

Automation Security System

Avinash Singh¹, Bharat Singh², Divyanshu Rawat³, Bhavnesht Jain⁴

Department of Electrical Engineering, Delhi Technological University, NEW DELHI

Abstract— Security systems has seen a rapid rise in its place in research and development, in the field of home automation and industries. This is a field where development occurs regularly yet still always leave some room for growth. In this paper, an endeavour has been made to develop advanced automation security system with ultrasonic range module, stepper motor and GSM module to detect theft. When a person comes within the range of the system, along with an alarm buzz and led indication, an alert message is sent using GSM module touser’s mobile. Use of stepper motor and ultrasonic module in system also provides an omni directional security of home detection. This system also very economical yet simple to implement. The system successfully developed, implemented and tested and that we found that its working is satisfactory. The abstract should summarize the content of the paper. Try to keep the abstract below 250 words. Do not make references nor display equations in the abstract. The journal will be printed from the same-sized copy prepared by you. Your manuscript should be printed on A4 paper (21.0 cm x 29.7 cm). It is imperative that the margins and style described below be adhered to carefully. This will enable us to keep uniformity in the final printed copies of the Journal. Please keep in mind that the manuscript you prepare will be photographed and printed as it is received. Readability of copy is of paramount importance.

Keywords— ATmega-328 Microcontroller, Stepper Motor, Buzzer alarm, GSM SIM900.

I. INTRODUCTION

In this era, need for security makes many folks quest for ways to safeguard their property. Many systems assure limited security in both indoor and/or outdoor environments. But, variety of them has very complicated connectivity and so the implementation cost reaches high values. In some of the cases this makes system highly inaccessible for the users. This includes hard and complicated locks or camera/sensor operated systems that are not economically viable. Furthermore such camera/sensor based systems are prone to blind spots intruder can take advantage of. This produces a requirement for security with decent number of varied systems integrated together, with as less resources as possible. This paper attempts to tackles these obstacles. The system proposed can be utilised in both security and safety of non-public sectors like homes, work places or other site that user wishes to protect. Security provides protection to our life and variable assets. Hence, we made an endeavour to develop an industrial security system with AVR microcontroller-At mega 328. Intruder is detected using ultrasonic sensor using its object detection capabilities [1]. Ultrasonic sensor is mounted on top of stepper motor. This stepper motor is rotated step by step using microcontroller and uses step angle to determine direction of intrusion [[3]]. Microcontroller, interfaced to GSM-SIM900 [[4]], sends distance and directional information of detection through GSM. Proposed system hence will be able to avoid problem of blind spots while being economical due to minimal design implemented.

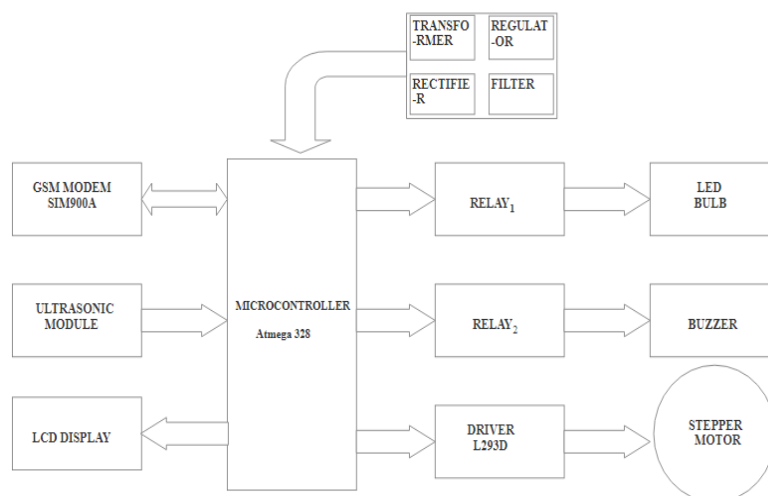


FIGURE 1: Block Diagram ATmega 328

II. LITERATURE SURVEY

As per the National Crime Records Bureau (NCRB), 2,44,119 cases of robbery, theft, burglary, dacoity, among others, happens in residential premises in 2017. This was a jump of over 10% from 2016 when the amount of such cases stood at 2,20,854. The loss thanks to these thefts and burglaries are staggering. In 2017, value of property stolen from residential premises was in more than Rs. 2065 crores, a 40% jump from Rs. 1,475 crores stolen the previous year [1].

A literature survey of GSM based Security system is conducted and presented: -

M. Sravan Kumar, M.Mounika proposed a system that uses GSM module, IR LED and Gas detector interfaced to OP AMP LM324. Whenever there is physical detection in IR LED or smoke detection through fire in gas detector, OP AMP will notify the user through GSM module [[5]]. B.Rama Murthy, O.Jagadish, proposed a home locker consisting of fingerprint scanner module and password protection through keypad and seven segment display and alert system through GSM using Arduino Uno. System will alert the user if one enters wrong fingerprint data or password [[6]]. E. Isa and N. Sklavos developed a password protected, camera monitored, home locker system with a GSM based alert system, using Arduino Uno, protection. System will alert the user when someone enters wrong password 3 times or when someone not closes the door within predefined time. It alerts user through sound, camera image and SMS sent through GSM [[7]]. Abhishek S. Parab and Amol Joglekar constructed a system with 8051 microcontroller, attached on the door, using magnetic relay alerts user through GSM if the door is opened in the absence of the user. Whenever door is opened magnetic relay, which acts like a switch, turns ON causing microcontroller to notify user through GSM [[8]]. B.Lakshmi Prathyusha and J.Anusha developed an all-round security system with object, fire, gas, voice and magnetic relay for door movements. User is alerted through GSM if any of the sensors is activated due to some intrusion. All sensors are controlled through Arduino Uno [[9]].

III. PROPOSED WORK

As per the research conducted, conventional security system has developed in many areas but still consists a drawback of having blind spots. Whether it is a proximity sensor or a camera they can be easily avoided if approached in their blind spot. This can be avoided using many sensors but then system loses its economic viability. This paper attempts to tackle this obstacle, by proposing a 360 degree/omni directional security system with no blind spots. Using same Atmega 328 and ultrasonic sensor but with modification through inclusion of stepper motor onto which ultrasonic module is mounted rotating it step by step to whole 360 degree, thus providing an all-round security. Combining this technique with conventional security methods enhances its all around capabilities. Additionally using GSM module and simple AVR commands user can be alerted of distance as well as direction (in terms of steep angle of stepper motor) along with alert through an alarm buzz and led indication.

3.1 Development of Hardware

The block Diagram of the Industrial security System with ATmega 328 microcontroller, ultrasonic sensor and sending alert message with GSM Technology and the schematic diagram in figure. The Industrial security consists of the mainly following units. They are:-

1. Ultrasonic ranging module
2. Positive voltage regulator
3. Character LCD
4. GSM Module
5. Microcontroller ATmega328

The description of each of these units and their interfacing with ATmega328 as presented below.

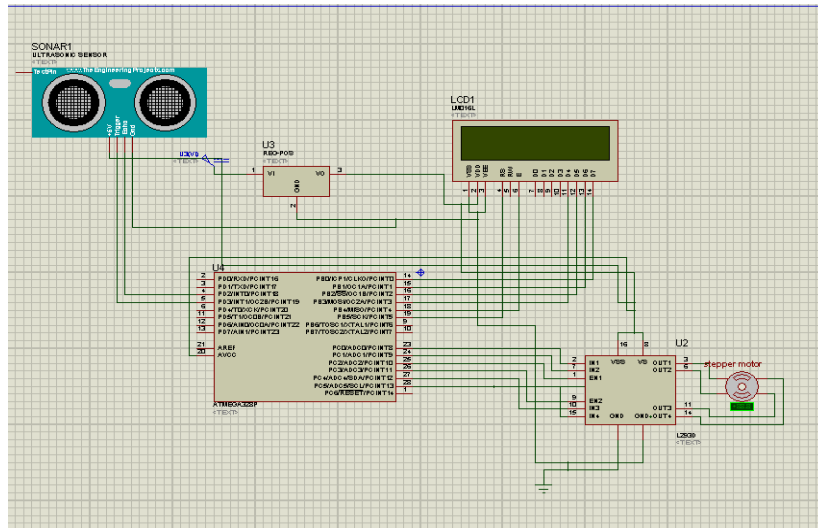


FIGURE 2. Simulation diagram of working model

3.2 Ultrasonic Ranging Module (HC - SR04)

Ultrasonic ranging module HC - SR04 provides object detection from 2cm - 400cm, with a ranging accuracy that can reach up to 3mm. This module includes ultrasonic transmitters, receiver and negative feedback circuit. The basic principle of work: IO trigger, for a minimum of 10 micro seconds (μ s), used to start the ranging module.

The Module automatically sends eight 40 kHz and detect whether there's a pulse signal back.

If the signal is received, through high level, time of high output IO duration is that the time from sending ultrasonic to returning.

Test distance can be calculated as = (high level time \times velocity of sound (340M/S) /2.



FIGURE 3. Ultrasonic Ranging Module (HC-SR04)

3.3 GSM modem – sim900

The worldwide System for Mobile communications (GSM) is the most used and popular standard in the world of mobile phones. Wireless communication module SIM900 which supports the standard of GSM is produced by SIMCOM Company and is employed within the developed application. To send the alert messages by implementing its commands within the software program. 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. Proposed system uses TX, RX pins for connection with microcontroller so that direct connection without the use of serial port can be established.



GSM Module SIM900A
FIGURE 4: GSM Module SIM900

3.4 ATmega 328 Microcontroller

The ATmega328 is a single-chip device. It is an 8-bit microcontroller with 28 Pins. Manufactured by Atmel, a part of AVR family, it follows RISC Architecture and has a flash type program memory of 32KB. It has an EEPROM memory of 1KB and its SRAM memory is of 2KB. It has 8 Pin for ADC (Analog to digital converter) operations, which consists of Port A (PA0 – PA7). It also has 3 built in Timers, two of them are 8 Bit timers while the third one is 16-Bit Timer. Its operates in the range of 3.3V to 5.5V but normally 5V is used as a standard. Atmega328 is known for its cost efficiency, low power dissipation, programming lock for security purposes, real timer counter with separate oscillator. Most commonly used in Embedded Systems applications with some applications in robotic, and many other applications.

FEATURES:

- No. of pins: 28
- CPU: RISC 8-bits AVR
- Operating Voltage: 1.8 to 5.5V
- Program Memory: 32KB
- Program Memory Type: Flash
- SRAM: 2048 byte
- EEPROM: 2048 byte
- ADC: 10-Bit
- No. of ADC Channel: 8
- Timer(3): 16-Bit Timer(1)
- 8-Bit Timer(2)
- I/O pin: 23
- Oscillation: up to 20 MHz
- Minimum Operating Temperature: -40 C to +85 C

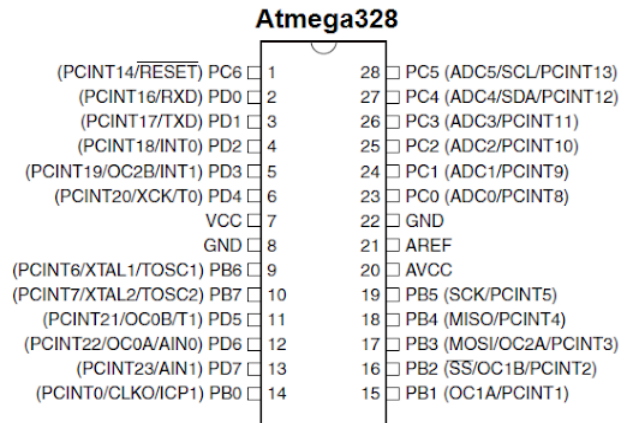


FIGURE 5. Atmega 328 Microcontroller

3.5 16*2 Alphanumeric Lcd Display

The LCD has been implemented to display the detected distance and angle which is also being sent to the user. It can exhibit 16*2 or 32 ASCII characters with 2 character lines where each line having 16. It has 8 data pins used in carrying the data from user to character LCD. Every Character has its unique bit code in accordance to ASCII format and is implemented to display characters on LCD. Other pins include enable, read/write and register selector. Ground, VCC, VO (LCD contrast) and Anode and cathode. Whenever the enable pin is low, the LCD is OFF and it is ON if the pin is high. The read/write pin, if high, reads the info from LCD and if low, writes data in it. The register select pin decides the sort of knowledge transferred through the info pins. If it is high, a character is written in LCD and if the low, command is sent to LCD. VCC is the power supply, which is 5V. VO sets contrast and brightness for the LCD display.



FIGURE 6: 16*2 LCD

3.6 Stepper Motor & L293D Driver IC

Stepper motors are DC motor that rotates in discrete step Stepper motor consists of many coils that are grouped together to form the phases. In order to rotate the stepper motor coils are energized phase wise using computerized sequences. Each phase is energized sequentially and each phase rotates rotor by some degree which is termed as step angle. Stepper motor used in the project has a step angle of 1.8 degree in or 200 turns per rotation. Other settings are also available including 24

and 48 turns per rotation. There are two types of stepper motor- unipolar and bipolar. Unipolar are energized in a constant manner. One coil will be positive while other is negative. Meanwhile in bipolar motors H-bridge connectivity is used for bidirectional functioning of motor.

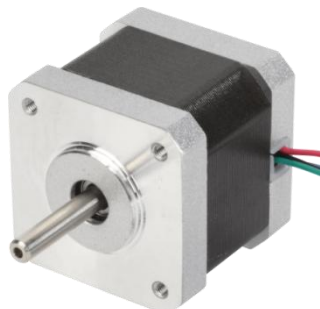


FIGURE 6: Stepper Motor

L293D (16 pin IC) is a Motor Driver IC which allows motors, be it stepper or DC, to drive on either directions. It is required as microcontroller itself cannot provide enough power for operation of stepper motor. It works on the concept of H-bridge. H-bridge is type of circuit with capabilities to allow voltage to change polarities which is essential in rotating the motor in both direction. It requires a supply of 5V for its functioning. The stepper motor rotates with the help of the driver IC.

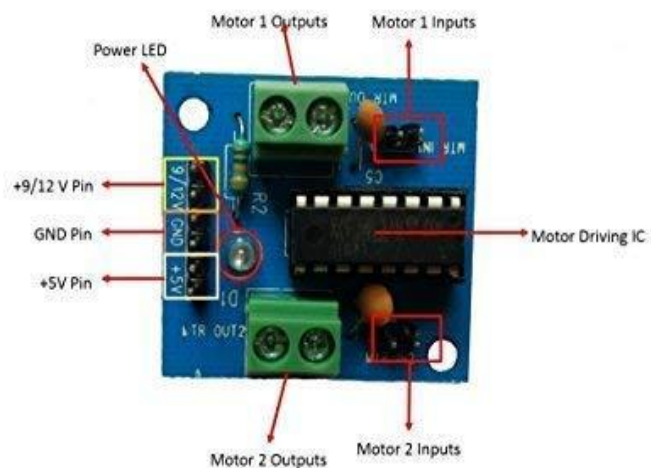


FIGURE 7: Motor Driver (L293D)

IV. SYSTEM DESIGN

The system is fully controlled by the microcontroller and it continuously monitors the sensors, detector and GSM modem.

Microcontroller repeatedly rotates stepper motor through L293D driver IC. Motor completes 1 revolution in 200 steps in accordance with its step angle 1.8 degree. Angle or Tracking is calculated based difference between variable “new angle” and “set angle” with “set angle” fixed at 0 and “new angle” calculated from number of pulses send to stepper motor.

Ultrasonic is mounted on top of stepper motor where object detection takes place and distance is calculated as $(\text{time} * 0.34) / 2$ where 0.34 is speed of sound in cm/ μ s. When distance calculated is less than 10 cm then an alarm will buzz off along with activation of GSM. In that instant then it will send the “AT +CMGS =”USER MOBILE NUMBER” to GSM modem through serial port.

GSM modem will send the detected distance as well its direction of detection in terms of angle.

V. TEST AND RESULTS

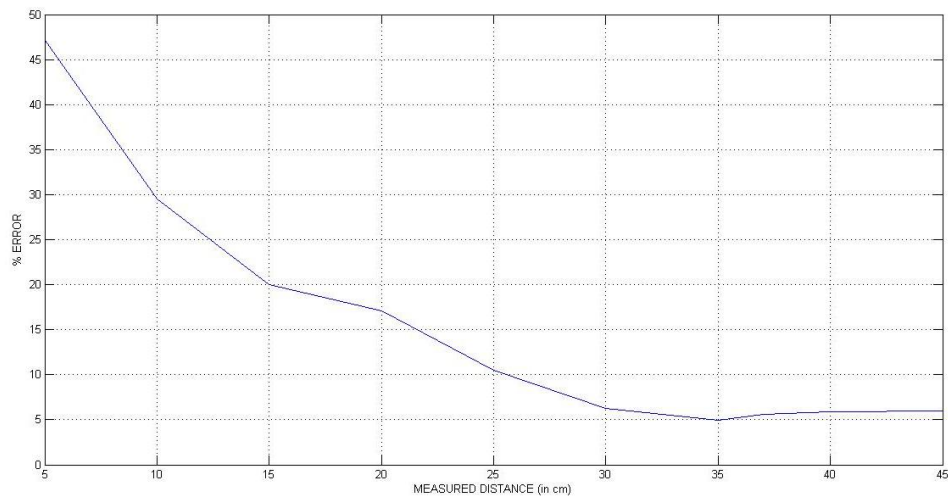
System is tested for ultrasonic sensors ability to detect distance while being in motion. For this, Ultrasonic sensor is rotated through stepper motor and distance detected is observed at different measurements. Data for this observation is shown below.

TABLE 1
DATA COLLECTED FROM OBSERVATIONS

MEASURED DISTANCE (in cm)	SMS DISTANCE(in cm)	Error(in cm)	Error (in %)
5	7.36	2.36	47.2
10	12.97	2.95	29.5
15	18	3	20
20	23.41	3.53	17.05
25	28.22	3.22	10.48
30	31.87	1.87	6.23
35	36.77	1.77	4.91
37	39.08	2.08	5.62
40	42.36	2.36	5.90
45	47.86	2.86	6.35

Below graph and above table are use to show the existence error in cm and %.

Plotting the graph between measured distance (in cm) and error (in %):-



GRAPH: Plotted of Data collected from observations

According to data and graph, accuracy decreases as distance is increased, and achieves a near constant accuracy in the range of 4-5% in the terms of percent error starting from 35 cm.

VI. OUR WORKING MODEL

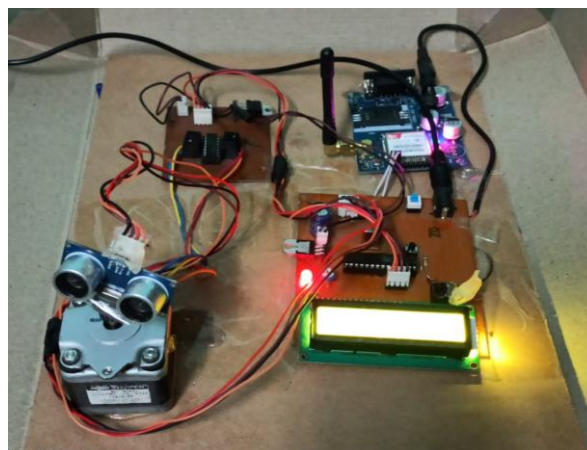
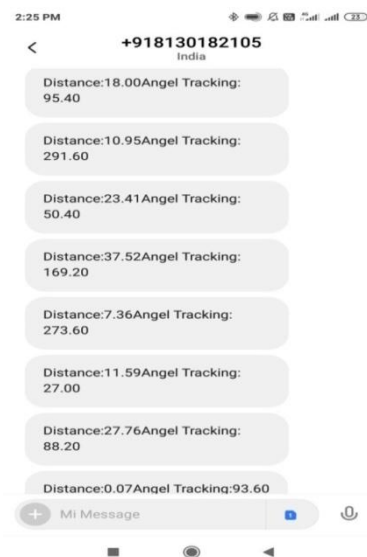


FIGURE 8: Project Designed

VII. OUTPUT OR RESULT

The distance (in cm) and angle (in degree) of the object which is detected by our model /through the SMS in the mobile (owner mobile) is:-



VIII. CONCLUSION AND FUTURE WORK

This security system is tested and implemented using ULTRASONIC RANGE, STEPPER MOTOR and GSM as an advance security over 360-degree angle in particular range. And we found systems' working is satisfactory. The systems having advanced features like its portable and low cost and standalone system. Our future work of this paper is planned to a develop in addition with some important equipment like:-

Wireless camera to help in identifying type of threat which is detected by the system and also some additional sensors like fire or gas sensors will enhance security prospects of this work when implanted with 360-degree detection.

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