

Smart Cart

Gayatri Gulbhele¹, Sanika Pawar², Dhanshree Biradar³, Chetan G. Kotangale⁴, Rajnandini Sonone⁵,
Bhumi Jadav⁶ and Dr. Pallavi Deshpande⁷

¹⁻⁷Department of Electronics and Telecommunication Vishwakarma Institute of Information Technology Pune, India

Abstract—This electronic document is about the usage of the Infrared sensing technology to help make a remotely controlled cart. The infrared senses the obstacle in the way of the cart, making it possible to avoid obstacles. The cart is equipped with phone-controlled technology, Wi-Fi enabled, to control it over longer distances using the ESP32 module. This document also discusses the possibilities of the integration of this technology into other fields. Additionally, this system can be programmed with live video streaming facility through the integration of camera and can be enhanced further via GPS to track your phone so that you wouldn't have to use your phone to control the device. The device may automatically detect your phone and follow it accordingly. This advancement may have a global impact on the transport as well as tours and travels industry.

Index Terms—esp 32, luggage, ir sensor, phone controlled.

I. INTRODUCTION

The technologies in everyday world has made many things easier in our day to day life. With the integration of tech- nologies things have become fast-paced. One such field of development is the electronic devices we use in our day to day life. This brings us to our main objective of this paper. We have been travelling all over the world for the development of the human civilization and the problem we usually face is the luggage barrier we need to carry around. So, to solve this issue we have developed a smart cart that can carry your essential with you without even touching your bags/ luggage.

This smart bag is comprised of an ESP32, Infrared Sensor (IR sensor), a motor driver, 2 BO gear motors and 9V battery. The bag is designed to be operated using a Wi-Fi server making it efficient by operating it via your mobile phone. The cart also has an IR sensor to stop the cart if an obstacle is detected.

The paper is comprising of 4 sections. Section 1 display the introduction to the project. Section 2 describes the literature survey conducted about project.

It also compiles down the hardware used for the cart and the specifications of the cart. Section 3 is the description of the future aspects of this model and how it can be integrated in our day-to-day life. This also describe the limitations and the possible solution for the problems. Section 4 concludes this paper with provided references.

II. LITERATURE SURVEY

A. Related Works

The world is ever-lasting with innovation and ideas. This section provides a brief description of the projects and works implemented in our smart cart. Following are some of the works that defines the foundation of this paper:

N. Sreeraman, G. Sathyapriya, G. Ganesan, G. Ajithkumar, S. Praveen Kumar...

The paper suggests the use of the IR sensor in braking system in the autonomous vehicle. We have used the same concept to make the smart cart obstacle avoiding using the IR sensor making it less troublesome. The IR sensor uses the emission detection technology in order to detect an obstacle. The emitted IR ray bounces back from the obstacle detected sending the signal to the ESP 32. The ESP 32 is the main controller of the cart which controls all the functions of the cart. It sends the signal to the motor driver to stop the cart if the IR sensor detect an obstacle. This is also accompanied

by a message that is being send to the phone through Wi-Fi server launched by ESP 32.

A same concept was used by [2]H. U. Zaman in his line following robot which uses the predefined path to drive the robot. It uses the same concept of using the IR sensor.

Vipul Dave...

The control system for the motor driver is based on a Wi- Fi based Web server deployed by the ESP 32 module. A web server is designed to do a great job of sending static content out to an address. The user may visit the web server and can access to the navigation of the smart cart. The ESP 32 uses the integrated Wi-Fi 802.11b/g/n.

B. Hardware Setup

The first step is setup all the hardware components required by the project. The cart includes an ESP 32 module, an IR sensor, a motor driver (L298N), 2 B.O. motors, 9V battery, wheels, chassis, etc.

ESP 32 module

The ESP 32 as shown in the Fig.1 is a powerful System on Chip (SoC) microcontroller with integrated 2.4 GHz of Wi-Fi 802.11b/g/n, dual mode Bluetooth version 4.2 and a variety of peripherals. The easy to use functionality and programmability provides the user the privilege to integrate it into many IoT projects. It is an ideal programming board with the integration of Wi-Fi and Bluetooth for a long distance communication channel.



Fig. 1. ESP 32

Some key features of the ESP 32 are as follows:

- 32-bit LX6 microprocessor
- Wi-Fi and Bluetooth connectivity
- GPIO pins for interfacing with other devices
- 5 V DC power supply

The ESP 32 is usually programmed by the Arduino IDE. This makes it pretty easy to understand of how the Arduino works and is programmed. ESP also has many variants provided for different kinds of functions.

Motor Driver

A motor driver is a kind of a circuit that is useful to control a set of motors using less power and can be used by a programming board to command the motors in certain inputs. The motor we have used for our project is a L298N Fig.2.

The L298N IC is a popular motor driver IC that controls the direction and speed of the motors connected to the mainframe. The component can control maximum four motors at the same time. We have used two motors for the cart.

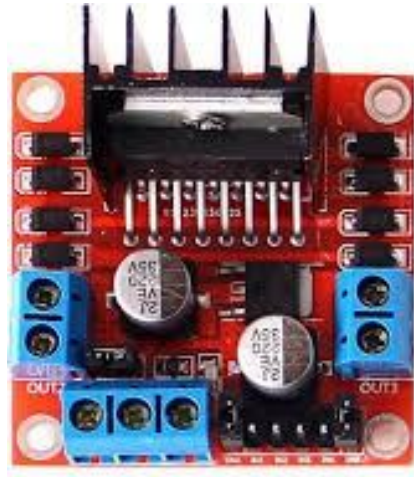


Fig. 2. Motor Driver

The L298N has two H-bridge circuits, which provide the function to control the direction of the motors. Each H-bridge consists of four transistors that can be controlled independently. The direction is determined by switching these transistors on and off in the correct sequence.

Infrared (IR) sensor

An infrared sensor works on the principle of the reflection of electromagnetic (EM) waves specifically infrared waves. The IR led produces the IR signal that bounces off the obstacle in the way and the photodiode.

Some key features of an IR sensor are as follows:

- Low power consumption
- Cost-effectiveness
- Minimal Interference
- Versatile Applications
- Efficient communication in short-distance communication.



Fig. 3. Infrared Sensor

IR sensing is still in its optimizing stage so the advancements in this field of study are huge. The integration of advanced materials and nanotechnology can further reduce the power consumption without compromising the transmission efficiency. The advancement allows for enhanced signal transmission, improved miniaturization and more robust system with high tolerance to the environmental factors. This opens up new possibilities in fields like remote sensing, healthcare and even space communications.

B.O. Motors

Battery operated motors also known as B.O. motors are DC geared motors operated at lower voltages. These are lightweight and provide good torque and rotations per minute (RPM). These are mostly used in do-it-yourself projects.

These motors are operated at a voltage of 3-12V. There are many different variations of these motors based on RPMs such as 1000, 150, or 300 RPM. These also facilitate the ability to rotate in both clockwise as well as anti-clockwise direction.

C. Working

The working of cart is based on a concept of using the IR for obstacle detection and a Wi-Fi server for the control of the cart. The Wi-Fi server provides an interface for the ESP 32 to get input to the system from the webpage.

The frontend comprises of a front, back, start and stop button. As any button is being clicked the signal is transmitted through the Wi-Fi to the ESP 32. The uploaded algorithm processes this data using the Wi-Fi.h and WebServer.h libraries. The Wi-Fi library is used by the ESP 32 to provide authentication to the user to provide IDE by connect it to their Wi-Fi network using the password. The cart doesn't respond to the commands unless is being connect to the Wi-Fi. This make sure that your cart is only in your own control. The WebServer.h library supports the HTTP GET and POST requests. The webpage can be handled by one client at a time. Thus, enhancing the security of the product.

The following is the schematic for the circuit of the smart cart:

Flow chart

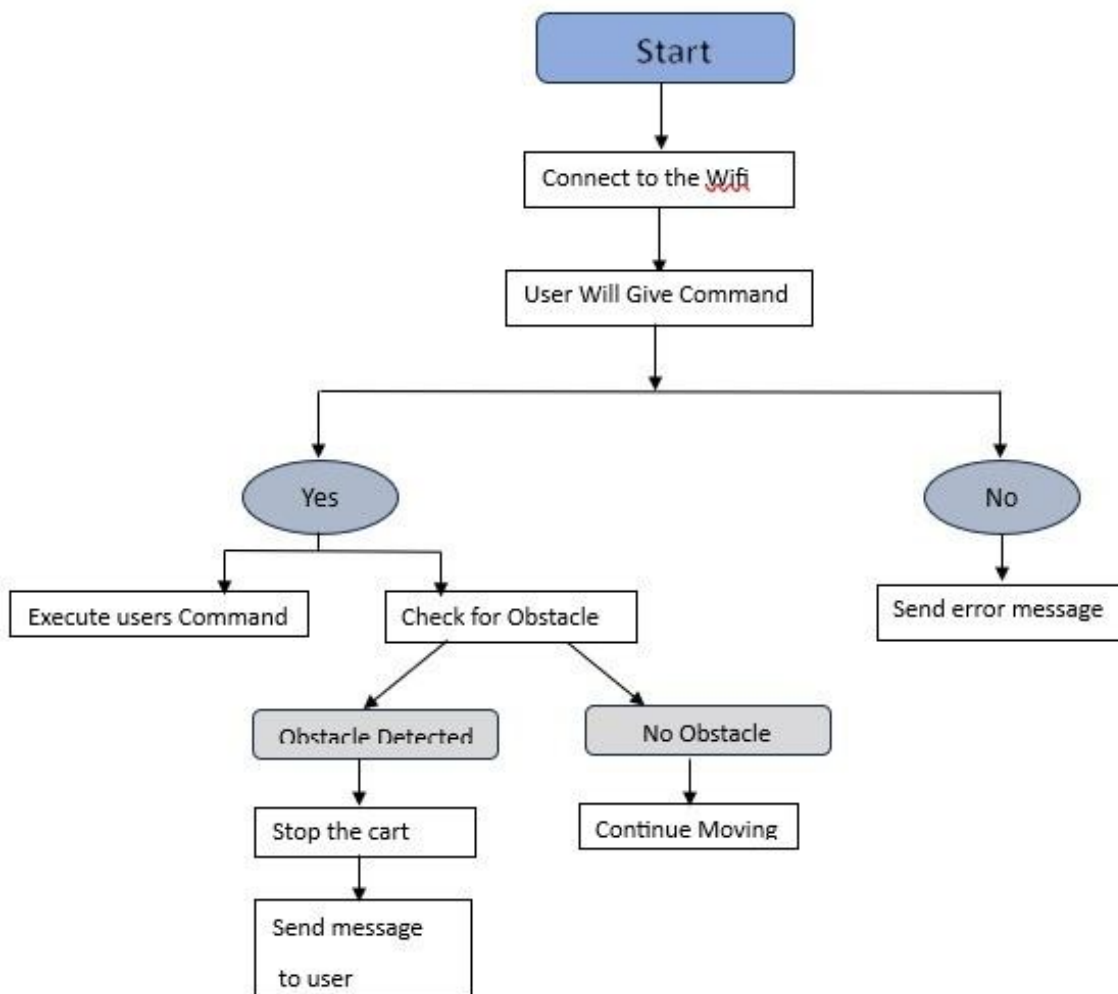


Fig. 4. Working Principle of the Smart Cart

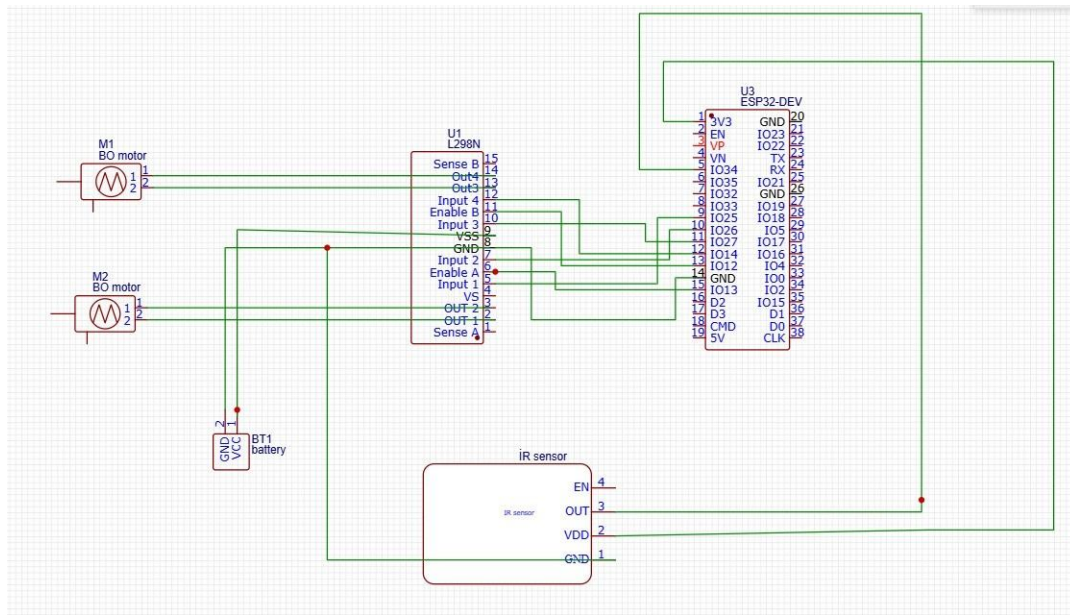


Fig. 5. Schematic diagram of the Smart Cart

III. RESULTS AND CONCLUSION

A. Results

The above given instructions provide us the facility to develop a cart which essentially help us to transport goods over a range of distance without using manpower or labour. The enhancement of technology has lead us to use our smartphones for our day-to-day needs. This idea led us to use the smartphone as a controller for the cart so you don't have to worry about yet another device to control your cart. The following are the images for the prototype of the cart:



Fig. 6. Smart cart

This concept is still at an under-developing stage. The development of technology this could provide a huge boost to the transport and tourism sector helping them with their baggage problems.

The design can further be enhanced by advance GPS tracking ability making it safer to be handled. This also means that the cart can follow you wherever you go. Hence, increasing the customer convenience and helps in solving the problem for multiple baggage handled by a single person if integrated for multiple baggage with the user-friendly interface.

The cart with integrated cam can result into a cart with surveillance security. This further enhance the security of the cart. The cart is prototypically power by the use of a 12V battery, replacing this with a rechargeable battery can further develop the product to a level of comparability with the current performing products.

The following are the images generated with AI about the ideal product design of our project:

It can also use a display about the specifications of the luggage. Also display some more information about the environment.

B. Conclusions

We have successfully made a phone controlled cart ready to carry your goods for you. This mechanism can be enhanced exponentially by making the car chassis more robust and with the development of the IR communication technology. The cart can further be enhanced by using the GPS module which makes the work hand-free and much more convenient.

This concept of hand-free mobilization can be very effective in case you want to move/ carry around a large number of luggage around you making it much more efficient and user-friendly.

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