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Robotic Arm Control For Collecting Liquid Aerosol Samples Using Microcontroller

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ABSTRACT: A PIC18f452 Microcontroller Based Robotic Arm For Collection Of Liquid Aerosol Samples Has Been Design And Developed. Robotic Arm Is Designed For Collecting 32 Number Of Liquid Samples In Which The Liquid Aerosol Samples Will Collect In Vile. Robotic Arm Will Move Circularly For Collecting The Next Liquid Aerosol Sample And Up-Down Motion For The Change The Vile (Liquid Aerosol Collector). Two Permanent Magnet DC Motor Is Used For Controlling The Horizontal And Up-Down Motion And Stepper Motor For Circular Motion. Keypad Is Used For Setting The Time Of Collection Of One Sample And The LCD Display Is Used For Showing The Reaming Time. As Result, We Have Achieved The Robotic Arm Control By Microcontroller And With Help Of Mechanical Assembly With Easy Fabrication And Better Outcome With Less Cost. It Will Reduce The Manpower Required For Collecting The Liquid Aerosol Samples. This System Can Be Used In The Meteorological Field And In Any Industrial Area With More Accuracy And Precision.
Keywords— PCB- Printed Circuit Board, LCD- Liquid Crystal Display.

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I. INTRODUCTION

Robotics Researchers Regularly Endow Robot Platforms With New Capabilities That Increase The Breadth Of Potential Applications And Push The Boundaries Of Autonomy. In Contrast, Industrial Automation Is Driven By A Pragmatism Dictated By The Need To Optimize Throughput And Reliability. The Hope Of Both Is That, As Multi-Purpose Robotic Platforms Become More Capable, They Will Be Able To Take Over An Increasing Fraction Of The Tasks Currently Handled By Application Specific, Fixed Installation Automation, Thereby Granting All Applications Greater Levels Of Modularity And Adapt Ability Which Is Expressed In [1]. The Field Of Automation Has Had A Notable Impact In A Wide Range Of Industries Beyond Manufacturing. Automation Is The Use Of Control Systems And Information Technologies To Reduce The Need For Human Work In The Production Of Goods And Services. In The Scope Of Industrialization, Automation Is A Step Beyond Mechanization. Whereas Mechanization Provides Human Operators With Machinery To Assist Them With The Muscular Requirements Of Work, Automation Greatly Decreases The Need For Human Sensory And Mental Requirements As Well.

A Robotic Arm Is A Type Of Mechanical Arm, Usually Programmable, With Similar Functions To A Human Arm; The Arm May Be The Sum Total Of The Mechanism Or May Be Part Of A More Complex Robot. The Links Of Such A Manipulator Are Connected By Joints Allowing Either Rotational Motion (Such As In An Articulated Robot) Or Translational (Linear) Displacement.

As Per This Project The Limitations Of Human Work Should Be Solved. The Human Works Have Many Limitations Likewise, Laziness, Less Accuracy, Time Limits, Etc. In The Industrial Work, Automation Is One Of The Essential Elements For Development. It Helps To Reduce The Need For Humans And Increase Efficiency And Productivity. The Field Of Automation Occupies Large Areas, Mostly In Industrial Manufacturing And In Addition To This; Automation Is Applied To Build A Lot Of Sophisticated Equipment Which Is Used Daily Such As Medical Equipment X-Ray Machines, Radiography, And Refrigerators, Automobiles Etc. Among All Of These Outcomes, The Robotic Arm Is One Of Them, Which Is Widely Used For Industrial Purposes.

It Is An Instrument With Diverse Applications And Is Designed Specifically For Sample Collection. It Allows Any Point On A Sample Rack To Be Approached. This Means That The Number Of Samples (Max. 32 Rack Positions) And Arrangement Of The Samples On The Sample Rack Can Be Selected Virtually At Will.

A. Features Of Proposed Robotic Arm

- User Defined Input.
- Implementation Will Be Done By Using Embedded In C

- Easy And Reduce Manpower.
- Cost Effective.
- Use Of Microcontroller Gives Reliability.
- Use Of Keypad Gives The Stability And The Proper Observation Time.

II. LITERATURE REVIEW

The Young And Dynamically Growing Field Of Cooperative Robotics Has Become A Diverse Research Area That Often Seems To Go In Several Different Directions At Once. Areas Of Interest Range From High-Level Human-Interactive Robots [1] To Biologically Inspired Autonomous Gnat-Like Agents [4]. In The Past Fifteen Years Many Different Research Areas Have Emerged, Each Generating Significant Amounts Of Progress. However, The Field Is So New That No Topic Area Within Cooperative Robotics Can Be Considered Mature [5].

There Are Various Ways In Which A Robotic Arm May Be Controlled. In The Past There Have Been Many Researchers Working To Control Robotic Arm Through Computer Terminals, Joysticks, Even Interfacing Them With The Internet So They Can Be Controlled From Anywhere In The World. [1][2] Usually Most Of The Robotic Arms Are Controlled By A Central Controller Which Makes Uses Of Values Taken In From The Terminal That Are Entered By The User At The Terminal To Move The Arm To A Particular Coordinates In Space. This Makes The Control Very Difficult As The Control Values Of The Motors Are Very Difficult To Predict To Achieve A Particular Movement. This Is Easily Achieved By Our Project.

III. METHODOLOGY

A. Hardware Requirements

1. Stepper Motor And Two PMDC Motor
2. PIC18F452 Microcontroller
3. 16x2 LCD Module (Display)
4. 4*4 Keypad
5. Proximity Sensor
6. Mechanical Assembly

B. Block Diagram

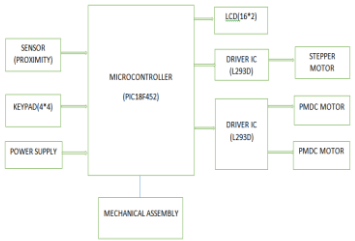

Fig. 1. Proposed Block Diagram For Robotic Arm For Collecting Aerosol Samples.

C. Description Of Block Diagram

In This System We Use The PIC 18f452 Microcontroller For Control The Overall Performance Of The Robot. The PIC18F452 Features A 'C' Compiler Friendly Development Environment, 256 Bytes Of EEPROM, Self-Programming, An ICD, 2 Capture/Compare/PWM Functions, 8 Channels Of 10-Bit Analog-To-Digital (A/D) Converter, The Synchronous Serial Port Can Be Configured As Either 3-Wire Serial Peripheral Interface (SPI™) Or The 2-Wire Inter-Integrated Circuit (I²C™) Bus And Addressable Universal Asynchronous Receiver Transmitter (AUSART). All Of These Features Make It Ideal For Manufacturing Equipment, Instrumentation And Monitoring, Data Acquisition, Power Conditioning, Environmental Monitoring, Telecom And Consumer Audio/Video Applications And This Controller Fulfill The Overall Requirement Of The System.

Two 10 Rpm Permanent Magnet DC Motor With L293D Motor Driver IC Is Used For The Horizontal And The Up-Down Motion Of The Arm With Better Feature Is Compatible With Any Microcontroller And Easily Available, Which Has Proper And Precise Output Rotation. 12vdc Stepper Motor Is Use For The Circular Rotation Which Is Shown In Fig 3. Proximity Sensor, 16x2 LCD Module, Keypad And The Mechanical Assembly Used For Better Performance Of Robotic Arm And Give Specified Output Which Is Requirement Of The Project. We Are Using The Dual 5vdc And 12vdc Power Supply. 5vdc Is For The Microcontroller And 12vdc For The Servo Motor And The PMDC Motor.

We Make The 30 Cm Diameter Acrylic Disc In Which Total 32 Sample Viles We Can Put Outer Circle Having The 16 Number Of Samples And Inner Circle Also Having The Same 16 Samples. This Disc Fix With Use Of Mechanical Assembly On The Stepper Motor So That It Can Be Rotate To Change The Sample Which Is Shown In Fig 3.

IV. DEVELOPMENT AND WORKING PRINCIPLE

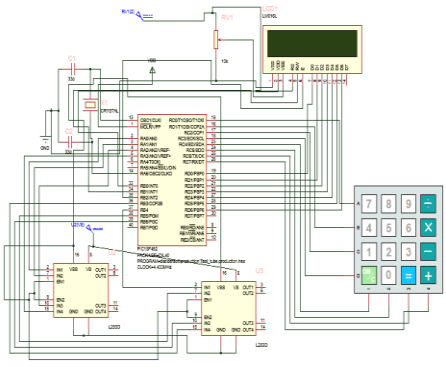

Fig. 2 Proposed Circuit Diagram For Robotic Arm For Collecting Aerosol Samples.

1. Background

The Various Factors To Be Considered While Designing Of Robotic Arm Are Been

Discussed As Follows. The Factors Are All Important While Designing Procedure Of The Robot.

1.1 Controls

The Mechanical Structure Of Robotic Arm Must Be Controlled To Perform Tasks. The Control Of A Robotic Arm Involves Three Distinct Phases - Perception, Processing, And Action. Proximity Sensor Gives Information About The Current Position Of Arm Which Is Always Set To Sample Number 1. This Information Is Then Processed To Calculate The Appropriate Signals To The Actuators (Motors) Which Move The Mechanical. In This Case We Use Two PMDC Motors And One Stepper Motor. In Action Rotating The Stepper Motor We Can Change Position Of The Samples To Next Liquid Aerosol Sample.

1.2 Working Principal

Initially The Position Of The Robotic Arm Is Set To Sample Number One And By Giving The Supply To The System It Will Check The Current Position Of The Conducting Sample If It Is Not To Initial Position Then By Moving The DC And Stepper Motor It Will Go To The Initial Position. Initial Position Of The Sample Can Be Detected With The Help Of Proximity Sensor. Then For Collecting Liquid Aerosol Samples Fix The Liquid Sample Outlet To The Arm (Needle). We Can Set How Much Amount Of The Needle Has To Deep In The Sample Vile By Using Push Button And Rotating The Dc Motor Forward And Reverse. Now We Have To Set How Much Time We Have To Collect The Sample For Example 30 Min. This Time Set By The Use Of Keypad Which Is Interface With The Microcontroller And The Time Will Be Display On LCD As It Will Goes On Decreasing Upto Zero And After That The Dc Motor Will Turn On Automatically And The Needle Will Move Upward And The Stepper Motor Will Move 22.5 Deg To Go To Next Sample And Again This Needle Will Move To The Sample Vile With The Same Depth Which We Set At The Time Of Staring The Process By Using The Dc Motor. When Total 16 Samples From Outer Circle Get Collected Then The Position Of The Needle Has To Change To Inner Circle Which Can Be Detect By Proximity Sensor. For Changing To The Inner Circle The Needle Has To Move Horizontally Which Can Be Done Through Dc Motor And Mechanical Assembly.

V. RESULT AND CONCLUSION

Fig. 3 Snapshot Of Robotic Arm For Collecting Aerosol Samples

The Objectives Of This Project Has Been Achieved Which Was Developing The Hardware And Software For A Microcontroller Based Controlled Robotic Arm. From Observation That Has Been Made, It Clearly Shows That Its Movement Is Precise, Accurate, And Is Easy To Control And User Friendly To Use. The Robotic Arm Has Been Developed Successfully As The Movement Of The Robot Can Be Controlled Precisely. We Achieved The Following Things.

- Improving Quality Of Work For Employees
- Increasing Production Output Rates
- Improving Product Quality And Consistency
- Increasing Flexibility In Product Manufacturing
- Reducing Operating Costs

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