

Pick and Place Robotic Arm Using Arduino

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Abstract— In recent years the industry and daily routine works are found to be more attracted and implemented through automation via Robots. The pick and place robot is one of the technologies in manufacturing industries which is designed to perform pick and place operations. The system is so designed that it eliminates the human error and human intervention to get more precise work. There are many fields in which human intervention is difficult but the process under consideration has to be operated and controlled this leads to the area in which robots find their applications. Literature suggests that the pick and place robots are designed, implemented in various fields such as; in bottle filling industry, packing industry, used in surveillance to detect and destroy the bombs etc. The project deals with implementing an pick and place robot using Robo-Arduino for any pick and place functions. The pick and place robot so implemented is controlled using RF signal. The chassis is supported for the displacement of robotic arm by four Omni wheels. The robotic arm implemented has two degrees of freedom. Many other features such as line follower, wall hugger, obstacle avoider, metal detector etc can be added to this robot for versatility of usage.

Index Terms— Pick & Place Robot, Robotic arm, Robo-Arduino.

I. Introduction

Since many years people try to replace human work with machines. Machines called robots are faster and more effective than people. The term robotics is practically defined as the study, design and use of robot systems for manufacturing. Robots are generally used to perform unsafe, hazardous, highly repetitive, and unpleasant tasks. They have many different functions such as material handling, assembly, arc welding, resistance welding and machine tool load and unload functions, painting, spraying, etc. Many elements of robots are built with inspiration from the nature. Construction of the manipulator as the arm of the robot is based on human arm. The robot has the ability to manipulate objects such as pick and place operations. It is also able to function by itself. The development of electronic industry robot system technology has been expanded increasingly. As one such application, the service robot with machine vision capability has been developed recently.

In this highly developing society time and man power are critical constrains for completion of task in large scales. The automation is playing important role to save human efforts in most of the regular and frequently carried works. One of the major and most commonly performed works is picking and placing of jobs from source to destination.

Present day industry is increasingly turning towards computer-based automation mainly due to the need for increased productivity and delivery of end products with uniform quality. The inflexibility and generally high cost of hard-automation systems, which have been used for automated manufacturing tasks in the past, have led to a broad based interest in the use of mechanical arm capable of performing a variety of manufacturing functions in a flexible environment and at lower costs.

The use of Industrial mechanical arm characterizes some of contemporary trends in automation of the manufacturing process. However, present day industrial mechanical arm also exhibit a monolithic mechanical structure and closed-system software architecture. They are concentrated on simple repetitive tasks, which tend not to require high precision.

The pick and place mechanical arm is a human controlled based system that detects the object, picks that object from source location and places at the desired location. For detection of object, human detect presence of object and move machine accordingly.

II. Literature Survey

John Iovine [1], in this book various aspects of designing a Robot is described. It deals with different types of Arm design, controlling techniques, vehicle design etc. ER. Rajput, in this book the operation and control of robots is discussed. Arduino cookbook, in this book details and methods of interfacing hardware components such as DC motor, Servo motor and RF Transmitter and Receiver is been discussed.

The other references listed in the references section discusses similar concepts in its various fields such as color identification and segregation robot, robot for surveillance, pick and place robot controlled using android etc.

III. Problem Statement

The pick and place robot being implemented to ease the process of sorting, process of moving heavy materials etc. Usually the transfer process of the heavy materials is being carried out, using man power and if the transfer process is repeated for a period of time, it can cause injuries to the operator. By using the particular robot the operator, will no longer have to bent and lift up heavy loads thus preventing injuries and increasing the efficiency of the work. Operator will make mistakes whether small or big in a while. In the

industrial world, the industry cannot afford to take any kind of mistakes. As every mistake is costly whether interns of time, money and material.

IV. Objective

The main objectives of this project are

- To control the displacement of the robotic arm so that the arm can be used to pick and place the elements from any source to destination.
- To control the displacement and movement of robotic arm using RF Transmitter and Receiver.
- To implement a robotic arm with two degrees of freedom.

V. Methodology

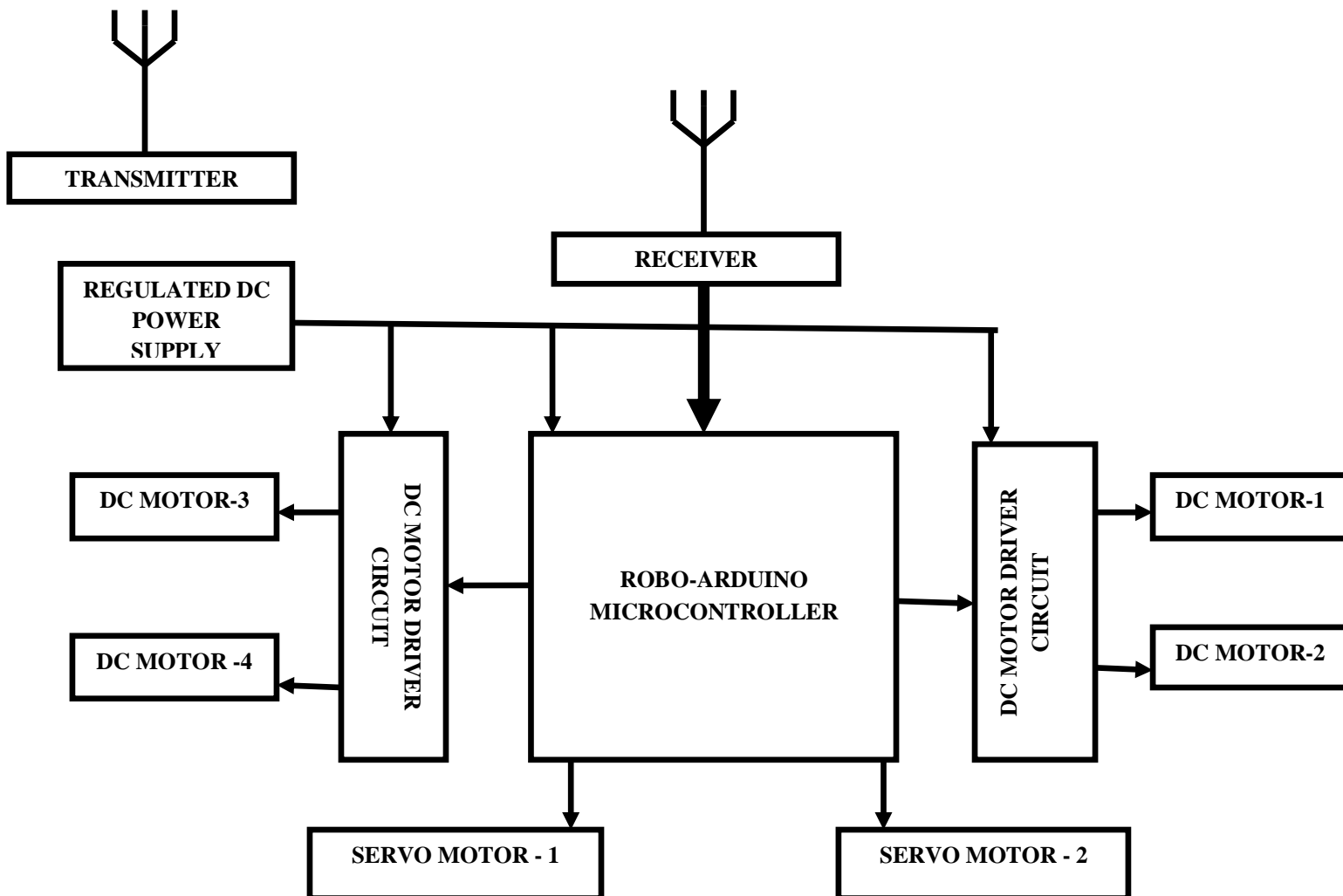


Fig 1 Block diagram of proposed concept

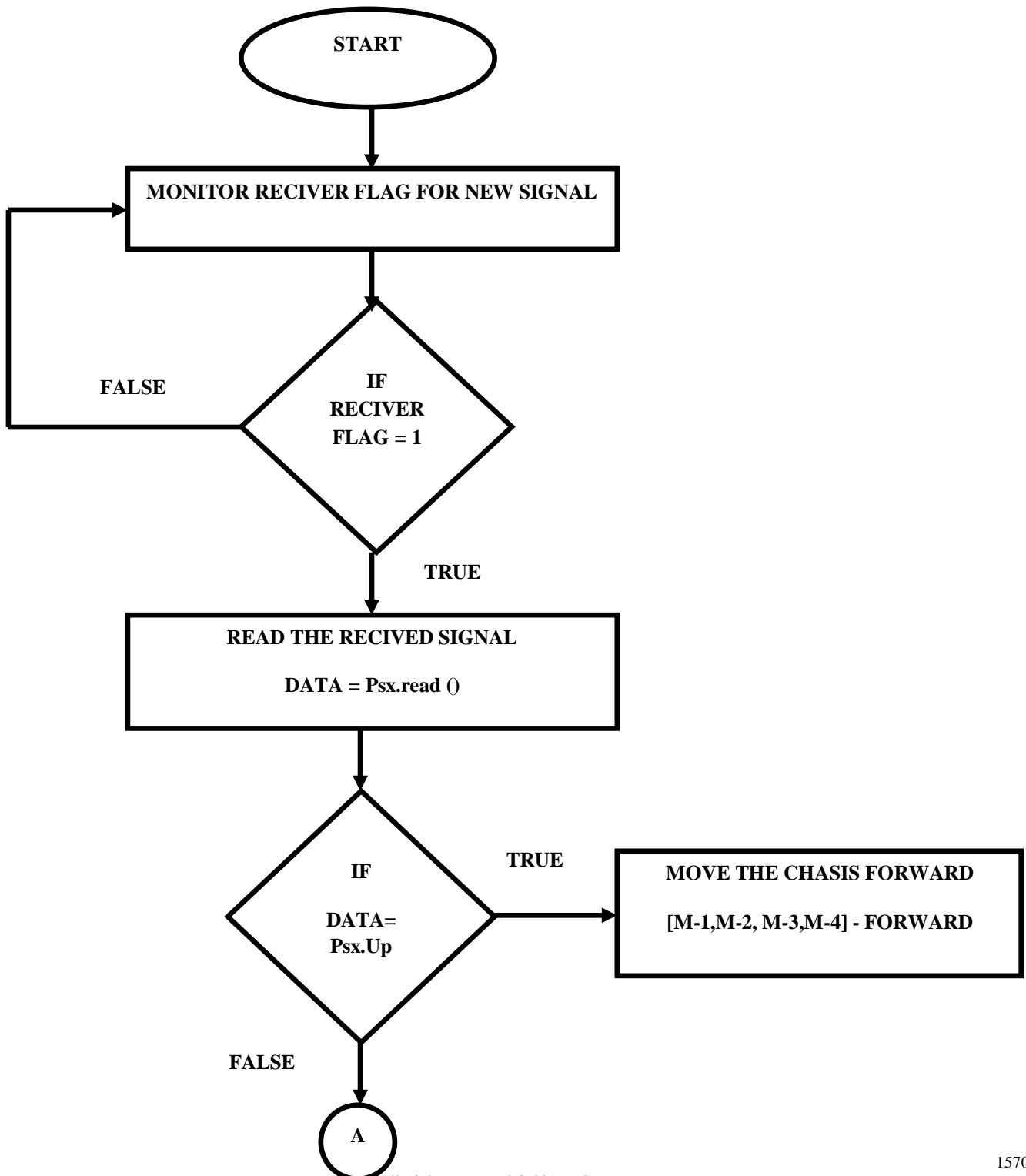
The block diagram of the proposed system is shown in Fig1. It consists of an Atmega328 Microcontroller IC, four DC Motors with driver IC, two servo motors and power supply.

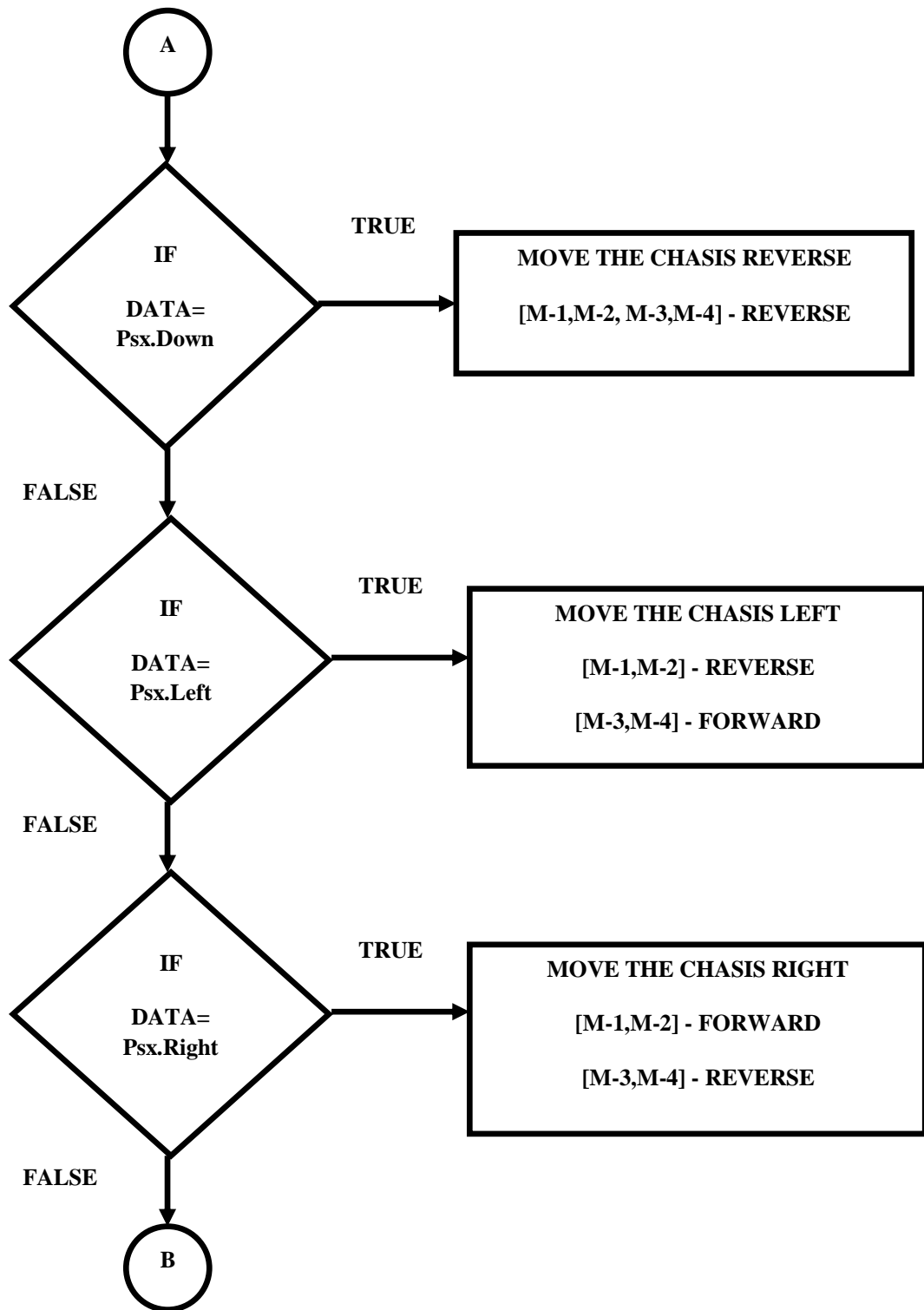
The pick and place robotic arm consists of a robotic arm placed on a moving vehicle (chassis). The vehicle is able to move along any type of surfaces irrespective of it is smooth or rough. The pick and place robot uses four motors for the operation of the chassis, two servo motors for the operation pick and place operation. The pick and place arm consists of an arm assembly with a jaw, which is only able to move in up and down direction.

There are two motors for the arm assembly, one for the up and down motion and other for jaw opening and closing.

For the controlling of motor, motor driver IC and Atmega328 micro controller is used. The input signal or controlling signal is given from a wireless play station, which is interfaced with the microcontroller by a RF receiver module. When the signal is sent from the play station it is decoded in the controller and proper controlling signal is sent to actuators (dc motors or servo motor) in the system.

VI. Flowchart of the implemented code





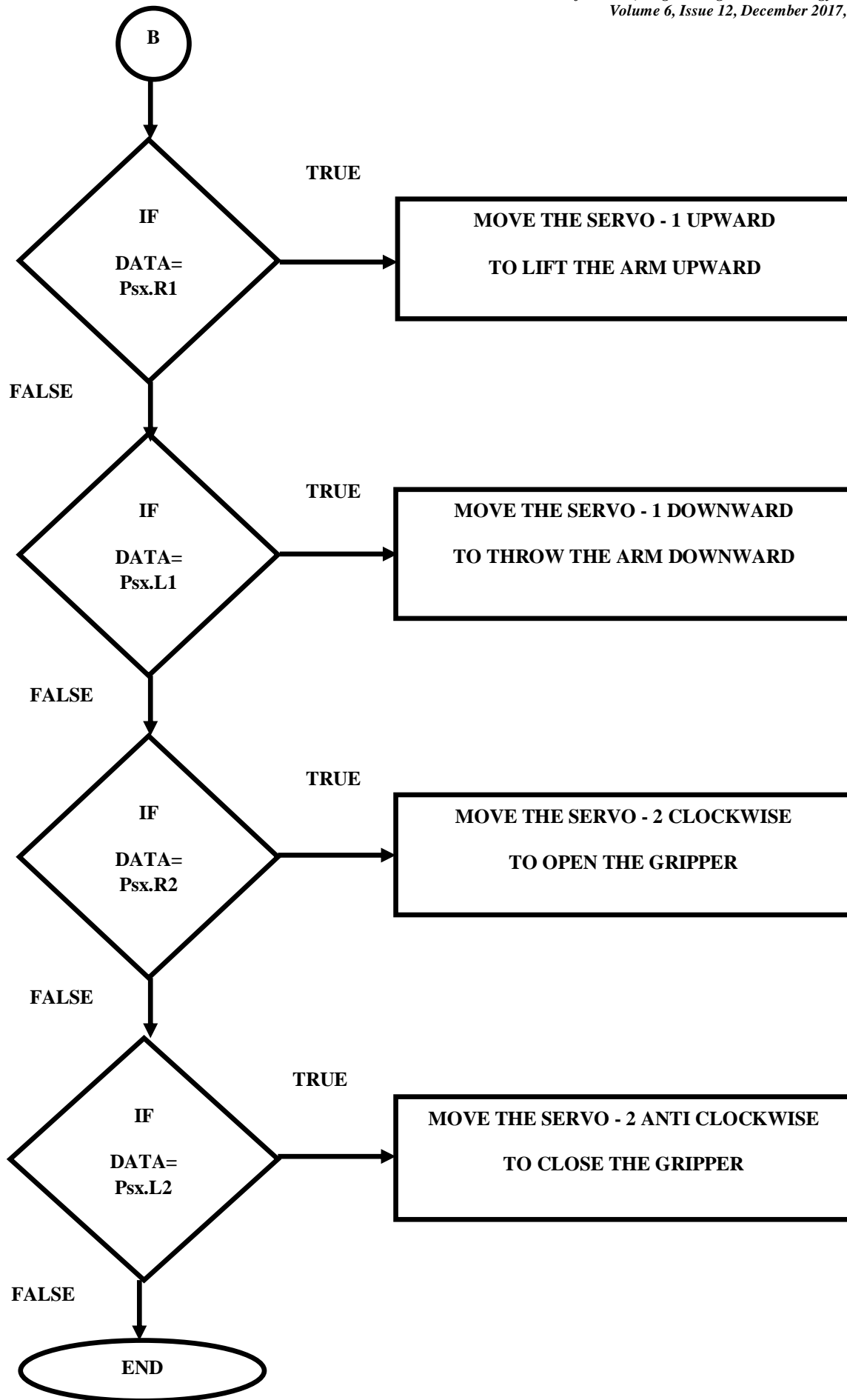


Fig. 2 Flowchart of implemented source code

The above Fig 2 depicts the methodology in which the system is programmed. In the Arduino platform the signal sent from play station can be read on Arduino using built in function `Psx.read()` by including `Psx.h` header file during including the supporting files for execution. The receiver flag of the Arduino controller is monitored to detect any instruction is applied to the controller.

Once the receiver flag becomes high it indicates a control signal is sent to the robot. The next task is to decode the instruction been requested to perform. The signal been applied is read and stored in the variable called "DATA" further the algorithm searches for the opcode that executes when it is matched with the code stored in "DATA".

Example: As we know that when UP button of the play station is pressed the code been read on Arduino by function is `DATA = Psx.read();` , due to which the value or data stored in variable DATA is `Psx.Up` now the program is constructed such that what the controller should perform when data is read as `Psx.Up`.

In this case all the four motors are instructed to move in the forward direction by the controller. Hence chassis moves in forward direction.

Similarly if data been read and stored in the variable is `Psx.Down` then all the dc motors re instructed to move in the reverse direction. Hence the chassis moves in reverse direction. Such eight conditions are programmed and depicted in the flowchart.

VII. Hardware Implementation

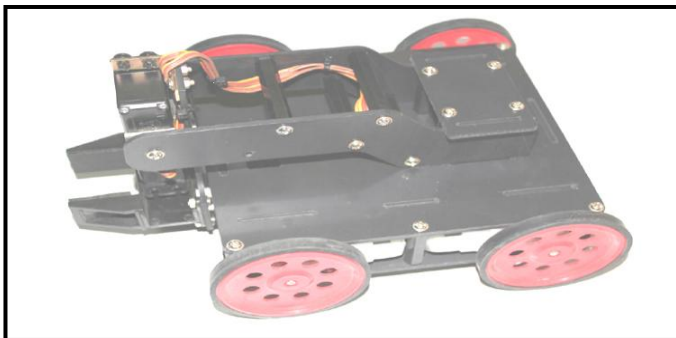


Fig. 3 Implemented project model

The above figure 3, represents the pick and place robotic arm mounted on chassis. The pick and place robot so implemented

is controlled using RF signal. The chassis is supported for the displacement of robotic arm by four Omni wheels. The robotic arm implemented has two degrees of freedom. The circuit powered up by 12V 1A battery fitted within the body of the chassis.

VIII. Conclusion

The proposed concept of pick and place robot using Arduino is implemented via RF play station. It is found that, the robot so implemented has the ability to locate itself to the location where the object to be lifted is available with the help of chassis and four dc motors. Further depending upon controlling action provided to servo motor it lifts the object and locates the same at required destination.

IX. Future Scope

The robot so programmed for pick and place operation can be made versatile and more efficient by providing the feedback and making it to work on own than any human interventions. It can be made possible by image processing tool interfaced with this Arduino. The features that can be added on to improve its efficiency, make it operate on its own thought without any human intervention are line follower, wall hugger, obstacle avoider, metal detector, bomb diffuser etc.

References

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