Catercam - A Sliding Camera Mechanism Using Gimbal Assembly

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ABSTRACT

In the current era of 21st century, technocrats focus on building more efficient, compact, power efficient and cheap substitute for technology presently used.

A CCTV camera is a widely used product for surveillance, but many times just to cover a small area it is required to have more than one camera at the same place viz. a parking space which requires 180 degrees coverage or a 'U' shaped road requires at least two cameras to have a complete footage of the sector area. Similarly for recording a remote area which is seldom used. Furthermore, in some areas cameras are installed to work for just a small amount of time for viz. CCTV in the classroom to check how many students were present in the class.

Adapting this technology will reduce the number of camera units used in a particular area, work of maintenance department and more over a huge amount of energy is saved which can be utilized for villages where people face scarcity of electrical energy.

KEYWORDS: *Catercam, Gimbal Assembly, CCTV Technology.*

1. INTRODUCTION

1.1 OVERVIEW OF THE SYSTEM

A Catercam is a sliding camera mechanism which gives a movement to the camera which initially used to be stationary. This dynamic camera is hence a transformation of the video recording and CCTV footage technology. A Catercam allows a camera to move in either direction of the rod on which it is assembled with the help of DC motor, servo motors or gimbal is used as an intermediate to give a highly stable video footage. The movement of the camera can be programmed to continuously cover a particular area at a particular time or can be manually controlled by remote sensing.

The project mainly focuses on implementing a cost and energy efficient camera system using NODEMCU which gives a far more convenience over the traditional use of ARDUINO (UNO/micro). Nodemcu provides us with a combined Wi-Fi and Bluetooth module in a single unit where in Arduino separate unit is to be purchased for each application which any how increases the cost.

More over the power required for each unit of Arduino is greater than Nodemcu Further the size of Arduino is as well greater than Nodemcu. Having less no of pinout is a sole limitation of Nodemcu.

1.2 PROBLEM STATEMENT
A CCTV camera is a widely used product for surveillance but many times it just to cover a small area; it is required to have more than one camera at the same place. For e.g. a parking space which requires 180 degree coverage or a 'U' shaped road requires at least two cameras to have a complete footage of the sector area. Similarly for recording a remote area which is seldom used. Furthermore, in some areas cameras are installed to work for a small amount of time for e.g. CCTV in the classroom to check how many students were present in the class sometimes between two buildings of a society there arises a problem for the camera on top to take a complete shot of the intersection between them. Drone camera is suggested to take the Ariel view but the footage is not that stable due to flowing wind and most of the drone battery can work maximum for 15 to 25 minutes, also recharging is required,

Fig 1: Surveillance CCTV

The figure above shows the current status for covering the surveillance of a semi-circular or 'U' shaped road.

1.3 OBJECTIVES
The solution to all the above problems can be achieved if the camera is movable by manual transmission or automatically programmed movements. Catercam is an instrument based on sliding camera mechanism which allows a camera to move in either direction of the rod on which it is assembled with the help of DC motor, servo motors or gimbal is used as an intermediate to give a highly stable video footage. The movement of the camera can be programmed to continuously cover a particular area at a particular time or can be manually controlled by remote sensing.

1.4 LITERATURE SURVEY

A. IP-CCTV the next generation of CCTV technology
The Next Generation's Surveillance Technology by Emily Robinson published on July 06, 2011 stated that CCTV cameras are used only in high profile events. Indeed this may be the Fact in the days to come. They are made compulsory by the government also avoid any miscreant's problems and untowardly incidents. These modern day tools if properly put into use can do wonders in the area of security. This article is related to the present study because the researchers believe that CCTV is a very useful tool to solve problems in the society because it serves as credible evidence.

B. Master thesis by Martin Orijas on UAV stabilized platform
The study is an about stabilized camera in UAV i.e. unmanned Ariel vehicles.
The work develops a performance analysis for a particular distribution of initial sensors implemented of prototype stabilized platform for UAV aircrafts the device used to stabilize is a 2 axis gimbal inner and outer gimbal axis there have been attached array of optical and electrical sensors gyroscopes are planned to sense the angular rates of the highly nonlinear coupled system in addition of the performance for different disturbance frequency and performance parameters.

Fig 2: Normal Axes of Gimbal

2. SYSTEM DESIGN

2.1 BLOCK DIAGRAM
Below diagram represents the major components of the Catercam system. Each block includes circuits or components

Fig 3. Basic Illustration of Catercam

2.2 WORKING
As the name suggests a working Catercam will glide on the attached rod and will give a dynamic motion to the terminal camera. Power supply being the essential requirement for any system to work is supplied to each of the internal unit (receiver, controller, driver, and stabilizer) of Catercam. The receiver extracts power from a source which enables it to receive the transmitted electromagnetic signal which may be transmitted from Bluetooth or Wi-Fi transmitter module. The signal hence received is converted into an electrically excited signal and give to the controller (Nodemcu in this case)the controller converts an electrical signal into binary format internally and performs the required arithmetic and logical calculations and the synchronised signal is passed accordingly to camera stabilizer and motor driving circuit. Hence the required output motion which can be manually controlled movement (forward, the backward movement of camera /360º motion of gimbal attached camera) or automated programmed movement can be achieved. The recorded footage is transmitted from the camera to the display in control room through electric cables or wireless trans receiver.

3. SYSTEM SPECIFICATIONS

3.1 Power Supply
A power supply is an electronic device that supplies electric energy to a load. The primary function of a power supply is to convert one form of electrical energy into other and as a result power supply is sometimes referred to as electric power converters. Some power supplies are discrete, stand-alone devices, whereas others are built into larger devices along with their loads. The types also include fixed, variable and dual power supply.

3.2 Driver Circuit
A motor driver IC is an integrated circuit chip which is usually used to control motors in autonomous robots. Motor driver ICs act as an interface between microprocessors in robots and the motors in the robot.

The most commonly used motor driver ICs are L293D series. These ICs are designed to control 2 DC motors simultaneously. L293D consists of two H-bridge. L293D has 16 pins as follows:

4 ground pins.

4 input pins.

4 output pins.

2 enable pins and 2 voltage pins.

Instead of L293D relay driver can also be used. The switching occurred in relay circuit is more efficient than L293D module, the only disadvantage of relay circuit is a heating problem. But the switching frequency is much higher than L293D.

3.3 DC Motors and Servos

The Geared DC motors of 60 RPM are used in Catercam. Also, 27 gram Servo motors are used. These motors are interfaced with the microcontroller using driver circuits.

3.4 Camera and Gimbal Assembly

A CCTV camera is a video camera that feeds or streams its image in real time to or through a computer or 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 email as an attachment. When sent to a remote location, the video stream may be saved and/or viewed. Unlike an IP camera (which connects using Ethernet or Wi-Fi), a CCTV camera is generally connected by a USB cable, or similar cable, or built into computer hardware, such as laptops. The purpose of CCTV camera is to capture surveillance footage and store its image in memory. A gimbal is used for more stable footage from the camera. Gimbal can be manually controllable or autonomous. Catercam is suitable for both types Gimbal.

3.5 Receiver Module

In Catercam we can use RF module or nRF module or Bluetooth Module. The nRF and Bluetooth are most suitable for our application. The controlling is done by mobile phone or portable controller module.

3.6 Controller

The **ESP8266** is a low-cost Wi-Fi chip with full TCP/IP stack and MCU (Microcontroller Unit) capability produced by a Shanghai-based Chinese manufacturer, Espressif Systems.

The chip first came to the attention of western makers in August 2014 with the ESP-01 module, made by a third-party manufacturer, Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style command

The **ESP8285** consists of 1MiB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi.

4. ALGORITHM

Following steps shows the working of Catercam:

➢   At the idle condition, the camera is in a motionless state.

➢   Input given from controlling device or transmitter or transponder, the signal is received at the reception side.

➢   According to the received signal, direction of the motor is decided.

➢   Due to the motion of the motor, the linear direction is set.

➢   As the signal coming from transmitter stops, Catercam remains stationary.

➢   Again, if the signal is provided, operation continues from the last position.

5. CONCLUSION

The idea is to build the Catercam which can be controlled using automated or manual transmission along with the advantage of being wireless. The compact size of NodeMCU, more reliability, usage of gimbal assembly and avoiding the usage of laptop/notebook pc for controlling is an added advantage to this technique. Using this technique it is possible to control the camera using signal taken from mobile as input and move it accordingly. In summary, this technique can replace the existing quantity and quality of security cameras in an economical way.

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