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A 4-Wheeled Drudge for Rescue Operation

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Abstract: Science and technology has gone in depth to all Day to day application like automation, biometrics, bio-medical and life saving system and equipment. We should like to develop a automated machine for saving human life and their belongings during natural and abnormal causes. The proposal drudge is a life saving machine and may extend the life of suffered peoples in the accidents and collision area.

Keywords: PIR sensor, wireless camera, MCU.

I. INTRODUCTION

The objective of our project is to cater the need of internal and external security to the industries, offices. Robots are programmable computers to perform a variety of tasks. Robots can be classified according to whether they are stationary or mobile. Mobile robots are free to move around but stationary robots remain in one place. Adaptive robots get feedback from sensors to alter the operation of the device. Our proposed robot has two main modules namely field and control room. The field module has three main components 1) mobile platform 2) suit of sensor 3) wireless communication link.

The mobile robot designed in our project is able to scan the environment using vision and gather environmental information. The vehicle is able to move around based on the commands sent over the wireless link from a remote user terminal. The videos will be retrieved and displayed on the user terminal in real time over the wireless link. The vehicle sends video and sensor information to base computer while the base computer controls the vehicle. All this is done wirelessly.

II. PROJECT DESCRIPTION

The Working field is divided into two major portions.

A. Control room

B. Mechanical model /Field device

2.1 Biological interface control room A

In control room we are going to monitor the images received from audio, video transmitters and appropriate control action will be delivered by embedded system with the support of pc and wireless

The following are the sub-division of module-1

1. Biological data collection
2. Signal conditioners
3. Embedded system
4. RS 232 converter

5. Relay
6. Wireless transmitters to control remote system
7. Wireless receivers to access image and audio data from the field.

2.2 Field device

The field device/the drudge is a mechatronics device consisting of mechanical model and electronic circuit required to control the mechanical model as per the instruction given from control room.

The field device consist the following

1. Wireless receiver 433.92 MHZ
2. AI Sensors
3. PIC 16F870
4. Transistors.
5. Opto couplers
6. Stepper motors
7. Mechanical model.
8. Nand gate
9. Wireless IR camera, audio sensing and transmitter.

2.3 Field room block diagram

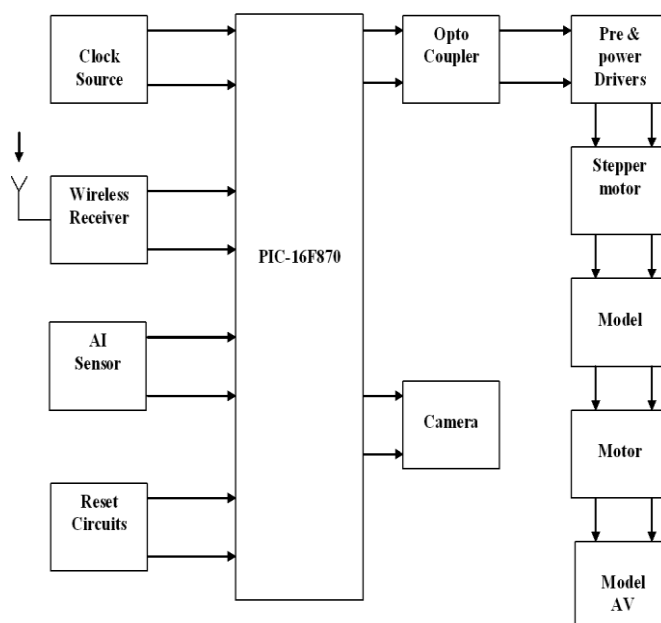


Fig.1.Field room

2.3.1. field device/Drudge block description

The above block diagram shows the methodology that is adapted in the project. The block diagram consists of AI sensor, wireless receiver, reset circuits, opto coupler, stepper motor, camera, power drivers, mechanical model and PIC controller. The AI sensor [1] includes PIR sensor, and microphone. The wireless transceiver is used to send the data and the data will be received by the receiver in control room. The PIR sensor (Pyro electric IR sensor) is designed specifically for human detection.

This sensor is made of a crystalline material that generates a surface electric charge when exposed to heat in the form of infrared radiation. It allows us to sense motion and used to detect whether a human has moved in or out of the sensors range.

The opto coupler is very much essential to avoid back emf, which may be generated by stepper motors during turn of conditions. Back EMF may destroy all electronic components. CNY 17 II type opto couplers will be used to pass the data by means of IR With greater electrical isolation. The power drivers are medium and light current amplifiers to drive stepper motor by accepting logical data's from opto coupler.

A hybrid IR enabled camera made up of CMOS technology will be employed in the drudge. The camera will have hybrid circuit to sense the ambient exit and activates IR radiation as and when required. This will have built in audio receiving MIC and both AV will be converted as wireless signal. Stepper motors provide a means for precise positioning and speed control. The stepper motor uses the theory of operation for magnets to make the motor shaft turn a precise distance. When a pulse of electricity is provided. A stepper or stepping motor converts electronic pulses into proportionate mechanical movement. Each revolution of the stepper motor's shaft is made up of a series of discrete individual steps. A step is defined as the angular rotation produced by the output shaft each time the motor receives a step pulse. Microcontroller is a general purpose device and is used for control purpose using a fixed program that is stored in EPROM. The signal from the sensor is fed to the microcontroller and the controller signal is transmitted to control room.

2.4. Control room block diagram

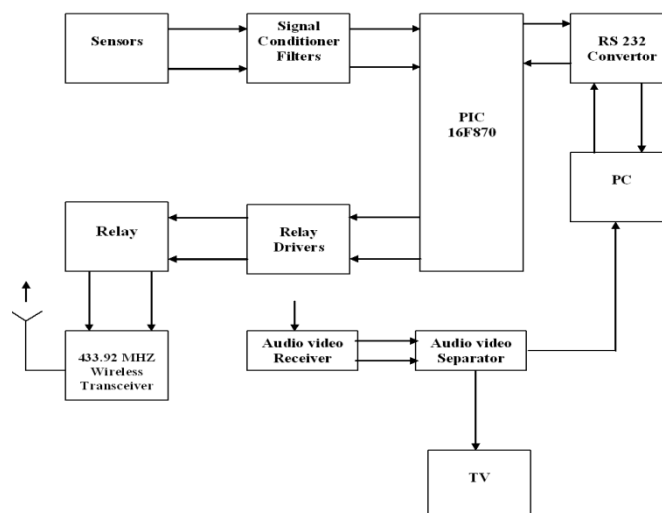


Fig.2. Control room

2.4.1. Control room block description

The signal conditioner circuit will receive analogue signal of 5mv -20mv and amplify then 3 to 5v to have interface with embedded microcontroller. This circuit consists of the amplifier, filters and current amplifiers. The Relay drivers are to obtain logical data's from embedded controller and amplifies the signals up to 60Ma from 5Ma. It collects logical data and switching the relays with back EMF protection is the purpose of this chip. The relay is an electromagnetic alteration type of component. It is electrically operated switch creates galvanic isolation between two circuits. The objective of this component is to create isolation between embedded circuit and wireless circuit.

The RS232 circuit is essential to convert embedded level data in to computer level data converting 5v into 20v and vice versa. This is an international standard of serial computing. On pc we can able to view the magnitude of biological data, selection of input type, data base, voice output and image. Control action related software will be developed on pc environment. A FM wireless transmitter is used in the range of 433.93 MHz to transmit the commands for the movement of the field device (robot).based on the command we give the robot will move in forward, reverse, left and right direction.

III. METHODOLOGY

To detect the human pulses PIR sensor is used (i.e.) if there is any human found to be alive, the PIR sensor senses the pulses from the being, it acts as a transducer and then the signal is given to conditioning circuit. The signal conditioning circuit amplifies the analogue signal and frees the signal from noise, ripples, etc., An IR enabled night vision camera is employed and MIC is attached with the unit. Then the AV signal is converted into wireless signal. The operation of wireless camera is explained below. An IP wireless camera is used to detect the human motion, audio recognition, video capturing, fire detection, etc. it can do the live telecast of the video or it can record the AV (audio/video). The wireless camera sends the recorded videos to control room through wireless transmission. To perform the video transmission, An ‘IPCAMERATOOL ‘software should be installed in the control room PC. By creating a wireless connection between the PC and camera the video signals can be transmitted. The various sensors are adopted to enhance the system such as metal detection, fire detection, etc. RF transmitter and receiver is used to transmit and receive the information at the range of 433.93MHz. The RS-232 serial communication interface is used to convert the embedded level data into computer level data. The PC is used to view the data, selection of input type, voice output, image and controlled action related to software.

3.1 Role of NAND gate

The two input NAND gate accepts two inputs. And do the logic NAND operation. After performing the logic NAND [22] operation, it produces one output. In our project when the forward command is given in the control room, the signal will be transmitted and received by the receiver, and then it is switched to NAND gate through PIC. In NAND board we have 5 enable pins. For the movement of robot (forward, reverse, left and right movement), four two pairs of pins are enabled and applied to the NAND gate, this will produce one output (any one movement of the robot/Forward/Reverse/Left/Right).

3.2. Operation

First the signal (movement command) is encoded in the control room through keyboard of the PC. It can be monitored through th hyperterminal system. The command is switched to controller and then sent to transmitter TWS – 434 through MAX232. The signal is transmitted by the transmitter. The transmitted signal is received by RWS – 434 and switched to the controller. Based on the command that received by the receiver the Robot moves at actual speed and the PIR sensor starts sensing. When it detects the human presence it stops the movement of the Robot and alarm will be produced.

Circuit diagram for 4-wheeled drudge

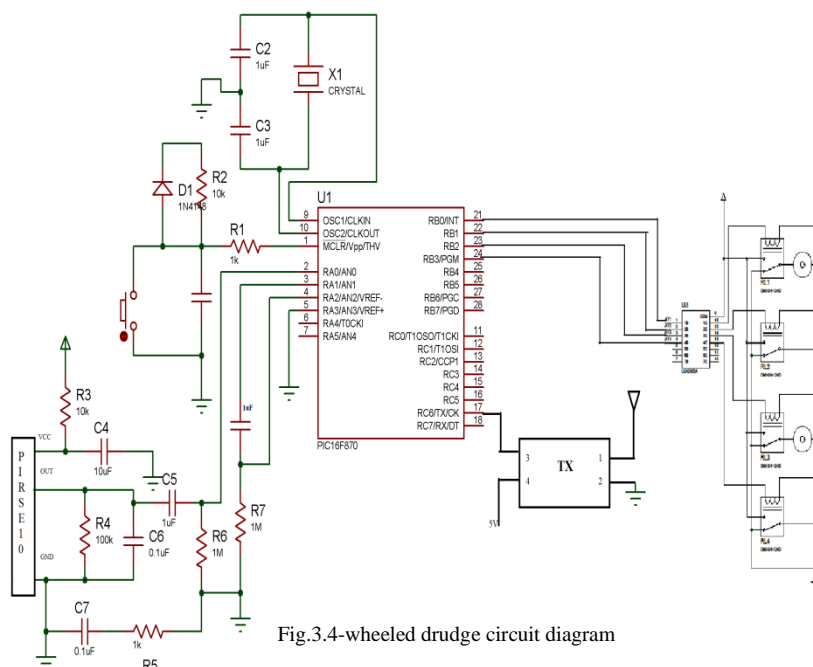


Fig.3.4-wheeled drudge circuit diagram

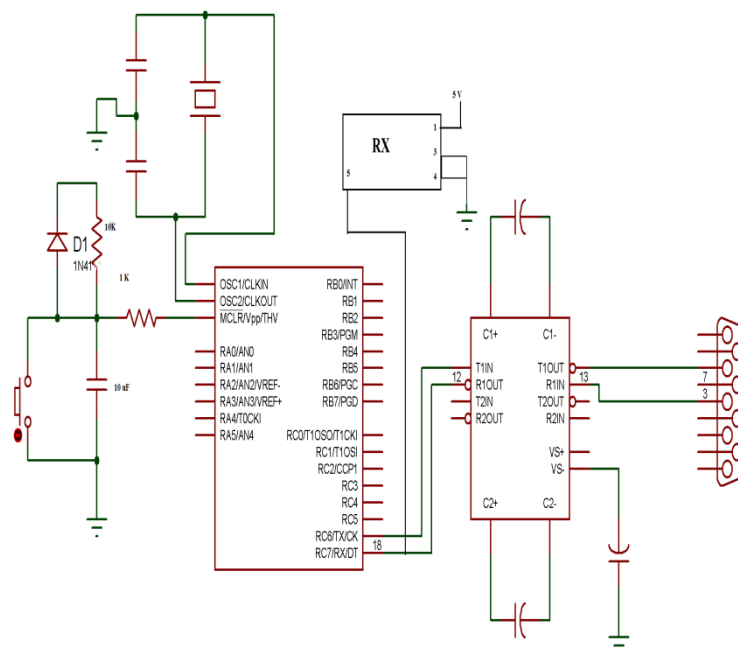


Fig.4.Control room Circuit diagram

Flow chart for the field device

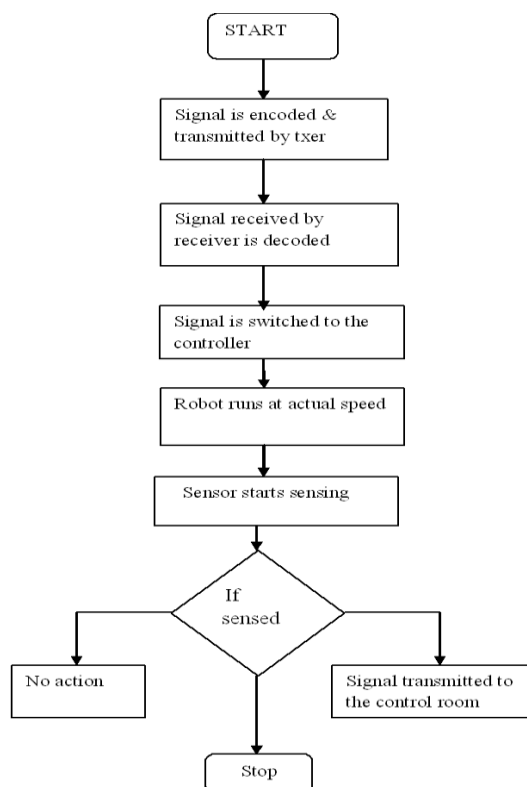


Fig.5. flow chart for the sensor movement

IV. SYSTEM COMPONENT

4.1. PIR Sensor

Pyroelectric sensors (PIR) are designed specifically for human detection. This sensor is made of a crystalline material that generates a surface electric charge when exposed to heat in the form of infrared radiation. It is calibrated to be sensitive to human heat wavelength (8 - 14 µm). These sensors are very sensitive, cheap and robust. They are composed of two infrared sensors, so they detect humans only if the human or the sensor is moving. PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use

and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyro electric", or "IR motion" sensors. PIRs are basically made of a pyro electric sensor (which you can see above as the round metal can with a rectangular crystal in the centre), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels.

- 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-9V input voltage
- Operating temperature -10° to 40°.
- Onboard LEDs light up the lens for fast visual feedback when movement is detected
- Small size makes it easy to conceal.
- Easy interface to any microcontroller.
- Jumper selects short or long settings



Fig.6.PIR Sensor

4.1.1. Testing circuit for PIR Sensor

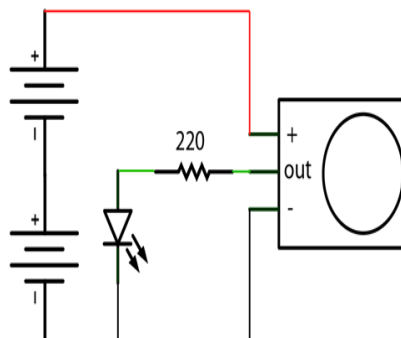


Fig.7. Testing circuit for PIR

4.2. Wireless Camera



Fig.8. Foscam FI8905 IP camera

The Foscam FI8905 is a wireless or wired IP camera solution for rescue operation. It combines a high quality digital video camera with network connectivity and a powerful web server to bring clear video to your desktop or smartphone from anywhere on your local network or over the Internet. The high quality video image is transmitted with 30fps speed on the LAN/WAN by using MJPEG hardware compression technology. The image resolution is 640 x 480 (300k Pixels). The Foscam FI8905 camera is based on the TCP/IP standard. The control, management and maintenance of the camera are done simply by using your browser to remotely configure and upgrade the firmware. The Foscam FI8905W IP camera can reach up to 30 meters of visibility in absolute darkness with 60 infrared LED's. The Foscam FI8905W Wireless IP Camera features high quality video, waterproof and weather proof outdoor housing, remote internet viewing, motion detection, night-vision as well as a built in network video recording system. This camera has 60 IR LEDs providing nightvision visibility up to 30 meters.

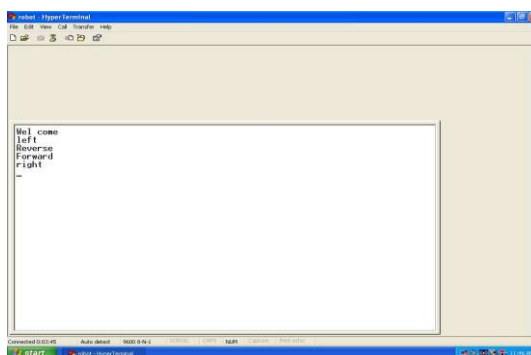


Fig.9. HyperTerminal monitoring system

V. PRACTICAL IMPLEMENTATION

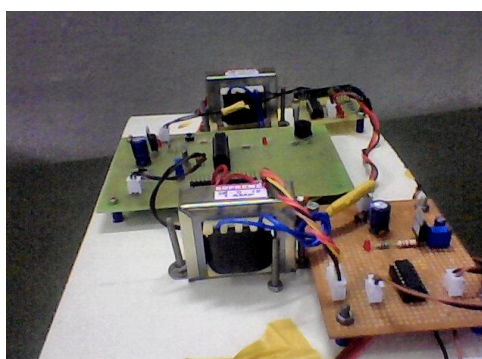
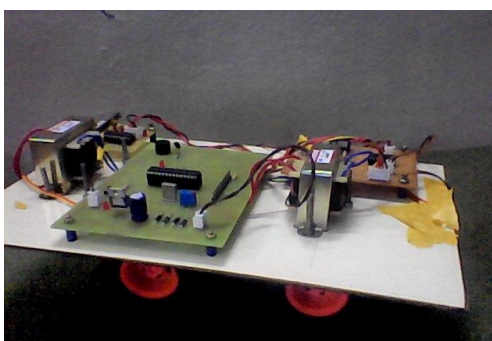


Fig.10. Practical Implementations of 4-wheeled drudge

VI. CONCLUSION

The project requirements stated that the salvage 4 wheeled drudges is able to maneuver into environment and send the information from that environment back to the user operator. It can send wirelessly the information about the movement of living human back to the base computer. The user/operator should be able to steer the robot and can move over the obstacle while viewing only the video. Thus I conclude that this project is suitable for developing countries like India. It can detect life in accidents which take place in remote areas. In case of mass disasters and it is used to detect life of the people.

Acknowledgement

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