Design and Implementation of Pick and Place Robot Using Arduino for Smart Grid Monitoring

[1]Dr.P.Gomathi, [2]S.Baskar
[1]Professor/Department of EEE
[2]Assistant Professor/Department of ECE
[1, 2,] N.S.N College of Engineering and Technology
Karur, Tamilnadu, India
Email:p.gomathi2006@gmail.com,connectbaskar@gmail.com

Abstract:

In this anticipate an automated arm with four degrees of opportunity is composed and can pick the items with a particular weight and place them in a sought area. To encourage the lifting of the items, Servomotors with a torque of 1 kg are utilized. The writing computer programs is done on ATMEGA-328 Microcontroller utilizing Arduino programming. The Potentiometers distinguish the edge of the revolution and the signs are sent to the Microcontroller in like manner. In the realm of apply autonomy, this Robotic arm has been ended up being stylish. This sort of the arms have numerous applications in the field of mechanical apply autonomy where the robotization is required. Automated pick and place a framework comprises of a stacking station, testing station, preparing station, and sorting station. The procedure included the sorting of plastic and metallic material into various openings.

I.INTRODUCTION

Mechanical robotization has offered more elevated amounts of profitability, productivity, and quality and in addition diminishment to cost on the business. In many Industries, the way towards expanded efficiency is through expanded mechanization process and control. Robotizing utilizing robot frameworks will build profitability, productivity and quality control. Amid operation, robots can be controlled to oblige more work, and even work past working hours.

With the coming of mechanical technology, arduous and tedious work in modern plant and production lines have made straightforwardness for labourers to finish the operation. These specialists are doled out to control or control these robots as opposed to obliging them to convey the assignment independent from anyone else. This control is made simple with the utilization of ARDUNIO. The ARDUNIO is currently utilized as a part of each present day generation procedures to naturally control each part of the operation without human intercession.

These days, robots are progressively being coordinated into working assignments to supplant people particularly to perform the dreary undertaking. As a rule, apply autonomy can be isolated into two regions, modern and administration mechanical technology. These robots are right now utilized as a part of numerous fields of utilizations including office, military undertakings, doctor's facility operations, unsafe environment and farming. Also, it may be troublesome or unsafe for people to do some particular assignments like getting unstable chemicals, defusing bombs or in most dire outcome imaginable to pick and place the bomb some place for regulation and for rehashed pick and place activity in commercial enterprises. Consequently a robot can be supplanted human to do work (1). This anticipate is a continuation of a late spring entry level position with Johansson Technology in 2010. Amid this entry level position in the Single Layer and Thin Films office, centre was coordinated toward programming newly bought Stäubli RS20 automated arm to get capacitors from a vibrating dish feeder and spot them into Gel-Packs, Waffle packs, and Ring packs.

A. Android

The most essential reason is to help us people appreciate life and to soothe us of a considerable lot of the everyday undertakings which we as a whole face each day. People have been outlining instruments and different gadgets to be utilized by different people for centuries. While you could outline and construct a robot to improve and quicker than a human, in the event that you manufacture a robot which has the same we have planned in the same way we would. In this way, the androids will have the capacity to assume control for us and perform those commonplace errands for us - however, just in the event that they have our shape and abilities.

A mechanical arm is a robot controller, generally programmable, with comparable capacities to a human arm. The connections of such a controller are associated by joints permitting either rotational motion (such as in an enunciated robot) or translational (direct) relocation (3). The connections of the controller can be considered to shape a kinematic chain. The business end of the kinematic chain of the controller is known as the end effectors and it is practically equivalent to the human hand. The end effectors can be intended to perform any sought errand, for example, welding, grasping, and turning and so on. Contingent upon the application. The robot

arms can be independent or controlled physically and can be utilized to perform an assortment of errands with extraordinary exactness as shown in fig (1). The mechanical arm can be settled or portable (i.e. wheeled) and can be intended for modern or home applications The deciding aftereffect of this anticipate will be a completely practical and exact pick and place framework that can bundle with high repeatability. This report starts with the foundation of the task and a depiction of why it is vital for Johansson Technology; it then goes into examination of key viewpoints in this anticipate and catches up with points of interest of the outline contemplations and the procedure behind the framework. What's, taking everything into account, condenses the monetary examination of the framework outlined and its advantages, and proposals.

B. Arduino

Arduino is an open source prototyping stage in light of simple to utilize equipment and programming. Arduino sheets can read. Inputs lighting on a sensor, a finger on a catch, or a twitter message and transform it into a yield initiating an engine, turning on a LED , distributed something on the web. You can advise your board what to do by sending an arrangement of guidelines to the microcontroller on the board (2). To do as such you Arduino programming dialect (in light of composing), and the Arduino programming (IDE), taking into account handling.

C. HC-05 Bluetooth Module

HC-05 inserted Bluetooth serial correspondence module (can be short for module) has two work modes: request reaction work mode and programmed association work mode (4). What's more, there are three work parts (Master, Slave and Loopback) at the programmed association work mode. At the point when the module is at the programmed association work mode, it will take after the default way set ultimately to transmit the information consequently. At the point when the module is at the request reaction work mode, client can send the AT order to the module to set the control.

There are sure issues connected with building a tile-worked automated vehicle with an inserted mechanical arm. Firstly, the issue of incorporating the units to shape a working machine. Besides, the issue of utilizing the right actuator (pneumatic, stepper engine, RC servo and so forth.). Thirdly, the issue of proper correspondence convention to execute furthermore the decision of material (aluminum, steel, carbon fiber, plastic and so forth.). The most imperative part of the Remote-Controlled Robotic Vehicle (RCRV) is the Joint Actuator. Its decision relies on upon the most extreme weight the arm can convey, reaction of the arm to charge, accessibility of the actuator, usability and cost. In this work, a smaller than normal Remote Control Robotic Vehicle (RCRV) with five level of opportunity (5DOF) automated arm has been outlined

and built up .The goal is to create an essential model with four wheels, standard sensors and a mechanical arm with the vehicle going about as a base for it portability. It is additionally expected that the structure of the robot ought to be easy to encourage simple adjustment and redesigning (5). The lodging is intended to make three particular layers inside the RCRVto separate components of the robot, therefore leaving space to include more gadgets when finished. The base layer was intended for battery lodging and mechanical equipment, for example, haggles as shown in fig (2).

II. PLAN ANALYSIS

This segment depicts the elements of the different units of the work and the calculation/approaches utilized amid its advancement. The square graph of the framework method of operation.

A. Mode of Operation

At the point when the administrator issues an order from the remote control to the automated vehicle all important undertakings will be done by sending signs to the microcontroller by means of the handset. The microcontroller then issues charge to the separate channels that makes up the correspondence joins. The electric engine reaction will rely on upon the sort of order issued; and the heading, speed and movement of the engine is managed by the microcontroller (8). The revolution of the fueled engine moves the influenced join associated with the engine and this basically influences the development of the automated arm.

B. System Description

The mechanical arm has five degrees of opportunity. It's made of different connections shaping an open chain. The course of action of these connections relies on upon the embraced plan. The arm has a turning construct that is resting in light of the upper district of the vehicle. The arm ends with a gripper or a specific apparatus holder; it has five degrees of opportunity. The initial three connections of the arm frame the body and which puts the device holder at the craved position at an area inside the workspace or environment. With the end goal of investigation, the automated arm will made of joints, which will be named as wrist, elbow, shoulder, and base. The preparatory portrayal from which the nitty gritty configuration was made depends on the representation.

C. End Effector: This is the gripper to whose operation is to hold and outgrip the items to be lifted or moved. The gripper is associated with the even pivoting servo engine.

D. Wrist: This is the joint that connections to the end effectors as appeared in fig 2. The wrist has one level of opportunity, which is impelled by a servo engine. It can pivot to around 1800 about the flat hub.

E. Shoulder: This is the joint between connections C and the base and has 1 level of opportunity which is impelled by a Dc engine (servo engine). It can likewise pivot to around 180o by connection C. An equipping framework is additionally used to impel the movement.

F. Elbow: This is the joint between connections B and C and it has one level of flexibility impelled by circular segment servo engine. It can turn to around 1800 (by configuration) by connection A. The movement about the elbow is impelled by an arrangement of rigging brains associated with the connections and the Dc engines.

G. Base: This is the joint between the automated arm and the vehicle; it has 1 level of opportunity which is impelled by a Dc associated with the rigging in the connection C (7). The Dc engine is like that utilized as a part of the shoulder yet an alternate adapting game plan. The base turns to around 1800. The base is the stage on which the arm stands and it conveys the heaviness of the arm which in turns decide most extreme load the automated are can lift. The circuit board wiring and different connections are altered to the base.
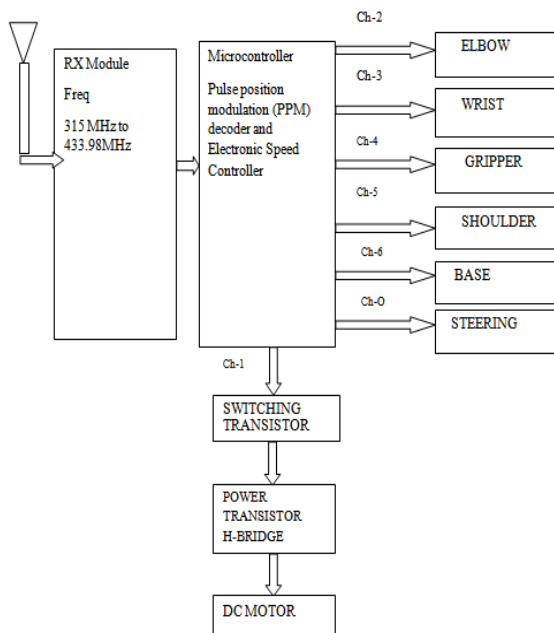

Fig 1 Motor Driver Circuit

H.System Channel Description

Channel 0---- Right/Left movement.
Channel ------ Forward and stop command.
Channel 2 ---------- Elbow movement.
Channel 3 ---------- Wrist movement.
Channel 4 ---------- Gripper movement.
Channel 5 ---------- Shoulder movement.
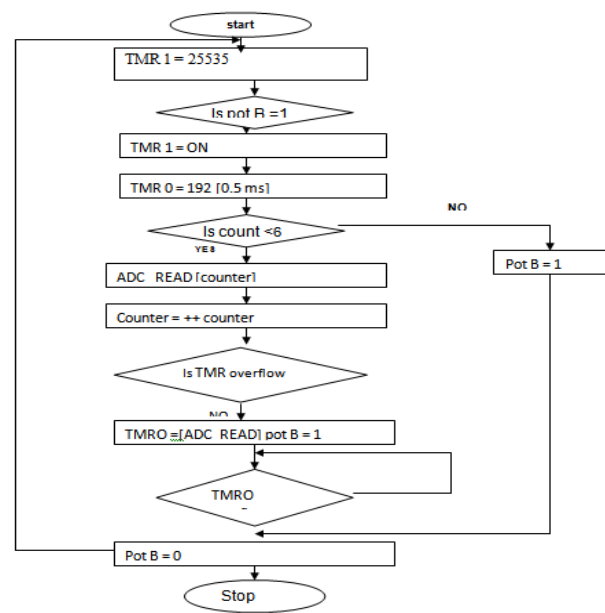Channel 6 ---------- Base movement.

Fig 2 Transmitter Flow Chart

I. *Channels Calculation Analysis*:

All Every single standard servo utilize the Pulse Position Modulation (PPM) dialect. A heartbeat is just regardless of whether the control voltage is on or off. The measure of time that a heartbeat is on amid a 2ms time span manages the servos position. This time allotment, or grouping, rehashes around 50 times each second. Amid the main portion of this 2ms time period, the beat is dependably on.

This begins a counter, in a manner of speaking, to advise the servo to begin listening for the charge. The second parcel of this 2ms time span is the charge that directs the position of the servo.below the measure of time amid the assigned 2ms time allotment that the beat will be on for the three most great positions (far left, far right, nonpartisan). There are a vast measure of positions in the middle of these qualities and measure of time the beat is ON changes in extent. This is the thing that makes Pulse Position Modulation simple. Servo #1: Far Left Command (0 degree): Time ON = 1 + 0.0 ms = 1.0 ms Servo #2: Neutral Command (90 degree): Time ON = 1 + 0.5 ms = 1.5 ms Servo #3: Far Right Command (180 degree): Time ON = 1 + 1.0ms = 2.0 ms

: III.Seven Channel Ppm Receivers

The recipient circuit comprises of collector module and a microcontroller which unravels the got PPM signal, translate the sign and sustain it to the suitable joint servo. The microcontroller likewise works as the electronic rate controller.

A. Theory of Operation:

The yield from the collector module is a PPM (beat position tweak) streams that is regular in the RC control world. A "cycle" starts with a high-going synchronous heartbeat that is around 6 milliseconds in span. Toward the end of the synchronous heartbeat the PPM pin will go high; this is the start of the Servo 1 timing as shown in fig(3).Now the Servo 1 yield is empowered and will remain focused the following low-to-high move of the PPM pin; now the Servo 1 yield is killed and the Servo 2 yield enacted. Note that on the off chance that you take a gander at the PPM waveform on an oscilloscope just the high-going part of every servo edge changes; the (low-going) confining heartbeat is consistent (~500 us); the high parcel will fluctuate from ~500 to ~1500 us.

This begins a counter, as it were, to advise the servo to begin listening for the charge. The second parcel of this 2ms time allotment is the summon that manages the position of the servo.
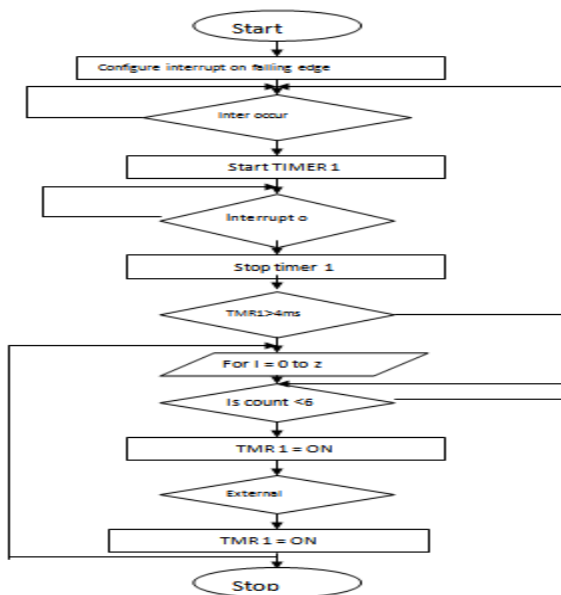

Fig 3 Receiver Flow Chart

IV. PROGRAMMING AND DUMPING

We utilize the accompanying programming to program and dump onto the ATmega32 and ATmega2560 Microcontrollers. The product is intended to accomplish the required target. There are three programming module switch make up the task are:

1. Programming advancement for ATmega32: To get information from the accelerometers and proselyte the ongoing simple sign to computerized flags and transmits these advanced signs to a PC by means of serial correspondence.

2. Programming improvement for the Computer (Processing Unit): To get information through serial correspondence from the ATmega32 and smoothens the information and figure the suitable estimations of the clock register substance for servo control and transmit these control words to ATmega2560 by means of serial correspondence once more.

3. Programming advancement for ATmega2560: To get information from the Computer and store them in their individual clock enlists and create comparing PWM signal for servomotor incitation as shown in fig (4).

The square outline in Figure demonstrates the middle of the road work/info entering the individual-pieces.
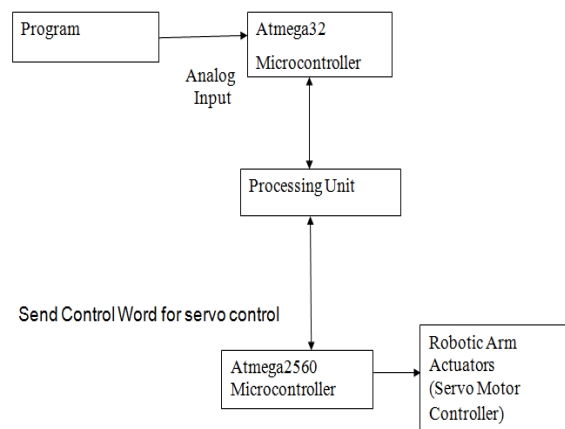

Fig.4 Block Diagram of the Implemented System with Signal Information

The association with dumping a system in Arduino board Atmega2560. The board interface with an automated arm capacity utilizing wired association and after that variable qualities to arm pivot capacity. The arm revolution values 180 degree every servo engine.

A. Servo Motors

Servo engines are a sort of electromechanical actuators that don't pivot persistently like DC/AC or stepper engines; rather, they are utilized to position and hold some article. They are utilized where nonstop revolution is not required so they are not used to drive wheels (unless a servo is altered). Interestingly they are utilized where something is expected to move to specific position and afterward halted and hold there.

Most regular use is to position the rudder of flying machines and vessels and so on. The servo can be instructed to turn to a specific edge (say 30) and after that hold its position there. Servos additionally utilize a criticism instrument, so it can sense a mistake in its situating and right it (8).

This is called servomechanism. Say on the off chance that you request that servo go and bolt itself to 30 degrees and after that attempt to turn it with your hand, the servo will make a decent attempt and its best to conquer the power and keep servo secured its predetermined edge.

Controlling a servo is simple by utilizing a microcontroller, no outside driver like h-extension and so forth are required. Only a control sign is should have been food to the servo to position it in any predetermined edge. The recurrence of the control sign is 50 Hz (i.e. the period is 20ms) and the width of positive heartbeat controls the edge. We can utilize the AVR microcontrollers PWM highlight to control servo engines. Thusly the PWM with consequently produce signs to bolt servo and the CPU is allowed to do different undertakings. Here we utilize AVR Timer1 Module which is a 16bit clock and has two PWM channels (An and B).The CPU recurrence is 8 MHz; this recurrence is the greatest recurrence that most AVRs are equipped for running. Thus it is utilized as a part of most improvement board like Low Cost AVR Development Boards. We picked the pre-scaler as 64. So the clock will get 8MHz/64 = 125 kHz (8uS period). We setup Timer Mode as Mode 14.

Clock Mode 14 highlights

• FAST PWM Mode

• TOP Value = ICR1

So the clock will tally from 0 to ICR1 (TOP Value).

B. ATMEGA2560

The ATmega32 is a part of the AVR family. It utilizes on-chip streak memory for project stockpiling, rather than one-time programmable ROM, EPROM, or EEPROM utilized by different microcontrollers at the time (9). Streak, EEPROM, and SRAM are all incorporated onto a solitary chip, expelling the requirement for outside memory in many applications. A portion of the Salient Features and Specifications of ATmega32 are as shown in fig (5):

a. High-execution, Low-control 8-bit Microcontroller
b. Advanced RISC Architecture
c. 131 Powerful Instructions
d. 32×8 General Purpose Working Registers
e. 32Kbytes of In-System Self-programmable Flash project memory
f. 1024Bytes EEPROM
g. Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
h. Data maintenance: 20 years at 85°C/100 years at 25°C(1)
i. Two 8-bit Timer/Counters with Separate Pre-scalers and Compare Modes
j. One 16-bit Timer/Counter with Separate Pre-scaler, Compare Mode, and Capture Mode

k. Four PWM Channels
l. 8-channel, 10-bit ADC
m. 8 Single-finished Channels
n. 2 Differential Channels with Programmable Gain at 1x, 10x, or 200x
o. Programmable Serial USART

p. External and Internal Interrupt Sources
q. 32 Programmable I/O LinesOperating Voltages: 4.5V - 5.5V for ATmega32

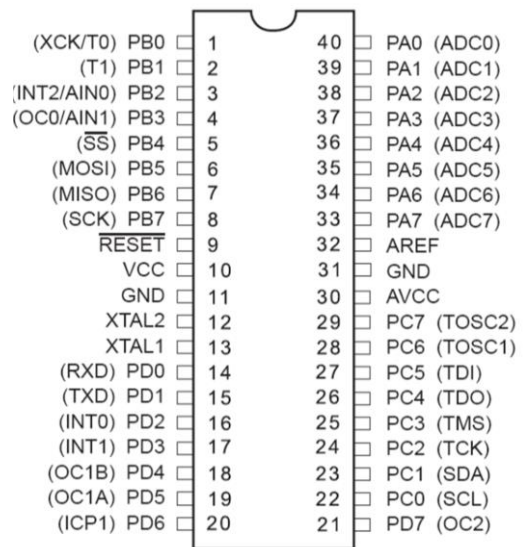r. Power Consumption at 1MHz, 3V, 25°C


Fig 5Pin Configuration of Atmega2560

The accelerometers are associated with the ATmega32 advancement board which is then associated with the Computer by means of serial correspondence. Presently the information got by the PC is prepared to evacuate however much commotion as could be expected (6). Again the ATmega640 improvement board is connected with the PC through another serial correspondence channel. The configuration of the product modules and equipment modules can be alluded back to individually. The physical usage of the framework as shown in fig (6).

Every engine moves the arm in one plane. As we have actualized two engines at the shoulder joint as can be seen MOTOR. M1 is to move the arm in Y-Z plane and M2 is for the development along the X-Z plane. Along these lines the two engines give the shoulder joint to be moved in any bearing in space. It can be seen that we have executed three engines at this joint. The Motor M3 is for the development of the arm along the Z-pivot in the X-Y plane. The Motor M4 is utilized for the bowing movement of the elbow and the Motor M5 is for the pivot/bending of the elbow to wrist part (11).

M2 is to move the arm in Z-Y plane and M3 is for the development along the Y-Z plane. Along these

lines the two engines give the shoulder joint to be moved in any course in space (10). It can be seen that we have actualized three engines at this-joint.

Fig 6 .Physical Implementation of the system & Robotic Arm Only
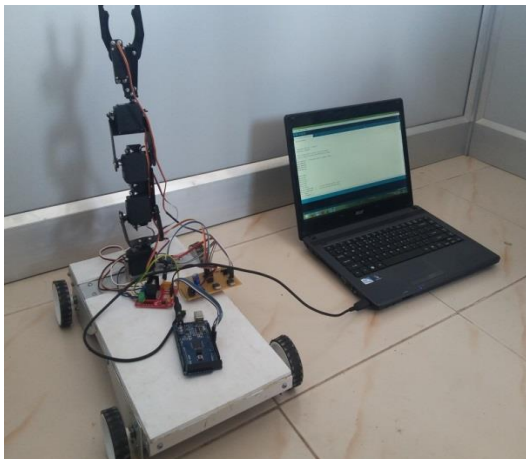
V.CONCLUSION

The goals of this anticipate has been accomplished which was building up the equipment and programming for a Bluetooth controlled automated arm. From perception that has been made, it unmistakably demonstrates that its development is exact, and is anything but difficult to control and easy to understand to utilize. The mechanical arm has been created effectively as the development of the robot can be controlled. This automated arm control strategy is relied upon to conquer the issue, for example, putting or picking protest that far from the client, pick and place risky item in a quick and simple way.

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Authors Profile

Dr.P.Gomathi received the **B.E.** degree in Electrical and Electronics Engineering from Kongu Engineering College, Perundurai, Tamil Nadu, India, in 1998 and **M.E.** in Applied electronics from Kongu Engineering College, Perundurai, and Tamil Nadu India in 2005. She has completed her PhD in Information and communication engineering in 2013 His research interest includes wireless communication Power electronics, smart grid, Sensor Networks, Neural Networks and fuzzy logic, Communication networks

Mr.S.Baksar received the **B.E.** degree in Electronics and Communication engineering from SNS College of technology, Tamilnadu, India, in 2005 and **M.E.** in VLSI design from SNS College of technology, Tamilnadu, India, in 2013. His research interest includes wireless communication Sensor Networks, Low power VLSI and Embedded system, Communication networks and IoT.