International Journal of Latest Research in Engineering and Technology (IJLRET)
ISSN: 2454-5031
www.ijlret.com ‖ PP.77-81

Pan & Tilt Motion Based Gyro Controlled Firing Gun

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Abstract: This paper involves the complete system design and construction of a gun to replace an armed guard. We aimed to develop a compact and highly mobile defence system that allows operational flexibility. The gun can autonomously track and shoot at moving targets, while also allowing a user to remotely access and control the gun via computer. The mobility, hardiness, and functionality of this system allows a reliable replacement for human beings in harsh and hostile environments; ultimately sparing a life.
Keywords: Arduino microcontroller, Xbee transmitter and receiver, servomotor, Grosvenor

I. INTRODUCTION

Defence is a nation's utmost priority and so is the lives of soldiers, use of technology in the defence field is a must and competition in this field is scaling up nowadays. The border infiltration is the major threat of terrorism, use of advanced automated guns which are remotely controlled and monitored by soldiers there by protecting themselves and also keeping the line of control much secured.The responsibility for national defence "rests with the Cabinet, which is discharged through the Ministry of Defence, which provides the policy framework and wherewithal to the Armed Forces to discharge their responsibilities in the context of the defence of the country [1]. The Raksha Mantri (Defence Minister) is the head of the Ministry of Defence. The Defence Ministry is responsible for "obtaining policy directions of the Government on all defence and security related matters" and communicating these directions to "Services Headquarters, Inter-Services Organisations, Production Establishments and Research and Development Organisations". The MoD works closely with the National Security Council, Ministry of External Affairs and the Ministry of Home Affairs.

The Army of India was raised under the British Raj in the 19th century by taking the erstwhile presidency armies, merging them, and bringing them under the Crown. The British Indian Army fought in both World Wars.The armed forces succeeded the military of British India following India's independence in 1947. After World War II, many of the wartime troops were discharged and units disbanded. The reduced armed forces were partitioned between India and Pakistan [2]. The Indian armed forces fought in all three wars against Pakistan and a war with the People's Republic of China. India also fought in the Kargil War with Pakistan in 1999, the highest altitude mountain warfare in history. The Indian Armed Forces have participated in several United Nations peacekeeping operations and are presently the second largest contributor of troops to the peacekeeping force.

II. XBEE MODULE ARDUINO PLATFORM

A. X BEE: Digi XBee is the brand name of a family of form factor compatible radio modules from Digi International. The first XBee radios were introduced under the MaxStream brand in 2005[2] and were based on the IEEE 802.15.4-2003 standard designed for point-to-point and star communications at over-the-air baud rates of 250 kbit/s. Two models were initially introduced — a lower cost 1 mW XBee and the higher power 100 mW XBee-PRO.[4] Since the initial introduction, a number of new XBee radios have been introduced and an ecosystem of wireless modules, gateways, adapters and software has evolved. The XBee radios can all be used with the minimum number of connections — power (3.3 V), ground, data in and data out (UART), with other recommended lines being Reset and Sleep.[5] Additionally, most XBee families have some other flow control, input/output (I/O), analog-to-digital converter (A/D) and indicator lines built in. A version called the programmable XBee has an additional on-board processor for user's code.

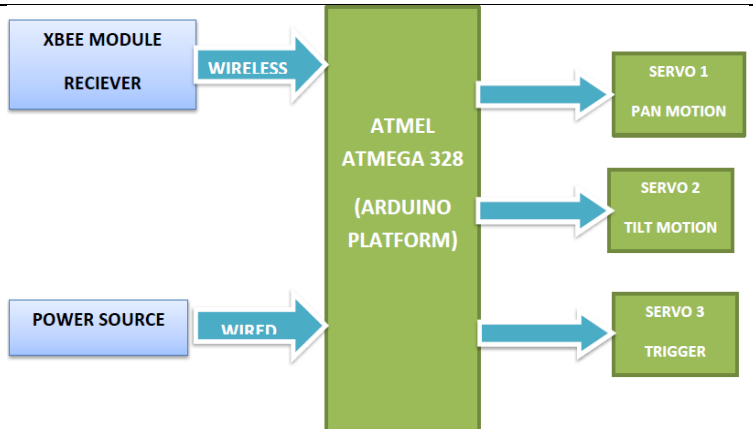

Fig: 1. Block Diagram for Receiver section

B. ARDUINO: Arduino was released in 2005 by students from the Interaction Design Institute Ivrea (IDII) as a modest tool for Mac OSX and Windows. Since then, Arduino has been able to initiate an international-do-it yourself revolution at the electronics industry. The open source microcontroller hardware has been designed in a way that it can easily interface with various sensors (registering user inputs) and driving the behaviours and responses of the external components such as speakers, motors, and LED (responding to the user inputs). The most important feature of Arduino is the ease of programmability hence users with little expertise are able to use it. This aspect has made Arduino one of the most popular tools of choice for designers and artists in creating interactive spaces and objects (Arduino Team).

C. DEVELOPMENT: While discussing the development of Arduino, it is worth introducing a brief history of microcontrollers. A revolutionary leap in the computing industry was seen in the 1960s following the development of solid state computers (including the IBM 1401), that used 17 transistors to process its operations and a magnetic core memory for its storage (instead of vacuum tubes), and these enabled an increase in the compactness of the computer hardware. This development enabled individuals with few years of expertise to carry out the basic operations on a computer. FORTRAN (for the scientific calculators) and COBOL (for business application) were the two main languages that were introduced in that period. The microprocessor was one of the greatest innovations in the history of the modern computer in the 1970's. Initially, the microprocessor miniaturized all the hardware components of CPU to fit into one, tiny, integrated circuit, popularly known as the microchip. The microchip became the major driving component of the microcontrollers including Arduino which is made up of a microchip, input/output hardware and memory storage hardware for sensors. The microprocessor, due to the small form factor, was incorporated into a surfeit of electronic devices ranging from personal computers to calculators and are still used up to date.

D. EVOLUTION: The microcontrollers have moved from the more complex requirements in the scientific, business or commercial fields. The reasons as to why the PIC microcontroller board was preferred were the speed and ease of its programming through simple languages including PBASIC. It was able to store programs on a flash memory chip that enabled the instructions on the board to be reprogrammed or erased at will with an infinite number of possibilities. It also supported output devices such as LEDs and motors as well as input sensors. The Arduino, therefore, incorporated several characteristics including a programming environment that is based on the processing language that was conceived by Casey Reas and Ben Fry and other artists and designers.Arduino also incorporated the ability to program its board using a standard USB connection with a low price point (Wheat, 2001).

III. CHARACTERISTICS OF ARDUINO MEGA 2560

The Arduino Mega2560 can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm centre-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and VIN pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The Mega2560 differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	54 (of which 14 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	40 Ma
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by boot loader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz

The power pins are as follows:

- The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- 5V the regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- 3.3V. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 0 mA.

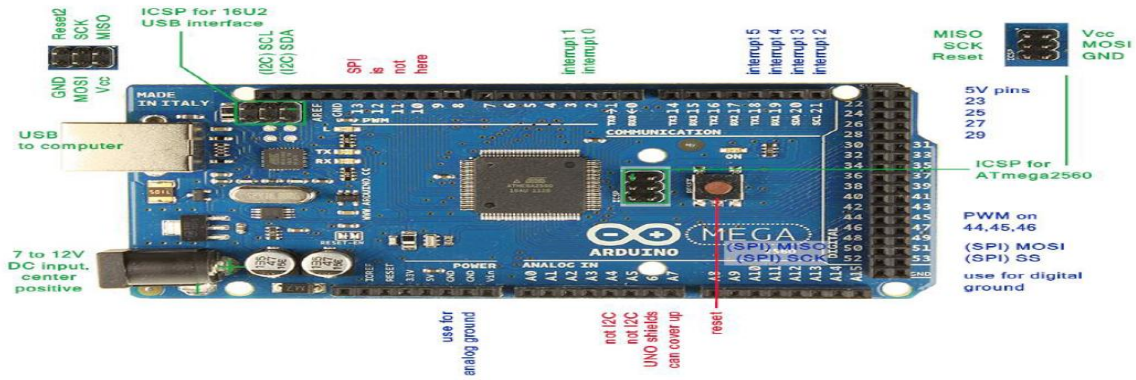

Fig. 2. Arduino Mega

A. ARDUINO WITH GYROSCOPE: Gyroscopes measure the rate of change of a particular axis at the current moment in time. This means that to keep track of our angle, we need to sum all of the rates of change over a given period of time. We're essentially looking for the integral of our gyro data. In the sample code below we'll be looking at just one gyro axis.

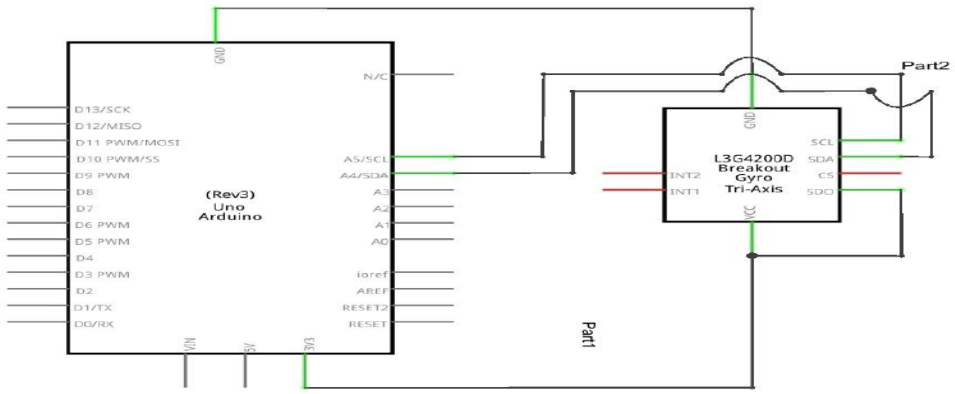

Fig. 3. Pin diagram for Arduino with Gyroscope

B. ARDUINO WITH SERVO MOTOR: This library allows an Arduino board to control RC (hobby) servo motors. Servos have integrated gears and a shaft that can be precisely controlled. Standard servos allow the shaft to be positioned at various angles, usually between 0 and 180 degrees. Continuous rotation servos allow the rotation of the shaft to be set to various speeds.The Servo library supports up to 12 motors on most Arduino boards and 48 on the Arduino Mega. On boards other than the Mega, use of the library disables analogWrite() (PWM) functionality on pins 9 and 10, whether or not there is a Servo on those pins. On the Mega, up to 12 servos can be used without interfering with PWM functionality; use of 12 to 23 motors will disable PWM on pins 11 and 12.

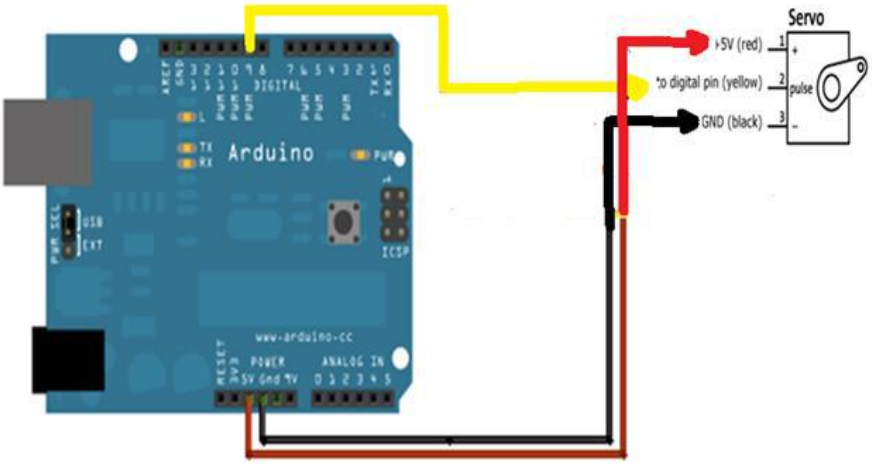

Fig. 4. Arduino with Gyroscope

C. ARDUINO WITH X BEE: The Xbee shield allows an Arduino board to communicate wirelessly using Zigbee. It is based on the Xbee module from MaxStream. The module can communicate up to 100 feet indoors or 300 feet outdoors (with line-of-sight). It can be used as a serial/usb replacement or you can put it into a command mode and configure it for a variety of broadcast and mesh networking options. The shields breaks out each of the Xbee's pins to a through-hole solder pad. It also provides female pin headers for use of digital pins 2 to 7 and the analog inputs, which are covered by the shield (digital pins 8 to 13 are not obstructed by the shield, so you can use the headers on the board itself)**.**

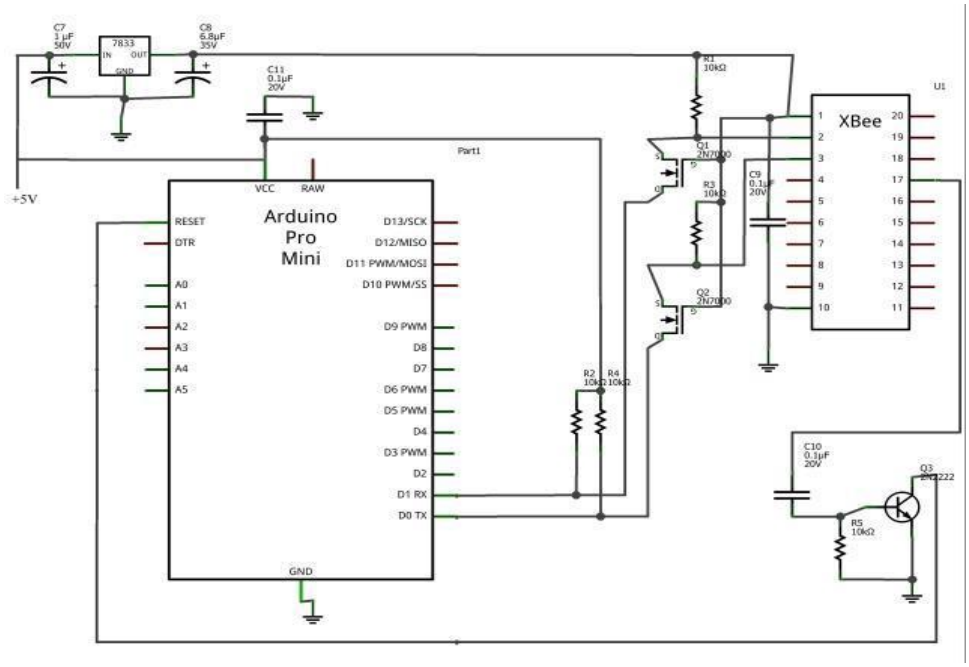

Fig.5. Arduino with Xbee

IV. CONCLUSION

Arduino Uno differs from other preceding boards due to its features which include ATmega8U2 that is programmed as a USB-to-serial. Arduino Uno may be powered either through the USB connection or using an external power supply. This paper involves the complete system design and construction of a gun to replace an armed guard. We aimed to develop a compact and highly mobile defense system that allows operational flexibility. The gun can autonomously track and shoot at moving targets, while also allowing a user to remotely access and control the gun via computer. The mobility, hardiness, and functionality of this system allows a reliable replacement for human beings in harsh and hostile environments; ultimately sparing a life. This remote accessible data could allow for military planning for that environment. Overall, we this system has a lot of potential in modern day military strategy and would help spare hundreds of our ally's lives. We hope that our system becomes a useful entity for military application, and forwards the use of robot technology in modern military strategy.

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