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Hardware Implementation of foot-over bridge with programmable crane mechanism for easy transportation of luggage

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Abstract:

The bridge described here may be used for two purposes: 1) as a pedestrian or foot-over bridge for crossing busy highways or railway lines, and 2) as a crane for lifting and hauling baggage or cargo bundles across the road without disrupting traffic. Various types of cranes are now in use for various uses, but this multipurpose crane is the first of its kind. Crane operators can improve their performance and safety by using a wireless remote-control system.
Keywords: pedestrian, foot-over bridge, remote-control system

I. INTRODUCTION

A crane is a horizontally moving machine that can lift, lower, and transfer large things. Cranes are not the same as hoists, which can lift and put goods; these machines may lift products from one location and dump them in another; each crane has a working range and completes its functions within that range. The crane, which is coupled to a pedestrian bridge, slides the luggage sideways across the bridge, allowing it to be utilized for a number of purposes. Conveyors continually hoist and transport bulk items such as grain and coal, whereas cranes lift and move bulk materials in batches.

Crane technology has advanced significantly in recent years, and they are now employed in a variety of applications. As part of our project work, we chose to build a modest prototype module of a multi-purpose bridge that includes a crane mechanism. This crane is meant to operate through remote and may be used for several purposes, such as a foot over bridge allowing people to walk from one platform to the other or from one side of the road to the other, in order to produce something new and inventive in the field of cranes. RF (Radio Frequency) remote control technology is used for this purpose. This technique has several advantages. The operator is mostly shielded from all abrupt impacts since the crane mechanism may be operated remotely from the machine. Wireless remote-control systems are now widely employed for a wide range of applications, from little toys to large machinery. The crane's operating efficiency may be increased by using a wireless system, and an 'accident-free' operation can be assured.

The employment of a wireless RF (Radio Frequency) control system to operate the crane is a milestone. The crane operator is required to be stationed within the driver's cabin to operate the crane motions during loading, unloading, and shunting at platforms or on the roadside until the operation is completed in the conventional fashion. A second person must be present on the floor to connect or hang the container that will be placed in the ship. Because the crane's cabin, which houses all the joysticks and switches for manually directing the crane, is generally 10 meters above ground, the person on the ground must instruct the cabin operator while transferring the weight. In such cases, the operator's view from the operator's cabin is limited. The operator is fully reliant on the signals of his coworkers most of the time. This leads to a dangerous situation. Accidents might occur because of faulty signaling or interpretation as a result of human mistake. Poor visibility slows down operations and hence diminishes productivity. To prevent all these issues, the remote-control approach is ideal, as the operator can judge properly, and no additional person is necessary to connect the container.

II. LITERATURE SURVEY

A crane is a type of hoisting equipment that is often outfitted with a winder (also known as a wire rope drum), wire ropes or chains, and sheaves that may be used to raise and lower goods as well as move them horizontally. It employs one or more basic devices to provide mechanical advantage and so move loads beyond a human's usual capacity. Cranes are extensively used in the transportation business to load and unload freight, in the construction industry to move materials, in dock yards to load or unload ships, in railway yards to load or unload trains, and in the manufacturing industry to assemble heavy equipment.

Cranes are distinct from hoists, elevators, and other vertical lifting devices, as well as conveyors, which continually lift or transport bulk items such as grain or coal. Cranes have only been commonly employed since the 19th century, with the development of steam engines, internal combustion engines, and electric motors. They range in size and purpose from the largest derrick (a platform coupled to a crane chain used to lift heavy goods) cranes to small, transportable truck cranes. Most derrick cranes can lift between 5 and 200 tonnes. Floating cranes erected on barges (floating platforms) for bridge construction or recovering submerged goods may have a maximum lifting capability of 3,000 tonnes. Small truck cranes are installed on big, customised vehicles; they compensate for mobility and strength.

Cranes relied on human or animal power until the mid-nineteenth century, when steam engines were introduced. By the end of the nineteenth century, internal combustion engines and electric motors were being employed to power cranes. Most cranes were built with steel rather than wood by this point.

European and American cranes evolved differently over the first part of the twentieth century. In Europe, where most cranes were utilised in towns with small streets, cranes were often designed in the shape of tall, thin towers, with the boom and operator on top. Because silent operation was vital in congested cities, when electric motors were widely accessible, these tower cranes were frequently driven by them.

Cranes were frequently utilised in regions remote from residential zones in the United States. Cranes were often designed with the boom attached to a trolley that could be readily moved from one location to another. Internal combustion engines were commonly used to power these mobile cranes. The availability of stronger steels, along with a growing need for higher structures, led to the creation of cranes with very long booms linked to compact trucks or crawlers with caterpillar treads in the 1950s. Many various types of mobile cranes and tower cranes are utilised widely on building sites across the world. The Ancient Greeks devised the crane for lifting huge items in the late 6th century BC. These cranes are used to hoist massive stone blocks used in the construction of Greek temples. Archaeologists consider these holes to be the positive evidence necessary for the presence of the crane since they point to the usage of a lifting mechanism and are situated either above or below the centre of gravity of the block.

With the development of the winch and pulley hoist, ramps were quickly replaced as the primary mode of vertical mobility. For the next two centuries, Greek construction sites saw a substantial decrease in weights handled as the new lifting technique made the use of multiple smaller stones more practicable than fewer bigger ones. In contrast to the archaic period's trend for ever-increasing block sizes, classical Greek buildings such as the Parthenon typically contained stone blocks weighing less than 15-20 tonnes. In addition, the practise of creating massive monolithic columns was almost entirely abandoned in favour of employing many column drums.

However, the Romans utilised far larger cranes than the Egyptians, with these cranes capable of lifting to 60 tonnes of stone blocks. These stone blocks are used to build Jupiter's temple. This is the documented history. Cranes, in general, might do vertical transport more safely and affordably than traditional techniques. Harbours, mines, and construction sites were typical areas of application for the tread wheel crane.

III. BLOCK DIAGRAM DESCRIPTION

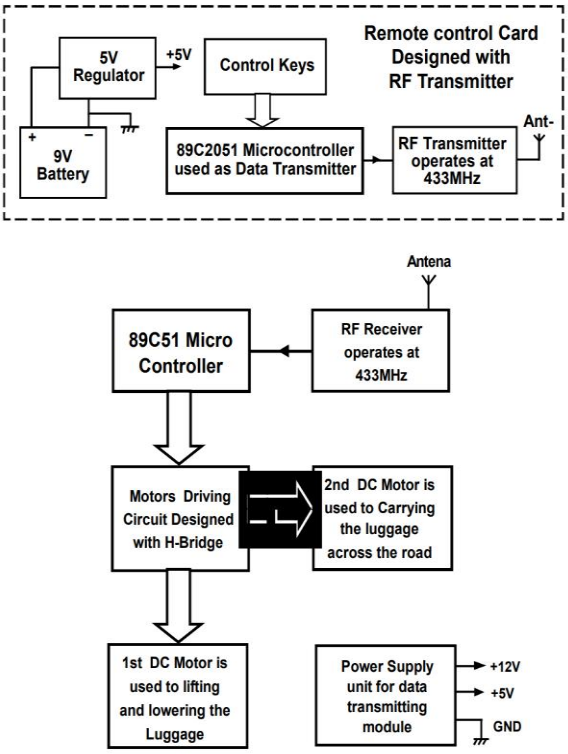


Fig.1:Block Diagram of multipurpose bridge

Remote Control Unit:

The remote-control unit is designed with 89C2051IC.

This is a 20 pin IC having a memory of 2 KB ROM. This is an 8-bit controller chip.

This controller can identify 64 different command codes as it input or output side.

This remote-control unit is designed with 8 control keys whenever any key is activated corresponding 8-bit binary code will be generated from the microcontroller and it will transmit through RF transmitter as a modulating signal. Since the command code is prepared to control both motors 4 different command quotes are required therefore 4 control keys are used.

RF transmitter used in this project operates at a high frequency of 433 Mmegahertz when the device is switched on. It generates 433-Megahertz frequency as a carrier, and it will be radiated into air through antenna.

Signal delivered from antenna will be radiated into the air in Omni directional.

The radiating power depends upon the power handling capacity of RF transmitter and range depends upon the transmitting power. Often, it is measured in milli watts and watts.

Since it is a prototype module the RF transmitter used here can transmit the signal of maximum distance of 30 feet to enhance the range.

Whenever any key is activated, the controller generates corresponding 8-bit binary code, and it is used as a digital signal which will be superimposed over the carrier and transmitted as a modulated wave.

L293D Bridge

The main processing unit is constructed with 89C52 microcontroller chip. This is a 40 pin IC and having 8 GB memory in ROM.

This is also 8-bit controller chip this IC is programmed to control both DC motors independently through the bridge IC as per the command code received through RF receiver, the chip drives in both motors in both directions.

Keil software is used to program the chip. The program is prepared in assembly language.

The Transformers used here are step down Transformers having 230 volts and 89C52 microcontroller chip is having 32 input output lines. With the help of a 11.0592 MHz crystal connected to the internal oscillator pins (18 and 19 pins) of chip specified frequency of 11.0592 megahertz will be generated internally and is used to run the internal program such a high speed so that fast action within 15 microseconds can be achieved instantly means whenever any command code is received from RF receiver immediately corresponding motor will be activated in specific direction.

Both microcontrollers used in transmitter and receiver crystals must be like each other thereby both units will be synchronized perfectly.

IV PRINCIPLE OF OPERATION

The operation of any electric motor is based on electromagnetism. When a current-carrying conduct put in an external magnetic field, it experiences a force proportional to the conductor's current and the intensi the external magnetic field. As you may recall from childhood experiences with magnets, opposite pola (North and South) attract, whereas like polarities (N and North, South and South) repel. The internal structu a DC motor is designed to create rotational motio harnessing the magnetic interaction between a cur carrying wire and an external magnetic field. Let's with a simple 2-pole DC electric motor (dark indicates a magnet or winding in this case).

The axle, rotor (also known as armature), s commutator, field magnets, and brushes are the essential components of a DC motor. High-stre permanent magnets provide the external magnetic fie most conventional DC motors. The stator is the m stationary component, which consists of the motor c and two or more permanent magnet pole parts. The revolves in relation to the stator, together with the axle associated commutator. Windings (usually on a core) up the rotor, which are electrically coupled to commutator. The rotor is enclosed within the stator (magnets, as seen in the diagram below.

Fig.2.L293D Bridge

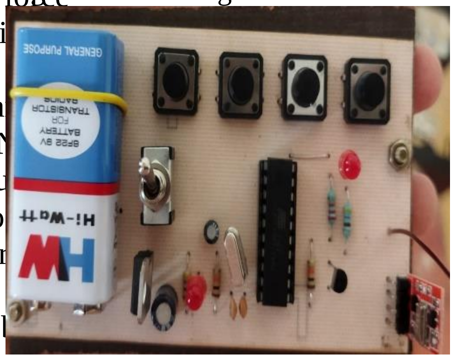
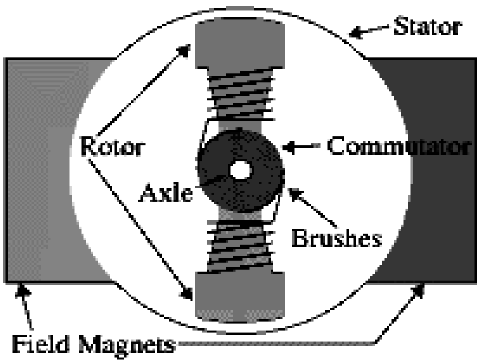


Fig.3.Remote Control Unit

Fig.4.MultiPurpose Bridge



V RESULTS AND DISCUSSIONS

VI CONCLUSION

The project work "Multi – Purpose Bridge" was successfully planned and developed. A prototype module is built for demonstration purposes, and the results are good. We engaged a few specialists with understanding in Mechatronics while designing and creating this prototype type module; these professionals working at various firms in Hyderabad assisted us in manufacturing the crane. Because it is a prototype module, little money is invested, and the entire machine is built with locally available components. The mechanical components used in this project work are procured from mechanical fabricators, and they are not up to the requirements, so design modifications are required to make it a real working system. As a result, the crane is to to be enhanced further for obtaining better results.

REFERENCES

[1] Mechatronics and measurement systems - By: DAVID G. ALCIATORE And MICHAEL B. HISTAND

[2] Mechatronics – Electronic Control Systems in Mechanical and electrical Engineering – By: W. Bolton

[3] Mechatronics – By HMT Limited

[4] Electronic Circuit guide book – Sensors – By JOSEPH J.CARR

[5] The 8051 Micro-controller Architecture, programming & Applications By: Kenneth J. Ayala

[5] Mechanism and Machine Theory By: J.S. Rao, R.V. Dukkipati

[6] Practical transistor circuit design and analysis By: GERALD E. WILLIAMS

[7] Programming and Customizing the 8051 Micro-controller By: Myke Predko

[8] The concepts and Features of Micro-controller By: Raj Kamal

[9] Digital Principles and Applications By ALBERT PAUL MALVINO and DONALD P. LEACH

[10] Industrial Robotics – Technology, Programming, & Applications. By: MIKELL P. GROOVER, MITCHELL WEISS, ROGER N.