

FIRE FIGHTING ROBOT USING ULTRASONIC CAMERA VIA BLUETOOTH AND SMARTPHONE

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Abstract - Fire disasters can occur anytime and lead to high losses. It is often that fire fighters cannot access the foundation of fire as a result of damage of building and very good temperature, or even as a result of presence of explosive materials. With such constraints and high risk in the handling of the fire, a technological breakthrough that may help fighting the fire is necessary. Our paper proposed the use of robots to extinguish the fire which can be controlled from a specified distance to be able to reduce the risk. A fire extinguisher robot was assembled with the intention to extinguish the fire by utilizing water pump as actuators. The robot movement was controlled using Android smartphones via Bluetooth networks. User commands were delivered to the microcontroller on the robot and then translated into robotic movement. We used PICC16XX as main microcontroller in the robot. The robot was designed with cameras and ultrasonic sensors. The camera played role in giving feedback to user and in finding the foundation of fire. In the fire test, the robot can perform the duty properly to extinguish the fire which could become guide during normal condition and also carry the medicines from ward to some other ward.

Key Words: Fire extinguisher, Android smartphones, PICC16XX, cameras, ultrasonic sensors

1. INTRODUCTION

Fire disasters can occur anytime and lead to high losses. It is often that fire fighters cannot access the foundation of fire as a result of damage of building and very good temperature, or even as a result of presence of explosive materials. With such constraints and high risk in the handling of the fire, a technological breakthrough that may help fighting the fire is necessary. Our paper proposed the use of robots to extinguish the fire which can be controlled from a specified distance to be able to reduce the risk. A fire extinguisher robot was assembled with the intention to extinguish the fire by utilizing water pump as actuators. The robot movement was controlled using Android smartphones via Bluetooth

networks. User commands were delivered to the microcontroller on the robot and then translated into robotic movement. We used PICC16XX as main microcontroller in the robot. The robot was designed with cameras and ultrasonic sensors. The camera played role in giving feedback to user and in finding the foundation of fire. In the fire test, the robot can perform the duty properly to extinguish the fire which could become guide during normal condition and also carry the medicines from ward to some other ward.

2. PROPOSED SYSTEM

The input received for the robot came from the smartphone, camera, and ultrasonic sensors, which will help in controlling the fire-fighting robot. Commands were delivered from smartphone to the robot, especially to the microcontroller via Bluetooth.

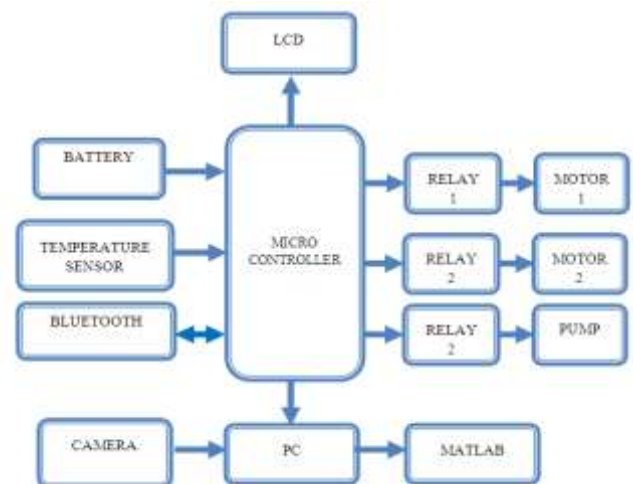


Fig -1: Block diagram of Fire extinguisher robot

The camera installed on the robot captured the view in front of the robot and then displayed on smartphones to help users control the robot. When the robot faces a fire then it extinguishes fire with assistance from pump motor attached to a water tank installed on its body. Remote operation is accomplished by any smart-phone/Tablet etc., with Android OS, upon a GUI (Graphical User Interface) based touchscreen

operation. The android application device transmitter acts as a remote control that has the main advantage of adequate range.

2.1 PIC MICROCONTROLLER

PIC16F877 belongs to a type of 8-bit microcontrollers of RISC architecture. It has 8kb flash memory for storing a published program. Since memory made in FLASH technology may be programmed and cleared more often than once, it makes this microcontroller suited to device development. It has data memory that really needs to be saved when there is no supply. It's usually useful for storing important data that must not be lost if power supply suddenly stops. For instance, one data is definitely an assigned temperature in temperature regulators. If during a lack of power supply this data was lost, we will have to make the adjustment yet again upon return of supply. IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

2.2 DC MOTORS:

A DC motor functions when the alternative polarity between the two magnetic fields within the motor cause it to turn. Brushed DC motors came into existence in the late 1800's with the capacity to develop a maximum torque when in stationary mode. The downside is when operation speed increases and the total amount of torque decreases. The operation of a DC motor is susceptible to a higher amount of wear and tear because of its rough operation mode. This DC or direct household current motor works on the principal, when a household current carrying conductor is placed in a magnetic field, it experiences a torque and has a tendency to move. This is known as motoring action. If the direction of household current in the wire is reversed, the direction of rotation also reverses. When magnetic field and electric field interact they produce a physical force, and based on that the working principle of dc motor established.

2.3 BATTERY

An electric battery is an accumulation of more than one electrochemical cells where stored chemical energy is became electrical energy. The principles of operation haven't changed much since the full time of Volta. Each cell contains two half cells connected in series through an electrolytic solution. One half cell houses the Anode to that your positive ions migrate from the Electrolyte and another houses the Cathode to that your negative ones drift. Both cells are may link via a partial permeable membranous structure allowing ions to flow but not the mixing of electrolytes as in the case on most primary cells or in the exact same solution as in secondary cells. The energy released during accepting an electron by a neutral atom is called electron affinity. Because the atomic structure for different materials will vary, the electron affinity of different materials will differ. If two different types of metals or metallic compounds are

immersed in the exact same electrolyte solution, one of them will gain electrons and another will release electrons. Which metal (or metallic compound) will gain electrons and that'll lose them depends upon the electron affinities of the metals or metallic compounds. The metal with low electron affinity will gain electrons from the negative ions of the electrolyte solution. On another hand, the metal with high electron affinity will release electrons and these electrons emerge in to the electrolyte solution and are included with the positive ions of the solution. In this way, one of these simple metals or compounds gains electrons and another one loses electrons. As a result, there is a difference in electron concentration between both of these metals. This difference of electron concentration causes an electrical potential difference to develop involving the metals. This electrical potential difference or emf can be utilized as a source of voltage in just about any electronics or electrical circuit. This can be a general and basic principle of battery .

2.3 RS232 (SERIAL PORT).

RS-232 (Recommended Standard - 232) is really a telecommunications standard for binary serial communications between devices. It supplies the roadmap for the way in which devices speak to one another using serial ports. The tools are commonly called a DTE (data terminal equipment) and DCE (data communications equipment); for instance, a computer and modem, respectively. RS232 is the most known serial port found in transmitting the information in communication and interface. Although serial port is harder to program compared to the parallel port, this is the very best method in that your data transmission requires less wires that yields to the less cost. The RS232 is the communication line which enables the information transmission by only using three wire links. The three links provides 'transmit', 'receive' and common ground... The 'transmit' and 'receive' line with this connector send and receive data between the computers. Whilst the name indicates, the information is transmitted serially. The 2 pins are TXD & RXD. You can find other lines with this port as RTS, CTS, DSR, DTR, and RTS, RI. The '1' and '0' are the information which defines a voltage level of 3V to 25V and -3V to -25V respectively. The electrical characteristics of the serial port as per the EIA (Electronics Industry Association) RS232C Standard specifies a maximum baud rate of 20,000bps, which can be slow in comparison to today's standard speed. Because of this, we have chosen the new RS-232D Standard, which was recently released.

2.4 MAX 232:

The MAX232 line drivers/receivers are designed for RS-232 and V.28 communications in harsh environments. Each transmitter output and receiver input is protected against 15kV electrostatic discharge (ESD) shocks, without latchup. It can operate from the Single +5V Power Supply. It is definitely an integrated circuit that converts signals from an RS-232 serial port to signals suited to used in TTL compatible

digital logic circuits. The MAX232 is just a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals.

2.5 RELAYS:

Relays are simple switches which are operated both electrically and mechanically. Relays contain a n electromagnet and also a couple of contacts. The switching mechanism is carried out with the aid of the electromagnet. Additionally there are other operating principles for its working. Nevertheless they differ according to their applications. All of the devices have the application of relays. The key operation of an exchange comes in places where merely a low-power signal can be used to manage a circuit. It can also be utilized in places where only one signal can be used to manage lots of circuits. The applying of relays started during the invention of telephones. They played an important role in switching calls in telephone exchanges. They certainly were also utilized in long-distance telegraphy. They certainly were used to change the signal originating from one source to a different destination. Following the invention of computers they certainly were also used to perform Boolean and other logical operations. The top quality applications of relays require high power to be driven by electric motors and so on.

2.6 KEYPADS

Keypads are a part of HMI or Human Machine Interface and play important role in a small embedded system where human interaction or human input is necessary. A keypad is a couple of buttons arranged in a block or "pad" which usually bear digits, symbols and usually an entire set of alphabetical letters. If it mostly contains numbers then it may also be called a numeric keypad. Keypads are observed on many alphanumeric keyboards and on other devices such as calculators, push-button telephones, combination locks, and digital door locks, which require mainly numeric input. Matrix keypads are well-known because of their simple architecture and ease of interfacing with any microcontroller.

2.7 PUMP

A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps could be classified into three major groups based on the method they choose to go the fluid: direct lift, displacement, and gravity pumps. Pumps operate by some mechanism (typically reciprocating or rotary), and consume energy to perform mechanical work by moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines, or wind power, come in many sizes, from microscopic for use within medical applications to large industrial pumps.

2.8 BUZZER

A buzzer or beeper is an audio signaling device, that might be mechanical, electromechanical, or piezoelectric. Typical utilization of buzzers and beepers is giving sound indication to the users. Power is applied this mechanical device will energize and by doing so interrupt the ability source and the cycle continue before power is removed. the frequency of oscillation is strictly determined by mechanical inertia.

3. HARDWARE AND SOFTWARE DESCRIPTION

3.1 ANDROID

Android phones are highly customisable and as a result can be altered to suit your tastes and needs; with wallpapers, themes and launchers which completely change the appearance of one's device's interface. You are able to download applications to complete all sorts of such things as check your Facebook and Twitter feeds, manage your bank-account, order pizza and play games. You are able to plan events on from your phone's calendar and see them on your pc or browse websites on your own desktop and pick them through to your phone. Another neat feature of Android is so it automatically backs up your contacts for you. When you put up an Android phone you'll need to produce a Google Account or sign in having an existing one. Everytime you save lots to the address book of one's Android phone it will soon be synced to your Google Account. The good thing about this really is that if you lose your phone all of your numbers will soon be saved. The very next time you receive an Android phone (or an iPhone or Windows Phone in the event that you prefer) and sign in with your Google Account, all of your contacts and friend's numbers will soon be displayed in your brand-new phone's address book immediately, you should not transfer or back them up anywhere else. Syncing is just a way for your phone to keep all of your information; websites, contacts, calendar entries and apps up-to-date. This may happen over your phone's mobile data or WiFi connection, seamlessly, in the background.

3.2 BLUETOOTH:

HC-05 module can be an simple to use Bluetooth SPP (Serial Port Protocol) module, created for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH(Adaptive Frequency Hopping Feature). It has the footprint no more than 12.7mmx27mm. Hope it will simplify your general design/development cycle.

3.3 MPLAB IDE

MPLAB IDE is a pc software program that runs on a PC to produce applications for Microchip Microcontrollers. It is known as an Integrated Development Environment, or IDE, because it gives just one integrated “environment” to produce code for embedded microcontrollers. The IDE is just a “wrapper” that coordinates all the equipment from just one graphical user interface – usually automatically. For instance, once code is written, it may be converted to executable instructions and downloaded in to a microcontroller to see how it works. In this method multiple tools are expected: an editor to create the code, a task manager to organize files and settings, a compiler or assembler to convert the source code to machine code and some sort of hardware or software that either connects to a target microcontroller or simulates the operation of a microcontroller.

3.4 HI-TECH C COMPILER

HI-TECH Software is just a world class provider of development tools for embedded systems, offering compilers featuring Omniscient Code Generation™, whole-program compilation technology, and an Eclipse-based IDE (HI-TIDE™) for 8-, 16-, and 32-bit microcontroller and DSC chip architectures. HI-TECH Software has provided this freeware HI-TECH PICC-Lite compiler as a tool for hobbyists and students, however the license allows its use for commercial purposes as well. It's ideal as a teaching tool for an introduction into the 'C' language and embedded programming on a Microchip device. The selected processors were chosen with this compiler because of their popularity. C compiler "translates" the code source into the code of the object. The compiler will also perform error tests and syntax checks. To shape machine code (op-code "HEX-CODE"), the object code is then connected to other object modules. Using debugger, the software can be run and checked after linking.

3.5 HYPERTERMINAL:

HyperTerminal may be the defacto terminal program for just about any Windows OS up to XP – Windows Vista, 7, and 8 don't include it. If you're on Windows Vista, 7, or 8, and really just have to have HyperTerminal, only a little scouring of the Internet should arrive some workarounds. But better alternatives are more easily available, we'll get to those shortly.

4. EXPERIMENTAL RESULTS

Table – 1: Results of Overall Testing

S.NO	TESTING SUBJECT	RESULT
1	Forward Movement	Succeed
2	Backward Movement	Succeed

3	Turn left	Succeed
4	Turn Right	Succeed
5	Sensor Ultrasonic	Succeed
6	Camera	Succeed
7	Water Pump	Succeed

5. CONCLUSION AND FUTURE WORK

We have created a fire extinguisher robot that connects to your smartphone through Wi-Fi networks to monitor it at a certain distance. A device can be used to help firefighters extinguish the fire remotely, thus reducing the risk of controlling the fire hazard, as well as allowing doctors to move the medicines from one ward to another.

Future work will be done to improve Cease Fire construction using better temperature protection through the use of more flexible connectors and components like cables and screen, compact batteries, heat-resistant structuring materials, etc.

6. REFERENCES

1. Punetha D, Kumar N and Mehta V 2013 Development and Applications of Line Following Robot Based Health Care Management System Advanced Research in Computer Engineering & Technology (IJARCET) 2(8): 2446 – 2450
2. Rahmansyah MF 2014 Prototipe Robot Line Follower Pengantar Makanan Berbasis Mikrokontroler ATmega32 Menggunakan Algoritma Fuzzy. Preprint Universitas Sumatera Utara
3. Park SU 2010 Wireless image communication system for fire-fighting robots The 2nd International Conference IEEE Computer and Automation Engineering (ICCAE) 3, pp : 254 – 256.
4. Doshay I 2002 Robotic fire protection system. Google Patents.
5. Suryatini F and Kustija J 2016 Robot Cerdas Pemadam Api Menggunakan PING Ultrasonic Range Finder dan UVtron Flame Detector Berbasis Mikrokontroler ATMEGA 128 ELECTRANS 12(1): p. 29-38.
6. Aji WS, Hermawanto F and Muchlas M 2009 Purwarupa Robot Pemadam Api Dengan Sensor Ultrasonic Dan Ultraviolet Berbasis At89s52. TELKOMNIKA (Telecommunication Computing Electronics and Control) 7(3): p.207-212
7. Rakib, T. and Sarkar, M.R., “Design and fabrication of an autonomous fire fighting robot with multisensor fire detection using PID controller”, 2016 5th IEEE International Conference on Informatics, Electronics and Vision (ICIEV), May 13-14, 2016, Bangladesh, pp. 909-914.



8. Suresh, J., "Fire-fighting robot", 2017 IEEE International Conference on Computational Intelligence in Data Science (ICCIDS), June 2-3, 2017, India, pp. 1-4.