Security Integrated System Using 3 DOF Robotic Lamps Along With SMS Alert

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Abstract: **This paper proposes Global System for Mobile Communications [GSM] based security system and automatic lighting system by using 3 degree of freedom [DOF] spherical type Robotic lamp. This integrated security system can provide motion in 3 directions for illuminating, tracking and capturing the movements of the human in confined area as well as to send an additional SMS alert to the concerned authority .The robotic lamp consists of three stepper motors for controlling the direction of orientation and also to control the intensity of light by zooming in and out. Also, it has infrared sensor to identify the location of person. The actuation of motor is done using microcontroller based system. When sensors of the security integrated system detect a person, signals are transmitted to the microcontroller to control the actuation of the motors, and sends SMS to the mobile number through the GSM. Lamp will illuminate, track and captures the movements of the human body. The two major functions of this integrated system are illuminating, tracking and recording the exact location of a person in the security enabled area and instantaneous sending of SMS alert to the concerned telephone number. ,**

Keywords: **3 degree of freedom [DOF] spherical type Robotic lamp, Global System for Mobile Communications [GSM] based security system , additional SMS alert.**

1.   INTRUDUCTION

Security is primary concern to everyone. Security SMS alert system that can used to monitors in industries, banks, offices, government sectors with the help of Passive Infra Red [PIR] sensors. There are many types of sensors are available in the market, PIR sensor, Ultrasonic sensor, Laser scanner, position sensing device etc. which can detect the person. PIR sensor detect the human body by measuring the body temperature and identifies the obstacle and human body[1],[2], and PIR sensor is not suited for real time operation[3]. A laser scanner –measure the distance between the sensor and objects [4],[5], and light is not affected to measure distance between sensor and object.[6], so it is help to detect the moving objects. In this project PIR sensor is used to detect the human body movement.

The GSM based security system is developed to build a security system for a home/office/Industry to prevent the other persons to enter into the important room/chamber by sending SMS through GSM to alert the person. GSM, which stands for Global System for Mobile communications, reigns (important) as the world's most widely used cell phone technology. The importance of the robotic lamp is to illuminate the person. LED lamps are used because it requires less power and brighter than incandescent lamp. Breazeal and Hoffman [7] proposed a table-mounted robotic lamp, which has 5-degree-of-freedom (DOF) serial type of arm and lights a human face or tracks human gestures. It also has a movable aperture that can change the width of the light. However, because this robot tracks a person using a camera, there is a time delay due to image processing even with a fast processor(e.g., $2\times$ Dual 2.66 Hz Intel processor).This type of serial robot is large and heavy and has a high inertia and deflection. Thus, it is difficult to install on a ceiling or wall. Lee *et al.* [8] proposed a 3-DOF robotic lamp. This robot tracks the position of one person inside a room with the aid of a PIR sensor.

In this paper, we propose a ceiling-mounted 3-DOF robotic lamp to realize an automatic lighting system to track and illuminate the person with the help of PIR sensor and captures the activity of the person inside the room as well as it sends

SMS alert system which provides security system to the office, home, banks, any government sectors etc. It is designed using a light and compact spherical parallel mechanism. Because the robotic lamp is a hemispherical shape, it is suitable for installation on the ceiling. This paper is organized as follows: The robotic mechanism and its design are introduced in Section 2. Section 3 describes the architecture of the automatic lighting system. Section 4 describes the experimental work. Finally, we draw our conclusions in Section 5.

2. ROBOTIC LAMP CONSTRUCTIONAL DETAILS

The constructional details of robotic lamp are depicted in Figure 1. Two parallel guide linkages are used to provide tilting motions for the lamp to track a person. The two stepper motors are used to provide the tilting motion using these two guide ways and the zoom-in and zoom-out motions are created by a bevel gear set, along with screw transmission operated by the additional motor provided in the system.

The Motor was chosen by considering the speed of a person in daily life which may be is less than 1 m/s. The maximum speed of the tilting motions is 1.3 rad/s. Therefore, if the robotic lamp is installed at a position higher than 1m, it does not have the speed problem. The maximum torque of motor was selected so that it is able to cope with an expected dynamic motion of the robotic lamp. Figure 1 also shows the side view of the robotic lamp and its sub- systems including a lamp module, parallel linkage, and a base frame with actuators.
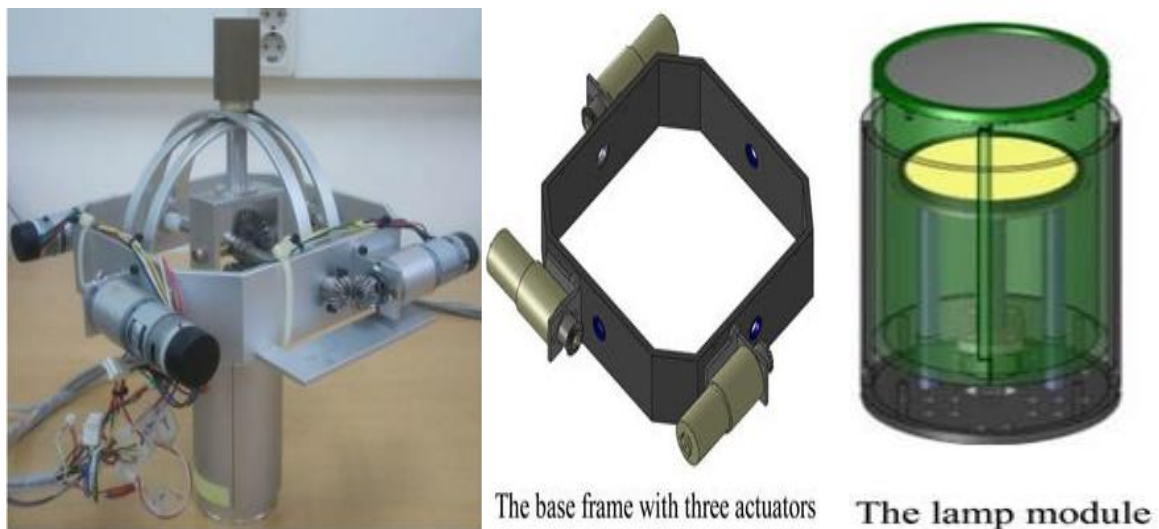

The base frame with three actuators   The lamp module

Figure:1 construction of 3DOF robotic lamp

There are several features in the robotic lamp. Using the spherical-type parallel mechanism, the two actuators are used to create the tilting motion and one motor is used for the zoom in and zoom out motions. The parallel linkage can operate the guide axis of the robotic lamp without applying any additional force to the guide linkage.

3. ARCHITECTURE OF THE AUTOMATIC TRACKING SYSTEM AND SMS ALERT SYSTEM.

3.1. Lighting system:

The automatic lighting system is consists of one robotic lamp, PIR sensors, motion control board, and microcontroller to manage the whole system. Robotic lamp tracks and lightens each person. Microcontroller, sensor and motion control board communicate each other through the RS-232. PIR sensor is detects the position of people. Data on people positions are gathered and transferred to the microcontroller. The microcontroller then transferred 8 bit digital signals to the diver, which is designed to control at most two motors simultaneously. Therefore, the three desired direction of one robotic lamp is controlled by two drivers. Figure-2 shows the block diagram of the robotic lamp.

PIR sensor:

PIR sensors allows to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in home businesses.
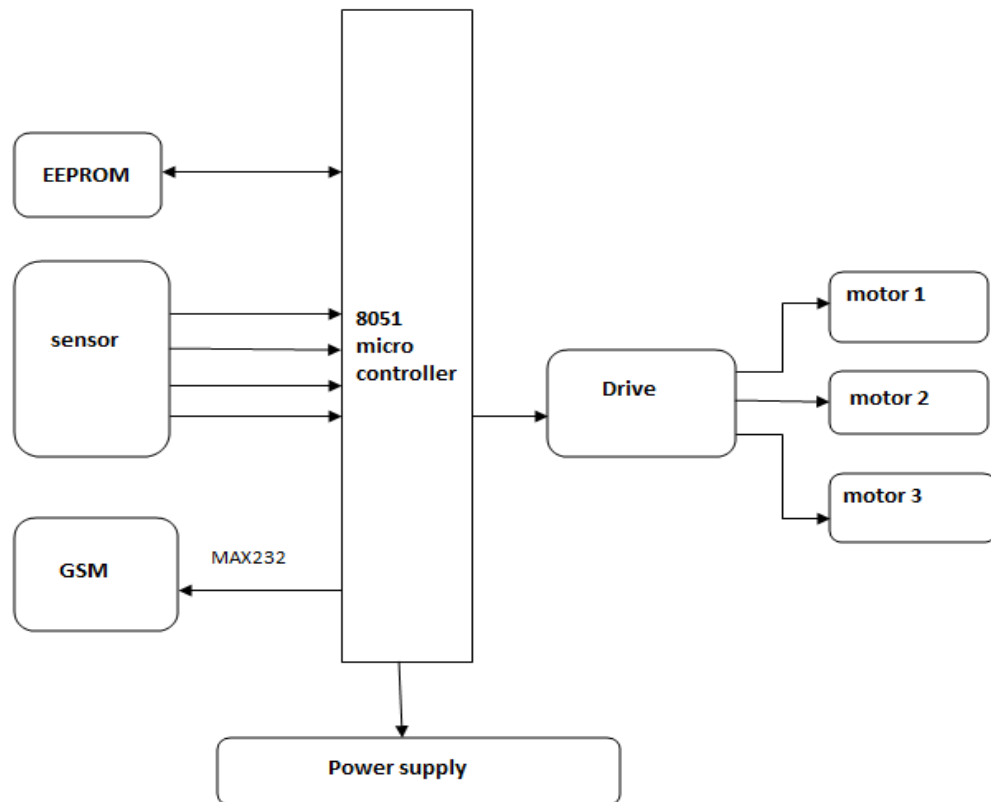
Figure:2 Block diagram of integrated security system

Microcontroller 8051:

8051 Microcontroller is a 40 PIN Integrated Circuit and is popular 8 bit microcontrollers and has an instruction set that enable coding of tiny, I/O intensive, application with large Program Memory that it is possibly to be used with C. Greatly used in embedded systems. The designation for this family is MCS51.The microcontroller was build using NMOS. However the version recognized by a C (80C51) use CMOS. It has an instruction time of 1µs (at 12 MHz) newer one may perform 40 instructions per 1µs at 40 MHz.

GSM (Global System for Mobile communication):

GSM, which stands for Global System for Mobile communications, reigns (important) as the world's most widely used cell phone technology. Cell phones use a cell phone service carrier's GSM network by searching for cell phone towers in the nearby area. Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication.GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band.

3.2. Methodology:

This security system is developed with aims to improve security systems available in current market. This project claims to produce a prototype 3-DOF robotic lamp with camera and global system for mobile communication (GSM) interfacing system for office, banks, home, industry and any government sector security.

This system uses PIR (passive infrared receiver).The PIR function is to detect changes in temperature of human in infrared radiation. The microcontroller 8051 is used, where it sends signal to motion control board to activate the 3-DOF robotic lamp and camera when the microcontroller receives signals from PIR sensor. To develop software for 3-DOF robotic lamp to the control motion of the actuators embedded c coding is used. Once the 3-DOF robotic lamp is activated it will start to illuminating and tracking the person and camera will start recording movement of the person. At the same time microcontroller send signals to the GSM and sends SMS to the mobile phone, sending process will automatically operate.

4.   EXPERIMENTAL SET UP

4.1.Tracking and illuminating by robotic lamp:

3-DOF robotic lamp was installed on the ceiling. When sensor detects the person LED lamp was activated and starts tracking and illuminating the person. Three motors are used in the system, in which two are used to control the actions of the lamp and helps to track the person and one more motor is used for to control the zoom in and zoom out motion. And camera is installed in between the LED lamp to capture the image and activities of the person. When person is entered into the room sensors are detected person at the same time microcontroller collects the data and send signal to the drive to start the motor and robotic lamp get activated as well as microcontroller send signal to the GSM for to Send SMS to the mobile number which are stored in the EEPROM. Figure 3 shows ceiling mounted robotic lamp.

4.2.Zoom-In and Zoom-Out Motion:

The zoom motion is changed continuously according to the distance between the robotic lamp and a person. For example, when the person is far from the robotic lamp, the zoom-out motion is used to focus the light on the person. The intensity of the light gets stronger to light the person at a greater distance. Figure- 4 shows the zoom-in and zoom-out motions of the robotic lamp.
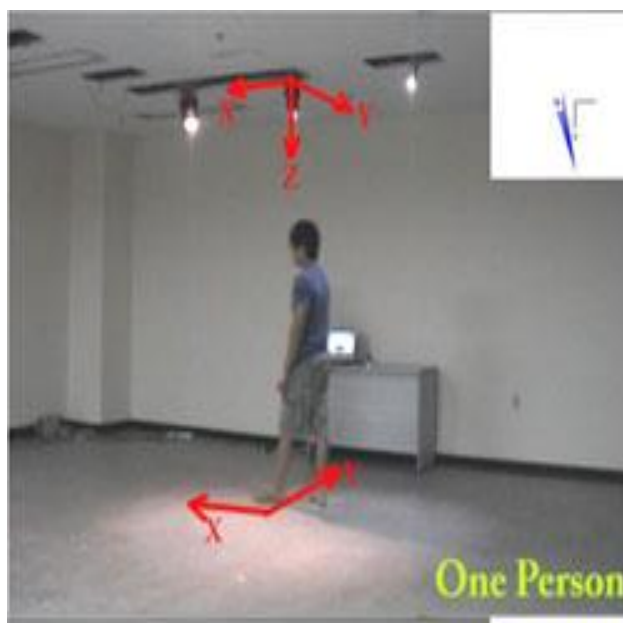

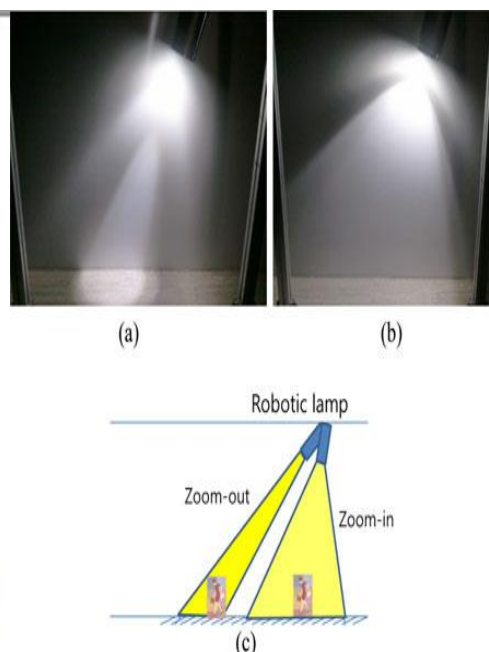**Figure.3 Human tracking robotic lamp(Dae- Keun Yoon,2014)**   **Figure 4. Zoom in, zoom out motion (Dae- Keun Yoon,2014)**

5.   CONCLUTION

The security integrated system using 3-DOF robotic lamp for security application with SMS alert system was designed to provide high security to the industries, banks, office and any government sectors. A robotic lamp with three DOFs creates the tilting motion for tracking, lighting and capturing the activities of the people and the zoom-in and zoom-out motions to control the intensity of the light. It sends SMS to the cell phone to alert.

 This research work was studied and implemented as a complete working model using microcontroller. The programming and interfacing of microcontroller was implemented for the successful operation of the security system. Also, this research includes the study of GSM modem by using sensor. This research involves the application of using PIR sensor for getting the acknowledgment from GSM modem to our mobile numbers which are stored in EEPROM and GSM network operators have roaming facilities. User can also get SMS alert to their mobile phones, when they travel overseas.

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