International Journal of Advance Research in Engineering, Science & Technology(IJAREST), ISSN(O):2393-9877, ISSN(P): 2394-2444,
Volume 2, Issue 5, May-2015

Wireless Remote for Bridge Crane

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Abstract

Human operators are facing many difficulties while driving cranes accurately and safely through wired remotes. It needs more experience to master. The proposed work utilises the RF module for making a wireless remote, which could be used to drive an output from distant place. RF module as a name suggests, uses Radio Frequency to send signals. These signals are transmitted at a particular frequency and baud rate. A receiver can receive these signals only if it is configured for that frequency.

The input signals, at the transmitter side are taken through 6 switches which are encoded by the 8-bit microcontroller and are sent by TXD pin. Similarly at the receiving end, the signal is received by RXD pin and decoded to operate corresponding relay to control direction of rotation of motor.

Keywords*-Microcontroller, RF module, switches, Relays, Motors.*

I. INTRODUCTION

A crane is a lifting machine, generally equipped with a winder (also called a wire rope drum), wire ropes or chains and sheaves that can be used both to lift and lower materials and to move them horizontally. It uses one or more simple machines to create mechanical advantage and thus move loads beyond the normal capability of a human. An overhead crane, commonly called a bridge crane, is a type of crane found in industrial environments. An overhead crane consists of parallel runways with a travelling bridge spanning the gap. A hoist, the lifting component of a crane, travels along the bridge. If the bridge is rigidly supported on two or more legs running on a fixed rail at ground level, the crane is called a *gantry crane* or a *goliath crane*.

Unlike mobile or construction cranes, overhead cranes are typically used for either manufacturing or maintenance applications, where efficiency or downtimes are critical factors.

Overhead cranes are commonly used in the refinement of steel and other metals such as copper and aluminium. At every step of the manufacturing process, until it leaves a factory as a finished product, metal is handled by an overhead crane. Raw materials are poured into a furnace by crane, hot metal is then rolled to specific thickness and tempered or annealed, and then stored by an overhead crane for cooling, the finished coils are lifted and loaded onto trucks and trains by overhead crane, and the fabricator or stamper uses an overhead crane to handle the steel in his factory. The automobile industry uses overhead cranes to handle raw materials. Smaller workstation cranes, such as jib cranes or gantry cranes, handle lighter loads in a work area, such as CNC mill or saw.

Almost all paper mills use bridge cranes for regular maintenance needing removal of heavy press rolls and other equipment. The bridge cranes are used in the initial construction of paper machines because they make it easier to install the heavy cast iron paper drying drums and other massive equipment, some weighing as much as 70 tons. [1]

II. RF TRANSCEIVER MODULE (CC2500)

The **CC2500** is a low-cost 2.4 GHz transceiver designed for very low-power wireless applications. The circuit is intended for the 2400-2483.5 MHz ISM (Industrial, Scientific and Medical) and SRD (Short

Range Device) frequency band. The RF transceiver is integrated with a highly configurable baseband modem. The modem supports various modulation formats and has a configurable data rate up to 500 kilo Baud.

CC2500 provides extensive hardware support for packet handling, data buffering, burst transmissions, clear channel assessment, link quality indication and wake-on-radio. The main operating parameters and the 64-byte transmit/receive FIFOs of **CC2500** can be controlled via an SPI interface. In a typical system, the **CC2500** will be used together with a microcontroller and a few additional passive components.

Radio frequency (RF) transceiver units are widely used in radio frequency communications system. The function of a radio frequency (RF) transceiver at remote control unit (transmitter) is to modulate, up convert and amplify signals for transmission into free space. The radio frequency power amplifier is coupled to an antenna that transmits the amplified modulated input signal at 2.4 GHz frequency. At the receiver unit a similar transceiver unit is used to receive the transmitted signal from free space, down convert and demodulate the signals. [2]

III. METHODOLOGY

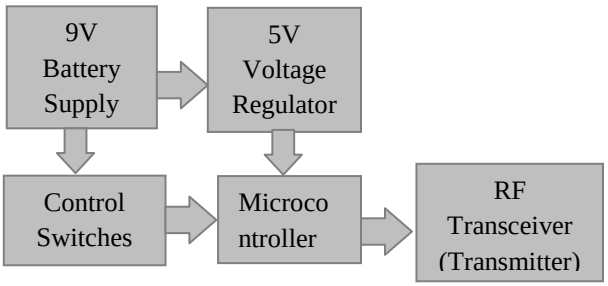

Fig3.1: Block diagram of remote control unit

The data-transmitting unit (hand held Equipment) including microcontroller (Atmel AT89C51) designed to operate at 5V DC, and the battery used in the card is 9Vpack, therefore with the help of a voltage regulator of 7805, constant supply of +5V is derived. Supply to the circuit is provided through the ON/OFF key and a small keyboard designed with eight keys is interfaced with this microcontroller. This keyboard is designed to generate the data that is stored in RAM and it is delivered through output pin of the controller (TXD). The output of the microcontroller is modulated at the frequency produced by the RF transmitter module, transmits the binary data to space in a particular range based on the

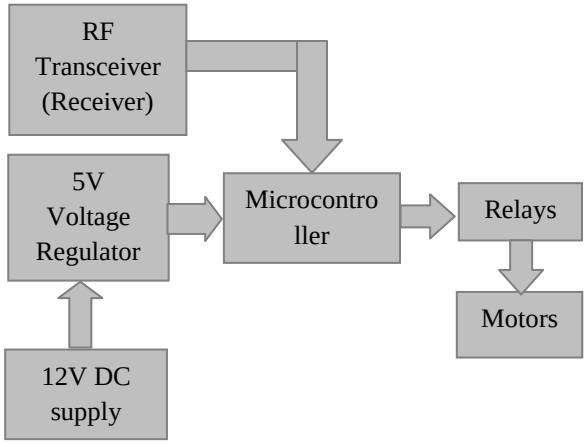

Fig3.2: Block diagram of Receiver unit

antenna used. Any digital data generated by the keyboard is transmitted as it is, once the key is pressed in the remote controller unit, binary data is transmitted and according to that data, the receiving controller unit is programmed.

The main function of the data transmitting section is to generate 8-bit binary code that is to be transmitted through RF transmitter module. The 8-bit binary code produced by the keyboard is fed to microcontroller, which functions as encoder; the data obtained from the keyboard is stored and it is converted into 8-bit information which is transmitted through amplified modulated input signal. If any key is pressed that information is converted into 8-bit data. The data receiving module consist RF receiver and driving circuit (Relays) that are interfaced with the microcontroller as source of information at the receiving side. [3]

The RF signal transmitted by the transmitter is detected and received by this section of the receiver. This binary encoder data is sent to the decoder for decoding the original data. For example, if No.1 key is pressed, 00000001 code is generated. Likewise each key function differs from another key to generate a different 8-bit code. Based on this code, the other micro controller used in the receiving module, designed as 8-bit code decoder, decodes this data and compares with the pre-defined program prepared in C language and operates the crane.

IV. CONCLUSION

Wireless Remote Operated Bridge Crane is designed and developed successfully. For the demonstration purpose prototype module is constructed & results are found to be satisfactorily.

This proposed work revealed that building a relatively low cost, high precision bridge crane is designed which is aimed control through a remote. The idea of controlling the crane through remote is to enhance the operator safety. Presently the system utilizes the RF remote technology with lesser transmitting power, there by the range is restricted to nearly less than 20m. Depending up on the crane size, this range is enough. The range restriction is always essential for operating this kind of machines, as it cannot be operated from too long because proper visibility is essential. For real applications, depending up on the crane size higher range wireless communication system can be designed by the same RF modules with high transmitting power for longer distances.

REFERENCES

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