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Automation By Hall Effect Empowered Relay

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Abstract:
It is an interesting area of research. In this era, electromagnetic relays, static or semi static relays are used. But due to many advantages of Hall Effect based relay as, it is an interesting research area. The Hall Effect sensor is used to trip the circuit breaker. The Hall Effect can give the both type of output analog and digital. When current exceed a predefined current (pick up value) relay is operated. It will trip the coil which will disconnect the system which is to be protected.

Key words: *Hall effect, Relay*

1.Introduction

The Hall effect is main technique involve in this project. The Hall Effect has been known for over one hundred years, but has only been put to noticeable use in the last three decades. The first practical application was in the 1950s as a microwave power sensor. The advent of new semiconductors has led, in recent years, to many important applications of the Hall effect, and the present proposal offers interesting possibilities in the use of that effect for the construction of a 'definite' impedance relay capable of performing the same function as the conventional induction type of instrument and with greater simplicity. With the mass production of semiconductors, it became feasible to use the Hall effect in high volume products. Micro Switch Sensing and Control revolutionized the keyboard industry in 1968 by introducing the first solid state keyboard using the Hall effect. For the first time, a Hall effect sensing element and its associated electronics were combined in a single integrated circuit. Today, Hall effect devices are included in many products, ranging from computers to sewing machines, automobiles to aircraft, and machine tools to medical equipment. With the help of this Impedance relay is made which have many advantages over induction type relays.

Principle- The Hall effect is the production of a voltage difference across an electrical conductor, transverse to an electric current in the conductor and a magnetic field perpendicular to the current. It was discovered by Edwin Hall in 1879.

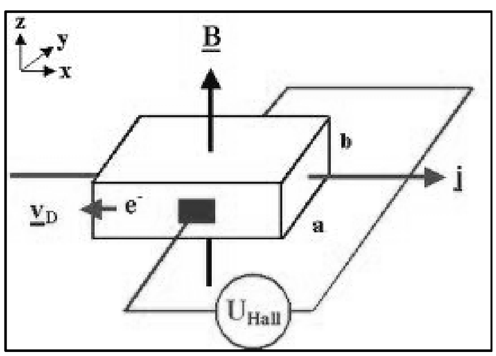

Figure 1: Hall effect

$$V_H = \frac{I \cdot B}{n \cdot q \cdot t} = \frac{R_H \cdot I \cdot B}{t}$$

Here; $V_{H=}$ Hall voltage

2.Literature Survey

In this paper, in-depth analysis has been done on Hall Effect based relays. It is mainly depend on Hall Effect.

The Hall effect was discovered by Dr. Edwin Hall in 1879 while he was a doctoral candidate at Johns Hopkins University in Baltimore. Hall was attempting to verify the theory of electron flow proposed by Kelvin some 30 years earlier. Dr. Hall found when a magnet was placed so that its field was perpendicular to one face of a thin rectangle of gold through which current was flowing, a difference in potential appeared at the opposite edges. He found that this voltage was proportional to the current flowing through the conductor, and the flux density or magnetic induction perpendicular to the conductor. Although Hall's experiments were successful and well received at the time, no applications outside of the realm of theoretical physics were found for over 70 years.

It is quite remarkable that Hall's experiments allowed him to observe the effect at all, when one considers the instrumentation available at the time and the subtle nature of the experiment, which most likely provided signals of only microvolt's. Neverthe- less, the Hall effect became reasonably well known early on; the Smithsonian Institute Physical Tables from 1920 include a table describing the magnitude of the Hall effect for a number of substances . In the 1950s, Hall-effect transducers were commonly used to make laboratory type magnetic measurement instruments. The availability of semiconductor materials enabled the fabrication of high-quality transducers.

In the 1960s and 1970s, it became possible to build Hall-effect sensors on integrated circuits with on-board signal-processing circuitry. This advance vastly reduced the cost of using these devices, enabling their wide spread practical use. One of the first major application was in computer keyboards, where the new integrated Hall-effect sensors were used to replace mechanical contacts in the key switches.

With the advent of semiconducting materials in the 1950s, the Hall Effect found its first applications. However, these were severely limited by cost. In 1960, an experimental impedance relay using the hall effect in a semiconductor by Professor H. E. M. Barlow, Ph.D., B.Sc. (Eng.), Member, and J. C. Beal, B.Sc.(Eng.)} Graduate is made. The paper describes a new type of 'definite' impedance relay applicable to the protection of power transmission systems. Its operation is based upon a differential balance, under normal conditions, between the output from Hall effect in a semiconductor element and a rectifier unit.

In 1965, Everett Vorthmann and Joe Maupin, Micro Switch Sensing and Control senior development engineers, teamed up to find a practical, low-cost solid state sensor. Many different concepts were examined, but they chose the Hall effect for one basic reason: it could be entirely integrated on a single silicon chip. This breakthrough resulted in the first low-cost, high-volume application of the Hall effect, truly solid state keyboards. Micro Switch Sensing and Control has produced and delivered nearly a billion Hall effect devices in keyboards and sensor products. The Royal Swedish Academy of Sciences has awarded the 1998 Nobel Prize in Physics jointly to Professor Robert B. Laughlin, Stanford University, California, USA, Professor Horst L. Störmer, Columbia University, New York and Lucent Technologies' Bell Labs, New Jersey, USA, and Professor Daniel. In this paper, in-depth analysis has been done on Hall Effect based relays. It is mainly depend on Hall Effect

Hall effect sensors detect whether a magnet is near. It is useful for non-contact/waterproof type switches, position sensors, rotary/shaft encoders. I tried dozens of different Hall Effect sensors to see which one would work best for the Spoke POV kit (to determine the wheel location) and this one came out on top! It runs at 3.5V up to 24V. To use connect power to pin 1 (all the way to the left), ground to pin 2 (middle) and then a 10K pull up resistor from pin 3 to power. Then listen on pin 3, when the south pole of a magnet is near the front of tsensor, pin 3 will go down to 0V. Otherwise it will stay at whatever the pull-up resistor is connected to. Nothing occurs if a magnet's North Pole is nearby (unipolar).

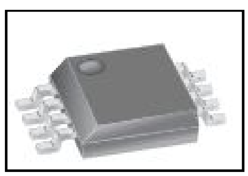

Figure 2: POV kit

2.1.Discription

ACS714 provides economical and precise solutions for AC or DC current sensing in automotive systems. The device package allows for easy implementation by the customer. Typical applications include motor control, load detection and management, switch-mode power supplies, and overcurrent fault protection.The device consists of a precise, low-offset, linear Hall circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field which the Hall IC converts into a proportional voltage. Device accuracy is optimized through the close proximity of the magnetic signal to the Hall transducer. A precise, proportional voltage is provided by the low-offset, chopper-stabilized BiCMOS Hall IC, which is programmed for accuracy after packaging.The output of the device has a positive slope (>VIOUT(Q)) when an increasing current flows through the primary copper conduction path (from pins 1 and 2, to pins 3 and 4), which is the path used for current sampling. The internal resistance of this conductive path is 1.2 mΩ typical, providing low power loss. The thickness of the copper conductor allows survival of he device at up to 5× overcurrent conditions. The terminals ofthe conductive path are electrically isolated from the signal leads (pins 5 through 8). This allows the ACS714 to be used in applications requiring electrical isolation without the use of opto-isolators or other costly isolation techniques.The ACS714 is provided in a small, surface mount SOIC8 package. The leadframe is plated with 100% matte tin, which is compatible with standard lead (Pb) free printed circuit board assembly processes. Internally, the device is Pb-free, except for flip-chip high-temperature Pb-based solder balls, currently exempt from RoHS. The device is fully calibrated prior to shipment from the factory.

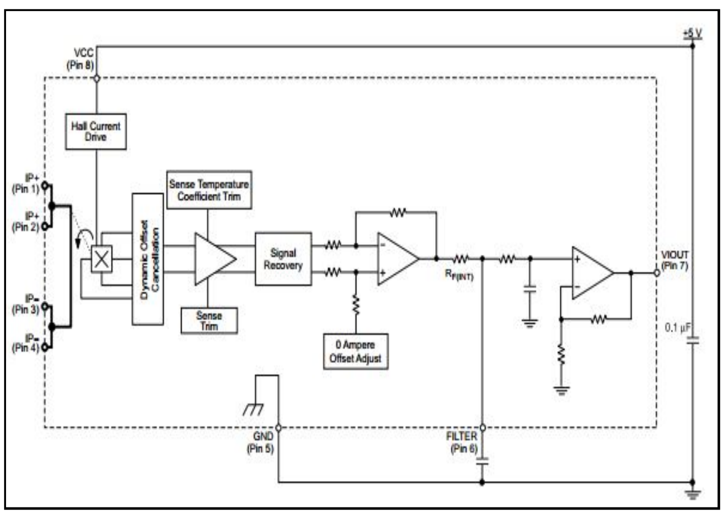

Figure 3: Hall effect switch

2.2.Basic Interfaces

When the electrical characteristics are known, it is possible to design interfaces that are compatible with NPN (current sinking) output Hall effect sensors. The current sink configuration produces a logic "0" condition when a magnetic field of sufficient magnitude is applied to the sensor.

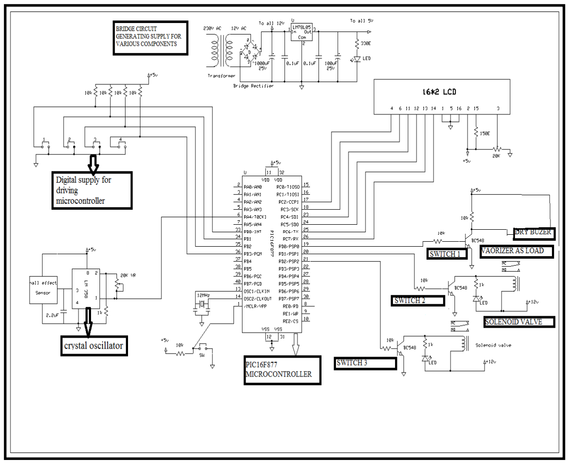

Figure 4: Interfacing with relay

3.Conclusion

Enormous amount of work has been done on finding the suitable way for Hall effect based relay. A brief review on developments of Hall effect sensor have been given and analyzed that the best way for this purpose is the semiconductor materials. Due to many advantages over induction type relay, Hall effect based relay can be used. The numerical relays are very expensive so impedance relays can be used for distribution lines protection.

As the experimental results show, this Hall-effect protective relay behaves, as anticipated, in a manner very similar to the more conventional induction-operated device, and consequently can be designed to take its place in a power system. The new type of impedance relay has ample sensitivity for most applications and possesses the advantages of small physical size, simplicity, linear operation over a wide range of currents and relatively low cost

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