Invisible Switch

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Abstract: *The popularity of switches depends on, its efficiency and simplicity in case of their usage. But safety and durability is a matter of concern. For example, traditional switches do not have any sort of preventive measure against wet hands and mechanical wear and tear. Thus, the switches in a manner are wasting our space since they are not providing immunity against electrical shocks and are also using space for wiring, which cannot be operated without touching. So stepping in new dimension, we can now perform switching functions without the need of traditional mechanical switches.*

Keywords: Communication, Mobile, Appliance, Module, Automation

1. Introduction

Invisible switch is a simple device which is developed to improve, mobilize and secure the way of operation of the switches available now a day. It is having simple elements such as ultrasonic sensor, microwave sensor, laser lights, Wi-Fi module of NodeMCU fitted or interfaced with a micro controller unit. The MCU (Micro Controller Unit) is the brain of the total setup of the product which will send, receive and process data at the same time which will indeed establish the communication between the user and the appliance virtually. There will be total of three types of communication with the MCU where two of them will be stationary and one of them will be static. The mobile communication will include sending of data through a mobile application & hardware, which will be received by the Wi-Fi module of NodeMCU at the receiver side (as shown in Fig.6) and in that case of static communication data will be received through an ultrasonic sensor.

2. Objective

- The first objective is to provide a touch free control to the switches of electrical appliance by simply making an interference with finger within given range, illuminated with laser lights.
- The second objective is to provide a portable force & pressure free switching system by simply making gesture of switching.
- The third objective is to provide a Portable unit for user to switch on and off all its appliances connected with the virtual switch.
- Another objective is to provide a Invisible switch comprising Wi-Fi for connectivity and controlling appliances by means of mobile application.

3. System Detailing

3.1 Hardware requirements

3.1.1 Microcontroller
A microcontroller is a small controller of the size of a small PCB. It is basically a dedicated computer. It can be programmed to do specific work. A basic microcontroller includes a processor, memory and input/ output peripherals on a single chip. The peripherals that can be mounted on the microcontroller depends on requirement. Importance of Microcontroller is more because of in-built memory and consumption of less power.

3.1.2 Ultrasonic sensor
Ultrasonic sensor ranging module HCSR04 provides 2cm400cm noncontact measurement function, the ranging accuracy can reach to 3mm.the module includes ultrasonic transmitter, receiver and a control circuit. An Ultrasonic sensor can gauge the distance between a human/interference and the peripheral on which the sensor is mounted. It simply calculates the time to send and receive the signal. From the time calculated and the speed of the signal sent, distance is calculated.

3.1.3 Microwave Sensor
Microwave sensors generate an electromagnetic (RF) field between transmitter and receiver, creating an invisible volumetric detection zone. When an interference enters the detection zone, changes to the field are registered and an alarm occurs. Some signals are similar to the human body induction signal, but the sensor can do intelligent identification of useful human body induction signal. Moreover, preventing other interfering signal from triggering the circuit.

3.1.4 Laser Lights
Laser light is a gadget that produces light through a procedure of optical intensification in view of the animated discharge of electromagnetic radiation.

3.1.5 Relay Module
It is an electrical gadget normally fusing an electromagnet, whose initiation is by an electrical signal in one circuit to open or close another circuit .It is used when a low power signal can be used to control a circuit.it is used where only one signal can be used to control a lot of circuits.

3.2 Hardware Functioning

3.2.1 Microcontroller (NodeMCU)

The controller receives signal from the ultrasonic sensor. The controller responds by turning the appliance ON if it is OFF. Alternatively, turning OFF if it is ON. According to measured distance, it will turn ON/OFF specific relay channel of Appliance.

Figure 1: NodeMCU

3.2.2 Ultrasonic sensor (HC-SR04)

The module works on the natural phenomenon of ECHO of sound. A pulse is sent for about 10us to trigger the module. After which the module automatically sends 8 cycles of 40 KHz ultrasound signal and checks its echo. The signal after striking with an obstacle returns and is captured by the receiver. Thus, the distance of the obstacle from the sensor is simply calculated by the formula given as

Distance = d,
Time = t,
Speed = s.
d= (t x s)/2

Figure 2: Ultrasonic Sensor

3.2.3 Microwave Sensor (AK9750)

The microwave sensor applies the Doppler effect to detect moving objects using microwaves. This differs from the method used by a regular infrared (IR) sensor, as microwave is sensitive to variety of objects that are microwave-reflective. This device can detect human presence not only in motion but also when static. Because it converts IR, waves of human body to electrical signal directly.
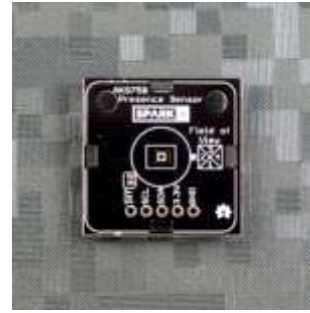

Figure 3: Human Presence sensor AK9750

3.2.4 Laser Lights

Laser works on principle of Light amplification by stimulated emission of radiation. It is used for plotting small symbols or images of specific appliance's projection on plain surface.

3.2.5 Relay Module (8-Channel Relay Module)

A relay is an electrical device, which is used to control high voltages using very low voltage as an Input. It works as a switch to turn ON/OFF appliance.

Figure 4: 8-Channel Relay

4. System Working

When we are in room or are in close proximity to the room and we wish to operate a switch, we will be using IOT. Signal is sent to the receiver for operating that appliance by using mobile phone. Mobile will be connected in the WI-FI of NodeMCU. The switch can be operated once Mobile and MCU are connected in the same network. Switch will be operated using the app, which will have the function to give different command to different switches.

Where as in case of the static communication there will be three elements: the ultrasonic sensor, microwave sensor and laser lights.
- The purpose of the usage of laser light is to provide user a descent, stylish and an attractive appearance in the area for gesture making.
- The purpose of the microwave sensor is that it will sense weather a human entity is there for the gesture making or not.
- Then the ultrasonic sensor will map the distance of the gesture made and then the data is sent to MCU.

After performing all this process, the MCU will be able to send signal to the relay and then relay will tend to change the state of the appliance as afore said.
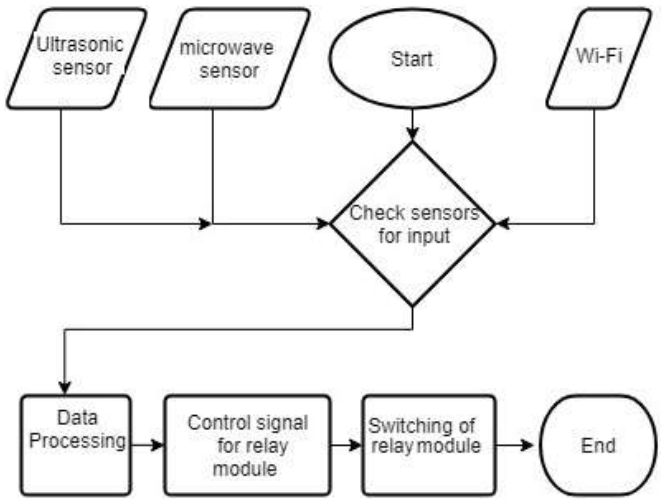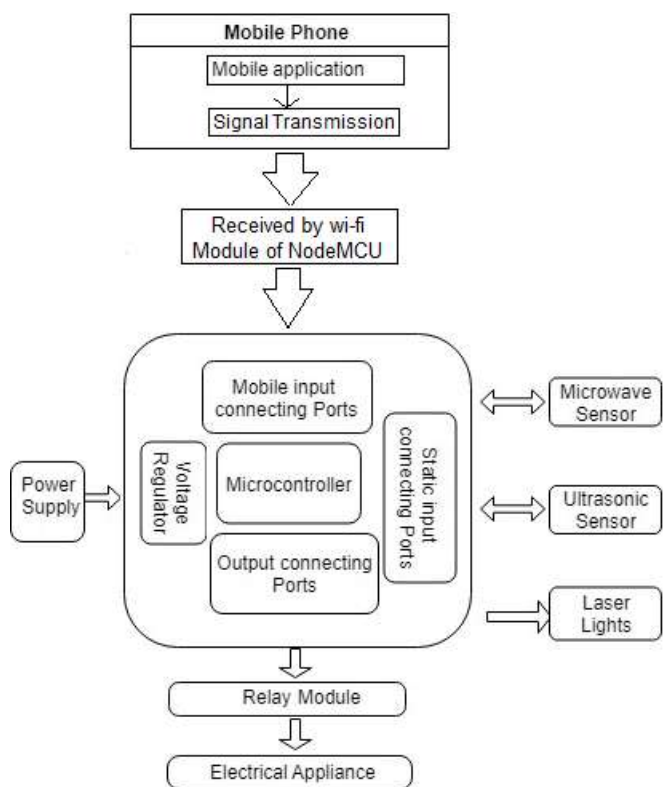
Figure 5: Flow algorithm
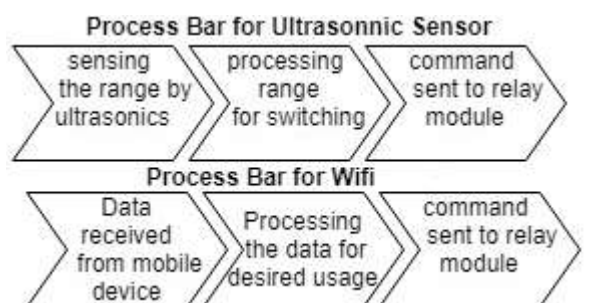

Figure 6: Overall flow diagram

Figure 7: Data flow for different communications

Figure 8: Mobile App UI of controlling devices

5. Conclusion

After analyzing the work, we can say that implementation of the device (Invisible Switch) will lead to the ease on the user side as well as on the appliance side as relays work more perfectly and safely than other conventional switches and, provide a modish interface to the user for a trendy usage. By using mobile application for switching function, we have stepped in a new dimension of safety, accuracy and comfort.

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