ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)

Vol 8, Issue 6, June 2021

Retro-fitment of Electronics System for Enhanced Safety Features

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Abstract: Prior research is to establish a connection with OBD of a vehicle which provides vehicular connectivity with smartphones using internet for existing vehicles that don't have an inbuilt vehicular connection and adds an additional sensor units which are not present making it easy to monitor all the systems in the vehicle. Most vehicles that are on roads don't have this technology and this is mostly found in expensive cars. Using the proposed system, such vehicular connection system can be installed separately at a cheaper expense in all vehicles. Through this, the status of the vehicle is diagnosed by the OBD system and the report is transferred to the laptop in the GUI.

Using the system, additional sensors can be added to a vehicle to upgrade its functionality, which the system supports. Additionally, driver assist functions are introduced, helping the driver during the travel period. Here our main motive is to provide the same comfort and features that has been introduced in the recent top end module vehicles. By ensuring that, it should be cost effective, long lasting and user friendly at the same time. This could be made possible for daily transportation like metro, services, public transportation, mid variant vehicles in car and busses. This can be achieved by introducing On-board Diagnostic system protocol over a control area network to scan and collect the data from the vehicle subsystems and feed this data to the display by means of USB connection which makes easier to visualize graphical represented data in a pc through a Graphical User Interface.
The expected output for this design would be the wiper should get on when the sensor in it recognises the rain droplets and turn on the LDR automatically as the rain could lead to fog and mist and these particles also have been recognised by the wiper or LDR. The continuous monitoring of the tyre pressure and reflecting the values of each to the dash board so that user could know if there is dangerous fall in the tyre pressure and could be able to stop the upcoming accidents or discomfort.
These all have been done through the software implementation, here we are using python to support our code. The hardware connection should be made ready to dump the code supported by python to make it run successfully.

I. INTRODUCTION

The main objective of the OBD is to monitor the changes in vehicle sub-systems. This leads towards the On-board diagnostics (OBD), which is a simple vehicle self-diagnosing system and has reporting capability. The OBD system gives access to the vehicle owner or repair technician to check and follow the status of vehicle subsystems. Since the 1980's introduced version of OBD varies with the amount of diagnostic information available via OBD through vehicle computers. The evolved OBD system uses a digital communication port to provide a real-time data in addition to a series of diagnostic trouble codes (DTCs) which allows user to rapidly identify malfunctions within the vehicle. Basically the system is implemented an OBD-II protocol over a CAN [Controller Area Network] bus, which corresponds to the scanner. OBD-II is an improvement over OBD-I in both capability and standardization. It provides a list of vehicle parameters to monitor along with how to encode the data for each. The connector pin that provides power for the scan tool from the vehicle battery, in turn it eliminates the necessity of connecting a scan tool to a power source separately. Finally, the OBD-II standard provides a list of DTC's, this leads to where a single device can monitor on-board computer in any vehicle. The scanner has a USB connection that eases the graphical visualization of data in a PC through an interface. With the help of OBD II parameters like engine wiper ON, LDR etc.., are monitored in the GUI.

GUI's are the interface which gives access to the user to interact with the electronic equipment through graphical icons and audio indicator instead of text-based user interface, are widely used in many fields for example, handheld mobile devices such as MP3 players, portable media players, gaming devices, smartphones and smaller household, office and industrial controls. A GUI allows

ISSN (Online) 2394-2320

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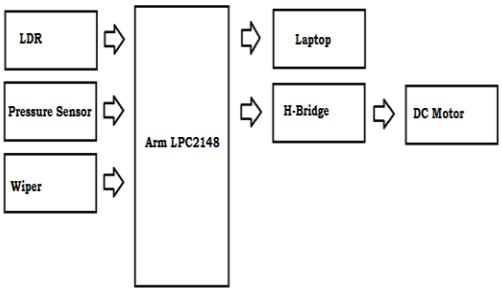
the user to communicate with the computer by moving a pointer around on a screen and clicking a button on it. A program on the computer is constantly checking for the location of the pointer on the screen, any movement of the mouse, and any buttons pressed. This operating system could be navigated by mouse. Keyboard can also be used through arrow keys. Have to know the commands to navigate to the directory containing the program, list the files, and then run the file with a command line interface.

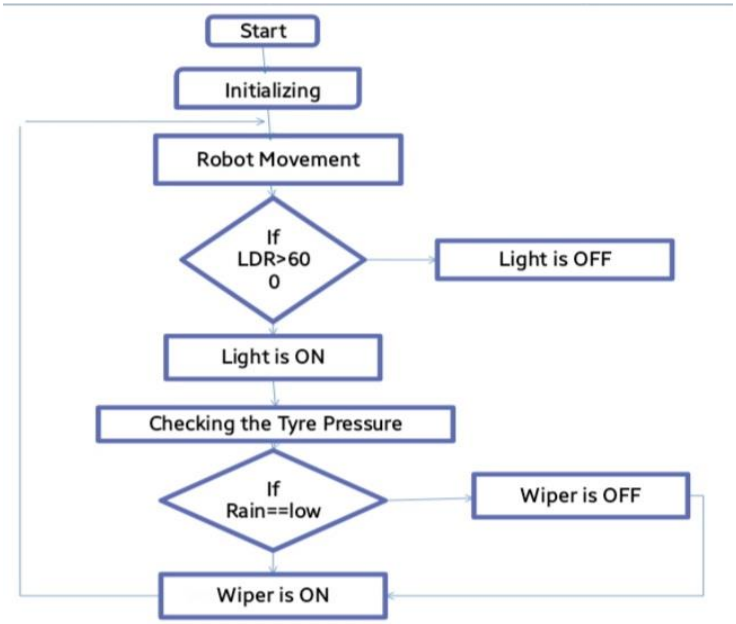
While driving by looking at the dashboard, have you tried collecting the meter reading and do some analysis? These data may contain hidden details of individuals, which replicates the driving habits with the speed, average mpg, traffic lights, and time at each cross. The main speciality of this is to analyse the weather change in surrounding and adapt the data and functions as required for the user Companies find difficulty in monitoring these data for real-time access. Vehicle condition, work load distribution, gasoline efficiency, and even vehicle location can all be fed back to a central control system through cloud. Companies can use driver's characteristics to analyse. This technology is widely adaptive and the above applications won't be far away to hit the market with the "ARM7 LPC2148MKR" boards. Targeting at IOT applications, it can build a device that talks to your car and uploads telemetric data into cloud all by yourself.

Functional Description:

Block Diagram:



Flow graph:



ARM Controller

The ARM7TDMI-S is a 32-bit microprocessor, which results in;

- a high instruction throughput.
- an excellent real-time interrupt response.
- a small, cost-effective, processor macro-cell.

These ARM gives high performance for very low power consumption and is based on Reduced Instruction Set Computer (RISC) principles where the instruction set and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) design.

To increase the speed of the flow of instructions to the processor, ARM7TDMI-S uses a pipeline which makes the several operations to take place parallel, and the processing and memory systems to operate continuously. A three-stage pipeline is used, so instructions are executed in three stages, fetch, decode and execute.

A 16-bit architecture has 16-bit instructions, and a 32-bit architecture has 32-bit instructions, overall the 16-bit architecture has higher code density, and greater than half the performance of the 32-bit architecture. A typical 32-bit instruction set has the ability to manipulate 32-bit integers with single instructions, and to address a large address space much more efficiently than a 16-bit architecture.

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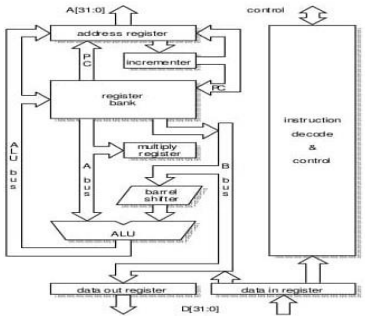
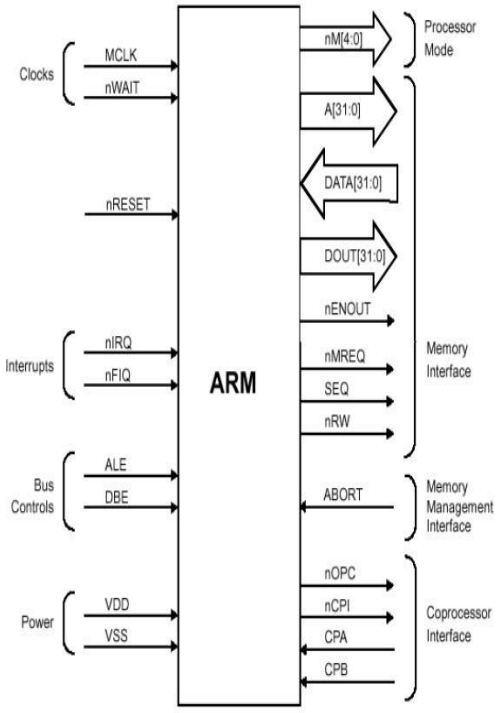
It is a subset of the most commonly used 32-bit ARM instructions each 16 bits long, and have a corresponding 32-bit ARM instruction that has the same effect on the processor model. It operates with standard ARM register configuration which allows inter-operability between "ARM and Thumb" states, without performance loss 16-bit Thumb instructions decompressed to full 32-bit ARM instructions in real time, on execution.

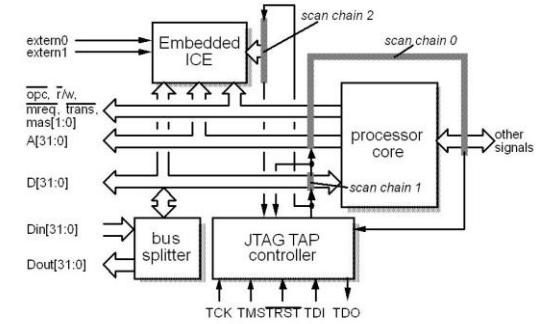
ARM architecture



ARM7TDMI-S functional diagram



ARM7TDMI Block Diagram



LDR Sensor:

A Light Dependent Resistor (LDR), resistor whose resistance depends upon the intensity of the light. When light strikes the surface of semiconductor material, here the electrons in valence band jumps to conduction band of the semiconductor material on the other side to create a charge carrier, this should happen in more numbers on either side to make a current flow. The photons of the light should have high energy to push more electrons to create a number of charge carriers resulting current starts flow through device. Hence the device resistance will decrease, results in automatic turn on/off the sensor.

LDR are used to detect light levels,
Example: an automatic security lights. Their resistance

ISSN (Online) 2394-2320

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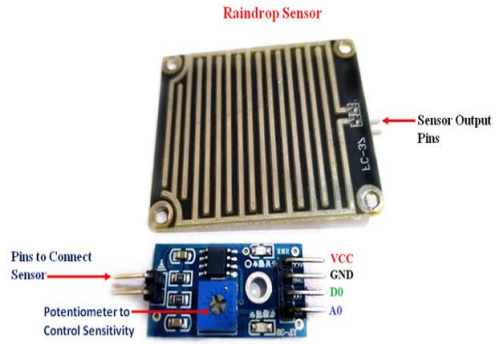
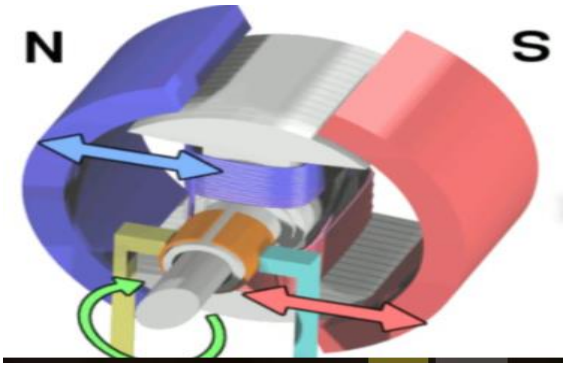
decreases as the light intensity increases.

Rain Sensor:



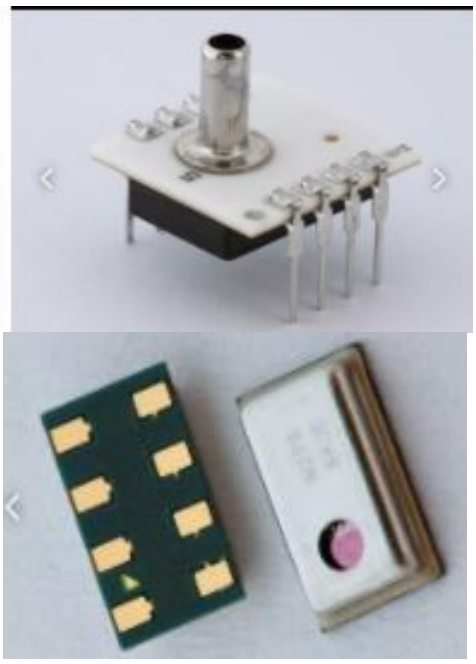
Rain drop sensor used to sense the rain drop components, which consists of potentiometer to control the sensitivity. The potentiometer is a measuring instrument, is essentially a voltage divider which measures the voltage. It consists of modules, rain board and control module, where rain board can detect the rain particles and a control module compares the resulting, analog value of input and converts it to a digital value.

DC Motor:



A Direct Current motor is an electrical motor that converts DC electrical energy to a mechanical energy. Every DC motors have some internal mechanism, either electromagnetic or electronic to periodically change the direction of the current. In the most common type DC motors, forces are produced by magnetic fields. A DC motor used for producing continuous movement with controllable speed of rotation, speed can be controlled over a wide range of using either variable supply voltage or by changing the strength of current in its field winding. The standard voltage requirement for the wiper motor is 12 volts DC. In a running automobile the electrical systems usually holds between 13 and 13.5 volts, so it will be safe to say the motor can handle up to 13.5 volts without problem.

Pressure Sensor:



Pressure sensors are classified in terms of pressure ranges and most importantly the type of pressure they measure. They are used according to their working purpose namely:

1) Absolute pressure sensor.
2) Gauge pressure sensor.
3) Vacuum pressure sensor.
4) Differential pressure sensor.
5) Sealed pressure sensor.

A pressure sensor is a device that used to measure the gases or liquids. Pressure is defined as the expression of force required to stop a fluid from expanding, defined in terms of force per unit area. A sensor usually acts as a transducer where it generates a signal as a function of the pressure imposed. Pressure sensors control and monitors everyday applications and also used to indirectly measure other variables such as fluid/gas flow, speed, water level and altitude.

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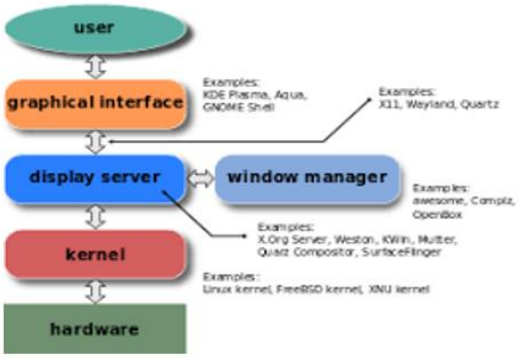
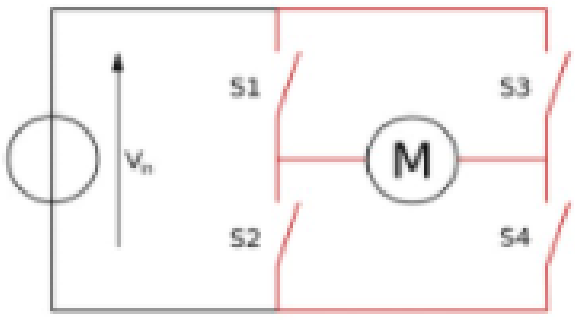
Tyre Pressure Monitoring System (TPMS), the majority usage of this is to confine the pressure of the tyres and to report the under-inflate possibly, and to reflect the alert and the readings of each tyre pressure values to user.

Graphical User Interface (GUI):



The GUI is a graphical user interface which allows system of interactive visual components for computer software to interact with electronic devices through graphical icons and audio indicator such as primary notation. It displays that convey information and represent actions. A GUI includes objects like icons, cursors, and buttons. These graphical elements could be enhanced with sounds, or visual effects like transparency. By using these objects, a user can use the computer without having to know commands. The actions in GUI are usually performed through direct manipulation of the graphical elements.

H-Bridge:



An H bridge is an electronic circuit that switches polarity of voltage applied to a load. These circuits are used in robotics and other applications to allow DC motors to forwards or backwards. The term H-bridge is derived from the typical graphical representation of such a circuit. An H-bridge is built with four switches. When the switches S1 and S4 are closed a positive voltage is applied across the motor. By opening S1 and S4 and closing S2 and S3 switches the voltage is reversed allowing reverse operation of motor. Using the nomenclature above the switches S1 and S2 should never be closed at the same time, as this would cause a short circuit on the input voltage source. The same applies to the switches S3 and S4. This is known as shoot through.

Connections:

- The Replacement of diagnosis tool kit which provides lesser time for updating ECU data.
- The proposed method of diagnosing the vehicle is different from existing OBD system. This system does not require a scan-tool technician and service centres.
- The different parts of vehicle are connected with multiple ECUs and this will have sensors attached with it for monitoring.
- All ECUs will be connected and it will be collecting values from the ECUs.
- Hence the user knows the condition and performance of the vehicle while driving.
- The proposed system will be preloaded with optimum maximum and minimum values of each parameter. The system will display abnormal indication in the GUI.

Results:

ISSN (Online) 2394-2320

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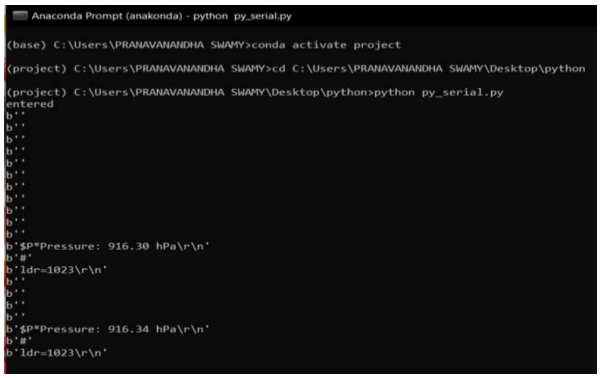

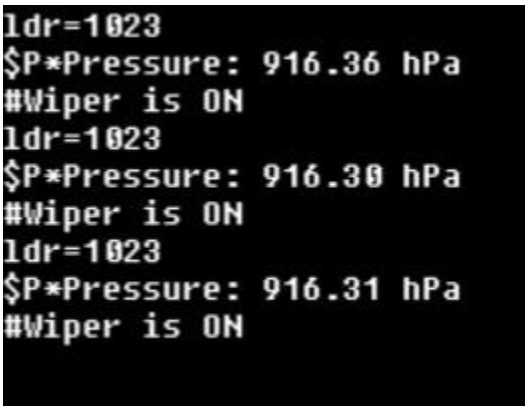

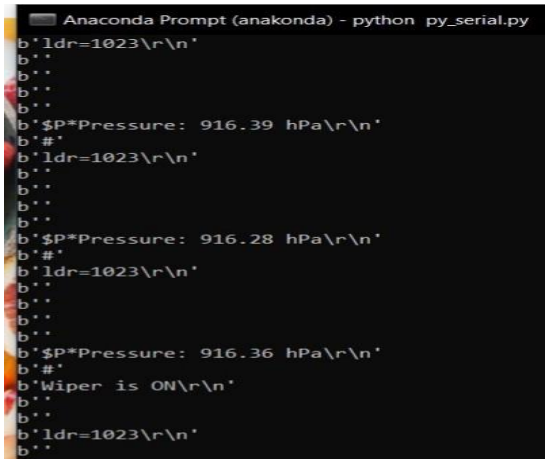

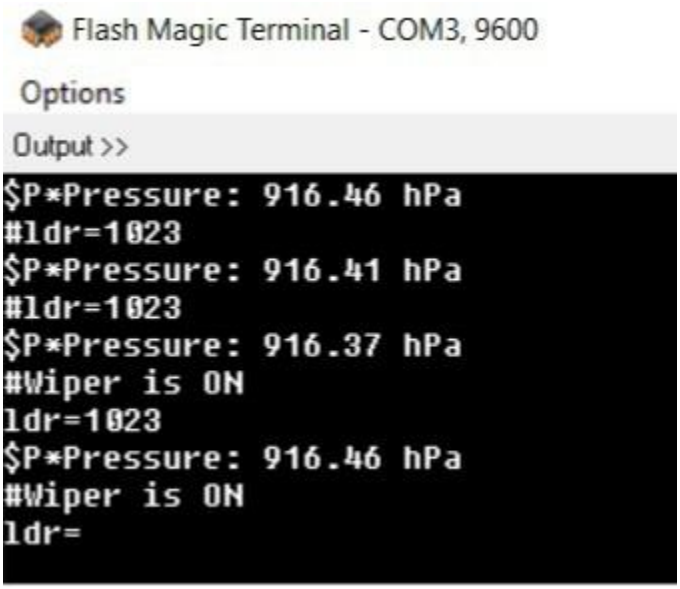

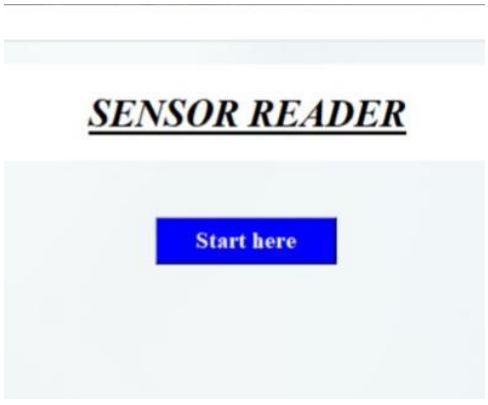

Here primarily, the code as to be done and should be dumped to the hardware. The project should be made activate so it could run the things in it. By entering the values of each tyre pressure, it should not fall beyond the given range. These indicate the dangerous fall in tyre pressure and alert the user. The rain sensor is used to read the rain particles this result in activation of potentiometer in it make wiper turn on. The LDR has the range for sensor to read the intensity of UV rays if there is any fall in that range it is turned on automatically and turned off when it is matched to the input range.

ISSN (Online) 2394-2320

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