CHAPTER ONE
INTRODUCTION

Chapter One
Introduction

1.1 backgrounds

Security systems have been around for a very long time, even before the introduction of microcontrollers. Over the course of all that time, they have come quite a long way. They have gone from being simple analog circuits with key switches and mechanical bells to being sophisticated digital systems that can automatically report alarms and status information to a monitoring center and even offer home automation to some extent. However, many modern security systems have some hidden shortcomings. For instance, one system that is advertised as having many innovative features still uses a POTS (plain old telephone service) line for monitoring by default. While reporting alarms in this fashion may be reliable, it can also be quite slow, not to mention it cannot be used in homes that do not have landline phone service (which, with cell phones becoming so common, is seen more and more often).

Other modern systems get around the no-landline limitation by using an internal “virtual cell phone” of sorts to emulate POTS-based reporting, it also introduced the cost of needing to connect to the cellular network, and it can be affected by poor cellular reception. A better method of reporting alarms is IP-based reporting, where the alarm system uses an Internet connection to report alarms to the monitoring center. Some alarm systems do offer this capability, but it hasn't caught on as much as one would think.

1.2 Problem Statement

Solar panels are usually installed on exposed fields which permit solar energy to reach it, but at the same time this situation makes them easily subjected to theft. Causing a great loss annually, stoppage of water pumping in these areas could cause severe water crisis, health problems and tribal conflicts in those areas.

1.3 Proposed Solution

Through this thesis is designed monitoring system that monitors solar panel system for water pump station. The proposed monitoring system is based on motion detector which consists of:

- An alarm circuit that produces a strong alarm sounds.
- Camera produces a clear picture during the theft processes.
- GSM module sends message to the director of the station using a motion detector which operates according to data.

1.4 Aims and Objectives

The aim of this thesis is to designing, simulating and implementing a cheap and reliable security system for solar panels station which consists of motion detector, Camera, a GSM module, LCD and a control platform.

The objectives of this thesis are:

-To protect the pumping units and reduce incidents theft.

-To ensure the continuity of the solar pumping units operation.

-To secure environment system for these solar pumping units will be a key point for the investigators to reach to the thieves.

1.5 Methodology

In North Darfur state, there are many of these solar pumping systems are installed in Internally Displaced Person (IDP) camps, in places of study in Zamzam camp as shown in figure 2.4 due To in availability of security protections, these modules have always been the subject to theft or to vandalism as such Certain precautionary measure got to be established in order to minimize if not eradicate theft or to vandalism of these modules. A security system such as installing wire mesh covering all the solar modules (A solar module is an individual solar panel - consisting of multiple solar cells, wiring, a frame, and glass). The wire mesh permits solar array to reach the modules without any reduction in their power output. The same power mesh could be used to protect the models form theft. The stealing (theft) issue continues to be a problem and requires urgent solution.

Figure1.1 solar pumping systems in Zamzam IDPs Camp

In this study lam trying to add a monitoring system connected into the electrical circuit of the Solar Electric Systems (plan).This monitoring system will produce high alarm sounds, send SMS and picture (MMS) message when approached or touched by an intruder (thief).

The main software that have been used for designing the electronic circuit's schemes was Proteus7.7 ISIS Professional the software is programmed using

BASCOM AVR .To make the simulation for monitoring the program flow was correct or run as needed by connecting the AT mega16 After completed, the program should be debugging Start connect all the input and output device and interfacing to the microcontroller .The designing program process was completed when the program can work as requirement.

1.6 Thesis outlines

The thesis includes five chapters, chapter one provides introduction, problem statement and objectives while chapter two covers background study of security system and related works. In chapter three he methodology, where circuit design and simulation Environments are defined while chapter four presents the result and discussion. And chapter five includes the conclusion and recommendation.

CHAPTER TWO

BACKGROUND AND RELATED WORKS

Chapter Two

Background and Related works

2.1 Background

2.1.1 Control System

Is an interconnection of components forming a system configuration that will provide a desired system response. Input - output relationship represents the cause-and-effect relationship of the process. A component or process to be controlled can be represented by a block as shown in Figure 2.1.

Input output

Figure 2.1 Process under control

Control system can be classified in two types:

A- An open-loop control system utilizes a controller or control actuator to obtain

The desired response as shown in Figure 2.2the open-loop control system utilizes an actuating device to control the process directly without using device. An

Example of an open-loop control system is an electric toaster.

Desired output

Output

Response

Figure 2.2 Open-loop control system.

B- Closed-loop Control System utilizes an additional measure of the actual output to compare the actual output with the desired output response. The measure of the output is called the feedback signal as shown in Figure 2.3. A feedback control system is a control system that tends to maintain a prescribed relationship of one system variable to another by comparing functions of these variables and using the difference as a means of control. As the system is becoming more complex, the interrelationship of many controlled variables may be considered in the control scheme.

An example of closed-loop control system is a person steering an automobile by looking at the auto's location on the road and making the appropriate adjustments.

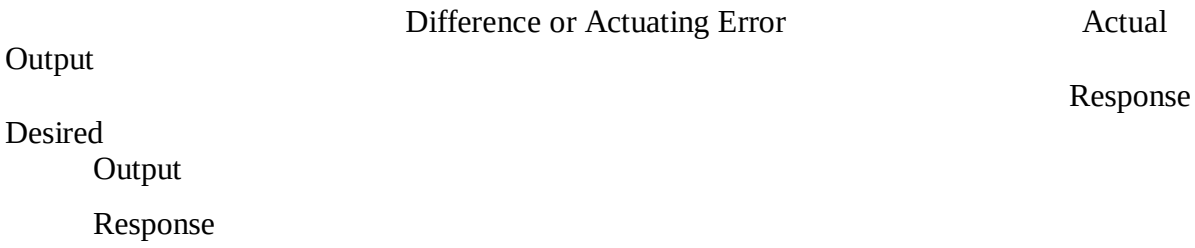

Fig 2.3 Closed-loop feedback system.

2.1.2 Solar pumping systems

Are specially designed to maintain constant water supplies for the population, animals and irrigation in areas where there's no electricity.

A benefit of using solar energy to empower power agricultural water pump systems is that increased water requirements for livestock and irrigation tend to coincide with the seasonal increase of incoming solar energy. When properly

designed, these PV systems can also result in significant long-term cost savings and a smaller environmental footprint compared to conventional power systems. The volume of water pumped by a solar powered system in a given interval depends on the total amount of solar energy available in that time period. Specifically, the flow rate of the water pumped is determined by both the intensity of the solar energy available and the size of the PV array used to convert that solar energy into direct current (DC) electricity .

2.2 Related works

The related works with security system can be summarized as following below:

Huang et al. designed one solution for establishing a low power consumption remote home security alarm system. The system, based on WSN and GSM technology, can detect the theft, leaking of raw gas and fire, and send alarm message remotely. The hardware of this system includes the single chipC5081F310, wireless receiving and sending chip CC1100 as well as the SIMENS TC35 GSM module. The system software developed in C51 language has the ability of collecting, wireless receiving and transmitting data, and can send a piece of alarm short message to the user's mobile phone when some dangerous condition has been detected. With the advantages of reliability, easy usage, complement wireless, and low power consumption, the system also has practical value in other fields.

Implement of wireless sensor network (WSN) and GSM technology inside this project due to three major advantages of it. First, an alarm message can received by user in time of intrusion occur. Second, it is ease establishment with no wire or cable applied and the third reason due to low power consumption.

Xiao et al. designed system consists of three parts include user intelligent control terminal, embedded home gateway and home ZigBee wireless network. It performs functions such as safety and alarm, the indoor environment monitoring, household electrical appliances control, intelligent lighting and other functions Users can access Internet web to monitor the home furnishing remotely. The users can also use cell phone with Android smart furnishing control client applications to interact remotely with home furnishing device. The experimental results show that the smart home control system is stable, reliable and practical. It has the advantages such as easy routing, easy moving and low power.

Xin-min et al. designed system uses nRF2401 for short-range wireless communications, GPRS for long-distance wireless communications, ARM9 for center console, Wireless Multi-sensor Fire Detector for node, and BP algorithm is used for judging the probability of fire. Wireless Multi-sensor Fire Detector is formed of the low-power electrochemical carbon monoxide sensor, photoelectric smoke detector and semiconductor temperature sensor. BP algorithm program is embedded in the S3C2440A ARM. The samples of BP algorithm were derived from the fire detection standard room of the State Key Laboratory of Fire Science of China. The Center Console uses Em GIS (embedded GIS) to show where the fire breaks out, and uses GPRS to transmit SMS to the fire command center. The system is low false alarm rate, low cost, fast response and convenient to install.

Arbab et al. discusses on implementation of a novel security and control system for home automation. The proposed system consists of a control console interfaced with different sensors using ZigBee. Suspected activities are conveyed to remote user through SMS (Short Message Service) or Call using GSM (Global System for Mobile communication) technology. Upon reply, the remote user can control his premises again through GSM-ZigBee combination. In addition, traditional burglar

alarm enhances security in case of no acknowledgment from remote user. This system offers a low cost, low power consumption and user friendly way of a reliable portable monitoring and control of the secured environment. Using the concept of serial communication and mobile phone AT-commands (Attention Telephone Terminal commands), the software is programmed using C-Language. The design has been implemented in the hardware using ZigBee EM357 module, Atmega128 MCU (microcontroller unit) and Sony Ericsson T290i mobile phone set. Figure 2.5 shows the block diagram and circuit connection of novel security and control system by Arbab et al.

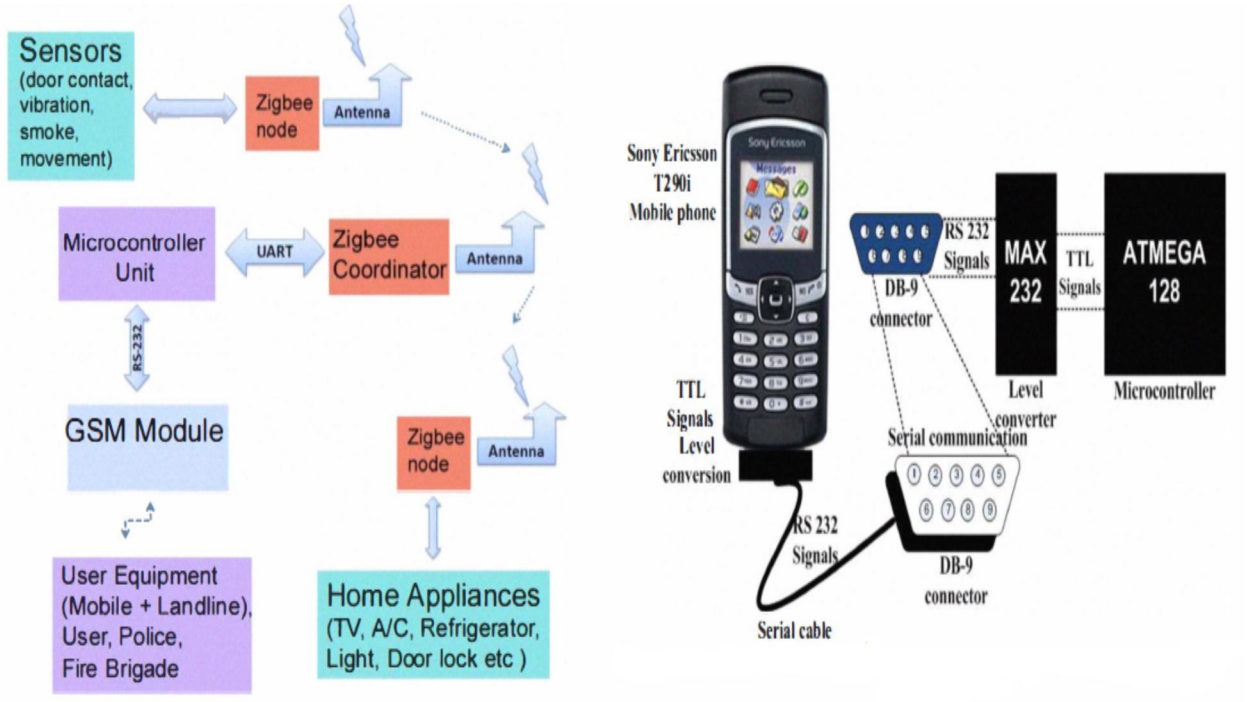

Figure 2.4: block diagram and circuit connection of novel security and control system by Arbab et al..

Bb Hwang et al. proposed digital door locking system which is a novel wireless access monitoring and control system. Digital door lock is an electronic locking system which is operated by certain combination of digital key which acts as a

security password. Wireless sensor network is achieved using the ZigBee module and ZigBee tags are used to identify the access objects. By using the digital consumer device, digital door lock module can be implemented to control the access system as well as locking system. It is very convenient system for the consumers and has extensible and flexible characteristics.

Malik et al. proposed System that allows user to control home appliances universally, provide security on detection of intrusion via SMS using GSM technology and sent breach alert. The system is low cost, secure, ubiquitously accessible, auto-configurable, remotely controlled solution for automation of homes has been introduced.

I.Yugashini et al. showed case of Design And Implementation Of Automated Door Accessing System With Face Recognition they used the means of face recognition as a device of opening the automated door In this by which the captured image is detected using a web camera and compared with the image in the database. If the image is an authenticated one the door will be opened automatically else an SMS will be generated using a GSM modem to the user that an unauthorized person has entered home. They achieved that face recognition system has been developed in order to study the potential application for automated door access control.

Choi et al. proposed a new algorithm for an acoustic intruder detection system for home security. This algorithm estimates the variation of features in the room acoustic transfer function to detect intruders. The system ranges from the personalized security systems of a home to large-scale systems for the protection of crucial national installations.

Y. Zhao and Z. Ye proposed a low cost GSM/GPRS based wireless home security system which includes two modules namely sensor nodes for wireless security and a GSM/GPRS gateway. Using a wireless transceiver module the data transfer between gateway and sensor nodes is established.

I.Kramberger et al. proposed the architecture of a door phone embedded system with interactive voice response. The main advantage of this system is even in noisy environment the effectiveness of speech recognition is increased using embedded microphone array. The system uses two different platforms namely user identification and verification platform based on a VoIP door phone embedded system and server-based speaker authentication system.

From these related works, it is stated that must of this related works are using GSM modem or modified hand phone to send SMS to owner to inform when there is intruder which are similar to the objective of this project. Must of work also use AT command to interface with microcontroller. The differences of these work using difference microcontroller and different application.

2.3 DC Circuit Design main component

2.3.1 Microcontroller subsystem

A microcontroller (also MCU or μC) is a small computer on a single integrated circuit consisting of a relatively simple CPU combined with support functions such as a crystal oscillator, timers, and watchdog, serial and analog I/O etc. Program memory in the form of NOR flash or OTP ROM is also often included on chip, as well as a, typically small, read/write memory.

Thus, in contrast to the microprocessors used in personal computers and other high a performance application, simplicity is emphasized. Some microcontrollers may operate at clock frequencies as low as 32 KHz, as this is adequate for many

typical applications, enabling low power consumption (mill watts or microwatts). They will generally have the ability to retain functionality while waiting for an event such as a button press or other interrupt; power consumption while sleeping (CPU clock and most peripherals off) may be just nano watts, making many of them well suited for long lasting battery applications .

Microcontrollers are used in automatically controlled products and devices, such as Automobile engine control systems, remote controls, office machines, appliances, power tools, and toys. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes.

2.3.2 AT mega 16 microcontroller subsystem

ATmega16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family with low power consumption. Atmega16 is based on enhanced RISC (Reduced Instruction Set Computing, Know more about RISC and CISC Architecture) architecture with 131 powerful instructions . Appendix (B) explains pin description of AT mega16.

2.3.2.1ATMEGA 16 Features:

- High-performance, Low-power AVR 8-bit Microcontroller.

Advanced RISC Architecture

- 131 Instructions - Most Single Clock Cycle Execution
- 32 x 8 General Purpose Working Registers
- Up to 16 MIPS Throughput at 16MHz
- Fully Static Operation
- On-chip 2-cycle Multiplier

Non-Volatile Program and Data Memories

- 16k Bytes of In-System Self-Programmable Flash
- Optional Boot Code Section with Independent Lock Bits
- 512 Bytes EEPROM
- Programming Lock for Software Security.

JTAG Interface

- Boundary-scan Capabilities According to the JTAG Standard
- Extensive On-chip Debug Support
- Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface

Peripheral Features

- On-chip Analog Comparator
- Programmable Watchdog Timer with Separate On-chip Oscillator
- Master/Slave SPI Serial Interface
- Two 8-bit Timer/Counters with Separate Prescalar, Compare
- One 16-bit Timer/Counter with Separate Prescaler, Compare an Capture mode
- Real Time Counter with Separate Oscillator
- Four PWM Channels
- Programmable Serial USART
- 8-channel, 10-bit ADC
- Byte-oriented Two-wire Serial Interface

Special Microcontroller Features

- Power-on Reset and Programmable Brown-out Detection
- Internal Calibrated RC Oscillator
- External and Internal Interrupt Sources
- Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby

I/O and Packages

- 32 Programmable I/O Lines
- 40-pin PDIP, 44-lead TQFP, and 44-pad ML

Operating Voltages

- 4.5-5.5V for ATmega16

Speed Grades

- 0-8MHz for ATmega16
- 0-16MHz for ATmega16

Power Consumption at 4 MHz, 3V, 35 °C

- Active: 1.1mA
- Idle Mode: 0.35mA
- Power-down Mode: < 1µA.

2.3.2Ultrasonic Motion Detectors subsystems

Ultrasonic transducers used to detect motion in an area where there are not Supposed to be any moving objects. This type of motion detector is most commonly used in burglar alarm systems since they are very effective in this application. Figure 2.1 shows the operation of an ultrasonic motion detector. There are two transducers: one emits an ultrasonic wave and the other picks up reflections from the different objects in the area. The reflected waves arrive at the receiver in constant phase if none of the objects in the area are moving. If something moves, the received signal is shifted in phase. A phase comparator detects the shifted phase and sends a triggering pulse to the alarm .

Using an ultrasonic motion detector that includes several active and passive sensors can improve results. Some systems combine an ultrasonic sensor with a passive infrared motion detector. Analyzing the sound and heat data together often gives a more accurate picture than either type would on its own.

Ultrasonic motion detectors have certain advantages and disadvantages when compared with other types of motion detectors. The main advantages are that they are very sensitive and extremely fast acting. However, the largest problem with this type of motion detector is that it sometimes responds to normal environmental vibration that can be caused by a passing car or a plane overhead. Some types of motion detectors use infrared sensors to avoid this problem, but even these detectors have some problems .

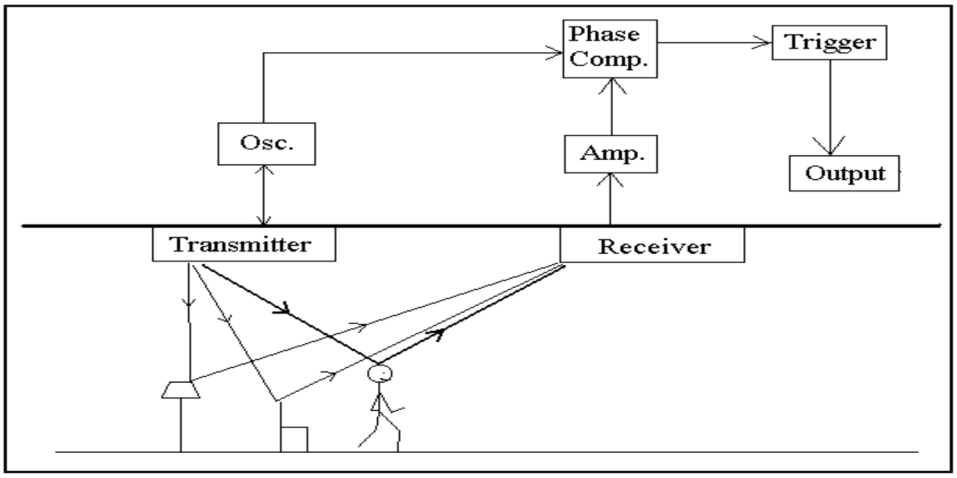

Figure 2.5 operation of an ultrasonic motion detector

2.3.3 Relay interface device

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations .

2.3.3.1 Type of relay:

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contact. Solid -state relay control power circuits with no moving part, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays".

Magnetic latching relays require one pulse of coil power to move their contacts in one direction, and another, redirected pulse to move them back. Repeated pulses from the same input have no effect. Magnetic latching relays are useful in applications where interrupted power should not be able to transition the contacts. Magnetic latching relays can have either single or dual coils. On a single coil device, the relay will operate in one direction when power is applied with one polarity, and will reset when the polarity is reversed. On a dual coil device, when polarized voltage is applied to the reset coil the contacts will transition. AC controlled magnetic latch relays have single coils that employ steering diodes to differentiate between operate and reset commands .

2.3.4 Stepper motor

A stepper motor is an electromechanical device which converts electrical pulses into discrete mechanical movements. The shaft or spindle of a stepper motor rotates in discrete step increments when electrical command pulses are applied to it in the proper sequence. The motors rotation has several direct relationships to these applied input pulses. The sequence of the applied pulses is directly related to the direction of motor shafts rotation. The speed of the motor shafts rotation is directly

related to the frequency of the input pulses and the length of rotation is directly related to the number of input pulses applied .

2.3.4.1Advantages and Disadvantages of Stepper Motors:

The Advantages and disadvantages of stepper motor are as mentioned below.

- Advantages

1. The rotation angle of the motor is proportional to the input pulse.
2. The motor has full torque at standstill (if the windings are energized)
3. Precise positioning and repeatability of movement since good stepper motors have an accuracy of 3 – 5% of a step and this error is non cumulative from one step to the next.
4. Excellent response to starting/ stopping/reversing.
5. Very reliable since there are no contact brushes in the motor. Therefore the life of the motor is simply dependant on the life of the bearing.
6. The motors response to digital input pulses provides open-loop control, making the motor simpler and less costly to control.
7. It is possible to achieve very low speed synchronous rotation with a load that is directly coupled to the shaft.
8. A wide range of rotational speeds can be realized as the speed is proportional to the frequency of the input pulses.

- Disadvantages

1. Resonances can occur if not properly controlled.
2. Not easy to operate at extremely high speeds.

2.3.4.2 Stepper Motor Types

There are three basic stepper motor types:

A- Variable-reluctance (VR)

This type of stepper motor has been around for a long time. It is probably the easiest to understand from a structural point of view. Figure 2.1 shows a cross section of a typical V.R. stepper motor. This type of motor consists of a soft iron multi-toothed rotor and a wound stator. When the stator windings are energized with DC current the poles become magnetized. Rotation occurs when the rotor teeth are attracted to the energized stator poles .

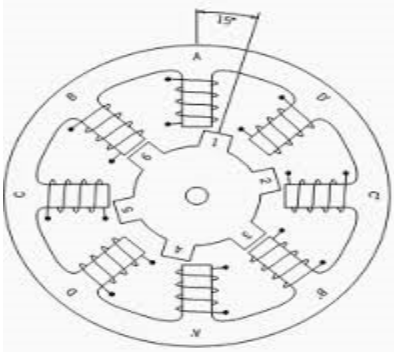

Figure 2.6 Cross-section of a variable reluctance (VR) motor.

B- Permanent Magnet (PM)

Often referred to as a “tin can” or “canstock” motor the permanent magnet step motor is a low cost and low resolution type motor with typical step angles of 7.5° to 15°. (48 – 24 steps/revolution) PM motors as thename implies have permanent magnets added to the motor structure as shown in Figure 2.2. The rotor no longer has teeth as with the VR motor. Instead the rotor is magnetized with alternating north and south poles situated in a straight line parallel to the rotor shaft. These magnetized rotor poles provide an increased magnetic flux intensity

and because of this the PM motor exhibits improved torque characteristics when compared with the VR type

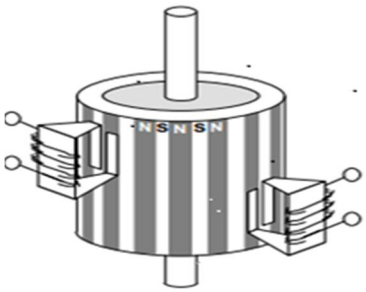

Figure 2.8 Principle of a PM or tin-can stepper motor

C- Hybrid (HB)

The hybrid stepper motor is more expensive than the PM stepper motor but provides better performance with respect to step resolution, torque and speed. Typical step angles for the HB stepper motor range from 3.6° to 0.9° (100 – 400 steps per revolution). The hybrid stepper motor combines the best features of both the PM and VR type stepper motors. The rotor is multi-toothed like the VR motor and contains an axially magnetized concentric magnet around its shaft. The teeth on the rotor provide an even better path which helps guide the magnetic flux to preferred locations in the air gap as shown in Figure 2.3This further increases the detent, holding and dynamic torque characteristics of the motor when compared with both the VR and PM types.

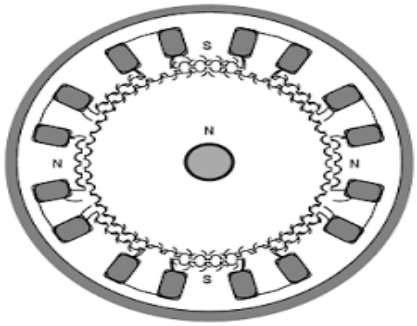

Figure 2.8 Cross-section of a hybrid stepper motor

The two most commonly used types of stepper motors are the permanent magnet and the hybrid types. If a designer is not sure which type will best fit his applications requirements he should first evaluate the PM type as it is normally .

2.3.5 IP camera

An Internet protocol camera, or IP camera, is a type of digital video camera commonly employed for surveillance, and which, unlike analog closed circuit television (CCTV) cameras, can send and receive data via a computer network and the Internet. Although most cameras that do this are webcams, the term "IP camera" is usually applied only to those used for surveillance. The first centralized IP camera was Axis Neteye 200, released in 1996 by Axis Communications

Figure 2.9 IP camera

2.3.5.1Type of IP cameras

A-**Centralized** IP cameras:

Which require a central NVR (Network Video Recorder) to handle the recording, video and alarm management.

C- Decentralized IP cameras:

D- Which do not require a central NVR, as the cameras have recording function built-in and can thus record directly to any standard storage media, such as SD cards, NAS (Network Attached Storage) or a PC/server.

2.3.6 GSM communication module

As we said previously every method has disadvantages so we decided to use Arduino to communicate over a GSM mobile telffewtephone networks using the SM5100B Cellular Shield, since it is easy to deal with and more flexible, also it supports AT Commands. It has unlimited transmission range and distance, so we can use it in any place .

GSM can easily send and receive data across the mobile network, and it can transmit instructions or commands or receive them from Pic microcontroller. More specifically, within the scope of this article we will do so mainly using text or SMS messages. See (appendix D) to explain more information about GSM modem.

Figure 2.10 GSM communication modem

2.3.7 LCD display system

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are

economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on .

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. (Appendix C) explain to pin description of a LCD.

2.3.8 Buzzer alarming system

A buzzer or beeper is an audio signaling device, which, maybe mechanical, electromechanical or piezoelectric typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Figure 2.11 buzzer

It requires a DC voltage to operate; it should generally be between 3 V and 28 V, depending on the model. A buzzer designed to operate at 6 V generally works very well for any supply voltage between 4 V and 8 V, and a buzzer designed to operate at 12 V can work perfectly at a voltage between 6 V and 28 V (see characteristics given by the manufacturer for not making stupidity). There are also buzzers that

work directly on the AC mains 230 V. This type of buzzer is convenient to use, because unlike piezoelectric buzzers simple (simple piezoelectric transducers without associated electronics), it has no work, except of course the eventual control stage which will enable it. He provides a simple DC voltage and presto, it sounds .

2.4 AT Command

AT commands are a set of commands that has been standardized to communicate with terminal equipments such as modem, mobile phone as well as control them. Most GSM modems support AT commands. The command set is quite elaborate. However, only a small part of it is related to SMS operations. The most frequently used commands are:

AT+CMGS: To send a short message

AT+CMGR: To read a short message from the GSM modem

AT+CMGL: To list SMS short messages stored in the GSM modem

AT+CMGD: To delete a short message from the GSM modem

AT+CNMI ： Remind mode Setup when receive a new SMS.

2.5 Summery

The main components of the project are described in this chapter. The first function in the system is that it can detect unknown person when the user activated this system. PIC microcontroller will read the data when the limit switch is activated. Then the GSM modem gets data from PIC Microcontroller to send SMS to owner hand phone. To communicate between GSM modem and hand phone, AT command is apply to this project. It is because, the GSM modem just can only

understand AT command declaration. From this, it can communicate with hand phone, computer and PIC microcontroller.

CHAPTER THREE

SYSTEM DESIGN AND IMPLEMENTATION

Chapter three

System Design and Implementation

3.1 Introduction

This section introduces the methods and techniques in order to accomplish the objectives of this project, discusses the process flow chart with the relevant steps. The development of this project is involving the software, hardware with the electrical circuit diagrams. Figure 3.1 shows the Process Flowchart of the design.

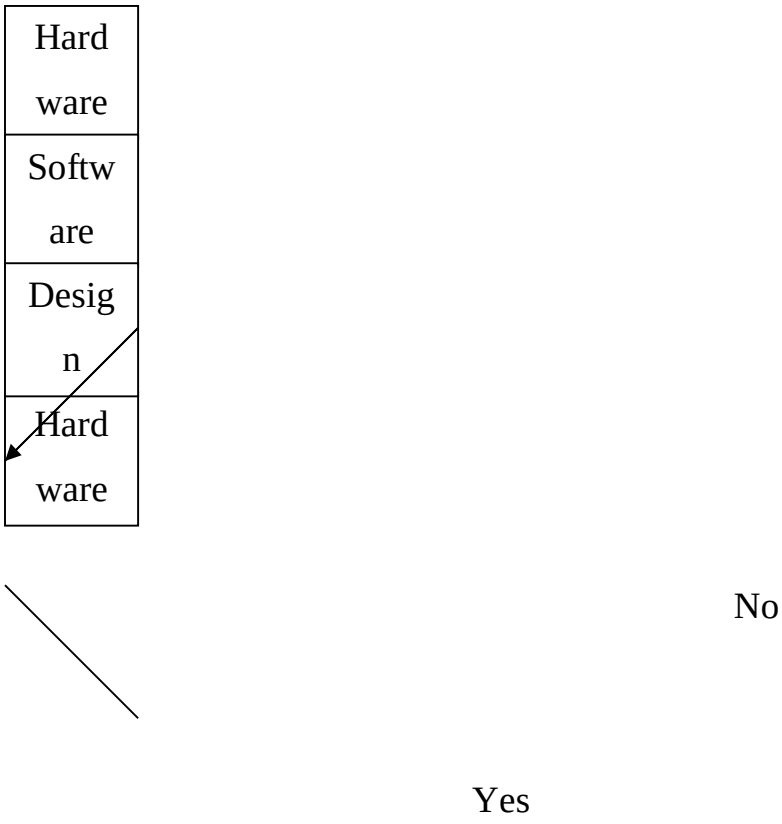

Figure 3.1 process flowchart

3.2 Circuit Block Diagram

- This section introduce the design techniques of proposed system Circuit Block Diagram

Figure 3.2 proposed system Circuit Block Diagram

Figure 3.2 Block diagram showing various components intrusion warning system. The various components and their connection have been explained below. From this block diagram the circuit in chapter 4 on implementation was developed.

3.2.1 Ultrasonic Sensor subsystem

Ultrasonic sensor pin1 (Vcc), pin2 (Trigger) connected with MU atmega16 pin (0) and pin (1).

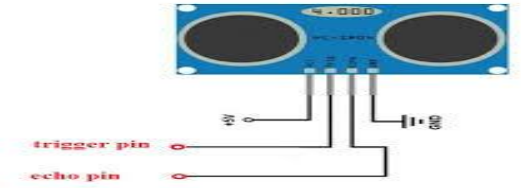

Figure 3.3 ultrasonic sensor subsystem block diagram

3.2.2 LCD 16x2 display device

Which connected through pins (D0…..D7) to the Atmega16 input pins.

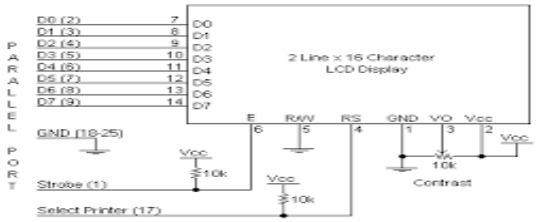

Figure 3.4LCD 16 x2 I/O pins.

3.2.3 Stepper Motor inter face device

Stepper motor is connected to driver for current amplification for motor device.

Figure 3.5 Stepper motor driver.

3.2.4 Driver inter face device

ULN2003 driver type for current amplification from 20 m A to 500 m A for Motor working.

Figure 3.6 ULN 2003 driver

3.2.5 Camera interface device

To capture any movements around the solar panel and send the picture to the administrator.

3.2.6 Relay interface device

As switching. Used for capturing techniques.

Figure3.7 Relay interface device

3.2.7GSM communication modem

It consists of a SIM900l module and additional circuitry for power management. It is serially connected to the micro-controller and hence can receive the AT (Attention commands) from the controller and respond to it respectively.

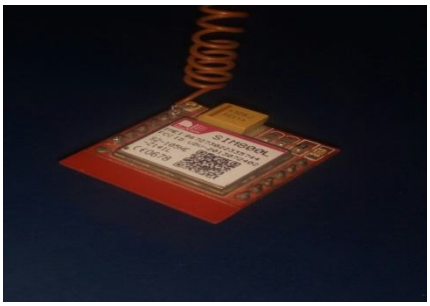

Figure3.8 GSM communication modem

3.3 Software design

The term software represents computer instructions or data where anything can be stored electronically. It is in contrast to storage devices which are called as hardware. Software can be categorized into two parts, which are, system software and applications software.

3.3.1 Proteus7.7 ISIS Professional

ISIS is a software program that enables users to design electronic circuit's schemes or printed circuit boards. The main advantage offered by this program to others such as OrCAD, is real-time simulation of all types of electronic circuits, watching clear graphics defaults sets... For interactive simulation of circuits, it was implemented PROTEUS VSM module. Thus using this module you can draw a complete circuit for a microcontroller based system, and then it can be tested interactively. ISIS also provides to the user options for customizing parts and components involved in making a circuit. ISIS uses the following file types and formats: Design Files (DSN), Backup files (DBK), Section-Files (CES), Module Files (. MOD), Library Files (LIB) and Netlist-Files (SDF). Type design files contain all the information about a circuit. Backup of type design files are created when the saving is carried over an existing file. Section files can be exported and readin another drawing and those with netlist type are produced through exporting in ProsSpice and ARES. Creating a new design is made by New Order Design. Startup of this command removes all existing design data and displaying a blank standard interfaces A4 size. The created design will be saved under the name UNTITLED.DSN standard. Loading a design can bedone in 3 modes. In DOS command line, by ISIS command <design name>or selecting Open Design once the program is on, or by double-clicking the file in Windows Explorer.

Proteus 7.7 it’s very easy to evaluate and design the DC circuit electronic components and to monitor the simulation results for the system operation whether it’s working efficiently or not because in proutous7.7 program environments we could correct the design and test systems before we continue to make the final Hardware design.

This software is being used to simulate the whole project and test the code (appendix A) and principle of the work before applying them actually using hardware components Fig 3.2shows the circuit design simulation.

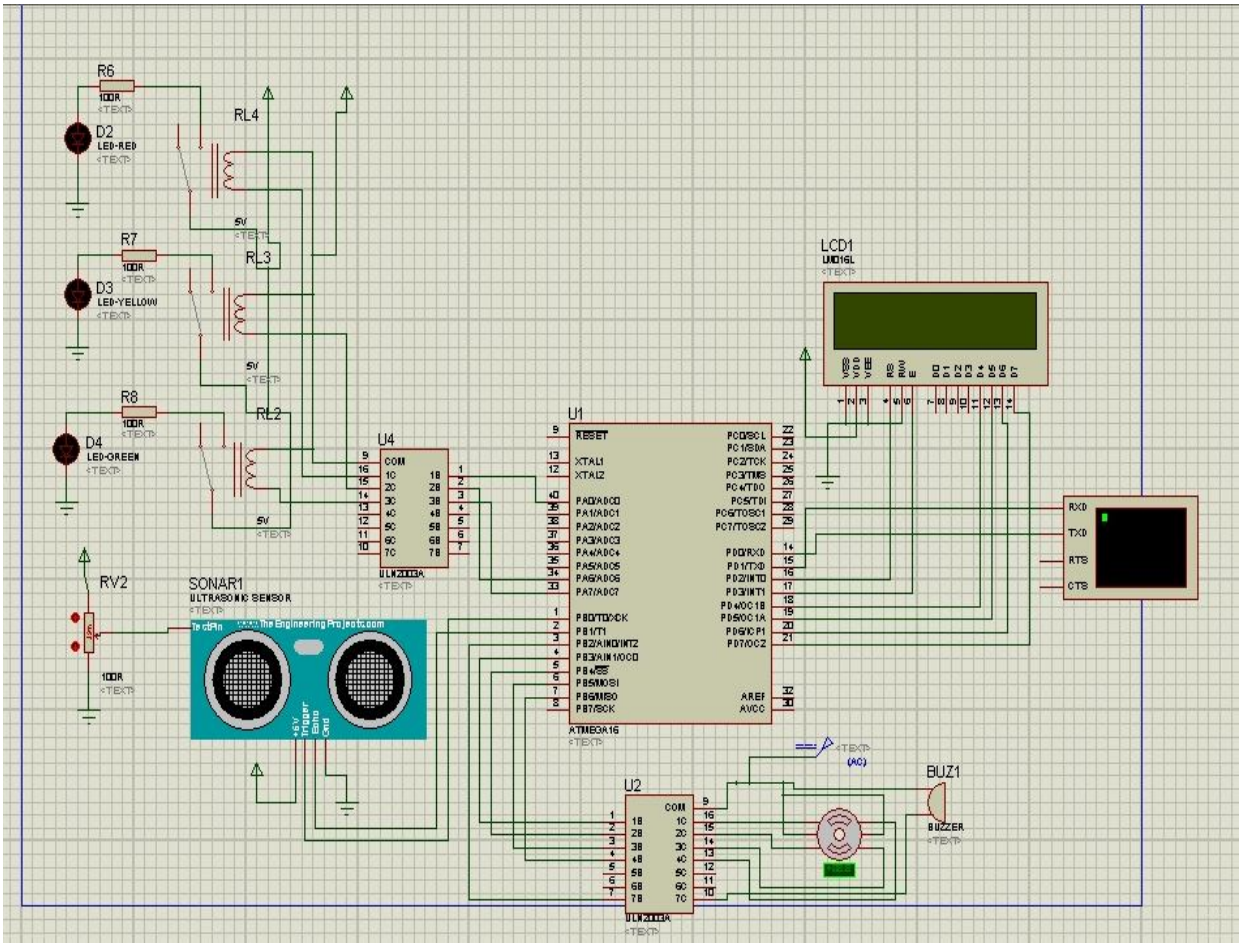

Figure3.9 circuit design simulation

3.3.2 System Simulation

The software used in the design was ISIS used for schematic designing and circuit testing. It easy job of burning the code on the microcontroller and testing it in that way. The BASIC language compiled the code into a HEX file. The HEX file was then ready to burn/program into the microcontroller. Refer to Appendix A, for the program.

3.4 System Flowchart

The flow chart gives a diagram representation of program algorithm the system flow chart is designed as show below.

No

Yes

Figure 3.10 system flowchart

3.5 program flow chart

the program flow chart of design when the device power on, it turns on the stepper motor, camera, GSM module on it must be connected to the microcontroller (AT mage16) when Ultrasonic sensor detect any movements surrounding less than 2 meters distance the system well stop the camera automatically and capture photo and send it through MMS through IP camera after that system well send another SMS message to the administrator through GSM and alarm buzzer will activated as show in figure 3.10 program flow chart .

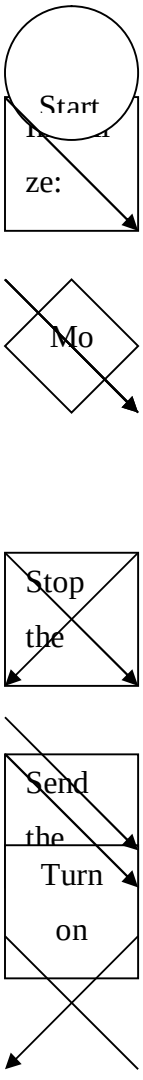

Figure 3.11 Program flowchart

3.6 System Operation

On this design we used stepper motor for connected to one driver to control the movements and the other driver control the ultrasonic sensor and the Camera, the LED (Light Emitting Diodes) used to indicate the Motor operation and the (100Ω) Resisters used for protection of the LED device.

Camera device; used for detection and recording system to monitoring the solar security system to the administrator and capture a photo which sent through MMS system.

The Ultrasonic sensor device have been used a as detection technique which could detect about (2meter distance) and to detect movements surrounding the solar system 360 degree and connected to the alarm system to give the specified alarm when it detect the movement at the same time the circuit well set voice alarm and send another MMS message to the administrator's cell phone.

3.7 Summary

This chapter presented both hardware and software step used in this thesis, there for setting have to be done carefully and correctly, these setting will be used and tested in chapter 4 results and Discussion.

CHAPTER FOUR

RESULT AND DISCUSSION

Chapter four

Result and Discussion

4.1 Proteus simulation results

The design circuit is tested by using Proteus 7.7 to test the functionality of the circuit before implement to the PCB Board. Show system design on figure 4.1 Then, the result of the simulation will be analyzed and the correction is made if there is any error or false connection between the component pin.

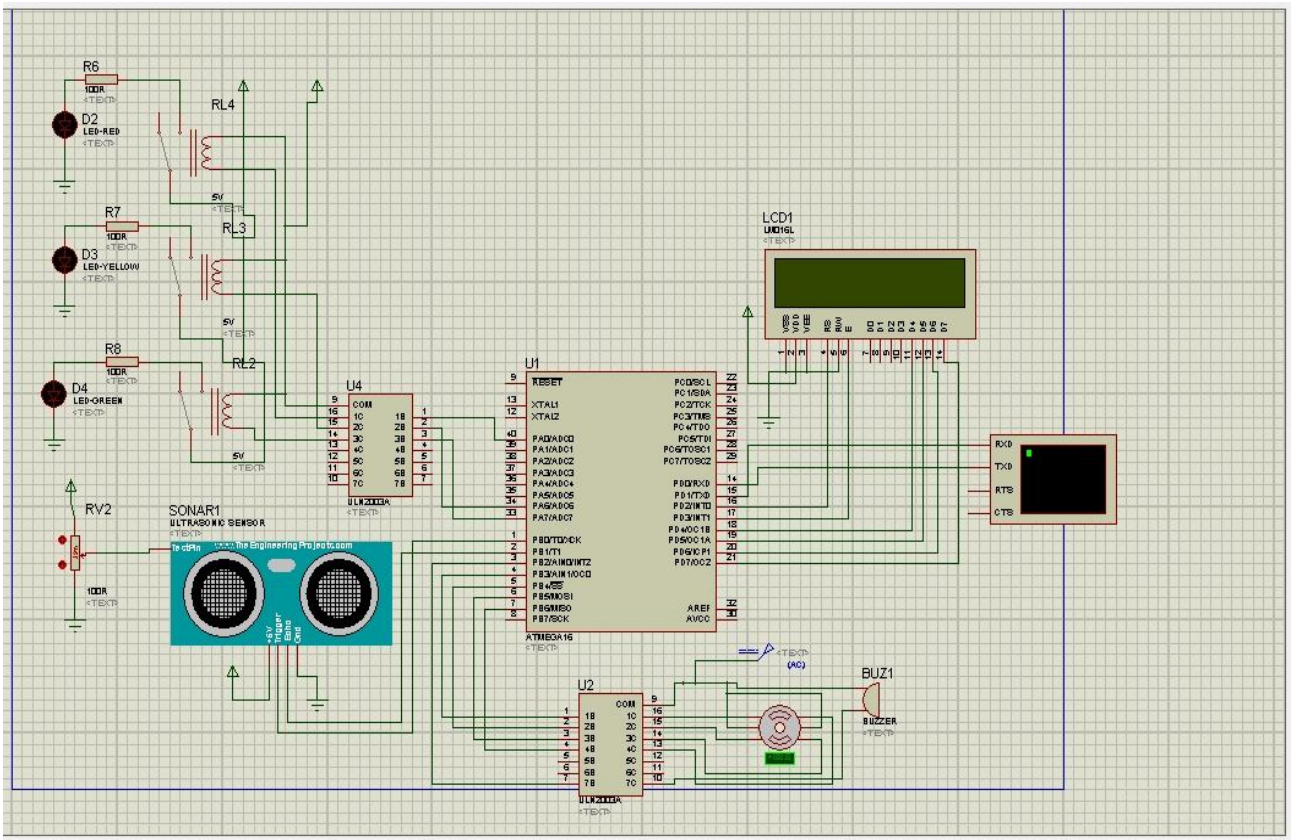

Figure 4.1 General System design over view

4.2 circuit operation

There are two states of circuit operations:

4.2.1 Normal state

When Ultrasonic sensor display more than 2meters, camera motor scanning movements 360 degree surrounding the solar panel system and buzzer be will be silent.

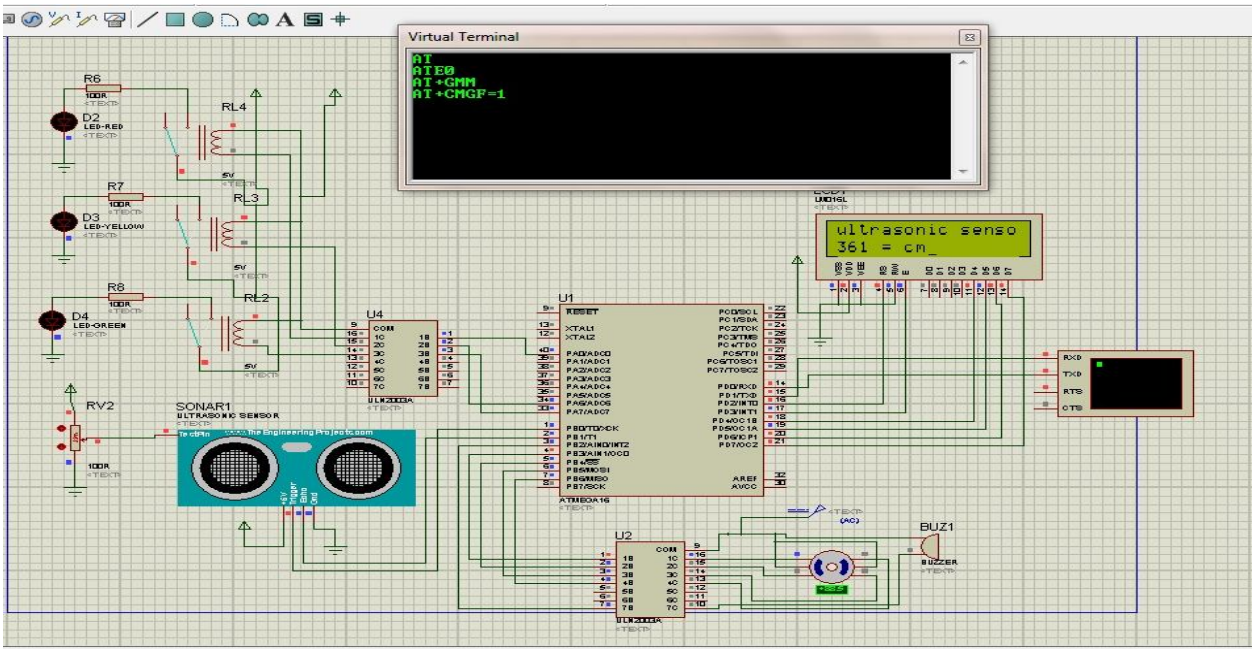

Figure 4.2 The Simulation Result when Ultrasonic sensor display more than 2meters

4.2.2 Detection state

When Ultrasonic sensor detect any movements surrounding less than 2 meters distance the system will stop the camera automatically and capture photo and send it through MMS through IP camera ,after that system will send another SMS message to the administrator through GSM and buzzer will be activated .

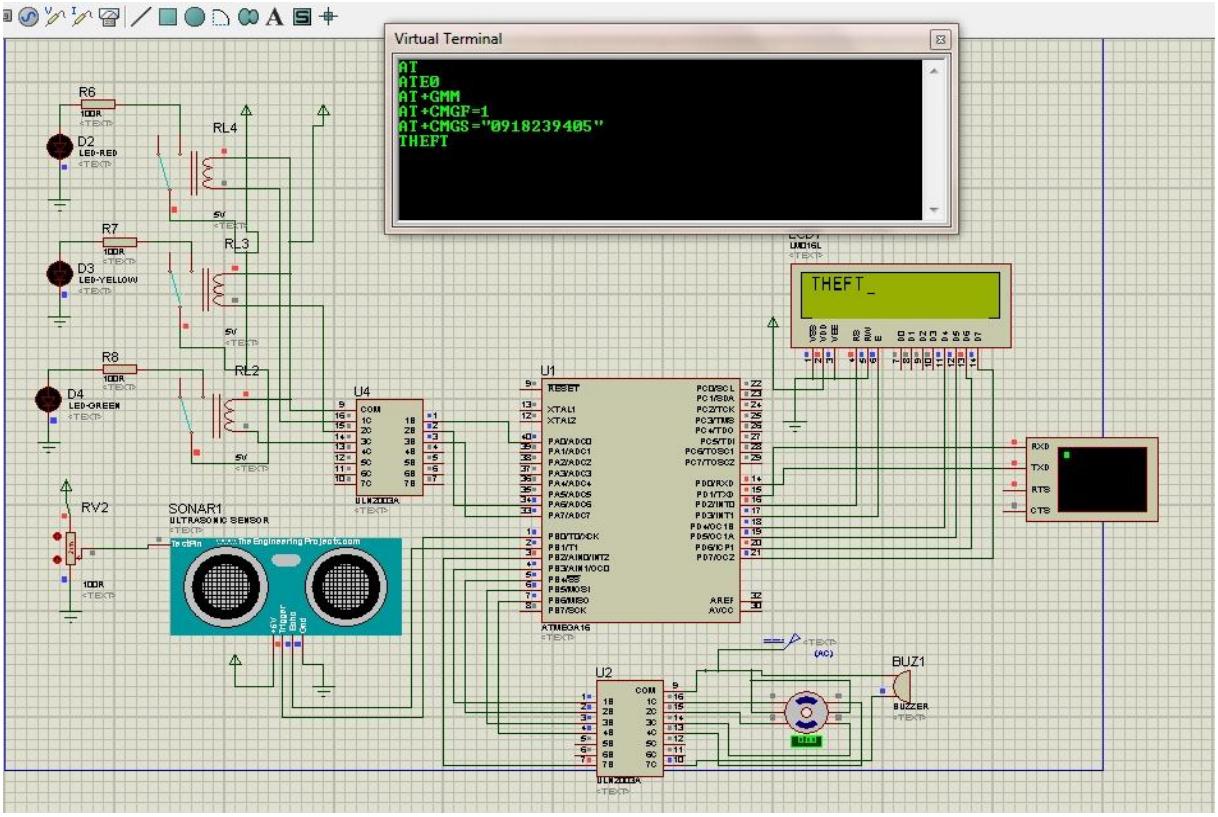

Figure 4.3 The Simulation Result when Ultrasonic sensor display less than 2meters

4.2 Hardware Implementation

The design circuit will be placed to the PCB after the design circuit is tested by using Proteus 7.7 the PCB will be etching and drill at PCB Laboratory, The figure below shows the picture of complete design of security system for remotely installed solar panels.

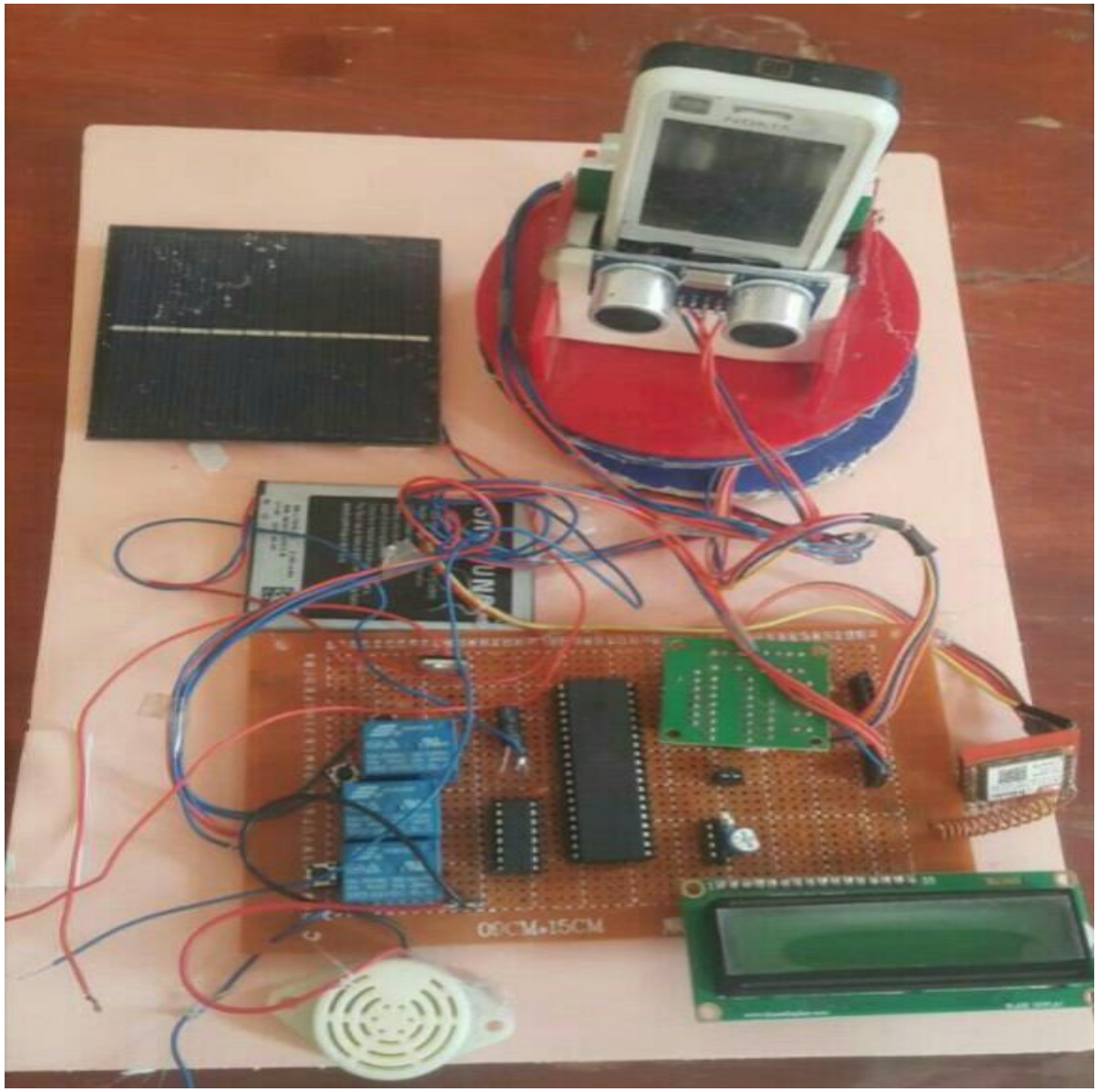

Figure 4.4 deign of security system for remotely installed solar panels

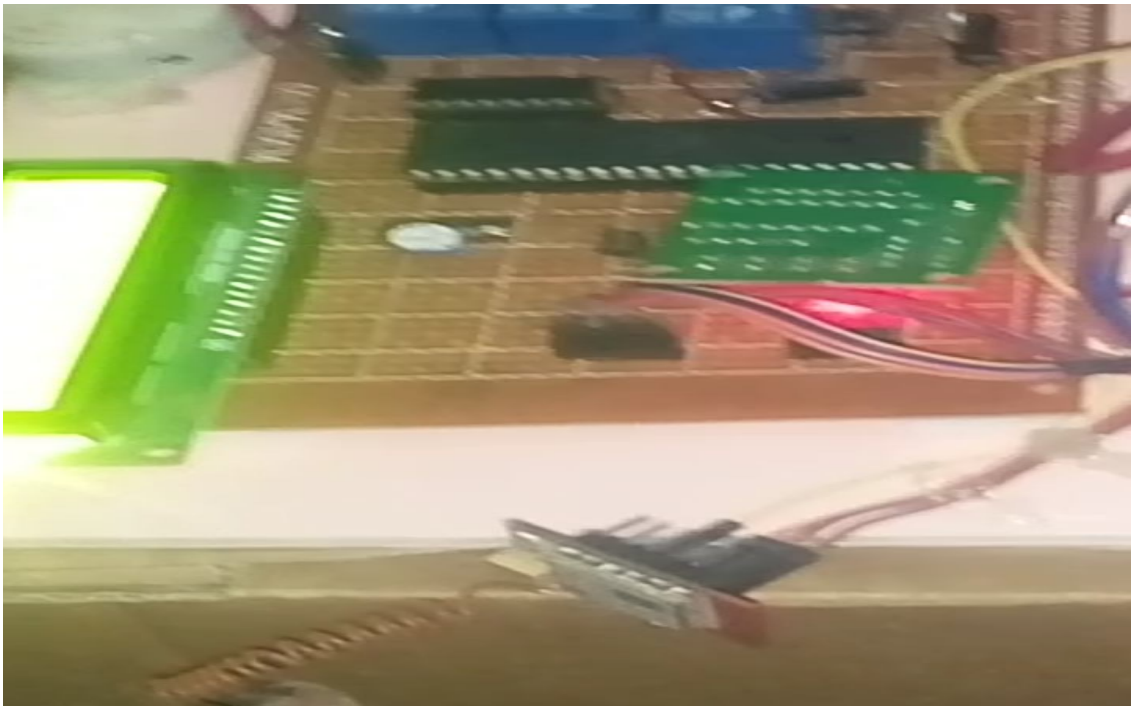

Figure 4.5 ultrasonic sensor motion detection, GSM send massage to administration phone and alarm active

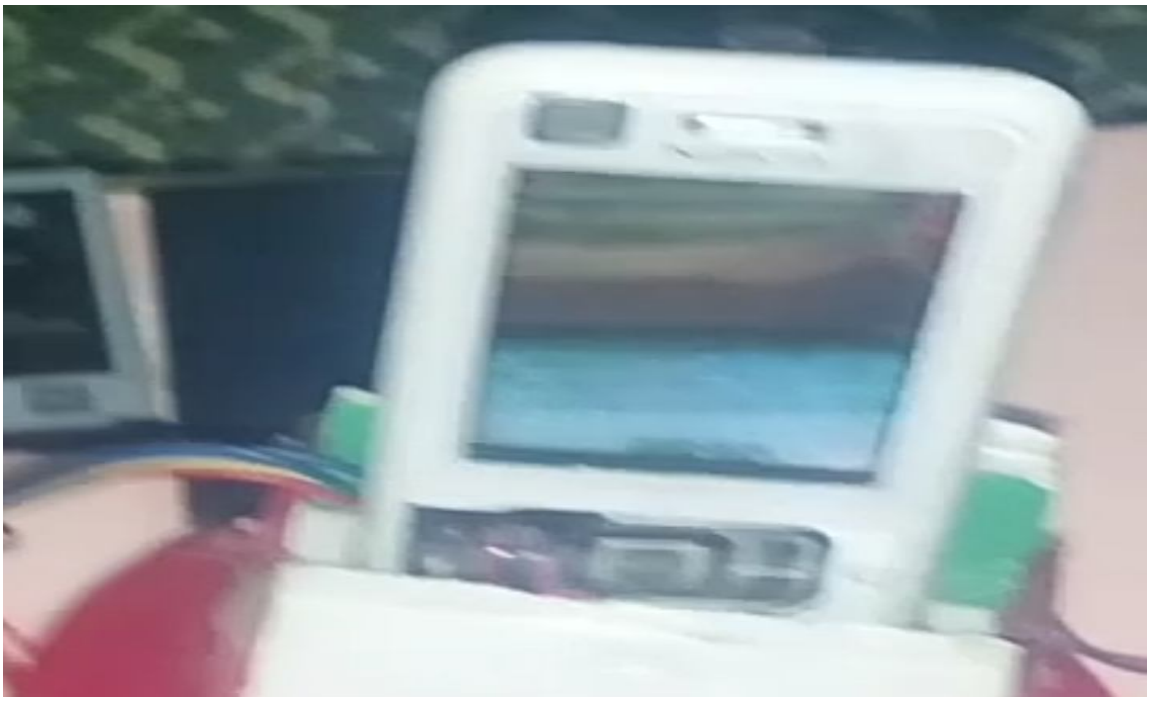

Figure 4.6 camera stepper motor which directed to left position.

Figure 4.7 LCD displayed ultrasonic sensor distance

CHAPTER FIVE
CONCLUSION AND FUTURE WORK

Chapter five

Conclusion and Future Work

5.1Conclusion

In conclusion, the main objective of this project is to secure the water solar pumping units. The security system which consists of few components like alarm, camera, ultrasonic, microcontroller and other accessories we designed, The experimental results show that the proposed system is stable, reliable and very practical. It has the advantages such as very compact in volume, easy to operate and very efficient and low power. The use of stepper motor in this system was very successful because its accurate rotation made the camera cover all of the area. And total cost is very low compared to the cost of the solar pumping unit.

All experimental tests show that the system works efficiently and the design requirement. The system also can be used in any places which require security and remote monitoring, such as banks, home, museums and so on.

5.2 Future Work

In future development of a security system for monitoring and control system must be allocated further more use of outdoor and security cameras may be applicable. In the long term always record emergency security contacts and make data base efficient to words the records, in addition there will be change of microcontroller systems in to PLC (programmable Logic Controller).

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APPENDICES

Appendix (A)

Program code

```
$regfile = "m16def.dat"
$crystal = 8000000
$baud = 9600

Config Com1 = Dummy , Synchrone = 0 , Parity = None , Stopbits = 1 , Databits =
8 , Clockpol = 0
Config Lcdpin = Pin , Db4 = Portd.4 , Db5 = Portd.5 , Db6 = Portd.6 , Db7 =
Portd.7 , E = Portd.3 , Rs = Portd.2
Config Lcd = 16 * 2                    'configure lcd screen
'buzzer
Config Portb.0 = Output                  'pingtrigger
Config Pinb.1 = Input                   'echo
Config Portb.3 = Output                  'camr motor
Config Portb.4 = Output                  'camr motor
Config Portb.5 = Output                  'camr motor
Config Portb.6 = Output                  'camr motor
Config Porta.0 = Output                  'mobile
Config Porta.6 = Output                  'mobile
Config Porta.7 = Output                  'mobile
Config Portb.2 = Output                  'BUZ1
Dim S1 As Long
Dim Cm1 As Long
Dim Q As Word
Dim C As Word
Dim Tt As Word
Tt = 500
Dim T As Word
T = 50
Dim Sr As String * 20
Dim Ss As String * 200
```

```
Cls
Locate 1 , 1                          'set cursor position
Lcd "waiting gsm"                     'display this
Waitms 500
Ss = "THEFT"
Sr = "AT+CMGS="
Sr = Sr + Chr(&H22)
Sr = Sr + "0918239405" ' "
Sr = Sr + Chr(&H22)
Print "AT"
Waitms 20
Print "ATE0"
Waitms 20
Print "AT+GMM"
Waitms 20
Print "AT+CMGF=1"
Waitms 20

A:
Porta.0 = 0
Porta.6 = 0
Porta.7 = 0
Portb.2 = 0
Do

Gosub Ultrsonic1

'Waitms 10
S1 = 0
Incr C
Gosub L2
If C = 12 Then
Gosub Hh
End If
Loop
Return
Hh:
Porta.0 = 0
Porta.6 = 0
Porta.7 = 0
```

```
Portb.2 = 0
Do
Gosub Ultrsonic1
'Waitms 10
S1 = 0
Gosub M2
Decr C
If C = 1 Then
Gosub A
End If
Loop
Return

Ultrsonic1:

Ff1:
Portb.0 = 0
 Waitus 100
Portb.0 = 1
 Waitus 10
Portb.0 = 0

If Pinb.1 = 0 Then
Gosub Ff1
End If

Dd1:
If Pinb.1 = 1 Then
Incr S1
Goto Dd1
End If

Cm1 = S1 / 12
Cls
Locate 1 , 1                          'set cursor position
Lcd "ultrasonic sensor" ; Cm1                 'display this
Locate 2 , 1                          'set cursor position
Lcd ; Cm1 ; " = cm"
Waitms 500
If Cm1 >= 201 Then
```

```
Portd.7 = 0
End If
If Cm1 <= 200 Then
Cls
Locate 1 , 1                    'set cursor position
Lcd Ss                          'display this
For Q = 1 To 2
Porta.0 = 0
Porta.6 = 1
Porta.7 = 0
Waitms 500
Porta.6 = 0
Waitms 10
Next Q

Waitms 60

Porta.0 = 0
Porta.6 = 1
Porta.7 = 0

Waitms 500
Porta.6 = 0
Waitms 10

For Q = 1 To 4
Porta.0 = 0
Porta.6 = 0
Porta.7 = 1

Waitms 500
Porta.7 = 0
Waitms 50
Next Q

For Q = 1 To 2
Porta.0 = 0
Porta.6 = 1
Porta.7 = 0
```

```
Waitms 500
Porta.6 = 0
Waitms 50
Next Q
Waitms 20

For Q = 1 To 4
Porta.0 = 0
Porta.6 = 1
Porta.7 = 0

Waitms 500
Porta.6 = 0
Waitms 50
Next Q

Waitms 30
Porta.0 = 0
Porta.6 = 1
Porta.7 = 0
Waitms 500
Porta.6 = 0
Waitms 50
Print Sr
 Waitms 20
 Print Ss
 Waitms 200
 Printbin &H1A
Waitms 10
Portb.2 = 1
Waitms 1000
Portb.2 = 0
Waitms 10

Gosub A
End If
Return

''''''''''''''''''
M2:
```

```
Portb.3 = 1
Portb.4 = 0
Portb.5 = 0
Portb.6 = 0
Waitms T
Portb.3 = 0
Portb.4 = 1
Portb.5 = 0
Portb.6 = 0
Waitms T
Portb.3 = 0
Portb.4 = 0
Portb.5 = 1
Portb.6 = 0
Waitms T
Portb.3 = 0
Portb.4 = 0
Portb.5 = 0
Portb.6 = 1
Waitms T

Return

L2:

Portb.3 = 0
Portb.4 = 0
Portb.5 = 0
Portb.6 = 1
Waitms T
Portb.3 = 0
Portb.4 = 0
Portb.5 = 1
Portb.6 = 0
Waitms T
Portb.3 = 0
Portb.4 = 1
Portb.5 = 0
Portb.6 = 0
```

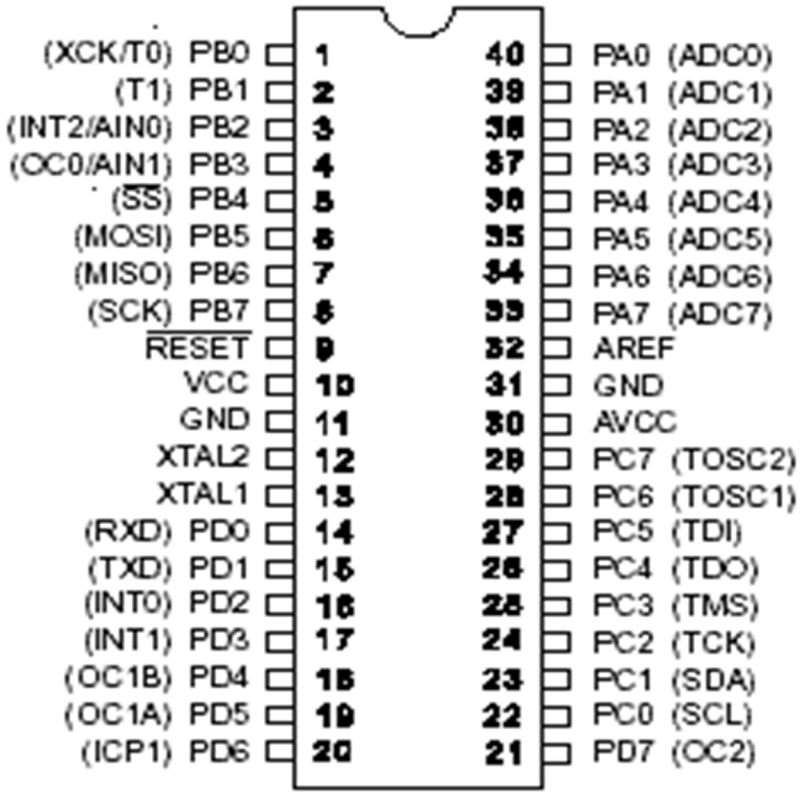
```
Waitms T
Portb.3 = 1
Portb.4 = 0
Portb.5 = 0
Portb.6 = 0
Waitms T
Return
```

Appendix (B)

Micro- atmega16

❖ **Phtograph**

❖ **Pin Layout**



Pin Number	Description

❖ **Pin**

Description

1	(XCK/T0) Port B0
2	(T1) Port B1
3	(INT2/AIN0) Port B2
4	(OC0/AIN1) Port B3
5	(SS) Port B4
6	(MOSI) Port B5
7	(MISO) Port B6
8	(SCK) Port B7
9	RESET
10	VCC
11	GND
12	XTAL2
13	XTAL1
14	(RXD) Port D0
15	(TXD) Port D1
16	(INT0) Port D2
17	(INT1) Port D3
18	(OC1B) Port D4
19	(OC1A) Port D5
20	(ICP1) Port D6
21	(OC2) Port D7
22	(SCL) Port C0
23	(SDA) Port C1
24	(TCK) Port C2
25	(TMS) Port C3
26	(TD0) Port C4
27	(TDI) Port C5
28	(TOSC1) Port C6
29	(TOSC2) Port C7
	AVCC
31	GND
32	AREF

33	(ADC7) Port A7
34	(ADC6) Port A6
35	(ADC5) Port A5
36	(ADC4) Port A4
37	(ADC3) Port A3
38	(ADC2) Port A2
39	(ADC1) Port A1
40	(ADC0) Port A0

Appendix (C)

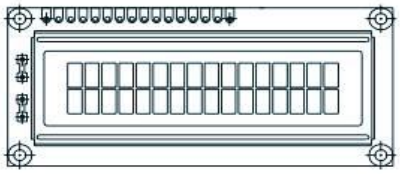
LCD 16×2 display device

VISHAY

LCD-016M002B

Vishay

16 x 2 Character LCD



FEATURES

- 5 x 8 dots with cursor
- Built-in controller (KS 0066 or Equivalent)
- + 5V power supply (Also available for + 3V)
- 1/16 duty cycle
- B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED)
- N.V. optional for + 3V power supply

MECHANICAL DATA

ITEM	STANDARD VALUE	UNIT
Module Dimension	80.0 x 36.0	mm
Viewing Area	66.0 x 16.0	mm
Dot Size	0.56 x 0.66	mm
Character Size	2.96 x 5.56	mm

ABSOLUTE MAXIMUM RATING

ITEM	SYMBOL	STANDARD VALUE			UNIT
		MIN.	TYP.	MAX.	
Power Supply	VDD-VSS	- 0.3	–	7.0	V
Input Voltage	VI	- 0.3	–	VDD	V

NOTE: VSS = 0 Volt, VDD = 5.0 Volt

ELECTRICAL SPECIFICATIONS

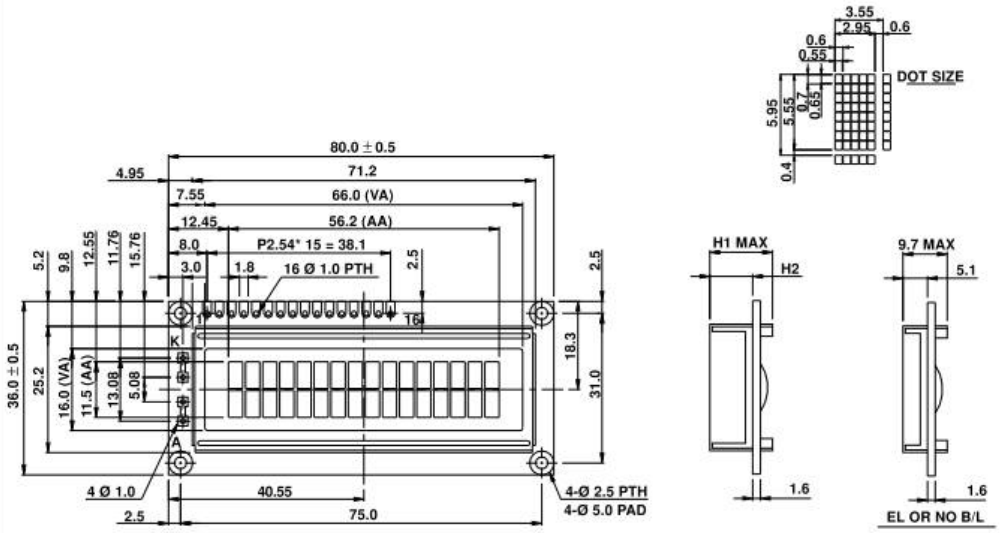
ITEM	SYMBOL	CONDITION		STANDARD VALUE			UNIT
				MIN.	TYP.	MAX.	
Input Voltage	VDD	VDD = + 5V		4.7	5.0	5.3	V
		VDD = + 3V		2.7	3.0	5.3	V
Supply Current	IDD	VDD = 5V		–	1.2	3.0	mA
Recommended LC Driving Voltage for Normal Temp. Version Module	VDD - V0	- 20 °C		–	–	–	V
		0°C		4.2	4.8	5.1	
		25°C		3.8	4.2	4.6	
		50°C		3.6	4.0	4.4	
		70°C		–	–	–	
LED Forward Voltage	VF	25°C		–	4.2	4.6	V
LED Forward Current	IF	25°C	Array	–	130	260	mA
			Edge	–	20	40	
EL Power Supply Current	IEL	Vel = 110VAC:400Hz		–	–	5.0	mA

DISPLAY CHARACTER ADDRESS CODE:

Display Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DD RAM Address	00	01														0F
DD RAM Address	40	41														4F

PIN NUMBER	SYMBOL	FUNCTION
1	Vss	GND
2	Vdd	+ 3V or + 5V
3	Vo	Contrast Adjustment
4	RS	H/L Register Select Signal
5	R/$\overline{W}$	H/L Read/Write Signal
6	E	H →L Enable Signal
7	DB0	H/L Data Bus Line
8	DB1	H/L Data Bus Line
9	DB2	H/L Data Bus Line
10	DB3	H/L Data Bus Line
11	DB4	H/L Data Bus Line
12	DB5	H/L Data Bus Line
13	DB6	H/L Data Bus Line
14	DB7	H/L Data Bus Line
15	A/Vee	+ 4.2V for LED/Negative Voltage Output
16	K	Power Supply for B/L (OV)

DIMENSIONS in millimeters



LED - H/L B/L	HIGH	LOW
H1	13.2	12.1
H2	8.6	7.5

Appendix (D)

GSM communication module

SIM900
GSM/GPRS Module

The SIM900 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications.

Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900 can fit almost all the space requirements in your M2M application, especially for slim and compact demand of design.

- SIM900 is designed with a very powerful single-chip processor integrating AMR926EJ-S core
- Quad - band GSM/GPRS module with a size of 24mmx24mmx3mm
- SMT type suit for customer application
- An embedded Powerful TCP/IP protocol stack
- Based upon mature and field-proven platform, backed up by our support service, from definition to design and production

General featrues

- Quad-Band 850/ 900/ 1800/ 1900 MHz
- GPRS multi-slot class 10/8
- GPRS mobile station class B
- Compliant to GSM phase 2/2+
  – Class 4 (2 W @850/ 900 MHz)
  – Class 1 (1 W @ 1800/1900MHz)
- Dimensions: 24* 24 * 3 mm
- Weight: 3.4g
- Control via AT commands (GSM 07.07 ,07.05 and SIMCOM enhanced AT Commands)
- SIM application toolkit
- Supply voltage range 3.4 ... 4.5 V
- Low power consumption
- Operation temperature: -30 °C to +80 °C

Specifications for fax

- Group 3, class 1

Specifications for data

- GPRS class 10: max. 85.6 kbps (downlink)
- PBCCH support
- Coding schemes CS 1, 2, 3, 4
- CSD up to 14.4 kbps
- USSD
- Non transparent mode
- PPP-stack

Specifications for SMS via GSM / GPRS

- Point-to-point MO and MT
- SMS cell broadcast
- Text and PDU mode

Drivers

- MUX Driver

Specifications for voice

- Tricodec
  – Half rate (HR)
  – Full rate (FR)
  – Enhanced Full rate (EFR)
- Hands-free operation (Echo suppression)
- AMR
  Half Rate(HR)
  Full Rate(FR)

Interfaces

- Interface to external SIM 3V/ 1.8V
- analog audio interface
- RTC backup
- SPI interface
- Serial interface
- Antenna pad
- I2C
- GPIO
- PWM
- ADC

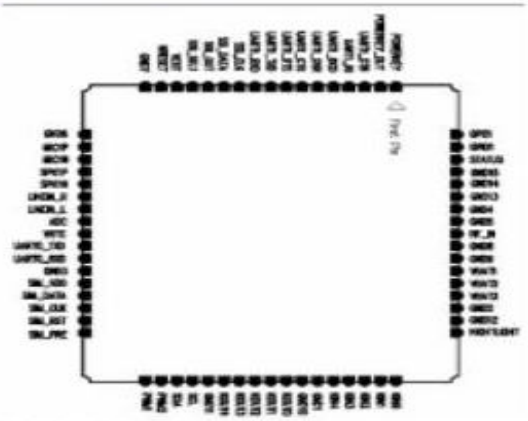
Compatibility

- AT cellular command interface

Approvals (in planning)

- CE
- FCC
- ROHS
- PTCRB
- GCF
- AT&T
- IC
- TA

Pin Assignment



More about SIM900 module, Please contact: Tel:+86 21 32523300
Fax:+86 21 32523301
Email:simcom@sim.com