An Extended Visual Cryptography using Simple Block Replacement Method

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Abstract: In this paper the technology of operating an industrial pick and place robot in both manual and automatic manner is proposed. The manual control deals with the DTMF control in which the robotic movements are controlled by using a basic cellphone keypad and the communication is established between controller and the prototype using DTMF tones. The automatic control incorporates color sorting technique using matlab interface for user input. Image processing procedure senses the objects in an image captured in real-time by a webcam and then identifies color and information out of it. This information is processed for pick-and-place mechanism. It aims in classifying the colored objects by colour by picking and placing the objects in its respective pre-programmed place. The input signals are sent to the microcontroller which drives the various motors of the robotic arm to grip the object and place it in the specified location. Based upon the detection, the robotic arm moves to the specified location releases the object and comes back to the original position. Thereby eliminating the monotonous work done by human, achieving accuracy and speed in the work.

I. INTRODUCTION

The objective of this project is to design a "pick and place robot" that has the capability of picking and placing objects without human effort. It can handle work in large scale which reduces time, energy and human resource consumption, leading to efficient throughput.

A robot can be defined as an electro-mechanical machine that is guided by a computer program or electronic circuitry. Robots are being used in every field today.

They are replacing humans to perform the same job with more accuracy and at a higher speed. Tasks which require objects to be moved from one place to another can be automated by using a 'Pick and Place robot'.

Such a system can be easily used in areas where it is difficult and/or dangerous for human to work. Human need only to give commands to the robot and it performs the required operation.

There are various input methods available, such as Voice command, Text command and command by gestures. Of these, DTMF tones and color recognition are chosen for the project. Interpretation of the color involves the use of Image Processing.

The pick and place operation is performed by the end effector as shown in Fig.1.

Although the appearance and the capabilities of robots vary vastly, all robots share the feature of a mechanical movable structure under some form of control.

The Control of robot involves three distinct phases: perception, processing and action.

Generally, the preceptors are sensors mounted on the robot, processing is done by the on-board microcontroller or processor, and the task is performed using motors or with some other actuators.

Conventionally, Wireless-controlled robots use rf circuits, which have the drawbacks of limited working range, limited frequency range and the limited control.

Use of a mobile phone for robotic control can overcome these limitations. It provides the advantage of robust control, working range as large as the coverage area of the service provider, no interference with other controllers and up to twelve controls.
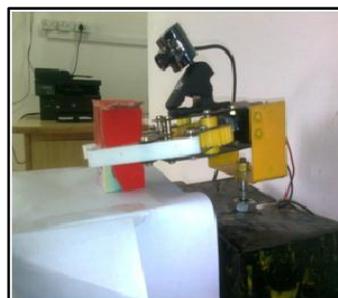
Fig. 1. A simple pick and place robot

II.   MOTIVATION AND PROPOSAL

In the highly developing society, time and man power are critical constraints for performing tasks in large scales. Repetitive tasks like loading and unloading goods in industries. The robot can be controlled from a distant place without much delay using wide spread GSM network. The tasks performed by the robot can be monitored using a camera. In war conditions soldiers face situations where they cannot enter dangerous areas where life is at risk. Robots can be used in such situations for placing bombs in enemy areas and disposing bombs planted by enemies, supply of first-aid box, arms and ammunitions at the warfront. Camera mounted on the robot can be used to spy and to detect unauthorized entry in military and research areas.

In industries such as nuclear and chemical plants laborers have to work under high temperature and hazardous conditions which may lead to severe health problems and accidental deaths. This can be avoided by using pick n place robots. Repetitive tasks like loading and unloading goods in industries can make use such robots.

For repetitive tasks like loading and unloading the same goods in large scale, human effort and time is required which may result in poor performance over the period of time due to human nature. Color sorting robot can be used in such situations.

III.   PROPOSED SYSTEM

Several options were considered for the design of the system. The first option was to send DTMF signals through the cell phone and decode it at the receiving end . However, since the robot needed to be fully controllable and a DTMF circuit could only send 16 tones at maximum, this idea was not chosen.

The other option was to use actual voice commands to control the robot. However the team could not come up with a satisfactory decoding scheme and this idea was not implemented either. The team decided to use another option, which was to send two single-tone frequencies in a continuous manner and decode them at the receiving end.

This option worked best with the requirements of the project since the two frequencies sent could be easily adjusted on the transmitter side. This would allow a larger continuous range of frequencies to be used which would allow a full analog range of control for the robot. On the receiving end, it would be relatively easy to decode the signal and change it into control signals. The block diagram summarizes the overall final design in Fig.2 that used to solve the problem.

The project defines a robot which can be operated manually using DTMF tones produced by pressing the mobile keypad and automatically by using color sorting technique.

At the transmitter side a keypad mobile phone is used to send the signal to the receiver side i.e prototype. The robotic vehicle is basically operated by sending signal from a GSM enabled mobile phone stacked on the robot.

The command is sent through DTMF signals which are processed by 89C51 microcontroller to control the movements of robot. The second input to the microcontroller is through USB to serial interface from processed image captured by the camera mounted on the robot. The H-bridge drives four motors which can be used to control the wheels in left, right, forward and backward directions. IR sensor is used to detect obstacles in the path of the robot. Motor driver circuit controls robotic arm movements to pick and place the desired object as shown in Fig.2.
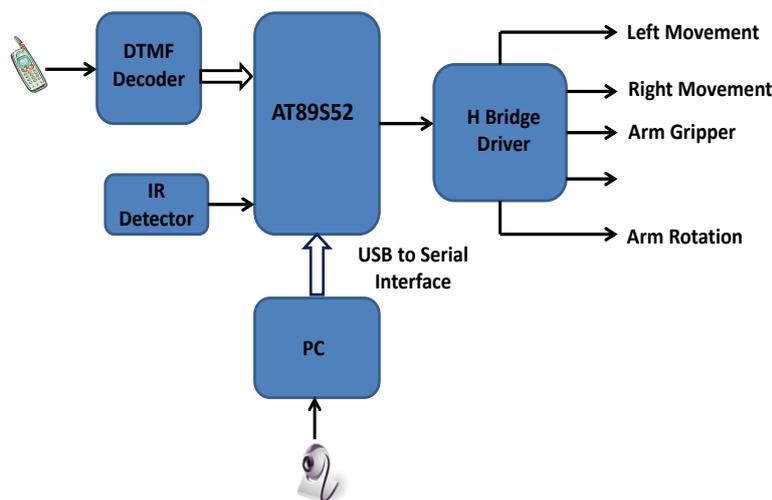

Fig.2. Block Diagram for DTMF operated pick and place robot

IV. SIMULATION

The HEX file for the control program was derived from compiling the code written in C language in Keil uVision tool. Various cases of operation was simulated using Proteus tool and functioning of the circuit was verified. Matlab GUI interface is built for input color for sorting with camera activation options.

The image can be browsed from interface and specified colored object is detected for pick and place operation by using MATLAB code.

V. WORKING

The feature of selecting the control mode gives the advantage of flexibility as per the requirement in application.

Manual Control

The manual control uses DTMF tones to communicate with prototype which is operated in remote places such as hazardous industrial and dangerous defence areas.

Basic mobile phone is used as a controller which generates DTMF tones with two different frequencies on pressing the each key. The call is made by the mobile phone at the controller side to the mobile phone staked on the robot.

Automatic receive option is provided in the receiver phone which is connected to the DTMF decoder HT9170 via 3.5mm jack connector.

Received DTMF tones are decoded to 4bit binary sequence and given to the input port of microcontroller 89C51 for processing. Processed signals from controller drives robotic arm incorporated with geared DC motors by using H-bridge driver. The operations are shown in flowchart Fig.3

Automatic Control

Automatic control of the robot is by using color sorting technique. Image processing in matlab tool is used for this purpose.

Camera mounted on the robot captures image of working environment on receiving activation signal and send it to the PC for processing. Image processing tool recognizes color given in the input interface. Each H-bridge IC L293D drives two DC motors. Since 5 motors required for the vehicle and arm movements total 3 IC's are used. (Geared DC motors with 100 RPM specification)
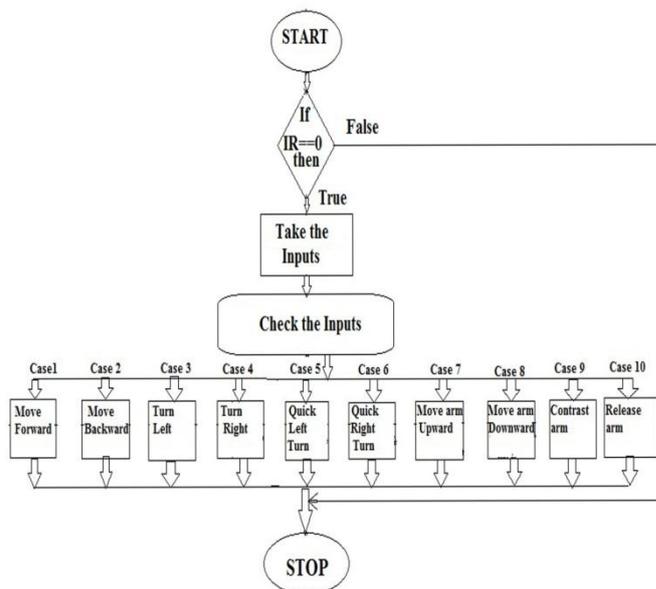
VI. ADVANTAGES

This project has advantages over other remote controlled devices;
- It has unlimited operating range because mobile network is worldwide
- It has less noise interference. It has large bandwidth.
- Mobile phone for robotic control can overcome RF limitations and provides the advantage of robust control, working range as large as the coverage area of the service provider, no interference with other controllers.
- Robots produce more accurate and high quality work.
- Robots rarely make mistakes and are more precise than human workers .They can produce a greater quantity in a short amount of time .
- They can work at a constant speed with no breaks, days off, or holiday time.
- They can perform applications with more repeatability than humans.Robots save workers from performing dangerous tasks . They can work in hazardous conditions, such as poor lighting, toxic chemicals, or tight spaces They are capable of lifting heavy loads without injury or tiring.Robots increase worker safety by preventing accidents since humans are not performing risky jobs
- Robots save time by being able to produce a greater magnitude of products
- They also reduce the amount of wasted material used due to their accuracy
- Robots save companies money in the long run with quick ROIs (return on investment), fewer worker injuries (reducing or eliminating worker's comp), and with using less materials.

The list of the advantages of robots does not end there; they have also created jobs for workers. Many people believe the misconception that robots have taken away jobs from workers, but that is not necessarily true. Robots have created new jobs for those who were once on production lines with programming. They have pulled employees from repetitive, monotonous jobs and put them in better, more challenging ones. Today robots are user-friendly, intelligent, and affordable. The benefits of robots continue to grow as more industries incorporate them.

VII.   DRAWBACKS

➢ This uses GSM platform, If there is no network we cannot operate the robot.
➢ Receiver cannot accept the tone of less amplitude than threshold
➢ After each pick and place operation robot returns to previous position in automatic control which may consume time.
➢ Multicolored or colorless objects are difficult to detect in color sorting technique.

VIII.   APPLICATIONS

Industry
➢ For working in hazardous environment
➢ Orderly arrangement, loading and unloading of materials
➢ Hygienic handling in food and pharmaceutical industry
➢ Fruit picking in farms can employ color sorting.

Military and Law Enforcement
➢   Bomb planting & disposal
➢   Medical assistance
➢   Rendering weapons

Household application
➢ Assistance to physically disabled

Construction
➢ Supply of heavy building materials

IX.   CONCLUSION

The robotic system with manual and automatic control is proposed in this paper which can overcome the drawbacks of existing systems. The widespread GSM network is advantageous over wide range of control and camera is used for continuous monitoring and color sorting method.

The system can be improved by implementing authentication procedure to operate and by finding solutions for the drawbacks. If implemented in real, can be a better substitute on existing systems for effortless job excecution.

VI.   REFERENCES

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