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Automated Guided Vehicle using Line Follower with WiFi Control and Monitoring

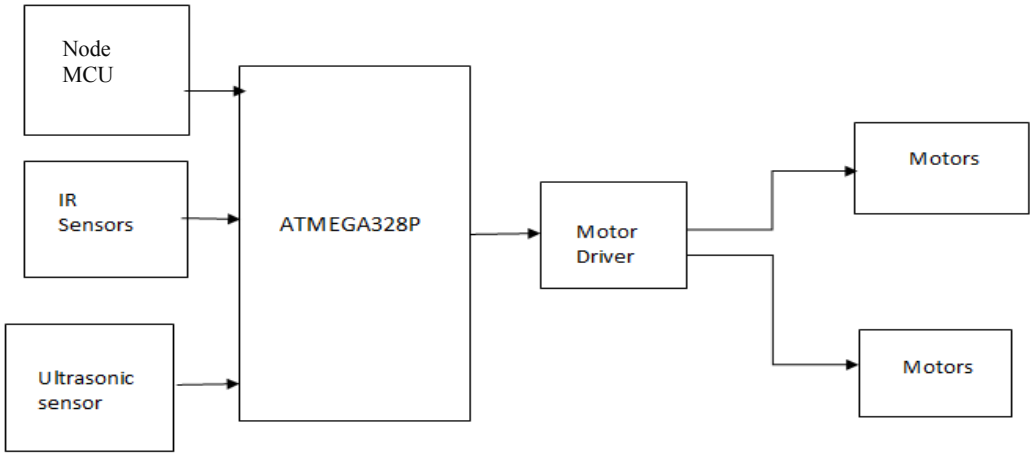
Pradnya A. Patil, Vaaideehi N. Sonavani, Khyati D. Kshirsagar
Students, Department of Electronics and Telecommunications,
Maratha Vidya Prasarak Samja's Karmaveer Baburao Ganpatrao Thakare College of Engineering, Nashik, India

Abstract: *In warehouses we can find the need of transporting navigation is the significant feature in applications of automated guided vehicles. Various kinds of navigation tools are available based on complexity & accuracy. This automated guided vehicle is a system that follows a particular line present on the ground. The line can be selected with a high contrast colour or with a black colour which is visible. This project includes the above concept and is further advanced with an IoT based system. The position control can be done using an online server.*

Keywords: Automated Guided Vehicle(AGV), IoT, Internet of Things

I. INTRODUCTION

The main aim of any system is to reduce human effort. One of the most crucial aspects of logistics systems is the handling of flow of material in industrial surroundings. The Automated Guided Vehicle based on IoT to carry goods is the ultimate solution. AGVs are capable of performing various transportation tasks which are fully automated at fewer expenses. Applications can be found throughout all industrial branches, from the printing, pharmaceutical and automotive sectors over metal and food processing to port facilities and aerospace.



Block Diagram

II. WHAT IS AUTOMATED GUIDED VEHICLE

Automated guided vehicle is a vehicle that does not need any human interference to work. The AGV is generally used to send goods or loads from one place to the other. The AGV follow the principle of line follower and follows the predetermined track to move from one location to other. We can control the AGV by connecting it to Wi-Fi so the user can keep track about the vehicle's location. The commands in the vehicle are given as per the user's will. The vehicle also detect obstacle and will stop as soon as the obstacle is detected.

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III. SELECTION OF MOTOR

We are using 60 rpm 12 v DC geared motor for our project. These motors are used for robotics applications. They come with metal gearbox and have a 6mm shaft diameter, shaft length 15mm, stall torque = 25kgcm torque, No-load current = 800mA(max), stall current = up to 9.5A(max). The motor is very easy to use and it comes in a standard size. It has an internally threaded shaft to easily connect a wheel. It has better wear and tear properties. The motor does not require any maintenance and it runs smoothly from 4v to 12v.

IV. COMPONENT DETAILS

4.1 Sensors:

A sensor is a device that takes an input from the physical environment and gives the output based on it. In our project, the sensors are used to sense the line and give the feedback to microcontroller to move the AGV. In our project we have used 2 IR sensors. These IR sensors will be mounted at the front of the vehicle and they will help detect the black line to move to the required destination. These sensors are widely used in motion detectors and line following applications. The IR sensors need an operating voltage of 5v DC and it's range is up to 20 centimetres. The range of sensing can also be adjusted according to the user's choice. The sensors will be continuously detecting the black line used as path to move forward.

4.2. Ultrasonic Sensor

An Ultrasonic Sensor is a device which detects the obstacle. It measures the distance of a target object by emitting ultrasonic sound waves and then converts the sound waves into electrical signal. For calculating the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its contact with the receiver. The formula for the calculation of distance is given by $D = \frac{1}{2} T \times C$ (where D is distance, T is time, and C is speed of sound ~ 343 meters/second). In this project we use an ultrasonic sensor to detect the obstacle that may come in the path of AGV, the sensor senses the object and sends an signal to the buzzer through the microcontroller to alert the user about the interference. after the obstacle is out of the way, the vehicle will start tracing it's path and take the load to the respective destination.

4.3 Microcontroller:

We are using microcontroller ATMEGA 328p for our project. ATMEGA 328p is a low cost 8-bit microcontroller based on the AVR RISC architecture. It has external and internal interrupts and has 23 general purpose I/O lines to connect input and output pins to various devices/sensors. It also has 32 general purpose working registers. Ithas maximum CPU speed of 20MHz. it has various sleep modes to control power consumption. For AGV the microcontroller acts as the brain, it receives all the commands from IR and ultrasonic sensors and sends signals to the sensors to act accordingly.

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4.4 Buzzer

A buzzer or beeper is an electronic audio signalling device, which may be mechanical, electromechanical, or piezoelectric. Buzzers can be used as alarm devices, timers, train and confirmation of user input such as a mouse click or keystroke. The main function of buzzer is to convert the signal to sound. The frequency range of buzzer is 3300 Hz. The operating temperature of a buzzer ranges from -20°C to 60°C. the sound pressure level of buzzer is 85 dBA or 10cm.

We are using the buzzer to generate a sound when the ultrasonic sensor detects an obstacle in the path. When the obstacle is detected by the ultrasonic sensor, it will send the signal to microcontroller and the microcontroller will send command to the buzzer to make the sound.

4.5 Node MCU

Node MCU is an low cost Iot open platform. It runs on the ESP8266 Wi-Fi chip. As it is an open platform we can modify the chip as per our requirements. By using Node MCU we can design or prototype our own IoT device. We have used Node MCU in our project to give indication to the user about the destination where the vehicle is. It also indicates the battery percentage of the system

4.6 Motor Driver

The L298D motor driver is a high power motor driver which is used to drive stepper and DC motors. This motor driver consists of L298 IC and 78M05 5v regulator. The IC can control up to 4 DC motors. It's supply voltage is 46v and supply current is 2A. it is an dual-channel H-Bridge motor driver. We use motor driver to driver the dc geared motor used in our project. It operated the motor to move in forward or reverse direction as well as in left and right direction.

V. WORKING

After pressing the star button on the phone, the AGV will start tracing its designated path with the help of IR sensors. If there is an obstacle in the path, the ultrasonic sensor will sense the obstacle and alert the microcontroller. Then, the microcontroller will send command to the buzzer to make a buzzing sound. After the obstacle is removed, the vehicle will again start moving to its destination. We have provided an LCD screen on the vehicle to see the destination of the vehicle. The LCD screen will be continuously kept on, and will notify about the destination of the vehicle.

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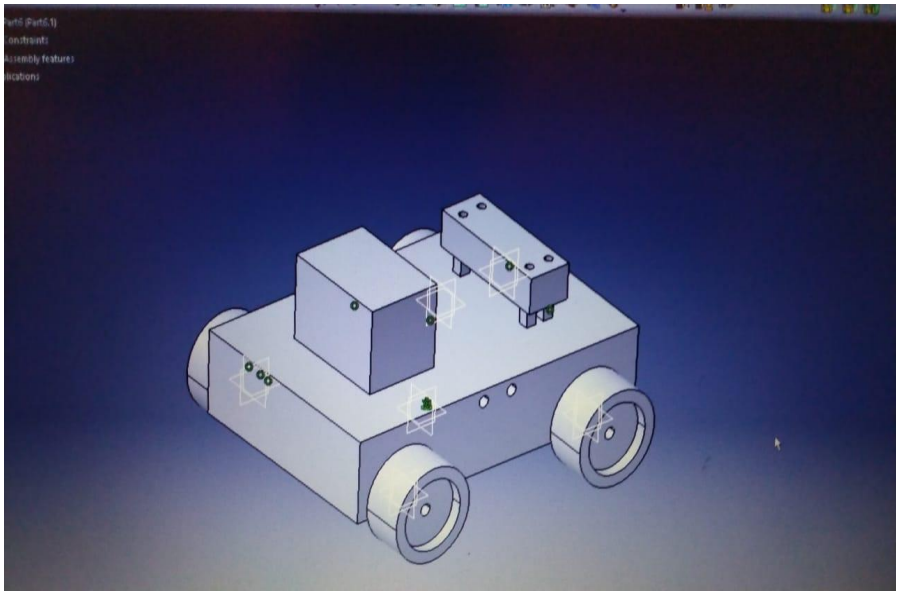
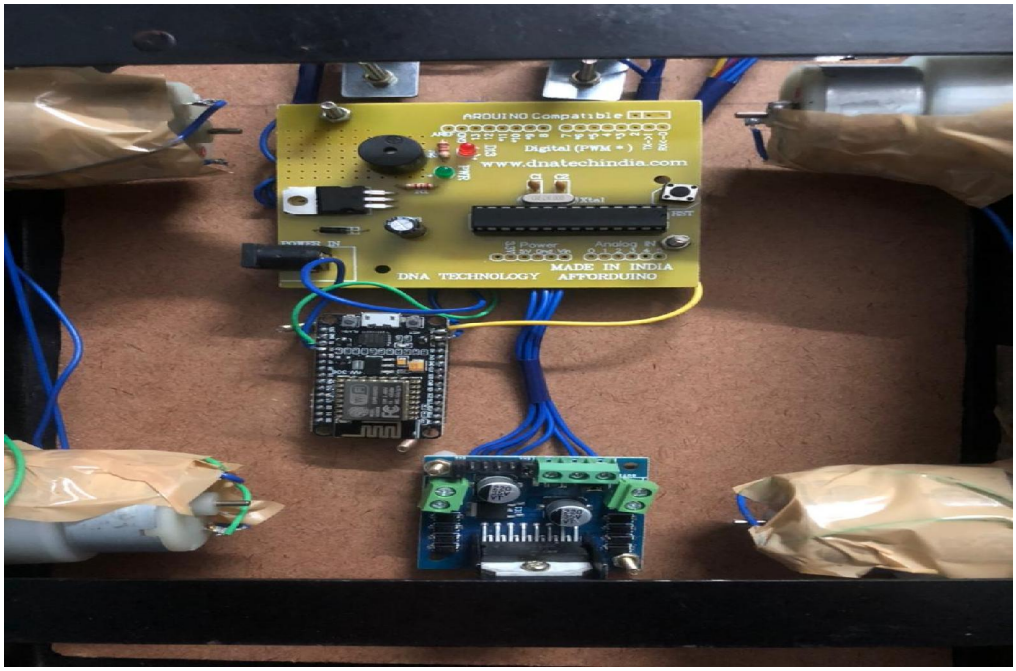
We have also used Node MCU so that we can send the data on cloud and the user can access the information about the vehicle on his/her phone. Once, the vehicle has reached its first destination, the LCD screen will display the location as destination 1 and so on. After the vehicle has reached all the required destinations, it will come to the start position and will remain there until next command is given.



3D model of AGV

VI. RESULT & DISCUSSION:



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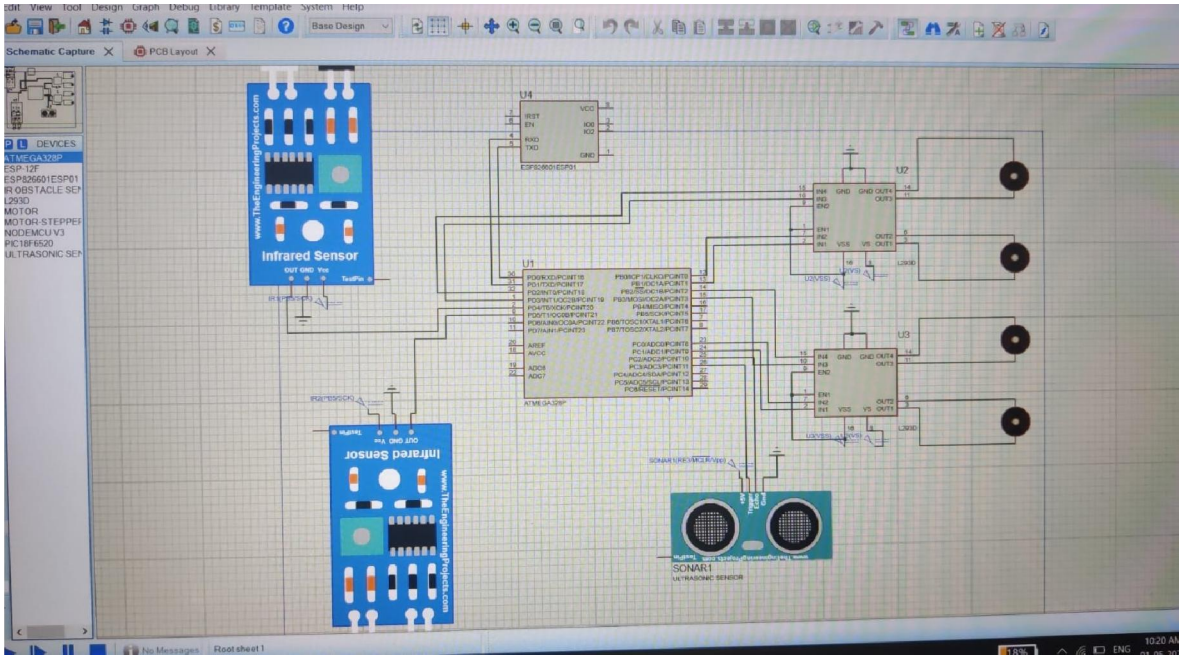

VII. APPLICATIONS

The AGV can be used in many other industries such as:

- Automotive.
- Food & Beverage.
- Health care & Pharma.
- Packaging.
- Paper & Printing &
- Production.

VIII. ADVANTAGES

1. Reduced labour cost.
2. No human error.
3. Better safety.
4. Increased accuracy.

IX. CONCLUSION

The automated guided vehicle market is increasing everyday. According to a study, the global market of AGV is set to grow by 10.8% by 2026. Hence, this basic implementation of an AGV can be utilized in small scale as well as large scale industry.

X. FUTURE SCOPE

- IR sensors along with ultrasonic sensors can be embedded into the same circuit minimizing the size occupied by the circuit.
- We can also add a camera to the system to keep an eye on the vehicle.
- Variable speed can be introduced into the system for different applications.
- We can set priority routes according to the users requirement.

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