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Adaptive Steering Control and Breaking System for Automobiles using Intel Galileo Board

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ABSTRACT: This paper deals with the design of Adaptive Steering Control and Breaking System for Automobiles in a pass on of vehicles, in order to solve traffic jamming. The more number of vehicles leads to more accidents. According to statistics, the majority of the car accidents are caused by over speed and disrespect of the inter-vehicles distance. A system which can reduce the number of accidents from this proposed system. The system contains Radar sensor, Zigbee, servo 9g motor. The radar sensor monitors the leading vehicle or obstacles and determines that collision is likely the driver is alerted by visible and audible warning if no action is taken then the break is applied automatically. Adaptive headlights turn their beam according to the steering input so that the light is incident on the vehicles path.

KEYWORDS: Intel Galileo Board, Radar sensor, Arduino, Zigbee, servo 9g motor.

I. INTRODUCTION

Adaptive Cruise control system (ACC) is the advanced system and it is commonly used in automobiles nowadays. The driver frequently checks the speed and monitors the pressure on the throttle pedal or the brake. ACC takes over the speed of the car by maintaining the constant speed automatically. Therefore, these systems can the help in reducing no. of accidents. In this system it receives the input signal, and progress the output signal to the actuator. The actual speed of the car is continuously monitored by a ultrasonic sensor and fed to the processor.

AUTONOMOUS driving requires handling a plethora of different driving scenarios, ranging from parking to crash avoidance on challenging road conditions. The objective is to ensure road safety and increase passenger comfort. A suitable candidate for the control strategy is model predictive control (MPC), due to its ability to incorporate system constraints and nonlinearities in a systematic way. Rear-end collisions are frequently caused by inadequate following distances, inattentiveness on the part of the driver and unexpected, abrupt traffic standstills. Here, adaptive cruise control (ACC) can provide remedy. This is ensured by the automated adaptation of vehicle velocity and the usage of proximity sensors [1]. From this paper we have taken the ACC technique to control the speed of the car.

The Driving Assistance System (DAS) can reduce the accident rate and enhance driving comfort and safety by providing assistant to drivers timely. As a typical kind of driving assistance system, lane change warning system can help drive be aware of the potential collision danger between ego-vehicle and surrounding vehicles and make judgment on lane change feasibility [2]. we have modified this technique to Advanced Driving Assistance System (ADAS).

Tracking the user environment and behavior is used for monitoring or advertising purposes. While the ethics of this practice are questionable in some cases, this activity can also used to improve the user experience by localizing the offered data content but they should require the user agreement. For example in the European Union, rules that regard the access to the user information have been established, but sometimes even large companies ignore them as long as the data tracking is not discovered [3]. we have proposed to tracking the light environment to adaptive to the vehicle.

Most of range based localization algorithms adopt the received signal strength indicator (RSSI) to estimate distance according to the received signal strength and path loss model. Using the obtained distances from RSSI, a localization algorithm is computed based on the relative distance between nodes. Unfortunately, the indoor radio channel is unpredictable, due to reflections of the signal against walls or ceiling may result in severe multi-path interference at the receiving antenna [4].

A Wi-Fi radio map shows received signal strength (RSS) of Wi-Fi access points (APs) at different locations in a given environment. Such a radio map is useful to many applications such as AP selection and localization. With a radio map, a user can select the AP that transmits stronger RSS or even move to a location with better RSS [5]. we have proposed the system to transfer the speed of the vehicle to the host vehicle.

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II. METHODOLOGY

We have implemented the project in Intel Galileo Gen 2 with some sensors and arduino software's to interface the program.

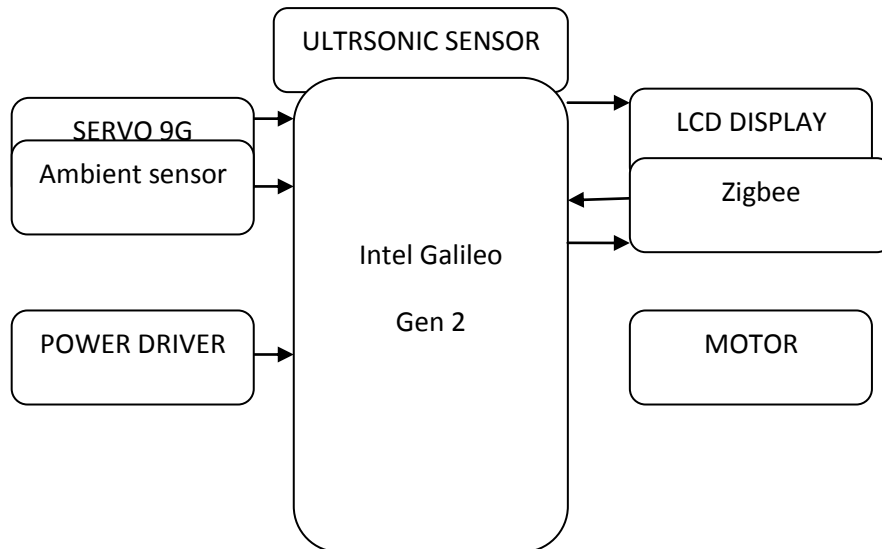


Fig.1. Architecture of Adaptive Steering and Breaking Control

A) ULTRASONIC SENSOR

The timing diagram of HC-SR04 is shown. To start measurement, Trig of SR04 must receive a pulse of high (5V) for at least 10us, this will initiate the sensor will transmit out 8 cycle of ultrasonic burst at 40kHz and wait for the reflected ultrasonic burst. When the sensor detected ultrasonic from receiver, it will set the Echo pin to high (5V) and delay for a period (width) which proportion to distance. To obtain the distance, measure the width (Ton) of Echo pin.

Time = Width of Echo pulse, in uS (micro second)

- Distance in centimetres = Time / 58
- Distance in inches = Time / 148
- Or you can utilize the speed of sound, which is 340m/s

Pin Description:

1. VCC = +5VDC
2. Trig = Trigger input of Sensor
3. Echo = Echo output of Sensor
4. GND = GND

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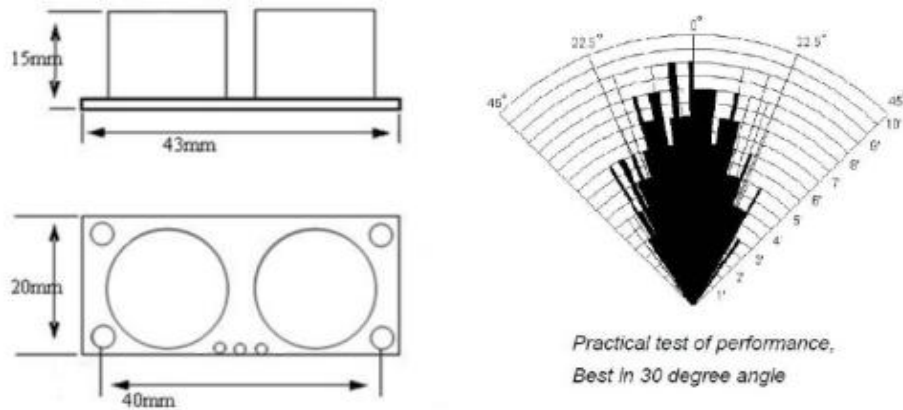


Fig.2. Architecture for ultrasonic sensor.

B) GEAR MOTOR - HELICAL GEAR

- 30 To 60 RPM 12V DC geared motors for robotics applications
- Very easy to use and available in standard size.
- Nut and threads on shaft to easily connect Wheel
- 6mm shaft diameter with internal hole
- 125gm weight
- Same size motor available in various rpm
- 1 kgcm torque
- No-load current = 60 mA(Max), Load current = 300 mA(Max)

Geared DC motors can be defined as an extension of DC motor. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM. The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. This Insight will explore all the minor and major details that make the gear head and hence the working of geared DC motor.

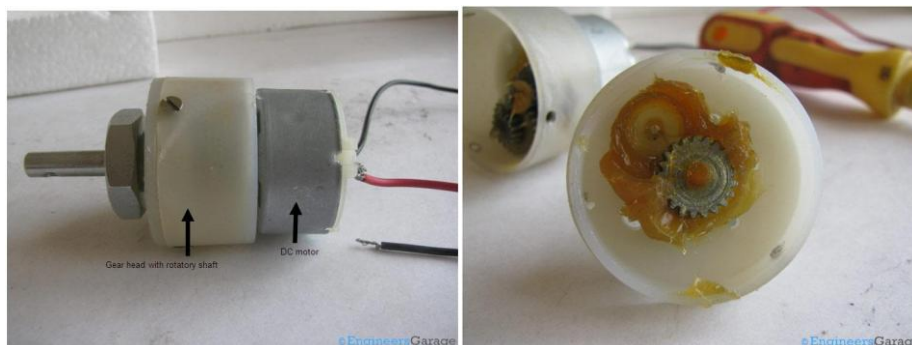


Fig.3. Gear motor structure

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C) RFM75(Zigbee)

RFM75 is a GFSK transceiver operating in the world wide ISM frequency band at 2400-2483.5 MHz. Burst mode transmission and up to 2Mbps air data rate makes them suitable for applications requiring ultra low power consumption. The embedded packet processing engines enable their full operation with a very simple MCU as a radio system. Auto re-transmission and auto acknowledge give reliable link without any MCU interference.

RFM75 operates in TDD mode, either as a transmitter or as a receiver.

The RF channel frequency determines the center of the channel used by RFM75. The frequency is set by the RF_CH register in register bank 0 according to the following formula: $F_0 = 2400 + RF_CH$ (MHz). The resolution of the RF channel frequency is 1MHz.

A transmitter and a receiver must be programmed with the same RF channel frequency to be able to communicate with each other.

The output power of RFM75 is set by the RF_PWR bits in the RF_SETUP register.

Demodulation is done with embedded data slicer and bit recovery logic. The air data rate can be programmed to 250Kbps, 1Mbps or 2Mbps by RF_DR_HIGH and RF_DR_LOW register. A transmitter and a receiver must be programmed with the same setting.

In the following chapters, all registers are in register bank 0 except with explicit claim.

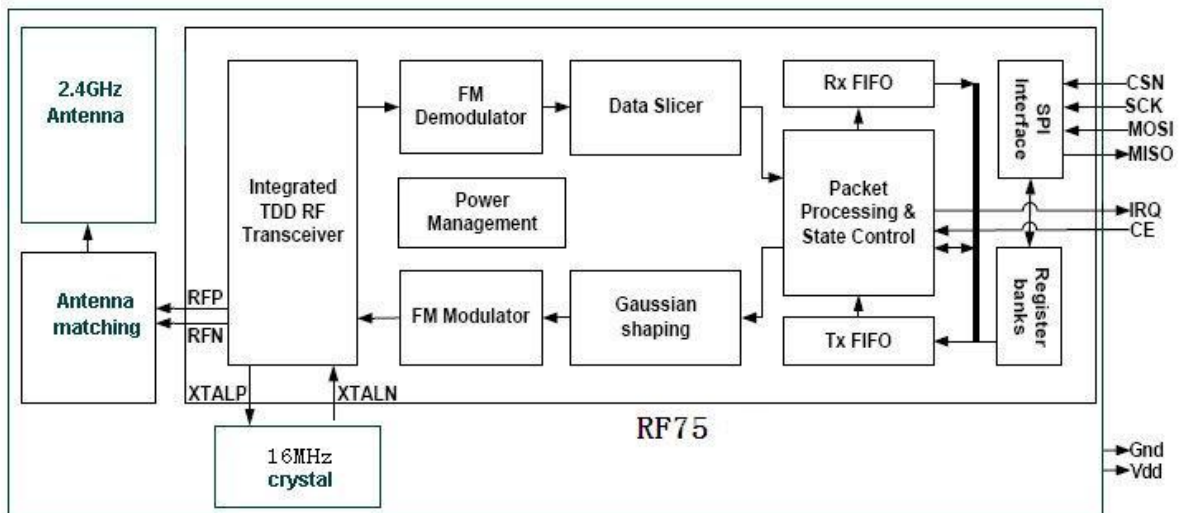


Fig. 4 Architecture for RFM75 Chip Block Diagram.

III. PERFORMANCE ANALYSIS

The performance of each and every module feature has been given there are vehicle to vehicle communication, monitoring the distance of lead vehicle, lane changing performance, adaptive light. Demonstrating the concept, the ultrasonic sensor constantly sense the distance between the vehicle if it is of closer proximity it initiates emergency brake.

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Fig. 5 Performance of monitoring the distance

Lane changing process is based on the authentication vehicle automatically detouring into the next lane and the system is stabilised by lane changing mechanism.

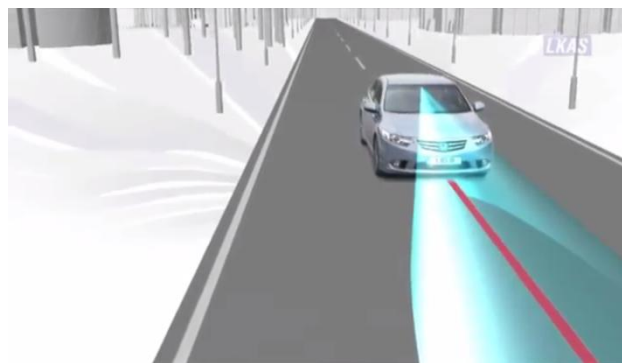


Fig.7. Performance of Lane changing process

The adaptive lightning is adjusted using servo 9g motor, the motor is synchronized with the steering thereby increasing the visibility at all the curves.

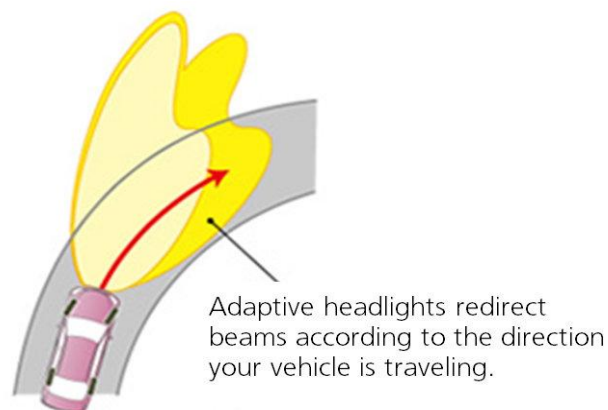


Fig.8 Performance of Adaptive headlights

The Zigbee communicates with the vehicle in the front and controls the speed of the car, therefore the speed of the car is varied according to the traffic.

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IV. CONCLUSION

Our implementing the above prototype, it increases the safety and security of the vehicle by providing wider angle light beam at turns, speed optimizations techniques are achieved by establishing communication with nearby vehicles .lane changing and line stabilizations methods can be performed by using blind spot sensing and collision avoidance mechanism.

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