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Prototype of Border Surveillance System

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***Abstract*—** Defence of any country requires proper surveillance of its border to counter attacks of other countries. However, Indian terrain does not allow manual surveillance due to rugged terrain and extreme weather conditions. It is required to create a remote monitoring and a surveillance system for distant monitoring and attacking. A proper and appropriate intelligence through surveillance could help combat enemies and terminate the threat. The proposed project aims at creating a pan-tilt camera surveillance system with features of object detection and weapon trigger controlled manually from the control room situated far away.

Keywords— Image processing, Pan and tilt camera, Arduino uno.

I. INTRODUCTION

The projects qualify as an innovative approach to combine a vivid set of hardware system to a stimulating programming software to create an automation system that can carry out a set of vivid yet precise actions. In short, the project is divided into two specific parts namely the hardware part and the programming part, co-joined together to form a single system. The hardware of the project involves creation of an almost 180° rotatory platform with two degrees of freedom in a cost-efficient manner. The project focuses on the controllability of the platform to provide precise rotations for linear operations, the goal being reduced cost with maximum efficiency. Pan-tilt (PT) cameras are one of the advanced security cameras in the market. These cameras have the ability to cover a very far field and can acquire high resolution of images. These cameras are deployed mainly for perimeter surveillance applications where the security guards have to monitor the intruders from a long distance. Although there are intrinsic advantages of using pan-tilt cameras, their application in automatic surveillance systems is still scarce. The difficulty of creating background models for moving cameras and the difficulty of optical geometrical projection models are key reasons for the limited use of pan-tilt cameras.

The other aspect of the project revolves around the programming module. Including the programming of rotation of platform, the main aspect of the programming module is to characterize the functioning of object as per the type of object placed. For example, if the object placed is a camera, functions such as image processing including environment acquisition and/or target acquisition can be obtained. If a laser is mounted on the platform, significant actions may take place.

Main advantages of video surveillance

1. Availability- There was a time when the surveillance techniques were utilized only in shopping centres and malls. Now-a-days, you can notice closed-circuit televisions almost at any place you visit, from a small store to homes and holy places. As a result, they guarantee greater public security at a fraction of the cost.

2. Real-time monitoring Traditionally big organizations have always had the benefits of video surveillance manned by security professionals. In the past times, the capturing and transmission used to take time. But, modern technologies let users to check and reply to alarms immediately.

II. LITERATURE REVIEW

After the Independence of India, the inter border activities have been a great concern for security

forces of the nation. Due to the uneven terrain and adverse topology and climate of the border areas, it becomes a great challenge for continuous human surveillance and prevent illegal intrusion by the hostile forces. For these various technological advances have been developed such as CCTV (Closed Circuit Television) developed by Siemens AG at Test Stand VII in Peenemunde, Nazi Germany in 1942 for observing launch of V-2 rockets.

At that time, the device was large and had many wires. With due course of time, the device size reduced and the device was made wireless through various new technological advances such as satellite communication and GSM module. But still manual surveillance and elimination is not possible and is risky for the lives of our soldiers. Since the CCTVs are stationary they are merely used to monitor the video captured. They have zero degree of freedom and cannot rotate. This limitation helps the hostile forces to deploy tactical measures to breach our defence barrier making a way for infiltration.

Recent terrorist activities in India such as Uri. Pathankot, Pampore and Baramula attacks have revealed the lack of intelligence and efficient surveillance and threat elimination system. This makes the precious lives of the soldiers vulnerable causing hundreds dead. We have lost our brave soldiers to this defect, and this has tarnished the image of the nation raising questions on our technical ability.

Our project takes the inspiration from this drawback and proposes a small and efficient solution to the problem trying to create a difference in the security outlook of the country. This project would be beneficial for the armed forces and various security services where lives are at stake.

It proposes an arrangement of pan and tilt motion provided by motors giving a 180 degrees horizontal and vertical view- a two degrees freedom. Above this arrangement we propose to place a gun and a camera which would be controlled from the control room by an operator who can view the situation of ground zero through the camera. Our project facilitates him to lock the target and trigger the weapon as per requirement and wisdom. This would eliminate the target with constant surveillance. It would reduce causalities of our brave warriors and reduce human error creating a better defence barrier outline on the border.

III. CONCEPT

The basic concept behind the system can be summarized as a remotely controlled rotating platform that can rotate vertically as well as horizontally and can be equipped with various tools as per the requirements.

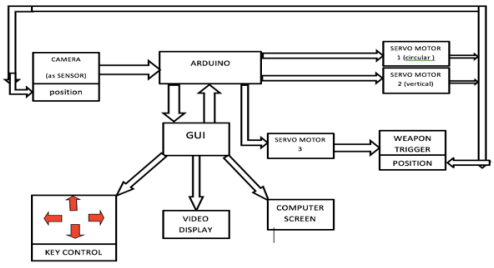

Figure 1: Surveillance system block diagram.

The system consists of two servo motors of preferably equal torques that facilitates the horizontal as well as vertical movement of the system. This structure helps the movement of the platform in any direction. These servo motors are attached to the arduino which communicates with the user interface and hence helps in powering as well as timing the servo motors. The arduino services a user interface which can be interpreted as a remote controlling of the motors by the user until the specific action is triggered. This action can be triggered in the form of Graphical User Interface or keystrokes and helps facilitate the movement of platform.

COMPONENT USED

A. Hardware

In the development of Pan And Tilt system, Arduino Uno as microcontroller, camera, Laser and wooden platform were used.

1) Arduino

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it

to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

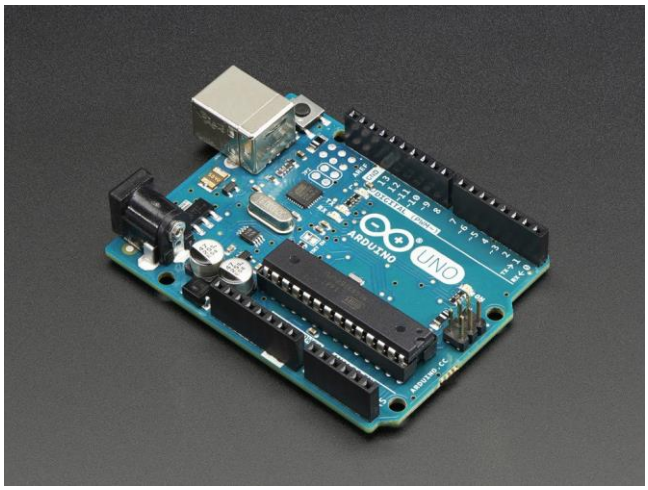

Figure 2: Arduino Uno

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack.

CPU	8bit ATmega328	32bit STM32F051C8T6
SRAM	2 KB	8 KB
FLASH	16 KB	64 KB
EEPROM	1 KB	None
Input Voltage	7-12V	7-24V
Digital I/O Pins	14(6*PWM)	14(6*PWM)
Analog Input Pins	6	6
Clock Speed	16 MHz	48 MHz
Grove Interface	None	4
I2C Interface	1	2
UART Interface	1	2
Touch Key	None	3
Size(L*W)	68.6 * 53.4mm	83.8 x 53.4mm

Figure 3: Arduino Uno specification table

Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

2) *Laser*

A **laser** is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation. The term "laser" originated as an acronym for "light amplification by stimulated emission of radiation". The first laser was built in 1960 by Theodore H. Maiman at Hughes Research Laboratories, based on theoretical work by Charles Hard Townes and Arthur Leonard Schawlow. A laser differs from other sources of light in that it emits light coherently. Spatial coherence allows a laser to be focused to a tight spot, enabling applications such as laser cutting and lithography. Spatial coherence also allows a laser beam to stay narrow over great distances (collimation), enabling applications such as laser pointers. Lasers can also have high temporal coherence, which allows them to emit light with a very narrow spectrum, i.e., they can emit a single color of light. Temporal coherence can be used to produce pulses of light as short as a femtosecond.

Figure 4: Laser

Among their many applications, lasers are used in optical disk drives, laser printers, and barcode

scanners; DNA sequencing instruments, fiber-optic and free-space optical communication ; laser surgery and skin treatments; cutting and welding materials; military and law enforcement devices for marking targets and measuring range and speed; and laser lighting displays in entertainment.

3) *Webcam*

A **webcam** is a video camera that feeds or streams its image in real time to or through a computer to a computer network. When "captured" by the computer, the video stream may be saved, viewed or sent on to other networks via systems such as the internet, and emailed as an attachment. When sent to a remote location, the video stream may be saved, viewed or on sent there. Unlike an IP camera (which connects using Ethernet or Wi-Fi), a webcam is generally connected by a USB cable, or similar cable, or built into computer hardware, such as laptops.

The term "webcam" (a clipped compound) may also be used in its original sense of a video camera connected to the Web continuously for an indefinite time, rather than for a particular session, generally supplying a view for anyone who visits its web page over the Internet. Some of them, for example, those used as online traffic cameras, are expensive, rugged professional video cameras.

Figure 5: Webcam

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