



VIRTUAL SWITCH BOARD FOR INDUSTRIAL AND COMMERCIAL APPLICATIONS

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Abstract

This paper mainly deals with the advanced wireless switching system. This system makes use of both AC and DC voltages. The system consists of two parts namely- Primary and Secondary. The primary part consists of the Virtual board which takes in the virtual signals from the user and converts the analog signals to digital. This is possible with the help of ultrasonic sensors which act as an interface between the user and the system in detecting the virtual signal. The virtual input from the user is detected as an obstacle by the ultrasonic sensor and it also senses the exact distance at which the signal is given. This signal is processed by the primary microcontroller which is paired up with the sensors. The distance from the sensors is transmitted to the secondary part of the system wirelessly. For this specific operation, the system makes use of the Bluetooth communication. The secondary part of the system consists of a control unit. This part comprises of a controller, receiving module and

a set of relays. The data from the primary is received in the secondary with the help of Bluetooth receivers. The data is processed and compared with existing values. If the values coincide, then the main controller switches the relay connected to the respective appliances. Thus the power is automated to extreme levels to the targeted appliances without involving real time switches and wires. Thus the system does not involve the high power coming down to hands and makes it highly efficient for an industrial background. The main advantage of this system is that it ensures higher levels of

Safety and makes the switchboard portable instead of a static object stuck to the walls.

Keywords:

Optocoupler relay, Arduino uno, Ultrasonic Sensor, Virtual board.

I. Introduction:

In the present global technological scenario, on one side there is an accelerated growth of

production houses, industries along with an array of allied and supporting enterprises and modernization in multiple dimensions right from manufacturing, processing, packaging, servicing along with the growth of dwelling and related development of sophistications in various amenities through towards the exponential expansion of modern and smart cities. On the other side, such a trend demands constant attention towards catering the need of ever increasing power requirement while constantly insisting upon energy saving at various levels, newer techniques of controls and automation in industries, newer gadgets to ensure thorough safety, protection of valuables and all such others necessitates the search for novel techniques that could impart a change in the very fundamental level of present electrical energy utilization and appliances. The proposed paper of 'Virtual Switch Board for domestic and industrial application' is one such path breaking technique that could be applied upon a wide variety of electrical applications right from modern housing to modern industries and also logistics as it puts forward a versatile and an altogether new method of switching of any electrical device be it an ordinary domestic fan or light or a huge industrial motor or compressor. Unlike the present switching, in the Virtual Switch Board (VSB) the switching is carried out completely without wires and the switching is totally separated from the main power circuit. The switch board would be free from power lines and therefore fully safe to handle and is also portable and at the same time it could be further and further customized to suit

a very wide variety of applications. The proposed VSB is a pilot model and could be tailored to suit any desired and specific usage accordingly to utmost precision and optimum purpose. As far domestic purposes the main power supply could be directly taken to any electrical appliance through a thyristor based solid state contactor or a relay when the contactor or the relay could be operated through the VSB. In the same way the present solenoid coil based contactors, relays or solid state contactors that switch On or Off a motor in any industry could be desirably operated through the VSB. Apart from this the method of virtual switching using an ultrasonic sensor and micro controller could be applied to a wide range of control devices to any desired automation and ultra sensitive control requirements. The above factor could be well utilized in several industrial safety measures and at the same time in protection and alarming devices in various safe keeping houses such as bank lockers, Museums, jewelry houses etc. Further to the above as the VSB is portable, the electrical appliances could be operated with ease thereby paving way for most optimum utilization of the same thereby would enable towards great power saving in the times to come. Thus the VSB, though it is a pilot model, since it addresses one of the very fundamental factors of electrical energy utility, could be further sophisticated and would open up a big gate for further development in many fields towards modernization and optimization.

II. Existing System

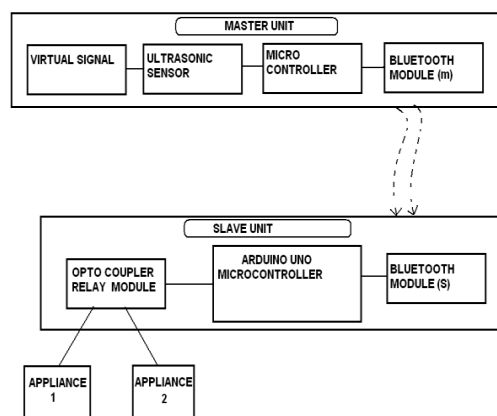
In the existing domestic systems, the power line is drawn at several places to switch boards that incorporate an array of switches and again taken to any respective load from the respective switch. In most of the systems the line voltage is being standardized as 240 V AC single phase and the current taken by any specific domestic appliance ranges between a fraction of an Ampere to a maximum of 15 Amperes. When the power line is drawn to a switch board, it is to bear the entire voltage and all the current that is drawn by the load. Thus the switch board has to bear the entire load and those heating components according to the load current and also the fluctuations of voltage. All the present switches are mechanical switches and any such mechanical switch is designed to a certain number of operations only. The operation, safety, working, durability and all such factors are completely dependent upon the quality of a switch. All the switch boards are rigidly fixed and stationary. The above traditional method is prevailing throughout the world where the system incorporates cost of power transmission wires, cost of multiple switches, their maintenance and so on and at the same time the power and voltage drops, hazards and accidents and so on. In the same way in industries, the power line is drawn towards the switch boards where the desired switching takes place either manually or through automatic sensor and control devices. In most of the industrial operations the line voltage is being standardized as 440 V AC three phase and the current taken by any specific industrial appliance ranges between a couple of Amperes to a maximum of

100 Amperes. In several cases apart from the power line, a control line with a reduced voltage is being used for control devices to operate small or huge loads. As for control systems various sensors, LDRs, proximity switches, thermostats, transducers are used to switch control devices such as relays thereby to switch the load On or Off through the main power line. In any case, it is essential that the main power line of higher voltage or the control line of a reduced voltage has to go through the entire circuit involving different sensing, control or switching devices. The risk of handling the power line in an industrial circuit is several times more than that of any domestic circuit, since it involves higher voltage and higher current and at the same time the On/Off switching frequency would be several times more in any industrial circuit.

III. Proposed System

In the proposed system of VSB, the main power line is taken to the load directly through a solid state relay or an electromagnetic relay. The VSB is totally independent of the power circuit that does not carry the voltage or current of any load. The VSB acts as the primary part of the circuit and the secondary part would be located along with the relay or the solid state contactor. The primary part consists of an ultrasonic sensor and accurately takes the desired command for switching the desired load. The signal is sent to the secondary part of the circuit via Bluetooth through which the same is transmitted to the microcontroller that processes the signal to operate the relay and thereby the load. The VSB could be designed to have multiple command

points over multiple layers and thus commands ranging from few hundred to a million could be processed in a single VSB. Since the VSB is portable with very less weight, multiple loads could be easily handled from any desired location or multiple locations.



BLOCK DIAGRAM

Working:

The system consist of two parts namely- the primary and the secondary part. The primary part consists of a Virtual board which contains the ultrasonic sensors for detecting the virtual signal, a microcontroller to process the sensor data and a Bluetooth transmitting module to share the data with the secondary part. The secondary part comprises of a Bluetooth receiving module, a controller to process the received data and a set of optocoupler relay

module to switch on the appliances. An important part of the system is the arduino microcontroller and the ultrasonic sensors. An Arduino UNO microcontroller is used here for both the operations. The ultrasonic sensors provide an interface between the system and the user. When the user gives a signal to the board at a specific location, it acts as a switch. Thus, when a virtual signal is given by the user, the ultrasonic sensors placed on the board detects it as an obstacle and measures the exact distance at which the signal is detected. This measured value is given to the microcontroller connected to it and the values are processed. The processed values are transmitted to the secondary part of the system with the help of HC05 Bluetooth module. The working frequency of the Bluetooth is 2.4GHZ which makes it an efficient and a faster way of communication. The data from the primary part is received in the secondary with the help of Bluetooth receiving module. The data is then sent to the microcontroller for further processing. Here the data is compared with an existing set of data which is already programmed. If the received data matches with the existing data, then the controller triggers the respective relay assigned to the respective appliance. Thus the power is directly sent from the control unit to the specific targeted appliance without any direct interference. This makes it an highly sensitive and an efficient way of switching which takes down all the risk factors associated and also helps in detecting the faults with ease thereby providing complete automation.

Advantages of Proposed Project:

The proposed system has a wide range of advantages compared to the existing system in many aspects. The merits of the system increase depending upon the application in which it is used i.e. the background for which the system is implemented. Whether it may be on the domestic side or the industrial basis, the pros of this system outlives the existing system in multiple features.

Portability:

The VSB is a portable switchboard which can be carried or fixed at any desirable point and can be handled with great ease.

Safety:

The system cuts off all the risk factors present in the existing system and make it completely safe and secure for the switching of any power range possible.

Cost:

As the system eliminates the usage of direct power line for the switching circuit, it would drastically reduce the installation cost and at the same time the cost of the complete array of the mechanical switches.

Simple Maintenance:

The maintenance linked with the system is completely low and the faults can be debugged and cleared up with great ease.

Virtual Touch:

Since there is no necessity for a real contact, this system provides a gateway in virtual sensing technology for the next generation.

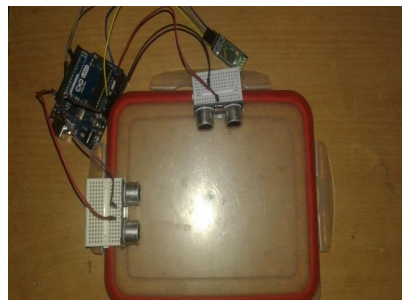
Heat:

Since the switch board and the power board are separated, the switch board does not involve any heat and is completely safe.

Cost:

The installation cost is very low compared to the existing system as no external wires are required for the board.

IV. RESULTS



Sample of working board



Arduino- sensor inter facing

Our paper does not involve the high power coming down to hands and makes it highly efficient for both domestic and industrial background. The main advantage of this system is that it ensures higher levels of safety and makes the switchboard portable instead of a static object stuck to the walls.

V. CONCLUSION

It could be observed that since the invention of electricity, though there have been huge inventions of modern gadgets and sophistications in the electrical appliances, the method of switching remains fundamentally unaltered. The switching in various avenues is carried out in the same old way along with all the hazards and risks it poses. Though there have been a lot of initiatives to reduce the risk of handling and incorporation of several safety measures, it could be discerned that the risk is not completely eliminated. VSB is a preliminary and elementary attempt in a direction towards complete elimination of risks in handling of electrical appliances. Considering the wide scope in the avenues for the usage of VSB, it could be understood that this method of switching would ease up several bottlenecks prevailing in the present system and would take the electrical utilization to an altogether newer dimensions by the contributions of several active and creative minds in the times to come.

VI. FUTURE SCOPE

The objective of this paper is to provide an advanced way of switching for both the domestic and industrial applications where there are still risk factors associated. Thus a sensor based virtual switchboard linked with a microcontroller helps in providing complete automation. The Wireless Sensor Network (WSN) and the Virtual concepts are new to the market and are in great demands for an immediate replacement of the existing ones. Hence, this project serves as an initial step in combining both the systems. The VSB can be highly customized and altered depending upon the applications, user compatibility and the cost range. Further research works can be made to make the system more efficient. For instance, from a single board an entire industry or a home can be controlled. The number of switches can be increased up to the compatibility of the controller used. Thus this paper which is an initial step when developed in the right direction may prove as a breakthrough towards the advancement in domestic and industrial automation.

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