Autonomous Biped Robot Using Arduino

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ABSTRACT— In the last few years artificial intelligence took a rapid enhancement and turned out to be a boiled up platform for innovation. In this paper we are throwing some light on automation in the biped robot, which is unlike normal conventional robots which are wheeled, stem. This robot utilized human structure to make movements and hence a small biped is what we call it, enhancing the research base in Humanoid Robots. Ultrasonic sensor is utilized for distance ranging which provides the sensing capability in the robot and a sound sensor is added on the bot to help the bot detect sound which enhances the instruction taking capability of the robot. This proposed paper can be an important landmark for the future research in automation as well as bipedal robots. Kinematic models of biped robots are also developed and simulated before experimenting and verifying the performances of the system. Overall a low cost, open source based, biped robot is underlying objective on which enhanced algorithms and movement controllers will be developed to further the enhance the research in the field of humanoid robot.

Index terms— Ultrasonic, Bipedal Robot, Obstacle avoidance, Sound Sensor

I. INTRODUCTION

There are various ways of making a biped robot. The typical method is to make the robot move in a sequence in which the center of mass of robot keeps shifting to stabilize the posture of the structure.

Another way of implementing the stabilization is using a accelerometer and gyro sensors. We adopted the first procedure to stabilize the structure. The legs of the robot are made using servo motors and the sensing is done with help of ultrasonic and sound sensors on board. A basic microcontroller ATmega8L acts as the processing and memory unit of the robot.

Areas involved in achieving this goal that are discussed in this report are motor testing, support system setup calibration and programming.

Risking human lives is no more a trend in the world and we are making sure that precious lives are not put up for risk to perform tasks which can be performed by machines! But a huge drawback we face in this concern is the intelligence of machines. That is where we hop in artificial intelligence.
The hardware concentration of our robot usually consists of a microcontroller or a processing unit that controls the whole structure and makes it move around with the help of servos and sensors. The controller we are using here is Atmel Atmega8L. This controller processes data, manipulates and performs actions accordingly. 4 Servo motors control the action of the robot by receiving the instructions from the microcontroller. 2 Servos of 3.7 Kg torque hold the central plate of chassis. 2 more servos control the feet of the bipedal helping it to take turns. The structure of bipedal can be used to either monitor and maneuver the place or also indulging in physical tasks of rescuing people. Giving live footage or data logging.

1.1.1 EXISTING SYSTEM:
Existing system uses basic ultrasonic sensors and have no provision to take any input from human. Hence making it more rely on its own internal data manipulations. Such system in case of any emergency cannot react according to the human interaction.

And also the system being used for the development for the bipedal robots is not based on open source hardware which acts as a huge drawback in the overall contribution towards the research. The current commercial kits available do not give a proper glimpse of the internal coding and also specification of the hardware being used for the development.

1.1.2 PROPOSED SYSTEM:
The proposed system uses an ATMEGA microcontroller board which is programmed by open source IDE and uses 4 servos for balancing. The system comprises of 2 sensors i.e. Ultrasonic and Sound sensors. Sound sensors help the bot detect any instructions to be given in form of voice. And the Ultrasonic sensor helps it avoid the obstacles in the way. The sound and ultrasonic sensors act as an input unit to the whole structure and the controller processes the data to give the output accordingly. The sound sensors here are used as a normal instruction taker but in case of emergency situation can be programmed in order to react to special words such as “Help” and also in taking any instruction like “Stand up”, “Stop”. Hence making the robot decide based on the sound input.

OPERATION:

![Fig 2](image)

Servo Motors are employed for the movement of the robot. Two servos at both the feet help the robot turn.

3.7 Kg torque servo motors are used to bear the weight of the robot. The servos on central plate of chassis help the robot lift up the legs. The ultrasonic sensors on the robot give the distance between any obstacle in front.

![Fig 3](image)
Ultrasonic Sensor Details and Distance Calculations:
The Ultrasonic sensor employed in BIPED is HC-SR04 model and has a range of 2cm to 400cm.
Time interval between the transmitted wave and the received wave is calculated in μsec. The distance is obtained using the formula:

\[ \text{Distance} = \frac{\text{Time Recorded}}{58.138} \times 0.39 \text{ inches} \]

Sound sensors makes use of a normal microphone and a 555 timer unit to give indications of sound over certain threshold. The microcontroller keeps a count of the data received from the sound sensor and feeds it to the motion algorithms which further decide the action based on the program.

Arduino Programming Skeleton

Include <Servo.h>

Initializing variables

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\text{-----}
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Interfacing variables to the controller

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Loop () function to execute the robots operations in real time

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During No Object

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\text{-----}
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During Object encounter

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Programming is done using the Arduino integrated development environment (IDE) which is a cross-platform application scripted in Java programming language, and is derived from the IDE for the Processing programming language and the Wiring projects. It includes units like a code editor with features such as syntax highlighting, brace matching, automatic indentation, boot loading and is also capable of compiling and uploading programs to the board with a single click. A programming code scripted for Arduino is called a “sketch”. Arduino programs are scripted in C or C++. The Arduino IDE comes with its own software library called “Wiring” from the original Wiring project, hence making many common input/output operations much easier.
This particular working model portrayed in this paper turned out to be a conventional one of such type, so further advancements in this prototype could ignite a revolution in the field of robotics.

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