Raspberry PI Based Mobile Controlled Robotic Arm For Repetitive Work

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Abstract : This paper represents the implementation of raspberry pi based mobile controlled robotic arm for repetitive work. For the repetitive work, it will be handled in record and play mode. In this implementation, the Raspberry Pi 3b+ module is used as a main controlling unit. The first approach of this project is to employing robotic arm to handle precise operations were seen in abundance like industrial, medical, and rescue operation.

IndexTerms - **Raspberry Pi, Robotic Arm, Mobile controlled, Repetitive work.**

I. INTRODUCTION

Nowadays robots are being used increasingly, especially for repetitive work. Instead of humans, robotic arms are used for repetitive work in the industry. Robotic arms are the programmable manipulators which work the same as the human arm[3],[4]. This gives an advantage of increasing the working time and efficiency of industrial work. This project involves the implementation of raspberry pi based mobile controlled robotic arm for repetitive work. Reducing human efforts is the main objective of this project. The main concept behind this project is to build the servo based robotic arm which has the capability to follow the instructions given by the user through the mobile application and work in a repetitive manner itself. It acts as a main controlling unit of this project. The project implementation has mainly occurred in two parts, hardware, and software. Hardware part consists assembly of required components to build this project. In this implementation, two types of motor are used namely servo motor and DC motor for the robotic arm and its base vehicle respectively. The current requirement of motor is accomplished by motor driver PCA9685 and L293D. The software part comprises programming in python of a proposed robotic arm and android application. The whole system can be controlled by the android application through Bluetooth.

II. PROPOSED METHOD

2.1Block Diagram

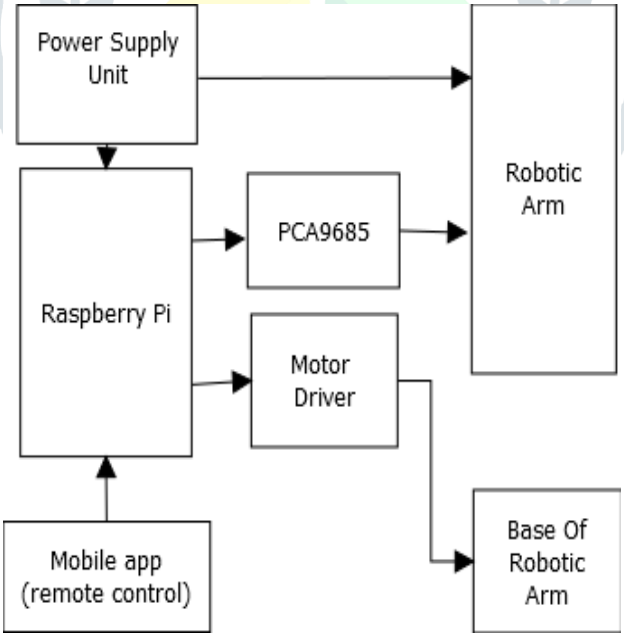

Fig. 1 Block Diagram of Proposed Method

2.2 Raspberry Pi

The raspberry pi is a very small sized computer[1] . We used b+ model. Good specifications and high flexibility in dealing with various programs make better controller or processor to the raspberry pi. It was released in February 2016[11]. In the project, it acts as a main controlling unit. It act as communication media between the android application and the robotic arm.

2.3 Android Application

The application used in this project is made by us on MIT APP INVENTOR platform MIT App INVERTER is a free Android app design platform. There are two types of connectivity available on this platform, on the first web viewer and the second Bluetooth[1],[2]. The app we made is connected to raspberry pi via Bluetooth. In this app, the first two buttons connect and disconnect. After this, the 6 sliders are for 6 servo motors and the seventh slider is to control the speed of the robotic arm, in addition to this the save, run, resets buttons are available in this app. After connecting the raspberry pi to the mobile, when first slider moved, the raspberry pi sends prefix s1 (indicate servo number) and thumb position through the Bluetooth and the servo motor moves according to the thumb position. Also, we can save the movement of the robotic arm saved and repeat it from the arm again and again.

2.4 Robotic Arm

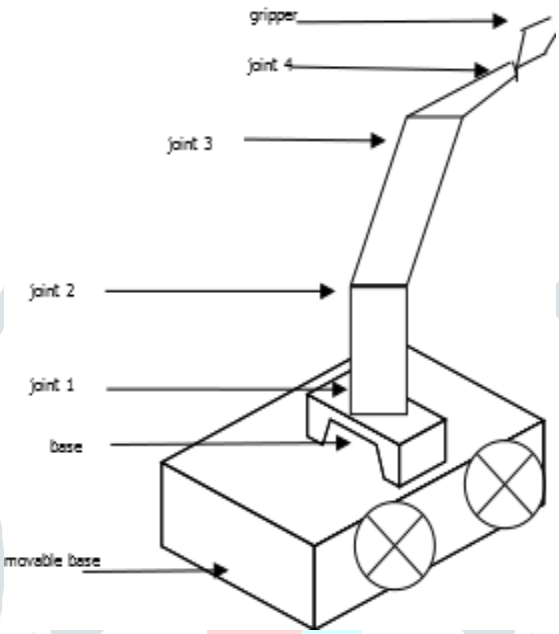

Fig. 2 Schematic Diagram of Proposed Robotic Arm

A robotic arm is reprogrammable manipulator designed for the moving parts, materials or tools through variable motions for the performance of a variety of task[8].

This robotic arm has four rotational joints, gripper and base. A base of the robotic arm moves in a left-right direction maximum up to 180 degrees. Joint 1, joint 2, joint 3 moves in upward and downward motion. It is made up of a metal body. While designing such robotic arm we have to consider gravity also because of the gravity the rotational velocity of each joint changes correspondingly[11]. A battery power supply is another factor which is an effect on the speed of the robotic arm[6],[12].

2.5Flowchart

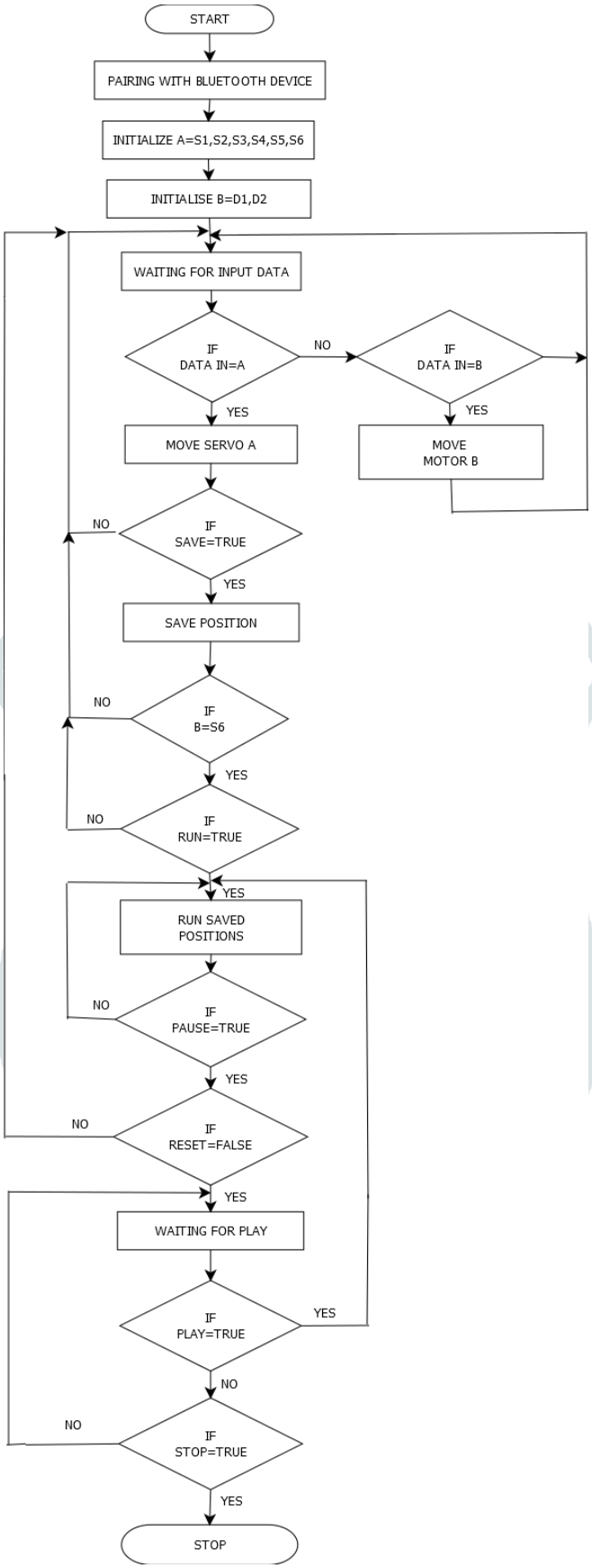

Fig. 3 Flow Chart of Proposed Robotic Arm

III. EXPERIMENTAL SETUP

The interfacing of the servo motors of the robotic arm and DC motors of the base vehicle of the robotic arm with the raspberry pi 3 is shown in figure 5. The robotic arm has six servo motors, so raspberry pi is unable to drive these all servo motors directly. Hence motor driver is required for the control of all motors of robotic arm. Here PCA9685 16 channel servo driver is used and interfaced with GPIO pins of the raspberry pi. It has 16 channels to drive 16 servo motors. Servo motors required PWM signal to rotate it's shaft. This signal is provided by the PCA9685 according to the control signal of raspberry pi. The communication between raspberry pi and PCA9685 is made through only two pins i.e. SCL and SDA. SCL pin provides clock. Data is transmitted on SDA pin through serial communication. OE pin of PCA9685 is made always enable by connecting to the ground for making all outputs enable or by default it is low (active). Base vehicle of robotic arm consist two DC motors, so one motor driver (L293D) IC is required to control it and is interfaced with raspberry pi. One driver IC can control maximum two motors. The enable pin should be made high for the motor to run. We can change the direction of the motor by changing the values of input pins as per the truth table of motor driver IC. We need to provide a separate power supply to the servo motors, as it's drawn more current. The whole system is controlled by the mobile application. A communication between raspberry pi and mobile app is done via Bluetooth technology. The robotic arm is capable to move in repetitive manner.

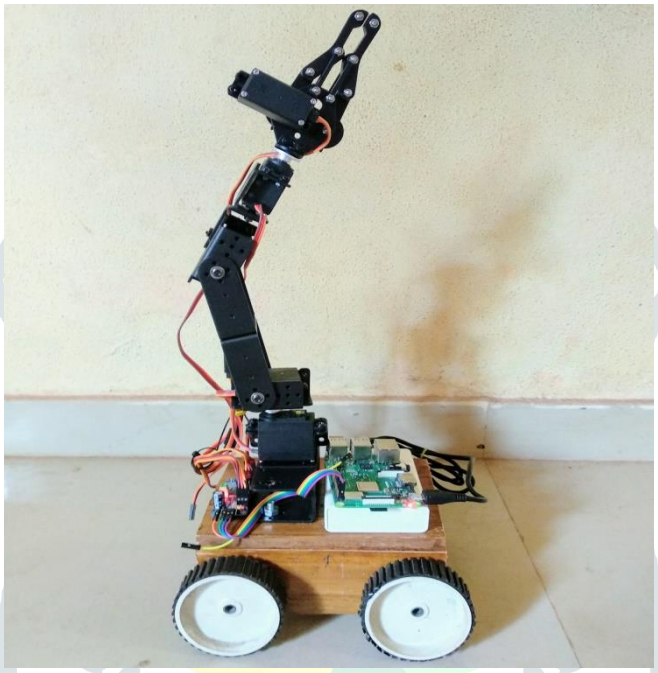

Fig.4 Experimental Setup Of Proposed System

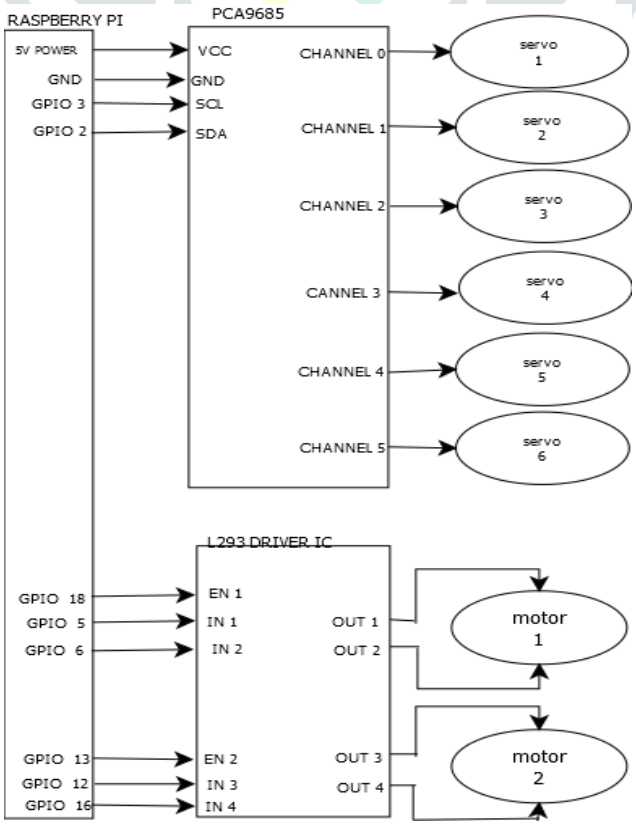

Fig. 5 Driver Circuit

IV. CONCLUSION

The objective to control the robotic arm without wires is achieved using raspberry-pi and smartphone. Servo motor provide precise movement of the robotic arm. Robotic arm reduce human efforts and increase productivity.

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