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AN IOT BASED SYSTEM FOR AUTOMATIC ELECTRICITY SAVING USING MACHINE LEARNING TECHNIQUES

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Abstract- This project aims to save energy which is wasted because of human irresponsibility and carelessness in using electricity and effectively control electronic devices using a micro controller (Raspberry Pi). The system here detects the presence of human. If any person found then the appliances will remain on and if no person is detected then the appliances gets turned off. This helps in saving electricity. For detecting humans, the camera will continuously capture the frames and then send these frames to the raspberry pi. From raspberry pi the signal will be sent to the appliances and the system will work accordingly. For detecting humans, the system uses haar cascade algorithm.

Keywords- Internet of Things, Image processing, Object detection, Haar cascade, Artificial intelligence, Computer vision.

I. INTRODUCTION

As we know, nowadays electricity has an important role in human life. So, one cannot afford to waste it unnecessarily. But still there are so many places where electricity is wasted on huge amount. Colleges, Organizations, Labs, Halls, etc. uses electricity on a large amount. One cannot always remember to turn off the appliances before leaving the room. Earlier, there are systems which does the automation but it need sensor so indirectly there is an intervention of human. A particular person needs to pass from that area. But our proposed paper helps in eliminating this drawback.

It makes the use of cameras and a microcontroller. The camera continuously takes the images and sends to the raspberry pi. From raspberry pi the signal is been sent to the relay module which is been used for controlling appliances.

As soon as the person gets detected in the frame to system automatically turns on the appliances and when no person is detected in the frame, the system will turn off the appliances.

As a result electricity will be saved on a huge amount which will be helpful for the future generations.

II. LITERATURE SURVEY

The research papers that we studied and understood the basic concepts, some of them are given below. The findings and the conclusions that we came up with these are mentioned below each paper.

A. Image Processing and Object detection

Nidhi presented a paper on Image Processing and Object detection. She used object detection analysis to detect the number, location, position, size of the object in the in- put image. She used object detection for object tracking and recognition, whose results gives accuracy of recognized object. She used OpenCV, RGB, HSV and threshold for object detection. In our system we are using deep neural network, Mobile-Net SSD to detect the human in the image. The author used OpenCV for present time image processing. The author faced a problem while working on a project because she only developed a code for red object observation and as a result the program could not able to recognize any other colour object. So, she made the changes at run time in compliance with the object colour. She set the value at the top for saturation, value span and hue.

B. Home automation using object detection

This paper uses Image Processing in classroom. But there is no exact idea where the object is present i.e. no location is identified. This paper can only state whether the object is detected in the classroom or not. It makes the use of Object detection methods.

III. METHODS

Haar cascade:-

It is an Object Detection Algorithm used to identify faces in an image or a real time video. The algorithm uses edge or line detection features proposed by Viola and Jones in their research paper "Rapid Object Detection using a Boosted Cascade of Simple Features" published in 2001.

Haar cascade works in four stages:

1. Haar Feature Selection : It captures only the small portion from the large input which is been provided
2. Creating an Integral image : Then in this stage, the selected image is been created as an integral image by creating square boxes around the object.
3. Adaboost Training : The pixel calculations are done on the selected image so that we get the accurate and efficient results.
4. Cascading Classifiers : In this the image is been divided into the positive and negative images i.e. if the image is within the bounding box then it is called as positive image and the region which is outside the bounding box then it is treated as negative image.

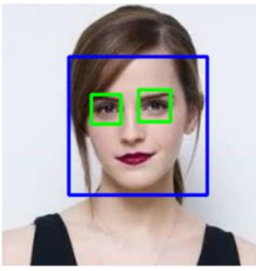

Figure.3 Haar cascade face detection.[15]

IV. DESIGN AND IMPLEMENTATION

Our system consist of some hardware components viz. switchboard, relay module, raspberry pi, bulbs and wires. Technically, each electronic appliance is connected to each button on a switchboard for turning it ON or OFF, similar connection have been done here. Now, as we want to turn ON and OFF the appliances on presence or absence of a person, a connections from another terminal of button is brought out to each channel of relay module. For a single appliance, single relay channel is connected to single switch on a board. This specific channel's connection from another terminal is affixed to pi's gpio pin with the help of jumper wires. The relay is materialized with LED that is used to indicate the status of relay showing as high and low. As relay is compatible with any 5V microcontroller, thus raspberry pi is used which operates on 5V. The raspberry pi has camera located on its picam slot which clicks real-time pictures. Raspberry pi processes this picture and send the signal to relay module via jumper wires. Further relay module that has a logical connection with switchboard does turning ON and OFF of the appliances.

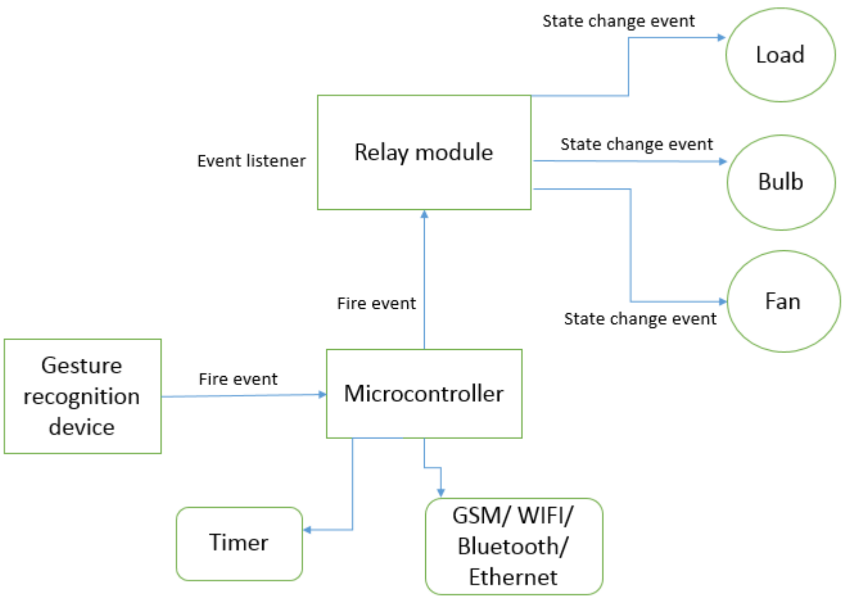

Figure. 4 General framework of system

The architectural diagram [Figure. 5] represents the structural view of the propose system. This system includes components like Camera, Raspberry Pi, Relay Module, Jumper wires and Cables. The relay module is interlinked with electrical appliances (tube lights, fans, etc.) for controlling them. The camera configured with raspberry pi. The raspberry pi is linked to relay module via GPIO pins and relay channels. The whole system monitors through camera and controls through raspberry pi and relay module.

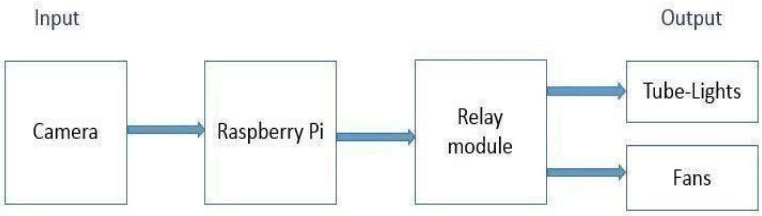

Figure. 5 External implementation of the system.

As per the system's design, if any person enters the room again, the electrical appliances which were previously On and turned OFF by the system, the system turns them on again. But this time, it checks the position of a person standing/sitting such as on the Left, Right or Middle of the room and then turns On only those appliances which are required by the person instead of turning all of them On. The position is considered by the viewpoint of the camera installed. This means, if we install the camera on the upper-middle side of wall and you are facing the camera lens then, Left is the left side of camera and right hand side of user, Right is right side of camera and left hand side of user and middle is center of camera viewpoint.

For detecting the position of a person from a captured image, we used the coordinates. After detecting the human in the image, the algorithm draws a rectangular block around the detected human. Then, the center of image and the center of that detected human rectangle-box is calculated and compared. If the x-coordinate value of rectangle-box i.e. human is smaller than the x-coordinate value of center of image, then the person is at the left. Similarly if it is greater, then the person is on the right. For determining the person's position for middle, the margin of 100px is left from the center of the image.
If people found on both the side in the room or in middle of the room, then all the appliances will be turned on.

V. Results

Below is the assumed illustration of electricity units saved and bill amount saved for one classroom. The electricity used is considered in units of Watts and week is considered of 5 days as per the college schedule.

Total power wasted in Watts (for 1 hr.) = 75 (Fan) + 20 (Tube light) = 95 Watts

For 1 week = 95 * 5 = 475 W

For 1 month= 475 * 4=1900 W = 1.9 kWh =2 kWh Approx.

Energy Consumed by system (8 hrs.) = (8*3) (Raspberry Pi) +
(8*2) (Camera) = 40 W

For 1 week = 40 * 5 = 200 W

For 1 month = 200 * 4 = 800 W = 0.8 kWh

Total Energy saved = 2 - 0.8 = 1.2 kWh

Total units saved = 1.2 * 40 (multiplying factor) = 48 Units (Here multiplying factor is standard unit in calculating electricity bill as per MSEB)

Total Money saved (1 month) = 48 * 11.47 = Rs.550

(Here Rs.11.47 per unit is considered as per the standard by MSEB).

VI. Conclusion

According to a survey conducted by us it is found that in the previous automations there is a need of human to some extent to control the devices manually. But our proposed paper is able detect the presence or absence of any human being in each segment. We are able to find the exact location where a person is present. This paper will be classifying correctly between humans and animals and will automatically control all the configured appliances when any human being is triggered and also will not change its state if some other object is been captured.

We have gone through all the possibilities that maybe used in implementing IoT and Artificial Intelligence so minimizes the limitations of existing systems and thought of implementing IoT with image processing.

References

[1] Kaustav Mani Pathak, Priyanka Jain, Swati Yadav, Veena Mittal , Prateek
Jain "An IOT based Mechanism for Automatic Classroom Electricity Saving" 2019 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (Com-IT-Con), India, 14th -16th Feb 2019.

[2] D. Ganiger, K. A. Patil, P. Patil and M. Anandhalli, "Automatic Control of Power Supply in Classroom Using Image Processing," 2017 International Conference on Recent Advances in Electronics and Communication Technology (ICRAECT), Bangalore, 2017, pp. 230-234. doi: 10.1109/ICRAECT.2017.16

[3] S. Lee, K. N. Ha and K. C. Lee, "A pyroelectric infrared sensor-based indoor location-aware system for the smart home," in IEEE Transactions on Consumer Electronics, vol. 52, no. 4, pp. 1311-1317, Nov. 2006. doi: 10.1109/TCE.2006.273150

[4] "Smart Home Automation using Computer Vision and Segmented Image Processing" , Mohammad Hasnain.R, Rishabh.S, Mayank.P and Swapnil.G , International Conference on Communication and Signal Processing, April 4-6, 2019, India

[5] H. S.Dhami, N, Chandra, N. Srivastava and A. Pandey,Raspberry Pi Home Automation Using Android Application. International Journal of Advance Re- search, Ideas and Innovations in Technology Vol.2 Issue 3.

[6] Nguyen, D. (2016). Human detection from images and videos: A survey.Pattern Recognition, 51, pp.148-175.

[7] Md. Ashikumar, Rahaman (2017).Computer Vision Based Human Detection. International journal of Engineering and Information Systems(IJEAIS),pp.62- 85

[8] Image Processing and Object detection, Niddhi

[9] [23] "Peep Through Exposed CCTV Cameras via Google Search",*Thegeekpage.com*, 2019. [Online]. Available: https://thegeekpage.com/cctv-google-search/.

[10] [8] S. (Deep), "rdeepc -Overview",*GitHub*, 2019. [Online]. Available: https://github.com/rdeepc. [Accessed: 29-October-2020].

[11] Roy, S., 2018. *Real-Time Object Detection On Raspberry Pi Using*
Opencv DNN. [online] Medium. Available at: https://heartbeat.fritz.ai/real-time-object-detection-on-raspberry-piusingopencv-dnn-98827255fa60 Accessed on: 29th October 2020 [11] Md Ashikur. Rahman. Computer Vision Based Human Detection. International Journal of Engineering and Information Systems (IJEAIS), 2017, 1 (5), pp.62 - 85. ffhal-01571292f

[12] https://www.google.com/search?q=mobilenet+ssd&tbm=isch&client=firefoxbd&hl=en&sa=X&ved=2ahUKEwis6aiC5d7sAhWeKrcAHR8cAS4QrNwCKAF6BQgBENoB&biw=1349&bih=654#imgrc=6Rztq7r55lh ZFM

[13] https://robu.in/product/raspberry-pi-3-model-b-bcm2837b0sociotpoeenabled/?gclid=CjwKCAiAv4n9BRA9EiwA30WND3yvXItiEYb6rp31 j 4cGNQ_w7-9ULDB1M31lcD7-2cckRMYbGkJxsBoC4LcQAvD_BwE

[14] https://www.google.com/search?q=iot&client=firefoxbd&sxsrf=ALeKk01KVopJhJFR0SECc88SlXcu4RhQkw:1604495295069&source=lnms&tbm=isch&sa=X&ved=2ahUKEwicvuzgujsAhUjILcAHdCqCRAQ_AUoAnoECA4QBA&biw=1366&bih=654# imgrc=bQDyrURpKqXwYM

[15] https://miro.medium.com/max/826/1*T9ijxp8KOaxiMpwVfwQviw.png