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DTMF Controlled Enemy Detecting Robot for Border Security with Live Video Transmission

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Abstract:
The main goal is to integrate a medium-size, ROBOT type Unmanned Ground Vehicle (UGV), for border security, here UGV is built with a human detection sensor for detecting the person. Once the person is detected the system will check for the authentication via RF. A wireless camera is attached to the spying robot that can reduce the human victim. This robot sends the signal to base station using wireless camera. With this feature the robot can transmit the real-time videos with the night vision capabilities and cannot be identified by the enemies in the war zone. One of the major applications of this project is DTMF technology which can be used to control the movement of robot. In today's age, a large number of robots are placed in many areas replacing man power in severe or dangerous work place. The main objective is to provide reliable, cost effective and accurate technique to find and destroy enemy.

Keywords: PIR, Monostable, RF ID, Microcntroller, DTMF.

I. INTRODUCTION

In this paper we are designing and developing an Unmanned Ground Vehicle (UGV) for Border Security. The aim behind this project is to design a robotic vehicle to help our soldiers to monitor the border areas especially in extreme climate conditions where it is difficult for the soldiers to survive. The robot is designed to control wirelessly from the control room using DTMF of mobile phone. The robot is fitted with a PIR sensor to find the human presence in border areas. If there is any human presence in the border area, then the robot will detect it with the help of PIR sensor. We are providing a unique RF ID tag for our soldiers that will help to identify our soldiers and enemies in border area. The robot is fitted with a RF ID reader to detect the RF ID tag. When the robot detect any human presence it will check for the RF ID tag to identify whether the person detected is our soldier or enemy. If the person detect is our soldier or enemy, the robot will send that information to the Control station. The robot is fitted with a wireless video camera which will capture the live video and transmit it to the Control station. With the help of this camera we can capture image of enemy detected and also we can track the movement of the enemy in border area.

II. WORKING PRINCIPLE

The Atmel AT89C51 microcontroller acts as the brain of the project. It controls the operation of the robot. This robot is designed to control wirelessly from the control station via DTMF of mobile. The number buttons on mobile is used to control the movement of the robot. When the number buttons on mobile is pressed the mobile will transmitter DTMF signal to the mobile connected with the robot. The mobile at the robot will receive this signal and gives it to the DTMF Decoder to decode the signal. The decoded signal will give to the microcontroller. The microcontroller will process the signal and activate the motor with the help of driver circuit to move the robot.

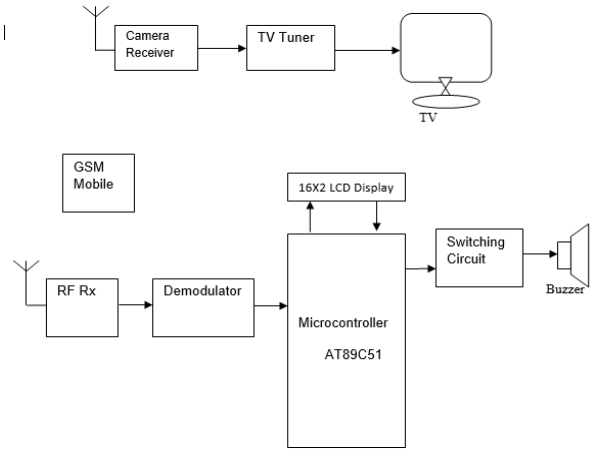


Figure.1. Block Diagram of Robot

The PIR sensor fitted on the robot will detect the human presence and give the signal to the microcontroller via monostable to provide stable input. When the microcontroller receives signal from the PIR it will check for the RF ID from the person detected with the help of RF receiver fitted in it. If the RF receiver receives the signal from the person detected, it will give it to the microcontroller. The microcontroller will process the signal to identify if the person detected is our soldier or enemy. Then the microcontroller will activate the RF transmitter with the help of driver and relay to send the signal to the control station. The wireless camera fitted on the robot will capture the video and send it to the control station. The camera receiver at the control station will receive this signal and display the video at the TV. The RF receiver at the control station will receive the signal from the robot and gives it to the microcontroller. The

microcontroller will process the signal and display the message on LCD display with a warning sound.

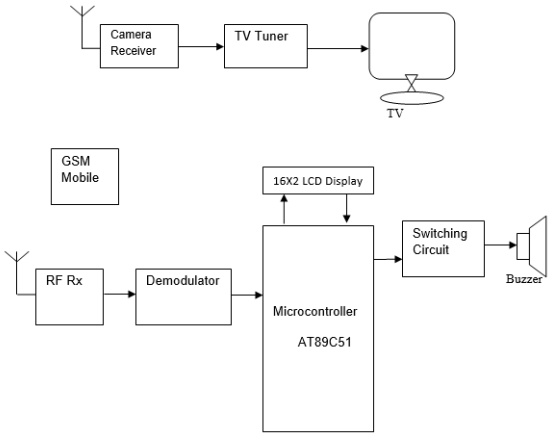


Figure.2. Block Diagram of Control Station

III. COMPONENTS

A. Microcontroller – Atmel AT89C51

The field parameters are monitored by this Microcontroller chip with the help of user written program and generates alert message for LCD display and fault code for remote monitoring end transmission. The Microcontroller Chip has input port for getting fault condition of field parameters and 'Stop' signal through RF Receiver and output port for sending fault code to DTMF Encoder and switching Relay [MCB] for isolating power line from load. The mother board of 89C51 has following sections: Power Supply, 89C51 IC, Oscillator, Reset Switch & I/O ports. Power Supply: This section provides the clean and harmonic free power to IC to function properly. If the CPU is the brain of the system then the oscillator, or clock, is the heartbeat. It provides the critical timing functions for the rest of the chip. There are a total of 32 i/o pins available on this chip. The amazing part about these ports is that they can be programmed to be either input or output ports, even "on the fly" during operation! Each pin can source 20 mA (max) so it can directly drive an led. They can also sink a maximum of 25 Ma current.

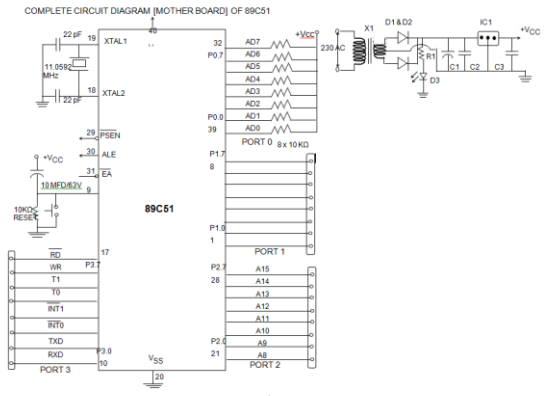


Figure.3. Circuit diagram of 89C51

B. PIR Sensor

When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves. When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. These change pulses are what is detected.

Specifications:

Output: Digital pulse high (3V) when triggered (motion detected) digital low when idle (no motion detected). Pulse lengths are determined by resistors and capacitors on the PCB and differ from sensor to sensor. Sensitivity range: up to 20 feet (6 meters) 110° x 70° detection range Power supply: 5V-12V input voltage for most modules (they have a 3.3V regulator), but 5V is ideal in case the regulator has different specs.

Figure.4. PIR Sensors

Sensitivity range: up to 20 feet (6 meters) 110° x 70° detection range

C. Buffer and Driver Circuit

The present circuit provides interfacing with the Microcontroller and the controlling circuitry. This circuit takes the 5-bit control signal, isolates the MICROCONTROLLER from this circuitry, boosts control signals for required level and finally fed to the driver section to actuate relay. These five relays in turn send RC5 coded commands with respect to their relay position. Circuit Description: The Hex Buffer/Inverter IC1's working voltage of +5V is applied at pin-1 and six control signals are applied at input pins 3, 5, 7, 9, 11 & 14. Thus the signal supplying circuit [i.e. MICROCONTROLLER] is isolated from this Buffer & Driver circuit. Further the grounding resistors R1 to R6 prevents the abnormal voltage levels passing inside the IC1. The buffered outputs are acquired at pins 2, 4, 6, 10, 12 & 15. Thus the varying input is further stabilized and fed to signal diodes [D1 to D6]. As the load is inductive, there is a chance of producing back e.m.f. So to cope with this back e.m.f, signal diodes are used. But this signal level is not strong enough to drive the low impedance relay. So, IC2 Darlington driver is used. Its working voltage is +12 V and only five input/output pins are used. The output signal from the Darlington driver IC is strong enough to actuate relays.

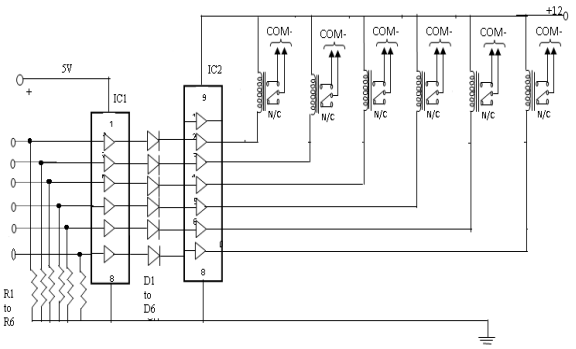


Figure.5. Switching Circuit

D. MONO-STABLE Circuit

In Monostable pulse generator mode, pin 4 is connected to pin 8 and that to +Vcc. The threshold pin 6 and the discharge pin 7 are connected together to +Vcc by a variable resistance (preset) R2 and capacitor C3. The trigger input pin 2 is connected to +Vcc using a pull-up resistor R1 and a capacitor C1. The output pin is connected to a LED through a resistor R3 to indicate the output. Pin 1 is connected to ground. In this we are using 555 IC as monostable multivibrator. The pin 2 is made active high with the help of the resistor R1 and capacitor C1. In order to get high output on pin 3, the pin 2 should give a low input (ground or 0V). When low input is given to pin 2, the monostable circuit will give high output (3.6V) on pin 3. The time duration of the output on pin 3 can be varied by varying the variable resistance (preset) connected to the pin 6 and 7. When the low input has been removed from pin 2, then the output on pin 3 will be deactivated and the output pin will set to 0V. The resistance value set on the variable resistance connected to pin 6 and 7 will decide the time to set the output on pin 3 to 0V.

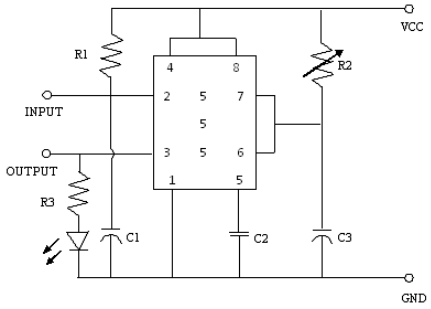
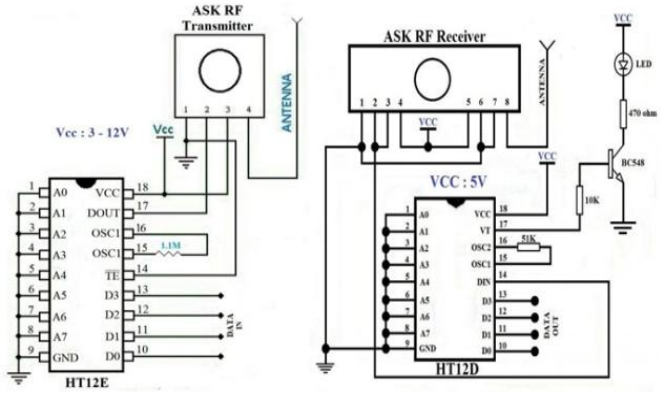


Figure.6. Monostable Circuit

Figure.7. Prototype Module of Monostable Circuit

E. RF Transmitter and Receiver

A wireless radio frequency (RF) transmitter and receiver can be easily made using HT12D Decoder, HT12E Encoder and ASK RF Module. Wireless transmission can be done by using 433 Mhz or 315MHz ASK RF Transmitter and Receiver modules. In these modules digital data is represented by different amplitudes of the carrier wave, hence this modulation is known as Amplitude Shift Keying (ASK). This circuit utilizes the RF module (Tx/Rx) for making a wireless communication, which could be used to drive an output from a distant place. RF module, as the name suggests, uses radio frequency to send signals. These signals are transmitted at a particular frequency and a baud rate. A receiver can receive these signals only if it is configured for that frequency. A four channel encoder/decoder pair has also been used in this system. HT12E Encoder IC will convert the 4 bit parallel data given to pins D0 – D3 to serial data and will be available at DOUT. This output serial data is given to ASK RF Transmitter. Address inputs A0 – A7 can be used to provide data security and can be connected to GND (Logic ZERO) or left open (Logic ONE). Status of these Address pins should match with status of address pins in the receiver for the transmission of the data. Data will be transmitted only when the Transmit Enable pin (TE) is LOW. 1.1MΩ resistor will provide the necessary external resistance for the operation of the internal oscillator of HT12E. ASK RF Receiver receives the data transmitted using ASK RF Transmitter. HT12D decoder will convert the received serial data to 4 bit parallel data D0 – D3. The status of these address pins A0-A7 should match with status of address pin in the HT12E at the transmitter for the transmission of data. The LED connected to the above circuit glows when valid data transmission occurs from transmitter to receiver. 51KΩ resistor will provide the necessary resistance required for the internal oscillator of the HT12D.



Transmitter Circuit **Receiver Circuit**

Figure. 8. RF Circuit

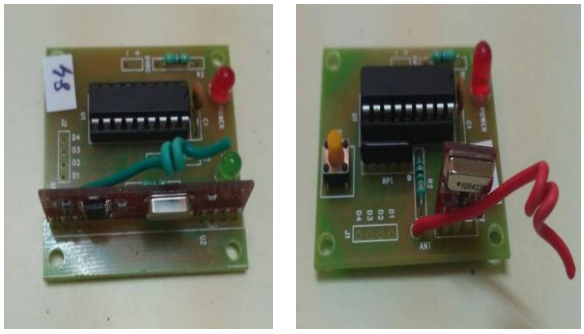


Figure.9. Prototype Module of RF Circuit

F. Power Supply Circuit

The circuit needs two different voltages, +5V & +12V, to work. These dual voltages are supplied by this specially designed power supply. The power supply, unsung hero of every electronic circuit, plays very important role in smooth running of the connected circuit. The main object of this 'power supply' is, as the name itself implies, to deliver the required amount of stabilized and pure power to the circuit. The transformer rating is 230V AC at Primary and 12-0-12V, 1Ampers across secondary winding. This transformer has a capability to deliver a current of 1Ampere, which is more than enough to drive any electronic circuit or varying load. The 12VAC appearing across the secondary is the RMS value of the waveform and the peak value would be 12 x 1.414 = 16.8 volts. This value limits our choice of

rectifier diode as 1N4007, which is having PIV rating more than 16Volts. The two diodes D1 & D2 are connected across the secondary winding of the transformer as a full-wave rectifier.
Here Capacitor C1 is used for filtering purpose and connected across the rectifier output. It filters the AC components present in the rectified DC and gives steady DC voltage. As the rectifier voltage increases, it charges the capacitor and also supplies current to the load. Across the point 'D' and Ground there is rectified and filtered DC In the present circuit KIA 7812 three terminal voltage regulator IC is used to get +12V and KIA 7805 voltage regulator IC is used to get +5V regulated DC output. In the three terminals, pin 1 is input i.e., rectified & filtered DC is connected to this pin. Pin 2 is common pin and is grounded. The pin 3 gives the stabilized DC output to the load. The circuit shows two more decoupling capacitors C2 & C3, which provides ground path to the high frequency noise signals.

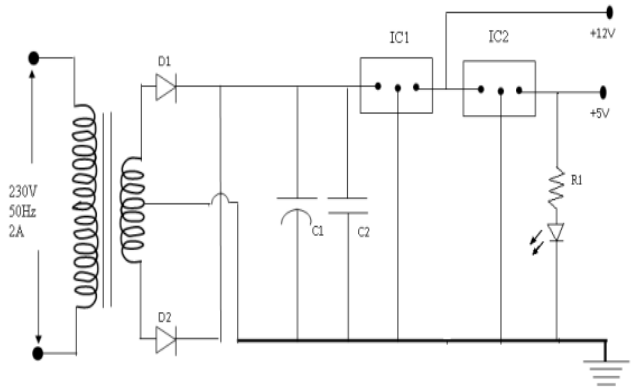


Figure.10. Power Supply Circuit

Figure.11. Prototype Module of Power Supply Circuit

G. DTMF CIRCUIT

This decoder stages helps IVRS Unit to get people phone number encoded in DTMF form to 4-bit binary form for easy processing by PC program. The output of this stage is fed to parallel port of PC for caller line identification. This Section decodes the DTMF form fault code signal sent by Field Unit, converts it into 4-bit Binary Coded Decimal form and fed to PC's parallel port for further processing. The circuit uses IC KT3170 (DTMF-to-BCD converter) and accepts fault code from Field Unit in the form of encoded DTMF signal convert them into 4-bit Binary Coded Decimal and fed to parallel port of monitoring PC for further processing. This circuit is to be connected to the FM Receiver output points. The DTMF Signals from FM Receiver are entering this stage through RC network formed by R1, R2, C1 & R3 components. Pin-3 of IC1 is biased with input telephone line through resistor R4. The Crystal X1 is fitted to pins 7 & 8 of IC1 for internal oscillation purpose. The pin-10 is Vcc and given to power supply line. Internal circuitry of IC1 needs biasing hence pin-16, 11, and 17 are connected with R5 and C2. The IC1 outputs DTMF signals coming from FM Receiver into 4-bit BCD form at pins 12, 13, 14 & 15. The Conversion checking bit is get from pin-18 of IC1. This pin output goes HIGH if DTMF-to-BCD conversion is successful. These outputs are fed to next stage Buffer for conversion indication and further taken out for PC's parallel port input. The Buffer section comprises of IC2, which has six buffers. Five Buffers of IC2 are used to drive five LEDs for output indication. These Buffers provide unit gain amplification to the DTMF outputted signals.

IV. CODE OF MICROCONTROLLER

A. Algorithm for Detecting ROBOT:

- Start
- Function module initialization
- DTMF Control
  - ➢ If 2 is pressed, left motor = 1, right motor=1, back motor=0, front movement
  - ➢ If 4 is pressed, left motor = 0, right motor=1, back motor=0, left movement
  - ➢ If 6 is pressed, left motor = 1, right motor=0, back motor=0, right movement
  - ➢ If 8 is pressed, left motor = 0, right motor=0, back motor=1, reverse movement
  - ➢ If 5 is pressed, left motor = 0, right motor=0, back motor=0, stop position
- Detection of person
  - ➢ If PIR=1 and Authorized Input=1, Authorized Output=1
  - ➢ If PIR=1 and Authorized Input=0, Unauthorized Output=1
  - ➢ If PIR=0 and Authorized Input=0, Authorized Output=0, Unauthorized Output=0

B. Algorithm for Control Station

- Start
- Function module initialization
- LCD Display and Buzzer
  - ➢ If RF1=1, Display Authorized Person, Buzzer=0
  - ➢ If RF2=1, Display Unauthorized Person, Buzzer=1

V. RESULTS

The prototype module for control station & Robot circuit is shown in below figures. When the PIR sensor detects a person the RF circuit checks for Authentication & respective signal is sent to the control station. Based on the requirement robot can be moved through the DTMF Technology. The movement of robot is monitored through the live video obtained in the control station through a wireless camera. Based on the Authentication

signal received in the control station necessary measures will be executed.

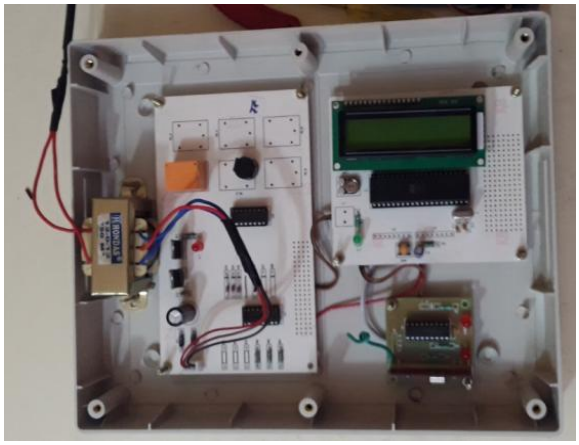


Figure.12. Prototype Module of Control Station

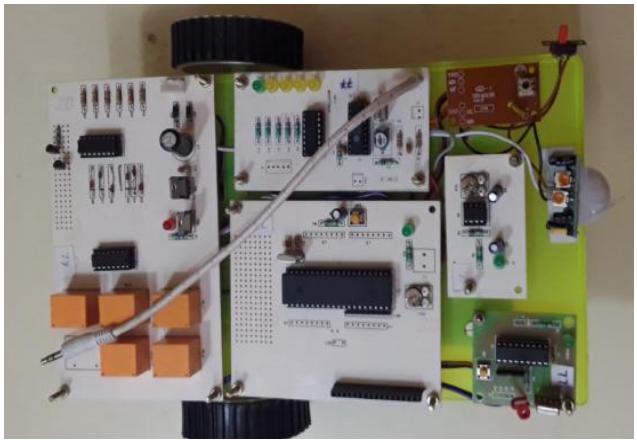


Figure.13. Prototype Module of Robot Circuit

VI. CONCLUSION

Design of an enemy detecting robot for border security purpose is implemented. The main goal to integrate a medium size, robot type unmanned ground vehicle (UGV) to help our soldiers to monitor the border areas especially in extreme climatic conditions is achieved.

VII. REFERENCES

[1].Yun Chan Cho and Jae Wook Jeon "Remote Robot control System based on DTMF of Mobile Phone", IEEE International Conference INDIN 2008, July 2008.

[2].B. Essendorfer, E. Monari and H. Wanning, "An Integer-ated System for Border Surveillance," IEEE Fourth Inter-national Conference on Systems (ICONS 09), Gosier, 1-6 March 2009.

[3].Roshan Ghosh. DTMF Based Controller for Efficiency Improvement of a PV Cell & Relay Operation Control Smart Home Systems,

[4].International Journal of Engineering Research and Applications. Vol. 2, Issue 3, May Jun 2012, pp.2903-2911

[5].Pratap, P.; Kallberg, J.M.; Thomas, L.A; "Challenges Of Remote Border Monitoring " 2010 IEEE International Conference on Technologies for Homeland Security (HST)

[6]. Awab Fakih, Jovita Serrao, "Cell Phone Operated Robotic Car." International Journal of Scientific & Engineering Research, ISSN 2229-5518.

[7]. "Live human detection robot", IJIRST, Volume 1, Issue 6, Nov 2014.

[8]."Design and implementation of unmanned ground vehicle for security applications", ISMA10, Sharjah, UAE, April 20-22, 2010.

[9]."Human detection robot using PIR sensors", IJSETR, Volume 4, Issue 3, March 2015.

[10].https://www.researchgate.net/publication/273074456_DTMF_Based_Controlled_Robot_Vehicle

TEXT BOOKS

[1].8051 Micro Controller By Muhammed Ali Mazidi

[2].Switchgear Protection And Power Systems By Sunil S Rao