

Hand Gesture Recognition Bomb Diffusing Surveillance Robot

Sagar Randive, Neha Lokhande, Apoorva Kamat, Shubhrojit Chakraborty, #Vishal Pande

Instrumentation, Vidyavardhini's College of Engineering and Technology

#Assistant Professor, Instrumentation, Vidyavardhini's College of Engineering and Technology

Address

sagarrandive@yahoo.com

neha_lokhande91@yahoo.com

apoorva.kamat12@yahoo.com

shubhro007@gmail.com

#vishalp_2000@yahoo.com

Abstract— This is an interesting robot that can be controlled by hand gestures and by a RF remote. The hand gesture recognition technology uses potentiometers fitted inside a glove and uses the phenomena of change in resistance for the corresponding motion of the robot. This can be moved forward and reverse direction using geared motors of 60RPM. Also this robot can take sharp turnings towards left and right directions. This project uses AT89S52 MCU as its controller. A high sensitive induction type metal detector is designed using Colpitt's oscillator principle and fixed to this robot. Also a mobile phone signal isolator is interfaced to the kit. When the robot is moving on a surface, the system produces a buzzer sound when bomb is detected and activates the jammer circuitry to jam all the 3G, GSM and CDMA networks in the vicinity of the object. The RF modules used here are STT-433 MHz Transmitter, STR-433 MHz Receiver, HT640 RF Encoder and HT648 RF Decoder. The three switches are interfaced to the RF transmitter through RF Encoder. The encoder continuously reads the status of the switches, passes the data to the RF transmitter and the transmitter transmits the data. This project uses 9V battery. This project is much useful for mines detection and surveillance applications.

Keywords— hand gesture recognition, wireless, metal detector, bomb diffusion, jammer, robot, surveillance

I. LITERATURE SURVEY

We researched a lot and after a lot of considerations we decided to implement the hand gesture mechanism by virtue of potentiometers fitted inside a glove. While doing the same we searched many websites on the internet and came up with the implementation methodology and circuit diagram for the same. The original idea was adopted from a research article named 'Microcontroller Based Gesture Recognition System for Handicap People' which was published in Journal of Engineering Research and Studies. The goal of the original project was to develop a computerized Indian Sign Language (ISL) recognition system. We also considered Matlab for the same but

since the software is not an open source we discarded the option. Another idea includes the use of IR proximity sensors for hand gestures recognition. The system allows a user to interact with mobile devices using intuitive gestures, without touching the screen or wearing/holding any additional device. Evaluation results show that the system is low-power, and able to recognize 3D gestures with over 98% precision in real time. Research showed that lack of alertness and awareness is one of the major cause of the mayhems occurring due to bomb blasts and hence we decided to use a metal detector and buzzer assembly for the detection of any malicious objects in the vicinity.

II. INTRODUCTION

An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers. Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result. As everyone in this competitive world prefers to make the things easy and simple to handle, this project sets an example to some extent. In this project we use a robot and it is controlled by hand gestures.

Gesture-based interfaces provide an intuitive way for users to specify commands and interact with computers. Existing gesture recognition systems can be classified into three types: motion-based, touch-based, and vision-based systems. For motion-based systems, a user must hold a mobile device or an external controller to make gestures. Touch-based systems can accurately map the finger/pen positions and moving directions on the touch-screen to different commands. However, 3D gestures are not supported because all possible gestures are confined within the

2D screen surface. Vision-based systems using camera and computer vision techniques allow users to make intuitive gestures without touching the device. However, vision-based systems are computationally expensive and power-consuming, which are undesirable for resource-limited mobile devices like tablets or mobile phones.

To overcome these problems we have designed the system that inputs hand gestures to the system through an electronic sensor glove and it identifies the gesture patterns via microcontroller network. Based on the movement of the hand the robot is moved in the respective direction i.e. either in forward, backward, left or right. Also the robot is supplemented with a metal detector to detect any malicious

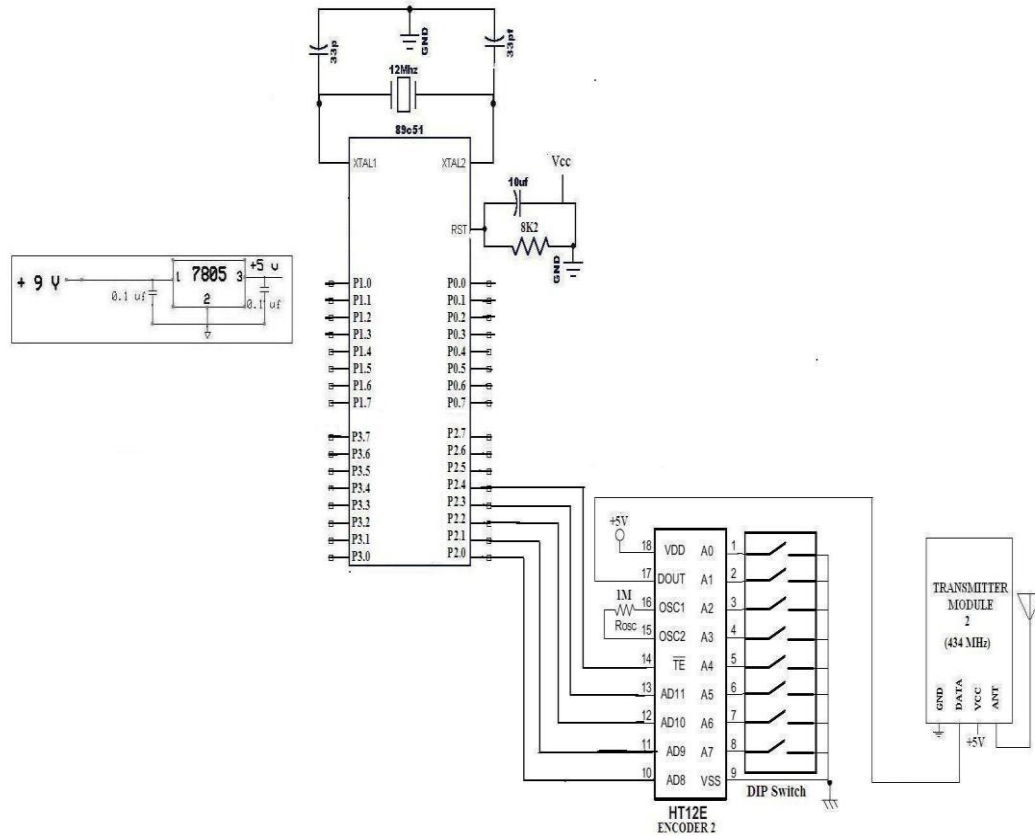


Fig. 2 Transmitter circuit diagram

object viz. bomb and a buzzer which will in turn alert everyone in the vicinity of that object.

III. WIRELESS/RF TECHNOLOGY

RF is the wireless transmission of data by digital radio signals at a particular frequency. It maintains a two ways, online radio connection between a mobile terminal and the host computer. The mobile terminal, which can be portable, even worn by the worker, or mounted on a forklift truck, collects and displays data at the point of activity. The host computer can be a PC, a minicomputer or a much larger mainframe. The end result is a seamless flow of information to and from the host, allowing workers to go wherever they need to go get their job done without fear of being out of touch with the data they need.

A. RF Transmitter



Fig. 1 RF transmitter module

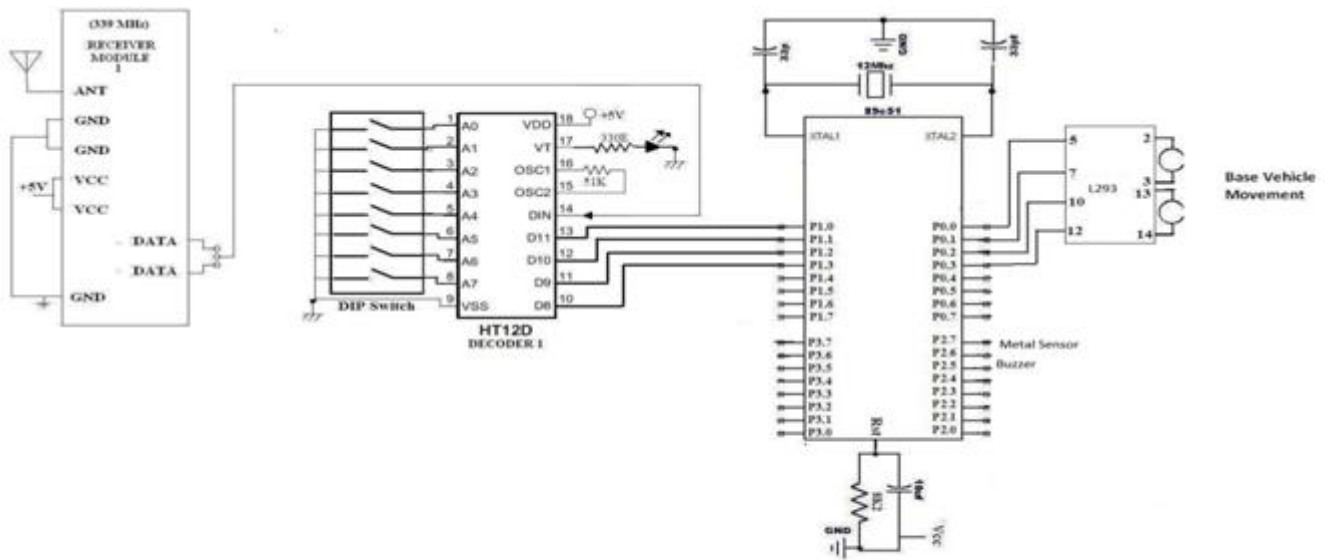


Fig. 6 Receiver circuit diagram

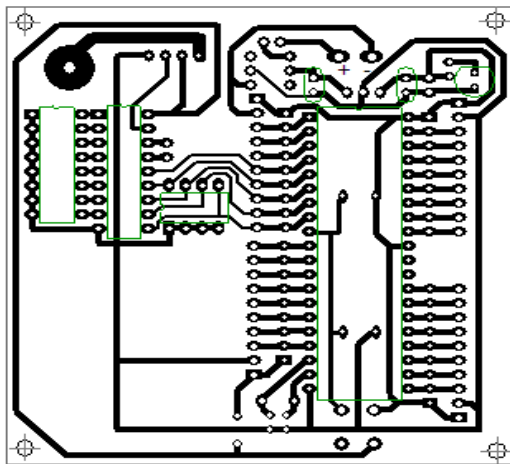


Fig. 3 Transmitter PCB layout

The STT-433 is ideal for remote control applications where low cost and longer range is required. The transmitter operates from a 1.5-12V supply, making it ideal for battery-powered applications. The transmitter employs a SAW-stabilized oscillator, ensuring accurate frequency control for best range performance.

B. RF Receiver

The data is received by the RF receiver from the antenna pin and this data is available on the data pins. two data pins are provided in the receiver module. thus, this data can be used for further applications

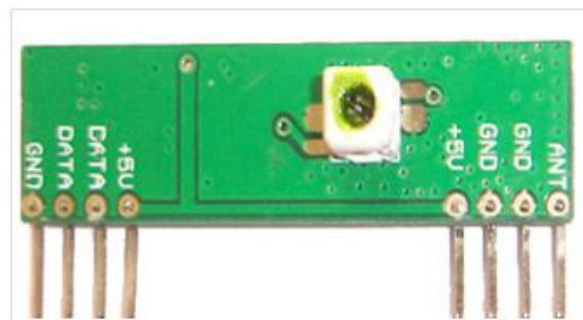


Fig. 4 Receiver module

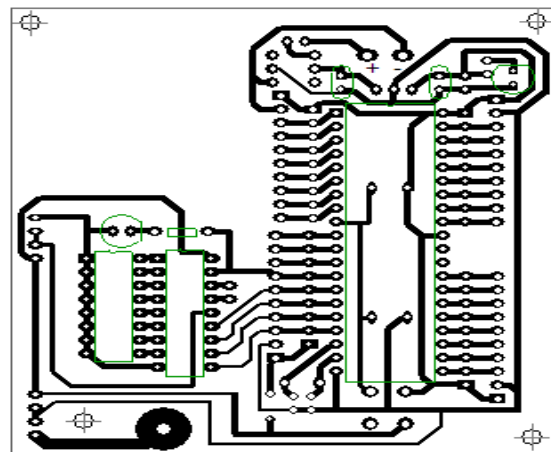


Fig. 5 Receiver PCB layout

IV. HAND GESTURE RECOGNITION

Position and orientation of hand is obtained by two main parts; data glove and sensor arm cover. Data glove consists of 5 potentiometer as shown in Figure 7. Bend of the five fingers can be measured by potentiometer.

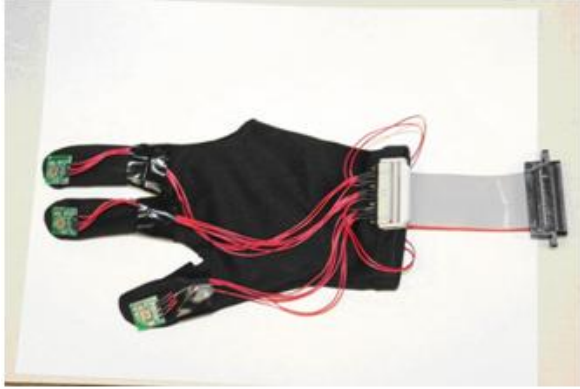


Fig. 7 Gesture input using gloves

A. Interfaced devices

1) ADC0808/ADC0809

The ADC0808, ADC0809 data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximation as the conversion technique. The converter features a high impedance chopper stabilized comparator, a 256R voltage divider with analog switch tree and a successive approximation register. The 8-channel multiplexer can directly access any of 8-single-ended analog signals. The device eliminates the need for external zero and full-scale adjustments. Easy interfacing to microprocessors is provided by the latched and decoded multiplexer address inputs and latched TTL TRI-STATE outputs. The design of the ADC0808, ADC0809 has been optimized by incorporating the most desirable aspects of several A/D conversion techniques. The ADC0808, ADC0809 offers high speed, high accuracy, minimal temperature dependence, excellent long-term accuracy and repeatability, and consumes minimal power. These features make this device ideally suited to applications from process and machine control to consumer and automotive applications.

2) Multiplexer

The device contains an 8-channel single-ended analog signal multiplexer. A particular input channel is selected by using the address decoder. The address is latched into the decoder on the low-to-high transition of the address latch enable signal.

3) Digital potentiometers

A digital potentiometer functions in the same manner as an analog potentiometer. It contains two end terminals and a movable wiper that changes the amount of resistance. However, the digital potentiometer also contains pins that are used to control the position of the wiper – as opposed to an analog knob or dial. The most common way to wire a digital potentiometer is to connect one end terminal to circuit ground and connect the other end terminal and wiper between a power source and an output component, such as a light emitting diode (LED). Because digital potentiometers range in complexity, the best learning strategy is to begin with a basic digital potentiometer that requires minimal connections.

A potentiometer is a variable resistor that is most commonly used as a volume control in consumer electronics. It usually has three connection pins and the amount of resistance can be controlled by turning a knob, dial or screw. For a 10k (10,000 ohms resistance) potentiometer, the amount of resistance can be adjusted from nearly zero ohms to around 10,000 ohms. A potentiometer is a very useful component because you can also vary the amount of voltage and current going through it by varying the amount of resistance. Potentiometers consist of a resistance track with connection at both ends and a wiper which moves along the track as the spindle is rotated. It is an electrical device which has a user adjustable resistance. It can as a variable voltage divider. A potentiometer is constructed using a flat graphite annulus (ring) as the resistive element, with a sliding contact (wiper) sliding around this annulus. The wiper is connected to an axle and, via another rotating contact, is brought out as the third terminal. On panel post, the wiper is usually the centre terminal. The modern potentiometer can be used as a potential divider (or voltage divider) to obtain manually adjustable output voltage at the slider (wiper) from a fixed input voltage applied across the two ends of the pot.

V. METAL DETECTOR

A metal detector is a device which responds to metal that may not be readily apparent. The simplest form of a metal detector consists of an oscillator producing an alternating current that passes through a coil producing an alternating magnetic field. If a piece of electrically conductive metal is close to the coil, eddy currents will be induced in the metal, and this produces an alternating magnetic field of its own. If another coil is used to measure the magnetic field (acting as a magnetometer), the change in the magnetic field due to the metallic object can be detected.

VI. CELL PHONE JAMMER

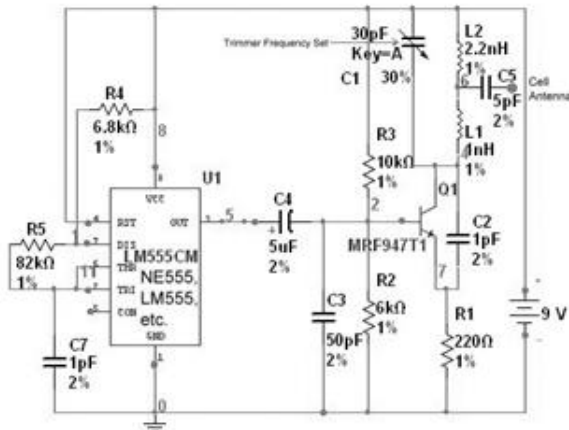


Fig 8. Cell phone jammer circuit diagram

A “Cell Jammer” is just way of saying “Dirty Transmitter” which happens to transmit within the Cellular Phone Bands. Reality is, the dirtier the better. The 555 timer [8 pin] IC simply makes a noise. It’s coupled via C4 [electrolytic] to modulate the MRF transistor oscillator. With C1 set at roughly 1/3rd, you will be close to 900 MHz. By sweeping the C1 trimmer capacitor, you can swing the output frequency from 800 MHz to 2 GHz with the transistor and values shown. You could replace the 555 chip with an electret microphone and listen to yourself talk on a scanner, so the unit could easily couple as a UHF Bug. Instead of a single Tapped Coil, I’ve used two molded inductors for ease of construction. Values for C1,C2,L1,L2 are critical for the frequency range. You might want to build the unit into a metal box, add an on/off switch in the batteries + line, and maybe even add a LED. Connect an old 800 MHz cell phone antenna to C5. Would you believe the whole thing can be built on top of the 555 IC itself when using surface mount components, and the lot will fit onto a nine volt battery clip. Output is reasonably good, although the current drain is a bit high, so a new 9 Volt battery will only run about an hour. The “Cell Kill Distance” is around 10 – 15 feet, ample for most purposes.

VII. RESULTS

This project was successfully executed under due guidance of our in-charge and showed successful results. The results were tested as follows- A cell phone with a metal body was the object in concern. The chassis was placed at a considerable distance from it. It was then manoeuvred using hand gestures so as to approach the object (here cell phone). As soon as the chassis neared the object the metal detector got activated and thus in turn triggered the mobile jammer mounted on the chassis. Later an attempt was made to

connect to the object by means of telecommunication but the attempt failed, thus indicating the successful running of the model. This model is a prototype which can modified and enhanced for wider application area.

VIII. CONCLUSION

This research paper describes designing and working of a system which is useful in areas concerning security, surveillance etc. This assembly and the set up would help spread awareness and thus prevent a dismay amongst masses which is posed by many malicious objects in the vicinity. Besides, the hand gesture recognition makes the robot more user friendly and less prone to accessibility hindrance. It is an effort to reduce crime levels and in turn curb terrorism.

IX. FUTURE SCOPE

- Designing of a whole jacket, which would be capable of vocalizing the gestures and movements of animals.
- Virtual reality application e.g., replacing the conventional input devices like joy sticks in videogames with the data glove.
- Improvising the range of wireless communication so as to be able to put to a wider use.
- The chassis can be modified to incorporate stealth in order to prevent it from radar detection.

REFERENCES

- [1] Engwirda, T. Engwirda, A. Vlacic, L. Dromey, G., Sch. of Microelectron. Eng., Griffith Univ., Brisbane, Qld., Australia, Industrial Technology 2000. Proceedings of IEEE International Conference on 19-22 Jan. 2008, Volume: 1, On page(s): 460- 465 vol.2, ISBN: 0-7803-5812-0, INSPEC Accession Number: 6715776.
- [2] Ray Lockton, Balliol college, Oxford University, Hand gesture recognition using Computer Vision.
- [3] Matuso et al, Hand Gesture Recognizing Device, United nations patent, Patent no. US6,215,890 B1, April 10, 2001.
- [4] Heng-Tze Cheng, Contactless Gesture Recognition System Using Proximity Sensors, Carnegie Mellon University, 1-1-2010.
- [5] Muhammad Ali Mazidi, 8051- Micro-controller and embedded system using assembly and C, 2nd edition, Prentice Hall publication, 2005.
- [6] Designer & Author: Laszlo Kirschner, Mobile jammer [Online]. Available: <http://www.circuit-projects.com>.
- [7] Maeyama, S., Yuta, S. and Harada, A., (1998) “Mobile Robot in the Remote Museum for Modeling the Evaluation Structure of KANSEI”, 7th IEEE International Workshop on Robot and Human Communication, pp. 315-320, Oct 1998.