ICCSE'21 International Conference on Contemporary approach on revolutionary Science and Engineering, April 9-10, 2021 ISBN: 978-81-910765-1-6

LOW COST SMART SOLAR SURVEILLANCE USING RASPBERRY PI

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***Abstract*— Nowadays Closed-circuit television (CCTV) surveillance is most needed things in the world. But Closed-circuit television (CCTV) surveillance is pricey. So, this study focused on the design and implementation of a low cost smart solar surveillance camera using Raspberry Pi (RPI) and Open CV. The system was designed to be used inside a warehouse, home residents, and other commercial surveillance. It has human detection and action identification capability that can provide precaution to potential crimes, robbery and differentiate burglar from ordinary people. The credit card size Raspberry Pi (RPI) and USB camera with Open Source Computer Vision (OpenCV) software handles the image processing, control algorithms for sends captured pictures and videos to user's email via internet. A part of its Power supply will provide by solar power source. It gives uninterrupted power to our device.**

***Index Terms*— Raspberry Pi, USB camera, OpenCV, Solar power source, Motion Detection.**

I. INTRODUCTION

Closed-circuit television monitoring system has now become an indispensable device in today's society. Supermarkets, factories, hospitals, hotels, schools, and companies are having their own CCTV system for 24/7 monitoring. It gives real-time monitoring, provides surveillance footage, and allows the authorities have evidences against illegal activities. It is believe that CCTV can deter crimes. Although surveillance camera records video and helps the authorities to identify the cause of an incident such as crime or accident, it is just a passive monitoring device. When dealing with the real-time imaging processing, Open Source Computer Vision (OpenCV) software, a powerful library of image processing tools, is a good choice. A good smart active low-cost camera must also be capable during day and night time.

The need to develop a cost effective surveillance system through innovative technology immensely influenced the development of this project. This project will design and implement a security system based on Raspberry Pi microcomputer. The system should be able to detect motion (intruder), activate a camera to take frames of video after A motion is sensed and then sends an alert to the facility owner through electronic mail plus an image and video attachment. Another aspect of this project is to present an idea of monitoring and tracking of an intruder through the use of a camera. Any object passing through the field of view of camera will be detected then tracked in case the object attempts to move any body part.

II. EXISTING SYSTEM

A smart surveillance security camera system can have many benefits for industrial site, including (Reduced theft, protect employees, building security, remote monitoring of facility from Smartphone or tablet, deter trespassers from attempting to gain access to facility). The problematic for surveillance system or CCTV camera is costly because of the use many expensive components like computer, camera, cable, also we need a hard disk with higher capacity for save video It reserves too much space for continues recording and require manpower to detect the unauthorized Activity. But compare to Raspberry Pi , system is much cheaper with high resolution and low power consumption feature. Which mean it can solve many of the issues of cost that may discourage consumers from investing in remote surveillance technology.

III. PROPOSED SYSTEM

In this project, we are going to implement a Raspberry Pi. It is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse, it is a capable little device that enables people of all ages to explore computing. In this System, the Raspberry Pi executes a Python program that starts when the Raspberry Pi is booted and waits for motion to be detected by the Open CV method. When motion is detected, the Raspberry pi is start records video or snaps a photo and send notification and to the Smartphone through application via Internet.

The main aim of this system is to provide security to our homes and other control applications. Also give uninterrupted power to our device. Because sudden power interrupt of our device cause corrupting of program and

 ISBN: 978-81-910765-1-6

process. In (Fig 1), The hardware module includes Raspberry Pi, wired camera, DC-DC buck and boost, L-ion battery, solar panel. When the buck and boost are use to adjust the power supply to give raspberry. Then solar panel converts solar power to DC power. This power become very less. So, we use boost to increase needed power. L-ion battery is used to backup the power, Then getting continuous power for our device.

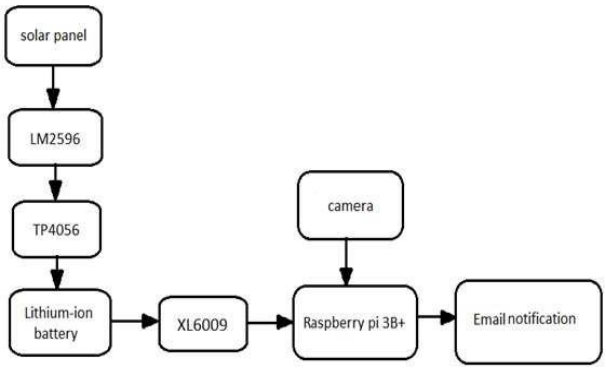

Fig 1: Block diagram of proposed system

IV. SYSTEM ARCHITECTURE

The Raspberry Pi is a credit card-sized computer. The Raspberry Pi 3 Model B+ is an improved version of the Raspberry Pi 3 Model B. It is based on the BCM2837B0 system-on-chip (SoC), which includes a 1.4 GHz quad-core ARMv8 64bit processor and a powerful Video Core IV GPU. The Raspberry Pi can run a full range of ARM GNU/Linux distributions, including Snappy Ubuntu Core, Raspbian, Fedora, and Arch Linux, as well as Microsoft Windows 10 IoT Core.

Powering our Pi using solar power (Fig 2) will allow you to build green Pi projects powered by the sun. And with the right solar panel and battery, our project can also run continuously, forever. We are used

For here, Ohm's Law allows us to provide two values (V, I, W, or Ω) and use it to find the other two values:

I = V/R — Ohm's Law for finding current (I) in amps (A)

By entering the solar panel's output power in watts (W) and output voltage (V), we can derive how much current the solar panel will output .

The XL6009 is a DC-DC Step-up boost converter module which can boost the voltage from 5V to 35V range. The module has a trimpot to adjust the desired output voltage. This module can take an input voltage of between 5 and 32V DC and converts it to an output voltage between 5 and 35V DC. The module uses the second generation of high-frequency switching technology XL6009E1 core chip that offers superior performance over the first generation technology (LM2577).

This TP4056 1A Li-Ion Battery Charging Board Micro USB with Current Protection is a tiny module, perfect for charging single cell 3.7V 1 Ah or higher lithium ion (Li-Ion) cells such as 16550s that don't have their own protection circuit. This Li-Ion 18650 3.7V 2000mAh Battery gives value for your money. It is a single cell, compact and powerful battery cell with 2000mAh capacity. It is very convenient to install in your project to fulfill a 3.7 Volt requirement with high capacity. The overall connection of solar supply shown in fig 2.

The camera supports the latest rasbian version and operating system of the raspberry pi. It used to capture images and high definition (HD) Video. It supports all models of raspberry pi. It is applicable in home security and camera traps of wildlife. It supports different modes such VGA90, 720p60, 1080p30.

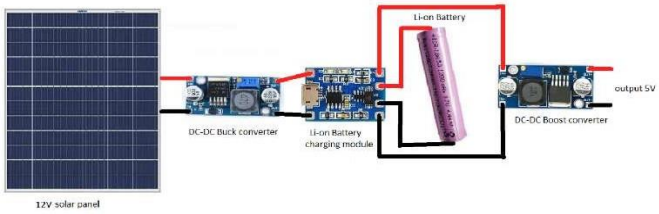

Fig 2: solar supply connection

OpenCV

Python Video Processing Open CV is a very powerful tool used to analyze images and video files. The basic processing procedure to be followed is detailed in the flowchart below. Thresholding as a technique of image processing was chosen for the implementation of motion detection and tracking in video streams. The choice to script using Open-CV – Python was because Python on its own does not support video processing. There is so far no video processing library in Python. Open-CV thus provided the necessary platform to achieve image processing. The following flowchart was used for this implementation

V. MOTION DETECTION

Since the camera used is monitoring at a fixed location, background subtraction algorithm can be used in detecting motion by the concept of frame differencing. Moving objects within a given background can be deduced from the difference of the current frame and a reference frame, often called the "background image" .There are several algorithms that can be used for motion detection like optical flow and edge analysis .There are different types of background subtraction based from the different journals. In choosing the type of background subtraction that will be used in the system, the researchers considered the place where the system will be placed and also the processing speed of the RPI .According to one comparative study, the basic background subtraction has

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the lowest processing speed requirement but it can't be implemented in a complex background environment. The researchers finally choose the basic background subtraction for motion detection due to its low computational requirement.

ALGORITHM:

1. Converting the current frame and the next frame to the gray type.

2. Comparing pixel peer to peer for the first frame with the corresponding pixel in the second frame.

3. Calculate the average of a selected color in frame 1

4. Wait for X seconds

5. Calculate the average of a selected color in frame 2

6. if abs (avg Frame1- avg Frame2)>threshold then motion detected.

7. Save the image as Reference image

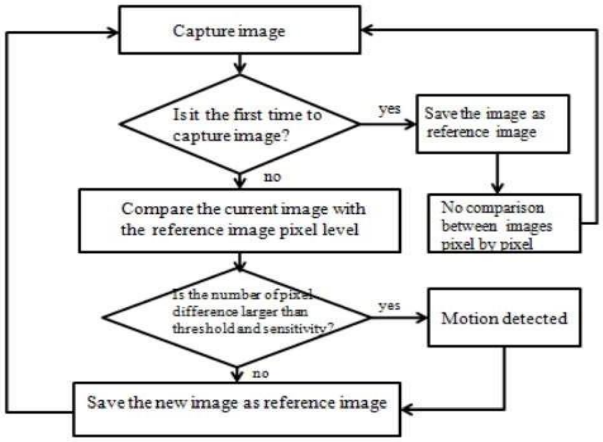

Fig 3: motion detection flow chart

In Motion Detection, the fig 3 shown capture the images and compare first and second images. All images are converted to gray type, because of low data and memory usage and fast action of process.

The OpenCV python package is best for camera programs. This package is coded and loaded to our raspberry pi and process as motion detection. And the system will record full-HD videos, save them on the internal storage packed into Webm file, while the live preview continuous. If there is any motion detected configuring the system to send an alert to the predefined subscriber, it was then necessary to generate and send the mail. Multipurpose Internet Mail Extension (MIME) package was then called and used to generate the attachment. MIME supports characters other than ASCII, non – text attachments (audio, video and application programs) etc. It thus extends the format of an email. Simple Mail Transfer Protocol (SMTP) program was then used to deliver the email from the Raspberry Pi to the configured mailhub.

VI. IMPLEMENTATION

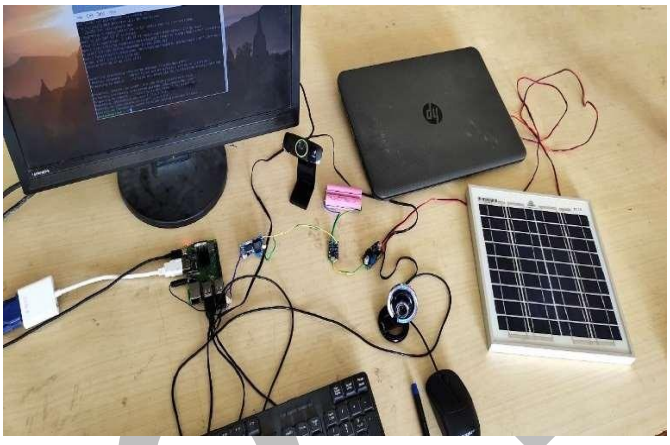

Fig 4: Overall device Setup

In fig 4 shown overall setup of the raspberry pi surveillance and connection setup. Solar power supply is given to the raspberry pi. Also camera connected to raspberry pi.

In our project, we can implement the Motion Detection algorithm for monitoring the camera system from remote end with the use of Internet. When motion is detected by the camera then it captures the image of an object and immediately sends to the email of the user through Email server. And it records the video that is happening in the surveillance area then it is directly uploaded to the user cloud server and store internal memory. Live streaming on any web browser can be accessed in the cloud server and send video link to user email address, from the raspberry pi. The images captured by the camera should be processed very fast to provide real time visualization of environment to the user

In fig 5 shown that Experimental results of receiving Email to the user, when motion is detected. This email is sending from the authenticated Gmail account of raspberry pi.

 ISBN: 978-81-910765-1-6

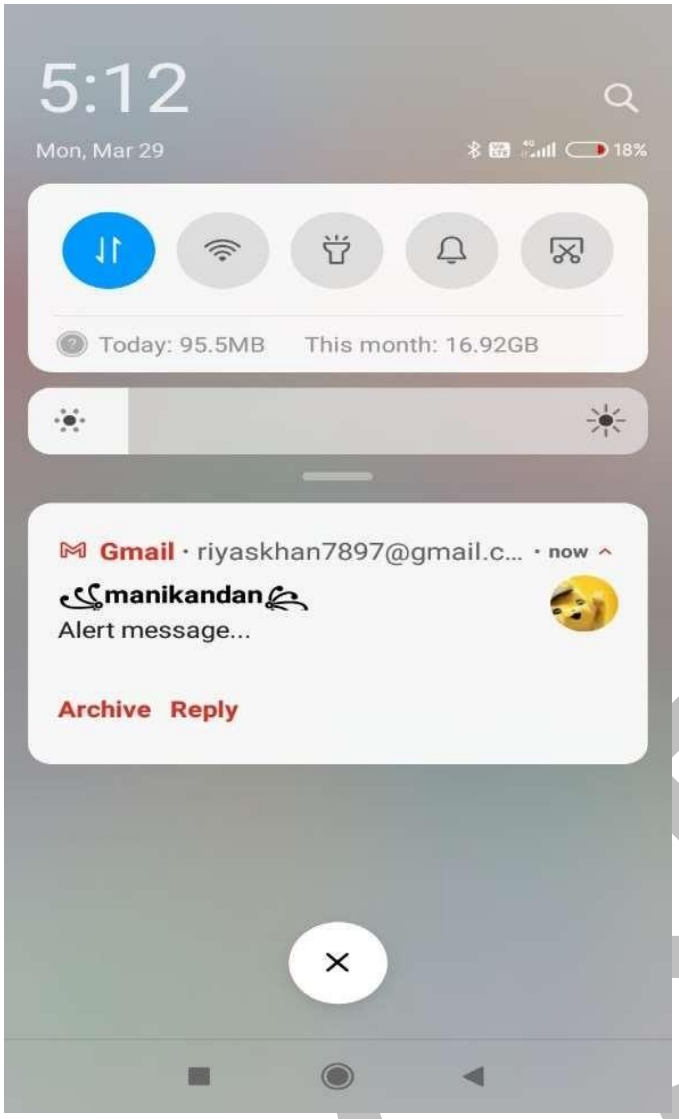

Fig 5: e-mail Notification

VII. CONCLUSION

An approach for the smart solar surveillance systems significantly contribute to uninterrupted power supply, which prevent corrupting of operating system in raspberry pi. Thus, we designed a smart surveillance system capable of recording/ capturing video to alarm notification a smart phone. it may be used and supports many persons concerned to view the details, Necessary action can be taken in short time in the case of emergency conditions. For instance, at one scenario it can be used by any person working in industry to be aware of the activity being happened at their own working places, it can be used for spy purposes at bank lockers, storage houses. military areas, smart homes, bank, offices, industries etc.

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