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AUTOMATED GUIDED VEHICLE USING ARM MICROCONTROLLER

[1]Jayani J
Student,
B.E Electrical and Electronics Engineering,
Dr.Mahalingam college of Engineering and Technology,
Pollachi.

[2]Jeeveth K
Student,
B.E Electrical and Electronics Engineering,
Dr.Mahalingam college of Engineering and Technology,
Pollachi.

[3]Priyanka P
Student,
B.E Electrical and Electronics Engineering,
Dr.Mahalingam college of Engineering and Technology,
Pollachi.

[4]Mr. Muthubharathi R
Assistant Professor,
Department of Electrical and Electronics Engineering,
Dr.Mahalingam college of Engineering and Technology,
Pollachi.

ABSTRACT

Now-a-days electric vehicle plays a major role in today's world. Since the hike of the petrol price is too demanding, there may be extinction of IC engine vehicle. Almost in few years the roads with AI vehicles will pave a way for it. So our main idea in the project is to make an Automated Guided Vehicle with human interference. In recent development ARM microcontroller plays an important role in the trendy world. Since it has many advantages and it has more specialized features we choose FRDM-K-64F as a microcontroller which plays as a heart of our project. With the help of real time electric vehicle and ARM processor vehicle has been controlled by Bluetooth and Accelerometer module controls.

1. INTRODUCTION

Death tolls caused by road accidents are alarmingly reaching high levels in recent years. Thus, the development of a smarter vehicle has been a major concern in the country. Hence a real time electric prototype vehicle which has been designed by TVS Motors with the front wheel is fitted with the Hub Motor. The rear two wheels are small normal wheels for motion. The Chassis is simple and has a Seating platform to carry a person. The Steering motor is mounted on the Front column below the handle bar. The battery, Motor Controller and the Vehicle Controller Unit (VCU) are housed below the Seat. This electric vehicle is operated at 48V, 240 KWH. For this vehicle we use four 12V& 5Ah battery which is connected in series to make 48V & 5Ah.This vehicle takes 48 minutes to get fully charged and runs one hour with no load at full speed. The vehicle maximum speed is 40km/hr. To turn this vehicle DC motor with operating voltage as 12V and operating speed as 55rpm.

The controller kit acts as the brain of the vehicle by analysing the given inputs, making decision for the given input and it gives commands to the other sub-system based on the decision taken. This vehicle also has digital security system i.e. the vehicle can only be started on giving the password. This reduces the risk of misusing of the devices and enhances protection. While enhancing security and accuracy it would also be user friendly, the manual control of the system is enhanced by the use of the mobile application. A person with

least knowledge of using a smart phone can easily access and control the device. The user can use the application with ease to perform the vehicle operation. The vehicle operates with wide range of speeds and has precise direction control, providing no drag while operation.

2. BRIEF WORKING

From the Bluetooth module data has been sent to the ARM microcontroller, these data had been created by android mobile application using MIT app inventor. The Bluetooth app and accelerometer app can be connected and accessed by providing the valid password. The speed and direction changes are achieved by clicking on to the app icons.

3. SYSTEM DESCRIPTION

The electric vehicle gains more attention over the people now-a-days, so over the modern world it may turn into complete autonomous vehicle. As a step to that the concept we have prepared is semi-autonomous vehicle using the ARM microcontroller. This ARM(FRDM-K-64F) controller which is placed under M4 cortex series with the core running upto 120MHz and embedding 1024KB RAM and lots of peripherals such as 16 bit ADCs, DAC, Timers and interfaces such as Ethernet, USB serial booter and USB serial data transfer.

3.1 SPEED CONTROL

The vehicle should ensure major two controls such as Speed control, Steering control. In the design of the vehicle the speed is manually controlled by Hall Effect sensor, this sensor senses electric pulses from the vehicle and uses a transducer which limits at a voltage from 0-3.3V which is compatiable to the microcontroller. At first PWM techniques had been used to control the speed of the vehicle. Later DAC method has been found to control the speed. Switching from PWM to DAC gives better result. Since we didn't have any speed indication in the vehicle, we used to sense the speed using tachometer which results in rpm, we used to convert rpm into km/hr and measure the voltage value and convert this value to DAC value.

3.2 STEERING CONTROL

Steering control is the major element in the automated guided vehicle. The major element is gearing setup to turn the vehicle. At first we tested with Bi-polar stepper motor, since it takes 15A it is not capable to deliver the current from the vehicle setup. Later we opted to DC motor, for this we designed a driver with TIP142(NPN) & TIP147(PNP) power switches. The driver didn't withstand the current and can't able to reverse the vehicle. Hence opted for relay module using this is used to control the pulses and turn the vehicle.

4. OBSERVATION AND RESULTS

4.1 HARDWARE ANALYSIS

The connection diagram of the Bluetooth module and controller pins are:

- Tx->Rx(Frdm-K64F)
- Rx->Tx (Frdm-K64F)
- Vcc->Vcc (Frdm-K64F)
- Gnd->Gnd(Frdm-K64F)

The DAC output pin and the ground pin are connected to the throttle. On the basis of the input given in the app the DAC values are changed and are fed to the throttle to achieve speed change.Two digital pins from the board are given to the relay module. And the relay module is connected to the steering motor. On changing the input given to the relay based on the user input the direction of the motor changes resulting in change in direction of the vehicle.

4.2 SOFTWARE ANALYSIS 1 – SECURITY SYSTEM

To access this vehicle and application we have set an password which should be entered. If the password is "**12345**" it enters to button type application or if we enter "**1234**" it enters to accelerometer type application.For the software analysis Android mobile application has been designed and named it as CONTROLLED VEHICLE. This application has been designed using MIT app inventor.

4.3 SOFTWARE ANALYSIS 2 – BLUETOOH CONTROL

For button mode these are the front end and back end of the mobile application. By using this application the speed and direction of the vehicle can be controlled. Using the Bluetooth connection between the Bluetooth module of the controller kit and the Bluetooth facility in the smart phone, the data are send in a particular baud rate for a corresponding choice. Base on the values received in the microcontroller board the decision are made in accordance with the program given.

4.4 SOFTWARE ANALYSIS 3– ACCELEROMETER CONTROL

For accelerometer mode these are front end and back end application. The accelerometer present in the smart phone is used as an direction controller. These values of the phone in a direction are encoded as values in xyz axis and are transmitted to the board via Bluetooth. This values run in accordance to the program in the board and the corresponding actions are done. This app has to be connected and then to start press connect in the app and to end the process click stop. In case of emergency situations click disconnect to discard from the action. The axis values are also displayed via the application. This application is also developed using MIT app inventor.

5. CONCLUSION

The speed and direction control using Bluetooth and accelerometer has been done successfully.

In Bluetooth control of the vehicle we have achieved three speed variations and two primary positioning. The speed variation includes low (2km/hr), medium (5km/hr), and high (10km/hr). This achieved by using DAC control technique. The two positions include left and right direction change which was achieved by providing input pulses to the motor driver

circuit which is the relay module. It also stops in case of emergencies and in case of reaching the destination.

In accelerometer control the positioning of the vehicle plays the vital role. It is more or less like motion control. The accuracy of the output is very much important and it is achieved by precisely calculating the position values for each positions and developing the program accordingly. For a particular position their axis values are calculated and the values are recalibrated again and again to attain perfect positioning. This system also has abrupt stopping in case of emergencies.

6. FUTURE SCOPE

For future development of the vehicle machine learning could be included. Machine learning is a very vast area and it can give a greater depth to the project. In machine learning there will be communication between the vehicles for better understanding and locomotion of the vehicle to avoid accidents. This has a very high importance and is still an area under research and development, so working this vehicle in that kind of field would be very useful for the future year and the society

7.FIGURES

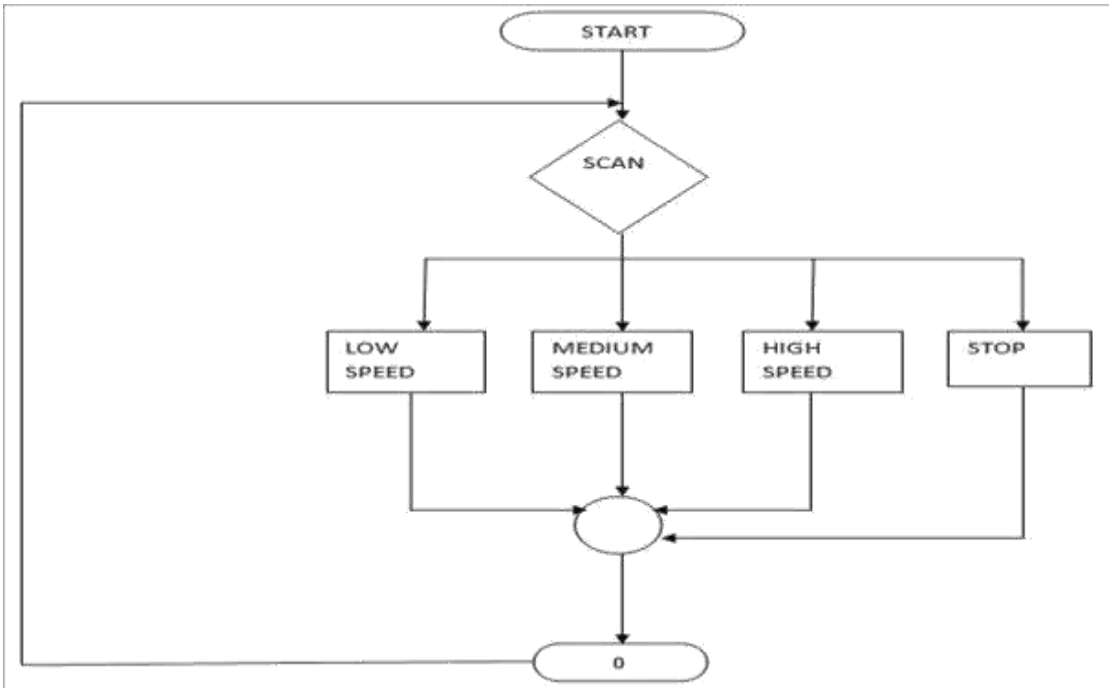

FIG . 1 SPEED CONTROL FLOWCHART

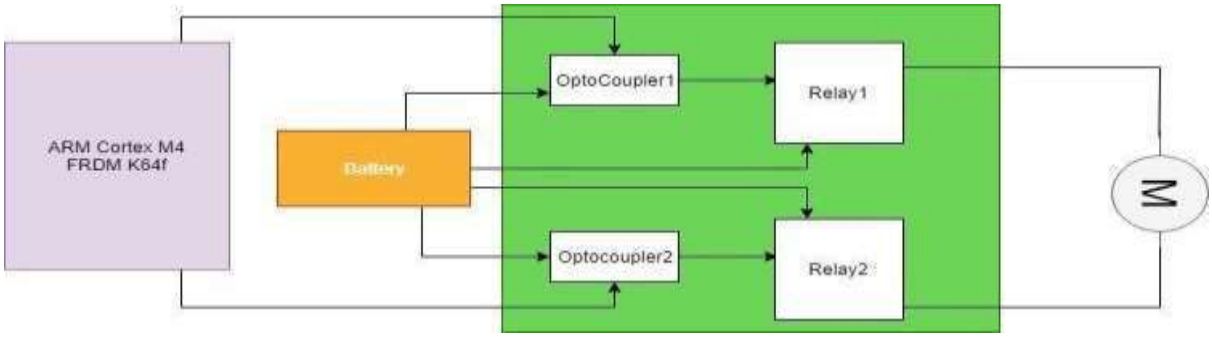

FIG .2 DRIVER BLOCK DIAGRAM

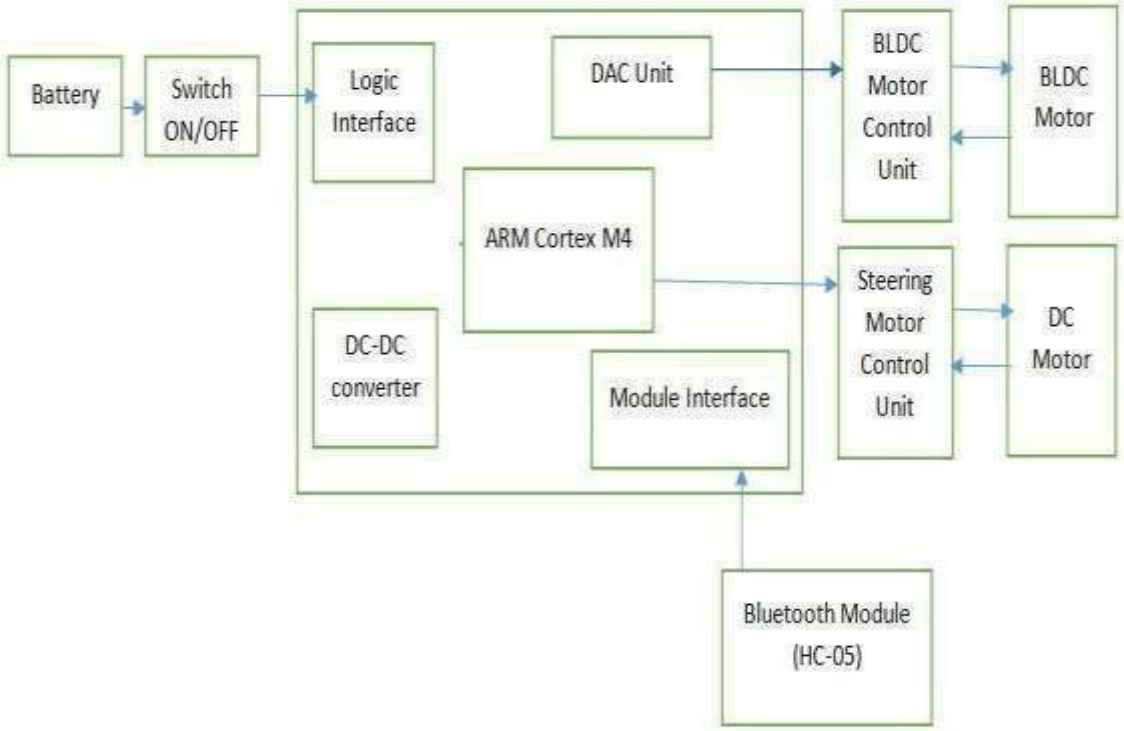

FIG .3. SYSTEM BLOCK DIAGRAM

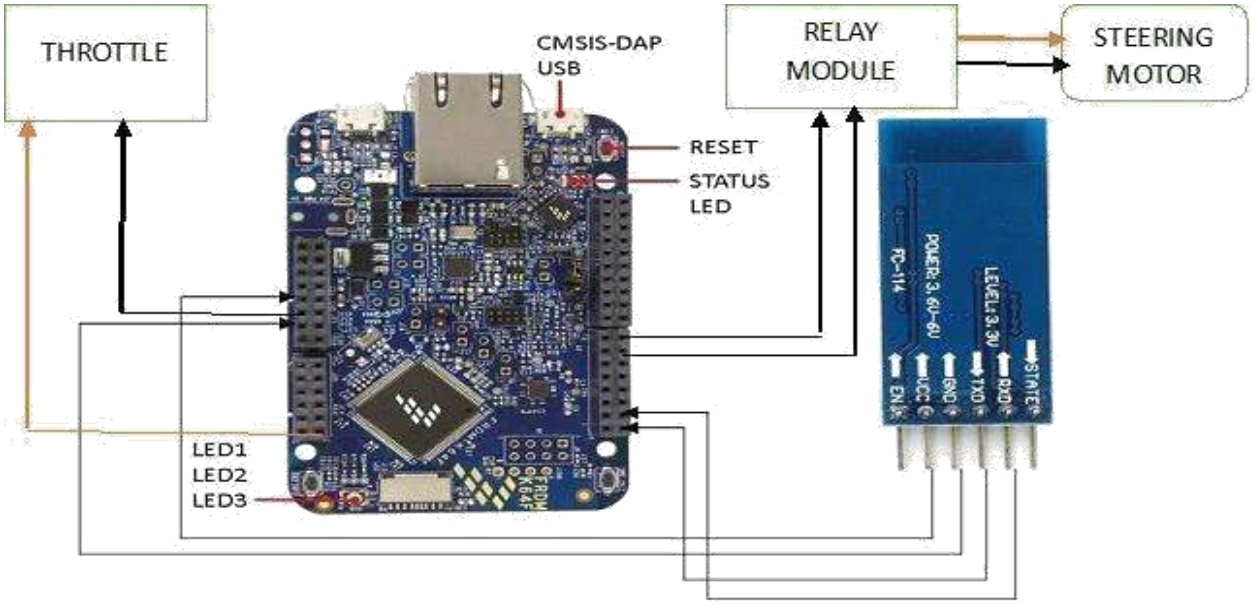

FIG . 4 CONNECTION DIAGRAM

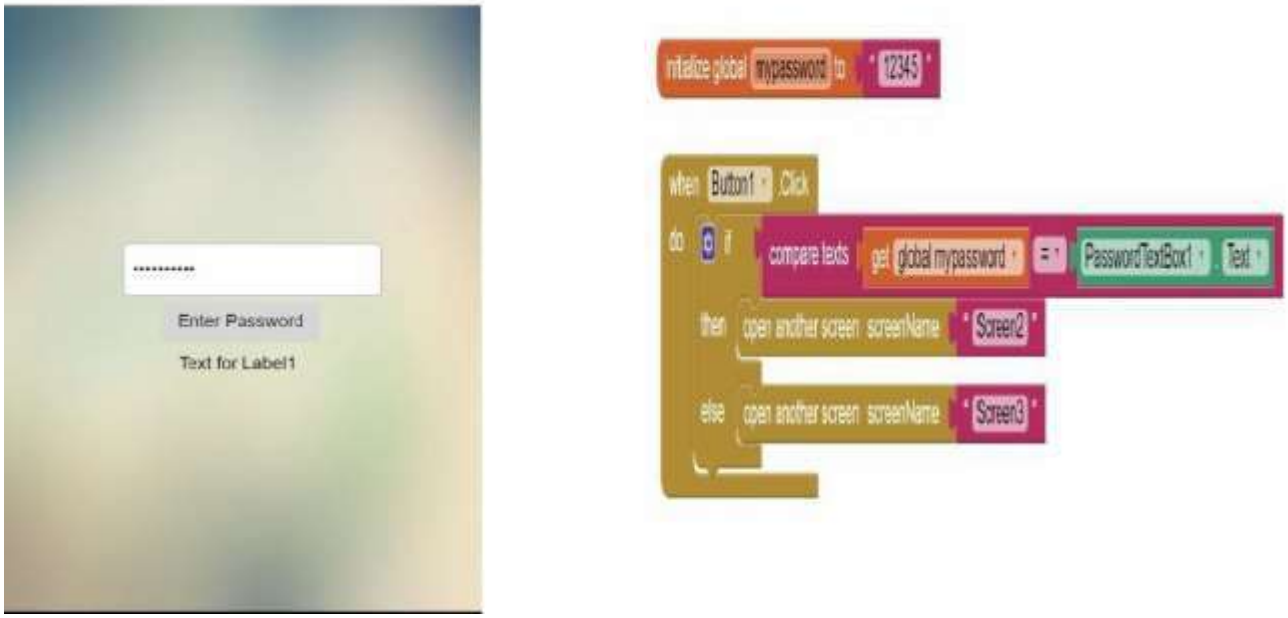

FIG. 5 SECURITY SYSTEM FRONT AND BACK END DESIGN

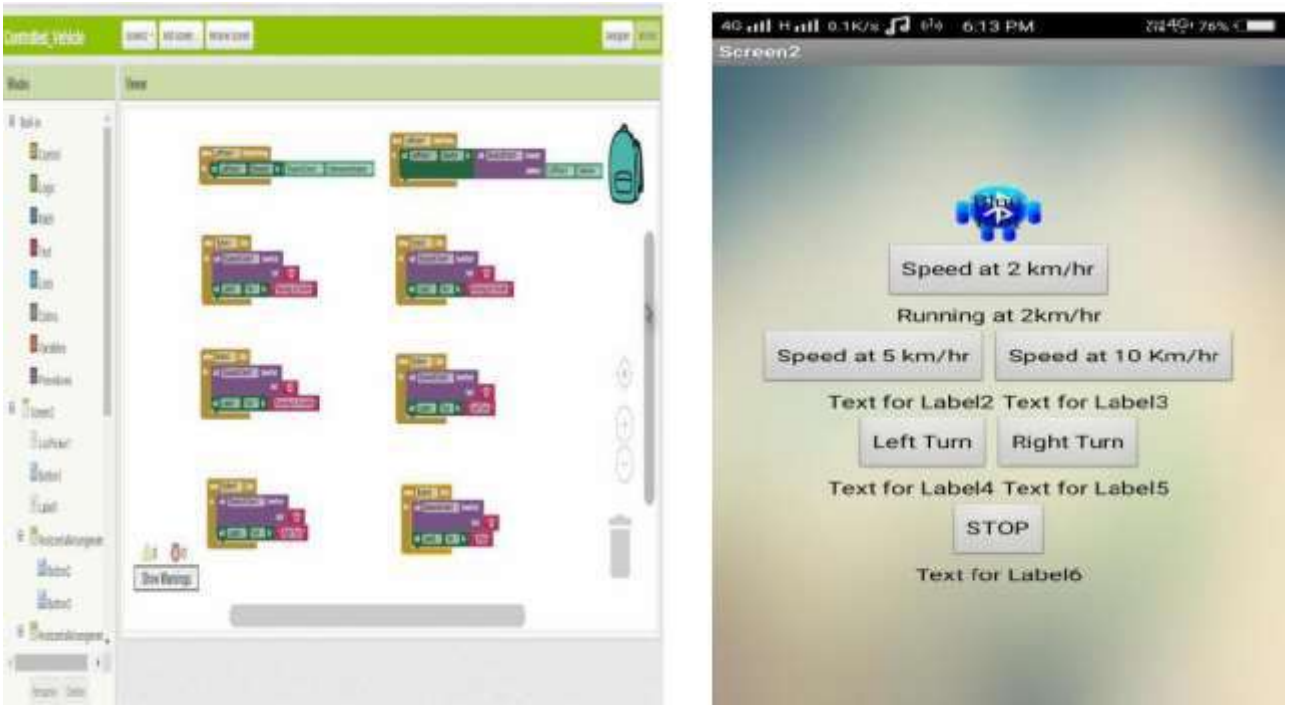

FIG. 6 BLUETOOH CONTROL FRONT AND BACK END DESIGN

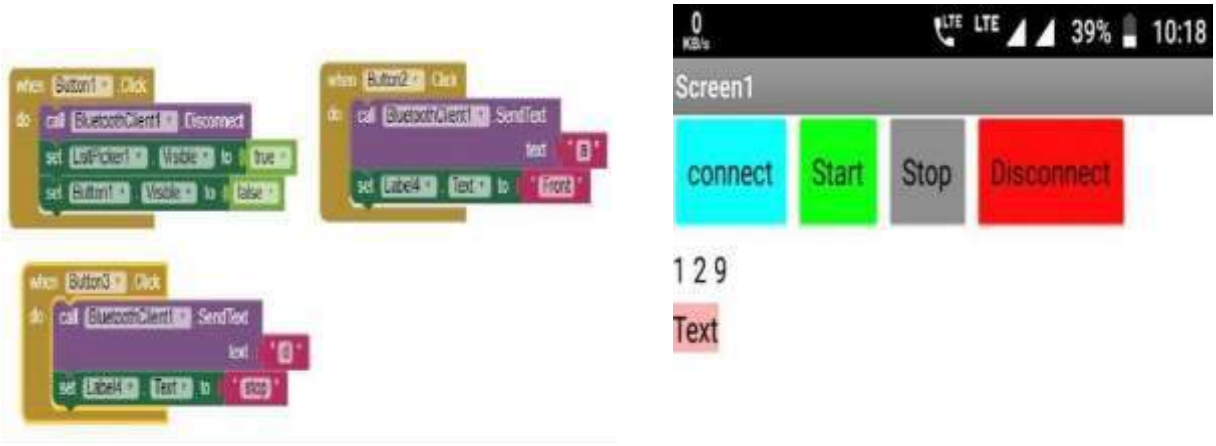

FIG. 7 ACCELEROMETER CONTROL FRONT AND BACK END DESIGN

8. TABLES

Table 10.1 Speed Analysis

S.NO	Speed in rpm	Speed in Km/hr	Voltage value	DAC Value
1.	30	2	1.64	0.4
2.	75	5	1.65	0.45
3.	148	10	1.68	0.51

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