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RASPBERRY PI BASED SOLAR CAMERA FOR CITY SURVEILLANCE

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ABSTRACT

Due to ever increasing threats to security, surveillance has become very important these days. In this paper we have proposed a design for Raspberry Pi based security camera with an integrated PIR (passive infrared) module that is capable of working on a solar powered battery. The surveillance camera performs two main functions. First it captures different images based on fixed interval rate for a fixed interval duration. Second, the camera is also synchronised to take a picture everytime the PIR detects motion. The captured image are uploaded on web based gallery that will store the pictures according to the date and time.This web Gallery is based on PHP for the front end design and on LAMP server for the backend framework. The implementation using Lamp server provides access to the different workstations i.e Hospitals, Police stations etc. Every workstation can access server by using the secure login id and password which provides a secure access to it. As an additional functionality we have programmed the module in a way that it will also be able to send SMS alerts to the registered users in case some activity is detected by the camera and the PIR sensor.

Keywords: Surveillance, Security, Raspberry Pi, PIR Sensor, LAMP, PHP, Solar Panel.

I INTRODUCTION

As more and more cities are in the process of becoming smart [1] security and surveillance becomes an radical issue to be solved. Recently, a lot of measures have been taken in overcome the issue and one being installation of security cameras throughout the city, especially in areas which draw heavy crowd. Through the paper we wanted to make the process of city surveillance more efficient, effective economic and hassle-free. To execute the process of a city makeover more reliable, integrated and power efficient security systems will be required. Our paper is an exemplar for the same.

Usually the security systems in Hospitals, Parking Lots or even at Public Places are monitored by a single group of people and all of them draw energy from the main power source. In big facilities the number of security

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systems are significantly high. This amounts to a significant energy consumption too[2]. This main aim of this paper is to present a surveillance system that is integrated as well as power efficient. Integrated means the access to the surveillance mechanism will not be restricted to a single entity but can be distributed among different trusted factions. Also the camera is capable of storing and utilizing powerfrom the sun hence, makes the system extremely power efficient and reduces the ever increasing demand of electricity to a significant extent.

II BACKGROUND OF RELATED WORK

Till date there are multiple solar power based surveillance mechanisms such as **Solar-Powered Automated Road Surveillance System for Speed Violation Detection p**owered by a battery array that is charged through solar panels The data communication with the authorized remote station is achieved via wireless communication technology. A dedicated digital signal processing chip is used to exploit computationally inexpensive image-processing techniques over the video sequence captured from the fixed position video camera for estimating the speed of the moving vehicles[3].Also**A Solar-Powered Video Sensor Node For Energy Efficient Multimodal Surveillance**which is a multi-modal video sensor node designed for low-power and low-cost video surveillance, traffic control and people detection based on wireless sensor networks [4].

III METHODOLOGY

The distinctive feature in this set up is the sharable access of the surveillance mechanism. Also it is powered by sunlight rather than typical energy source. The detection mechanism is also two way, one automatic at a certain time interval (80s) other using the infrared detection using PIR sensor (range 10m) [5]. The whole set up is integrated using a Raspberry Pi module. The pictures taken will be uploaded to a web based gallery that will store the pictures according to the date and time. The web platform will be made by using PHP and server will be handled by MySQL. The module will also be able to send SMS alerts to users in case some activity is detected by the camera and the PIR sensor.

Objective of the paper is as follows:

1. Designing a Wireless control of system through Raspberry pi.
2. Live photo and video feed directly uploaded to the server.
3. Power the pi using solar panel.
4. Independent tracker of movement through PIR sensor.
5. Immediate notification through extended SMS feature.

3.1 System Architecture

The Raspberry Pi remains the core of the system at the centre. The power source is a rechargeable battery which I connected to a solar panel through a step down transformer. The webcam is interfaced directly with the Pi module through a USB interface. The Pi module is connected to a database and a web page through a LAMP

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server (Linux,Apache,MySQL,Python). With the help of the lamp server different authorized work stations are able to access the system[4].

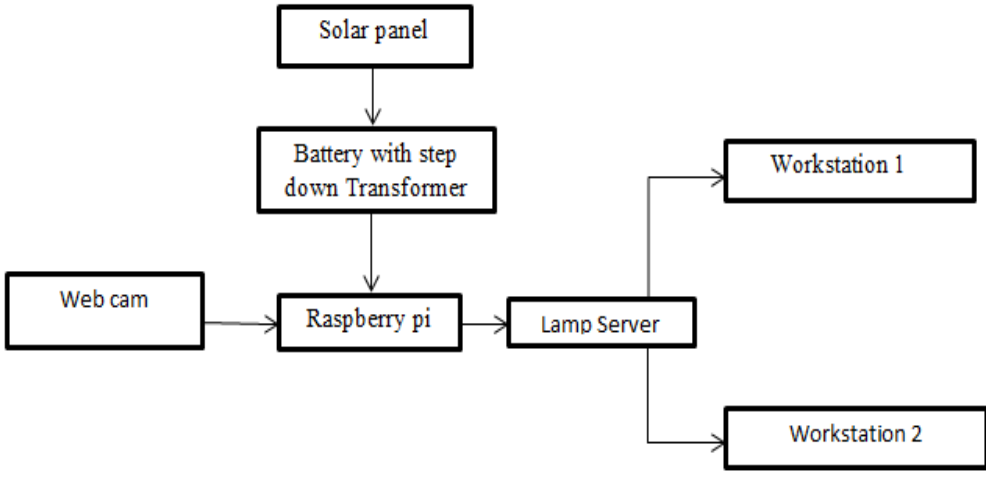

Fig.1 System Architecture Block Diagram

3.2 Hardware Description

3.2.1 Raspberry Pi: The Raspberry Pi is a series of credit card–sized single board computers developed by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools and developing countries. Raspberry Pi include the VideoCore IV GPU, and either a single core ARMv6-compatible CPU or a newer ARMv7compatible quad-coreone ; and 1 GB of RAM . They have Secure Digital (SD) (models A and B) sockets for boot media and persistent storage. The Foundation provides Debian and Arch Linux ARM distributions for download. Tools are available for Python as the main programming language, with support for BBC BASIC (via the RISC OS image or the Brandy Basic clone for Linux),C, C++, Java, Perl, Ruby [6].

The module can be programmed in order to serve an array of services. In the set up Raspberry Pi works as the core module used to interfacing each and every components and implement the specific surveillance functionality. The module runs on Linux and all the functionalities have been programmed using Python.

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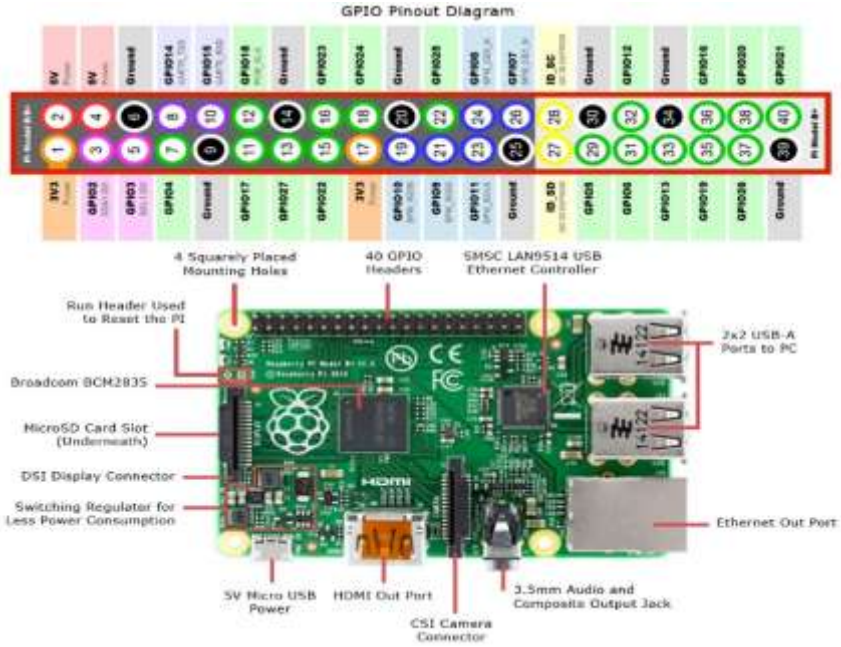

Fig.2 Raspberry Pi Pin Diagram

3.2.2 PIR Sensor*:* PIR stands for Passive Infrared (PIR) motion sensor. All objects whose temperatures are above absolute zero emit infrared radiation. Infrared wavelengths are not visible to the human eye, but they can be detected by the electronics inside one of these modules. The sensor is regarded as passive because it doesn't send out any signal in order to detect movement. It adjusts itself to the infrared signature of the room it's in and then watches for any changes. Any object moving through the room will disturb the infrared signature, and will cause a change to be noticed by the PIR module.

Fig.3 PIR Sensor

3.2.3 Step Down Transformer: A Step Down Transformer is one whose secondary voltage is less than its primary voltage. It is designed to reduce the voltage from the primary winding to the secondary winding. This kind of transformer "steps down" the voltage applied to it. As a step-down unit, the transformer converts high-voltage (12V), low-current power into low-voltage(5V), high-current power. The larger-gauge wire used in the

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secondary winding is necessary due to the increase in current. The primary winding, which doesn't have to conduct as much current, may be made of smaller-gauge wire.

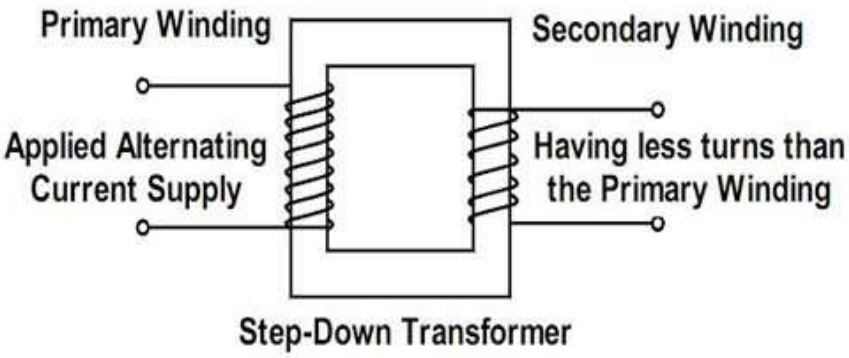

Fig.4 Step Down Transformer

1) ***Solar Panel****:* A solar cell or photovoltaic cell is a device that converts solar energy into electricity by the photovoltaic effect. The collection of solar cells is called a solar panel or solar array. Solar panel is placed on top of the tracker board which absorbs the maximum sunlight which is used as supply to the motors or stored in the battery for future use.

2) ***Camera****:* We have used a general purpose camera with USB integration with pi which has a normal resolution of 1024 x 768. It is a 1.3 Mp camera with a range of 10-30 meters. The camera that we used was just for testing purposes. As a matter of fact any High Quality camera with USB Interface can be connected.

3.3. Software Description:

3.3.1LAMP Server*:* The whole web deployment including the live photo and video feed viewing and server integration is done through LAMP server.

LAMP stack is a popular open source web platform commonly used to run dynamic web sites and servers. It includes Linux, Apache, MySQL, and PHP/Python/Perl and is considered by many the platform of choice for development and deployment of high performance web applications which require a solid and reliable foundation [7].

3.3.2 PuTTY**:** PuTTY is a free and open-source terminal emulator; serial console and network file transfer application. It supports several network protocols, including SCP, SSH, Telnet, rlogin, and raw socket connection. It can also connect to a serial port.

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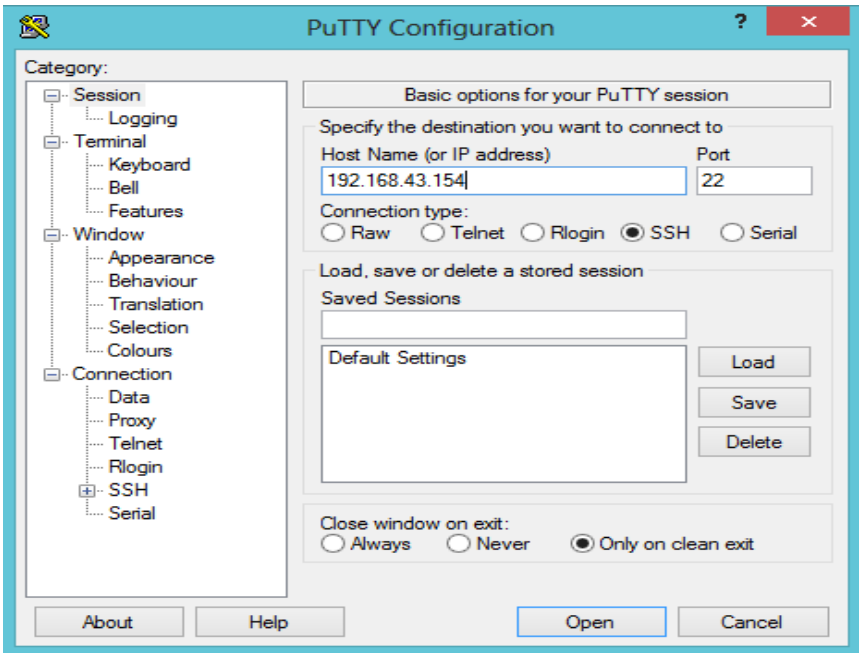

Fig. 5 PuTTY Interface

It is basically a medium for us to communicate with the Raspberry pi device through Shell commands. We send commands to start and stop the set-up suing PuTTY.The programming language used to program the module is Python.

IV RESULTS

The Raspberry Pi module was powered through the rechargeable DC battery which was charged using solar power. The Raspberry Pi Module was interfaced with the webcam and PIR sensor. The module was connected to a secure and reliable internet connection. After the connection we ran two scripts in order to communicate with the device. The first script initiated the functionality of clicking pictures through webcam after every 80s and sending an SMS alert for the same. The second script activated the PIR sensor and initiated the module to click pictures whenever the PIR sensor detected any activity and send SMS alert for the same to the registered mobile user. All the functionalities were working efficiently.

V CONCLUSION

The paper has presented a system for surveillance through the use of Raspberry pi and the implementation of a camera based on this technique can offer smart security as shown through the results. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced computing modules such as Raspberry Pi and sensors and with the help of growing technology, the idea can be implemented in different fields for different purposes.

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