MOBILE ROBOT WITH ROBOTIC ARM UTILIZING MICROCONTROLLER AND WIRELESS COMMUNICATION

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Abstract: - The main objective of the project "MOBILE ROBOT WITH ROBOTIC ARM UTILISING MICROCONTROLLER AND WIRELESS COMMUNICATION" is to develop the purpose of this study is to design a prototype of a mobile robot equipped with a robotic arm which can be controlled by wireless technology. In this scheme, the mobile robot in the form of 2 Wheel Drive Robot equipped with robotic arm 2 Degree of Freedom and is controlled wirelessly through remote control based on mobile communication.

The development of robotics technology basically aims to assist humans in performing a particular job, and it is a very fast evolving research field today. Some specific kinds of robots that can ease human task are mobile robots, the arm robot (manipulator robot), or a combination of both. Mobile robots are widely used for faster movement, especially on wheels. Arm robots are designed to hold, lift and move objects. While combining the two obviously aims to equip the robots with all the functions.

In this research, a detailed explanation of Robotic arm technology with DTMF technique which will comprise all the major aspects of our project.

1. INTRODUCTION

In this project, we present the controlling of a Robot using DTMF technique. The robot is controlled by a mobile phone that calls the other mobile phone attached to the robot. In the course of the call, if any button is pressed, the robot moves forward, backward or its arm is moved above or lower, or it can close depending upon the button pressed. This tone is called "Dual Tone Multi Frequency tone (DTMF)". Using DTMF code, direction of motion of the robot can be controlled by mobile phone. The above system can be used for military purpose as 'bomb detector' and as 'spy robot' and also for surveillance.

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This usually involves programming the arm each time with set of instructions to be followed. Well, we hereby develop a smartphone controlled programmable robotic arm that can be easily programmed via a smartphone to perform any automated repetitive tasks as desired by user.

DTMF Mobile ROBO is a machine that can be controlled with a mobile . In this project, the robot is controlled by a mobile phone that makes a call to the mobile phone attached to the robot.

In the course of a call, if any button is pressed, a tone corresponding to the button pressed is heard at the other end of the call.

This tone is called "Dual Tone Multiple-Frequency" DTMF) tone. The robot perceives this DTMF tone with the help of the phone stacked on the robot.

The received tone is processed by the microcontroller with the help of DTMF decoder. The microcontroller then transmits the signal to the motor driver ICs to operate the motors & our robot starts moving 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.

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.

To be called as a modern robot system, a machine comprises at least three main things:

1) Manipulator. A manipulator is a mechanical unit that performs the functions of the movement. In the robot, manipulator normally consists of a sleeve (main frame) and wrist. The function of this manipulator is to allow the robot to reach a certain position with precision.

2) Actuator. Serves as a source of energy to drive manipulator. Actuators on the robot can be hydraulic systems, pneumatic systems, DC motors, AC motors, stepper motors and various types of other drivers.

3) Processor. Is the brain of the robot, serves to store and process every sequence of movements on the robot Typically, the processor enables the robot to perform a variety of tasks programmed to it.

2. LITERATURE SURVEY

1. In this experiment, the student was explained by the technician on robotic system. The robot part introduced to the student with basic layout of the robotic where consist robot arm, robot arm link and robot arm joint. We practice the robot with basic movement that have been shown by the lab assistant and recorded all the data of the robot arm movement. The basic movement of the robot arm depends on the joint types where our robot has revolute joints for rotary joint and prismatic joint for the linear movement of the robot arm.

2. Patil, C., Sachan, S., Singh, R. K., Ranjan, K., & Kumar, V. (2009). Self and Mutual learning in Robotic Arm, based on Cognitive systems. West Bengal: Indian Institute of Technology Kharagpur

The paper presents a novel implementation of self-learning and mutual learning of the Robotic arm based on Cognitive systems. The proposed arm can learn different motions or tasks in supervisory mode under the supervision of similar master arm having exactly same degrees of freedom at the same places. The cognitive approach results in efficient learning based on past history. The proposed hardware provides cheaper solution to the expensive industrial robotic arms for numerous applications. In order to enable a humanoid robot to perform useful work for a human, it is necessary that it can perform some task using the arms as well as walk around freely. Therefore, evolution of robotic arms is very much necessary to widen the applications of humanoid robots. It is an important topic in research related to humanoid robots.

3. Craig, J. J. (2005). Introduction to Robotics-Mechanics and Control (3rd ed.). (M. J. Horton, Ed.) Upper Saddle River, USA: Pearson Prentice Hall

The study of robotics concerns itself with the desire to synthesize some aspects of human function by the use of mechanisms, sensors, actuators, and computers. Obviously, this is a huge undertaking, which seems certain to require a multitude of ideas from various "classical" fields. Currently, different aspects of robotics research are carried out by experts in various fields. It is usually not the case that any single individual has the entire area of robotics in his or her grasp. A partitioning of the field is natural to expect. At a relatively high level of abstraction, splitting robotics into four major areas seems reasonable: mechanical manipulation, locomotion, computer vision, and artificial intelligence.Angelo, J. A. (2007). Robotics: A Reference Guide to the New Technology. Westport: Greenwood Press.

Research led by bunch of working professionals into making cost effective robotics parts and a guide to streamline the process by making multiple proposed models which can be used in both industrial automation as well as developing further projects.

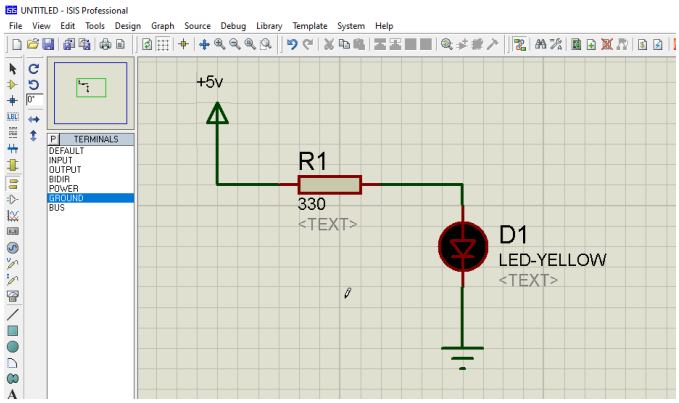
4. ROBOT ARM CONTROL WITH ARDUINO By Aimn Mohamed Ahmed Ghiet MECHANICAL AND AERONAUTICAL ENGINEERING Designed and realized in the project, the robot arm has the ability to move in 4 axis directions with 5 servo motors. Thanks to the holder, you can take the desired material from one place and carry it to another place, and also mix it with the material it receives. While doing this, robot control is provided by connecting to the android APP via Bluetooth module connected to Arduino Nano microcontroller.

3. RESEARCH METHODOLOGY

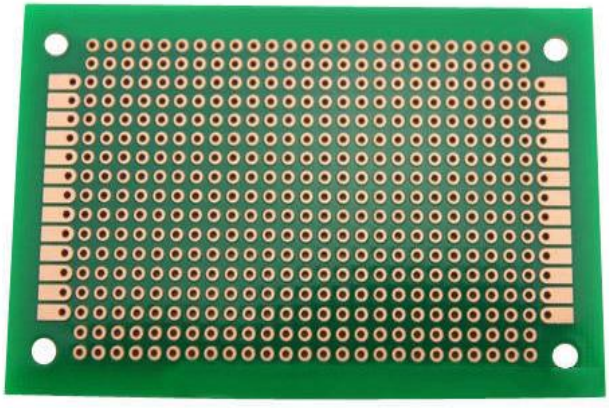
A robotic arm is a mechanical model arm, usually programmable, with similar functions to a human arm. It is connected by joints allowing either rotational motion (Such as in a articulated robot) or linear displacement. With technology advancing and the rapid increase in the flow of information, people are now guided to search different markets that cater with the rapidly increasing human needs and people have then entered the competition to manufacture quality products cheaply. Our aim is also to make it cost effective so that many numbers of people can get the benefit from this. And it should be usable to anyone and helpful for them Here mainly, we have these tasks.

Circuit Implementation

- Create a circuit layout using Proetus
- Write the code used in the microcontroller into AVR Studio.
- The frame is made out using cardboard.
- A Blank PCB board is used to implement all the circuit parts into the circuit



Proetus project implementation



Blank PCB

4. CODING

The coding for the project has been done on the following platforms. These platforms/coding environments have been used for designing the front end and back end of this project:

4.1 AVR STUDIO OR MPLAB IDE

Especially created to provide a means of putting together applications based on Atmel ARM Cortex-M and Atmel AVR microcontroller- technologies, this program comes fully equipped for a wide range of tasks. Projects can be built from the ground up, tested and verified within the same environment. Part of the package, the editor facilitates code writing by adding suggestions as soon as some letters of a certain symbol are put down on the canvas. More so, you can begin your work by selecting one of the numerous pre-existing samples.

4.2 Dedicated C/C++ compiler inside AVR studio

There is also a dedicated C++ compiler at your disposal to help build your apps faster, as well as a simulator and assembler that work together to make sure the final products are thoroughly tested. To make this complete, the powerful debugger brings a solid set of functions for inspecting the code up close to identify any possible errors.

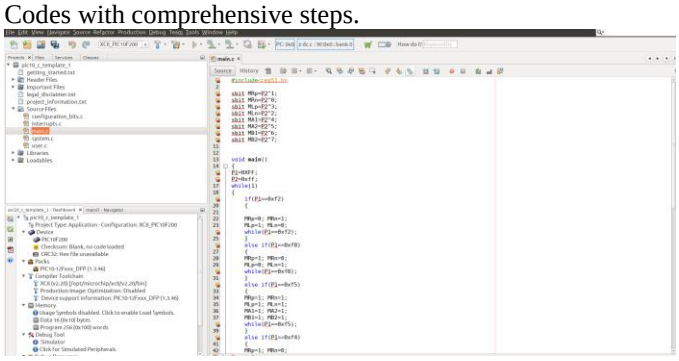
4.3 Proetus

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards.
Proteus is used to simulate, design and drawing of electronic circuits. It was invented by the Lab center electronic. By using proteus you can make two-dimensional circuits designs as well.

Is Proteus software free?

Proteus is free trial software published in the Math & Scientific Tools list of programs, part of Business. This Math & Scientific Tools program is available in English. It was last updated on 26 January, 2022.

Codes with comprehensive steps.



Step 2: Click on the microcontroller you are using and type the following code in main function

```
#include<reg51.h>
sbit MRp=P2^1;
sbit MRn=P2^0;
sbit MLp=P2^3;
sbit MLn=P2^2;
sbit MA1=P2^4;
sbit MA2=P2^5;
sbit MB1=P2^6;
sbit MB2=P2^7;

void main()
{
P1=0XFF;
P2=0xff;
while(1)
{
        if(P1==0xf2)
        {

        MRp=0; MRn=1;
        MLp=1; MLn=0;
  while(P1==0xf2);
        }
        else if(P1==0xf8)
        {
        MRp=1; MRn=0;
        MLp=0; MLn=1;
        while(P1==0xf8);
        }
        else if(P1==0xf5)
        {
        MRp=1; MRn=1;
        MLp=1; MLn=1;
        MA1=1; MA2=1;
        MB1=1; MB2=1;
        while(P1==0xf5);
        }
        else if(P1==0xf4)
        {
        MRp=1; MRn=0;
        MLp=1; MLn=0;
        while(P1==0xf4);
        }
        else if(P1==0xf6)
        {
        MRp=0; MRn=1;
        MLp=0; MLn=1;
        while(P1==0xf6);
  }
        else if(P1==0xf1)
        {
        MA1=0; MA2=1;
        while(P1==0xf1);
}
else if(P1==0xf3)
{
MA1=1; MA2=0;
while(P1==0xf3);
}
else if(P1==0xf7)
{
MB1=1; MB2=0;
```



```
  while(P1==0xf7);
  }
  else if(P1==0xf9)
  {
  MB1=0; MB2=1;
  while(P1==0xf9);
  }
}
}
```

5. RESULT AND CONCLUSION

5.1 RESULT

After the completion of all the codes and designing of the project, the project would appear as follows in theend. Below are pics depicting how the project will look. After following all the necessary steps and implementing the coding, this illustrates the completed project. It will vary user to user too if they decide to use prebuilt frame or cardboard of their own as per requirement.

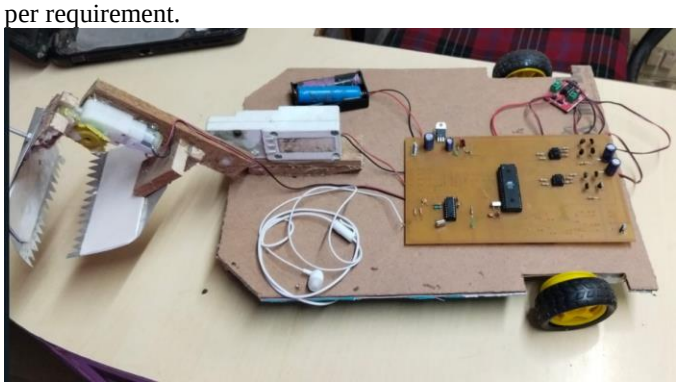


Fig 5.1: Total project preview

5.2 CONCLUSION

In the process of realizing this project, the construction was initially carried out on a breadboard to allow for checking and to ascertain that it is functioning effectively. All irregularities were checked then tested and found to have a satisfactory output. The component was then removed and transferred to a Vero board strip and soldered into place and all discontinuous point was cut out to avoid short-circuiting.

6. FUTURE SCOPE

The main aim of this project is to reduce human workload and efforts along with the enhancement of a smart city vision. We have often seen manual labor as a low level job which takes time and human resource, that work can be now be automated using robots and robotics, Industrial hazards can be prevented if there is no human working in a dangerous site, unlike humans robots don't get tired and have no emotions, they can be preprogrammed to do task skilled labor can do and that too in less amount of time, same concept of robotics when applied in medical field can save countless live surgeries can be performed remotely, by using robotic arm and motion sensors thus breaking the barrier of distance and travel by performing surgeries from miles away using Wi-Fi. Fully Mobile robots can do whole more than any robotic arm, they can be used to do tasks such as cleaning, defense and even maintenance. A fullbodied humanoid robot which is currently in development by many big companies and institutions with the use of AI can redefine our future.

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