Method Article

Microcontroller based intruder lighting system (MBILS)

Abstract

The microcontroller Based intruder lighting system is a design that applies automated lightens system in homes, offices, industries, military etc. The project will feature microcontroller based intruder lighting system that will illuminate environment in the presence of an intruder in restricted area and also inform the user about the position of the intruder.

The microcontroller AT89C51 and other electronic design were employed to achieve the above stated purposes. The interfacing medium will make use duplex communication. The sensors (Light Dependent Resistor and LEDS) will receive the signal when the intruder is around while the control program will translate the received signal from the sensors to useful information about the function of the camera and lighting system. The design is to achieve energy saving techniques and increase security strength of target environment.

Keywords: Intruder, Light dependent resistor, duplex communication, control program

Introduction

There was various research works on intruder systems on difference technology. This designing of microcontroller based intruder system is based on the simple Boolean logic concept that a sensor's switch contacts can be either open or closed [1].

The need to secure home, industries and other related properties has been a major priority of our target, since then, an aggressive development of technology in the area of security has exponentially been driven to today's trend.

A system cannot have high assurance if it has poor security and requirements in its design. For maximum assurance, systems will logically include security protocol requirement as well as availability, reliability and robustness requirements to satisfy prototype system design [2].

The intrusion techniques required logistic workflow with the implementation of intruder lighting system outgrows the then security measures and more values added to lives and properties, are sophisticated measures were developed to ensure an intruder lighting system proof environment. In recent days, has become one of the most interesting aspect of individual, National and even international concern. There are three procedure to people take to create a home intruder system before adding any special technological components. (1) Install exterior lights and include either a timer or a motion detector (2) Secure all exterior doors and windows with well-built, sturdy locks (3) Trim back trees and shrubs in the yard, especially around windows and doors, Some home intruder system tasks are easy and fast projects to install for the fact that is can offer paramount security.

Looking at trend of technology, there are different kinds of home intruder systems technology which based on dynamic system protocols, among were the basic types of components:

i. **Wireless Security Alarms** A wireless security alarm offers user good coverage. This suit for a home intruder system that will stop intruders before looping entrance and summon help immediately; ensure home protection is absolutely safe.

ii. **Micro computer based security system**

This system senses the presence of an intruder and alerts the user on the obstruction detected, it also displays the position of the intruder on a screen.

iii. **Motion Sensor Lights**

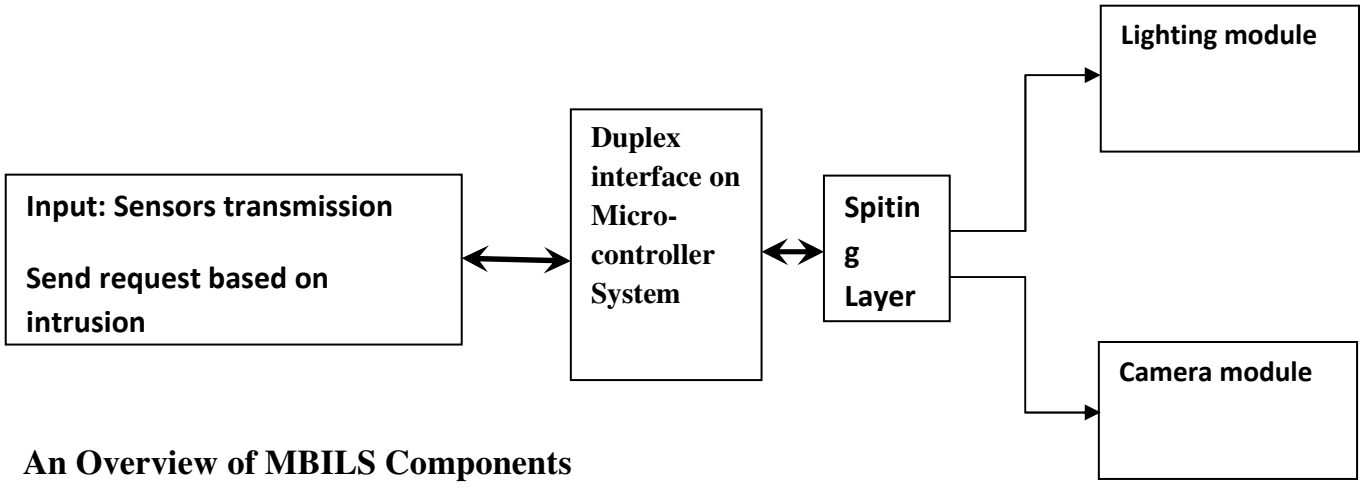
Motion sensor lights system make intruders react like a deer in the headlights. It is difficult to break into a home when there is a spotlight shining down right on user.

iv. Access Control Gates: This technology makes it hard for the intruder to even penetrate property, let alone into house, by surrounding home with a high fence and installing an access control gate. An access control gate gives specific points of entry onto user properties, and this can be monitor from inside [4]. A gate allows user, family, and friends to come and go, but says "NO!" to intruders on striction based. It's a home intruder lighting system sage energy and that keeps criminals further away from family and properties.

The MBILS Device Framework

MBILS devices framework is an evolutionary interface modules that render full duplex communication using microcontroller device. This will be described in precise using block segment as it's interfaced on framework.

Figure 1: An overview of the internals of a MBILS network.



An Overview of MBILS Components

From the figure 1 above, the microcontroller operating di-directional mode as seen at the centre of design receiving the input from intelligent sensor as well as output to the other peripheral components (camera module and light module). The block diagrams consist of three stages, which are:

Sensor Module

The sensor module consists of the touch sensor, the light detector and the darkness detector. Each of these alarm sensing units make up the different type of intruder detection system incorporated in this design.

The input transducers (sensors) vary their resistance and in most case, voltage divider is used to convert this to a varying voltage. The voltage signal in this design fed as an input into a NPN (C945) transistor switch [5].

Selection of resistor value

The output voltage depends on resistor (R) values. Using a millimeter to find the minimum and the maximum values of the sensor's (LDR) resistance(Rmin*Rmax).

In this context: Rmin = 1.50Kohm

Rmax = 560kohm

Note: SQRT = Square Root

R=SQRT (Rmin*Rmax) = SQRT (1.50kohm * 560kohm)

Since the MBILS is capable of monitoring three different intruder positions, the above design was repeated three times to serve as input to the parallel port status pins.

The transistor input state

V_{out} = (Vin x R2)/(R1+ R2)

V_{in} = 5v, Thus, in darkness:

$V_{out} = 5 \times 560 \times 10^3 / 4.7 \times 10^3 + 560 \times 10^3$

$V_{out} = 28 \times 10^5 / 564700$

V_{out} = 4.96v

This increases the base current that drives the transistor to saturation.

In bright light:

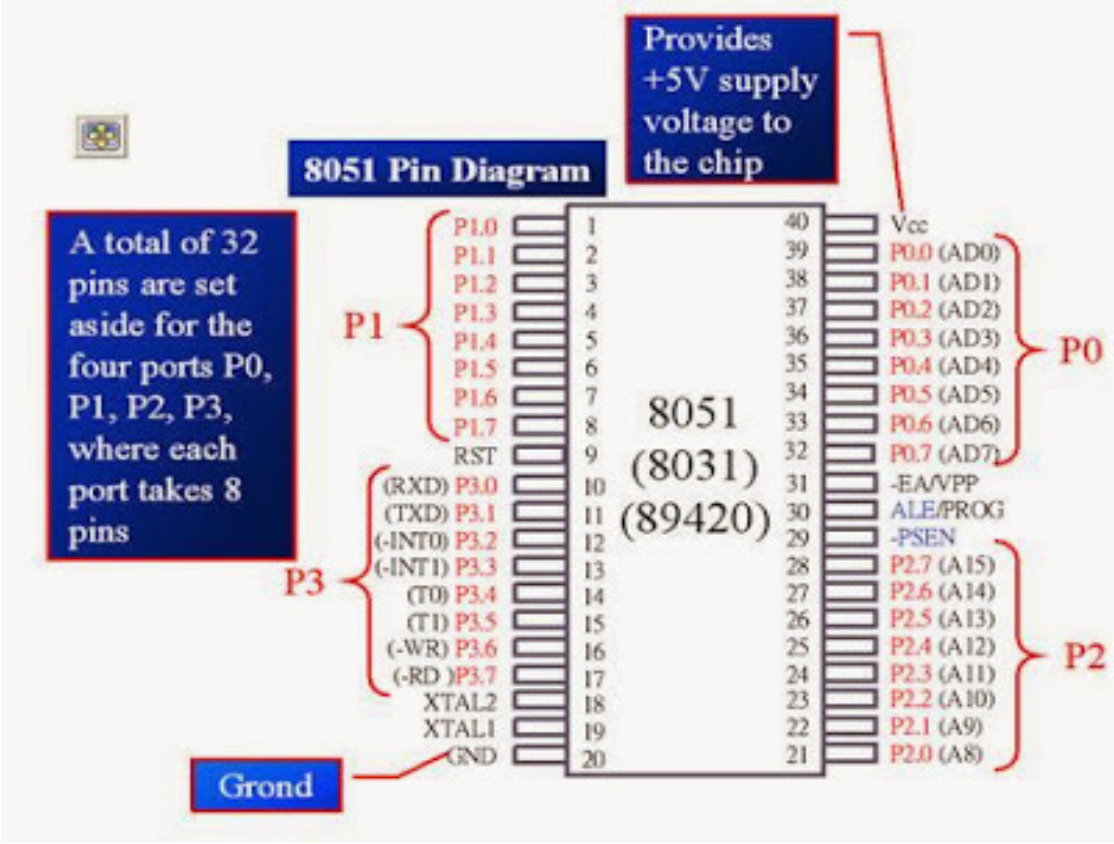
$Vout = 5 \times 9.5 / 4.7 \times 10^3 + 9.5$

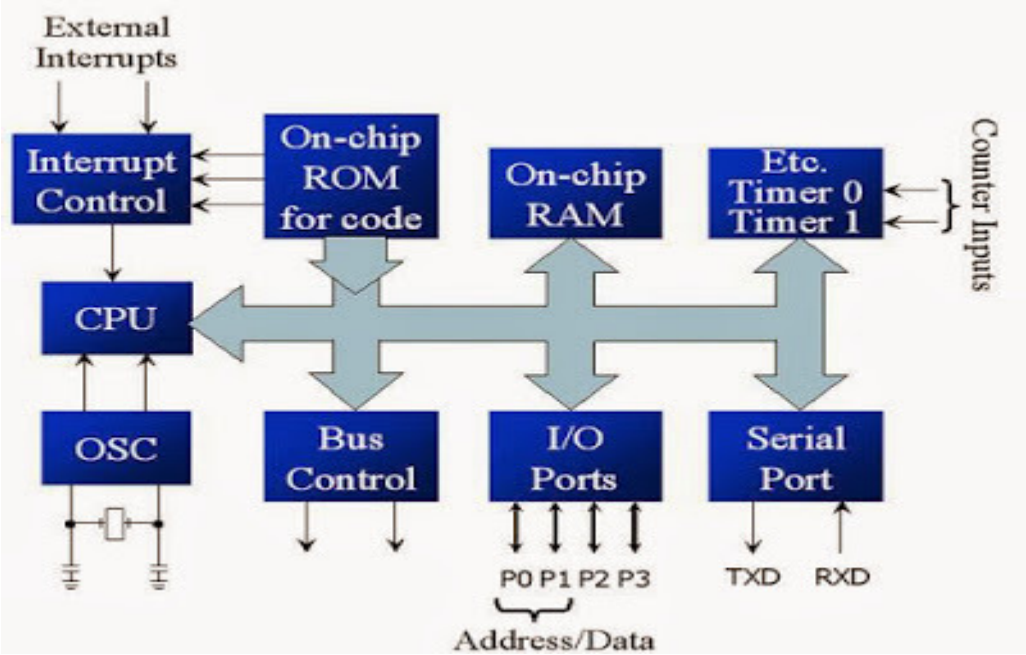
Vout = 47.5 / 4709.5, Vout = 0.01v

Microcontroller (AT89C51) Duplex mode:

The design specification for this design is AT89C51, an integrated circuit programmed with an universal programmer to receive input signals and relating it to other interfaced sub-module attached to it for their corresponding signals output [6].

Figure 2 showing Pin description of 8051/AT89C51 microcontroller



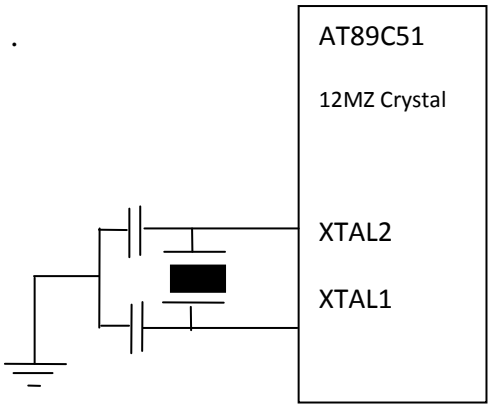


The Serial ports interrupt:

MBILS will receive 'R' data byte then a bit will be set to 1 in the SCON register and if to transmit data type 'X' then will be witted and interrupt then set in SCON. The external as INT 1 are used by external CKT. It can be configured to either X' mission actionist or the external depending upon value at the units.

MBILS cycle and crystal frequency

The 8051 used in the design has an on-chip oscillator and also requires an external clock to run it. Most case a **quartz crystal oscillator** is connected to inputs XTAL1 (pin 19) and XTAL2 (pin 18). The quartz crystal oscillator connected to XTAL1 and XTAL2 also needs two capacitors of 33 pF value interface. One side of each capacitor is connected to the ground as shown in Figure 3a and 3b respectively.



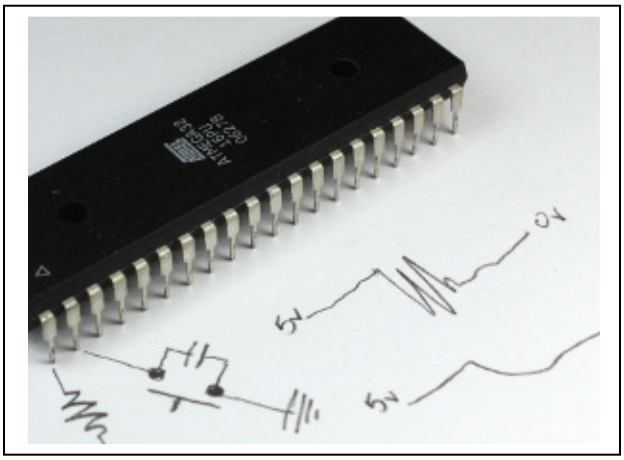


Figure 3a: Crystal Oscillator ***Figure 3b: Crystal Oscillator***

To determined BMONS cycle for compactable chips as follow. If XTAL = 11.0592MGZ

For (a) AT89C51 :- 1/11.05952MGZ = 90.42 nanoseconds (ns)

Therefore MBILS cycle = 12 X 90.42 ns = 1.085US

1 X 90.42ns = 90.42ns

4 x 90.42ns = 361.68ns

It must be noted for this design about various speeds of the 8051 family. Speed refers to the maximum oscillator frequency connected to XTAL. Instance, a 12-MHz chip must be connected to a crystal with 12 MHz frequency or less. Likewise, a 20-MHz microcontroller requires a crystal frequency of no more than 20 MHz to function well. When the 8051 is connected to a crystal oscillator and is powered up, the frequency from the pin XTAL2 was clearly observed over oscilloscope.

For this reason the experiment deduced that “almost” is that the number of machine cycles it takes to execute an instruction is not the same for the AT89C51 andDS89C4xO chips as narrated [7].

Lighting Module

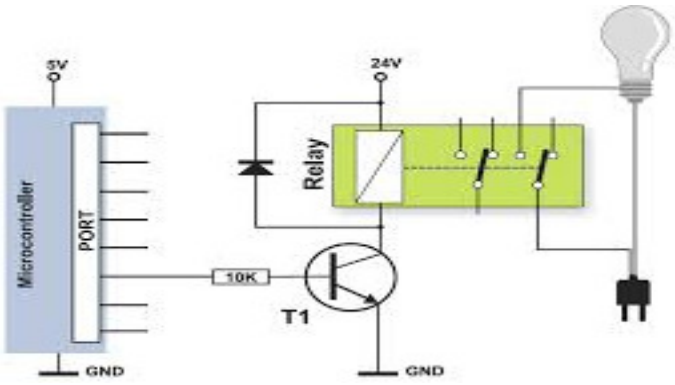
Relays are made up of electromagnet material and a set of contacts generally based on Single Pole Double Throw (SPDT) or Double Pole Double Throw (DPDT) switching method. It has 3 pins to perform functions

COM = Known as Common, always connect to NC; it is the moving part of the switch.

NC = Known as Normally Closed, (COM) is connected to this when the relay coil is off.

NO = Know as Normally Open, COM is connected to this when the relay coil is on.

The light device was connected to relay device interfaced with microcontroller with port 0 (P3.2). Relay will receive high and low signal from the microcontroller to enable open and close output terminal. This interface module as shown in figure 5 indicate mono-directional communication with microcontroller AT89C51

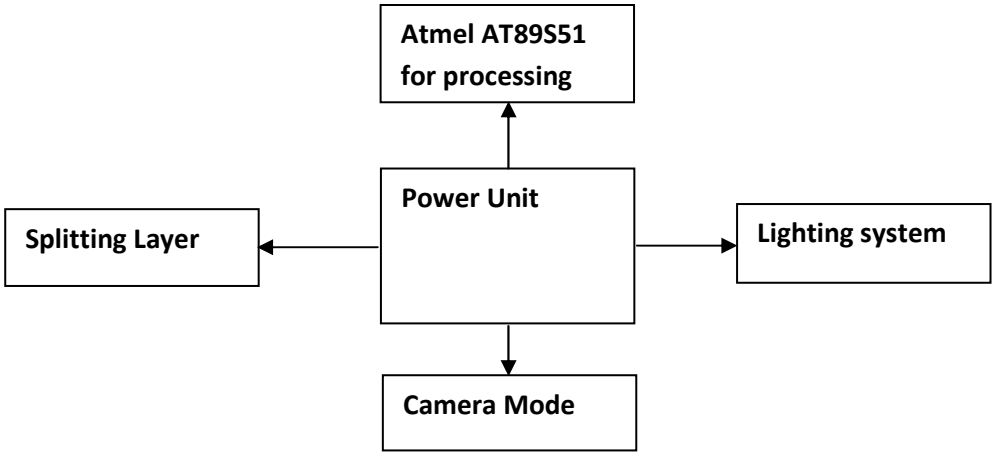


Display Camera Module

The camera display module is made up of intelligent 4.5 pixies to display the point of intrusion from camera view. The display unit is used in the design to make it easy for security operatives and users using the system to locate the intruder position.

Power Supply Transmission Model

The step-down transformer used as transformation AC signal, bridge rectifier diodes was used as rectification, capacitors used as filter by allowing AC component to passing by block DC component and lastly, a voltage regulator used to regulate output to voltage to +5v.



Benefit of MBILS Device

The MBILS helps detect unauthorized entry onto a target environment. The system sends a signal to central processing and monitoring center when activated. The processing and monitoring centers provide 24/7 service and will alert owner, security unit and other authorities on the nature on invasion scene [4,8].

DESIGN ANALYSIS

The design methods and then analysis employed in the design of the microcontroller based provided duplex communication between input and output. These analyses are required to make the correct choice of component values for effective performance. The analysis is divided into modules namely

i. The power supply module

ii. The light detector module

iii. The darkness detector module

iv. The processor module

v. The camera module

Design of the Light Detector Module

The design of the light detector module was achieved using an LDR interfaced to an NE555 timer to detect presence of light in the dark environment. When an intruder flashes a light device in the restricted zone, the LDR resistance decreases and the NE555 is triggered through pin 2 and then sends out an output through pin 3 to the microcontroller pin as a high signal.

The light detector detects an intruder either trying to open a door in a secured area kept in darkness; therefore, once light is detected, this will trigger or activate the camera to snap image at the scene and initialize video stream with support of activated lighting module to ensure clear image detection over active camera (shown in figure 4).

Design of the Darkness Detector Module

The design and implementation of the darkness detector unit was achieved using a Light Dependent Resistor (LDR) interfaced to an NE555 timer to detect absence of light. When an intruder obstructs a lighting point or casts a shadow to block light falling on the sensor

in the activated area, the will be camera is activated and the display screen displays the zone where the intrusion is coming from [9].

Design of the Processor Module

The design of the processor unit was achieved using AT89C51microcontroller. The processor unit takes care of taking the signals from the sensors and activating the camera and display to show the point of intrusion or enable lighting system for clear vision or illumination of the target environment. This makes it easy for the intruder to be caught. The Processor unit controls the overall function of the system since it takes the signals from the sensor inputs and determines the necessary action to take by showing the zone of intrusion points and also directing the authority in modality to apprehending the criminal by giving away the position of the criminal scene [8],[9].

The Software Design Module

This is the written program in c language and its contains the bearer's intension. With particular reference to this research work, the essence of this program is to control which of the sensors, camera and light device. The software/firmware development was executed in the following phases [10],[12];

i. Writing of the source code in C language.

ii. Compiling the source code using Keil micro-vision compiler.

iii. Programming the microcontroller with the output hex file from the compiler using Unipro Universal programmer.

Discussion

During the design and construction of this project, testing was carried out at different stages to determine if the result obtained at each stage met the desired output. Then phase module of the sub-system module was built and tested for durability, efficiency, and effectiveness and also ascertain if there is need to modify this design. The system was first assembled using a breadboard. All components were properly inserted into the breadboard from whence some tests were carried out at various stages.

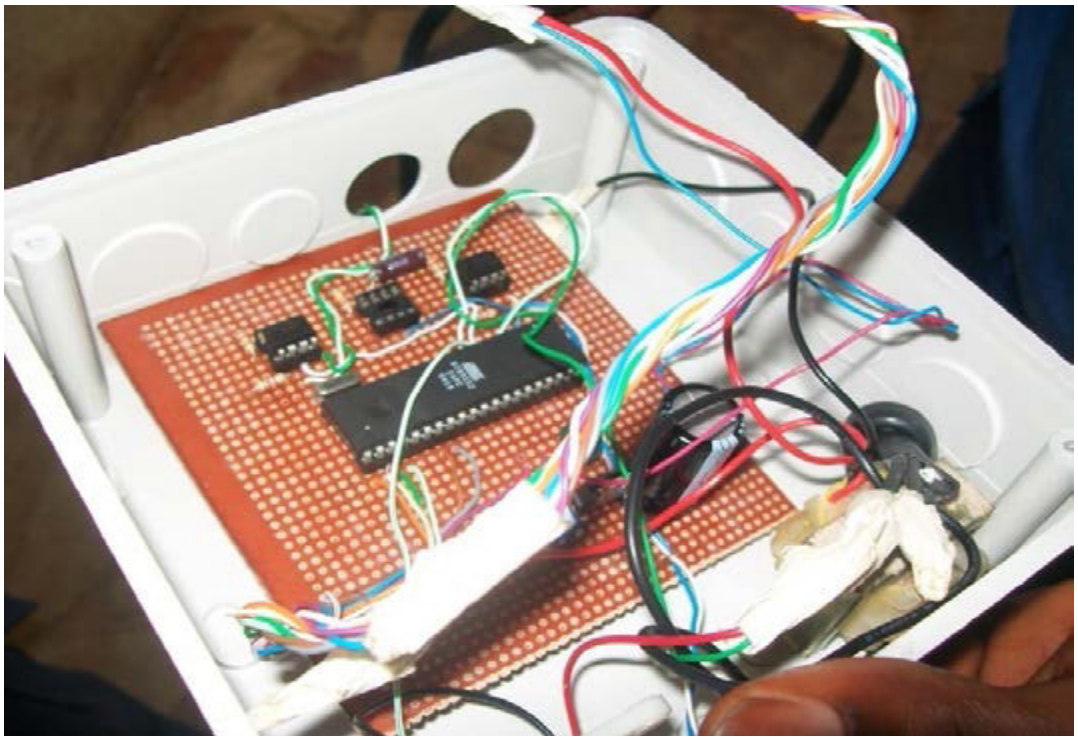
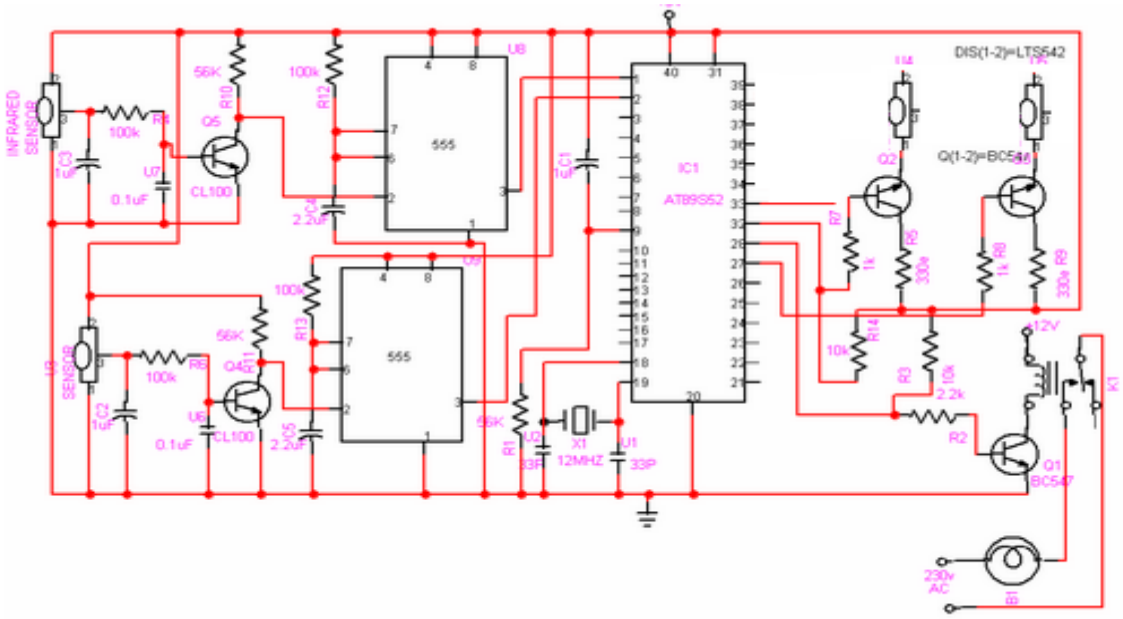


Figure 4: Diagram above showing internal structure of sensors, camera and light device



Conclusion and Recommendation

MBILS device are installed in buildings to protect human being and properties. When an lighting and camera has been triggered, a captured image from the camera is needed for investigation. Normally, the authority must setup investing panel to capture the intruder using security protocol at their disposal on the other hand the device can serve as energy saving device for situation when light to be used and customize energy consumption patterns in when necessary using intrusion automation to activated light in the environment.

This project has basic steps taken in the design and construction of automated lighting system in an electrical/ electronic workshop, houses, office, Institution, etc these places which are well equipped, model for students of electrical/electronics to enhance and impact in them adequate knowledge on the various electrical devices and components installed .

Therefore, this research has implored the use of both hardware and software to bring about the project entity. Going through the planning, flow process, design and software implementation the system had extensive prototype but there are multiple numbers of security systems are available to protecting life and properties likewise energy saving devices for electrical and electronics system. Feature work is required to develop extension link for adaptive alert module and wireless network intrusion but this will be additional cost and resources for feature upgrade using Atmel AVR ATmega16 microcontroller.

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