An Intelligent Irrigation Scheduling System Using Low Cost Wireless Sensor Toward Sustainable and Precision Agriculture

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Abstract- The idea of this project is to develop intelligent machines. The manufacturing and distribution processes' most crucial step is material handling. Between two workstations or locations, materials and parts have been carried utilizing an automated guided vehicle. Material handling must be done without damaging the material in a safe, effective, economical, timely, and accurate manner. We are building a four-wheeled prototype that can travel between stations for this purpose. A Hall Effect magnetic sensor, often known as magnetic tape or a magnetic strip, is used by the AGV to follow the course. The AGV's whole navigation is controlled by an Arduino Uno controller and a motor driver IC L298N. AGVs are equipped with safety features like a fire sensor and buzzer-based obstacle detection. There is no need for human involvement during task completion. AGVs are frequently utilized in industrial settings, social services, and dangerous work environments that are inaccessible to humans.

Keywords – AGV(Automated Guided Vehicle), Arduino Uno, Motor Driver, Magnetic Sensor, Fire sensor, Obstacle Sensor, Battery.

I.INTRODUCTION

PLC and microcontroller technology is being used to automate numerous sectors in the modern world. AGVs are becoming more significant and useful for both industrial and commercial applications. Through advancing technology, it also contributes to building a sustainable future. A programmable mobile vehicle used for transferring items is called an automated guided vehicles system (AGVS). In practically every setting, including businesses, medical facilities, and storage facilities, material handling is necessary. Either people perform it directly or humans aid in doing so (Material handling done with trucks, trailers, etc).

This project provides a superior material handling solution that eliminates the need for people to move the material from one place to another. A group of cooperative driverless vehicles operated on the same production floor is known as an AGVS. It is coordinated by a computer-based control system that can be distributed or centralized and is created to carry out a given duty flawlessly.

II. DEVELOPING AN AUTOMATED GUIDED VEHICLE FOR SMALL AND MEDIUM-SIZED ENTERPRISES

The first commercial automated guided vehicle was launched in the United States in 1953. Normal AGV costs around Rs.8, 00,000 or $ 80,000. As a result, it is prohibitively expensive for small businesses. The main goal of the project is to create a low-cost AGV for small businesses using an Arduino Uno board.

III.PROPOSED SCHEME

3.1. AGV WITH THE USE OF ARDUINO UNO

Arduino is a great platform for prototyping projects and inventions. There are different types of Arduino available in the market but one of the most popular Arduino boards out there is Arduino Uno. Arduino Uno is programmed through Arduino IDE.A Set of instructions tells the board what functions to perform when the program is uploaded. The whole system operates as per the instructions given to Arduino and drives the vehicle system accordingly.
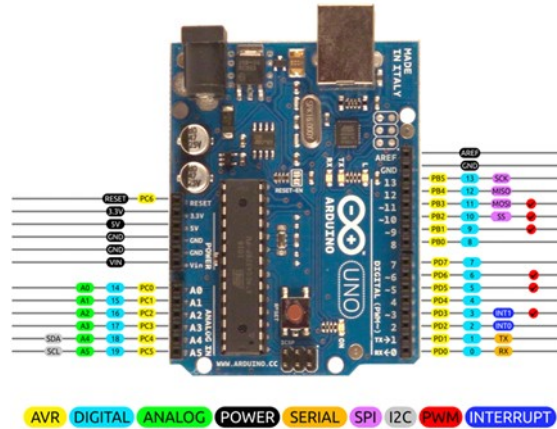
Figure 1. Pin diagram of Arduino Uno

A microchip AT mega 328 microcontroller acts as the basis for the open-source Arduino Uno board. The Arduino Uno requires 5V to operate.

3.2. POWER SOURCE AND DRIVER SYSTEM OF AGV

The AGV consumes 12V of power. The motor driver, fire detection sensor, obstacle detection sensor, and Arduino Uno will all be powered by this 12V battery. The Arduino Uno and motor driver are used to connect four motors. The motor rotates at 500 revolutions per minute.

3.3. CONTROL PATH OF AGV

An AGV's path is predefined, i.e. a fixed path with multiple locations. So AGV is controlled via the program written or uploaded to the Arduino Uno via the Arduino IDE. Magnetic tape is used to create the path.

3.4. AGV's NAVIGATION

Fixed navigation is equipped with sensors such as a magnetic Hall Effect sensor. The Hall Effect magnetic sensor detects the magnetic field around it and follows it in line. When the Hall Effect sensor detects a magnetic field, the motor starts or rotates, and the AGV moves. AGV not only follows the path effectively, but it can also start and stop in response to obstacles in the path. The input switches are provided to specify the location of the material to be delivered.

3.5. SAFETY SYSTEM IN AGV

The safety of any device or machine is the primary concern. So, for safety, two sensors, namely obstacle detection and fire detection, are used in conjunction with a buzzer.

FIRE SENSOR: The AGV senses fire when it is detected and sounds the alarm. The buzzer is used to produce the beep or sound.
OBSTACLE SENSOR: When an object comes in front of the AGV, it stops for safety reasons. So it is used to stop the vehicle whenever an object comes close to it when it detects an obstacle, and it also produces a sound or beep with the help of a buzzer.

BUZZER: An audible signal is a buzzer. The buzzer's operating voltage is 5V. The buzzer is turned on and off using an Arduino.

IV. BLOCK DIAGRAM OF AGV
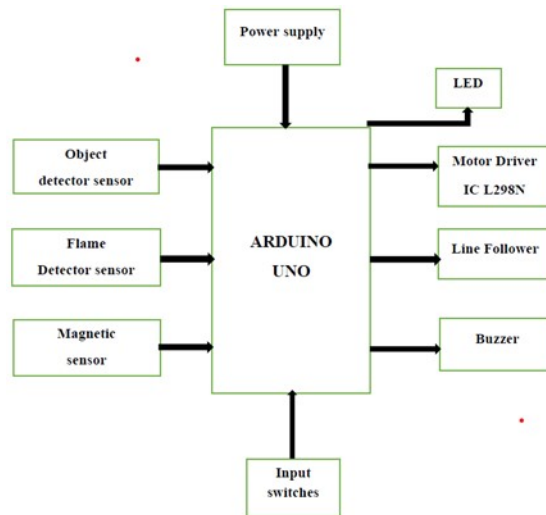
V. COMPONENTS REQUIRED FOR AGV

a) SOFTWARE COMPONENTS
➢ Arduino UNO

b) HARDWARE COMPONENTS
➢ Motor Driver (IC LC298N)
➢ Gear Motor
➢ Magnetic Sensor
➢ Object detector Sensor
➢ Fire Sensor
➢ Battery
➢ LED Bulbs
➢ Connecting Pins

c) MECHANICAL COMPONENTS
➢ Motor supports
➢ Bolt and Nuts
➢ Plywood Base
➢ Plastic Glass Plate

VI. PROPOSED SYSTEM

The aim of this system is to deliver the parts in a given time without causing any damage to the materials. The whole system of an AGV is controlled by Arduino Uno with the programming. The performance of AGV is obtained by the program uploaded into the Arduino Uno through Arduino IDE. This driverless vehicle travels along its navigation path with the help of a magnetic sensor. This navigation is achieved by following lines which are made up of magnetic tape on the warehouse floor. Hall Effect magnetic sensor senses the magnetic field around it and proceeds in line.

It follows the track and delivers the material to the destination point. After completing its process, it comes back to its original position. A fire sensor and an obstacle detector are added to this device for safety purposes.

An obstacle detector helps to stop the vehicle whenever an object comes near AGV. It also indicates the system by producing a beep sound with the help of a buzzer.

This AGV system is developed to reduce manual material handling and avoid accidents during the delivery of materials. AGV will increase productivity with the decrease in expenditure and transportation time.

This automation can be achieved by the use of an embedded system which includes computer hardware, software, and mechanical parts.

VII.CIRCUIT DIAGRAM OF ARDUINO WITH MAGNETIC SENSOR

Figure 2. Circuit Diagram
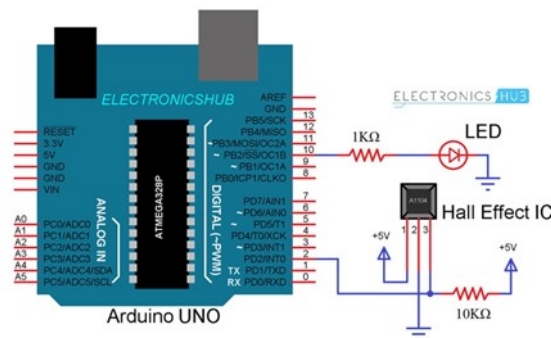
The moving magnetic tape is recognized by a magnetic sensor that is fixed to the bottom of the AGV. Sensors locate the vehicle with the belt, and they use that information to power the right wheels so that the vehicle stays inside the track's permitted tolerances. When sensors start to notice that the AGV is drifting off course, they rectify the power being given to the steering motor and realign the vehicle.
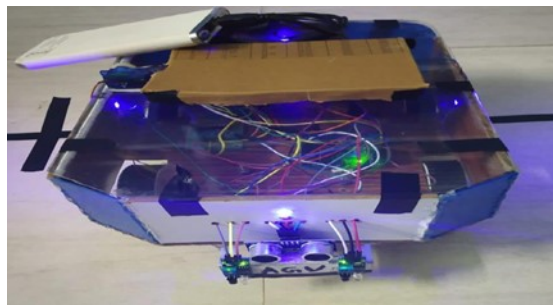

Figure 3. Base of AGV

Figure 4. Final Assembly
An automatic-guided vehicle can transport materials weighing between 10 and 20 kg.

VIII.PROGRAMMING ARDUINO

Once the Arduino IDE is installed on your computer, connect the board to your computer using a USB cable.
Open the Arduino IDE, select Tools > Boards >Arduino/Genuine Uno, select the correct board, and select Tools > Ports, select the correct port. The Arduino Uno is programmed using his Wiring-based Arduino programming language.

For example,
To get started with your Arduino Uno board and blinking the built-in LED, load the example code by selecting File > Examples > Basic > Blink. Once the sample code (see also below) loads into the IDE, click the Upload button on the top bar. The Arduino's built-in LED should blink when the upload is complete. Below is a sample code for

```
// the setup function runs once when you press reset or power the board

void setup() {

 // initialize digital pin LED_BUILTIN as an output.

 pinMode(LED_BUILTIN, OUTPUT);

}


// the loop function runs over and over again forever

void loop() {

 digitalWrite(LED_BUILTIN, HIGH);  // turn the LED on (HIGH is the voltage level)

 delay(1000);                 // wait for a second

 digitalWrite(LED_BUILTIN, LOW);  // turn the LED off by making the voltage LOW

 delay(1000);                 // wait for a second

}
```
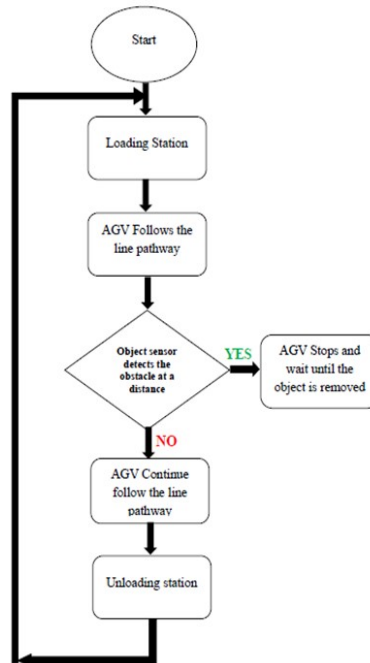
blinking.

Figure 5. Sample program output

X.WORKING SYSTEM OF AGV
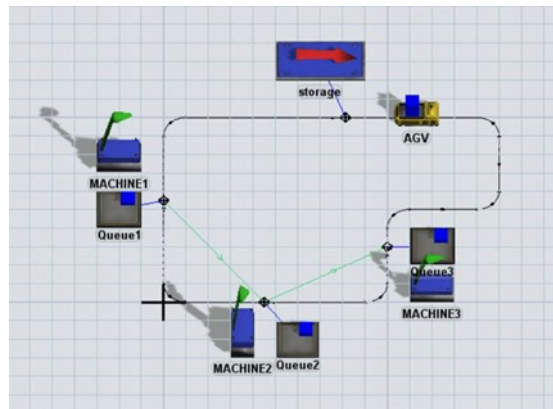
IX.FLOW DIAGRAM OF AGV

The AGV is used not only inside the production site but has expanded to include places for various service industries.

1. MATERIAL HANDLING: Used in highly automated plants that produce both automobiles and electronics.

2. WAREHOUSE: Used to transfer the material in an e-commerce warehouse.

3. COMMERCIAL: Transporting luggage inside an airport, a store, or a shopping center.

4. ENERGY AND DEFENSE: Transporting the material to inaccessible areas for humans, mapping for bombs and mines, inspecting nuclear plants for retrieval and disposal, steam generators, and pipelines, among other tasks.

5. MEDICAL SERVICE: Distributing food and medicine, handling hazardous materials, and disposing of biological waste.

XII.RESULT AND DISCUSSION

The AGV is an efficiency-expanding highlight in a plant. The main goal of the project is to develop a low-budget AGV with the use of Arduino Uno broad. During planning this AGV we have given the essential capacities like line follower and impact keeping away from both material damage and accidents. Also, the primary capacity is the transportation of merchandise from station to station. The followings are the principal highlights of the model which we have planned

1. Speed of conveyance
2. Modification of vehicle speed
3. Adaptability of the way
4. Versatile to changes in industrial facility formats
5. Maintain a strategic distance from the crash with different items
6. Decrease in labor cost
7. Decrease in running expenses contrasted with transport frameworks
8. Ability to add sensors to determine the conditions of the cargo
9. Proceeds with the pattern of working
10. Criteria for line following are easily modifiable.

XIII.CONCLUSION

In practically every industry, manual material handling becomes a challenging and time-consuming task. It is therefore assumed that an AGV will boost productivity in a large-scale manufacturing facility by reducing costs and transportation times. The project in this case is amazed by the performance of using Arduino. It is reprogrammable and offers more operational freedom. The Arduino Uno is one of the most widely used Arduino boards. Although it wasn't the first board made, it is the most popular and well-known board available. Due to its fantastic features and simplicity of use, Arduino Uno is becoming more and more well-liked. This project efficiently controls the task and the vehicle from one machine to another. So, the strategy to process the system in a certain amount of time without altering any objects is evaluated in this study.

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