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INTELLIGENT HANDBRAKE CONTROL SYSTEM IN VEHICLE

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Abstract: This article deals with both mechanical and electrical terminologies with existing technologies. This is a simple automotive hand brake layout that has been designed with chassis, pedal assemblies, actuators, control units and other sensing devices. This system mainly focuses on the easier vehicle operations that are been handled by the drivers of the vehicle. This system comprises the automatic technology in releasing the hand brake lever with certain possible conditions that are safer and easier for the drivers to operate the vehicle. Its main aim is to prevent accidents that are mis-leaded due to driver faults while operating the hand brake lever, and also helps in maintaining the braking efficiency.

IndexTerms – Hand braking, Gyroscope sensors, Limit Switch, Arduino

1. INTRODUCTION

In cars the hand brake is a latching brake usually used to keep the car stationary. Automobiles e-brakes usually consist of a cable directly connected to a brake mechanism on one end and to some type of mechanism that can be actuated by the driver on the other end .the mechanisms is often a hand –operated lever, on the floor on either side of the driver, a pull handle located below and near the steering wheel column, or a pedal located far apart from the other pedals. Although sometimes known as an emergency brake, using it in any emergency where the footbrake is still operational is likely to badly upset the brake balance of the car vat increase the likelihood of loss of control of a vehicle for example by initiating the rear –wheel skid. Additionally, the stopping force provided using the hand brake of or in addition to the footbrake is usually small and would not significantly aid in stopping the vehicle, again because it usually operates on rear wheel while braking. If gentle half before seeking service assistance the most common use for an automobile emergency brake is to keep the vehicle motionless when it is parked, thus the alternative name, parking brake .car emergency brake have a ratchet locking mechanism that will keep them engaged until a release button is pressed . On vehicles with automatic transmission, this is usually used in concert with parking pawl in the transmission. Automotive safety experts recommended the use of both system is required by laws in some jurisdictions. Yet many individuals use only the park position on the automatic transmission and not the parking brake.

2. AUTOMATIC HANDBRAKE RELEASE MECHANISM

Due to failure of above unit or concept, we decided to change the system and modify it for a different conditional working processes. The newer concept was to introduce Micro controller along with H-Bridge circuit, dc-geared tooth motor, and accelerator and brake pedal assembly, LCD- display which can lead to efficient as well as flexible in design and manipulate the Power Actuator. The use of Power Actuator (linear-type) made our operation easy and risk free. An actuator is a device that actuates or moves something. An actuator uses some type of energy to provide motion or to apply a force. For example, an electric motor uses electrical energy to create a rotational movement or to turn on object, or to move an object. A tire jack or screw jack uses mechanical energy to provide enough force lift a car. In short, an actuator converts some type of energy into motion. Actuators include motors, gears, pumps, pistons, valves, and switches

2.1 ACTUATORS

An actuator is something that actuates or moves something. More specifically, an actuator is a device that coverts an input energy into motion or mechanical energy. The input energy of actuators can be ―manual‖ (e.g., levers and jacks), hydraulic or pneumatic (e.g., pistons and valves), thermal (e.g., bimetallic switches or levers), and electric (e.g., motors and resonators). In the transducers unit, a transducer was defined as any device that converts one form of energy to another form of energy; therefore, by the definition, an actuator can be a specific type of a transducer. The motor is one such actuator. A motor converts electrical energy to mechanical energy; therefore, a motor is both an actuator and a transducer.

2.2 H- BRIDGE

The L298N is an integrated monolithic circuit. In a15- lead Multi-watt and Power SO20 packages. It is a high voltage high current dual full-bridge driver de- signed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external

terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage

3. CONSTRUCTION

L298N dual H bridge motor driver. One way to build an H bridge is to use an array of relays from a relay board. A "double pole double throw" (DPDT) relay can generally achieve the same electrical functionality as an H bridge (considering the usual function of the device). However a semiconductor-based H bridge would be preferable to the relay where a smaller physical size, high speed switching, or low driving voltage (or low driving power) is needed, or where the wearing out of mechanical parts is undesirable. DC push-pull converter, most motor controllers, and many other kinds of power electronics use H bridges. In particular, a bipolar stepper motor is almost invariably driven by a motor controller containing Two H Bridges. Another option is to have a DPDT relay to set the direction of current flow and a transistor to enable the current flow. This can extend the relay life, as the relay will be switched while the transistor is off and thereby there is no current flow. It also enables the use of PWM switching to control the current level.

4. OPERATION

The two basic states of an H-bridge. The H-bridge arrangement is generally used to reverse the polarity/direction of the motor, but can also be used to 'brake' the motor, where the motor comes to a sudden stop, as the motor's terminals are shorted, or to let the motor 'free run' to a stop, as the motor is effectively disconnected from the circuit.

4.1 GYROSCOPE SENSORS

Gyroscope sensor is a device that can measure and maintain the orientation and angular velocity of an object. These are more advanced than accelerometers. These can measure the tilt and lateral orientation of the object whereas accelerometer can only measure the linear motion. Gyroscope sensors are also called as Angular Rate Sensor or Angular Velocity Sensors. These sensors are installed in the applications where the orientation of the object is difficult to sense by humans. Besides sensing the angular velocity, Gyroscope sensors can also measure the motion of the object. Depending on the direction there are three types of angular rate measurements. Yaw- the horizontal rotation on a flat surface when seen the object from above, Pitch- Vertical rotation as seen the object from front, Roll- the horizontal rotation when seen the object from front. Working principle of Gyroscope sensor can be understood by observing the working of Vibration Gyroscope sensor.

4.2 MPU6050 Module

MPU6050 sensor module is complete 6-axis Motion Tracking Device. It combines 3-axis Gyroscope, 3-axis Accelerometer and Digital Motion Processor all in small package. Also, it has additional feature of on-chip Temperature sensor. It has I2C bus interface to communicate with the microcontrollers.MPU6050 sensor module is complete 6-axis Motion Tracking Device. It combines 3-axis Gyroscope, 3-axis Accelerometer and Digital Motion Processor all in small package. Also, it has additional feature of on-chip Temperature sensor. 3-Axis Gyroscope: The MPU6050 consists of 3-axis Gyroscope with Micro Electro Mechanical System (MEMS) technology. It is used to detect rotational velocity along the X, Y, and Z axes 3-Axis Accelerometer: The MPU6050 consist 3-axis Accelerometer with Micro Electro Mechanical (MEMs) technology. It used to detect angle of tilt or inclination along the X, Y and Z axes

4.3 ARDUINO

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

4.4 BUZZER

A buzzer is a small yet efficient component to add sound features to our system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications.

4.5 GEARED DC MOTORS

Geared DC motors can be defined as an extension of DC motor which already had its Insight details demystified here. 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. Gear motors are used in applications that require lower shaft speed and higher torque output. This describes a wide range of applications and scenarios, including many of the machines and equipment we interact with on a daily basis. From ATV wipers to hospital beds, servo mechanisms to packaging equipment, paint mixers to juice dispensers, gear motors are used to power a significant number of machines and applications.

4.6 LIMIT SWITCHES

Limit switches are used to automatically detect or sense the presence of an object or to monitor and indicate whether the movement limits of that object have been exceeded. The original use for limit switches, as implied by their name, was to define the limit or endpoint over which an object could travel before being stopped. It was at this point that the switch was engaged to control the limit of travel. Presence Sensing is the act of detecting the presence or absence of an object with a contact or non-contact sensing device. The sensors then produce an electrical output signal that can be used to control equipment or processes. Mechanical limit switches are contact sensing devices widely used for detecting the presence or position of objects in industrial applications. The term limit switch is derived from the operation of the device it-self. As an object (or target) makes contact with the operator of the switch, it eventually moves the actuator to the "limit" where the electrical contacts change state. Through this mechanical action, electrical contacts are either opened (in a normally closed

circuit) or closed (in a normally open circuit). Inductive proximity, capacitive proximity, and photoelectric sensors perform this same process through non-contact sensing.

4.7 FUNCTIONS OF SPECIFIED COMPONENTS

1	**Actuator**	Activates the hand brake lever.
2	**Limit switch**	Senses the position of pedals.
3	**Gyroscope sensor**	Senses the angle of the vehicle.
4	**Slide switch**	Used as gear shifter.
5	**LCD display**	Displays the ongoing process.
6	**Buzzer**	Alerts the driver.
7	**DC geared motor**	Power train with wheel.
8	**H bridge**	Controls both actuator and DC motor.
9	**Arduino**	Controls the overall process.

5. WORKING

This mechatronics system is made up of flat thin steel plated chassis which holds all the mechanical and electrical components together. Then, the hand brake lever unit, linear actuator are bolted to the chassis and also other pedal assembly unit i.e., brake pedal and accelerator pedal are screwed to the chassis separately. Then, all other electrical circuits like 36 H-bridge, Arduino, gyroscopic sensor, DC-geared motor LCD-screen display, buzzer are fixed using double-side tapes which holds the items firmly in positions. Wiring connections of male and female ports are glued using glue-gun for proper wiring Connectivity that are visible to naked eyes of an individual. A separate electric power source is powered to function the system which takes the form of the adapter of 12V to make the system a live one. This complete working prototype is a stable working model designed overall. First of all its overall working states how will be a typical hand brake system works if it is automated. The power train and moving wheels are totally laid its foundations on the DC-geared motor, designed in the prototype. The gear shift is given in the form of slide switch (SPDT).

5.1 Conditions in Functioning of Automatic Hand Brake Retrieving and Locking System

Wheel	Gear	Ignition	Hand Brake
Rest	Neutral	On	Engage
Running	On Gear	On	Disengage
Rest	Neutral	Off	Engage

Table 5.1 Conditions in Functioning

The above mentioned table gives an overview of working of automatic hand brake retrieving and locking system. As usual operating conditions, driver first starts the vehicle, operates the clutch, then unlocks the hand brake lever to move the vehicle forward by shifting gears in sequential. But in the case of this system, when the vehicle is in rest condition, i.e., wheel in rest, no gear engaged, these are all sensed by the sensors such as VSS (Vehicle Speed Sensor), Gear Shift Leveler sensing unit, and after verification of all of these conditions, these recognized inputs are given to the H-bridge and Arduino Uno. So that the system identifies the situation and locks the hand brake lever automatically.

Condition 1

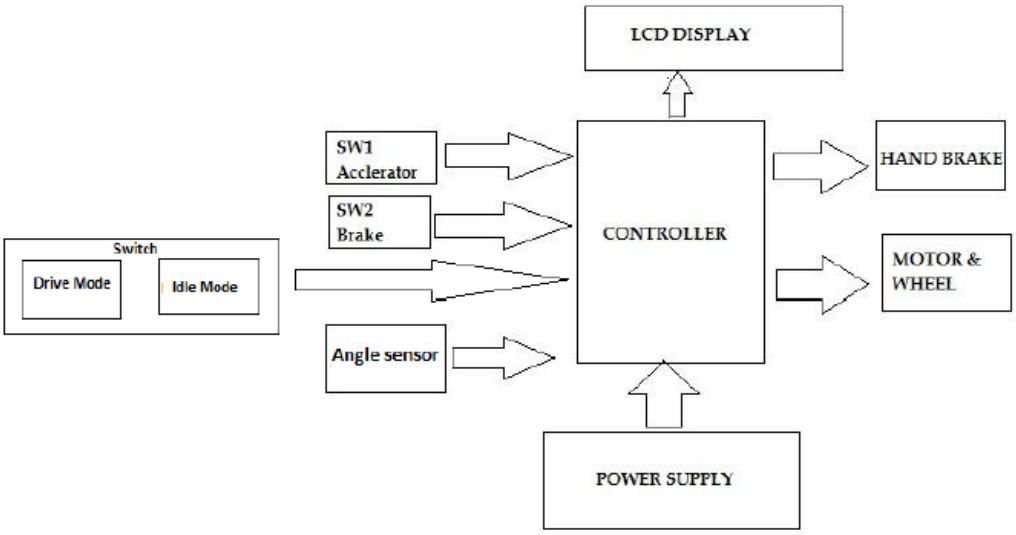
When the ignition is ON, brake (or) clutch pedal (operation of Limit Switch) is operated by the driver, then the Gear Shift is made (operation of Slide Switch), under such conditions, the sensors such as VSS, Gear Shift Leveler sensor, pulse generated in the Limit Switch are all transferred as inputs to Arduino and H-bridge. Then the central processing section, passes the command to H-bridge circuit to handle both linear actuator and DC-geared tooth motor. So at last H-bridge activates the actuator which in turn releases the hand brake lever down also in turn makes the DC-geared tooth motor which is considered as the power train, rotates the wheel forward. These all stages are observed, when releasing the foot from the brake (or) clutch pedal. All these are considered as the loop process when the vehicle is in a normal straight plane angle. Then after the initial movement of vehicles by accelerator usual gear shifts are made accordingly to the requirements. At vehicle running, stages, hand brake remains dead till the vehicle stops or becomes stationary at idle conditions.

Condition 2

At vehicle parking situations, when the vehicle parked at angles i.e., in slopes (inclined) or hilly regions, this system does not behave as ordinary conditions as seen in condition-1. This system when parked at angles behaves intelligently to the required operating conditions for the user or driver of the vehicle. At these conditions, when the driver intends to handle the vehicle that is parked at angles, the angle of the vehicle is measured by the gyroscopic sensor which is fitted next to the hand brake lever unit. So when driver makes the ignition key ON, engages the brake or clutch pedal and shifts the gear, the H-bridge circuit does not command the actuator to release the hand brake lever, all these controls are received by the Arduino, at these circumstances the Arduino invokes the gyroscopic sensor which senses the angle of the vehicle parked, when foot from the clutch or brake pedal is intended to be released, alert via Buzzer is intimated to the driver that vehicle is parked at slopes or hilly regions and also the alert made from the Buzzer is made till the handling of the vehicle is in a right and proper manner and the sound the Buzzer stops when driver arrives finally in a straight plane from the slope or hilly regions. So this intelligence operation, makes the driver aware in such conditions in operating the vehicle.

Condition 3

Finally, when the vehicle arrives at rest which makes the spinning wheels to stop, and where hand brake system senses those conditions, the system automatically locks the hand brake lever by Arduino unit which passes the signal to H-bridge to activate actuator. This actuator locks the lever which locks the drum of the wheels firmly by making the vehicle stationary. This condition is possible for both straight plane angle and slope or hilly regions.



5.1 Block Diagram of Automatic Hand Brake Retrieving and Locking System

6. CONCLUSION

This system is mainly designed for user-friendly performances that ensures the safety first procedure of both human and vehicle from being made accident or injured. Advancements in such technologies are much essential and are unavoided by people due to efforts taken in handling the vehicular operations and to abide by various rules and regulations. Transportation department of Indian government. This system would be a better outcome if implemented with proper training and with manual specifications.

REFERENCES

1. AUTOMATIC HAND BRAKE SYSTEM- by S. Thivagar, C. Nantha kumar (department of mechanical engineering)- International Journal of Engineering Research and General Science Volume 4, Issue 1, (ISSN 2091-2730)- January-February, 2016
2. ADVANCEMENTS IN AUTOMATIC HAND BRAKE SYSTEM- Sachin S.Dharia, Sachin S.Bhopale, Prathmes P. Kumbhar, Kedar S. Pathak- international journal of advance research in science and engineering, vol.no:5, issue no:05- ISSN(2319-8354)-May 2016
3. AUTOMATIC ENGAGEMENT AND DISENGAGEMENT OF HANDBRAKE SYSTEM USING PNEUMATIC SYSTEM- Prof. D. L. Shinde, Mr. Talandage Nikhil M, Mr. Attarde Varad R, Mr. Mashalkar Akash s, Mr. Mahajan Rohit B- International Journal for Research in Applied Science & Engineering Technology (IJRASET)- Volume 5 Issue VI(ISSN: 2321-9653)- June 2017
4. DEVELOPMENT OF ELECTRO-HYDRO AUTOMATIC PARKING BRAKING SYSTEM FOR AUTOMOTIVE SYSTEM- Ataur Rahman, Mohiuddin AKM, Ahsan Sakif- International Journal of Recent Technology and Engineering (IJRTE), Volume-7, Issue-6S, ISSN (2277-3878)- March 2019
5. DESIGN AND DEVELOPMENT OF HAND BRAKE RELEASE SYSTEM- Rohan E. Dalvi, Ramesh G. Sutar, Prashant H. Karke, Jitendra B. Satpute- Global Research and Development Journal for Engineering, Volume 2, Issue 6, ISSN (2455-5703)- May 2017
6. DEVELOPMENT OF AUTOMATIC HAND BRAKE SYSTEM- Gokul Gopan, Gopi krishnan EJ, Gritto Joseph Cherian, Jacob Shibu Samuel- International Journal for Innovative Research in Science & Technology- Volume 3, Issue 11, (ISSN: 2349-6010)- April 2017
7. MODIFICATION AND IMPLEMENTATION OF AUTOMATIC HAND BRAKE SYSTEM USING SENSOR- Rohit Khubalkar, Saurav Kumar, Kishen Jadhav, Vaibhav Regundawar, Aniket Phatangare- International Research Journal of Engineering and Technology (IRJET)- Volume: 06 Issue: 04, (e-ISSN: 2395-0056), (p-ISSN: 2395-0072)- April 2019
8. DESIGN AND ANALYSIS OF PARKING BRAKE SYSTEM OF CAR- Amit B. Maske , S.B Tuljapure , P.K Satav, International Journal Of Innovative Research In Science, Engineering And Technology (ISSN : 2319-8753)- July 2016