ATS's SBGI, Faculty of Engineering, Miraj

Department of Computer Science and Engineering

Class- T.E (CSE)

Batch No- T1

Mini Project Title: -

"Automated Guided Vehicle"

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2018-19

CERTIFICATE

This is to certify that the following students of T.E. Computer Science & Engineering have Successfully completed the project report entitled

"Automated Guided Vehicle"

in the partial fulfillment of degree in the Computer Science &Engineering, of **"Shivaji University, Kolhapur"** during academic year 2018-2019

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Submitted By:

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ABSTRACT

Automated Guided vehicle is a robot that can deliver the materials from the supply area to the technician automatically. This is faster and more efficient. The robot can be accessed wirelessly. I.e. a technician can directly order the robot to deliver the components rather than order it via a human operator (over phone, computer etc. who has to program the robot or ask a delivery person to make the delivery). To avoid collision with human workers, a proximity detector has been added which causes the robot to stop as long as there is an obstacle in its way, thus avoiding accidents.

ACKNOWLEDGEMENT

We express our deep sense of gratitude and indebtedness to **Prof. C. G. Kokane sir**, Head, Department of Production Engineering for her valuable advice, constant encouragement and constructive criticism during the course of the project and also during the preparation of this manuscript, We place on record the valuable suggestions and numerous constructive comments rendered by **Ms. S. S, Peerzade mam**, Gu, Department of Production Engineering and for being our internal guide in the design and implementation of our project

We are highly indebted to all the staff members of Production Department for their wholehearted support and co-operation.

We also express our sincere thanks to all the classmates for their support and co-operation in completing the project work.

Above all, we should express our supreme gratitude to almighty God for making this project a reality.

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1. INTRODUCTION

AUTOMATED GUIDED VEHICLE

An automated guided vehicle or automatic guided vehicle (AGV) is a mobile robot that follows markers or wires in the floor, or uses vision or lasers. They are most often used in industrial applications to move materials around a manufacturing facility or a warehouse

Automated guided vehicles increase efficiency and reduce costs by helping to automate a manufacturing facility or warehouse. The AGV can tow objects behind them in trailers to which they can autonomously attach. The trailers can be used to move raw materials or finished product. The AGV can also store objects on a bed. The objects can be placed on a set of conveyor and then pushed off by reversing them. Some AGVs use fork lifts to lift objects for storage. AGVs are employed in nearly every industry, including, pulp, paper, metals, newspaper, and general manufacturing. Transporting materials such as food, linen or medicine in hospitals is also done.

An AGV can also be called a laser guided vehicle (LGV) or self-guided vehicle (SGV). Lower cost versions of AGVs are often called Automated Guided Carts (AGCs) and are usually guided by magnetic tape. AGCs are available in a variety of models and can be used to move products on an assembly line, transport goods throughout a plant or warehouse, and deliver loads to and from stretch wrappers and roller conveyors.

AGV applications are seemingly endless as capacities can range from just a few kgs to hundreds of tons. The Aim of the project is to design and fabricate such a AGV

2. AGV COMPONENTS

MECHANICAL

- The Mechanical components include the steering system.
- Steering system is for steering the AGV

ELECTRICAL

- Electrical components include the motor and the power supply for the motor itself.

ELECTRONIC

- Electronic components provide sensing, logical decision and control of the vehicle. It includes microprocessor for the decision logic, the motor driver as both sensing and control of motor.

MOBILE

- The Mobile acts as a viable substitute for a central system that provide the AGV's with the path to proceed.

3. BLOCK DIAGRAM

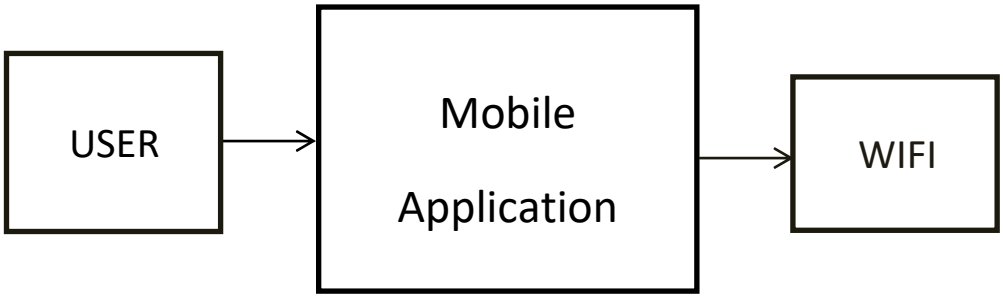

Fig 3.1: Mobile Application

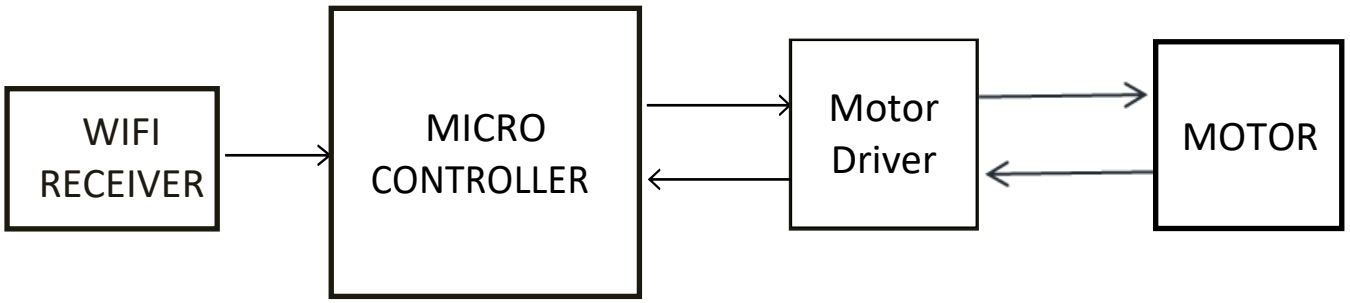

Fig 3.2: AGV (Hardware)

4. MECHANICAL DESIGN

STEERING SYSTEM

The steering system used in the model is of differential type. A differential wheeled vehicle is a vehicle whose movement is based on two separately driven wheels placed on either side of the body. It can thus change its direction by varying the relative rate of rotation of its wheels and hence does not require an additional steering motion. It allows the turning center to be on the vehicle body thus the ability to rotate on the point

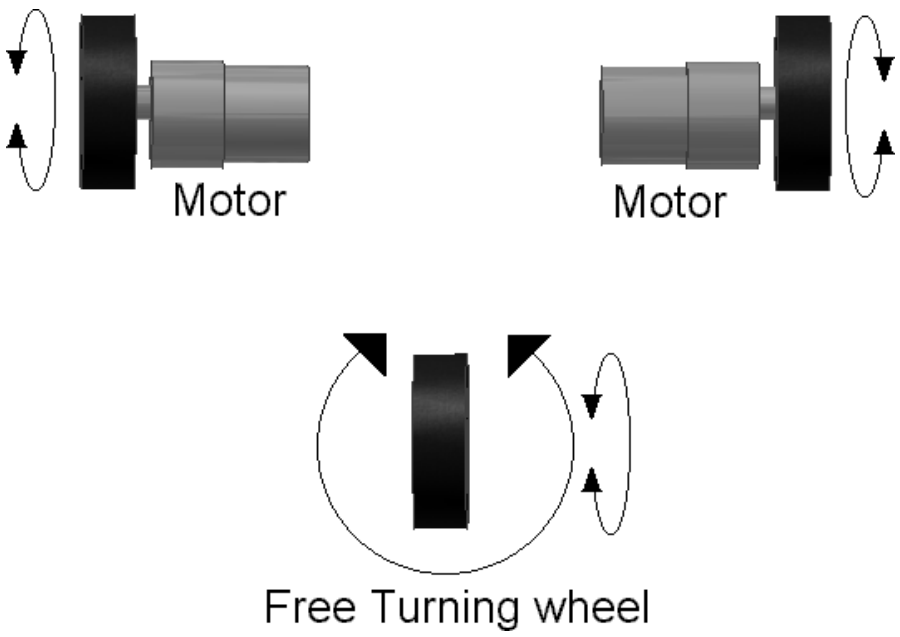

Fig 4.1: Differential Steering

If both wheels rotate at the same speed and in the same direction, the robot will move in a straight line.

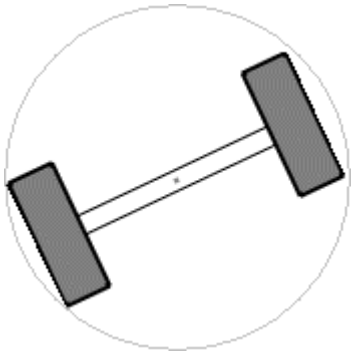

Fig: 4.2 Spinning by differential steering

If the wheels rotate at equal speed, but in opposite directions, both wheels will traverse a circular path around a point centered half way between the two wheels. Therefore, the robot will pivot, or spin in place.

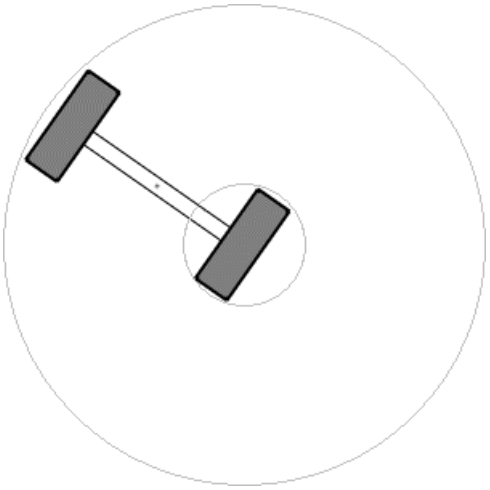

Fig 4.3 Small radius turning

If one of the wheels is stopped, while the other continues to rotate, the robot will pivot around a point centered approximately at the mid-point of the stopped wheel.

Fig: 4.4 Large radius turning

If one wheel rotates faster than the other, the robot will follow a curved path, turning inward toward the slower wheel.

Steering Specifications: Table 1.1

Feature	Data
Wheel Base	142mm
Wheel Diameter	70mm
Turning Radius range	0-∞
Point of Zero Radius Turn	Halfway along Breadth,

LOAD TESTS

The following load tests were made on the chassis and the result

Table 1.2

Movement under 5Kg Load	Passed
Movement under 5Kg load at Front & back edge load	Passed
Movement under 5Kg side edge load	Failed
Maximum angle uphill (Unloaded)	40degree
Maximum angle downhill (Unloaded)	55degree
Maximum side angle (Unloaded)	25degree

5. ELECTRICAL AND ELECTRONIC COMPONENTS

L293D MOTOR DRIVER

- L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal.
- This higher current signal is used to drive the motors.
- L293D contains two inbuilt H-bridge driver circuits.
- In its commo0n mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction.

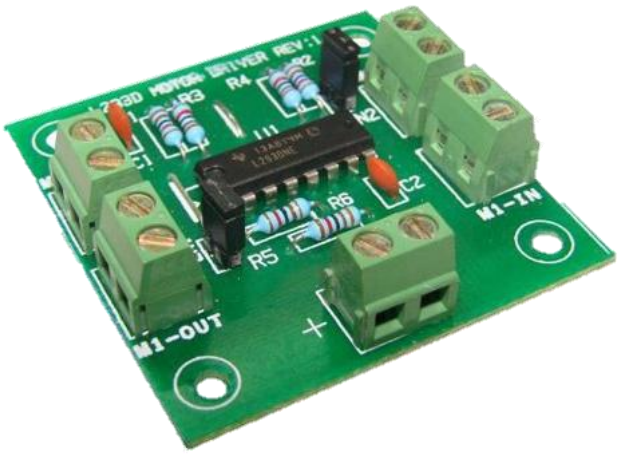

Fig 5.1 L293D MOTOR DRIVER

- The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor.
- Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.
- Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled.

Connection: -

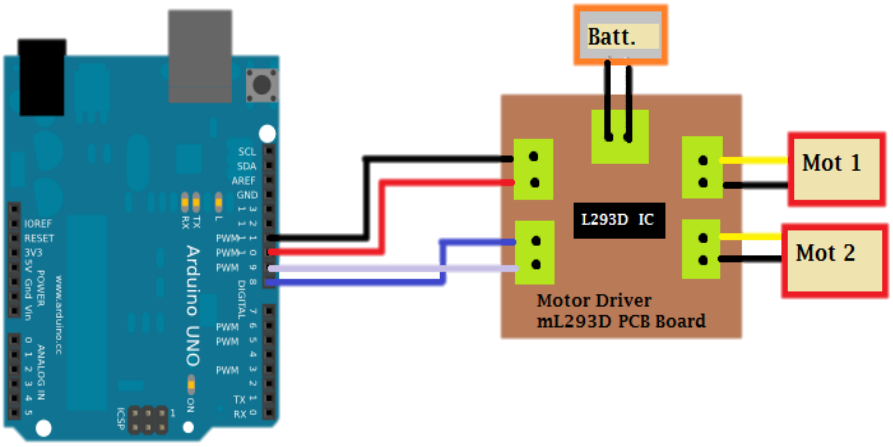

Fig 5.2: Connection

Module 5V (VCC) - Arduino 5V.

Module GND - Arduino GND.

Module 1 - Arduino D8.

Module 2 - Arduino D9.

Module 3 - Arduino D10.

Module 4 - Arduino D11.

Module Motor terminals - DC motors.

MICROCONTROLLER

A microcontroller (µC, uC or MCU) is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general-purpose applications.

The Microcontroller used in the AGV is Arduino Uno. The reasons for using Arduino Uno are

1. Cheap cost
2. Easy to program
3. High stress values

The Microcontroller is programmed with the required program to accept the data from the wireless transmitter, interpret it, calculate the path in terms of spatial orientation and five logical values to the Motor driver.

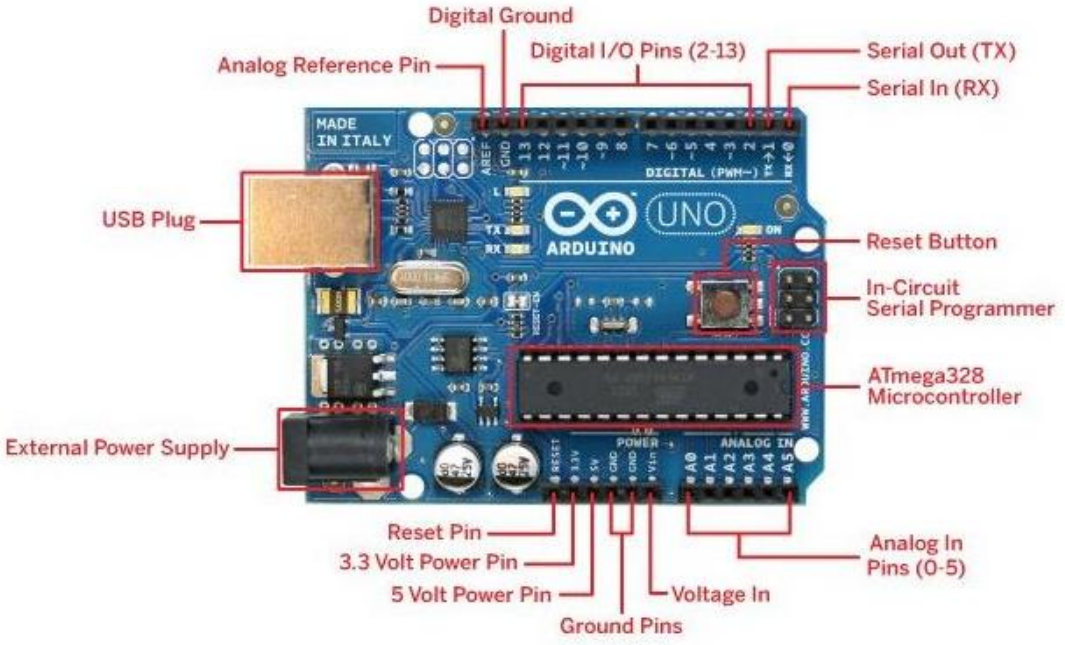

Fig 5.3 : Arduino Uno

Specification of Arduino Uno 16: Table: 1.3

Type:	Single-board microcontroller
Width:	68.6 mm × 53.3 mm [2.7 in × 2.1 in]
Height:	68.6 mm × 53.3 mm [2.7 in × 2.1 in]
Minimum/Maximum Voltage:	3.3/5V
Maximum current:	1A
Number of PORTS	1
No of Data Pins per port	21
Bus width	8Bit
Oscillation Speed	16Mhz
UART Receiving Speed	1200Baud

MOTOR DRIVER

It is an electronic circuit which enables a voltage to be applied across a load in either direction. It allows a circuit full control over a standard electric DC motor. That is, with an H-bridge, a microcontroller, logic chip, or remote control can electronically command the motor to go forward, reverse, brake, and coast. The current provided by the MCU is of the order of 20mA and that required by a motor is ~500mA. Hence, motor can't be controlled directly by MCU and we need an interface between the MCU and the motor.

A "double pole double throw" relay can generally achieve the same electrical functionality as an H-bridge, but an H-bridge would be preferable where a smaller physical size is needed, high speed switching, low driving voltage, or where the wearing out of mechanical parts is desirable.

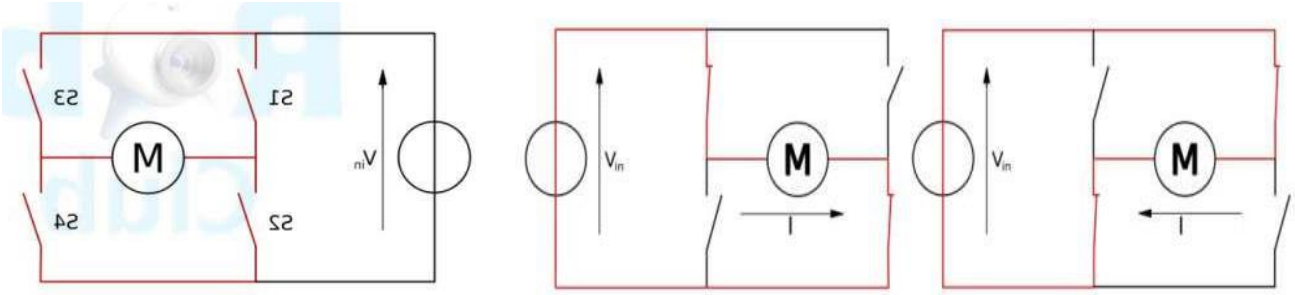

Fig: 5.4 H Bridge

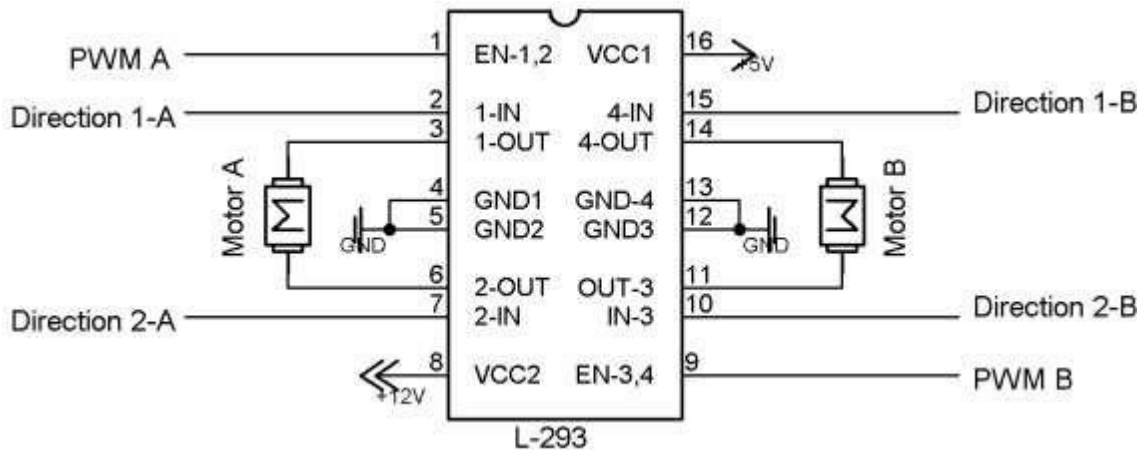

Fig: 5.5 Circuit of Motor Driver

To control motor speed, we can use pulse width modulation (PWM), applied to the enable pins of L293 driver. PWM is the scheme in which the duty cycle of a square wave output from the microcontroller is varied to provide a varying average DC output.

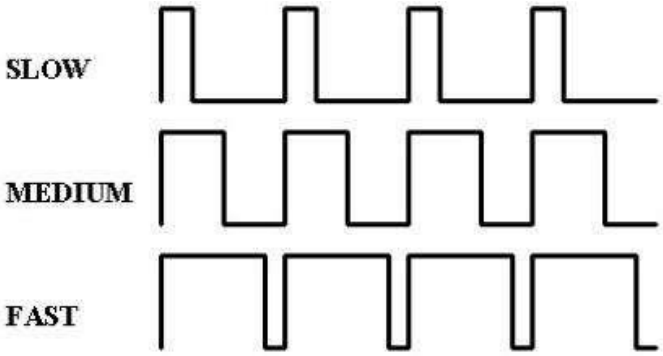

Fig: 5.6 PWM.

Technical Specification of L293D Table 1.4

Type:	16 Pin Dual Inline packages
Max Logic Voltage:	5V
Max Supply Voltage:	36V
Channels:	2
Current per channel:	600mA

MOTOR

Gear motor is used in this machine because it delivers more torque and full rotation compared to servo motor. Actuator that converts electrical signal to rotational motion. Contrary to usual belief it is an open loop control, A new technology of Back Emf interference is used to approximate a closed loop.

Technical specification of Motor: Table 1.5

Speed	200rpm
Rated voltage	12 V
No load current	60mA
Full load current	500mA
Stall current	580mA
Back emf interference range	300 to 500uA
Torque	2 kg cm

FC-03 INFRARED SPEED SENSOR

- we can calculate the speed of rotation of the wheels of our robot.
- If anything is passed between the sensor slot, it creates a digital pulse, then with Arduino we can read this pulse.
- By using this pulse count we can calculate the distance and angle of our robot.
- This module is ideally suited to adding speed measurement or light break switches to your project. This is an infrared slotted switch.
- This allows you to build in motion sensing and control, providing motion feedback or triggering systems when the module detects movement.
- These modules are most often used with a slotted disc which provides link between a mechanical rotation and the sensor.

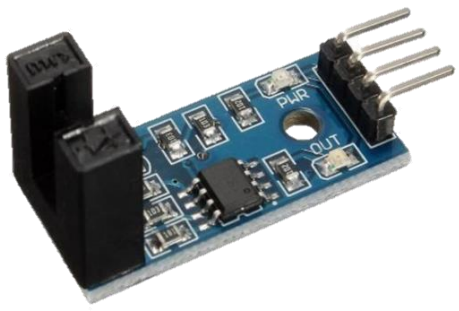

Fig: 5.7 FC-03 INFRARED SPEED SENSOR

Connections: Table 1.6Connections of Bridge

FC-03 INFRARED SPEED SENSOR	Arduino Uno
Vcc	+5v
GND	GND
UT	D2

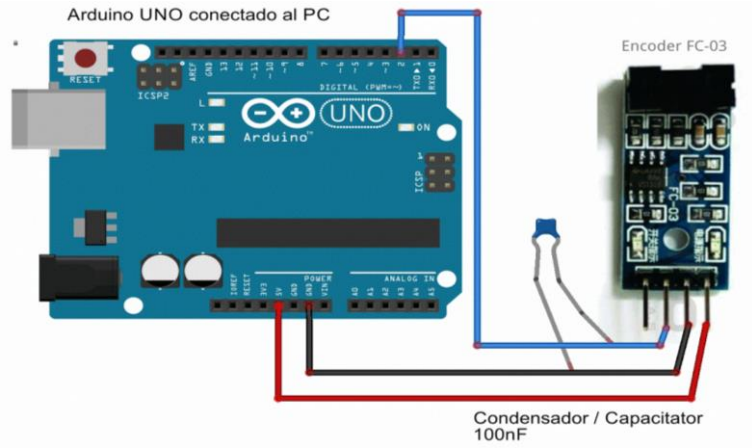

Fig 5.8 : IR speed sensor to Arduino connection.

ESP8266 WIFI MODULE

- ESP8266 WIFI MODULEESP8266 is Wi-Fi enabled system on chip (SoC) module developed by Espressif system. It is mostly used for development of IoT (Internet of Things) embedded applications.
- The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WIFI network.

- The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.
- The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack produced by manufacturer Espressif.

Fig: 5.9 Esp8266 Module

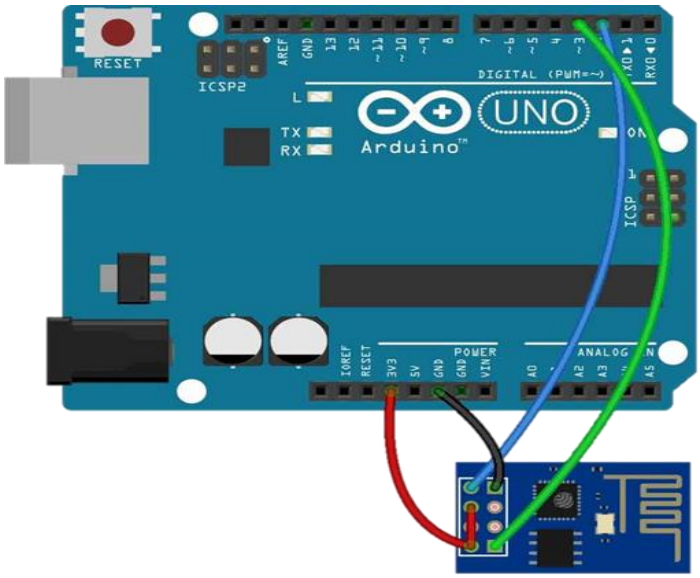

Fig 5.10: Esp8266 to Arduino Connection

Module VCC + GPIO0 - Arduino 3.3V.

Module GND - Arduino GND.

Module Tx - Arduino D2.

Overall Connection :-

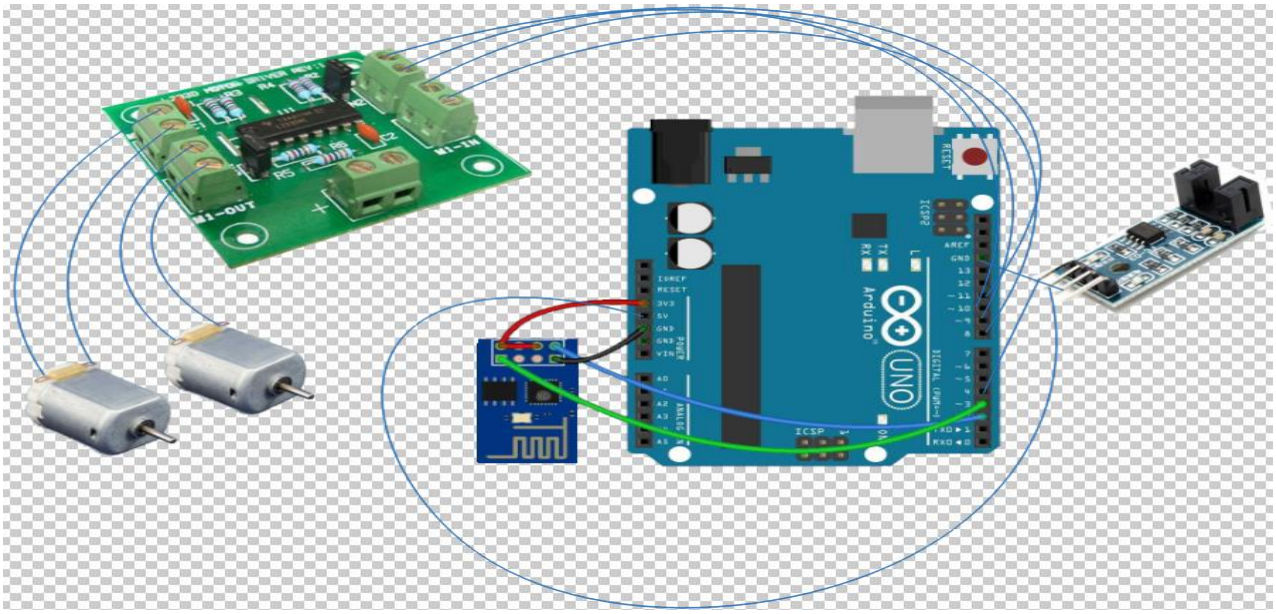

Fig 5.11 : Overall Connection

6. MOBILE

PROGRAMMING ALGORITHM USED

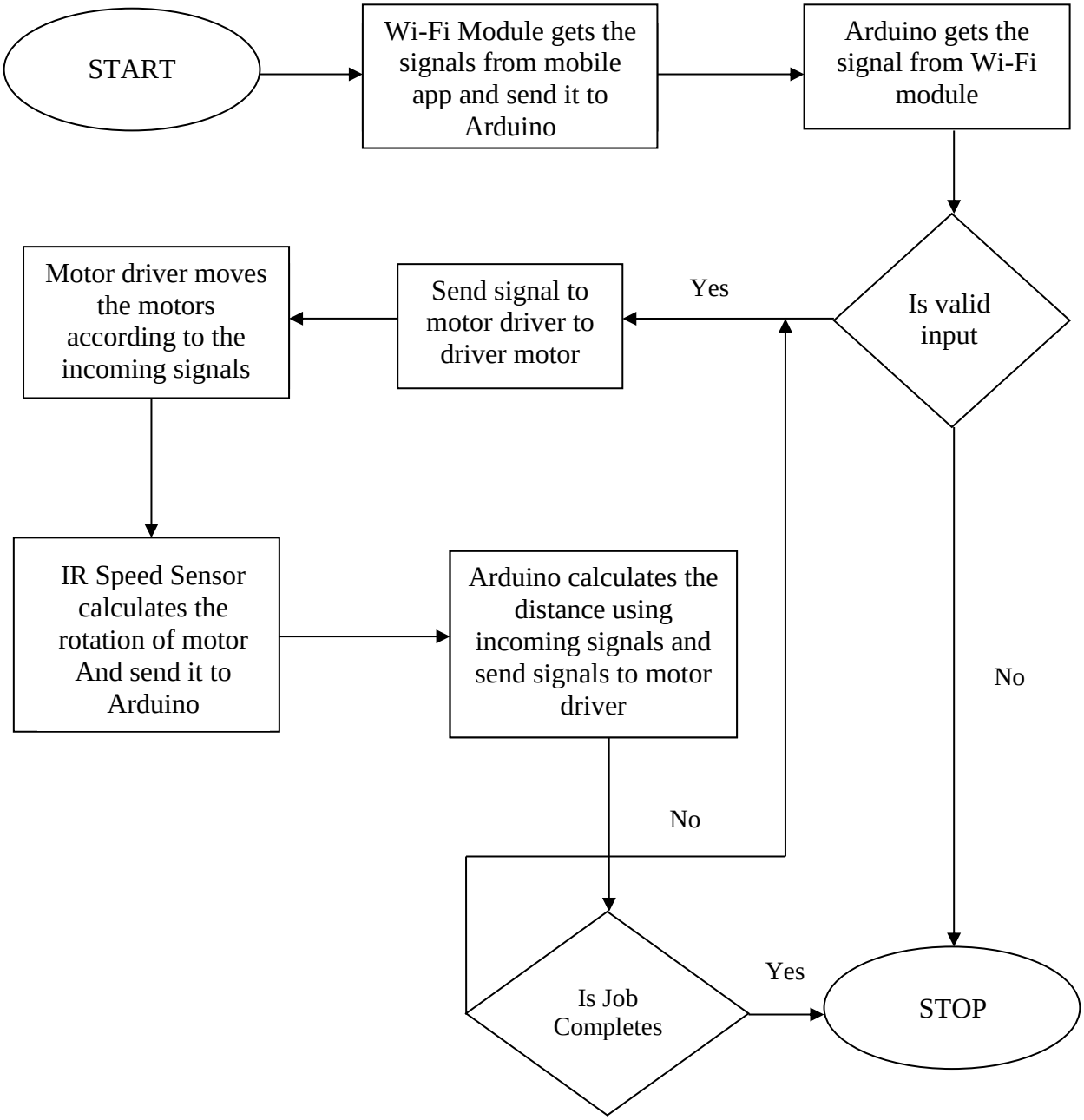

Fig: 6.1 Programming Algorithm

7. PATH PLANNING

PATH DECISION:

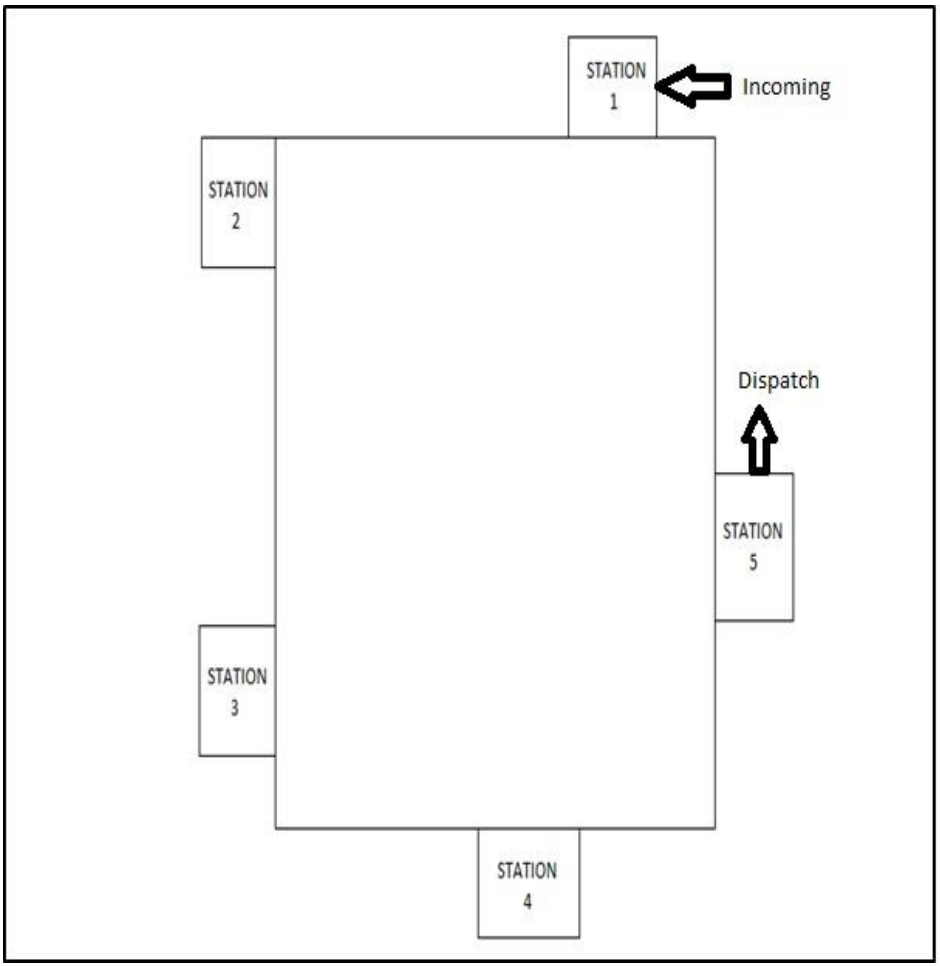

Fig 7.1: Example of path planning

- All five stations are fixed at their position, the agv is programmed to move according to the distance between fixed stations.
- Distance is calculated by using incoming signals from the IR speed sensor.
- IR speed sensor sends the count of tics which was passed from the sensor.
- By using incoming signals from IR speed sensor, we can also calculate the angle of rotation of wheels.
- The distance between stations are fixed so that the agv can easily locate the stations and move towards them.

Distance is calculated by using formula:

Distance = (2 * 3.141 * Radius of wheel) * (Total No, of tics / Total tics on encoder wheel);

Angle is calculated by using formula:

Angle = ((Total no. of tics) mod 360) * (90 / no. of tics needed to rotate in 90 degree);

FORMULAS USED

Distance = (2 * 3.141 * Radius of wheel) * (Total No, of tics / Total tics on encoder wheel);

Angle = ((Total no. of tics) mod 360) * (90 / no. of tics needed to rotate in 90 degree);

MOBILE APPLICATION

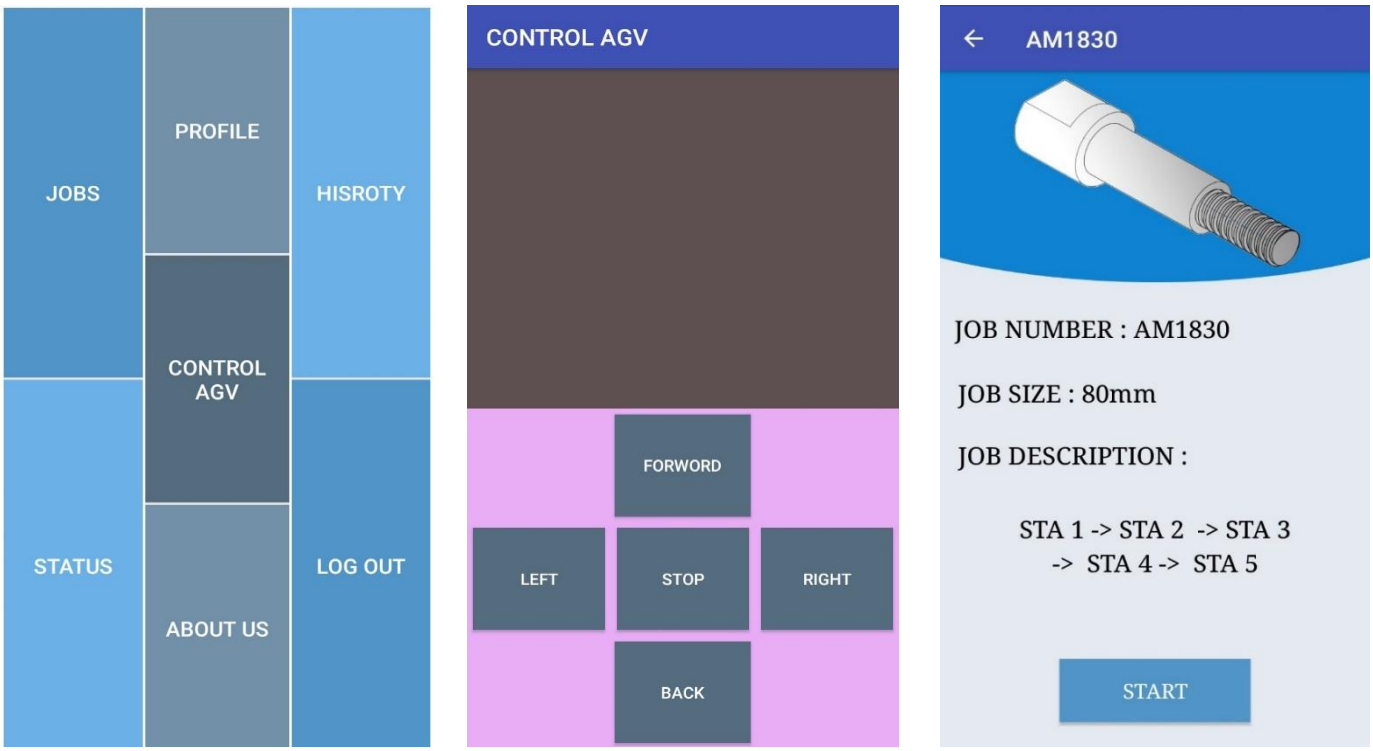

Fig 7.2: Mobile Application

8. PROJECT COSTS

MODEL COSTS

Table 1.7 cost of model

Microprocessor	400
L393 Speed Sensor	200
Wi-Fi Modul	250
Motor	350
Motor Driver	200
Tyres	130
Battery	500
Microprocessor	400
L393 Speed Sensor	200
Wi-Fi Modul	250

LOAD DEPENDENT COSTS

Motor, driver, typeset are dependent on the payload. The cost per unit load is 350+400+50+130+900/10 = 183Rs per Kg payload. It is estimated that these loads vary linearly.

9. CONCLUSION

The AGV is a productivity increasing feature in a factory that has the following advantages

1. Speed of delivery
2. Flexibility of path
3. Adaptive to changes in factory layouts
4. Central control
5. Reduction in labor cost
6. Reduction in running cost compared to conveyer systems
7. Ability to add sensors to detect the payload conditions

Disadvantages:

1. Should be recharged periodically
2. Will stop delivery when the AGV is forced off the path.
3. High Initial cost

The Advantages of the AGV far shadow over the disadvantages and hence it is concluded that in a mass production factory with large area, a AGV will definitely increase productivity, decrease expenditure

10. BIBLIOGRAPHY

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