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Design and Construction of a Remote Controlled Fan-Speed Regulator

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ABSTRACT
The design and construction of a remote controlled fan-speed regulator, was designed to improve the regulation of the speed of fan using a remote control device. The variation in the firing angle of triac will be used for regulating the speed. Any button on the remote can be used for controlling speed of the fan. This circuit will be used for controlling the speed of the fan in 3 levels. This project facilitates the operation of the fan regulators around the home or office from a distance. This provides a system that is simple to operate, cheap and affordable, reliable and easy to maintain and durable irrespective of usage. It adds more comfort to everyday living by removing the inconvenience of having to move around to operate a fan regulator. The system seeks to develop a device that is cost effective while not undermining the need for efficiency. This innovation can be a success only if people are made aware about its advantages and how efficient and reliable it is.Having completed the construction process on Vero board, the functional unit (circuit) was transferred into a plastic casing of 3xm X 3m x 1cm dimension. Also the casing was perforated to allow free ventilation inside the housed circuit and the construction was successfully tested and it was found to meet the expected result which is to control the speed of fan with remote device from 2m to 7m.
Keywords: Fan-Speed Regulator, Remote device, Circuit.

I. INTRODUCTION

Fan is an unavoidable electrical appliance in our day to day life (Som and Bose, 2013). While the basic fan has evolved very little, the methods of controlling its speed have changed vastly, from bulky regulators using resistances, to the present day miniature solid state regulators. In our research, we have devised a method to control the fan using a remote. Though there have been ways to control speed using remote, the novelty of our method lies in the fact that any kind of remote can be used to control its speed (Som and Bose, 2013). For example, consider a TV remote. Just like the fan, a TV is also consider a basic necessity nowadays. And if there is a TV, there is a remote. This remote can be used to control the fan speed. Thus it is a universal method. This innovation is highly recommendable for elder people, who have problems like arthritis, and cannot walk to the switch board to change the speed. It is also a great benefit to sick people (Som and Bose, 2013). The objectives of this research work is to design and construct an electronically based remote control fan-speed regulator and to investigate the working principles of remote controlling the speed of the fan from a distance of 3-7m using a hand-held remote. Also to analyze the components used in designing a remote control device for standing.

Mahmud Shehu Ahmed and team introduced remote controlled main power supply in 2007 and fan regulator in 2006 (Theraja, 2002; Suh and Ko, 2008). The design included analog and digital components which were less compact and it needed dedicated infrared remote transmitter. The system also was less flexible to alter for other control applications. This demanded the development of a remote control fan regulator which is compact and can be used without the need to design a remote transmitter. The aim of this work is to regulate the speed of fan in a room from a distance 3-5m. This will work with any button of any modern day remote control module. The remote control device sends an infra-red beam, which is received by the infra-red sensor on the regulator and the speed of the fan is increased when any button is pressed. The speed of the fan can smoothly be altered to ten different speed levels (Theraja, 2002; Suh and Ko, 2008). Remote control device facilitates the operation of fan regulator

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around the home or office from a distance (Ahmed et al., 2006) it provide a system that would be cheap, affordable and easy to maintain. It adds more comfort to everyday living by removing the inconvenience of having to move around to operate a fan regulator. The system seeks to develop a device that is cost effective while not undermining the need for efficiency (Ahmad et al., 2006).

The first remote control called lazybones was developed in 1950 by Zenith electronics corporation (then known as zenith radio corporation) (Ahmad et al., 2006). The device was developed quickly and it was called "zenith space command". Later in 1956, becoming the first practical wireless remote control device. Today, remote control is the standard use on other consumer electronic products, including VCRs, cables and satellite, boxes, digital video disc player, and home audio players. The most sophisticated TV set have remote with as many as 50 buttons. In the year 2000, more than 99% of all VCR and DVD player sold are required with remote control (Ahmad et al., 2006). Basically, a button is pressed, this complete a specific connection which produces a Morse code line signal specific to that button. The transistor amplifies the signals and sends it to LED which translates the signal into infrared light. The sensor on the appliance detects the infrared light and reacts appropriately. The remote control function is to wait for the user to press a key and then translate that into infrared light signal that are received by the receiving appliance. the carrier frequency of such infrared signal is typically around 36KHz (Ahmad et al., 2006).usually the transmitter LED can be turned ON/OFF by applying a TTL (Transistor-Transistor Logic) voltage on the modulation controlled input. On the receiver side, a photo transistor or photo diode takes up the signals. The approach used in this work is the modular approach where the overall design was broken into functional block diagrams, where each block in the diagram represents a section in the circuit that carried out a specific function. The system will be design using the block diagram below.

II. LITERATURE REVIEW

Chain (2008), in China came up with another intervention. The intervention made use of infrared remote control and a controlled device for switching. The remote was operated at a comparatively low frequency whereas the controlled device were built around 555-timer, SCR (Silicon Controlled Rectifiers) are major components. For the fact that the remote was operated at low frequency, hence the limiting points were prove to switch ON/OFF as other high frequency form automobile interfered with the circuit of the transmitter.(Chain Huang, 1980).

Users loved the concept of dangling a wire across the living room, this clearly left something to be defined and soon work started on the elimination of cable. In 1955, this resulted in the introduction of the ultrasonic remote, (Marvin Nelson, 1999). The early device uses a mechanical trigger-like arrangement to generate a distinctive high frequency sound for each key. A special receiver in the TV interpreted the sounds and performed the appropriate function. As an aside, according to company history, the Reason Zenith originally went with a purely mechanical implement was that the marketing people of the era did not believe the consumer would accept the need to replace batteries in a remote control, be that it may be the 1960s battery powered ultrasonic remotes using electronics rather than mechanical sound generation had become the technology of choice (Marvin Nelson, 1999).

George (2010) An American made improvement over the previous invention. He had been able to operate remote control at an undisruptive frequency (38KHz), which freed his own invention from error of operation .The invention scored credibility, only that it could control 2-lighting points.

Zenith (1951), developed the first fan regulation (known as Zenfanneg). The device was developed quickly and it was called "Zenfanreg," the fan regulator went into production in the fall of 1956, becoming the first practical fan regulator control device.Remote sensing data became very widespread in recent years, and the exploitation of this technology has gone from development mainly conducted by government intelligence agencies to those carried out by general users and companies (Lee et al., 2011). There is a great deal more to remote sensing data than meets with the eye, and extracting that information turns out to be a major computational challenge. For this purpose, high performance computing (HPC) infrastructure such as clusters, distributed networks or specialized hardware device provide important architectural development to accelerate the computation related to information extraction in remote sensing. In this work more review in particular. HPC- based paradigms include multi-processor system, large scale and heterozygous network of computers, grid and cloud computing environment, and hardwires system such as field programmable gate arrays (FPGAs) and graphics processing units (GPUs), combines these parts deliver a snapshot of the state of the art and most recent developments in those

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areas, and offers a thoughtful perspective of the potential and emerging challenges of applying (HPC) paradigms to remote sensing problems. (Lee et al., 2001).Despite the increasing acceptance of machine-learning classifiers, parametric methods appear still to be commonly used in application articles and remain one of the major standards for benchmarking classification experiments. For example, in a meta-analysis of 1651 articles that compared remote-sensing classifications methods,(Yu et al. 2014) found that the parametric maximum likelihood (ML) classifier was the most commonly used method, employed in 32% of the articles, even though machine-learning methods were routinely found to have notably higher accuracies than (ML. Yu et al., 2014) attribute this dominance of ML to its wide availability in conventional remote-sensing image-processing software packages and call for further software development and training relating to machine learning. Our anecdotal experience in working with users of remotely sensed data supports this argument. Indeed, we have found that uncertainties regarding how to use and implement machine-learning techniques effectively are the principal barrier for their use by many application scientists. These uncertainties exist despite the large number of remote-sensing research articles that have investigated machine learning for classification in remote sensing. This includes a number of excellent review articles for specific methods, such as (Mountrakis, Im, and Ogole2011) review of support vector machines (SVMs), and Belgiu and Drăguţ (2016) article about Random Forests (RFs), as well as articles reviewing the process of classification and its complexities, such as that of Lu and Weng (2007).

III. METHODOLOGY

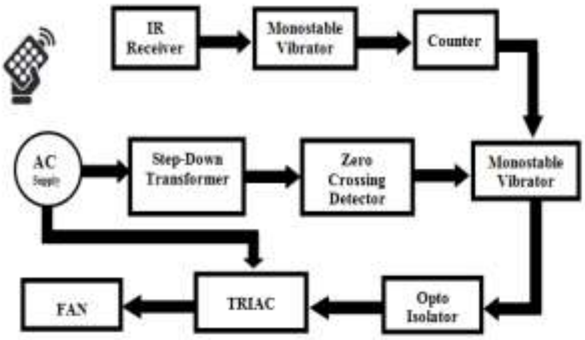

Figure 1: Remote Control Fan Speed Regulator

Power Supply Unit

Electronic device and circuit required D.C sources for their operation. The most convenient and economic source of power is the domestic A.C supply and it is advantage to convert this alternating voltage (usually 220V r.m.s) into D.C voltage. This is called rectification and is accomplished with the help of a rectifier filter and voltage regulation unit.

Transformer Selection

The transformer selected to satisfy the circuit power requirement for its operation has the following technical specifications

Output voltage = 9V
Frequency = 50Hz
Current = 500mA

The maximum secondary voltage of a transformer is given by the relation.

Since, $V_{max.} = \sqrt{2V_{r.m.s}}$

Voltage Regulator Selection
This system gives a Constant 9V D.C output at 1A Current rating; the selected regulator has the following specifications.
Minimum Input Voltage (V_{min}) = 12v
Maximum Input Voltage (V_{max}) = 24v

$$V_{av} = \frac{V_{max} + V_{min}}{2}$$

$$V_{d.c} = \frac{2V_{max}}{\pi}$$

Rectifier Diode Section
The output voltage of a bridge rectifier circuit is given by
$V_{rec}=V_{max}-2V_f$

$$P.I.V = V_{max}$$

$$\Delta v = Vav - V_{max}$$

Filter Capacitor Selection
the capacitor is shunted across the output of the rectifier and its value is given by:

$$C = \frac{V_{av}}{\Delta V \quad f_V R_L}$$

Remote Stage (Infrared Transmitter)
The infrared transmitter also consumes low power and is usually powered in D.C. An infrared transmitter is used to control the speed of the fan.

$$R = \frac{V_s - V_f}{I_f}$$

Receiver Unit (Sensor)
The LED issued as the photodiode and it is therefore operation in the reverse biased position.
Let transmission resistance =10 KΩ
And break-beam resistance = 1mΩ
Voltage across diode during transmission (V_{DT}) is

$$V_DT = \frac{R_0}{R_2 + R_0} X V_S$$

Voltage across diode during break -beam (V_{DM})

$$V_{DM} = \frac{R_2}{R_2 + R_0} X V_S$$

Switching Transistor Stage for Opto-isolator
The switching transistor switches the opto-isolated which powers the fan circuit. The opto-isolator is switched ON when the monostable given a HIGH output. A base resistor is required to ensure perfect switching of the transistor in saturation

Instrument Used
The following instruments were used for testing in this research work: digitalmulti-meter and an oscilloscope.
Digital multi-meter: This instrument was used in measuring of A.C. voltage. A.C.Current, D.Ccurrent and used in determiningthe resistance value of mostcomponents used in this project.
Oscilloscope: The cathode ray oscilloscope is an instrument that displays all themeasured electrical quantity in details (Waveform). This instrument isusedtomeasure peak-to-peak valve amplitude of A.C. signal.

Casting
Having completed the construction process on veroboard, the functional unit (circuit) was transferred into a plastic casing of 3xm X 3m x 1cm dimension. Also the casing wasperforated to allow free ventilation inside thehoused circuit.

IV. RESULT AND DISCUSSION

Elements	Output result of obtained
Transformer	12V.a.c
Bridge rectifier	13.4V d.c
Filer capacitor	13.4V d.c
Voltage regulator	8.9V d.c

V. DISCUSSION

The circuit presented here can be used to control the speed of fan in five levels.The 220V from AC mains is stepped down to 12V and regulated by IC7809, capacitor and diode to 9V

DC. This filtered 9v is used for providing supply to the entire circuit.

The remote produces infrared which isreceived by the TSOP infrared receiver module. The TSOP used here is TSOP1738. It is capable ofreceiving Signalsup to 36KHz. The infrared rays are received by the TSOP Sensor and its output is given as a trigger, the first mono-stablemulti-vibrator NE55 through a LED and resistor R4.The NE555 which is more as mono-stablemulti-vibrator is used to delay the clock to decode counter CD4017.The output of the TSOP can be given directly to the counter, but while doing so, all the smallpulse or noises may also act as clock to counter and counter starts country.The decade counterhas ten outputs from Q_o to Q_a. But here, only Q_o to Q_3 were used. Q_4 andQ_5 were not used and Q_6 is used to reset the counter. The output of the counter is takenthrough resistor R_5 and R_8.The resistor R_5 and R_8 and capacitor C_9 controls the pulse width which is actuallydetermining the speed of the fan.

Ifthe Q_0 output high, the capacitor C_5 is charged through R_5, if Q_1 is high. Capacitor $C_5$is charged through R_6 and so on, thereby controlling the speed of the 1an accordingly. Hencewere controlling the speed of the fan in fire levels that is why fire outputs have been taken(Q_0 to Q_4).Another NE555 is used hence, wired also as monostablemulti-vibrator. This is triggered in pulsefrom opto- coupler MCT2E. It is wired as a zero crossing detector.

The output from decade counter is given to IC_3 (NE555) and this is given to the transistor BC548. It is given to the opto-Isolator MOC3021. It is also used for driving thetraic BT136.

Theresistor R_{13} (470) and capacitor C_7 (0.0lμf) combination is used as snubernetworkfor the triac.The resistor R5 and to Ro and capacitor C5 are used to control the pulse width. When Q_o output is high the pulse width is maximum,when Q_1 output is high, pulse width is decreasedlightly. As the pulse width decreases,firing angle of the traicis increases and speed of the fan also increases.By using remote control, we are usually controlling pulse width, which in turn varies thefiring angle of triac and thereby varying the speed of the fan.

VI. CONCLUSIONS

The design and construction of controlled speed regulator was design to improve the regulation of the speed of fan using a remote control device, the variation in the firing angle of traic is used for regulating the speed, any button on the remote can be controlling speed of the fan. This system seeks to develop a system that is cost elective while not undermining the need or efficiency. This innovation can be success only if people are made aware about its advantages and how efficiency and reliable it is.The research was found to meet the expected result which is to control the speed of fan with remote device from 2 to 7m.

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