

# Smart Surveillance for Intruder Identification in Forest Areas Using Image Processing

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**Abstract-** In today's technically advanced world, autonomous systems are gaining rapid popularity. With the advancements in technology and the availability of cheap electronic control devices, automation is getting more and more common. Instead of being present only in high-tech industries, it is now stepping into our forests. Now a day, the problems are deforestation where humans cut the trees from restricted areas and so the wild animals from the forest enter the human habitation and cause problems. This system will be more useful to identify humans in the forest. We could easily find them and alert either the forest department or the village people in that locality. Our proposed system is designed with PIC microcontroller to identify the presence of humans. when face of the person is detected by camera the data will be transferred to forest officials. Simultaneously, buzzer and message alert will be given to intimate about human presence

**Index terms-** PIR Sensor; GSM; PIC microcontroller; Camera.

## I.INTRODUCTION

After physiological desires are consummated, the second level of human desires is safety desires. Safety desires embody personal security, monetary security, health and well-being, safety web against accidents/illness and their adverse impacts. within the absence of economic safety – because of slump and lack of labor opportunities – these safety desires manifest themselves in ways that like a preference for job security, grievance procedures for safeguarding the individual from unilateral authority, savings accounts, insurance policies, incapacity accommodations, etc. within the absence of physical safety, humans could feel anxious, traumatic, or vulnerable. One technical thanks to fulfill the wants is doing the observance method.

Monitoring process is used to know the process status, as the reference to evaluate the system, that

later will determine the next response to the system. The monitoring implementation is always based on controlling periodically and recording all of the activity on the system continuously, with purpose if something unwanted happened, the controller could handle it as soon as possible. The monitoring process can be done manually, but it will harm the humans based on time and energy usage.

The existence of Information and Communication Technology has facilitated humans in doing monitoring process. One of technology which has given biggest contribution for monitoring process is camera. But other problem appears when the camera installed is always recording, even there is no significant change of the system, so it will waste the memory. It also implies the system is not efficient caused of too much of the image observed. It also gives the possibility to the human gives an incorrect inspection. One of alternative solution to solve this problem is with designing one smart system that able to improve the efficiency of the observed image, memory, and human energy, so that the camera will detect and capture the image only when the motion object is detected (intruder).

In the system implementation, user's interface to the system is using Dropbox API. With this application, user can monitor the system using any platform, whether PC or smartphone. To process the image, the author uses Background Subtraction algorithm with the background being updated continuously. As the alert of the system, the author uses Arduino and Buzzer as the actuator of the system when an intruder appears.

Designed an advanced GSM based electronic security system for home applications using infra-red motion detectors and RISC based Micro controller using embedded C language. Infra-red motion detectors will sense any intruder with 10 feet and alert the

Owner of house or police control room by sending SMS through GSM modem about the intruder.

In section II, existing system are discussed. In section III, proposed system are discussed. In section IV, discuss about hardware specifications. In section V, discuss about conclusion of this project.

## II. RELATED WORK

A number of assessments on the theme of Wireless Sensors methods were done before as projects reports or, as research papers on IoT based motion detection. Atzori, et al [1] presents that at the point when a protest (characterized by a distinction in luminance from its environment) moves, the movement can be recognized by a generally basic movement sensor intended to recognize an alteration in luminance at one point on the retina and interface it with a conceded change in luminance at a adjacent point on the retina. Sensors that work along these lines have been alluded to as Reichardt detectors.

Rayte, et al [2] represents the essential thought behind the vitality show is to manufacture spatio-transient channels which are arranged in space-time and accordingly coordinate the situated space-time structure of moving spatial examples. This is refined by including space-time distinguishable channels. A detachable channel is one in which the spatial profile continues as before shape after some time yet is scaled by the estimation of the transient channel. For every course two space-time channels are produced one which is symmetric (bar-like) and one which is asymmetric (edge-like). The entirety of the squares of these channels is known as the movement vitality. The distinction in the flag for the two headings is known as the adversary vitality. However, the reaction of this framework will likewise rely on differentiation thus the outcome must be isolated however by the squared yield of another channel which is tuned to static difference. This gives a stage free measure which increments with speed however does not dependably give the right speed esteem. The model can represent various movement marvels.

Piyare, et al [3] accessed and defines the typical workflow of an infrared motion detection sensor. The different sort of movement indicator had clarified in area above and infrared was decided for this undertaking. This in light of the capacity of sensor to work, effortless to get the extra part segment and

quick to work with considering the length of undertaking is in here and now. This segment will expand more insight about infrared movement indicator. Infrared sensor likewise surely understood as an elector optic identifier retains electromagnetic radiation and yields an electrical flag that is generally corresponding to the irradiance (power of the occurrence electromagnetic radiation). Contingent upon the kind of indicator and the manner by which it is worked, the yield flag can be either a voltage or a current.

Prasad, et al [4] proposed the concept of reflected radiation. The radiation exuding from a surface incorporates not just that produced by the surface yet additionally that reflected by the surface. The articles encompassing the surface in question additionally transmit radiation in ghostly conveyances fitting to their individual temperatures. This radiation, or if nothing else some bit of it, is episode on our surface of intrigue where it is incompletely consumed and in part reflected. To a spectator the reflected radiation is undefined from the discharged radiation. An IR producer is a LED produced using gallium arsenide, which emanates near IR vitality at around 880nm. The IR photo transistor goes about as a transistor with the base voltage directed by the measure of light hitting the transistor. Henceforth it goes about as a variable current source. More prominent measure of IR light reason more noteworthy streams to course through the authority producer leads. The photo transistor is wired in a comparable arrangement to the voltage divider as appeared in the outline underneath. The basic cause of a voltage drop in the draw up resistor is the variable current going through that resistor. This voltage is estimated as the yield of the gadget.

## III. METHODOLOGY

In this proposed system, the forest surveillance system which evaluates the development of a very Low-cost security system using PIR (Pyroelectric Infrared) sensors and video cameras built around the PIC(Peripheral Interface Controller) microcontroller. the human movement is detected using the PIR sensors. In this time,the system triggers an camera and machine learning alogorithm will detect the person and triggers alarm detecting the presence of unauthorized person in a specific interval of time and simultaneously sends a message to the SMS through

GSM Modem. When the security system is activated, the CCTV camera is activated. This highly reactive approach has low computational requirement. Therefore it is well suited for home surveillance system. All this will be possible only with coding and applying automated code using different programming languages.

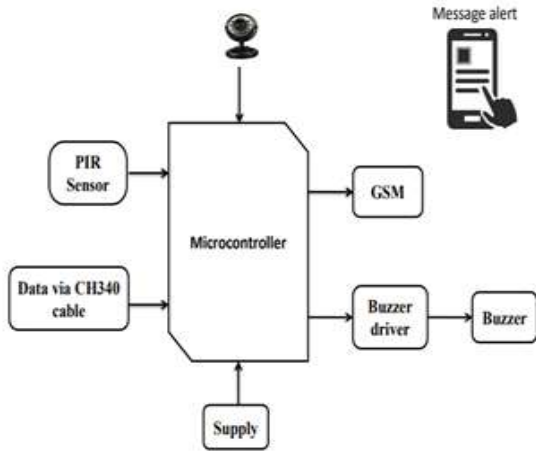


Fig 1:Proposed Block Diagram

A. Hardware Requirements

- PIC Microcontroller
- PIR Sensor
- Camera
- GSM Module
- Buzzer

B. Software Requirements

- MPLAB IDE
- Open CV with Python

IV. HARDWARE IMPLEMENTATION

A. PIC Microcontroller

PIC is a family of modified Harvard architecture microcontroller made by Microchip technology, derived from the PIC1650 originally developed by General Instrument’s Microelectronics Division. The name PIC is referred to as "Peripheral Interface Controller". PICs are popular with both industrial developers and hobbyists due to their low cost, wide availability, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability. Microchip introduced the new PIC32MX family of

32-bit microcontrollers operates at 2.3V to 3.6V supply voltage with 80 MHz frequency. The initial device line-up is based on the industry standard MIPS32 M4K Core. The device can be programmed using the Microchip MPLAB C Compiler for PIC32 MCUs.

PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory. The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques. Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877.

TABLE 1. Various PIC Microcontrollers

PIC MCU device	PIC MC U No. of Pins	PIC MCU Flash memory
12F675	8	1k
16F88	18	4K
16F877A	40	8K

B. PIR Sensor

A Pyroelectric Infrared Sensor (PIR sensor) is an electronic sensor, in that type of sensor measures the infrared (IR) light radiating from objects or human in its field of view. The normal sensor emits the radiation but in this sensor detect the radiation.

All the objects with a temperature above absolute zero emit heat energy in the form of radiation. Usually this radiation is not visible by human eye because it radiates at infrared wavelengths, but in this infrared can be detected by electronic devices designed for detecting the human movement.

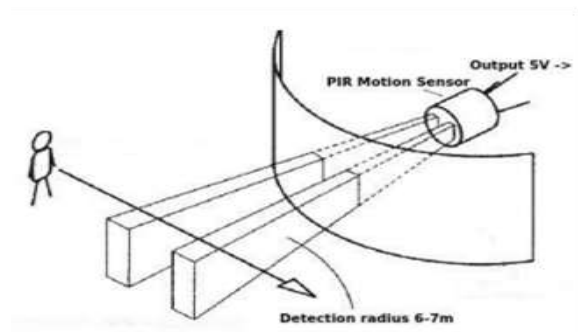


Fig 2.PIR Working

The PIR Sensor has a range of approximately 20 feet (6 meters). The sensor is designed to identify the slowly changing conditions that would happen normally as the daily progresses and the environmental condition changes, but it responds by making its output when sudden changes occur, such as when there is motion. This device is designed mainly for indoor use. Operation outside or in very high temperatures may affect stability negatively. Due to the high sensitivity of PIR sensor device, it is not recommended to use the same condition like rapid environmental changes and strong shock or vibration and also in not working in direct sun light or direct wind from a heater or air condition.

### C. GSM Modem

The GSM stands for Global System for Mobile Communications. In this technology is used to the communication purpose; it operates at a baud rate of 9600bps in standard UART model through AT Commands. This GSM Modem can accept any of the 2G or 3G network operator SIM card and act like as mobile phone with its unique phone number. Advantage of using this GSM modem will be that it can use RS232 port to communicate and develop embedded security applications or any other applications.

This modem used to SMS Control, data transfer, remote control and logging can be developed easily. The modem can either be connected to PC serial port directly or microcontroller. It can be mainly used to send and receive SMS or make/receive voice calls. This GSM modem is a highly flexible for plug and play quad band GSM modem for direct and easy integration to RS232 applications. AT commands are also noted as Hayes AT commands. There are many views to understand the meanings of —AT|. Some call it —Attention telephone|, whereas others

understand as —Attention Terminall commands. AT commands giving instructions to both mobile phone and normal landline telephones. The AT commands are sent to the phone’s modem, which can be a GSM modem or PC modem. Different producer may have different sets of AT commands. Luckily, many AT commands are the same commands. Mobile phone manufactures may also provide with attention to operators to allow or not to allow some commands on phones.



Fig 3:GSM Modem

### D. Buzzer

A buzzer or beeper is an audio signaling device which is mechanical, electro mechanical or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or roke. A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep. The most common sizes for Sound Level are 80 dB, 85 dB, 90 dB and 95 dB. We also carry buzzers with Sound Level up to 105 dB.

## V. SYSTEM IMPLEMENTATION

OpenCV enables us to teach the machine using its machine learning algorithms to distinguish between various user use cases and unauthorized perpetrators’ unusual unwanted activity in order to take appropriate action as per the environmental conditions (normal functions or retaliation). Using the image processing tactics and mathematical

deductions, we are able to successfully implement logic to enact the artificial intelligence concept at hand to identify and classify the events that occur. In addition to that, the system is capable of taking action in accordance with the event taking place. All this is designed using a simple interface of C / C++ to make the most of the optimized libraries in OpenCV.

A. Viola-Jones Algorithm

The features employed by the detection framework universally involve the sums of image pixels within rectangular areas. However, since the features used by Viola and Jones all rely on more than one rectangular area, they are generally more complex. With the use of an image representation called the integral image (A summed area table, also known as an integral image, is a data structure and algorithm for quickly and efficiently generating the sum of values in a rectangular subset of a grid).

Rectangular features can be evaluated in constant time, which gives them a considerable speed advantage over their more sophisticated relatives. The evaluation of the strong classifiers generated by the learning process isn't fast enough to run in real-time. A cascade ordering is used in order of their complexity, where each classifier stronger than its predecessor is trained only on the select candidates who have passed the classifiers prior to them. If at any stage in the cascade a classifier rejects the sub-window under inspection, no further processing is performed and continues on searching the next sub-window.

Face detection:

The face detection function takes one frame at a time from t frames provided by the frame grabber, and in each and every frame it tries to detect the face. This is achieved by making use of a set of pre-defined Haarcascade samples.

Eyes detection:

Once the face detection function applied if there is no face, the eyes detection function of viola Jones algorithm tries to detect the eyes. If there is no faces checks for eyes.

Upper body detection:

In this we estimate the upper body of the human from the image and mark that by rectangle. This will help

to find out human who is in forest. we are using viola Jones function as upper body detection framework.

B. Working

The Architecture of system is divided into two parts, first part is motion detection using PIR sensor and second part is human detection using camera. The system consists of PIC microcontroller, buzzer, GSM module, and surveillance camera. PIC microcontroller is used for controlling the hard ware with help of embedded software, controller is 16 bit process or it can use by many industrial application system. output device is used in the system. GSM module send message to the forest officer when the human detected. when camera detect human using viola jones algorithm will send the message to forest officer. By this alert user can know he is authorized or unauthorized entry in forest. Surveillance camera is used to capture the live video and that video can be processed with help of opencv python programming and send back to the PIC microcontroller.

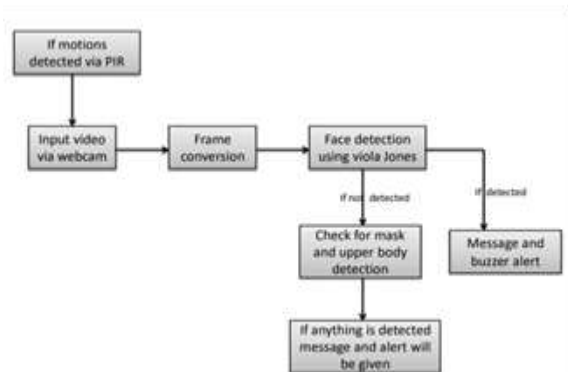


Fig 4: Work Flow

VI. RESULTS AND DISCUSSION

In the proposed system, the forest ranger gets immediate alert when someone enter the forest in restricted zone. The system employs PIR sensors to detect the persons entering the restricted area and sends the output signal to the computer via serial cable for processing further. Then laptop camera will be activated. After Opening Camera the viola jones algorithm will search human faces and eyes, body. if the algorithm found any human this will trigger the PIC microcontroller via serial cable. The PIC board drives the buzzer circuit It also consists of GSM



modem to send SMS (short messaging service) to the forest ranger. Figure 5 shows a experimental setup.



Fig 5: Experimental Setup

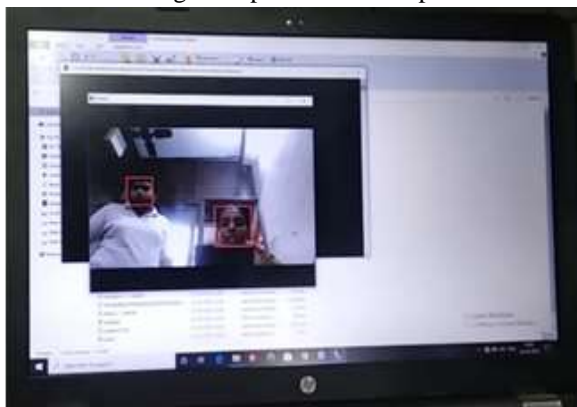


Fig 6: Face Detected Output



Fig 7.Sms Output

## VII. CONCLUSION

Wireless sensor network had been used in every industry and day to day life. This paper is designed in monitoring the smuggling of forest wood. Our system would detect theft in advance using image processing and it can send alert messages to long distance. This system has an advantage of low power, reliable and long distance message transmission in real time which has a better scope in applications like forest surveillance and monitoring. In addition to this, this system can be equipped with glass break detectors to enhance the level of protection. Use of multi-sensor data fusion and complex algorithm can be used to increase the effective FOV for larger spaces. In order to enhance the location accuracy and to enhance the method of processing the PIR sensor signal, use of more advanced techniques such as probabilistic theories.

## REFERENCES

- [1] M. Shankar, I. Burchett, Q. Hao, B. Guenther, "Human tracking systems Using pyroelectric infrared detectors", *Optical Engineering*, vol. 10, no. 45, pp. 106401 (01-10), Oct. 2006.
- [2] Kandhalu, A.; Rowe, A.; Rajkumar, R.; Chingchun Huang; Chao-Chun Yeh —Real-Time Video Surveillance over IEEE 802.11 Mesh Networks—, *IEEE Conference on* 2009.
- [3] Bilal Ahmad Khan, Muhammad Sharif, Mudassar Raza, Tariq Umer, Khalid Hussain —An Approach for Surveillance Using Wireless Sensor Networks (WSN)l, *Journal of Information & Communication Technology*, Vol. 1, No. 2, 2009.
- [4] Anurag Kumar,, Bharadwaj Amrutur —Wireless sensor networks for human intruder detectionl, *Journal of the Indian Institute of Science* ,VOL 90:3 Jul–Sep 2010.
- [5] Adamu Murtala Zungeru —Design and development of an ultrasonic Motion detectorl *International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)* Volume 1, Issue 3, june 2010.
- [6] Ms. Sneha Nahatkar, Prof. Avinash Gaur, Prof. Tareek M. Pattewar —Design of a Home Embedded Surveillance System with Pyroelectric Infrared Sensor & Ultra-Low Alert Powerl, *International Journal of Advanced Research in Electronics and Communication*

Engineering (IJARECE)Volume 1, Issue 3, September 2012.

- [7] Taslee mandrupkar, Manisha kumari ,Rupali mane —Smart Video Security surveillance with mobile remote controll, International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 3, March 2013.
- [8] Qi Hao,Fei Hu,Yang Xiao —Multiple Human Tracking and Identification with Wireless Distributed Pyroelectric Sensor Systems| IEEE Transactions Volume 1, Issue 3, September 2013.
- [9] Arulogn,o.t., Adigun,a.Okedirn o —Design and Development of a Security Surveillance System based on Wireless Sensor Network” International Journal of Innovative Science, Engineering & Technology, Vol. 1 Issue 4, march 2014.
- [10] Ying-Wen Bai, and Yi-Te Ku, —Automatic room light intensity detection and control using a microprocessor and light sensors,| IEEE Transactions on Consumer Electronics, pp. 1173-1176, Aug. 2008..
- [11]M. Moghavvemi and C.S. Lu, "Pyroelectric sensor for intruder detection," in Proc. TENCON 2004 Conf., pp. 656-659.
- [12]Upendran Rajendran and Albert Joe Francis, |Anti-Theft Control System Design Using Embedded System|, Proc. IEEE, vol. 85, page no. 239- 242, 2011.
- [13]R. C. Luo, O. Chen, C. W. Lin, —Indoor human monitoring system using wireless and pyroelectric sensory fusion system,| The 2010 IEEE/RSJ International Conference on Intelligent Robots and Systems, Taipei, Taiwan, October 2010, pp.1507-1512.
- [14]Wahl, F.; Milenkovic, M.; Amft, O. A green —autonomous self-sustaining sensor node for counting people in office environments|, In Proceedings of the 5th European DSP Education and Research Conference, Graz, Austria, 13–16 May 2012; pp. 203–207.
- [15]Zappi, P.; Farella, E.; Benini, L. —Tracking motion direction and distance with pyroelectric IR sensors|, IEEE Sens. J. 2010, 10, 1486–1494.