SMART LUGGAGE CARRIER USING RASPBERRY Pi, GPS and COMPASS

Aaron Rajkumar, Ramprashant, Manikandan Velar and Suresh Kannan
Student,
Department of Electronics and Telecommunication Engineering,
SIES Graduate School of Technology, Nerul
Navi Mumbai, India

Prashant L.Ahire
Assistant Professor,
Department of Electronics and Telecommunication Engineering,
SIES Graduate School of Technology, Nerul
Navi Mumbai, India

***Abstract* — Distribution of goods using Automated Carrier Vehicle has been widely used by some of the industry. The robotics industry is evolved so much and is used to perform a certain task. In this paper, our attempt is to reduce the human efforts in domestic and industrial applications.We have built a robotic cart which is able to track and follow the target in any surrounding. A follower robot can be more helpful in medical and military purpose. More specifically, our approach is to design a control system which can carry luggage as well as follow the target person. In this project, the follower robotic cart is proposed by interfacing the microcontroller with an ultrasonic sensor.**

Index terms: Automated Carrier Vehicle , robotic cart , ultrasonic sensor.

1.INTRODUCTION

In today's era robots play a very important role. Robotic technology has been increased in this generation. Robots are used to perform various tasks which are dangerous for human beings in certain cases. Robot assistance is proved to be always helpful for us. A robot that can carry our stuff and accompany us in shopping malls, home, golf courses. There are many advantages of having such kind of robots. Mobile robot has a focus in a process of transferring goods from one point to another point in the industrial sector.It can also be used in civil and industrial applications. It is desired in many applications that the robot is able to track and follow the person.The robot should be able to track the movements and the exact current location of the person and follow him.In order to follow a human, a mobile robot needs to know the position of the person and must be able to determine its own path in order to follow his target. This type of robot is implemented using sensors. We present the effectiveness of our approaches by showing the experimental result using a real mobile platform. The methods of following the target person involve constant analysis of distance between the target person and the robot. These systems have many drawbacks. A simple robot is interfaced using sensors. These sensors detect the path and follow it. For a robot that performs autonomously,the communication between the person and the robot is the most important factor.A significant awareness has been observed regarding the usage of such a technology. These systems are able to avoid the obstacles since they are using Ultrasonic sensors. Data received from the ultrasonic sensor is processed by microcontroller and thus the movement of the cart is decided[1].Distribution of goods using Automated Guided vehicle has been widely used by some of industry.This research discusses the movement control algorithm of weighted vehicle by trolley using fuzzy Inference System[2].A follower cart equipped with ultrasonic sensors at the front and luggage on the top of it.The distance between the target person and the robot is fully measured and the movement of

the following robot is decided by the inputs received by microcontroller from the ultrasonic sensor[3].A robot which is able to pursue a specific person through an airport while assisting and also carrying the target persons luggage[4].The Automated Guided vehicle using fuzzy Inference System has a drawback of moving only in a particular path and it also consist of many sensors[2].The electronic luggage follower has a drawback of a rope which is used to drag the luggage's direction to left and right which is not robotic and user friendly and in path if there is a obstacle they it create a disturbance in surrounding by activating the alarm[4].The human following robot has a drawback of tag detection because of that the tag should be always on the target and it also uses camera which increases the cost of the system and it also uses a ultrasonic sensor only on the top because of it there can be can be a possible of not detecting the object which is below the sensor[1].The car controlled using bluetooth communication has a drawback of consuming high power and it also requires a good internet connection and since it uses bluetooth communication the operational range is limited to 10 meters only and the charge in LIPO battery cannot be determined so anytime the car can be stopped working[3].

2. BLOCK DIAGRAM

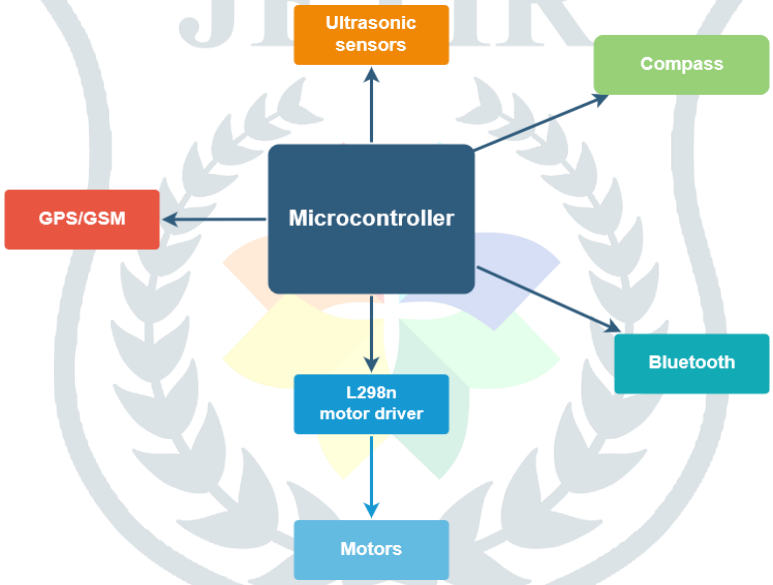

Fig. 1.Block Diagram

It is a robot easy to be used and to be manageable by any person.It is a wireless system made of a transmitter part and a receiver part connected to the luggage.It has an optional way to carry the luggage in case of any problem. It consist of sound structure and base design to resist load, different temperatures, and external forces. It is a luggage with an attractive and innovative exterior design.it also consist of security system so that the user can be free of worries of his or her luggage being stolen or left behind.it can also be used for defense purpose.

3.FLOWCHART

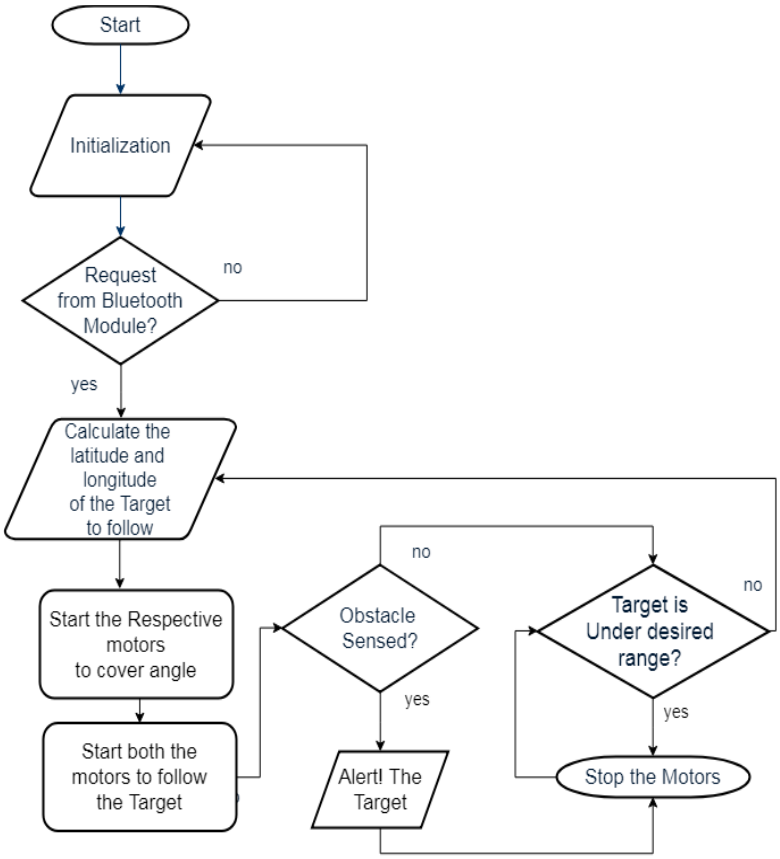

Fig. 2.Flowchart

4.SYSTEM COMPONENTS

i)Raspberry Pi 3(Model B) -

The Raspberry Pi 3 Model B is the third generation Raspberry Pi. This powerful credit-card sized single board computer can be used for many applications and supersedes the original Raspberry Pi Model B+ and Raspberry Pi 2 Model B.It has a Power of 5V and 2.5A,it supports a SD card between 8-32 GB so that we can download operating system,Python is the recommended programming language.

ii)Ultrasonic sensor -

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit.It has a Working Voltage of 5V DC, Working Current of 15mA ,Working Frequency of 40Hz ,Max Range of 4m, Min Range 2cm, Measuring Angle of 15 degree ,Trigger Input Signal 10uS TTL pulse.

iii)L298n motor driver -

The L298 Driver is a high voltage, high current dual ful bridge driver designed to accept standard TTL logic levels and drive inductive loads such relays, solenoids, DC and stepping motors.Two enable inputs are provided to enable or disable the device independently of the input signals. it has a Operating supply voltage up to 46 V,Total DC current up to 4 A,Low saturation voltage,Over temperature protection,Logical "0" input voltage upto 1.5 V.

iv)GPS(NEO-6M) -

GPS Module embeds the very capable uBlox PAM-7Q GPS device in a project-friendly module.The PAM-7Q GPS device gives your project the ability to understand its position anywhere on the earth, as long as it has a clear view of the sky. It has a Power requirements of 3.3 V – 5V, 55 mA,max (typically 35 mA),Communication: TTL Asynchronous Serial (UART), Operating temperature range: -40 to +185 °F (-40° to +85° C)

v)Compass -

The Honeywell HMC5883L is a surface-mount, multi-chip module designed for low-field magnetic sensing with a digital interface for applications such as low-cost compassing and magnetometry. It has a Supply Voltage from VDD Referenced to AGND 2.16-3.6 Volts,Operating Temperature of -30 to 85°C, Storage Temperature of -40 to 125 °C

5.IMPLEMENTATION

This bot was designed keeping in mind of domestic usage of carrying things following automatically and can also be controlled manually under a specific radius of space. Smart luggage carrier is divided into several phases of constructing process as follows:

A)Designing a mechanical structure

A structure which is having the capacity to carry enough weight and size of a daily use things or luggage. Hence we have decided to build it using wood. The inner part of the carrier will have space for the microcontroller and the hardware components to be placed .

Fig. 3.Conceptual Body Structure

This carrier travels using 3 wheels, with 2 front wheels controlled using motors and motor driver circuit and 1 Swivel Caster at the back to get a free easy turnaround .This type of 3 wheel mechanism gives more easier turnings then the usual 4 wheel mechanics.

B) Constructing the carrier circuitry

On basis of the idea conceptualized the carrier should carry the weight and follow the microcontroller who is connected wirelessly through mobile.Using the Raspberry Pi which here is our microcontroller the GPS location parameters of the carrier cart is been sensed and recorded through NEO-6M GPS

module.The GPS module is connected to UART pins TxD and RxD of the Pi. The magnetometer connected to the I2C pins of the Pi , simultaneously senses the directional axis parameters and sends it to the Pi.The parameter read from the magnetometer and the GPS are used to calculate the angle to be turned by the carrier towards the host to be followed and then the distance between the carrier cart and the host are been calculated.According to the calculated parameters the corresponding motors are activated to rotate towards to host direction.The motors are also correspondingly activated to cover the distance calculated .

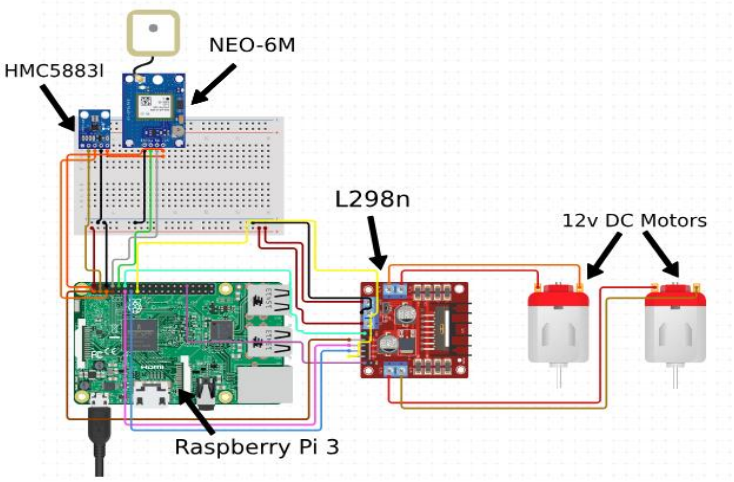

Fig. 4.Circuit Diagram

Motor stops after coming under a specified radius .Both the motors are connected to the l298n motor controller .

C) Customizing the controller application

As per the constructed design of the carrier circuit and the expected way it has to work ,a mobile application is import and the last phase of the smart lugguage carrier. The app user interface should consist of a Bluetooth ON switch to connect to the carrier and a "follow me" switch which when made ON makes the carrier to follow the host.

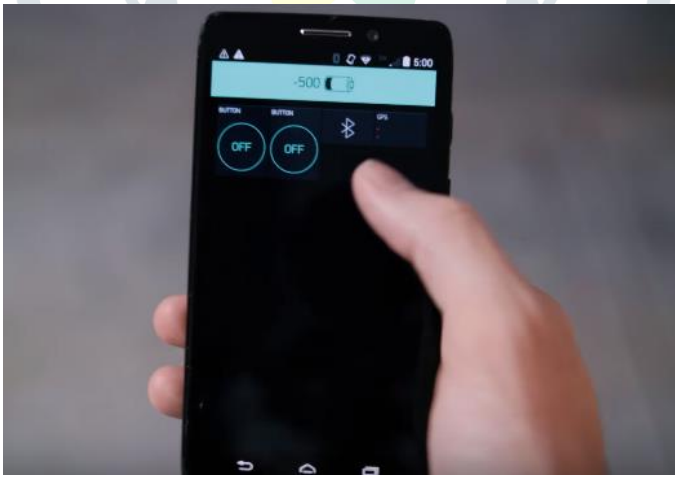

Fig. 5.Controller mobile application

A GPS activator button is also added to get the GPS parameters of the host controller device.

CONCLUSION

The major aim is to design and construct a follower robotic cart using the ultrasonic sensor which can track and follow the target person in unstructured environments. The follower robotic cart is achieved

using the ultrasonic sensor, motor drivers and microcontroller . The system provides a new approach in the field of robotics. This cart would be helpful in reducing work while performing a certain task. The follower robotic cart has better scope in the near future. The different sensors that were integrated with the robot added an additional advantage. The machine is developed to be affordable for a new invention that can lead to new applications to aid humans further. The team is also planning to make experiments using sound CONTROL SYSTEM such that the robot follows the human instructions

REFERENCES

[1] Muhammad Sarmad Hassan,Mafaz wali Khan, and Ali Fahim Khan "Design and Development of Human Following Robot" July 2015

[2] Riesa Krisna Astuti Sakir,Angga Sigit Yuwono,Agung Surya Wibowo,Silvirianti and Nadia Tri Jayanti "Movement control algorithm of weighed automated guided vehicle"2017

[3] Dipali Namdev Shelke,Azmina Gayasuddin Maniyar and Poonam Kisan Pawar"Android App Based Car controller Using Bluetooth"May 2017

[4] Cesar Nunez,Alberto Garcia,Raimundo Onetto,Daniel Alonzo

[5] Riesa Krisna Astuti Sakir,Angga Sigit Yuwono,Agung Surya Wibowo,Silvirianti and Nadia Tri Jayanti "Movement control algorithm of weighed automated guided vehicle"2017

[6] Dipali Namdev Shelke,Azmina Gayasuddin Maniyar and Poonam Kisan Pawar"Android App Based Car controller Using Bluetooth"May 2017

[7] Cesar Nunez,Alberto Garcia,Raimundo Onetto,Daniel Alonzo

[8] Riesa Krisna Astuti Sakir,Angga Sigit Yuwono,Agung Surya Wibowo,Silvirianti and Nadia Tri Jayanti "Movement control algorithm of weighed automated guided vehicle"2017

[9] Dipali Namdev Shelke,Azmina Gayasuddin Maniyar and Poonam Kisan Pawar"Android App Based Car controller Using Bluetooth"May 2017

[10] Cesar Nunez,Alberto Garcia,Raimundo Onetto,Daniel Alonzo and Sabri Tosunoglu"Electronic Luggage Follower"May 2010.

[11] *Ms. Sneha Jainwar, Mr. B. HariKishore Rao, Ms. Khyati Varma, Ms. Honey Tamrakar "The Intelligent Suitcase", Sep 2016.*

[12] *Keerthi .S. Nair, Anu Babu Joseph, Jinu Isaac Kuruvilla "Design of a low-cost human following porter robot at airports" Feb 2014.*

[13] *Dimitar Karastoyanov, MilenaGrouev, "Wireless Controlled Luggage Carrier"2011.*

[14] Riesa Krisna Astuti Sakir,Angga Sigit Yuwono,Agung Surya Wibowo,Silvirianti and Nadia Tri Jayanti "Movement control algorithm of weighed automated guided vehicle"2017

[15] Dipali Namdev Shelke,Azmina Gayasuddin Maniyar and Poonam Kisan Pawar"Android App Based Car controller Using Bluetooth"May 2017

[16] Cesar Nunez,Alberto Garcia,Raimundo Onetto,Daniel Alonzo and Sabri Tosunoglu"Electronic Luggage Follower"May 2010.

[17] *Ms. Sneha Jainwar, Mr. B. HariKishore Rao, Ms. Khyati Varma, Ms. Honey Tamrakar "The Intelligent Suitcase", Sep 2016.*

[18] *Keerthi .S. Nair, Anu Babu Joseph, Jinu Isaac Kuruvilla "Design of a low-cost human following porter robot at airports" Feb 2014.*

[19] *Dimitar Karastoyanov, MilenaGrouev, "Wireless Controlled Luggage Carrier"2011.*