
Gesture Recognition based Contactless Switch using IoT

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Abstract: Today with expanded mechanical progressions, switches require refreshing with current events. To stay away from the danger of contracting the Coronavirus, it has gotten imperative to not touch surfaces of catches and keys that have been regularly utilized by others. This requires a need to advance the exchanging innovation for supplanting a hand-worked switch, with a contact-less switch. So today, we will plan a no-contact switch that works available signals. Our keen contactless switch incorporates a sensor that is equipped for recognizing hand developments and interprets them into orders for controlling lights, fans, and different home machines. Our main idea is to build a feasible device for wireless switching, this will eliminate the touching of a switch so people can use it very easily.

KEYWORDS: Ambient light and RGB colour sensing, gesture recognition, ADC, Web page, virus on surfaces, IoT.



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INTRODUCTION

To stay away from the danger of contracting Coronavirus, it is significant not to contact surfaces including switches, door handles, and keys that have been as often as possible utilized by others. This undertaking is for a contactless switch that works with hand signals. The savvy switch incorporates a sensor that can identify hand developments and make an interpretation of them into orders for controlling lights, fans, and different other home machines. As of late the extension for motions has been expanded for collaboration with shopper gadgets and cell phones. Conventional home mechanization frameworks are not reasonable for maturing populaces or cripple people. While motion-based mechanization gives a benefit to those individuals who are incapable of effectively playing out the everyday exercises. The goal of the proposed framework is to make a framework that can handle home apparatuses utilizing any of the two allocated strategies: - 1. Motion-based 2. Online.

Infections can be affected by factors like temperature and moistness. As per the Communities for Infectious prevention and Anticipation (CDC), most corona-viruses Trusted Source get by for a more limited time frame at higher temperatures and mugginess levels. For example, in one perception from the Lancet article, SARS-CoV-2 stayed truly stable when hatched at 4°C Celsius (about 39°F). Nonetheless, it was quickly inactivated when hatched at 70°C (158°F). The strength of SARS-CoV-2 on fabric was additionally tried in the Lancet article Trusted Source referenced before. It was tracked down that feasible infection couldn't be recuperated from material following 2 days. As a rule, it's likely not important to wash your garments after each time you go out. Notwithstanding, on the off chance that you've been not able to keep up an appropriate actual separation from others, or if somebody has spited or wheezed close to you, it's a smart thought to wash your garments. An examination in Arising Irresistible Infections evaluated which surfaces in an emergency clinic were positive for SARS-CoV-2. A high number of positives were found from floor tests. A big part of the examples from the shoes of ICU laborers likewise tried positive.

RELATED WORK

Many research activities are conducted on this problem statement, But for the application, we have chosen limited approaches as the virus has been started a year back. We have worked on the trending problem statement. The approach about color based object recognition. In this approach the author have processed the image and converted into various scales like Grey scale etc., then the outline of the object then according to the shape the object is determined. But in this case the finger will be moving and the proposed model will not detecting the moving objects.[1] Ros delley in his article stated that coronavirus or any other virus will stick on surfaces. The time is varied based on the surfaces. In his article, it is declared that the virus will stay on surfaces like plastic, steel for 3-7 days which is very dangerous. So washing with soap after using them is very important.

In 2016 Depak has introduced an approach called "gesture controlled robot", where the hand of the user is equipped with accelerometer which detects the tilt of the hand so that respective data will be sent to controller then it will control the appliances this approach will be used by physically handicapped, but it will not work effectively for the problem addressed by us.[2][6]

It is stated that the APDS9960 sensor can perform proximity detection along with motion detection.[3] Some approaches by using cameras are also done in gesture control. In 2018 Dr. Michel et, proposed a model based on an IR sensor and microcontroller. The approach uses an IR sensor which detects the proximity of any hand places close to it, then it detects and performs switching operation. In this case, the IR sensor may fail to detect black color objects and also this model will fail to detect the hand in low light. We cannot use too many switches by using this model.

In 2016 krishna Kumar proposed a model for disabled people using DTMF technology. But this kind of approach won't work effectively in the problem addressed, where the remote has to be touched by many people.[8] Nowadays, the web need to wound up a typical interface that countless contraptions use to set up will improve the regular daily existence of various people. Web helpers, us to get the speedy outcome for a tremendous number of issues able to interface beginning with any of the far off spots which

contributes with general cost decline moreover impressiveness use.

In 2017 P. N. Arathi proposed a model named gesture based home automation. Where the hand gesture sign are captured by camera module and the processed with MATLAB algorithms. Practically common people cannot remember the sign of different switches this approach will not work effectively in public applications.[10]

Internet of Things became popular tool in embedded system projects. An approach using IoT blink application has been proposed by Kumar mandula in 2015. in that model he used an application which is used by user to control different appliances connected to the IoT cloud. But in this approach user need to install an application but in public places people have no time to spare for installing applications so feasibility in the model very less.[11]

Home automation may make depicted as a presentation for development association in the home climate which gives straightforwardness which is safer with its inhabitants. Towards using the advancement of the web for Things, those assessments Besides execution about home motorization have additional Normal. A different far-off advance which can help a kind of far-off information trade, identifying also the chiefs like Bluetooth, WiFi, and other cell division frameworks would be used to enter bounteous measurements for shrewdness inside the home.

PROPOSED SYSTEM

Principle

Our principle in this approach is quite simple, but we feel most complex projects also have very small solutions. So we have used this sort of guideline. This project can be explained in form of stages. First, the detection process will be done where gesture detection will happen. Before the detection it checks for proximity values whether an object comes near it if any object comes to it then it starts detection. After detection it starts the recognition process after this it will extract values from the experiment. Those values will be validated by the controller and it will perform the final task i.e, execution. We are using a sensor that is capable of doing multiple tasks in our project. Anyhow the main component in our project is the controller.

Approach

Our project consists of a single sensor which is used for detection purpose. We are using the common but most novel approach. This model will detect and then execution will be done based on commands fashion. In this project, the apds9960 is used to perform the task of detection and recognition. We used this sensor because it can perform multiple tasks. Switches plays major role in controlling multiple devices connected to the hub. Some kind of switches are circuit breakers and circuit maker, it actually connects the particular device to the hub when it is required. Switches permit you to control who approaches different pieces of the organization. Switches allows us to monitor the whole model. The digital values from the sensor will be sent to Wemos D1. We are using Wemos D1 as our controller. Here it will control the whole project. A 5v power supply is connected to Wemos D1 to work. The controller will send the supply to the respective digital pin. The output voltage of Wemos D1 is 5v so when we declare digital write HIGH then the whole 5v will be delivered to that pin. Then the appliance which is connected to that pin will be switched on. We are using a relay module to switch. Relay is mainly used switching purpose in embedded system projects. To operate 230v appliances we require this relay module. By giving zero or five volts it performs switching from normally open to normally close state. We will make the relay connected pin high. The controller will assign different directions to different applications. The sensor can detect 6 directions for each direction respective task will be executed by the controller. There is a display module to display the status of the switch which will help the user to know the status of the switch. We are using a 1.3' OLED display which increases the feasibility of this model.

To make the model more feasible we are adding two methods. The second one is based on IoT here we will create a web page using HTML. Some approaches are using the application but in the addressed application, the user has no tie to install and operate so we are using a web page where no login or installation and awareness is required, just a user who knows to operate a smartphone can use this model with ease. On the web page, we create two buttons for each switch

which are denoted by ON and OFF along with that the status of the switch is also displayed.

Block Diagram

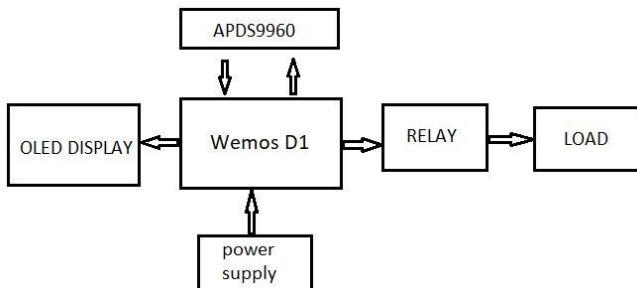


Fig. 1 Block diagram of proposed system.

METHODOLOGY

Gesture control

Gesture control is a sort of interpreting method UI that permits PCs to catch and monitor human motions as orders. The overall meaning of signal acceptance is the ability of a PC to detect motions and execute commands respective on those motions. Major applications use this idea through, X-box, and virtual video games, for example, "Simply Dance" and "Kinect Sports". In order to check how signal acceptance functions work, it is important to see how "motion" is specified. In its most broad sense, the word motion can be used to any non-verbal event that is proposed to convey a particular message. In the context of signal acceptance, a motion is specified as any actual movement, large or small, that can be recorded by a movement sensor. It may be anything like, indicating anything by pointing a finger towards the object or a gesture sign using hand or waving the hand to form a pattern. Signals can be extensive and clearing or little and contained. Sometimes, the meaning of "motion" may interpret unknown voice or voice commands. The Gesture detection feature provides motion identification with the help of direction sensitive photodiodes to receive the reflected back IR rays which are emitted from source which is an LED. The special purpose registers and control bits monitor motion activity and the operational procedure.

When the rays are detected by the photo-diode from the emitting diode then the sensor will get know the direction of movement. Once the working of the motion sensor, the IR detecting process starts with IR

discovery at the photodiodes and connection with the four diodes, 8 bit motion results compared to collected sign power on each diode. A signal from the four photodiodes is amplified, and balance changed to meet the further execution. Photodiodes are compared to frame of two sign directions: which are TOP or BOTTOM and LEFT or RIGHT. Photodiode data can be verified from the received data by using first in first out principle.

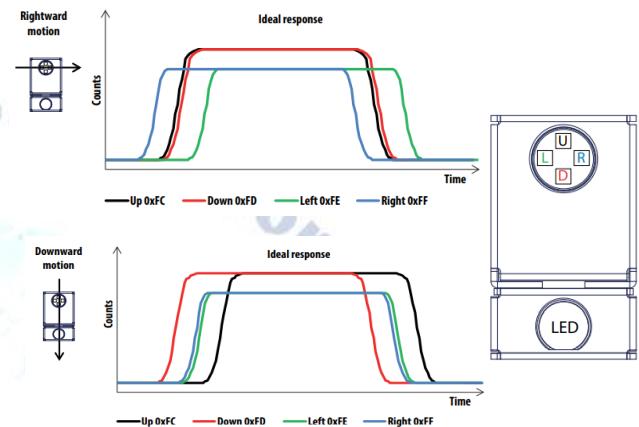


Fig. 2 Direction orientation.

Color and ALS detection

The Tone and ALS location highlight give red, green, blue, and clear light power information. Every one of the R, G, B, C channels has a UV and IR hindering channel and a committed information converter producing 16-bit information at the same time. This engineering permits applications to precise gauge encompassing light and sense shading which empowers gadgets to ascertain shading temperature and control show backdrop illumination.

IR LED Characteristics, $V_{DD} = 3\text{ V}$, $T_h = 25^\circ\text{C}$ (unless otherwise noted)

Parameter	Min	Typ	Max	Units	Test Conditions
Peak Wavelength, λ_p	950			nm	$I_f = 20\text{ mA}$
Spectrum Width, Half Power, $\Delta\lambda$	30			nm	$I_f = 20\text{ mA}$
Optical Rise Time, T_R	20			ns	$I_f = 100\text{ mA}$
Optical Fall Time, T_f	20			ns	$I_f = 100\text{ mA}$

Fig. 3 Apds 9960 ir LED characteristics

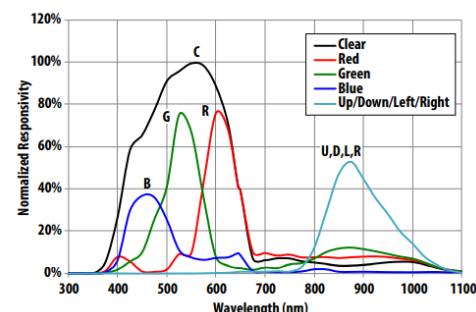


Fig. 4 responsivity to wavelength graph

PROXIMITY DETECTION

The proximity detection gives distance between two objects or distance between the sensor and object by the help of photodiode detection from reflected IR rays (which are emitted by the source). The distance measure is done by emitting rays towards free space, when these rays meet objects then they will reflect back and which are detected by some photodiodes in case of APDS9960 it has four diode detectors which convert the photons into electrical energy. By calculating the total time travel of the emitted rays then the distance will be divided by 2 to get the actual distance from object.

$$T_{PROX_RESULT} = T_{INIT} + T_{CNVT} + P_{PULSE} \times T_{ACC}$$

$$T_{TOTAL_LED_ON} = P_{PULSE} \times T_{LED_ON}$$

$$T_{TOTAL_LED_OFF} = T_{PROX_RESULT} - T_{TOTAL_LED_ON}$$

$$\text{Distance} = (T_{total} * \text{Speed of light})/2$$



Fig. 5 APDS9960 sensor.

Flow Chart

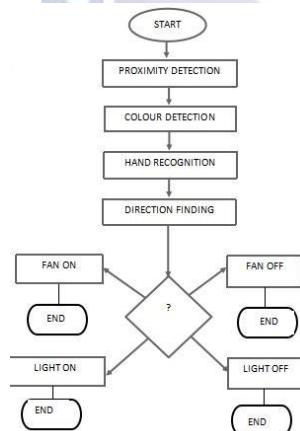


Fig. 6 Flow chart of the contactless switch

WORKING

In the initial stage user's finger needs to be placed close to the sensor to activate the sensor. We have written the code like that, it first checks the proximity then the actual function of the sensor will be activated. The person needs to move the finger, just by spacing about

6cm to 10cm. The sensor will detect the finger and movement of the finger then recognizes the direction of movement then the data is sent to the controlling unit. We are using an Wemos D1 board as our controlling unit, when the data is received from the sensor it executes the commands loaded into it. Wemos D1 and sensor will be connected through the I2C communication protocol. The serial data pin and serial clock pins of both components are to be connected to build good communication between the two components. According to the data received from the sensor, the particular digital pin will make high by Wemos D1 and a message will be displayed on OLED to make the user acknowledged. The sensitivity of the sensor is adjusted earlier to detect the hand movement and also has predefined functions to perform the task.

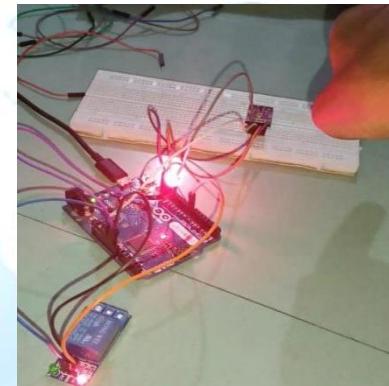


Fig. 7 Working with sensor.

As we have mentioned this project consists of two methods one is offline method people can use their hand, another is using IoT where the user can control the switch using his mobile phone. The link to the web page is shown on the switchboard user can directly scan the QR code on it and it will open a web page then he can directly control the switches and the status of the switch is displayed on the web page which will be easy for the user to use. There is no need of installing any application or software for this as the application we addressed is in public places so the user doesn't have time to install and operate the switch so we have used a web page that can be accessed by everyone with ease.

FUTURE SCOPE

Many researchers are working on technologies like deep learning, Image Processing, MATLAB, neural network to build the best model for gesture recognition. In future, many applications will be developed with gesture control. In our approach, we can integrate multiple apds9960 chips in a single module so that we

can use the single module for many switches. This feature will eliminate the drawback of the switch limit. Complications in image processing have been reduced with python programming. The fate of IoT is practically limitless because of advances in innovation and purchasers want to incorporate gadgets, for example, PDAs with family machines. A Systems management and availability protocol have made it possible to connect individuals and machines at every state.

CONCLUSION

We hereby infer that, this technique is convenient in exchanging gadgets with motion control. Present improvement in sensor management is inclining toward expanding flexibility in sensor architecture. The more reliable and feasible and low power consumption devices has huge demand. The main purpose of this project is to develop an feasible model to detect the motion of the finger and based on the motion performing the switching actions of the electrical and electronics appliances. To improve the feasibility of this model, the web page is working by which the user can utilize the model with ease. Notwithstanding, from the view of source to the end user, the sensor working currently seems less complexity even with its improved functionality and internal complications. This approach is very simple and effective which will make people's life more comfortable. Everyone can use this model and they can easily understand the approach. The eventual outcome can be work at a moderate cost. Working of this model is tested with multiple times, we can confidently conclude that our model working is same as we mentioned earlier i.e desired to work without any blunder.

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