

Smart Security System Using Artificial Intelligence and IoT

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Abstract— Westernization of today's society has led to the increase in the number of small families while the gradual spread of living into the suburban areas has raised a significant concern in the security of the individuals. Although there are many security systems available in the market today, they are mostly expensive. The objective of the model described in this paper is to present a simple and low-cost design to make our homes smarter and safer. The Raspberry pi based framework built in this project comprises of Pan and tilt mechanism, IR Camera module, and a PIR sensor for alerting if someone approaches the camera module it not only senses the presence of the person it also helps the user to identify the person by tracking and recognizing the face of the intruder and showing their name and their threat level around their name it also captures the images and recordings through a camera from the scene. An intrusion can be identified with the help of OpenCV and a tracking mechanism is activated which will track the person if the person is found to be unknown along with that an alert is sent to the user through IoT Devices. The rightful person receives a message on his phone immediately followed by images of the person causing the sceptical situation along with a captured video along with a encrypted live video stream that gives a detailed picture of the happenings and will also serve as an evidence for further investigations. The individual detection and identifying the threat level also makes the user to guard the premises before any unwanted things happening.

Index Terms—Infra Red(ir) Computer Vision (CV), intruder detection, Passive infrared sensor(pir)

I. Introduction

IN today's world. Security and privacy have always been a dilemma. In order to enhance the security of the area several techniques have been implemented in the past. Since conventional security cameras can only monitor small area efficiently. And since it only records or streams video it does not prevent any crime and it is only used to inspect and analyze the area after a crime has been committed. And the conventional security camera always requires human assistance to function efficiently.

So we don't need to record videos at all times even when there is no suspicious activity taking place. Now, take a scenario where there is an office space and the proposed system is enabled by the administrator while leaving the office space. So when someone breaches the office space the system will detect the breach i.e. motion. The motion made during the breach is detected and then processed by the system. As soon as the motion is detected the proposed system starts recording video and simultaneously it will send a push notification alert of the breach to the administrator along with some images of the office space at the time of the breach. Then the administrator will take action. The recording will be saved in the memory of the raspberry pi which can be used afterward as a piece of evidence for any criminal activity. This is not the first time that someone has proposed this type of system. Similar systems have been proposed before this system. The objective of this research is to design the System which reduces human efforts and provides security. We proposed a Raspberry Pi security surveillance camera, which is a system that runs and is controlled over Local networks and the Internet. The photographs are sent to a cloud server. At the point when the cloud isn't accessible then the information is put away on the Raspberry Pi and sent after the association is restored. These will come in handy depending on how you want to transfer your security cameras pictures. This will likewise help to Increase the use of portable innovation to give basic security to our homes and for other control applications. We present a literature review in section 2. Section 3 and 4 contain specification and implementation details respectively. The setup details are present in section 5. Finally, section 6 contains a conclusion and future work.

II. LITERATURE REVIEW:

In the past few years, a few papers have been published related to the prerequisites of a smart security system associated with raspberry pi and nvidia jetson nano It is required to create and

actualize a reasonable low-cost web-camera based observation framework for remote security checking. Many ventures probed raspberry Pi with the Raspbian working frame work with buster frame work. The framework has the capacity to screen an area away from the observation territory through cell phones. The Internet of Things is a system of gadgets where those gadgets speak with one another with no human impedance. The project aims to simplify detect motion and the interface to be user friendly, which would send a prompt notification when motion is detected. CCTV cameras are costly because of the use of personal computers.

It requires too much space for consistent recording and requests labor to recognize the un-approved actions. In any case if we contrast and compare it with the AI model proposed the system itself will be able to recognize and produce a advanced alert message and the margin of error is reduced up-to a large extent. IOT based system is superior to other methods that are used for home security purposes, for example, Micro controller-based wired and remote security frameworks, CCTV framework, and so forth. IoT based system is quite costly and have a few disadvantages in effectiveness and availability to the client. IoT based anti theft systems are implemented on vehicles successfully. And many models have been used with a raspberry pi but the systems often consists of many sensors like IR and other separate sensors attached to the module. In our propose module the camera itself takes care of all those sensors work with the help of the ai built into it. The camera and the raspberry pi uses the USB storage connected to the main board. The usb acts as only secondary storage when the raspberry pi is disconnected from the network whenever there is a power failure or some one tapers with the network.

III. RELATED WORK

The home security today has changed a lot since the start of the technology revolution we have changed from a simple lock and key system to a more complex systems that includes a cascade of sensors and cameras connected to the internet which helps them to be accessed from anywhere in the world. Even though the CCTV has become advanced the CCTV camera has always been there to investigate the crime place and not prevent the crime. And in some cases, to prevent the crime from happening there is always a requirement for human guidance this makes the system less reliable and less

efficient and the margin of error always increased and there is always a risk of the intrusion. Considering the above said downside of the current surveillance systems and to curtail the intruder activity or trespassing, efficient monitoring and immediate signalling is required. The best component about the present current security system is that, one can control their home gadgets just by utilizing Internet. In some security systems, IR sensors are utilized to detect the nearness of a burglar. At that point it advises the owner about the criminal behavior or burglary and alarm begins ringing. The warning to client is sent through Bluetooth or SMS. The client gets mindful of the interruption on accepting the warning. But the system does not inform earlier. The use of ai and ml can solve all these issues.

IV. PROPOSED SOLUTION

The primary point is to ensure the safety of our friends and family and our valuables at home. It can also improve the security of the area along with burglary and accident detection using blood. the technical advancements of IoT in the application of home security system have been a happening area of research. The primary concern is if the intruder posses quite some knowledge about a security system, the sensor can be de routed, hence employing additional sensors are required to record various other sensory captures. To safeguard our premises in absence of our presence we have delivered a product with less sensors and wires making the system more efficient and a compact one. The system screens the whole floor for movement. This system is controlled by Raspberry pi incorporated with PIR/ultra-sonic sensor and a picamera module, and sound sensor with a connection of wifi. At whatever point the intruder goes into the house the camera detects human movement and starts to verify weather it is a known or an unknown intruder in the premises. If the intruder is not found in the premises the data is collected by the raspberry pi and process it and detects what is going on. It also helps the user to see the data easily using the simple gui in a webpage format as it will be used by a common man.

V. HARDWARE COMPONENTS DESCRIPTION

- IR Camaera
- PIR sensor
- Sound sensor
- Raspberry pi
- Power supply

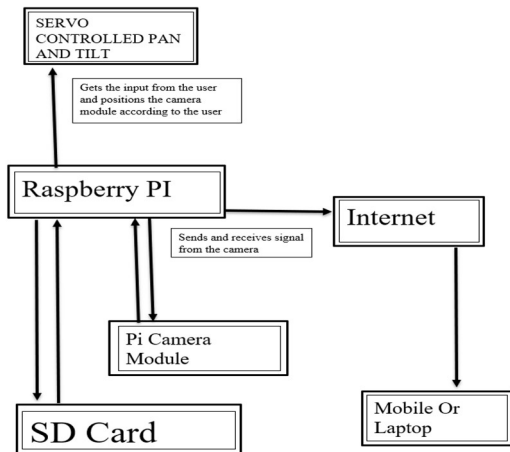


Fig 1. Block Diagram of the IoT based Home security system

A. SENSORS

The PIR Sensor helps to detect movement within the sensor's range. The sensor emits radiation which is split into two halves. The two parts are wired up with the goal that they counterbalance one another. In the event that one half observes an increased IR radiation than the other, the yield will swing to high. A change in energy observed in the monitored area due to an intervention is recorded, '1' is sent to Raspberry Pi, else '0' is sent. PIR requires 5 Volts and 50 mA current and it detects the movement up to 12ft, i.e., about 4 meters in a semicircular edge.

An IR sensor is an electronic gadget that produces infrared radiation to detect the objects in the surrounding. An IR sensor basically detects the warmth as well as the motion of an object. The IR sensor module comprises of the IR Transmitter and Receiver, Operational speaker, Variable Resistor (Trimmer pot). IR LED radiates light, in scope of Infrared recurrence. IR light is imperceptible to human vision as its frequency (700nm - 1mm) is a lot higher than the VIBGYOR range. These kinds of radiations are not visible to human eyes and can be identified only by an infrared sensor.

The SONY IMX 230 21mp equipped with IR sensor helps it to switch between day light and night vision without any struggle. And fetch a high-quality feed for the ai system even at dark times to improve the accuracy of the system



Fig 2. SONY IMX 230 sensor

Since we are integrating the sound sensor with the camera module there is no requirement for separate sensor for it.

B. RASPBERRY PI COMPUTER

The model used here us Raspberry Pi 4 Model B 4gb variant The quad-core Raspberry Pi 4 Model B is both faster and more capable than its predecessor, the Raspberry Pi 3 Model B+. For those interested in benchmarks, the Pi 4's CPU -- the board's main processor -- is offering two to three times the performance of the Pi 3's processor in some benchmarks.

Unlike its predecessor, the new board is capable of playing 4K video at 60 frames per second, boosting the Pi's media center credentials. That's not to say, however, that all video will play this smoothly, and supporting this hardware acceleration for H.265-encoded video is currently a work in progress across the Pi's various operating systems, so this is more a potential future feature than something available today.

The Pi 4 also supports wireless internet out of the box, with built-in Wi-Fi and Bluetooth.

The latest board can also boot directly from a USB-attached hard drive or pen drive, and, following a future firmware update, will support booting from a network-attached file system, using PXE. Using a network-attached drive is useful for remotely updating a Pi and for sharing an OS image between machines.

It is so powerful it can be used as a separate desktop pc with the ability to do day to day tasks without occupying a large amount of space. It is used to do basic machine learning efficiently.



Fig 3. Raspberry Pi 4 Model B 4GB

The compactness of the raspberry pi make it easier for developing devices which requires more processing power in small enclosure.



Fig 4. Prototype of the Home security system

The final prototype is a completely wireless and independent model capable of running on battery power for long time

V. RESULT AND ANALYSIS

An intruder activity is sensed based on the information received from the installed sensors in terms of motion, sound detection and observation through energy variation in the area monitored. The Processor uses this information to alert the home owner through SMS along with the name of the person if known the message signal is sent along with a warning if an unknown person is detected. The person is also able to see the live feed from anywhere in the world and if a unknown person has entered the area it tracks the person automatically using pan and tilt mechanism built right into it. Figure 5 shows the facial detection feature of the system

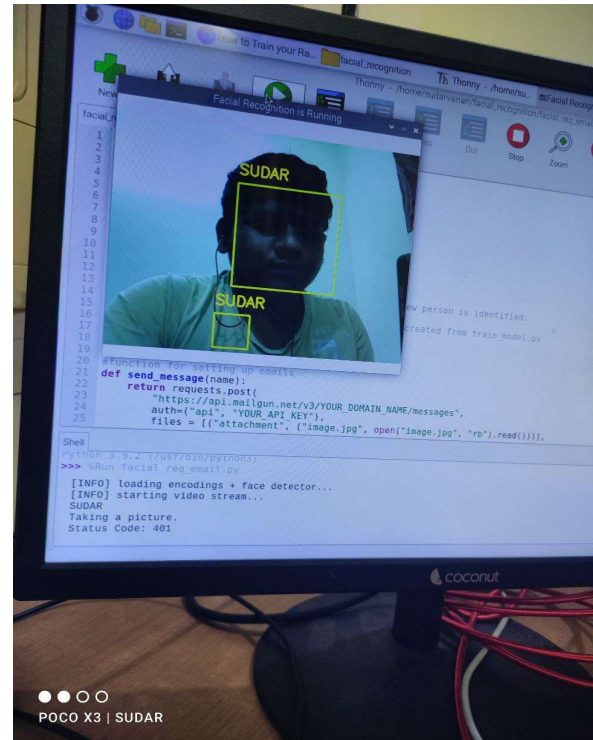


Fig 5: Shows the face recognition feature

The facial detection feature helps to identify the face in real time and sends the information to the alert along with other information

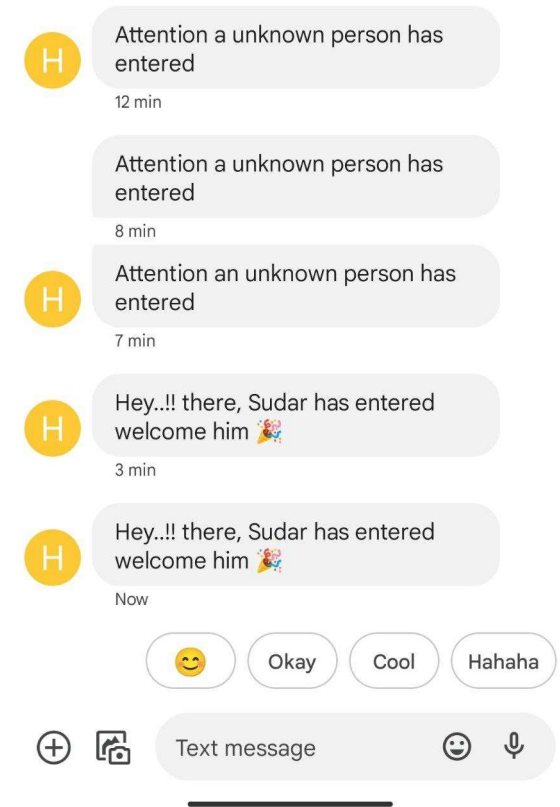


Fig 6. Screenshot of SMS alert of Intruder activity

VI. CONCLUSSION & FUTURE SCOPE

The project "IOT Based Raspberry Pi Home Security System Using Motion Detector" has demonstrated how to get a fully functional embedded product developed from scratch. This incorporated the cross aggregation and organization of fundamental libraries, the arrangement of implanted Linux and distributed computing innovation. The system is highly recommended to implement on construction sites, Government offices and institution where the entry has been restricted in some areas where the authorization provided by the security system helps in improved security. It can also be implemented in individual office lodge, bank storage space, stopping passage. At whatever point the movement is distinguished through. The fundamental Advantage of the undertaking is Easy to actualize, Minimal effort with High quality.

The Night vision also helps the user to detect accurately who enters the area and this provides security around the clock.

In the improvement point of view the Ai can further be trained to monitor the facial expression of the person and by getting the criminal record of the individual the persons threat level can be identified and a warning can be sent well in advance. The ai can be further trained when for reducing the false alarm.

VII. REFERENCES

[1] Mohd Muntjir, Mohd Rahul, Hesham A. Alhumyani, 2017, An Analysis of Internet of Things (IoT): Novel Architectures, Modern Applications, Security Aspects and Future Scope with Latest Case Studies, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) Volume 06, Issue 06 (June 2017)

[2] Khanna, A., & Tomar, R. (2016). IoT based interactive shopping ecosystem. 2016 2nd International Conference on Next Generation Computing Technologies (NGCT), 40-45.

[3] Pirbhulal, S., Zhang, H., E Alahi, M. E., Ghayvat, H., Mukhopadhyay, S. C., Zhang, Y. T., & Wu, W. (2016). A Novel Secure IoT-Based Smart Home Automation System Using a Wireless Sensor Network. *Sensors (Basel, Switzerland)*, 17(1),69.

<https://doi.org/10.3390/s17010069>

[4]R.J. Anderson,Computer Laboratory, University of Cambridge, Cambridge, UK A security policy model for clinical information systems

DOI: 10.1109/SECPRI.1996.502667

[5] Cui Xiaolin, Department of Automation, University of Science and Technology, Hefei, Anhui, China. Tan Xiaobin, Department of Automation, University of Science and Technology, Hefei, Anhui, China, Zhang Yong Department of Automation, University of Science and Technology, Hefei, Anhui, China, Xi Hongsheng, Department of Automation, University of Science and Technology, Hefei, Anhui, China A Markov Game Theory-Based Risk Assessment Model for Network Information System

DOI: [10.1109/CSSE.2008.949](https://doi.org/10.1109/CSSE.2008.949)