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Arduino Based Fire Fighting Robot with High Pressure Water Sprinkler

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Abstract:
Nowadays, many places such as schools, colleges and Our proposed project aims to develop an Arduino controlled fire fighter robot that can be used to extinguish the fire through remote handling. The vehicle consists of a water tank along with a pump which can throw water when needed. The system uses an Arduino Uno microcontroller board for this purpose. The Infrared receiver on the vehicle is used to receive the amount of flame. These values are used to find the location of the fire. These are then fed to the motors responsible for controlling the vehicle movements in front, back, left and right directions. The IR sensor is interfaced with an Arduino Uno microcontroller for this purpose. The microcontroller after receiving input commands operates the motors through a driver IC for vehicle movements. The use of android has one more advantage in addition to improved GUI. It also uses a sprinkler which is used to spray water with a desired pressure. It allows use of the Bluetooth technology for communication allowing the vehicle to operate in a good range from the device. The system can also be later enhanced through the use of a wireless camera to be used for monitoring purposes.

Keywords: Arduino Uno Microcontroller, IR Sensor(Infrared), IDE: Integrated Development Environment, IC: Integrated chip, GUI: Graphical User Interface.

1. INTRODUCTION

The flat form for this project is based on **Embedded System.** An **Embedded system** is a special-purpose system in which the computer is completely encapsulated by the device it controls. Unlike a general-purpose computer, such as a personal computer, an embedded system performs one or a few pre-defined tasks, usually with very specific requirements. Since the system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product. Embedded systems are often mass-produced, so the cost savings may be multiplied by millions of items. An embedded system is a special-purpose computer system designed to perform a dedicated function. Unlike a general-purpose computer, such as a personal computer, an embedded system performs one or a few pre-defined tasks, usually with very specific requirements. Since the system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product. Embedded system comprises of both hardware and software. Embedded system is the fast growing technology in various fields like industrial automation, home appliances, automobiles, aeronautics etc. Embedded technology is implemented to perform a specified task and the programming is done using assembly language programming or embedded C. Ours being a developing country the power consumption is increasing on large scale to meet the growing need of the people. Technology stack are discussed under section- 2.

2. TECHNOLOGY STACK

2.1 Hardware Requirements: Arduino Uno, fire sensor (MQ135)

2.1.1 Arduino Uno

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It is intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments.

2.1.2 Fire Sensor (MQ135):

It is a hazardous gas detection apparatus for the family, the environment, suitable for ammonia, aromatic compounds, sulphur, benzene vapour, smoke and other gases harmful gas detection, gas-sensitive element test.Air quality sensor is for detecting a wide range of gases, including NH3, NOx, alcohol, benzene, smoke and CO2. Ideal for use in office or factory with simple drive and monitoring circuit.

2.2 Software Requirements: Arduino IDE, Embedded c.

2.2.1 Arduino IDE:

Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of **software**, or **IDE** (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

2.2.2 Embedded C:

Embedded C is most popular programming language in software field for developing electronic gadgets. Each processor used in electronic system is associated with embedded software. Embedded C programming plays a key role in performing specific function by the processor. In day-to-day life we used many electronic devices such as mobile phone, washing machine, digital camera, etc. All these devices works based on the microcontroller that are programmed by embedded C. Proposed system is discussed in section-3.

3. PROPOSED SYSTEM

In our proposed system, it is a movable robot that consists of gas sensor for detecting the fire, gear motor and motor driver for the movement of the robot, relay driver for pump control

and air receiver which are used for detecting and extinguishing the fire. Usually, the robot moves at a steady speed. When the gas sensor detects the fire in the environment, the signal indicating the presence of fire will be sent to the Arduino through which the extinguishing is done. In the extinguishing process, whenever the detection of fire is positive the robot will stop at the place of fire occurred and starts the pump and sprinkle water through a sprinkler until the smoke is put off. The entire control is achieved using Arduino which is interfaced with the infrared sensor, so that the control of the robot can be achieved automatically. Requirements are discussed in section-4.

4 REQUIREMENTS OF EMBEDDED SYSTEM:

4.1. Functional Requirement

1. Direct digital control
2. Data collection
3. Man-machine interaction

4.2. Temporal Requirement

1. Tasks may have deadlines
2. Minimal error detection latency
3. Timing requirement
4. Human-interface requirements.

4.3. Dependability Requirement

1. Reliability
2. Safety
3. Availability
4. Maintainability
5. Security

Overview of system is discussed under section -5.

5. OVERVIEW

The Processing program works at the top most layer of the software design solution used for the SRC (see Figure 4). The program resides on a PC (personal computer) with the appropriate operating system (Linux, Windows, or Mac OS X), and Java virtual machine. The C program is implemented in C and programmed into the Arduino's Atmel microcontroller. The data flow between the two layers is bidirectional using a COM Serial port. The Processing program itself is composed of three components: serial communication, display GUI, and computation. A scheme for serial communication was necessary in order to interface with the C code. The display GUI was set up to provide the user with a friendly and easy-to-read visual feedback system. The computation algorithms take care of the basic arithmetic functions of the calculator. It is depicted diagramatically in Figure 5.1 Algorithms are discussed under section- 6.

6. ALGORITHM

6.1 Hardware Algorithm

The voice recognition system will continually transmit the eight bit value of the last recognized phrase or word. Since the loop( ) function is constantly evaluated, the basic algorithm will constantly transmit a ASCII value to the graphical user interface. As a result, even if the voice recognition system has not recognized any new phrases or words, the last recognized word is still transmitted, In order to decrease the amount of data flow to the graphical user interface, a decision loop must be added. Every time the loop( ) function is ran, this decision loop will store the current decoded ASCII value and the previous decoded ASCII value of the last evaluation of the loop( ) function. When the previous and current ACSII value differs, this means a new phrase or word has been recognized. As a result, this new ACSII value will be transmitted over the serial bus.

6.2 Software Algorithm

Within the setup ( ) function, the eight pins on the microcontroller are establish as inputs. This allows the eight pins to sense digital logic levels transmitted by the voice recognition components. This setup function also establishes the data rate at which the serial bus will be transmitted or received data. The serial bus is the communication link between the microcontroller and the graphical user interface. Therefore, any data written on to the serial bus by the microcontroller will be read by the graphical user interface, and vice versa. The loop ( ) function will handle all the decoding of data from the voice recognition components and transmissions of data to the graphical user interface. This function will begin by reading the eight pins on the microcontroller. Since the value held on eight pins correspond to a specific phrase or word stored in the SRAM, the loop ( ) function will decide that phrase or word into its ASCII value. That ASCII value will be transmitted to the graphical user interface over the serial bus. This methodically will be repeated continuous after the setup ( ) function is executed. This is the basic algorithm of the Arduino microcontroller. Pros are discussed under Section-7.

ARDUINO INTERFACE WITH SPRINKLER AND MOTOR

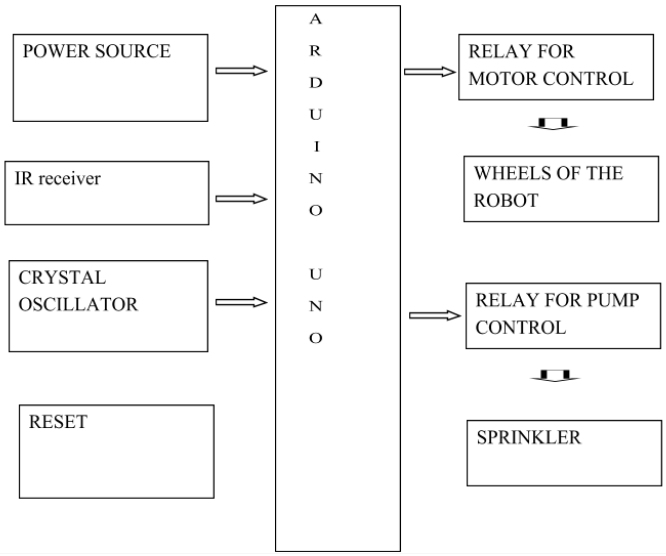

Figure.5.1. Arduino Interface with Sprinkler and Motor

7. PROS

1. By inventing such a device, humans as well as property can be saved at higher rate with minimum damage caused by the fire.
2. As instrumentation engineers, our task was to design and build a prototype system that could autonomously detect and extinguish a fire and also aims at minimizing the air pollution.
3. The possibilities of fire are at any remote area or in an industry such as in garments go down, cotton mills, and fuel storage tanks, electric leakages may result in terrible fire & harm

The Conclusion is covered under SECTION-8.

8. CONCLUSION

In many places such as schools, n colleges and Our proposed project aims to develop an Arduino controlled fire fighter robot that can be used to extinguish fires through remote handling.By this we can avoid Fire accidents and also prevent manual intervention of fire extinguishing.

References are stated below in SECTION-9.

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