument that is used to measure distance between the sensor and object. It consists of transmitter and receiver usually known as Trig and Echo. The trig produces ultrasonic waves and echo receives those emitter wavs after hitting the object. The ultrasonic sensor uses ultrasonic wavers (20-20000hz frequency). These wave travel at the speed of 432 meters per second. The distance can be measure by calculating the time requires for one wave to bounce back.



d. IR Sensor:

An infrared sensor (IR sensor) is a radiation-sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780 nm to 50 µm. IR sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests.

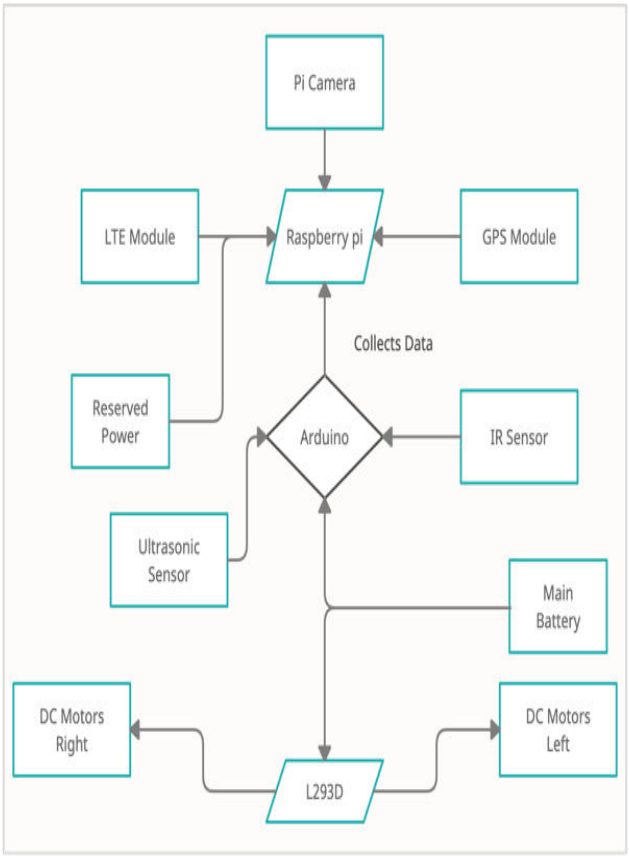
IR follows same principle as Ultrasonic Sensor but, in this case, Light plays an important role. Here, light is replaced with Ultrasonic Waves. When the light emitted by one IR LED, it travels and hits the object. These IR light then travels back and the other LED receives the incoming light.



e. Battery:

The power house for this project is 14V 3-cell LiPo Battery, connected directly to the motor driver and an alternate battery used to power micro-controller so that both DC motors and brain of the project receives enough amount of power.

IV. Use Case:



V. Conclusion:

In this paper, I have presented the Autonomous Rover for Grocery Delivery. In this project we performed many tests before developing further. The idea is to make the project as portable as possible and as efficient as possible.

The technology involved is very minimal so, hence this rover is very affordable and consistent.

VI. References:

Body Structure idea – YouTube Channer Navin khambhala. LTE module reference – infratec.com, Arduino.cc, Rasbperrypi.org.