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Bluetooth based Microcontroller Operated Baby Bed Security System with IP Webcam Video Monitoring

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Abstract: ***The objective of our proposed work is to provide a system that will replace the usual baby cribs with smart baby which will with the problems of a mother's/parents' constant taking care of a baby. It will be dealing with a number of things. Like, firstly there is a mechanism in this device that will prevent a baby from falling from the crib/a bed. Secondly, it has a mechanism that'll send a 'notification' to the mother's/parents' smart phone by making him/her aware if the baby is crying or whether the bed sheet is wet and needs replacing. It'll also have a feature of live video feed of the baby if the baby is okay and needs care, which will also act as an addition safety feature of the device. In our proposed system, Arduino UNO operated PIR Sensor is used to detect the baby's movement which further leads to the 180 degree rotation of the Servo Motor/ Shaft and keep the baby safe from free-falling. In other side, by using FC 04 Sound Sensor we can detect whether the baby is crying or not and also using the Rain Sensor we can detect the notification regarding the baby's toilet via HC 05 Bluetooth Module. Whole system can be recorded through Live Video Monitoring using IP Webcam.***
Keywords: PIR, Crib, Servo-Motor, IP Webcam, Arduino-UNO etc.

I. INTRODUCTION

This paper deals with a topic which is a very common problem of a family where a mother or a father has to take care of their baby who needs constant attention. In our busy daily life one faces many difficulties in such cases where a baby's safety is the primary concern of every parent but they also have to take care of other things. Here comes the importance of a smart baby crib, where with the help of it parents can easily concentrate on their daily work while also keeping an eye on their baby with much effort, as it has features like sending an alert to their mobile devices if the baby is crying or not, and also if the bed sheet has become wet somehow and needs immediate attention or not. These actions are done by using a Rain Sensor and a Sound module.

This project also focuses on the matter of preventing any kind of unfortunate accidents that can happen due to the baby falling from the crib. Here a PIR sensor is used which helps to detect any living object in its line of sight and sends a signal to the microcontroller which further helps a Servo Motor to lift a shaft with protects the baby from rolling down and falling from the bed.

II. OUR PROPOSED WORK

In our proposed work we used Rain Sensor which will be placed under the bed sheet, which will help it to detect if the bed is wet and the bed sheet needs replacing or not. Then we used a FC 04 Sound Sensor to detect if the baby is crying or not. A Bluetooth module is also used which will help the device to connect it with a mobile device where the notifications will be sent to let the parents know about the current situation. A Servo Motor which will be attach to a shaft to the side of the bed/crib which will rotate and prevent the baby from falling by detecting it's presence near the edge of the bed/crib. Also a mobile device can be used to send a live video feed to the mother's/father's mobile device or computer/laptop to let them know if the baby is safe.

A. Components Required For Proposed Work

1) *Servo Motor:* A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which run through servo mechanism. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight packages. Doe to these features they are being used in many applications like toy car, RC helicopters and planes, Robotics, Machine etc.The position of a servo motor is decided by electrical pulse and its circuitry is placed beside the motor.

Fig. 1 Example of servomotor

2) *FC 04 Sound Sensor:* This multipurpose sound sensor which can be used to sense sound and audio. The sensor provides a digital output when the measured sound increases beyond a set threshold. This threshold level can be adjusted using an onboard potentiometer. The sensor outputs a logic one (+5V) at the digital output when it detects sound and a logic zero(0V), when there is no sound detected. An onboard LED is used to indicate the output status. This digital output can be directly connected to an Arduino, Raspberry Pi, AVR, PIC, 8051 or any other microcontroller to read the sensor output.

Fig. 2 Example of Sound Sensor

3) *Microcontroller Board (Arduino UNO-R3):* Arduino is an open-source hardware and software company.The Arduino Uno is a microcontroller board based on the ATmega328. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer (or appropriate wall power adapter) with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Fig. 3 Example of an Arduino UNO-R3

4) *Jumper Wire:* A jump wire (also known as jumper wire, or jumper) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them –simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other .Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed.

Fig. 4 Example of Jumper wire

5) *PIR Sensor:* A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view.PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are most often used in PIR-based motion detectors. It works on 5V DC and gives TTL output which can be directly given to microcontroller or to relay through a transistor.It consists of pyroelectric sensor and Fresnel lens that detects motion by measuring change in the infrared levels emitted by the objects. It can detect motion up to 20ft. This module is very sensitive to change in infrared levels subjected by human movement.

Fig. 5 Example of PIR Sensor

6) *Rain Sensor:* The sensor uses high quality FR-04 double material, with a large area of 55mm x 40mm. Conductive rails on surface are treated with nickel plating which fights oxidation, gives better electrical conductivity, and has superior life performance. Sensitivity can be adjusted through the on board potentiometer.When no water is present, DO output is HIGH. When the sensor detects water, DO output will be LOW. AO output will be proportionate to how much water there is on the plate, which will determine how conductive it is between the rails.

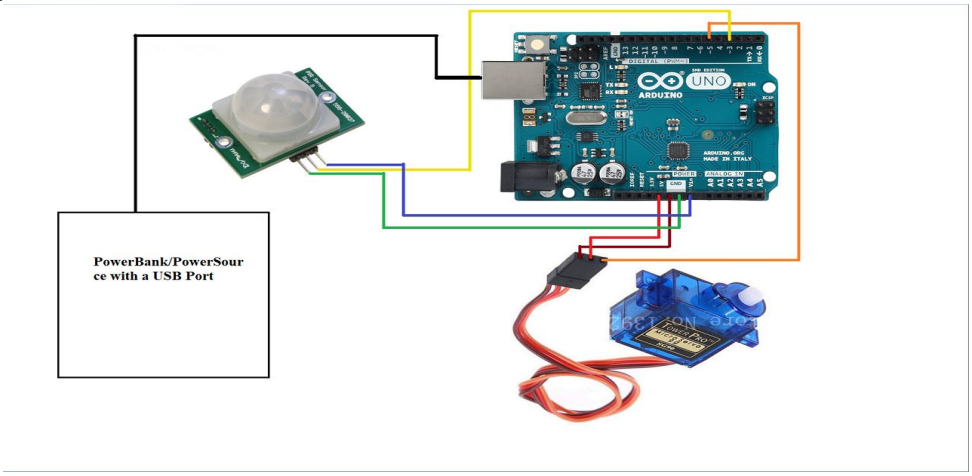
Fig. 6 Example of Rain Sensor

7) *Bluetooth Module:* HC05 Module is an easy to use Bluetooth SPP (Serial Port Protocol) module and it is designed for wireless serial communication applications. Thanks to its pins coming out from the board, you can use it easily on breadboard with Arduino or your projects and you can prototype quickly. It supports master mode which the most of the Bluetooth modules don't.You can wire it to your circuits with the jumper wires sent together with the module.This module supports Bluetooth 2.0 and it provides a 10m communication range in open spaces and it communicates in 2.4GHz frequency. You can use it in hobby, robotic or academic projects.

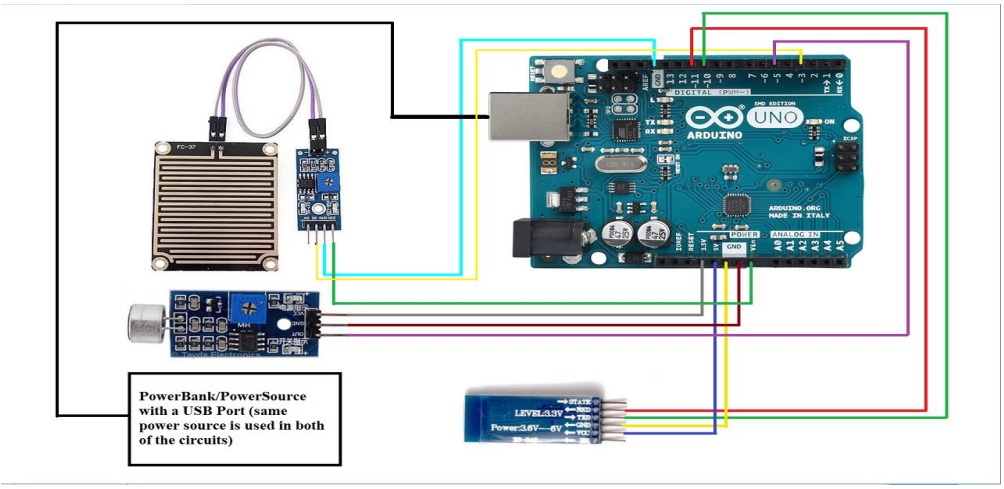
Fig. 7 Example of Bluetooth Module

B. Proposed Circuit Diagram

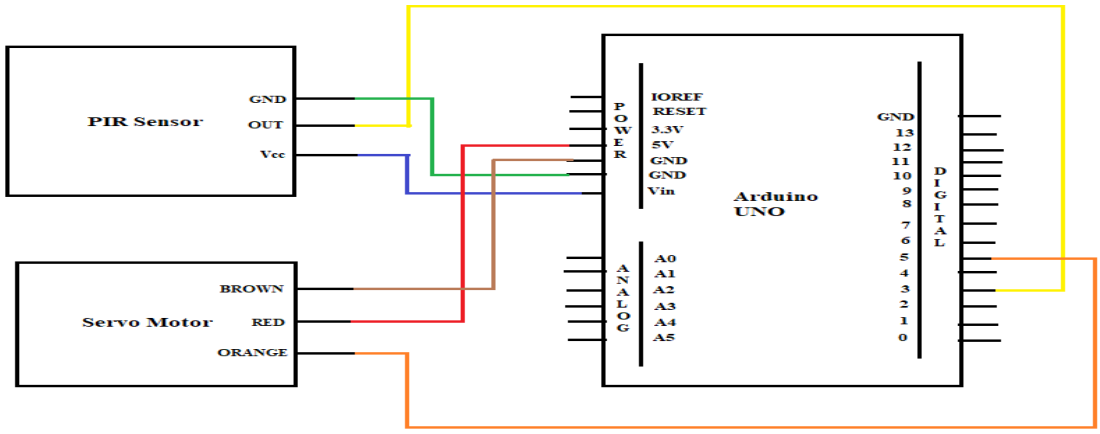
1) Circuit diagram for P.I.R. and Servo Motor Connection with Arduino UNO



2) Circuit Diagram for Bluetooth Module, Rain Sensor, Sound Sensor W/ Arduino UNO



C. Block Diagram Of The Circuit



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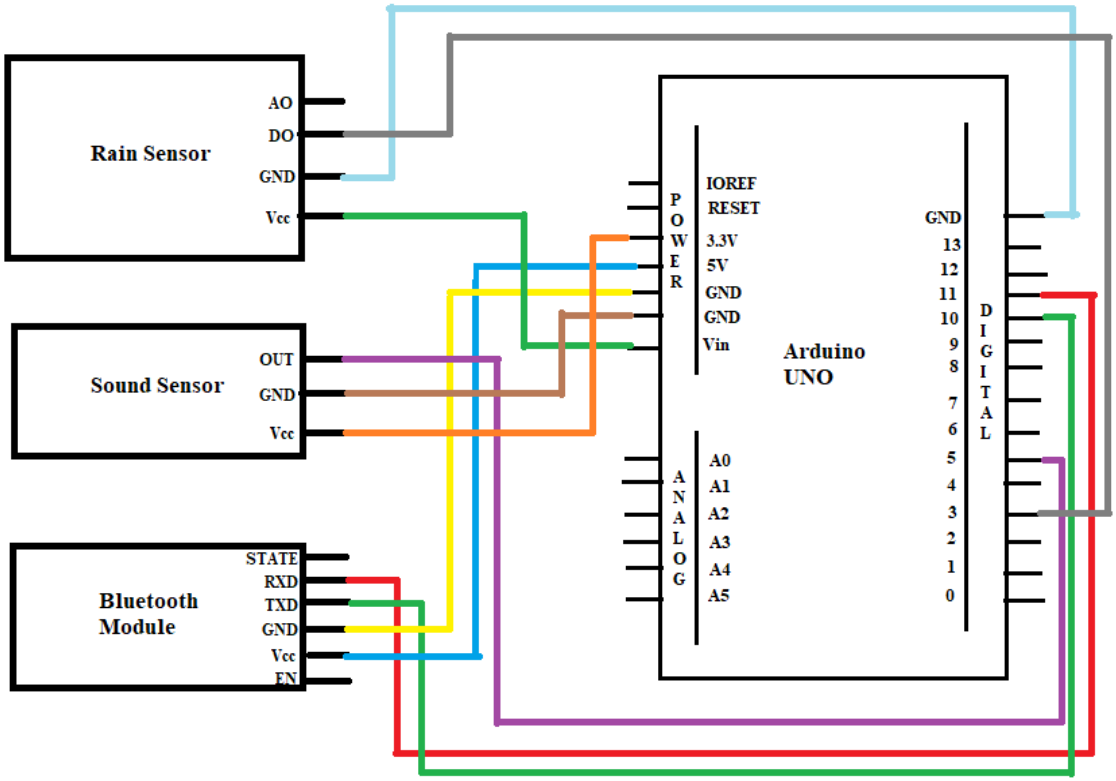


1) *Circuit Diagram's Explanation:* The components used in the above shown diagram are i) Arduino UNO, ii) P.I.R., iii) Servo Motor, iv) Rain Sensor, v) Sound sensor, and vi) Bluetooth Module. It's a fairly simple circuit to construct, but to make it even simpler we will try to walk you through the connections. One important thing to notice that for both circuits one power source is used. The same power source (which contains two USB connections) will send 5v output to both of the circuits at a same time.

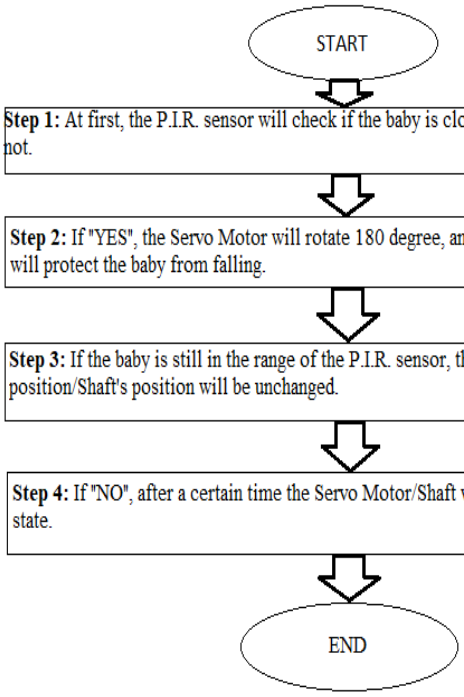
On the first circuit where an Arduino UNO, PIR and a Servo Motor is used, a) The 'GND' of the PIR is connected to the 'GND' of the Arduino UNO (which is next to 'Vin'), b) 'OUT' is connected to the pin number '3' of the digital side of the Arduino UNO, c) 'Vcc' of the PIR is connected to the 'Vin' of the Arduino UNO. On the first circuit where the Arduino UNO is connected to the Servo Motor a) the 'BROWN' wire of the Servo Motor is connected to the 'GND' of the Arduino (which is next to the '5V'), b) the 'RED' wire is connected to the '5V' of the Arduino, c) the 'ORANGE' wire is connected to the '5' pin of the digital side of the Arduino.

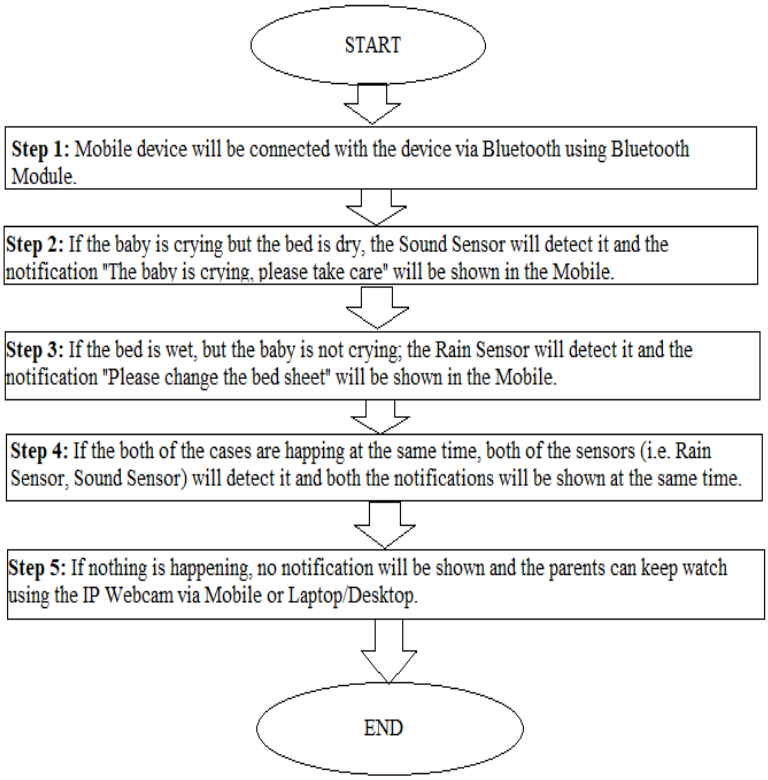
On the second circuit where the Sound Sensor and the Rain Sensor is connected to the Arduino a) the 'OUT' of the Sound Sensor is connected to the '5' pin of the dgital side of the Arduino, b) the 'GND' of the Sound Sensor is connected to the 'GND' of the Arduino (next to Vin), c) the 'Vcc" of the Sound Sensor is connected to the '3.3V' pin of the Arduino. d) the 'D0' pin of the Rain Sensor is connected to the '3' pin of the Digital side of the Arduino, e) the 'GND' of the Rain Sensor is connected to the 'GND' of the Arduino, f) the 'Vcc' of the Rain Sensor is connected to the 'Vin' of the Arduino.

On the second circuit where the Bluetooth Module is connected to the Arduino UNO, a) the 'RXD' of the Bluetooth Module is connected to the '11' pin of the digital side of the Arduino, b) the 'TXD' pin of the Bluetooth Module is connected to the '10' pin of the digital side of the Arduino, c) the 'GND' of the Bluetooth Module is connected to the 'GND' of the Arduino, d) the 'Vcc' of the Bluetooth Module is connected to the '5V' of the Arduino.

In this way, we construct the whole circuit. There is also an option of connecting a mobile device this device which will help to deliver a 'Live' video feed to the parents' Laptop/Desktop or even Mobile Phones if necessary, so that they can reach out to the baby if needed immediately.

D. Proposed Algorithm for Automatic Baby CRIB System (Combining II.B.1, II.B.2 AND II.C)





III.EXPERIMENT AND RESULTS

In our project of a 'Smart Baby Crib' we tried to avoid the unfortunate accidents that can happen as much as possible while also taking care of other simple problems which further enhance the usability of the device. Also Parents can be aware of the situation by using the IP Webcam if needed other than just relying on the safety features of it. Also, despite using various connections the device turned out to be pretty safe. In terms of overall productivity we tried to make this device as useful as possible.

IV.CONCLUSIONS

The circuit was fairly reliable and useful. The notifications and the other components were fairly easy to use and attach. We tested the rain and sound sensor and checked thoroughly if it is safe to install on a baby crib, and it was. We also checked whether it is safe to put the Rain sensor under the bed sheet and also it turned out to be pretty safe. By using the PIR we were also able confirm that the other safety features are in check. Our project was necessary in our daily basis problems and by using this device the problem we wanted to handle was successfully reduced.

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