MINI PROJECT REPORT
(2019-20)

FOUR LEG WALKER

Institute of Engineering & Technology

Team Members

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ACKNOWLEDGEMENT

We thank the almighty for giving me the courage and perseverance in completing the project.

This project itself is an acknowledgement for all those people who have given me their heartfelt co-operation in making this project a grand success. We extend my sincere thanks to **Mr. Amir Khan,** our mini project trainer , for providing valuable guidance at every stage of this project work. We are profoundly grateful towards the unmatched services rendered by him.

Last but not least ,we would like to express our deep sense of gratitude and earnest thanksgiving to our dear parents for their moral support and heartfelt co-operation in completing the project.

ABSTRACT

The project four leg walker helps the people in detecting the mining. The evolution and the state of the art in the area of legged locomotion systems. In the first phase different possibilities for mobile robots are discussed, namely the case of artificial legged locomotion systems, while emphasizing their advantages and limitations. In a second phase an historical overview of the evolution of these systems is presented, bearing in mind several particular cases often considered as milestones on technological and scientific progress. After this historical timeline, some of the present day systems are examined and their performance is analyzed. In a third phase are pointed out the major areas for research and development that are presently being followed in the construction of legged robots. Finally, some of the problems still un- solved, that remain defying robotics research, are also addressed.

The objective of our project is to develop the four leg walker using a minimum number of servomotors. The minimum number of servo motors allows the walking robot to minimize the power consumption while constructing a program that can produce coordination of multi-degree of freedom for the movement of the walker.The main objective is to reduce the human workload and to keep humans out of harm's way and reduce the time of the humans so that the work can finish on time.

DECLARATION

We hereby declare that the work which is being presented as Mini Project, **FOUR LEG WALKER using INTERNET OF THINGS (IOT) ,**in partial fulfillment of the requirements for mini Project viva voice, is an authentic record of our own work carried under the supervision of " **Mr. Amir Khan** (Technical Trainer) ".

Signature of Candidates:

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Course: **B.Tech (Computer Science)**

Year: **3rd**

Semester: **6th**

CONTENTS

INTRODUCTION

Project Description

The project mainly aims to make an IOT Based four leg walker which detects the metal found inside the caves and the mountains.The project will help to detect whether the material found is a metal and can be used for further use. Moreover, it will reduce the load of the people by detecting whether the material found is metal or not and generates a sound to notify. The project will also further extend its limits by adding a camera and can change their path by depicting the obstacle in its way.

The project solves the issue related to human workload. As the world is shifting towards machines and robots ,this project is also an attempt to reduce the work stress,and to prevent human resources from any mishappening in the mining industry.

About Internet Of Things

The area of computer science used in this project is Internet Of Things. It is the most commonly and widely used technology in this era. The most important benefit of this technology is it's easy to learn and take less time in implementation. The prerequisites for iot are not very high, just some little basics will be enough to give us awareness about this .

Hardware Requirements:

- **ARDUINO UNO** :- Arduino is an open-source electronics prototyping platform/environment .We can program an arduino using arduino ide.
- **SERVO MOTOR** :- A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor.
- **CAMERA / VISION SENSOR** :- The camera module OV7670 can be interfaced with Arduino UNO.
- **INDUCTIVE PROXIMITY SENSOR** :- An inductive proximity sensor can detect metal targets approaching the sensor, without physical contact with the target.
- Power Supply circuit and metal/plastic body frame,etc

Software Requirements:

- Intel Pentium / AMD Athlon processor or equivalent **running** at 1 GHz or more. 512 MB RAM (1 GB RAM recommended). 10MB free hard drive space or more (only for PROGRAMING **IDE** for **Arduino**).

Database:

:-MY SQL OR ORACLE if we extend this project further in future.

PROBLEM DEFINITION

The goal is to make a four leg iot based walker which helps in mining as a metal detector and ease the human workload .Features like camera module ,night vision can also be added to make it more efficient.
As the world is shifting towards machines and robots ,this project is also an attempt to reduce the work stress,and to prevent human resources from any mishappening in the mining industry.

Applications:

1.This project can be used in the mining industries to detect the metal.

2. Variation in the model can be introduced according to the need of surrounding and work.

OBJECTIVE

The project solves the issue related to the harm that workers have to face during mining. We develop the four leg walker using a minimum number of servomotors. The minimum number of servo motors allows the walking robot to minimize the power consumption while constructing a program that can produce coordination of multi-degree of freedom for the movement of the walker. The main objective is to reduce the human workload and to keep humans out of harm's way.

The study has the following specific objectives:

i) To develop a system that will surely satisfy the workers.

ii) To design a system which is able to complete the huge amount of work on time.

iii)To develop a system which works as perfect as humans and also protects human resources from any mishappening during work.

iv)To develop an IOT based system which helps in mining as a mining bot in order to be more efficient and which reduce workload to some extent.

The project mainly aims to scan a particular area and find any metal and after finding that the model generates a sound to tell us a metal is detected. The project will reduce the manual work of the miners and help in detecting in the smallest area, the model can reach.

Moreover, it will make the process of mining reliable as miners don't have to go and search the whole day for detecting the metals and also help in saving the resources such as the utilisation of humans who can be used in other tasks.

The project will also further extend its limits as a stable structure can be formed and also features like collecting the metals with the help of the walker and reducing the task of miners can also be added.

METHODOLOGY

Data Flow Diagram

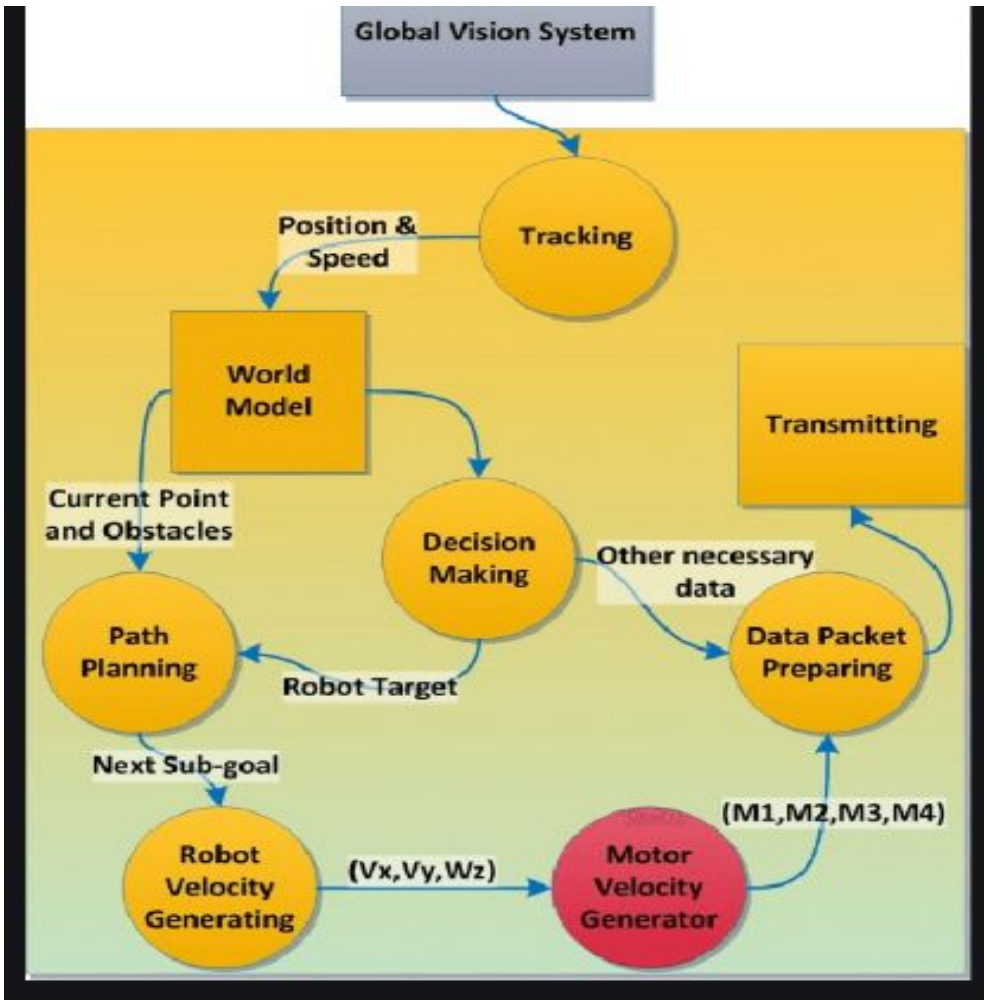
DFD (Data Flow Diagram) is a hierarchical model of a system showing different data interchange among these functions.Activities of functions that the system performs and the da

In the DFD, there are four symbols:

1. A square defines a source(originator) or destination of system data
2. An arrow identifies data flow. It is the pipeline through which the information flows.
3. A circle or a bubble represents a process that transforms incoming data flow into outgoing data flows.
4. An open rectangle is a data store, data at rest or a temporary repository of data.

Here we have considered each function as a processing station that consumes some input and produces some output.

Level-1 DFD


Global Vision System
Tracking
Position & Speed
World Model
Transmitting
Current Point and Obstacles
Decision Making
Other necessary data
Path Planning
Robot Target
Data Packet Preparing
Next Sub-goal
(M1,M2,M3,M4)
Robot Velocity Generating
(Vx,Vy,Wz)
Motor Velocity Generator

4. TESTING

Testing in simple terms is checking your application for potential bugs before it's made live or before code is moved into the production environment. During this stage issues such as that of application bugs, security, the functioning of the site, its access to handicapped as well as regular users and its ability to handle traffic is checked.

Some of the testing are as follows :-

Functionality Testing:

This is used to check if your product is as per the specifications you intended for it as well as the functional requirements you charted out for it in your developmental documentation. It is a kind of black box testing that is performed to confirm that the functionality of an application or system is behaving as expected.

Performance testing:-

Performance testing is the process of determining the speed, responsiveness and stability of a computer, network, software program or device under a workload. Performance testing can involve quantitative tests done in a lab, or occur in the production environment in limited scenarios. It is a type of testing performed to check how application or software performs under workload in terms of responsiveness and stability.

IMPLEMENTATION DETAILS

Here you see us measuring the parts , making a sketch for the frame , and then grabbing a ruler to make a paper template and a proper plan to make our robot walk.

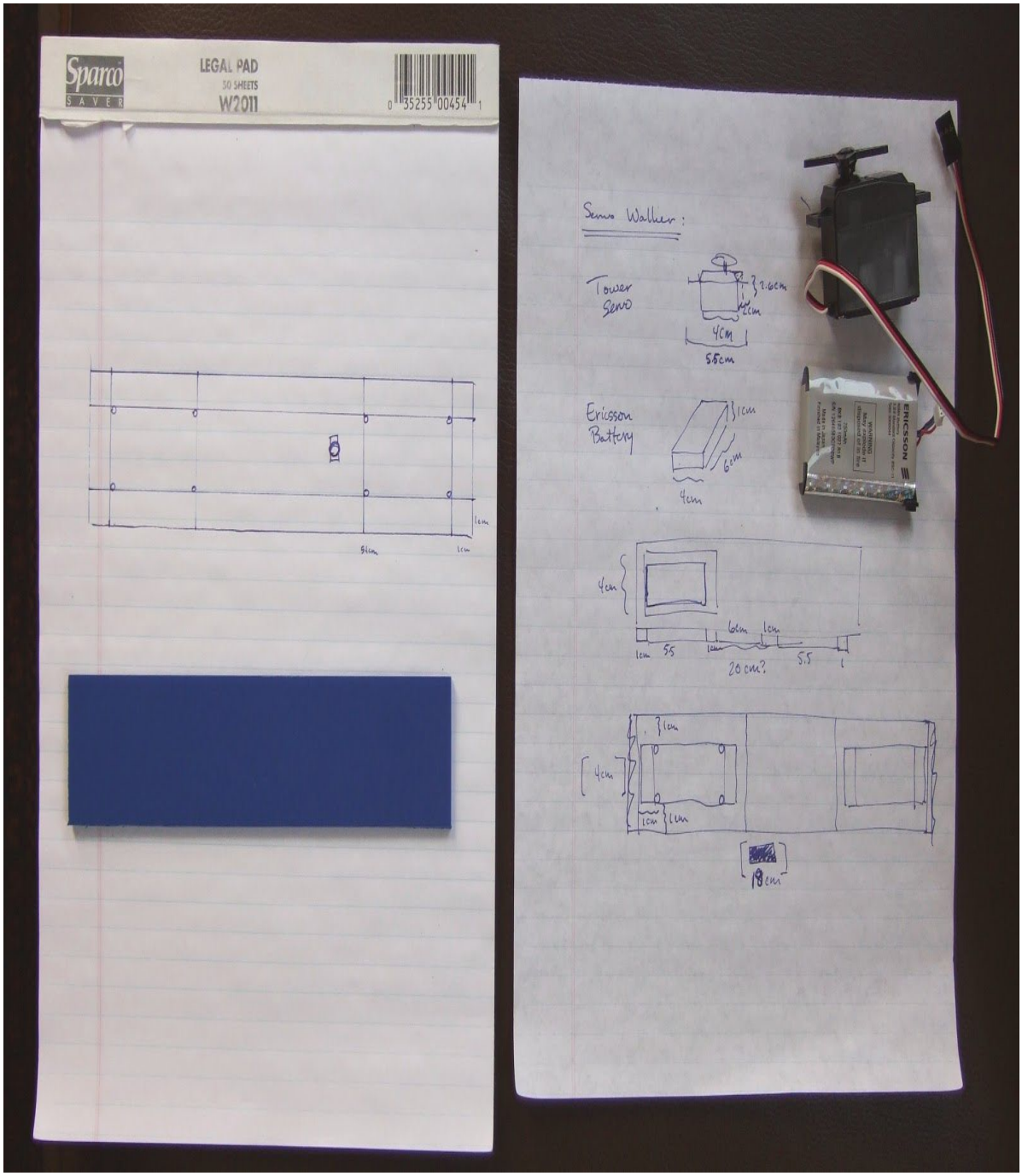


Fig 1 : pictorial view of our procedure.

Then we drilled holes on the corners of the motor cutouts,then scored along the edge of a ruler from hole with a knife.

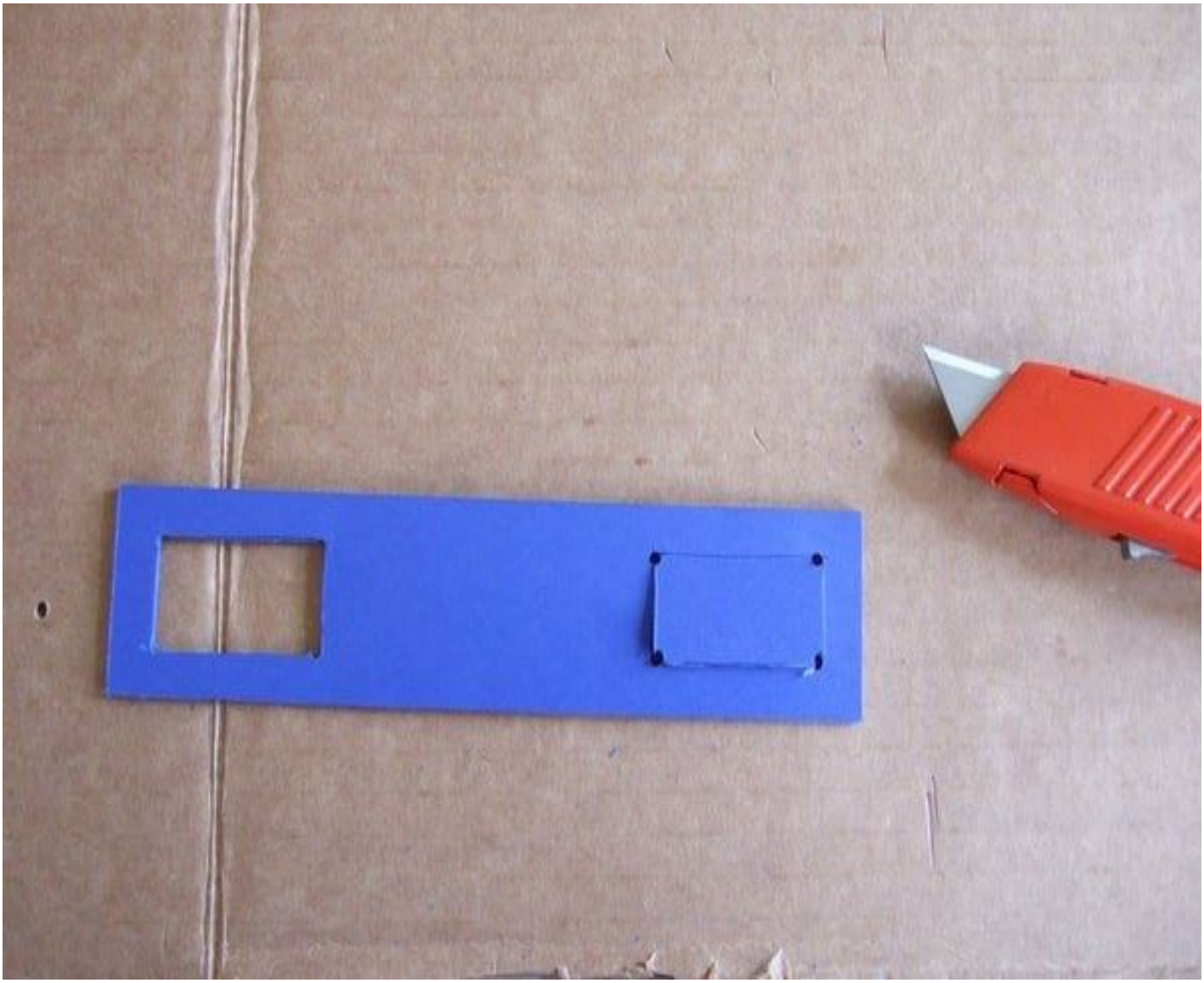


Fig 2.building frame of walker

After cutting out the holes we test-fit the motors just to know how it worked.

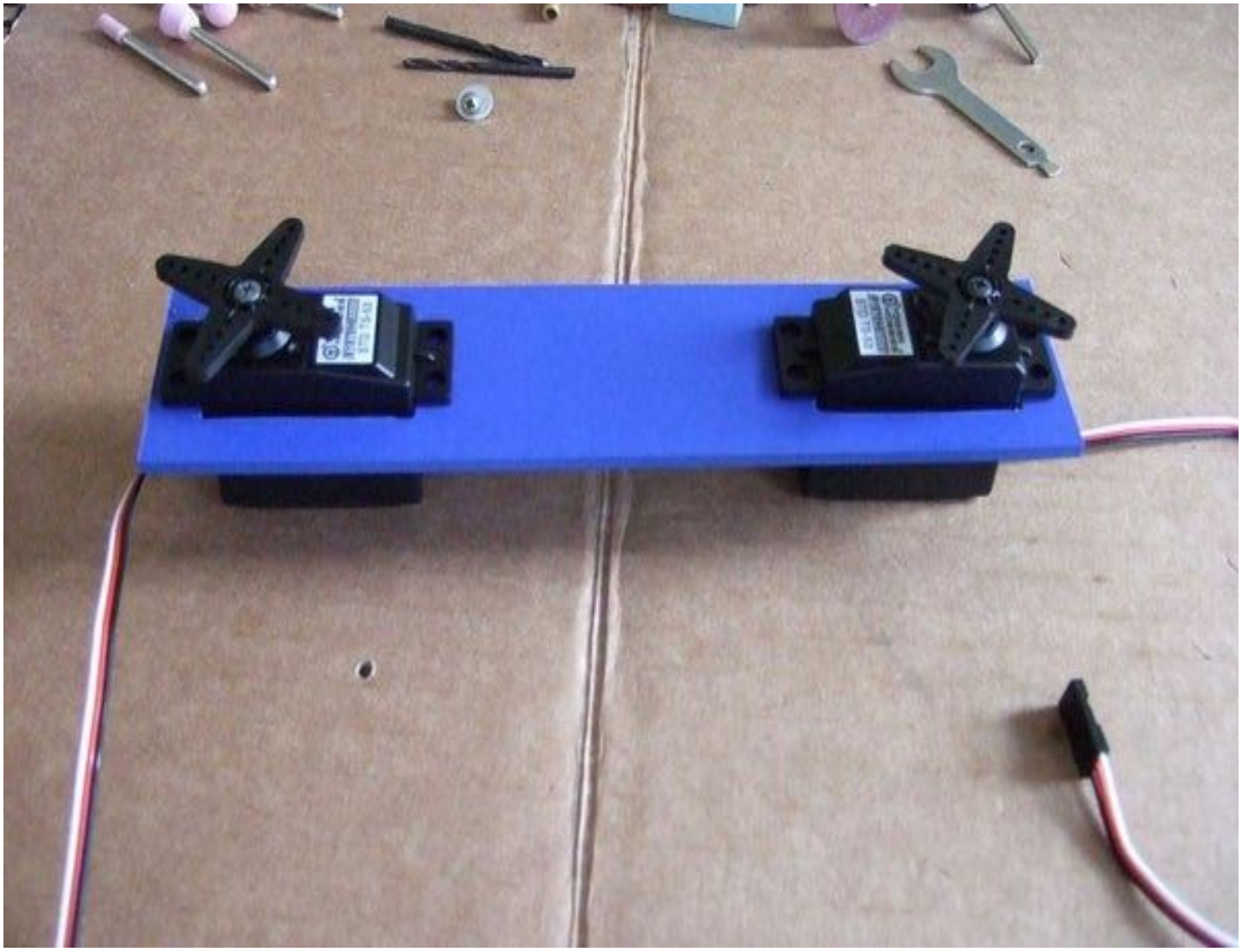


Fig 3. fitting motors.

After that much of work we will gonna bend our robots's base frame(Sintra) in order to provide a necessary center of gravity to stand properly in future by using following steps:
1)Boiled a small pot of water on the stove.
2)Held Sintra under water for a minute or two with a wooden spoon (Sintra floats).
3)Pulled it out, and with hot mitts and something flat,held it bent at the right angle until it cooled down till normal temperature.

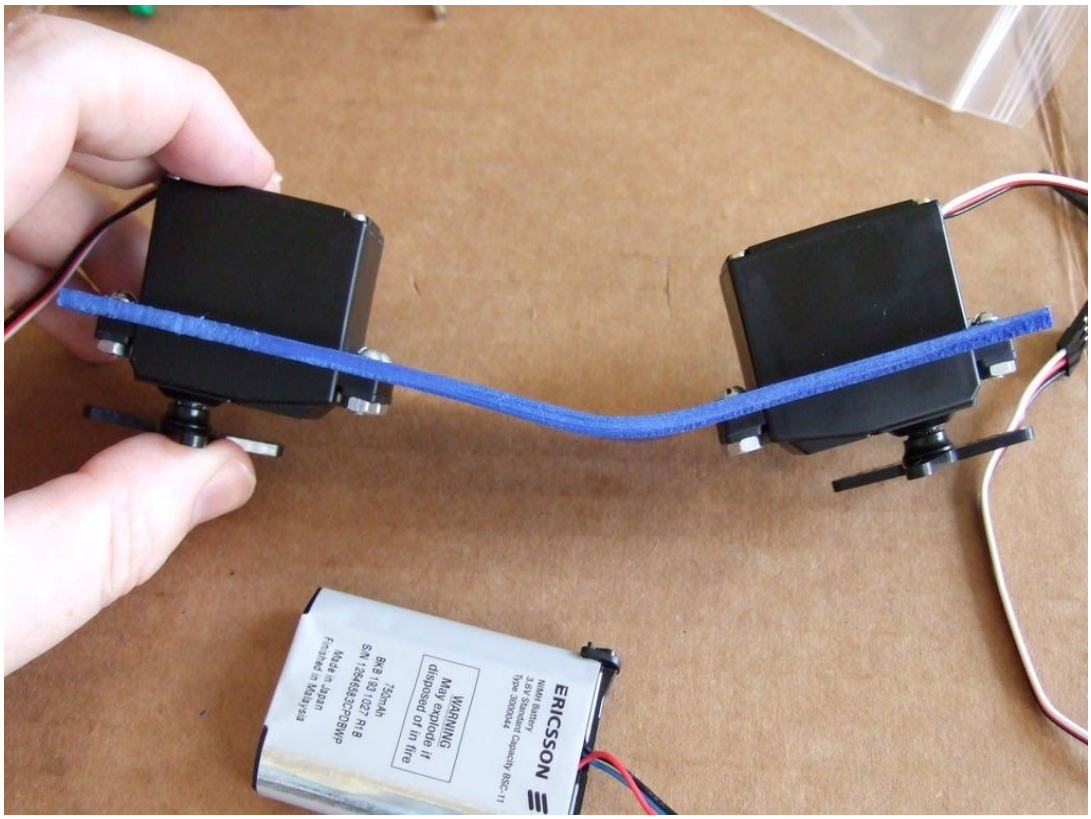
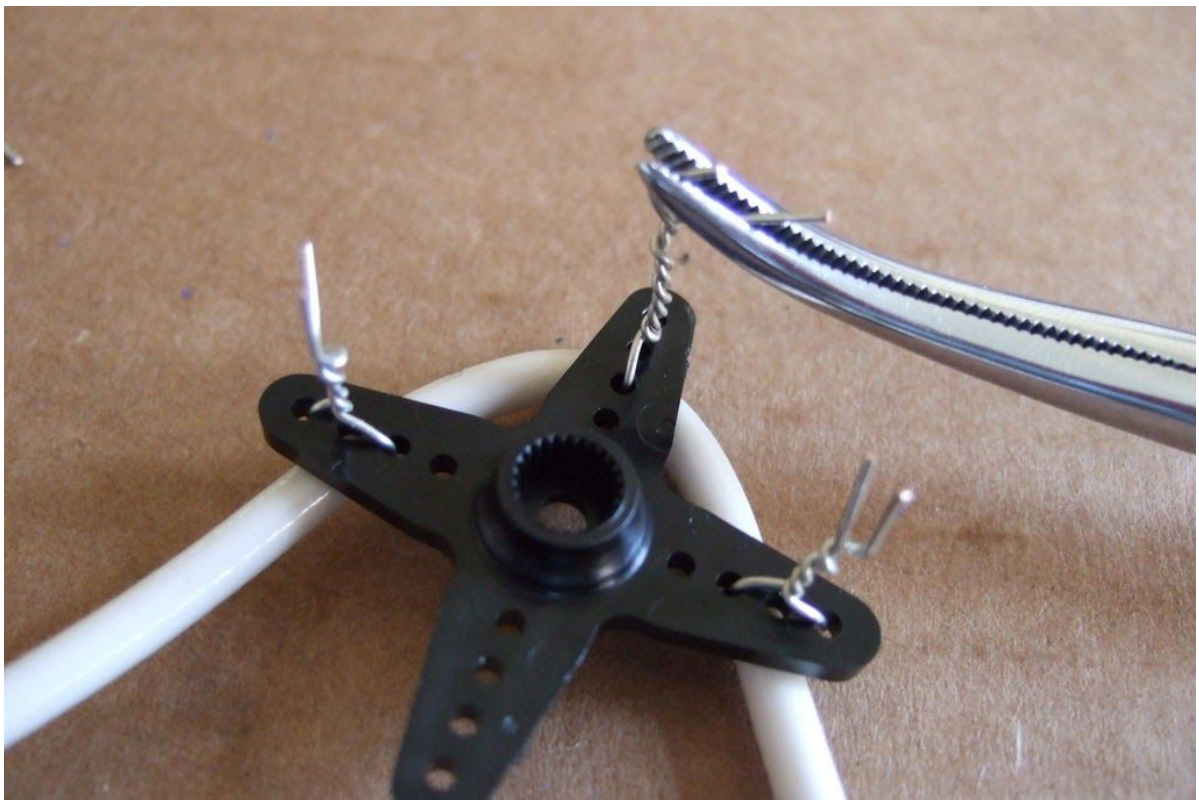


Fig 4 and 5: Bending Sintra and attaching motors.

Then we cut a 12” and 8” section of thick copper wire with tin snips to make the front and back legs, respectively. Then we bent them at an angle to attach to the servo horns.
Then wew tied things with hookup wire when we were in need to attach things then we stripped some hookup wire, ran it through the horns and around the legs, and twisted it up a lot.



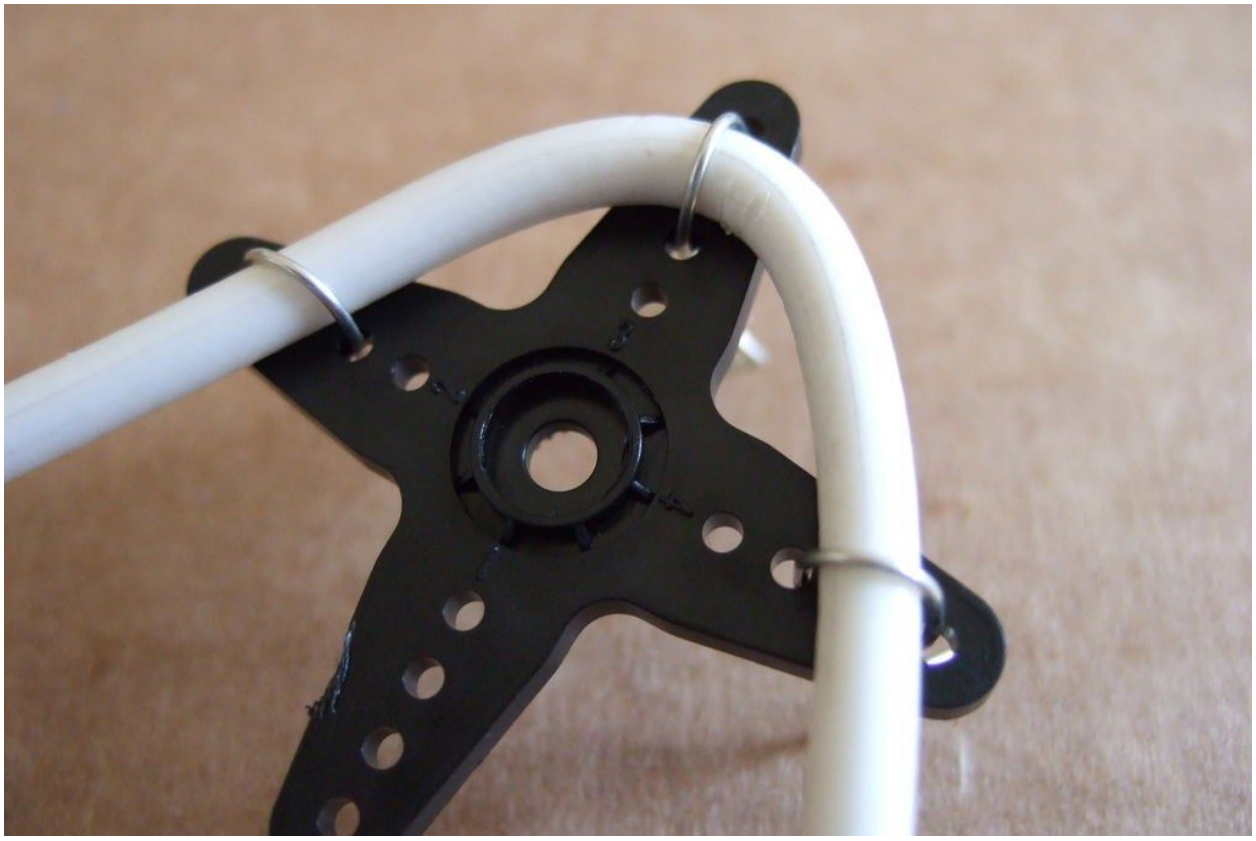
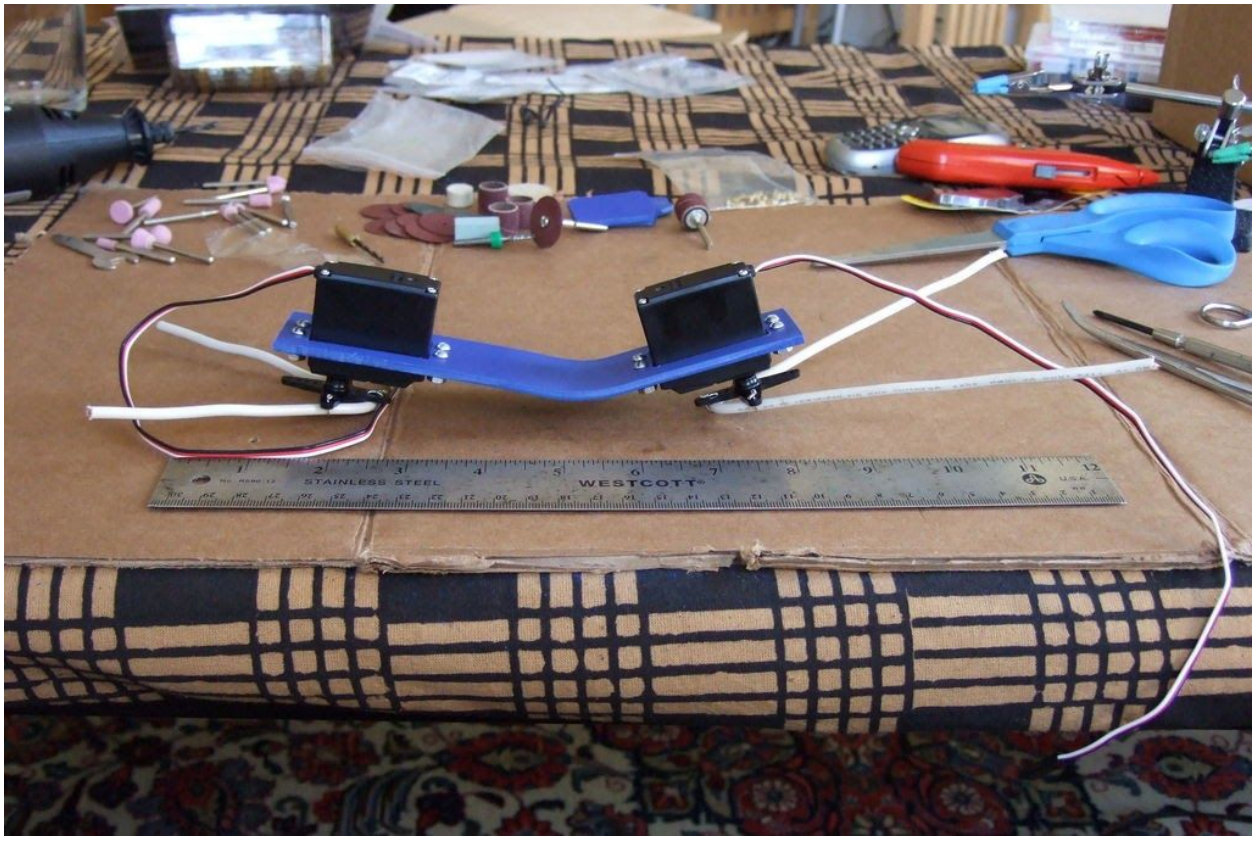
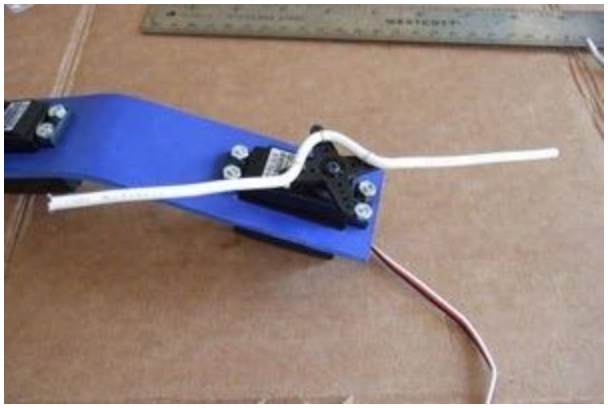


Fig 6,7 and 8:Attaching legs to star-shaped servo motor horns

Then we screw the servo stars(with the legs on) back on to the motors, then get bending.The only critical bit is to get the center of gravity enough in the middle so that it walks right.

Ideally,when one front leg is in the air, the back legs turning will tip the bot forward onto the high/forward front leg,which will then do the walking.





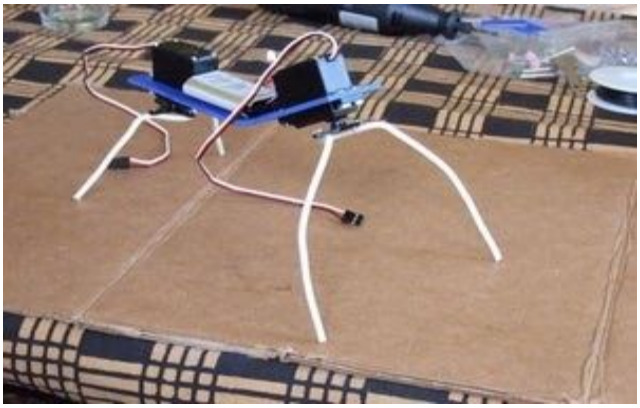
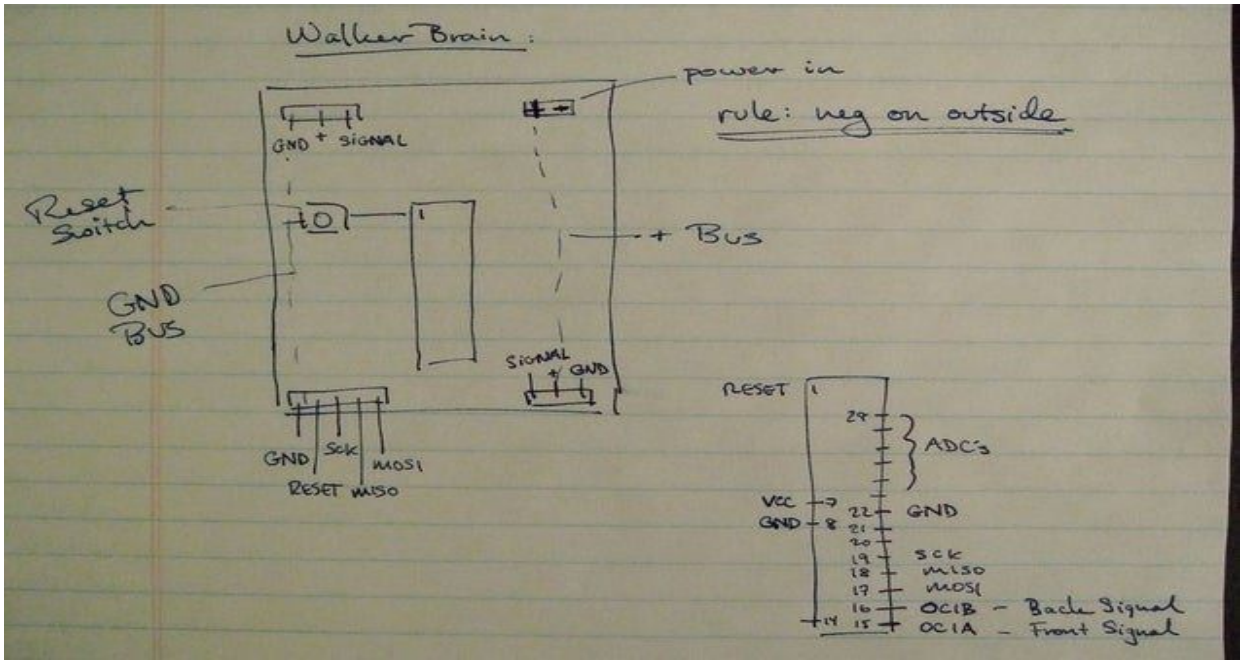


Fig 9,10 and 11:providing enough center of gravity

Then we make the brain of our bot,by cutting a piece blank pcb stuff,and super-glued headers onto it.Two 3-pin headers for the servos,one 2-pin header for the battery,one 5-pin header for my AVR programmer and 28-pin socket for the ATMega 8 chip.

Once all the sockets and headers were glued on,we soldered them up,most of the wiring is on the underside of the board.



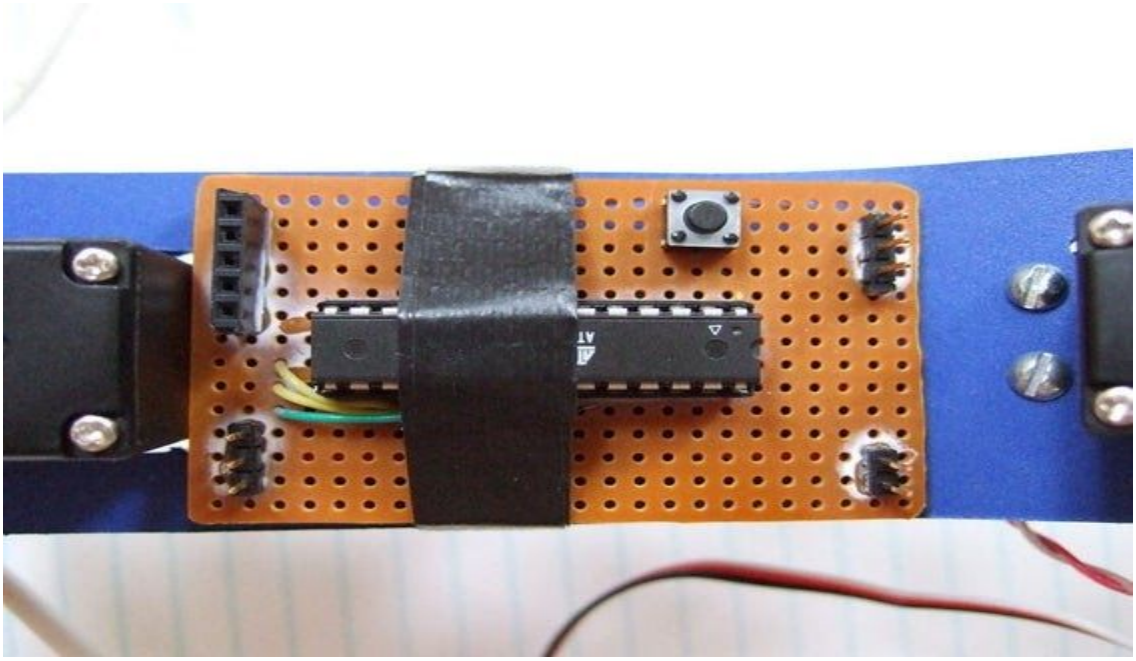


Fig 12,13: brain of our walker

Then we simply programmed the chip.

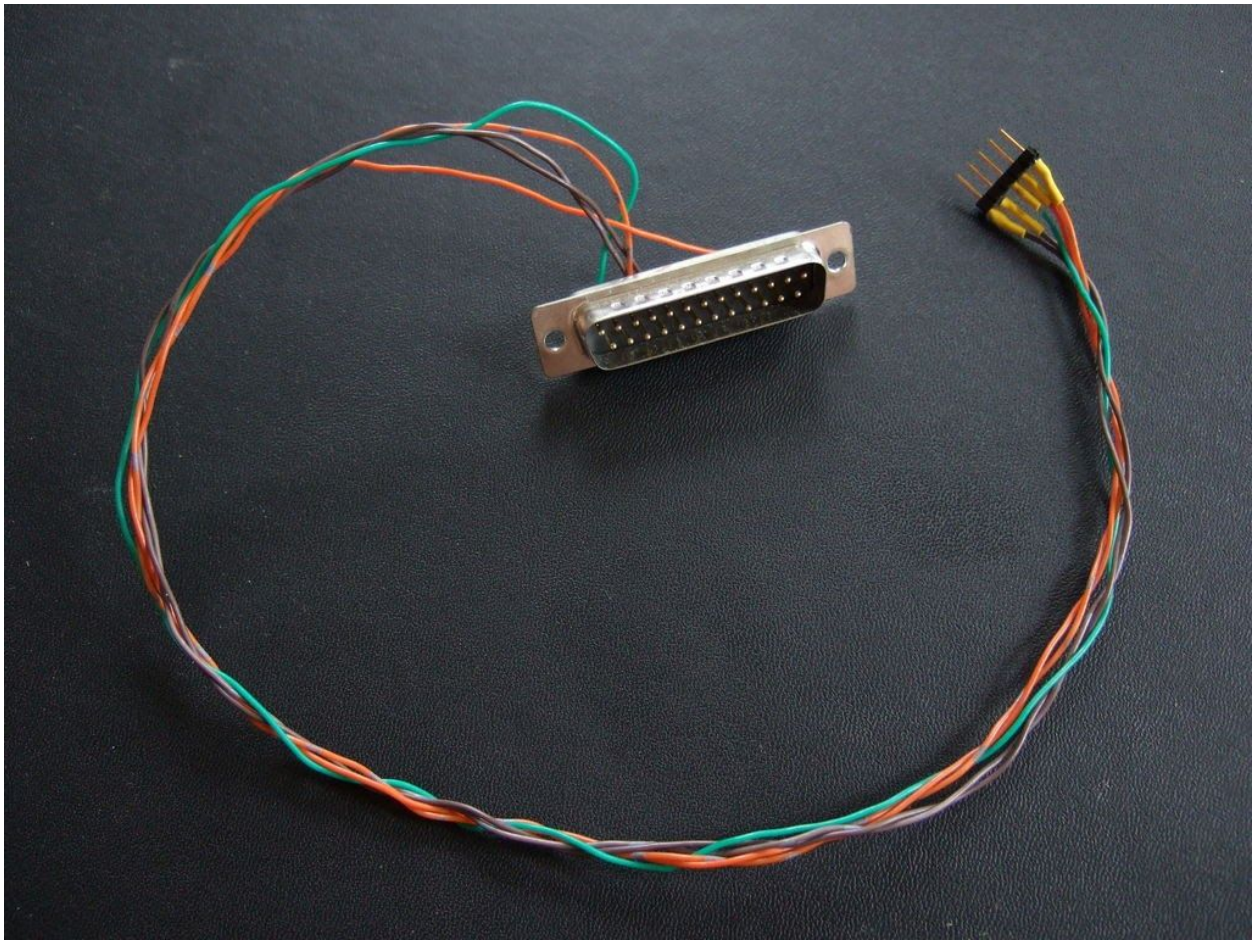


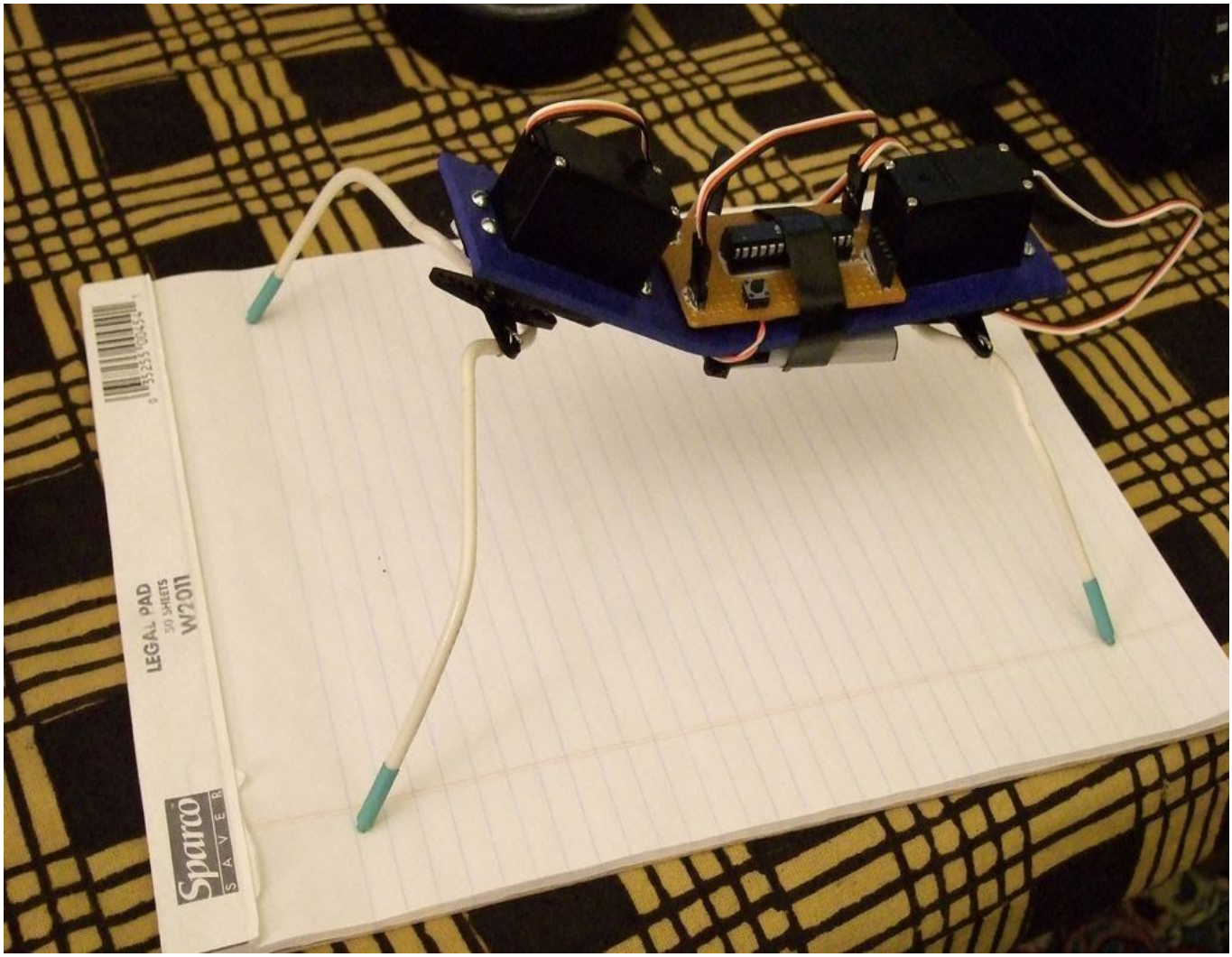
Fig 14.ghetto programming

CODE:

```
/* Standard Includes */

#include <stdint.h>
#include <avr/interrupt.h>
#include <avr/io.h>

#define F_CPU 1000000UL /* Stock 1mHz rate */
#include <util/delay.h>

/* Pin hookups defined here */
#define FRONT_MOTOR            PB1
#define FRONT_MOTOR_OC         OC1A
#define FRONT_MOTOR_OC_REGISTER OCR1A
```

```
#define REAR_MOTOR            PB2
#define REAR_MOTOR_OC         OC1B
#define REAR_MOTOR_OC_REGISTER  OCR1B


/* Centering and Tweaking */
/* These values vary across motors -- tweak here to get it centered */
#define FRONT_CENTER 1340
#define REAR_CENTER  1400
#define SLEW_SCALE   6


/* Declares */
void init(void);
int main(void);

void turnFront(uint16_t, uint16_t);
/* turns to location, waiting for specified milliseconds */
void turnRear(uint16_t, uint16_t);
/* turns to location, waiting for specified milliseconds */

void walkForward(uint16_t, uint16_t, uint16_t, uint16_t, uint16_t);
/* front right, back right, front left, back left, pause */
void walkBackward(uint16_t, uint16_t, uint16_t, uint16_t, uint16_t);
/* front right, back left, front left, back right, pause */

void stand(void);
/* centers for standing */
```

Then the work is almost done. We got the front legs swinging about 40 degrees either way, and the back legs about 20 degrees.
Now we will be able to see our baby(walker) taking first steps.



Scope for extension into a major project:

1. A certain app can be made for this model which will allow us to access the bot from a distance also .

2. We can make our bot self balancing by using PID algorithms and hardware like MPU6050 as a gyroscope or accelerometer.

3. Various Machine Learning Algorithms can be applied on the data collected by the BOT, in order to analyze the pattern so obtained which will surely help in predicting the metal position.Moreover, metal detection would become easy by keeping an eye on the pattern from the large data.

CONTRIBUTION SUMMARY:

1) Hardware part is done by Yashika Goyal and Rachit Chaudhary .
2) Software part is done by Rachit Chaudhary and Apoorvi Goyal.
3) Assembled by Yashika Goyal and Apoorvi Goyal.

WORK DETAIL:

Our 4 Leg Walker is ready to walk and is now able to meet the objective of the project.

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